Interim Record of Decision

Harbor Island Superfund Site
East Waterway Operable Unit
Seattle, Washington
EPA Site ID: WAD980722839

U.S. Environmental Protection Agency
Region 10
May 2024

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Acronyms, Abbreviations, and Units of Measure

API	Asian and Pacific Islander
ARAR	applicable or relevant and appropriate requirement
BaP	benzo[*a*]pyrene
BaP-eq	benzo(a)pyrene equivalents
BEHP	bis(2-ethylhexyl) phthalate
BERA	baseline ecological risk assessment
BHHRA	baseline human health risk assessment
bgs	below ground surface
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
cfs	cubic feet per second
CIP	community involvement plan
cm/s	centimeters per second
cm/yr	centimeters per year
CMA	construction management area
COC	contaminant of concern
COPC	contaminant of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSM	conceptual site model
CSL	cleanup screening level
CSO	combined sewer overflow
cy	cubic yards
CWA	Clean Water Act
DDT	dichlorodiphenyltrichloroethane
DMMP–	Dredged Material Management Program
dw	dry weight
EAA	early action area
Ecology	Washington State Department of Ecology
EF	exceedance factor
ENR	enhanced natural recovery
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
EW OU	East Waterway Operable Unit
EWG	East Waterway Group
FS	feasibility study
g/day	grams per day
HI	hazard index
HPAH	high-molecular-weight polycyclic aromatic hydrocarbon
HQ	hazard quotient
ICs	institutional controls
IROD	interim record of decision
LADD	lifetime average daily dose
LC50	medial lethal concentration

LDW	Lower Duwamish Waterway Superfund Site
LOAEL	lowest observed adverse effects level
LPAH	low-molecular-weight polycyclic aromatic hydrocarbon
µg/L	micrograms per liter
µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
MLLW	mean lower low water
MNR	monitored natural recovery
MTCA	Model Toxics Control Act
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ng/kg	nanograms per kilogram
ng/L	nanograms per liter
NOAEL	no observed adverse effects level
O&M	operation and maintenance
OC	organic carbon
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PbB	blood lead concentration
PCB	polychlorinated biphenyl
RAL	remedial action level
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RMC	residuals management cover
RME	reasonable maximum exposure
ROC	receptor of concern
SD	storm drain
SF	cancer slope factor
SHNIP	Seattle Harbor Navigation Improvement Project
Site	Harbor Island Superfund Site
SMS	Sediment Management Standards
SRI	supplemental remedial investigation
SQS	sediment quality standard
SQV	sediment quality value
SVOC	semi-volatile organic compound
SWAC	spatially-weighted average concentration
T-25	Terminal 25
TBC	to be considered
TBT	tributyltin
TEQ	toxicity equivalence
TRV	toxicity reference value
UU/UE	unlimited use and unrestricted exposure
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard

VOC	volatile organic compound
WAC	Washington Administrative Code
WSDOH	Washington State Department of Health
WQC	water quality criteria

Definitions

Dry weight (dw): the concentration of a chemical based only upon the weight of the sediment particles (dried sediment without water).

Organic carbon (OC): a form of carbon associated with organic matter (such as leaf litter) that is found in sediment. Organic carbon binds certain chemicals influencing bioavailability (the amount of a chemical absorbed into an animal's body) and the potential toxicity. To compare sediment samples that have different amounts of organic carbon, sediment concentrations are normalized to the amount of organic carbon present.

Toxic equivalencies (TEQ): is used to express the toxicity of a class of chemicals to the toxicity of a reference chemical. This is used for dioxins and furans as well certain PCB congeners to express the concentration relative to 2,3,7,8-tetrachorodibenzo-*p*-dioxin.

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Part 1: Declaration

Site Name And Location

Site Name: Harbor Island Superfund Site
Location: Seattle, Washington
U.S. EPA ID No.: WAD980722839
Operable Unit: East Waterway
Lead Agency: U.S. Environmental Protection Agency, Region 10
Support Agency: Washington State Department of Ecology

Statement of Basis and Purpose

This Interim Record of Decision (IROD) presents the interim remedial action selected by the United States Environmental Protection Agency (EPA) for the East Waterway Operable Unit (EW OU) of the Harbor Island Superfund Site located in Seattle, Washington (Site). This interim remedial action is chosen by EPA in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 USC § 9601 et seq., as amended, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, as amended.

This decision is based on the Administrative Record, which has been developed in accordance with Section 113(k) of CERCLA, 42 U.S.C. 9613(k), and which is available for review at the EPA Harbor Island Superfund website (www.epa.gov/superfund/harbor-island). The Administrative Index (Appendix C to this IROD) identifies each of the items comprising the Administrative Record upon which the selection of the interim remedial action is based.

The State of Washington Department of Ecology concurs with the selected remedy (see Appendix A).

Assessment of Site

The interim remedial action selected in this IROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants, or contaminants. Such releases or threats of releases may present an imminent and substantial endangerment to public health, welfare, or the environment. A final remedial action for the EW OU will be selected by EPA in the future.

Description of the Selected Interim Remedy

This interim remedy addressees contaminated sediment within the EW OU that is the result of historical industrial activities. The interim remedial action for the EW OU consists of the removal of contaminated sediment from a majority of the waterway, along with smaller areas of capping, in situ treatment, and enhanced or monitored natural recovery. In this IROD, EPA is not selecting cleanup levels for the EW OU. Institutional controls in the form of fish advisories and education, and waterway and land use restrictions will be implemented to further limit exposures to contamination and protect the integrity of the interim remedy. The interim remedial measures will substantially reduce unacceptable risks to human health associated with consumption of fish and shellfish, and direct contact, and will reduce unacceptable risks to benthic organisms, crab, and resident fish.

The major components of the interim remedy are:

- Cleanup of approximately 121 acres of contaminated sediments, consisting of:
  - Dredging 99 acres in open water portions of the EW OU. Approximately 940,000 cubic yards of sediment would be dredged and disposed off-site in accordance with regulations.
  - Capping 7 acres, which may include dredging to accommodate elevation needs.
  - In situ (in place on-site) treatment in 12 acres under docks and piers using activated carbon or other organic contaminant-sequestering agents.
  - Enhanced natural recovery in 3 acres under the West Seattle Bridge/Spokane Street Bridge corridor where there is limited access for barge-mounted dredges.
- Monitored natural recovery in 36 acres where there will be no dredging, capping or ENR.
- Placement of a residual management layer in all dredged and adjacent areas where dredge residuals may settle.
- Institutional controls to further limit exposures and protect the integrity of the remedy.
- Short-term monitoring will be conducted during and after construction to measure the progress and effectiveness of the remedial action. Cleanup levels will be selected in a future decision document.

EPA has determined that there are no principal threat wastes at the EW OU.

The selected interim remedy is estimated to require 10 years to construct, assuming a 4.5-month construction window each year. The total estimated capital cost for the selected interim remedy, updated to 2023 dollars, is $401 million ($223 million in net present value at the start of construction).

The EW OU is one of seven OUs designated by EPA for the Site. While part of the same Superfund Site, each OU is a distinct area with unique characteristics. The EW OU is the last of the seven designated operable units at the Harbor Island Site to be addressed by EPA under CERCLA.

The overall strategy for addressing contamination and the associated risks in the EW OU includes controlling sources of contamination and addressing the contaminated media that pose unacceptable risk. Control of sources that empty directly into the EW OU (lateral inputs) as well as sources throughout the watershed is occurring under various non-CERCLA Federal, State, and local regulatory programs (see Section 5.3). Contaminated sediment in the EW OU is being addressed through this CERCLA interim remedial action. The primary objective of this interim remedial action is to remove or otherwise manage contaminated sediments in a manner that is protective of human health and the environment.

The selected an interim remedy includes a combination of technologies, including dredging, capping, in situ treatment, enhanced natural recovery, monitored natural recovery, and institutional controls to address the entire EW OU. Actively addressing contaminated sediment will reduce contaminant concentrations in other contaminated media. EPA anticipates developing and selecting cleanup levels in a future decision document based on data collected during and after construction of the interim action. The data collected will be used to evaluate the effectiveness of the interim action and of ongoing source control actions identified above. A source control sufficiency assessment for lateral loading is being conducted by the East Waterway Group (EWG) with oversight by EPA and will need to be finalized prior to proceeding with remedial action. These data will provide EPA, the public, the State, Tribes, the EWG, and other stakeholders information needed to develop cleanup levels.

The selected interim remedy provides the best tradeoffs compared to the other alternatives. Remediation of the EW OU will reduce contaminant concentrations in sediments within the waterway. In addition to implementation of the selected interim remedy, effective control of sources of contamination throughout the Green/Duwamish River Watershed, including as regulated or otherwise addressed under non-CERCLA authorities implemented by federal, state, and local governments, and the adjacent CERCLA cleanup of the Lower Duwamish Waterway will be essential to achieving EPA's long-term objective of reducing sediment concentrations to be protective of both human health and the environment. These combined efforts may allow the Washington State Department of Health to minimize associated seafood consumption advisories and will advance the possibility of reaching concentrations of polychlorinated biphenyls (PCBs) in sediments that are at or near concentrations measured in non-urban background for Puget Sound (2 µg/kg PCBs).

Statutory Determinations

This interim action is protective of human health and the environment in the short term and is intended to provide adequate protection until a final remedy is selected. It complies with Federal and State requirements that are applicable or relevant and appropriate (unless justified by a waiver). The interim action is cost-effective and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

Because the interim remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure (UU/UE), a review will be conducted within 5 years after initiation of the interim remedial action to ensure that the interim remedy continues to provide adequate protection of human health and the environment. Hazardous substances and pollutants or contaminants remain above UU/UE in other OUs at the Site following response actions; because of this a Five-Year Review of these actions was completed by EPA in 2020. The next Five-Year Review of the Site will be performed by no later than 2025 and will include this interim action.

IROD Data Certification Checklist

The following information is included in the Decision Summary section (Part 2) of this IROD. Additional information can be found in the Administrative Record file for the Site (see Appendix C).

IROD Data		Section
☒	Chemicals of concern and their respective concentrations.	Section 5.4: Nature and Extent of Contamination
☒	Baseline risk represented by the chemicals of concern.	Section 7.1.5: Human Health Risk Summary Section 7.2.7: Ecological Risk Summary
☒	Rationale for not selecting cleanup levels.	Section 12.1: Rationale for the Selected Remedy Section 12.2.1: Cleanup Levels
☒	Current and reasonably anticipated future land use assumptions used in the baseline risk assessment and IROD.	Section 6: Current and Potential Site and Resource Uses Section 7.1.2: Exposure Assessment
☒	Potential land use that will be available at the Site because of the selected Interim Remedy.	Section 12.4: Expected Outcomes of the Selected Interim Remedy
☒	Estimated capital, annual operation and maintenance costs, and total present worth; discount rate; and the number of years over which the Interim Remedy cost estimates are projected.	Section 12.3: Summary of Estimated Interim Remedy Costs
☒	Key factors that led to selecting the Interim Remedy.	Section 12.1: Rationale for the Selected Interim Remedy

Authorizing Signatures

This IROD documents the selected interim remedy for sediment at the East Waterway Operable Unit of the Harbor Island Superfund Site. This interim remedy has been selected by EPA with the concurrence of the Washington State Department of Ecology (see Appendix A for the State concurrence letter).

U.S. ENVIRONMENTAL PROTECTION AGENCY

By:______________________	Date: May 28, 2024

Barry Breen, Principal Deputy Assistant Administrator

Office of Land and Emergency Management

Part 2: Decision Summary

Section 1 Site Name, Location, and Brief Description

The Harbor Island Superfund Site (Site) is in Seattle, Washington. The U.S. Environmental Protection Agency (EPA) is the lead agency for the Site, and the Washington State Department of Ecology (Ecology) is the support agency for the Site.

The East Waterway Operable Unit (EW OU) is one of seven operable units (OUs) of the Site addressed by EPA. The East Waterway is part of the Duwamish River estuary and is located at the confluence with Elliott Bay. It was constructed in 1905 by dredging and filling the former Duwamish River channel during the construction of Harbor Island. The EW OU extends 8,250 feet (about 1.5 miles) along the eastern side of Harbor Island, encompassing approximately 157 acres. A Federal navigation channel within the EW OU was established by Congress in 1919 is. The northern portion of the waterway is dredged to depths needed for deep-draft container ship navigation, while the southern portion is maintained to accommodate smaller vessels. The EW OU is located immediately downstream (north) of the Lower Duwamish Waterway Superfund Site (LDW) (see Figure 1).

Over the past 100 years, the East Waterway has been substantially modified to support urban and industrial development. Historical activities along the East Waterway include marine terminals, shipyards, bulk fuel terminals, recycling and scrap metal yards, cement manufacturing, small boat marinas, and boat manufacturing and repair. Today, the East Waterway remains an active industrial waterway and is used primarily as a container ship terminal.

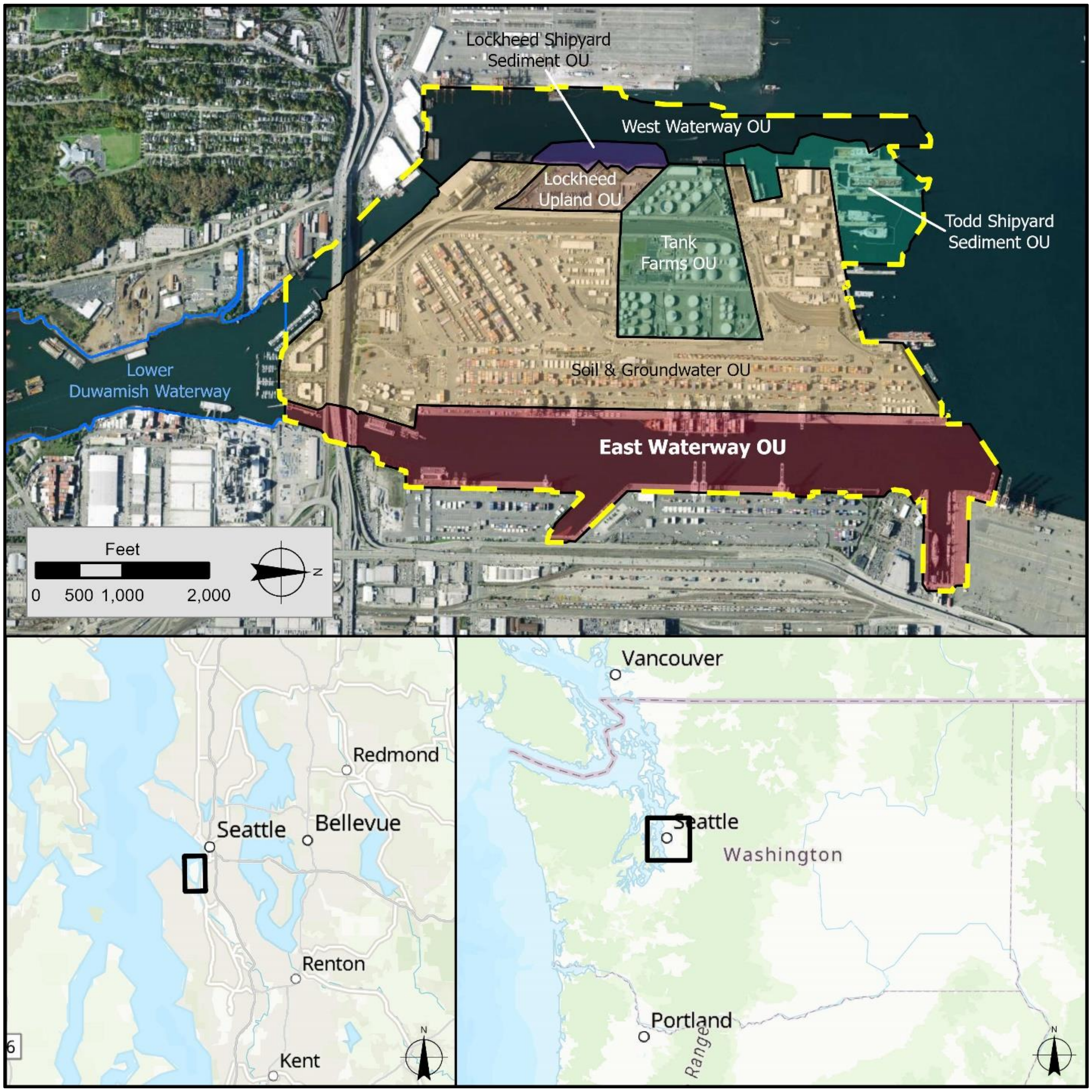

Figure 1. Location of the East Waterway Operable Unit

Section 2 Site History and Enforcement Actions

This section provides the history of the EW OU, describes past activities that have led to the current contamination, and details previous Federal and State investigations and cleanup actions conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601 et seq. and other authorities.

2.1 History of Site Use

Early industrial and commercial use of the EW OU was originally focused on the eastern shore and consisted of fish processing facilities, shipyards, and facilities with flour mills, grain elevators, lumber yards, and cold storage. Wharves constructed on creosoted piles were built in the early 1900s along both sides of the East Waterway. Commercial and industrial use occurred throughout the waterway, including oil terminals (constructed in 1929), shipyards, rail transfer terminals, lead smelter, cold storage, lumber yards, and sand and gravel transfer stations. Raw sewage was discharged into the East Waterway until 1958, when King County began directing wastewater to the West Point Treatment Plant.

By 1919, the East Waterway was an authorized Federal navigation channel. Dredging in the East Waterway has been conducted to maintain and deepen existing berths and to deepen part of the Federal navigation channel. As of 2018, the northern portion of East Waterway has an authorized depth of -57 feet mean lower low water (MLLW) and the southern portion is -34 feet MLLW. The main channel has been dredged at least 13 times since 1960 to maintain the authorized depth (Figure 2).

2.2 Previous Investigations

An initial remedial investigation was completed by EPA for the Harbor Island Superfund Site in 1993 (Weston, 1993). That remedial investigation focused primarily on the upland OUs of the Site. In 2006, additional work began to specifically characterize the EW OU. Together, the Port of Seattle, the City of Seattle, and King County make up the EWG, which has been performing or funding investigations and studies of the EW OU. A supplemental remedial investigation (SRI) focusing on the EW OU was completed in 2014 (Windward and Anchor QEA, 2014), and a feasibility study (FS) was completed in 2019 (Anchor QEA and Windward, 2019). The SRI and FS were performed by the Port of Seattle under the supervision of EPA. The nature and extent of contamination in the EW OU and alternatives for remediation of that contamination are detailed in the SRI/FS.

2.3 History of Enforcement Activities

An Administrative Settlement Agreement and Order on Consent (ASAOC) for the SRI/FS was entered into between the EPA and the Port of Seattle on October 20, 2006, in CERCLA Docket No. 10-2007-0030. The Port of Seattle, with funding assistance provided by King County and the City of Seattle, completed the SRI/FS in accordance with the ASAOC.

2.4 Previous Response Actions

The Port of Seattle performed a removal of some of the most contaminated sediments in the EW OU pursuant to Administrative Order on Consent, EPA Docket No. CERCLA-10-2003-0166, issued by EPA on September 9, 2003. The non-time-critical removal action conducted by the Port of Seattle from 2004-2005 addressed an area of the EW OU with sediment containing the greatest contaminant mass.

The removal action is detailed in the Phase 1 Removal Action Completion Report (Anchor and Windward, 2005). The removal area consisted of 20 acres in the middle to south portion of the EW OU (Figure 2). The following actions were completed as part of the Phase 1 Removal Action:

- Dredging 273,300 cubic yards (cy) of sediment.
- De-watering 206,000 cy sediments not suitable for open water disposal at an upland staging area prior to disposal at an off-site landfill. The remaining 67,000 cy of dredged sediment suitable for open-water disposal were disposed of off-site.
- Placing a 10-inch layer (19,100 cy) of clean sand in the contingency dredge area (an area that required additional dredging to achieve project goals)
- Placing 750 cy of gravel to cover the new cut-back surface at the entrance to Slip 27 (the Mound Area).

In addition to the Phase 1 Removal there has been dredging to maintain the authorized depths in the Federal channel. While not cleanup actions, they have removed sediment from the EW OU.

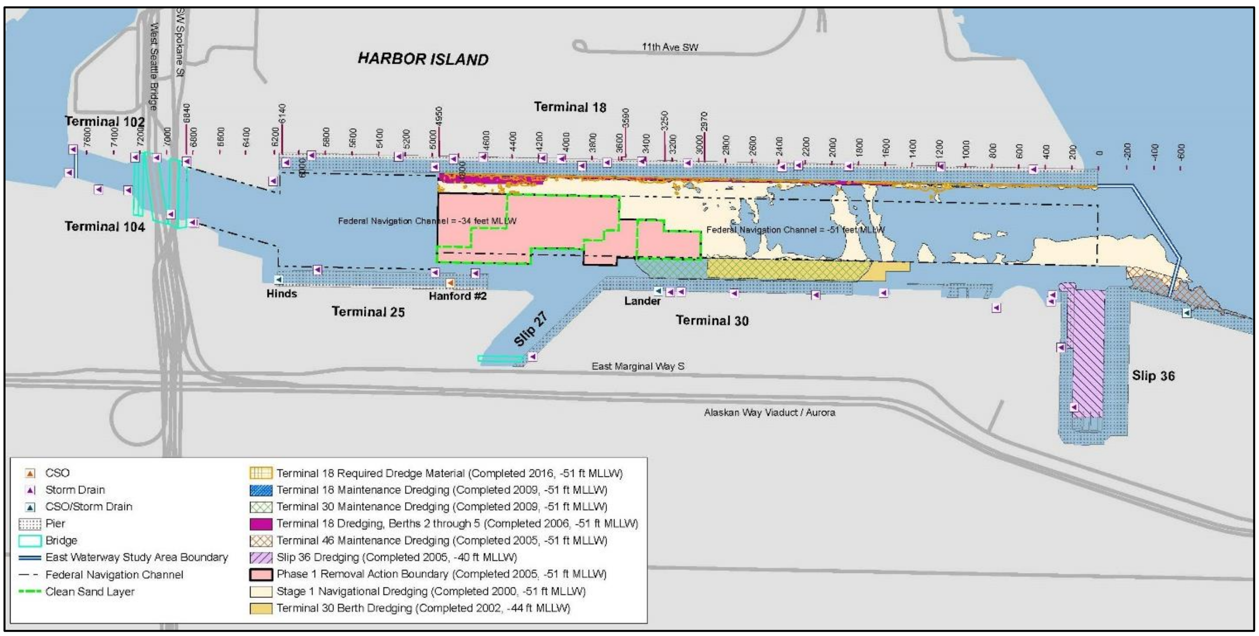

Figure 2. Maintenance Dredging and Phase 1 Removal Action Areas

Section 3 Community and Tribal Participation

EPA, along with Ecology and the EWG, have conducted public involvement activities during the EW OU work. Fact sheets, emails, informational signs, public meetings, and a website that provides the history and current cleanup activities at the Harbor Island Superfund Site have been used to communicate with the community, local businesses, and other stakeholders. An updated draft EPA Community Involvement Plan (CIP) for the Harbor Island Superfund Site (including the EW OU) was released for public comment in January of 2023, and a final CIP will be released in 2024. An environmental justice review will be completed as part of the final Harbor Island Superfund Site CIP. Community groups, including the Duwamish River Community Coalition, Fisher Community Health Advocates, and the Duwamish River Accountability Group, have played a significant role in community outreach, particularly for the fishing community.

The Proposed Plan describing the interim remedial actions for the EW OU was made available to the public in April 2023. The Proposed Plan, along with the SRI/FS reports, can be found in the Administrative Record and can be downloaded from the project webpage for the Site: http://epa.gov/superfund/harbor-island. The notice of the availability of the Proposed Plan was published in the Seattle Times on April 20, 2023. Additional public notices were placed in El Siete Dias (translated into Spanish), the Georgetown Gazette, the South Seattle Emerald, the West Seattle Blog, and the Vietnamese Today Weekly News (translated into Vietnamese). A public comment period was held from April 28 to August 11, 2023. A radio ad in Spanish was run in the Amigos de Seattle on May 25th, 2023 and ran for one month. In addition, two public meetings were held: a virtual public meeting on May 25, 2023, and an in person- public meeting on June 3, 2023. The purpose of the public meetings was to present the Proposed Plan to a broader community audience than those who had already been involved at the EW OU. At these meetings, representatives from EPA and Ecology answered questions about contamination at the EW OU and the remedial alternatives set forth in the SRI/FS. EPA also used these meetings to solicit input from a wider cross-section of community on the reasonably anticipated future use of the East Waterway and associated upland areas. EPA's response to the comments received during this period is included in the Responsiveness Summary, which is Part 3 of this IROD.

The EW OU is within the usual and accustomed fishing areas for the Muckleshoot Indian Tribe, the Suquamish Tribe, and the Confederated Tribes of the Yakama Nation. Treaty rights held by these Tribes include the custom and practice to hunt, fish, and gather within their usual and accustomed grounds and stations, which are the basis of the Tribe's source of food and culture. Treaty-reserved resources situated on and off reservations include, but are not limited to, fishery resources situated within each Tribe's usual and accustomed fishing area. These Tribes, as sovereign nations, have directly engaged with EPA on the EW OU investigation and cleanup process. The Tribes have also actively participated in meetings evaluating the course of the investigation and cleanup. Coordination by EPA with the Tribes will continue throughout the planning, construction, and monitoring of the interim remedial action.

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Section 4 Scope and Role of the Operable Unit or Response Action

The EW OU is one of seven operable units (OUs) of the Harbor Island Superfund Site (see Figure 1. EPA has been working since 1983 to address the risks posed at the Site by addressing the contaminated media associated within each OU. Final remedies have been selected and implemented at six of the CERCLA OUs. The EW OU is the last operable unit in the Harbor Island Superfund Site to be addressed. The following are brief summaries of the remedies at the other OUs shown on Figure 1:

- **Soil and Groundwater OU (OU-01):** The remedy was selected by EPA in 1993 and modified by EPA in 1994, 1996, and 2001. The selected remedy (soil excavation, soil capping, and removal of liquid contaminants) was completed in 2012. Institutional controls, a component of the remedy, have been mostly implemented by EPA and the property owners; however, some controls remain to be addressed. Annual groundwater monitoring continues to take place. The remedy is performing as designed and continues to be protective of human health and the environment.
- **Tank Farms OU (OU-02):** This OU is managed by Ecology under the Washington State Model Toxics Control Act (MTCA) because it involves only a release of petroleum, which EPA cannot address under CERCLA. Ecology issued Cleanup Action Plans for the three OU-02 facilities in 1999 and 2000. The selected remedy (soil excavation, in situ remediation via air sparging and soil vapor extraction, and institutional controls) is ongoing. The remedy is performing as designed and remains protective under MTCA.
- **Lockheed Upland OU (OU-03):** The remedy was selected by EPA in 1994. The selected remedy (soil excavation, soil capping) was completed in 1995. The remedy also includes institutional controls that have not yet been fully implemented. Although tetrachloroethene concentrations greater than established cleanup levels have been reported, porewater sampling indicates that the remedy remains protective of human health and the environment.
- **Lockheed Shipyard Sediments OU (OU-07):** The remedy was selected by EPA in 1996 and modified in 2002 and 2003. The selected remedy (removal of in- and over-water structures, dredging and capping sediment) was completed in 2005. Source tracing for sediment cap recontamination from an off-site source is expected to be completed soon. Based on those results, EPA will work with Ecology to develop and evaluate whether additional action is needed. The remedy remains protective of human health and the environment.
- **West Waterway Sediments OU (OU-08):** The Record of Decision (ROD) was issued by EPA in 2003, determining that no action was warranted under CERCLA at this OU.
- **Todd Shipyards Sediments OU (OU-09):** A ROD was issued by EPA in 1996 and modified by EPA in 1999 and 2003. The selected remedy (removal of over-water structures, sediment dredging, and sediment capping) was completed in 2007. Additional sediment cleanup occurred 2021--2023 following removal of piers during a habitat restoration project. The remedy remains protective of human health and the environment.

East Waterway Operable Unit (OU 10)

The overall strategy for addressing contamination and the associated risks in the EW OU includes controlling sources of contamination and addressing the contaminated media that pose unacceptable risks. Control of sources that empty directly into the EW OU (lateral inputs) as well as sources throughout the watershed is occurring under various Federal, State, and local regulatory programs (see Section 5.3). Contaminated sediment is being addressed through this CERCLA interim remedial action. The primary objective of this interim remedial action is to remove or otherwise manage contaminated sediments in a manner that is protective of human health and the environment.

EPA selects this interim remedy that includes a combination of technologies, including dredging, capping, in situ treatment, enhanced natural recovery, monitored natural recovery, and institutional controls to address the entire EW OU. Actively addressing contaminated sediment will reduce contaminant concentrations in other contaminated media. EPA anticipates selecting cleanup levels in a future decision document based on data collected during and after construction of this interim action. The data collected will be used to evaluate the effectiveness of the interim action and of ongoing source control. A source control sufficiency assessment for lateral loading is being conducting by the EWG with oversight by EPA, and will need to be finalized prior to proceeding with remedial action. These data will provide EPA, the public, the State, Tribes, the EWG, and other stakeholders information needed to develop cleanup levels in the future.

The selected interim remedy provides the best tradeoffs compared to the other alternatives. Remediation of the EW OU will reduce contaminant concentrations in sediments within the waterway. In addition to implementation of the selected interim remedy, effective control of sources of contamination throughout the Green/Duwamish River Watershed, including as regulated or otherwise addressed under non-CERCLA authorities implemented by federal, state, and local governments, and the adjacent CERCLA cleanup of the Lower Duwamish Waterway will be essential to achieving EPA's long-term objective of reducing sediment concentrations to be protective of both human health and the environment. These combined efforts may allow the Washington State Department of Health to minimize associated seafood consumption advisories and will advance the possibility of reaching concentrations of PCBs in sediments that are at or near concentrations measured in non-urban background for Puget Sound (2 µg/kg).

Section 5 Site Characteristics

This section of the decision document is intended to provide a brief overview of the site characteristics as they relate to the selection of the remedial action. A more detailed account of the investigation activities for this site can be found in the January 2014 Supplemental Remedial Investigation report (SEMS Document No. 100030307) and the June 2019 Feasibility Study (SEMS Document No. 100189627).

5.1 Physical Setting

The EW OU is a 157-acre federally maintained waterway along the eastern side of Harbor Island. The EW OU is approximately 8,250 feet (1.5 miles) long, and for most of its length is 750 feet wide. The mudline elevations range from -60 to -6 feet MLLW; see the bathymetric maps in Figure 3. The tidal range in EW OU is approximately -4 to +14 feet MLLW.

The EW OU is divided into subareas with similar physical characteristics impacting construction needs, called construction management areas (CMAs). These CMAs are shown in Figure 4, detailed descriptions in Table 1, and summarized below.

The EW OU contains a Federal navigation channel for much of its length (Figure 3). The navigation channel within the northern portion of the Deep Main Body Reach is currently at a depth of -51 feet MLLW, but in 2018 Congress authorized an increased depth of -57 feet MLLW. The southern portion of the Deep Main Body Reach is authorized to -34 feet MLLW and is currently at approximately -51 feet MLLW. The navigation channel within the Shallow Main Body Reach is authorized to and maintained at a depth of -34 feet MLLW. The Sill Reach is characterized by a naturally occurring shallow area, or sill, with mudline elevations between -13 and -6 feet MLLW. The Junction Reach on the southernmost end where the EW OU adjoins with the Lower Duwamish Waterway has mudline elevations near -25 feet MLLW. There are two slips in the EW OU, Slip 36 and Slip 27, both with a berth elevation of -40 feet MLLW.

The EW OU main channel shoreline is artificially constructed, and primarily composed of over-water piling-supported piers, riprap slopes, seawalls, and bulkheads for industrial and commercial use. Approximately 60 percent of the EW OU shoreline contains over-water piers (aprons) above riprap slopes. Another 30 percent of the shoreline is exposed, nearly all of which is armored with riprap, including the entire area south of the Spokane Street Bridge corridor. A portion of the shoreline area does contain some small unarmored areas. The remaining 10 percent is comprised of steel sheet pile bulkheads with no overwater structure. No natural shoreline exists (Figure 5).

The shoreline within Slip 27 and Slip 36 is also developed, predominantly with armored riprap and pier structures. The southern shore of Slip 27 has an adjacent intertidal bench that was constructed during re-armoring of the Port of Seattle property. A limited number of exposed intertidal sediments are present above the riprap slopes in locations along the eastern shoreline of the EW OU, including at the head of Slip 27 (Figure 6).

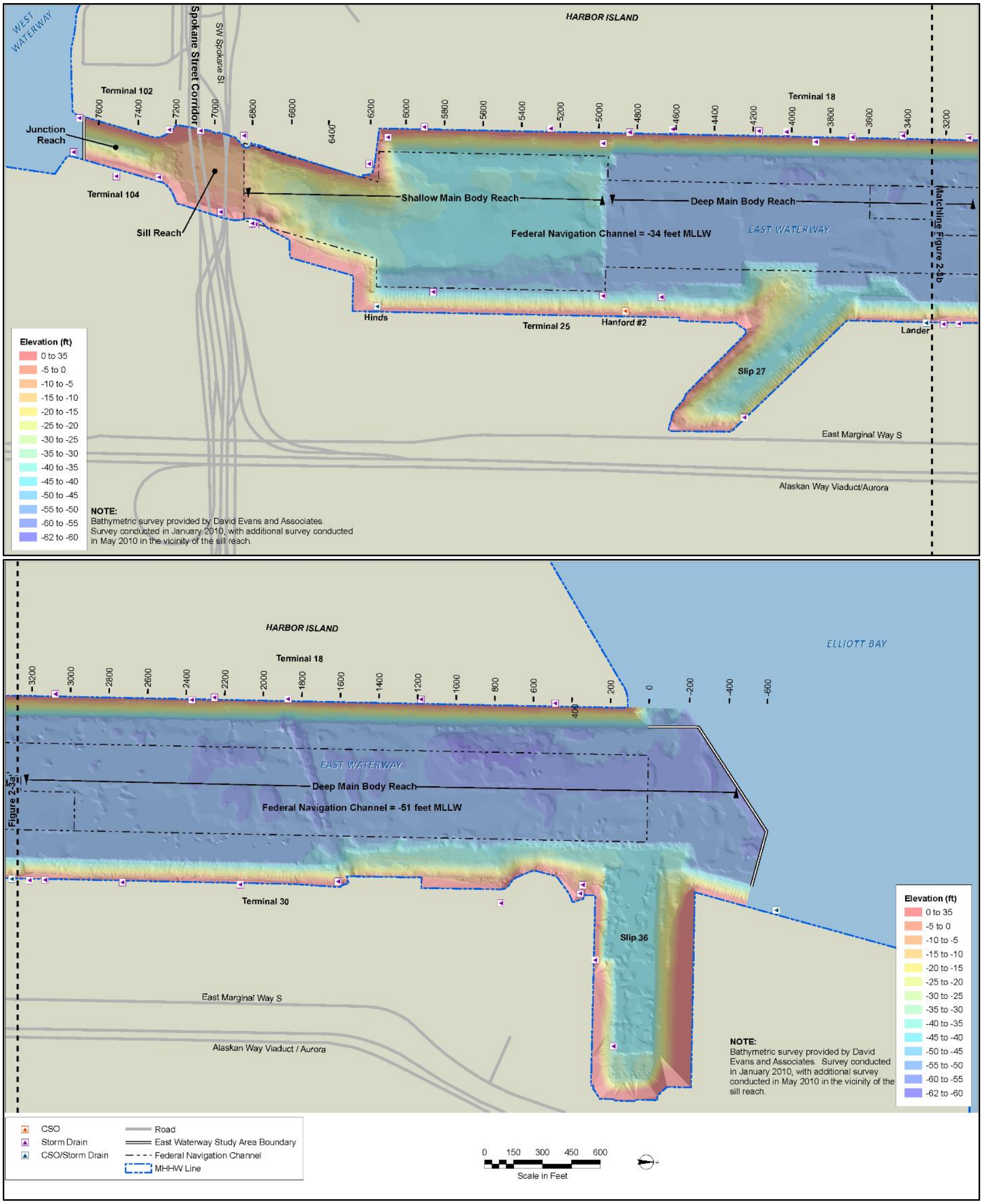

Figure 3. Bathymetry of the East Waterway Operable Unit

Many of the concrete wharves along the Main Body Reach are approximately 100 feet wide from the outer edge (fender line) to the inner bulkhead, which intersects the mudline at +9 feet MLLW. Substrate beneath the wharves is typically engineered riprap slope to approximately -50 feet MLLW (some areas to -40 feet MLLW).

A communication cable crosses the EW OU between T-18 and the northern portion of T-30. This cable was originally buried in 1972 in an armored trench between -61 and -66 feet MLLW. This area is designated as a unique CMA due to the presence of the communication cable.

The Deep Main Body Reach supports large commercial vessel traffic. Within the Sill Reach, in-water vessel access is limited to small vessels with shallow draft as depths range from -13 and -6 feet MLLW, and the low Spokane Street Bridge and the railroad bridge limit over-water clearance. Public access to the water is limited to the exposed shoreline at Jack Perry Park (Figure 6).

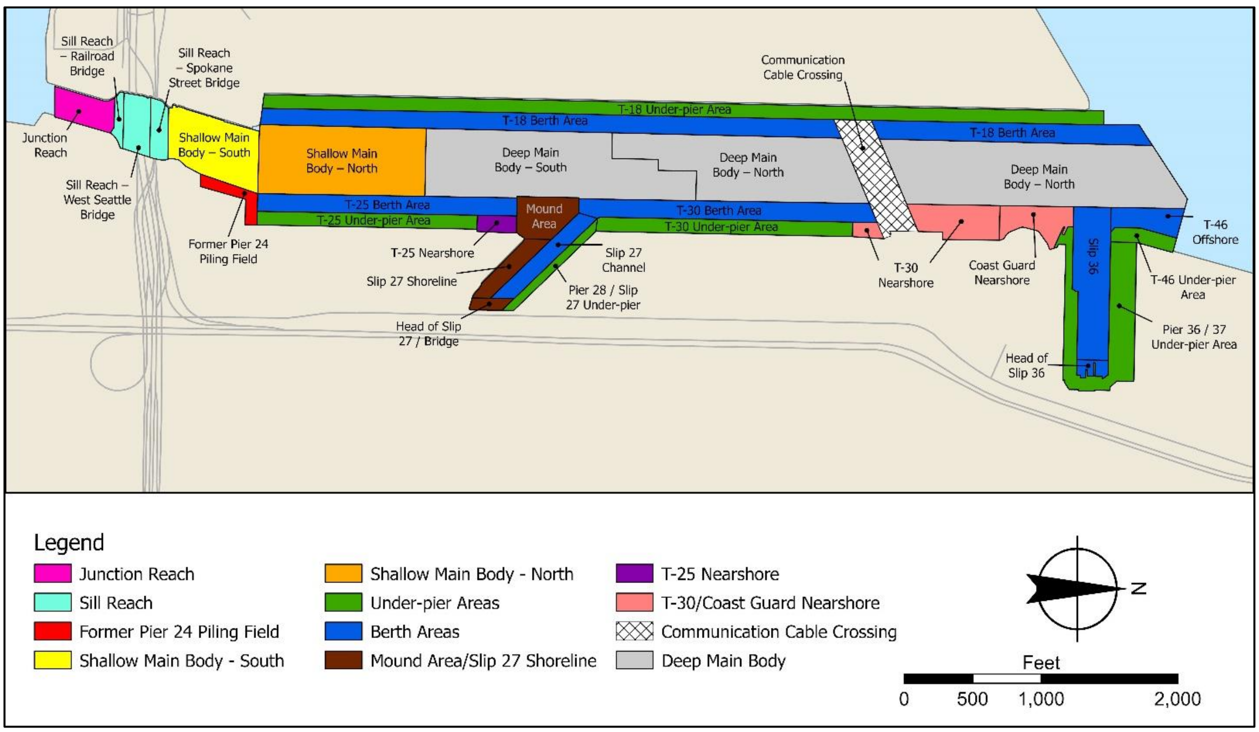

Figure 4. Construction Management Areas

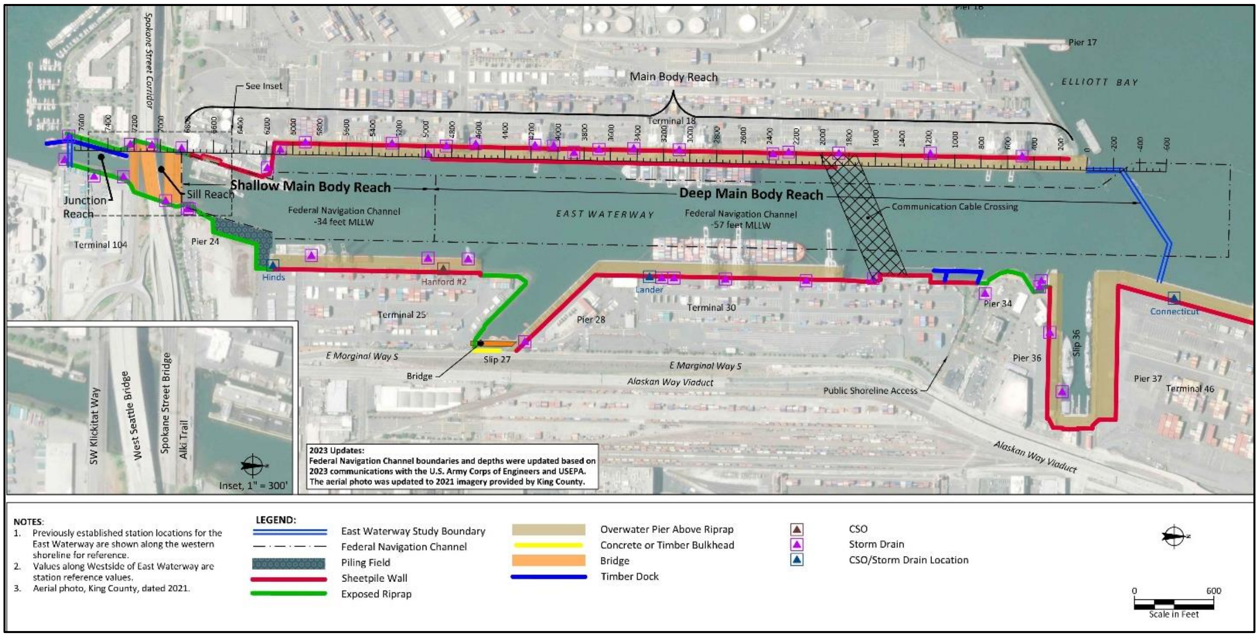

Figure 5. Shoreline Conditions and Structures in the East Waterway Operable Unit

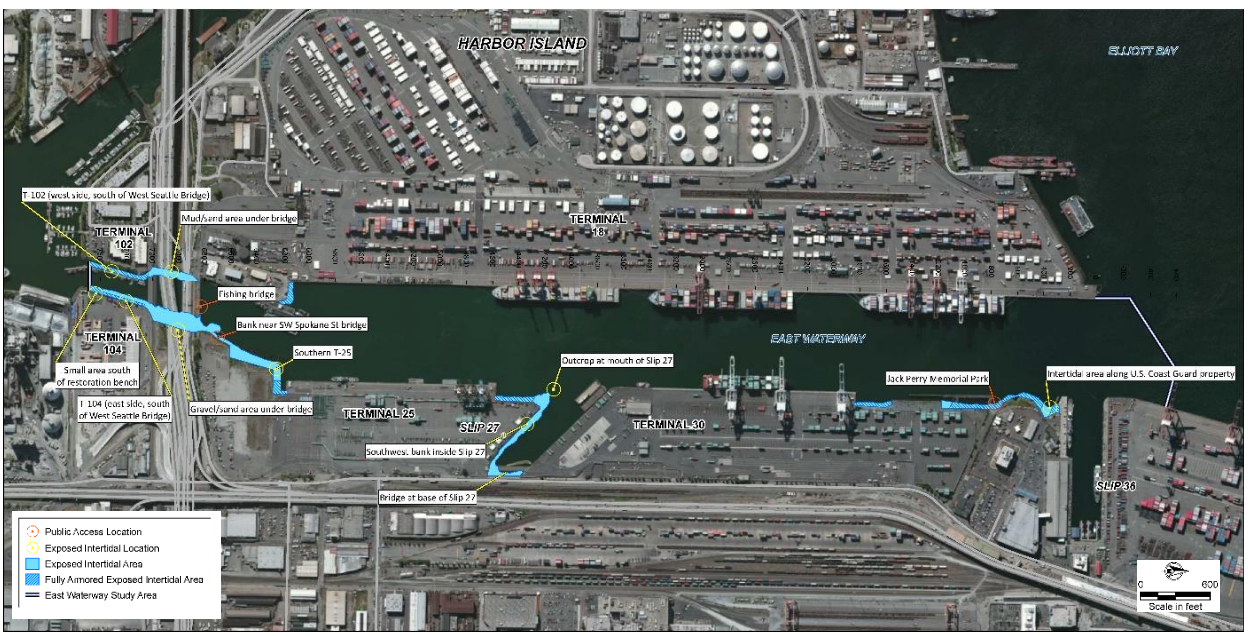

Figure 6. Exposed Intertidal Areas and Public Access Locations

Table 1. Construction Management Areas

Construction Management Area	Description	Structural Restrictions	Use, Habitat, and Water Depth Considerations
Junction Reach	Located south of the Spokane Street corridor and north of the junction with the Lower Duwamish Waterway Superfund Site (LDW). Both west and east sides of the EW OU in this area contain riprap slopes, with floats for small vessels along the west side of the waterway.	Piles and small vessel floats are present in the waterway, but present minimal structural restrictions in this area. It is assumed that dredging adjacent to the piles should be minimized, and dredging at the base of slopes should consider overall slope stability. Existing riprap slopes may limit the ability to conduct remediation immediately adjacent to the riprap slopes without slope improvements.	A shallow bench along the eastern shoreline at Terminal (T)-104 was constructed of fine-grained substrate and provides valuable shallow water habitat for juvenile migratory fish, and intertidal areas provide clam habitat. Small draft recreational and commercial boats move in and out of the Harbor Island Marina (T-102) from the LDW. Tribal netfishing may occur within this area.
Sill Reach	Located under the bridges in the Spokane Street corridor. Four bridge structures pass through this area, including the Spokane Street Bridge and Service Road Bridge between T-102 and T-104, West Seattle Bridge, and BNSF Railway (Railroad Bridge). Elevations in this area range from -4 to -11 feet MLLW.	The West Seattle bridge columns located in the water on each side of the EW OU are supported by a pile-supported footing or pile cap (approximately 26 feet by 32 feet each) with top of footing at approximately -7 feet MLLW. There are similar-sized pile caps for columns upland on each side of the EW OU. Additional areas adjacent to these columns may have seen some soil improvements that provide additional structural stability to the column and should be considered if significant soil were to be removed. The existing bridge structures limit access for equipment and may restrict removal and/or containment remedial actions underneath the bridges or immediately adjacent to the bridge structures. The bridge structures are considered critical infrastructure to transportation needs.	Clam habitat is present in intertidal areas. Habitat restoration is proposed for the west side of the EW OU under the West Seattle Bridge, which would provide off-channel mudflat and marsh habitat, along with riparian vegetation. The project would also involve removal of debris and creosote structures from the shoreline areas. The restoration is subject to Natural Resource Damage trustee approval, EPA coordination, and obtaining permitting from Federal, State, and City agencies. No timeline is established for construction.
Former Pier 24 Piling Field	A timber bulkhead and timber piles are present along the southern shoreline of Pier 24. The top of the existing bulkhead is lower than high tides. Removal is planned for these piles, a small pier, and in-water debris, which occupy approximately 2.1 acres of aquatic and shoreline area that are to be used for fish and wildlife habitat improvements. No timetable for this work is currently established based on the need to coordinate with CERCLA actions. This work may be completed in conjunction with the CERCLA action or may be conducted for habitat restoration purposes ahead of the CERCLA action.	Removal or cutting of piles would be required prior to implementation of remedial actions in this area. Structural condition of the existing bulkhead wall is severely deteriorated. As such, removal of the piles and/or any dredging in this area will require strengthening of this wall or removal of the wall plus associated upland grading to contour in-water and upland slope to final desired grades.	This area is potentially slated for Port of Seattle habitat restoration.
Shallow Main Body – South	Located north of the Sill Reach before the EW OU widens to its full 750-foot width. This area is used to moor tugs and barges along the western side, where a concrete bulkhead is present. There is also a wooden wharf pile-supported structure in-line and to the south of the concrete bulkhead. Details on the date and type of original construction of these structures are unknown. This CMA is within the portion of the Federal navigation channel authorized to -34 feet MLLW.	Design and construction details of the concrete bulkhead and timber wharf structure on the west side of the EW OU are unknown. The condition of the concrete structure is relatively poor, based on visual observation. Dredging adjacent to the bulkhead may cause structural impacts.	Numerous barges and tugboats are moored along the west side of the CMA. This CMA also contains a mound of rock placed in the southeast portion of this area specifically for habitat restoration purposes. The mound provides shallow water habitat just north of the Spokane Street pedestrian bridge. Tribal netfishing occurs within this area. Shoreline slope stabilization has recently been proposed along the northwest corner of this CMA (independent of CERCLA).
Shallow Main Body – North	Located north of where the EW OU widens to its full 750 feet and south of the navigation area maintained at -51 feet MLLW. This area extends approximately from Station 4950 to Station 6200 and is included in the portion of the Federal navigation channel authorized to -34 feet MLLW.	No structural restrictions.	The water depths in this area reach a maximum depth of -45 feet MLLW (except for the berthing area at T-25, which was designed for -50 feet MLLW). Some limited vessel navigation occurs in this area, including container ships to T-25 at high tide. Tribal netfishing occurs within this area.
Under-pier Areas	Under-pier areas apply to T-18, T-25, Slip 27, T-30, Pier 36/37, and T-46 and extend from approximately 125 feet shoreward of the pierhead line.	Due to very limited access to under-pier areas, only from the water, it is considered extremely difficult to remove sediments from the under-pier slopes. Specialized dredging equipment may be capable of removing some of the under-pier sediment, but not 100 percent of sediment. Any under-pier removal work would likely need to be conducted using diver assisted methods, and the risks for injury and death during construction will need to be weighed against long-term risk of leaving contaminated sediment in under-pier areas. Capping or placement of certain enhanced natural recovery (ENR) materials within the under-pier areas may be infeasible due to equipment access and placement issues. Also, the under-pier slopes are typically too steep to place a stable cap over them, and a potential drawdown effect on piling from placing material on the slopes may cause structural damage.	Under-pier areas provide habitat for rockfish and epibenthic food for salmon. However, in situ treatment in under-pier areas is not restricted based on habitat.

Construction Management Area	Description	Structural Restrictions	Use, Habitat, and Water Depth Considerations
Berth Areas (T-18, T-25, T-30)	Berth areas extend along T-18, T-25, and T-30 and are approximately 150 feet wide. Berth areas at T-18 and T-25 extend from the pierhead line into the Federal navigation channel.	Berth areas within the EW OU are actively used by a variety of vessels, the largest of which are container ships. Required berthing elevations typically match the former federal navigation channel's authorized elevation of -51 feet MLLW (deepened to -57 feet MLLW in 2018). Removal in front of these terminals may need to limit dredging depths and may include setback areas from the structures to avoid adversely impacting the existing pile-supported wharves. At T-18, a sheet pile wall was installed to provide slope stability to allow dredging along the toe of slope between approximate Stations 4950 and 1900 (terminating at Communication Cable Crossing CMA at bent 213). The capacity of the existing sheetpile wall limits any significant additional material removal at the toe of slope; the sheetpile was designed for a dredge elevation of -51 feet MLLW. The keyways at the base of riprap slopes at T-25 and T-30 are at approximately -50 feet MLLW. For T-18 south of Station 4950, no sheetpile wall exists; T-25 has not had any significant structural berth deepening performed since initial construction in the 1970s. As such, it is unlikely that the structure can accommodate dredging below the initial design dredge elevation. Recent improvements at T-30 (accomplished by the Port of Seattle in 2007) were completed to allow for dredging in the berth area to -50 feet MLLW.	Along T-18, berthing area elevations are -51 feet MLLW from Station 0 to 4950. Berth 6 (south of Station 4950) depths at T-18 are approximately -35 to -40 feet MLLW. Along T-25, berthing area elevations are -50 feet MLLW. Along T-30, berthing area elevations are -50 feet MLLW. Tribal netfishing occurs within these areas.
Slip 27 Channel & Pier 28	Slip 27 is located on the east side of the EW OU, between T-25 and T-30. It is 850 feet long and 240 feet wide. Pier 28 is the concrete structure located on the north side of Slip 27.	A 34-foot-wide truck bridge is present in the eastern portion of Slip 27 connecting T-25 and T-30. This bridge is located to the west of a structural bulkhead wall. The wall and bridge will likely limit the maximum depth of dredging in this area. Pier 28 is a concrete deck and concrete pile structure that is considered at or near the end of its useful life. Structural observations of this facility in 2001 indicate that the pier is deteriorated.	Miscellaneous vessels berth in Slip 27. Pier 28, at the northern portion of the slip, is currently used to berth various vessels and barges. The Slip 27 and Pier 28 areas provide shallow water habitat for juvenile migratory fish, and intertidal areas provide clam habitat. Tribal netfishing occurs within this area.
Slip 36 & T-46 Offshore	Slip 36 is located on the east side of the EW OU, between Pier 36 and Pier 37. It is approximately 1,200 feet long and 300 feet wide.	Recent construction work on Pier 36 and within Slip 36 included dredging the berth areas to -40 feet MLLW. Further sediment removal may be limited without structural impacts. Recent dredge work at Terminal 46 determined that a non-structural maintenance dredge was possible to allow a berth depth of -51 feet MLLW. Further deepening of the berth area along the west face of the Pier 46 apron would likely require associated structural improvements.	The U.S. Coast Guard (USCG) vessels frequent Slip 36, which serves Pier 36 (south) and Pier 37 (north). The western half was dredged to -40 feet MLLW in 2005. USCG berths numerous vessels in Slip 36 and has U.S. Department of Homeland Security access restrictions.
Mound Area, Slip 27 Shoreline, & Head of Slip 27/Bridge	This area is located on the east side of the EW OU just south of the mouth of Slip 27 and along the southern and eastern shoreline of Slip 27. It is open slope, typically with a riprap face.	It is possible that structural walls could be necessary to accomplish significant removal of material along this slope without impacting the slope and/or yard area above.	The upland areas along the southern part of Slip 27 have been replanted as part of habitat restoration. The restoration extends from the top of bank (18.5 feet MLLW) down to 12 feet MLLW. The shallow water and intertidal areas also provide habitat for clams and juvenile salmon. Tribal netfishing occurs within this area.
T-25 Nearshore	This area is located on the east side of the EW OU, between the T-25 Pier and the Mound Area. It is open slope, typically with a riprap face.	It is possible that structural walls could be necessary to accomplish significant removal of material along this slope without impacting the slope and/or yard area above.	The shallow water and intertidal areas also provide habitat for clams and juvenile salmon. Tribal netfishing occurs within this area.
T-30 Nearshore & Coast Guard Nearshore	This area is located on the east side of the EW OU, between Slip 27 and Slip 36.	This area includes several deteriorated structures including remnant piers and both sheetpile and rock bulkhead walls. The specific structural condition of all structures is unknown but appears to be severely deteriorated, suggesting that additional dredging and slope modifications would be problematic without associated structural improvements. This IROD assumes that the derelict structures may be removed to facilitate remediation as needed.	Jack Perry Park is a 1.1-acre park located north of T-30 and south of the USCG facility. It provides 120 feet of intertidal area and shoreline access for public recreational activities. Smaller vessels, such as tugboats, barges, and Tribal fishing vessels navigate in this nearshore area. Future development along the shoreline of T-30 is possible, which could result in water depth requirements of -50 feet MLLW (the same as the current T-30 berth area water depth requirements). Shoreline areas provide shallow water habitat for juvenile migratory fish, and intertidal areas provide clam habitat. Tribal netfishing occurs within this area.

Construction Management Area	Description	Structural Restrictions	Use, Habitat, and Water Depth Considerations
Communication Cable Crossing	A communications cable crosses the EW OU between T-18 and the northern portion of T-30. This cable was originally buried between -61 and -66 feet MLLW in 1972 in an armored trench. The location shown on Figure 7-1 changed following repair due to a vessel anchor incident at T-18. During the T-18 North Apron Upgrade in 2006, the existing crossing at the T-18 face of bullrail was located between bents 213 and 214 (Station 1850). On the T-30 side, the approximate crossing location is indicated by a visible marker on the shore (Station 1550).	For the purposes of this IROD, it is assumed that the depth of sediment removal may be limited in this area by the presence of the cable crossing.	Water depths in the footprint of the cable crossing range from - 53 feet MLLW to -59 feet MLLW in the Federal channel and berth areas. Vessel use is similar to the navigation channel, T-18, and T-30. Tribal netfishing occurs within this area.
Deep Main Body – North	The Deep Main Body – North is 450 feet wide and extends from Station 0 to between Stations 2970 and 3590, depending on location (boundary varies from east to west as shown on Figure 7-2). In 2018 the authorized channel depth was increased to -57 feet MLLW, and but currently maintained to -51 feet MLLW.	No structural restrictions	The authorized channel elevation of -57 feet MLLW is required to support movement of large container ships throughout the EW OU. Most vessel traffic consists of shipping companies moving container ships and assorted tugboats into and out of the EW OU. Each container ship requires at least one tugboat to maneuver the ship during docking and undocking. Container ships call at T-18, T-25, and T-30. Other vessels, such as tugboats, barges, and USCG vessels, regularly use the navigation channel. Also note the Communication Cable Crossing CMA described earlier in this table. Tribal netfishing occurs within this area.
Deep Main Body – South	The Deep Main Body – South is 450 feet wide and extends from Station 4950 to between Stations 2970 and 3590, depending on location (boundary varies from east to west). It is within the Federal navigation channel and is authorized to -34 feet MLLW but is maintained to -51 feet MLLW.	No structural restrictions.	Maintenance of this portion of the authorized channel to -57 feet MLLW is required to support movement of large container vessels into berthing areas at T-18 and T-25. Most vessel traffic consists of shipping companies moving container ships and assorted tugboats into and out of the EW OU. Each container ship requires at least one tugboat to maneuver the ship during docking and undocking. Container ships call at T-18 and T-25. Other vessels, such as tugboats, barges, and USCG vessels, regularly use this area. Tribal netfishing occurs within this area.

Notes:
CMA – Construction Management Area
ENR – enhanced natural recovery
EW – East Waterway
EW OU – East Waterway Operable Unit
FS – Feasibility Study
LDW – Lower Duwamish Waterway Superfund Site
MLLW – mean lower low water
Port – Port of Seattle
T - Terminal
USCG – U.S. Coast Guard

5.1.1 Geology

The geologic setting has been influenced both by natural and anthropogenic events, particularly the channelization of the waterway and placement of fill in the adjacent uplands. The East Waterway lies in a north-south trending glacially scoured trough that is part of the Duwamish River delta at the north end of the Greater Duwamish Valley. The trough contains post-glacial alluvium up to 200 feet thick and is bounded by upland plateau regions composed of thick sequences of Pleistocene glacial deposits, placed approximately 15,000 years ago.

Three main geological units are recognized in the Duwamish Valley and include a lower assemblage of volcanic sedimentary rocks, known as the Tukwila Formation; an upper unit of arkosic sedimentary rocks, known as the Renton Formation; and the younger Blakely Formation, which overlies these units. The Blakely Formation ranges from 50 feet to approximately 1,000 feet below ground surface (bgs) and is composed of marine sandstone, conglomerate, and siltstone. Bedrock units throughout the Duwamish valley range from impervious to relatively impervious.

Most of the upland fill east and west of the EW OU is hydraulic fill dredged from the channel of the Duwamish River, estimated to be 15 to 35 feet bgs in the east uplands and between 3 to 15 feet bgs in the west uplands (Harbor Island). Beneath the alluvium, very dense, till-like glacial sediments were measured at depths ranging from approximately 115 to 135 feet bgs.

5.1.1.1 EW OU Sediment

The three stratigraphic subunits within the EW OU are comprised of recent silts overlying alluvial, deltaic sediments. These, in turn, overlie deeper alluvial, deltaic deposits associated with early and pre-industrial time periods. In some areas, dredging and site use have altered the depths at which these units outcrop compared to initial deposition. The bottom substrates of the EW OU are typically mud, sand, gravel, cobble, or riprap. Most sediment samples consisted primarily of clay and silty sand, with an average of approximately 40 percent sand and 50 percent fines (silt and clay). More fines are present in sediments in the central and northern portions of the EW OU than in the vicinity of the Spokane Street corridor, due to shallower water and higher tidal velocities in the Spokane Street corridor. Under-pier areas are armored with riprap and generally contain sediment only in the lower portions of the slope.

The primary stratigraphic units are, from top (mudline) to bottom:

- **Recent:** This upper unit consists of recently deposited material dominated by unconsolidated organic and inorganic silt. The surface fraction of silt often contains fine sand and gravel. This material is characterized by higher moisture content, soft to medium stiff density, smooth and homogenous texture, and higher visible organic matter compared with the underlying materials. Shell fragments, decomposed wood, and anthropogenic materials are present scattered vertically throughout the unit (rather than in distinct layers as is common in lower units). A hydrogen sulfide odor is common.
- **Upper Alluvium/Transition:** This middle unit forms a transition between the Recent and Lower Alluvium units. The Upper Alluvium unit has characteristics that are a mix of the units lying above and below it. It consists of a mixture of silty sand and sandy silt matrices with a higher density and a higher percentage of sand compared with the Recent unit. Pockets of inorganic and organic silt, layers of decomposed wood, and shell fragments are often present.

- **Lower Alluvium/Native:** This base unit is predominantly a sand matrix with laminated and stratified beds of slightly silty to silty sand, and silt. The sand matrix consists of multicolored grains of red, beige, black, white, and gray. Layers of un-decomposed wood and shells are often present in the matrix. The Lower Alluvium sand unit typically grades to stiff, inorganic silt as depth increases.

The Recent and Upper Alluvium units are generally found between 0 to 5 feet below mudline and primarily consist of fines (silt and clay) and sand. Gravel-sized particles (including shells) are primarily present in the upper layers (0 to 3 feet below mudline). Below 5 feet in the Lower Alluvium, grain size increases, consisting of sand with lesser amounts of fines than upper units, and trace amounts of gravel.

5.1.2 Surface Water Hydrology

The EW OU is directly adjacent to Elliott Bay and is a saltwater body, with the majority of the water column remaining saline under the 100-year flow conditions. It also receives freshwater flow from the Green River/Duwamish River watershed (approximately 362,000 acres). Hydrodynamic circulation in the EW OU is controlled by tidal exchange with Elliott Bay to the north and freshwater inflow from the Green River (through the LDW) in the south. Tidal range within the waterway is approximately -4 to +14 feet MLLW.

Flow can be generally described as two-layer flow, with saltwater extending from Elliott Bay upstream through the EW OU and into the LDW, underneath a thin layer of fresher water flowing downstream from the Green River via the LDW. Rivers that historically flowed into the Green River were diverted in the early 1900s, reducing the volume of water entering the LDW and EW OU by approximately 70 percent. Water flows are now managed approximately 65 miles upstream by the Howard Hanson Dam, constructed in 1961. As a result, peak flows are much smaller, with maximum flows rarely exceeding 12,000 cubic feet per second (cfs). Average river flows are estimated to be 1,340 cfs. These conditions influence the hydrodynamic and sediment transport processes in the EW OU.

The EW OU receives freshwater discharges from 39 outfalls, including 36 storm drains (SDs), one combined sewer overflow (CSO), and two CSO/SDs (Figure 7). The two outfalls that are shared by separated SDs and CSOs are the Hinds and Lander CSO/SDs. These CSO/SD outfalls and the Hanford CSO outfall discharge along the eastern shoreline of the EW OU. The stormwater-only outfalls are located along both sides of the waterway. Discharges from these outfalls are intermittent, and the relative contribution of freshwater flows from the outfalls is small in comparison with flows from the Green River/Duwamish River.

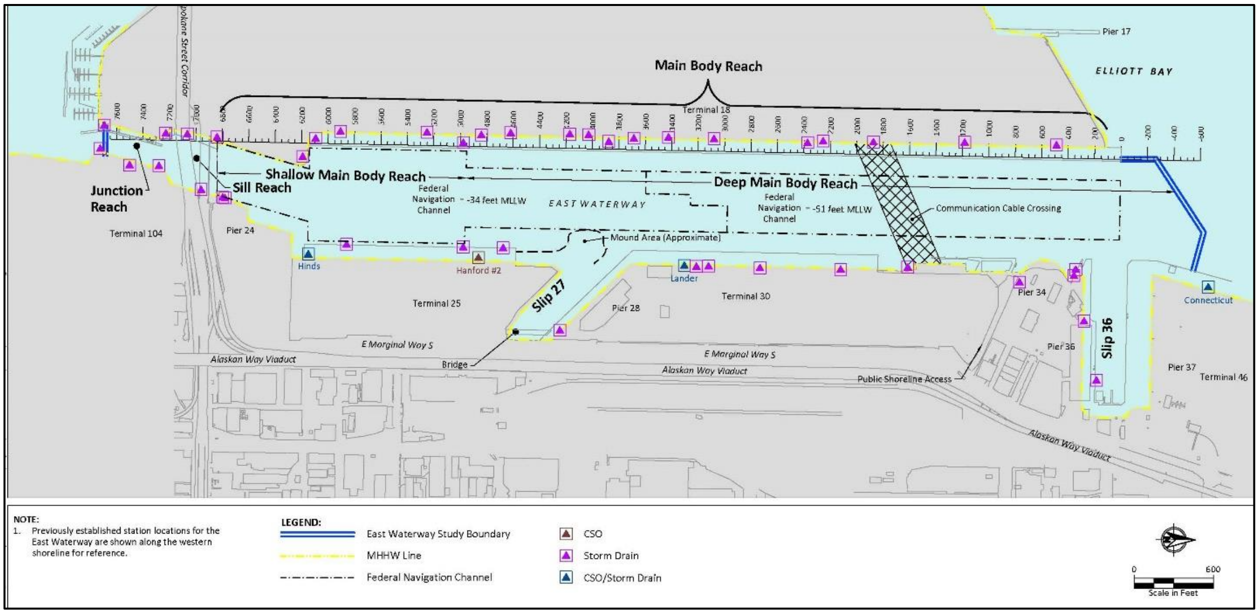

Figure 7. Outfalls into the East Waterway Operable Unit

5.1.3 Hydrogeology

Bedrock in the Greater Duwamish Valley provides the lower boundary of the aquifer system, restricting groundwater flow in the basin. The aquifer in the vicinity of the EW OU is a shallow, unconfined aquifer within fill and alluvial, deltaic, and estuarine sediments. Shallow groundwater (approximately 8 to 14 feet bgs) in the adjacent nearshore areas primarily flows toward the EW OU and discharges within the tidal zone. The installation of sheet pile walls along many of the bulkheads has reduced, but not eliminated, mixing of surface water and groundwater. The aquifer extends deeper than the walls, so that the overall groundwater flow continues to be towards the waterway, with an estimated average horizontal groundwater gradient of 0.003 feet per foot. Hydraulic conductivity is estimated to be 1 x 10-2 centimeters per second (cm/s), typical of an aquifer matrix composed of medium sand. Average groundwater velocity is calculated as 2.5×10^{-4} cm/s, with water table elevation velocities ranging from 1.9×10^{-4} to 8.8×10^{-4} cm/s, and deeper groundwater velocities ranging from 8.1×10^{-5} to 1.2×10^{-4} cm/s.

Extensive nearshore groundwater and seep information is available for nearshore cleanup sites throughout the EW OU. These data were developed during previous investigations and cleanup activities. In general, contaminant concentrations were near or below reference values. While there have been some discrete detections of metals (zinc, arsenic, and mercury) and polycyclic aromatic hydrocarbons (PAHs), they have not been directly linked to sediment contamination. Groundwater monitoring is ongoing to confirm the absence of groundwater sources to EW OU sediments.

5.1.3.1 Surface Water/Groundwater Interactions

Where the groundwater and tidally influenced nearshore surface water interact (landward of the slope armoring), mixing results in brackish groundwater (primarily deeper and waterward of the sheet pile wall). The area of tidal mixing is within approximately 50 feet from the shoreline. The effects of tidal mixing on nearshore groundwater prior to discharge into the EW OU indicate that in the nearshore environment, freshwater overlies denser saltwater and thereby confines freshwater to the upper portion of the aquifer; and upland groundwater mixes with saline groundwater prior to discharging at the shoreline, meaning there is no direct discharge of fresh water to the EW OU. Rather, it is all tidally mixed, and tidal influx results in dilution and attenuation of groundwater between nearshore wells and the shoreline.

5.2 Conceptual Site Model

A conceptual site model (CSM) was developed for the EW OU and is presented in detail in the FS and is depicted on Figures 8 and 9. The CSM describes the relationships between the sources of contamination, the affected environmental media (including sediment, biota, surface water, groundwater, and air), and the people and wildlife that are potentially exposed to hazardous substances, pollutants, and contaminants. This conceptual site model serves as a basis for assessing the risks from the contamination and for developing cleanup strategies. The following sections summarize the different elements of the conceptual site model. The conceptual site exposure models are further detailed in Section 7.

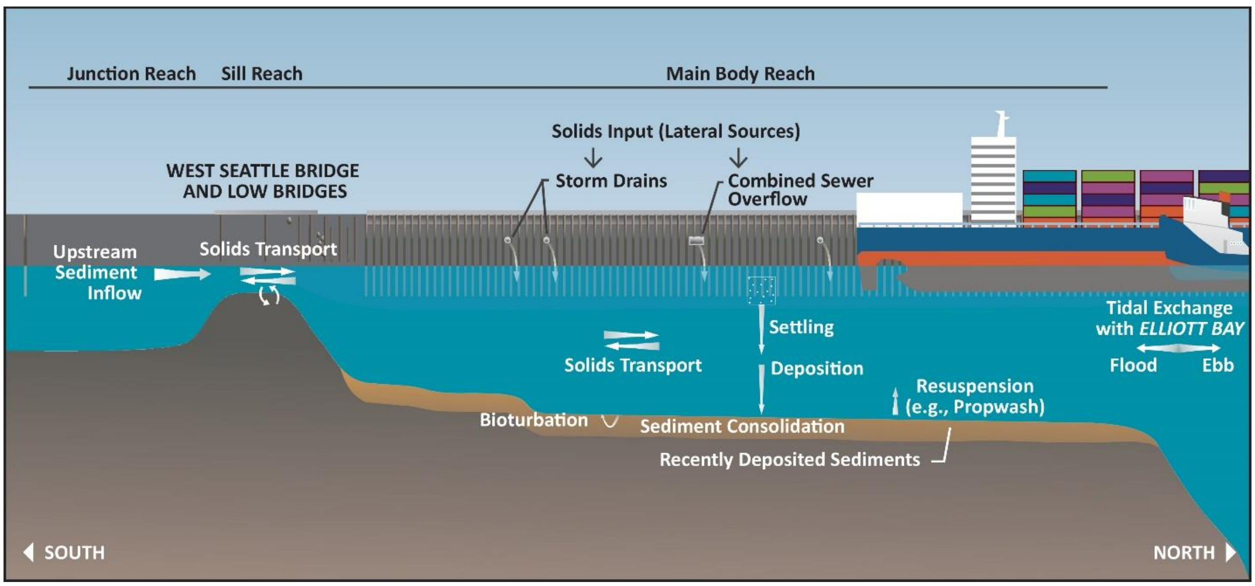

Figure 8. Physical Conceptual Site Model for the East Waterway Operable Unit

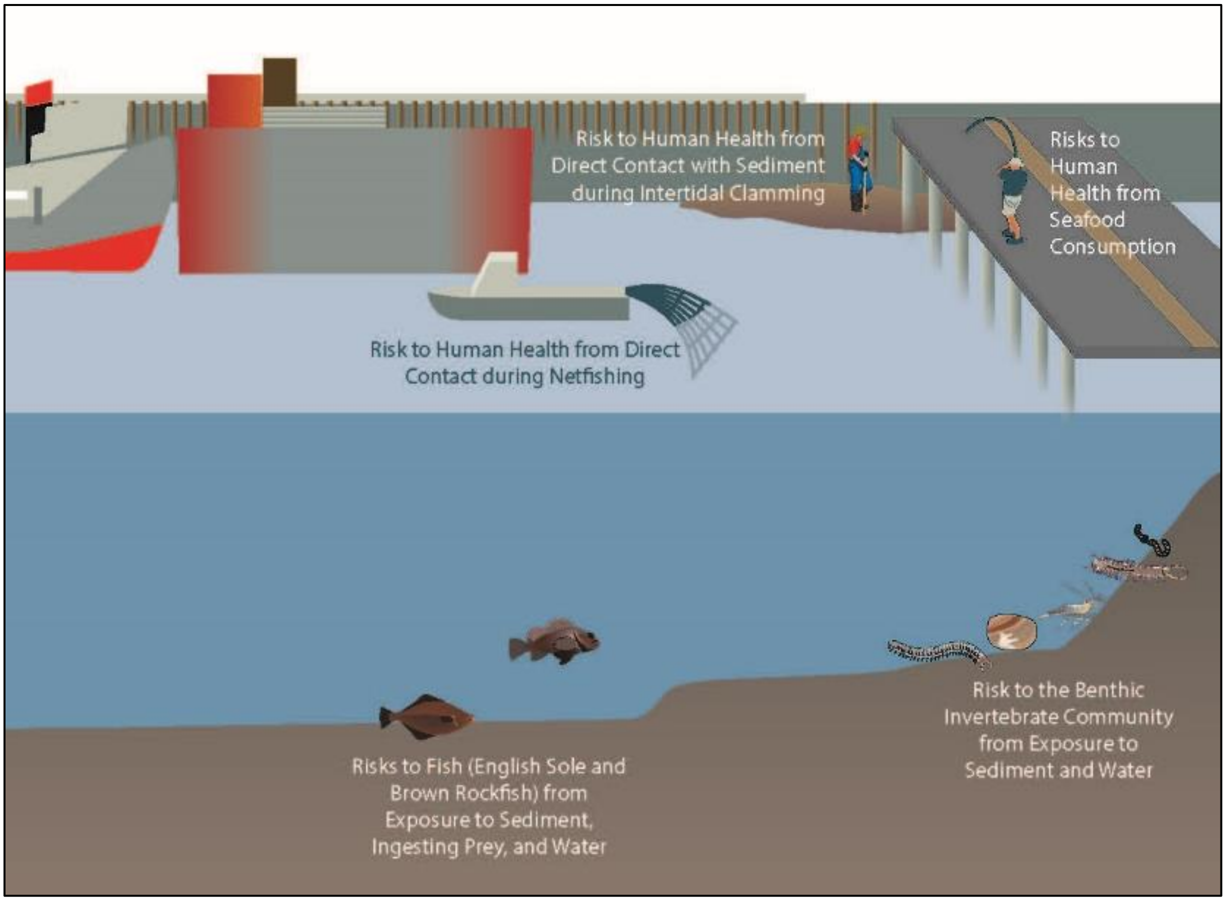

Figure 9. Risk Conceptual Site Model for the Selected Receptors in the East Waterway Operable Unit

5.3 Sources of Contamination

The primary sources of contamination to the EW OU are associated with historical activities, including past commercial and industrial uses of the waterway and direct discharges from sanitary, storm, and industrial waste streams. Early industrial and commercial use of this area consisted of fish processing facilities, shipyards, petroleum tank farms, flour mills, and lumber yards. Industrial and commercial use continued after the 1940s on both sides of the EW OU, including oil terminals, shipyards, rail transfer terminals, cold storage, lumber yards, and sand and gravel transfer stations. During the 1970s and 1980s, significant shoreline areas along both the west and east sides of the EW OU were transitioned into shipping terminals and container storage. Prior to 1958, local sewer systems along the waterway discharged raw sewage and mixed industrial wastes directly into the EW OU and the LDW. A combined storm/sanitary sewer system for the waterway was implemented in 1958, and by 1969 large portions of the public and private sewer lines were connected into the sewer system. However, CSOs are still necessary to prevent wastewater from backing up into homes and businesses during extreme rainfall events. Episodic releases from the CSOs to the EW OU occur at the current King County and City of Seattle CSO locations. In addition to direct discharge of historical sanitary and industrial wastewater, historical flows of surface water and suspended sediment contaminated from historical practices have likely been transported to the EW OU from the Green River/Duwamish River and Elliott Bay.

Ongoing sources to the EW OU include contaminated upland sites, spills and leaks, bank erosion, and deterioration of treated-wood structures. Ongoing urban pollution that includes EW OU contaminants of concerns (COCs) enter directly through lateral stormwater drains and CSOs. Monitoring of contaminant concentrations in suspended sediments in the Green River/Duwamish River watersheds show low levels of COCs, including PCBs, dioxins/furans, and arsenic, which are considered an ongoing source to the EW OU (Conn and Black 2014; Conn et al. 2015; 2018a; 2018b). The contribution from groundwater and seeps is minimal.

Within the EW OU direct watershed, King County, the City of Seattle, and the Port of Seattle, continue to conduct studies to identify and control potential sources of contamination. EPA is working with the EWG to implement source control plans that address chemical sources directly discharging to the EW OU. The Port of Seattle, King County, and the City of Seattle have reduced contaminant discharges to EW OU by conducting source tracing and cleanup programs in upland facilities and properties. These include cleaning and maintaining storm drains, tracking actionable sources of pollution to the storm system and CSOs discharging into the EW OU. The EWG is conducting studies on contaminant concentrations and lateral loads to the EW OU, with the objective of determining whether additional management is needed for source control prior to beginning remedial actions at the EW OU.

The control of upstream sources in the Green River/Duwamish River watershed is led by Ecology and includes completing the CERCLA sediment cleanup and source control work for the LDW and implementing existing Federal, State and local regulatory authorities to control pollutants in stormwater discharges throughout the Green River/Duwamish River watershed. The Green River/Duwamish River watershed includes the more heavily industrialized and residential areas of the Duwamish River (including the LDW) and the lower Green River, as well as the more rural, light industrial, and residential areas of the middle Green River watersheds. Contamination originating from developed land across the watershed is associated with diffuse sources that are challenging to identify (such transportation-related sources of polycyclic aromatic hydrocarbons [PAHs] and metals) and require a multi-agency long-term management strategy. The Clean Water Act's National Pollutant Discharge Elimination System permit program for stormwater, coupled with State of Washington chemical -specific actions such as product bans, are key aspects of this long-term management strategy. Ecology is identifying actionable sources in the Green River and is working with municipalities, businesses, and landowners to control known sources. Activities include contaminated site cleanup, removal of underground storage tanks, and stormwater management actions. Ecology is also developing a Pollutant Loading Assessment for the watershed to support future source control actions. These efforts, while not specific to the EW OU, are anticipated to reduce the amount of contamination entering the waterway.

During remedial design, there will be a source control sufficiency analysis to ensure that major sources within the EW OU are sufficiently controlled to minimize risk of recontamination. Upstream source control efforts throughout the Green River/Duwamish River watershed will continue through other Non-CERCLA regulatory programs, including those of the State of Washington, and will be essential to reduce future contaminant concentrations in the EW OU.

5.4 Nature and Extent of Contamination

Environmental investigations conducted within the EW OU, primarily in support of the SRI/FS and dredging activities, have included the collection of surface sediment, subsurface sediment, fish, shellfish, benthic invertebrate tissue, surface water, and porewater samples for chemical analysis. This dataset was used to support analyses in the SRI/FS and is summarized below.

5.4.1 Contaminants of Concern

During the SRI/FS process, risk assessments were completed to identify the COCs for the EW OU (Section 7). The COCs determined to exist at the EW OU are shown in Table 2.

- PCBs belong to a broad family of man-made organic chemicals known as chlorinated hydrocarbons. They were manufactured domestically from 1929 until manufacturing was banned in 1979. PCBs are mixtures of up to 209 compounds (or congeners). Some commercial PCB mixtures are known in the United States by the industrial trade name Aroclor©. Because they do not burn easily and are good insulating materials, PCBs were used widely as coolants and oils, and in the manufacture of paints, caulking and building materials. PCBs stay in the environment for a long time and can build up in fish, shellfish, and mammals. They are classified as probable human carcinogens, and children exposed to PCBs may develop learning and behavioral problems later in life.
- Dioxins and furans are by-products of chemical manufacturing, combustion (either in natural or industrial settings), metal processing, and paper manufacturing. . Dioxins stay in the environment for a long time and can build up in fish and shellfish. Toxic effects in humans include reproductive problems, problems in fetal development or early childhood, immune system damage, and possibly cancer. In animals, effects include developmental and reproductive problems, hemorrhaging, and immune system problems.
- PAHs are a major component of petroleum products, or are formed during incomplete burning of coal, oil, gas, wood, or other substances. There are more than 100 different PAHs, and they generally occur as complex mixtures. PAHs are toxic to invertebrates and cause inhibited reproduction, delayed emergence, sediment avoidance, and mortality. In fish, PAHs cause liver abnormalities and impairment of the immune system. PAHs can cause cancer in humans, and adverse effects on reproduction, development, and immunity in birds and mammals.
    - **High-molecular-weight PAHs (HPAHs):** a subgrouping of PAHs consisting of: benzo[*a*]anthracene, benzo[*a*]pyrene, benzo[*g*,*h*,*i*]perylene, total benzofluoranthenes, chrysene, dibenzo[*a,h*]anthracene, fluoranthene, indeno[1,2,3-*cd*]pyrene, and pyrene.
    - **Low-molecular-weight PAHs (LPAHs):** acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene
    - **Carcinogenic PAHs (cPAHs):** a subset of PAHs that includes benzo[*a*]pyrene (BaP), benzo[*b*]fluoranthene, benzo[*a*]anthracene, benzo[*k*]fluoranthene, indeno[1,2,3-*cd*]pyrene, dibenz[*a*,*h*]anthracene, and chrysene.

Table 2. Contaminants of Concern

Metals	Acenaphthene
Arsenic	Benzo[*a*]anthracene
Cadmium	Benzo[*a*]pyrene
Mercury	Benzo[*g,h,i*]perylene
Zinc	Total benzofluoranthenes[a]
Organic Compounds	Chrysene
Total PCBs	Dibenzo[*a,h*]anthracene
Dioxins/Furans	Dibenzofuran
Bis(2-ethylhexyl) phthalate	Fluoranthene
Butyl benzyl phthalate	Fluorene
Di-*n*-butyl phthalate	Indeno[1,2,3-*cd*]pyrene
1,4-Dichlorobenzene	2-Methylenaphthalene
2,4-Dimethylphenol	Phenanthrene
N-Nitrosodiphenylamine	Pyrene
Phenol	Total HPAHs
Tributyltin	Total LPAHs
Polycyclic Aromatic Hydrocarbons (PAHs)	Carcinogenic PAHs (cPAHs)
Anthracene	

Notes:

a. Total benzofluoranthenes is the sum of benzo[*b*]fluoranthene and benzo[*k*]fluoranthene.

5.4.2 Extent of Contamination in Sediments

During the baseline human health risk assessment (BHHRA; summarized in Section 7.1), human health risks were primarily associated with four COCs: total PCBs, arsenic, cPAHs, and dioxins/furans (Table 3). During the baseline ecological risk assessment (BERA; summarized in Section 7.2), risks to the benthic invertebrate and fish community were primarily associated with 29 COCs, including metals, PCBs, PAHs, and tributyltin.

5.4.2.1 Surface Sediment

The surface sediment dataset from the SRI/FS consists of 342 individual surface sediment samples collected between 1996 and 2014. The samples are well distributed spatially and are representative of the EW OU as a whole. Tables 3 and 4 summarize the data for human health and benthic COCs; Figure 10 shows the spatial distribution of COCs in surface sediment.

Sediment contamination in the EW OU is primarily located in the upper 10 cm, which is the depth most frequently occupied by benthic communities. PCBs, cPAHs, and metals (such as arsenic) are frequently detected throughout the EW OU (Figure 10). Tributyltin (TBT) and dioxins/furans are also found in surface sediment samples but are more limited in distribution. The areas with higher contaminant concentrations in surface sediment are in the portions of the EW OU that have not been recently dredged.

PCBs are widely distributed in surface sediment throughout the EW OU. Total PCBs were detected in 95 percent of the 248 surface sediment samples analyzed, at concentrations ranging from 6 to 8,400 micrograms per kilogram (µg/kg), with a mean concentration of 490 µg/kg, and a spatially-weighted average concentration (SWAC) of 460 µg/kg.

At least one cPAH compound was detected in 97 percent of the 248 surface sediment samples, with concentrations ranging from 15 to 68,000 µg/kg benzo(a)pyrene equivalents (BaP-eq), with a mean concentration of 1,600 µg/kg BaP-eq and a SWAC of 680 µg/kg BaP-eq.

Arsenic was detected in 71 percent of the 239 surface sediment samples analyzed, with a range of concentrations from 2.3 to 250 mg/kg with a mean concentration of 11.0, and a SWAC of 9.0 mg/kg.

Dioxins/furans were detected in subtidal composite sediment samples from 13 subareas throughout the EW OU. They were detected in all 13 samples, with 2,3,7,8-TCDD toxicity equivalence (TEQ) concentrations ranging from 4.0 to 31 nanograms per kilogram (ng/kg). In addition, 19 individual surface sediment grab samples were analyzed for dioxins/furans, and dioxins/furans detected in all 19 samples, with 2,3,7,8-TCDD TEQ concentrations ranging from 2.8 to 71 ng/kg.

The remaining COCs were associated with the numerical chemical SMS criteria (Table 4). The benthic COCs in surface sediment included arsenic, cadmium, mercury, and zinc, 14 individual PAHs, total LPAHs and total HPAHs, phthalates, PCBs, total dichlorodiphenyltrichloroethane (DDT), and 4 semi-volatile organic compounds (SVOCs). Mercury, zinc, PAHs, and PCBs were the most frequently detected COCs observed throughout the EW OU.

5.4.2.2 Subsurface Sediment

The subsurface sediment dataset from the SRI/FS includes 346 subsurface samples from 146 cores collected between 1992 and 2010. A total of 214 samples (from 67 cores) were collected during the remedial investigations. The sample locations were well distributed spatially and are representative of the a entire EW OU.

Contaminant concentrations in subsurface sediment were typically correlated with concentrations in surface sediment. The contaminants that are most frequently detected in subsurface sediment (deeper than 10 cm) are PCBs and mercury, and are generally found between 10 cm to 4 feet below the sediment surface. In portions of the Shallow Main Body Reach and Deep Main Body Reach that have not been dredged since the 1960s, the depth of contamination is generally 5 to 10 feet, with some areas as deep as 14 feet. Contaminant concentrations are generally greater than the surface sediment concentrations. Sediments in Slip 27 generally had higher subsurface sediment contaminant concentrations compared to the surface sediment concentrations; the Shallow Main Body areas had higher subsurface sediment concentrations of total PCBs and mercury relative to the surface sediment concentrations of these contaminants.

Ninety-five percent of the cores collected from the EW OU during SRI sampling events bounded the vertical extent of contamination, with concentrations that were less than the SCO in the deepest interval of the core that was analyzed. In cores from the lower alluvium (74 percent of the total cores), concentrations greater than the SCO were noted in only three locations ; however, the exceedances at depth at these locations were likely due to inclusion of transitional or contact layer material from the upper unit.

Table 3. Statistical Summary of Human Health COCs in Sediment

Contaminant	Units	Frequency of Detection	Concentration: Mean	Concentration: Median	Concentration: Maximum	SWAC
Surface						
Total PCBs[a]	µg/kg	235/248	490	290	8,400	460
cPAHs	µg/kgBaP-eq	15/15[b]	1,900	230	17,000	680
		241/248	1,600	250	68,000	
Arsenic[c]	mg/kg	170/239	11	6.7	250	9.0
Dioxins/furans	ng/kg TEQ	13/13[d]	16	16	31	nc
		19/19[e]	32	38	71	
Subsurface						
Total PCBs[a]	µg/kg	207/290	1,500	275	17,600	nc
cPAHs	µg/kg BaP-eq	218/269	1,000	250	23,000	nc
Arsenic[c]	mg/kg	250/255	10	9	96	nc
Dioxin/furan TEQ	ng/kg	16/16	17.2	2.7	184	nc

Notes:

a. Total PCBs represent the sum of the detected concentrations of the individual Aroclors. If none of the individual Aroclors were detected in a given sample, the non-detect value represents the highest reporting limit.

b. Intertidal composite samples.

c. Summary statistics were calculated assuming one-half the reporting limit for non-detect results.

d. Subtidal surface composite samples collected in 13 subareas of the waterway.

e. Sediment grab samples selected for dioxin/furan analysis.

nc – not calculated

SWAC – spatially-weighted average concentration

Table 4. Summary Statistics for Ecological COCs in Surface Sediment

Contaminant	Frequency of Detection[a]	Minimum	Median	Mean
Metals (mg/kg)				
Arsenic	162/231	2.3	241	10
Cadmium	155/231	0.13	6.76	0.9
Mercury	233/239	0.02 J	1.1J	0.3
Zinc	231/231	25.3 J	1,230 J	100
Organic Compounds (µg/kg)				
Acenaphthene	126/240	10 J	3,000	170
Benzo(a)anthracene	226/240	9.8 J	9,000	350
Benzo(a)pyrene	225/240	15 J	7,800	340
Benzo(g,h,i)perylene	212/240	10 J	1,800	120
Total benzofluoranthenes	228/240	14 J	10,800	790
Chrysene	230/240	12 J	13,000	540
Dibenzo(a,h)anthracene	156/240	3.0 J	690	52
Dibenzofuran	107/240	7.1 J	1,700	110
Fluoranthene	233/240	12 J	75,000	1,100
Fluorene	144/240	8.6 J	3,800	140
Indeno(1,2,3-cd)pyrene	210/240	11 J	1,800	130
2-Methylnaphthalene	87/240	9.7 J	2,800	77
Phenanthrene	230/240	12 J	24,000	540
Pyrene	235/240	18 J	41,000	920
Total HPAH	237/240	3.0 J	148,000 J	4,200
Total LPAH	230/240	12 J	41,000	1,000
Bis(2-ethylhexyl) phthalate	146/231	1.9	15,000	190
Butyl benzyl phthalate	14/231	6.1	90 J	16
Di-n-butyl phthalate	2/231	160 J	180	170
1,4-Dichlorobenzene	146/231	1.9	15,000	190
2,4-Dimethylphenol	14/231	6.1	90 J	16
N-Nitrosodiphenylamine	2/231	160 J	180	170
Phenol	94/231	13 J	630	110
Total PCBs	227/240	6.0	8,400	520
Total DDTs	8/143	2.3	32	8.8

Notes:

a. Number of detected concentrations per number of surface sediment grab samples analyzed for that chemical in the dataset.

DDT – dichlorodiphenyltrichloroethane
dw – dry weight
EW – East Waterway
aromatic hydrocarbon

J – estimated concentration
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
PCB – polychlorinated HPAH – high-molecular-weight polycyclic
SVOC – semi-volatile organic compound

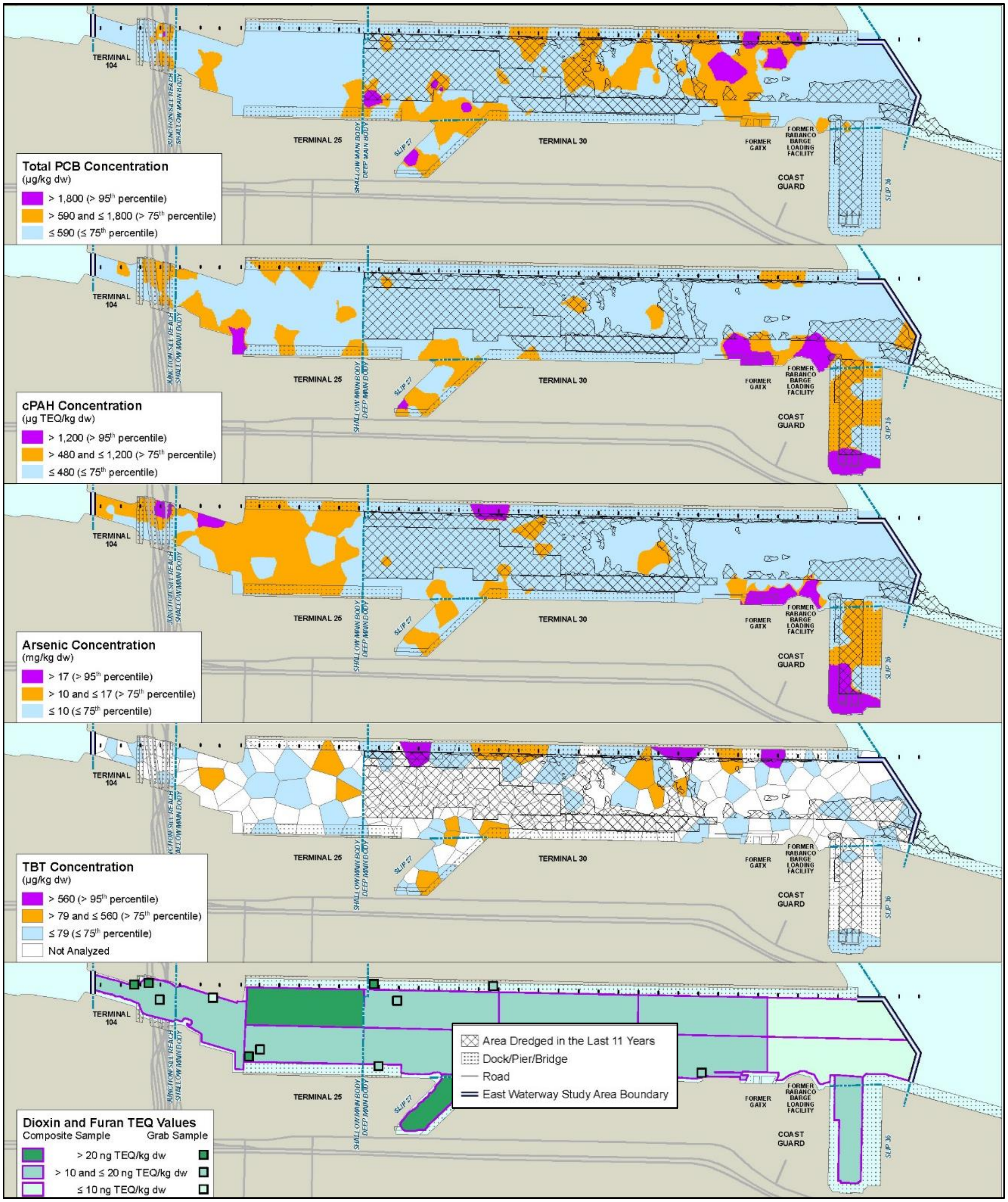

Figure 10. Contaminant Distribution in Surface Sediment

5.4.3 Extent of Contamination in Fish and Shellfish Tissue

Tissue samples of many different fish and invertebrate species were collected and analyzed for a wide variety of contaminants; English sole, shiner surfperch, brown rockfish, juvenile Chinook salmon, red rock and Dungeness crabs, clams, mussels, geoducks, shrimp, and benthic invertebrates that live in or on the sediment. These species were selected because they were either known or thought to be representative of species that could be consumed by people, fish, or aquatic-dependent wildlife within the EW OU, or they were identified as important ecological receptors (receptors of concern).

A summary of average contaminant tissue concentrations for COCs associated with tissue residues are presented in Table 5. Contaminant concentration ranges in different tissue types for all COCs are presented in Section 4.2 of the SRI. The mean total PCB concentrations were highest in fish, including brown rockfish, English sole, and shiner surfperch (Table 5), and were lowest in shellfish (geoducks, mussels, and clams). Mean dioxin and furan concentrations were highest in fish and lowest in shellfish. Mean cPAH concentrations were highest in clams, mussels, and benthic invertebrates. Concentrations of inorganic arsenic were highest in clams and other shellfish (geoducks and mussels). TBT concentrations were highest in brown rockfish and benthic invertebrates.

Table 5. Average Contaminant Concentrations in Fish and Invertebrates

Average Concentration					
	Total PCBs	**Dioxins/Furans TEQ**	**cPAHs BaP-eq**	**Inorganic Arsenic**	**TBT**
	µg/kg	ng/kg	µg/kg	mg/kg	µg/kg
Fish					
Rockfish	2,000	26.9	ND	0.008	160
Sole	540 – 3,200	14 – 37	0.3 – 11	0.03	5.7 – 26
Perch	155 – 1,500	14	1	0.021	20 – 58
Invertebrates					
Crab	130 – 590	2 – 12	0.6 – 1.3	0.03 – 0.06	ND – 6
Mussel	26	NA	20	0.078	33
Clam	19 – 66	0.4 – 0.9	1.6 – 16	0.03 – 0.17	7.6 - 47
Benthic Invertebrates	210	NA	170	NA	110

Notes:

a. These values originate from data that was presented as average concentrations for various species or collection efforts during the SRI. Where data was available for multiple species or more than one collection effort, the range of average concentrations is presented.

NA: not available
ND: not detected
TEQ: Toxic equivalent
mg/kg: milligram per kilogram
µg/kg: microgram per kilogram
ng/kg: nanogram per kilogram

5.4.4 Extent of Contamination in Surface Water and Porewater

Surface water grab samples were collected during two sampling events in 1996/1997 and 2008/2009. Total PCB concentrations in whole-water samples ranged from 0.07 to 5.8 ng/L, with a mean concentration of 1.3 ng/L. cPAHs were infrequently detected in surface water samples (4 out of 59 samples), with concentrations ranging from 0.009 to 0.01 micrograms per liter (µg/L). Dissolved surface water arsenic concentrations ranged from 0.4 to 1.4 µg/L. Tributyltin was detected in 1 out of 59 samples at a concentration of 0.01 µg/L.

Porewater data was collected from subtidal surface and subsurface sediments for the analysis of tributyltin, primarily in selected areas where samples were collected for dredge material characterization and post-dredge monitoring studies. Tributyltin was detected in 83 out of 99 samples. In addition, 13 porewater samples were collected from two intertidal areas for the analysis of volatile organic compounds (VOCs). Naphthalene was detected in two samples, benzene was detected in two samples, and *cis*-1,2-dichloroethene was detected in one sample.

Further detail of surface water and porewater data can be found in the SRI/FS.

5.5 Contaminant Fate and Transport

Hydrodynamic modeling of the EW OU was completed and documented in the *Sediment Transport and Evaluation Report* (Anchor QEA and Coast & Harbor Engineering, 2012). The model was developed through modification of an existing model used to evaluate hydrodynamics in the LDW. The model utilized a three-dimensional environmental fluid dynamics computer code to represent hydrodynamic processes. It is a physics-based model that incorporates algorithms to describe the hydrodynamic processes in the system. The full model domain extends from the Duwamish River at the south to a boundary between Puget Sound and Elliott Bay that is located between Alki Point and West Point. The EW OU study area was then defined within that domain.

The CSM developed for the EW OU (Figure 8) is based on both site-specific empirical data and output from hydrodynamic, sediment deposition, and propeller wash (propwash) models. Empirical data included: tidal elevations from Elliott Bay and the East Waterway; flow data from the Green River/Duwamish River; velocity and salinity profile measurements south and north of the Spokane Street corridor and within the main body of the East Waterway; sedimentation data; and in situ measurements of critical shear stress. Model output included predictions of current velocities, salinities, and suspended solids for average and high-flow events, predictions of annual average initial deposition patterns from lateral sources, and near-bottom current velocities due to vessel operations.

5.5.1 Hydrodynamics

Flow from the LDW is split by Harbor Island into the East and West Waterways. During normal flow events (annual average) flow is divided equally between the two waterways. However, during flow events of 2-year or greater, only 30 percent of the flow moves through the East Waterway. This is in part due to constrictions (both width and depth) at the Junction Reach and the Sill Reach.

Hydrodynamic circulation within the EW OU is controlled by tidal exchange with Elliott Bay and freshwater inflow from the Green River (through the LDW). SD and CSO flows from the adjacent drainage basins have a negligible influence on large scale circulation in the EW OU.

In general, as river inflow increases, predicted surface velocities within the EW OU increase; however, near-bed velocities remain relatively constant over the range of river flows. Average near-bed flow is 5 cm/s with maximum near-bed velocities ranging from 18 to 28 cm/s during high river flow. Surface velocities are more variable, with average surface velocities ranging from 20 to 25 cm/s and maximum surface velocities ranging from 90 to 95 cm/s (2- and 100-year flows, respectively).

River and tidal currents in the waterway are not expected to cause significant erosion of bedded sediments, as the maximum predicted bed shear stress for a 100-year high-flow event is modeled to be less than the critical shear stress of the bed sediments. Modeled bed shear stress due to vessel operations indicates that bed sediments are subject to episodic erosion and resuspension due to propwash activity.

5.5.2 Sediment Transport

Approximately 32,000 to 54,000 metric tons of sediment are estimated to enter the EW OU each year. Between 40 to 75 percent of that mass is estimated to be deposited within the waterway; the remaining suspended sediment moves out into Elliott Bay and other locations in Puget Sound. Net sedimentation rates were estimated from recovered cores using radioisotope data (Cesium-137 and Lead-210) and ranged from 1.1 centimeters per year (cm/yr) to greater than 2.0 cm/yr, with a site-wide area weighted average of 1.2 cm/yr.

Sediment sources to the EW OU include upstream sources (Green River/Duwamish River, LDW bed sediments, and LDW lateral load sediments), downstream sources (Elliott Bay), and local sources (SDs and CSOs that drain directly to the EW OU). As shown in Table 6, 99 percent of the sediment load settling in the EW OU is estimated to come from the Green River/Duwamish River, approximately 0.7 percent is from the LDW (bed sediments and lateral loads), and about 0.3 percent is from lateral loads. Sediment input from Elliott Bay was determined to be negligible. Sediment entering the waterway primarily consists of suspended fine-grained particles (silt/clay) with little to no coarse grained (sand) particles.

Sediment deposition modeling indicates that sediment from local lateral sources initially deposits close to the outfall locations, with relatively little deposition occurring in the deeper areas of the EW OU. Bioturbation occurs in the top 10 cm, mixing newly deposited sediment into the surface. As described further in Section 5.3, continued source control is expected to reduce sediment from lateral sources in the future. However, relative contributions of each sediment source will not change significantly (Table 6).

Although the EW OU is generally net depositional, there are some strong localized erosive forces. Vessel propwash varies throughout the EW OU and typically resuspends and mixes the top 0.5 to 2 feet of bottom sediments, particularly in ship berthing areas. Propwash may affect sediment as deep as 5 feet below the sediment surface in some areas. Tidal and current movements are generally not a significant erosional force in the EW OU, although portions, such as the Sill Reach, are affected by bottom currents. Under-pier areas may also be subject to periodic erosion and resuspension due to propwash and vessel thrusters.

Under-pier areas are generally depositional, with sediment accumulation dependent upon the substrate and the bank slope beneath the overwater structures. The typical thickness of under-pier sediments in the EW OU is approximately 2 feet based on probing data, which equates to approximately 53,000 cy. Due to propwash, under-pier sediment can become resuspended and resettle in the main channel. The sediment transport model assumed that 25 percent of the total volume of under-pier sediments mixes with the open water areas every 5 years.

Table 6. Net Sedimentation Rates for Sediment Sources

Scenario	Average Net Sedimentation Rate	Annual Deposition from Sediment Sources				
		Green River	LDW Lateral	LDW Bed	EW SDs	EW CSOs
Current	1.2 cm/yr	1.182 cm/yr (98.5%)	0.0029 cm/yr (0.24%)	0.0066 cm/yr (0.55%)	0.0067 cm/yr (0.56%)	0.0023 cm/yr (0.19%)
Future	1.2 cm/yr	1.182 cm/yr (98.8%)	0.0029 cm/yr (0.24%)	0.0066 cm/yr (0.55%)	0.0003 cm/yr (0.03%)	0.0047 cm/yr (0.39%)

Notes:

a. Scenarios are the modeled 'base case'; other modeled scenarios include upper and lower bounding cases (see FS Table 5-4). Current scenario based on measured net sedimentation rate and modeled relative source contributions. Future scenario based on likely effects of ongoing and future source control actions.

cm/yr – centimeters per year
CSO – combined sewer overflow
LDW – Lower Duwamish Waterway
SD – storm drain

5.6 Current and Potential Future Exposures

The ways in which people and wildlife may be exposed to contamination in EW OU are summarized in Figure 9. In addition to commercial activities, people may be exposed to EW OU-related contamination during recreational activities, including boating and fishing. WSDOH has issued advisories against consuming any resident fish or shellfish harvested from the Lower Duwamish River. However, recreational and subsistence fishing is a common activity in portions of the EW OU such as the Spokane Street Bridge. Tribal members' potential exposure to contamination in the EW OU is primarily through consumption of resident fish and shellfish, and this has been a primary factor shaping the BHHRA (see Section 7.1). Ecological communities in the EW OU include wildlife dwelling in and on the sediment and in the water column, as well as birds and marine mammals at the water's surface. Further detail on EW OU uses and potential exposure routes can be found in Section 6.

Section 6 Current and Potential Site and Resource Uses

The land surrounding the EW OU is currently zoned industrial and commercial. The current and reasonably anticipated future land uses of the EW OU form the basis for the exposure assumptions used in the risk assessment and were considered in the development of remedial action objectives and remedial alternatives and are considered in the selection of the appropriate remedial action.

6.1 Land Use

The East Waterway is a developed waterway primarily supporting commercial and industrial uses. Some Tribal and public uses occur, though they are limited by the developed nature of the waterway.

A Federal navigation channel extends from the northern tip of Harbor Island to the Spokane Street Bridge. The northern portion of the EW OU is dredged to depths currently needed for deep-draft container ship navigation, while the southern portion of the waterway near the bridges is maintained to accommodate smaller vessels. Most vessel traffic consists of container vessels and assorted tugboats moving into and out of the waterway. Each container ship requires at least one tugboat to maneuver the ship during docking and undocking. Container ships berth at T-18, T-25, and T-30. Numerous barges and tugboats are moored at the head of the waterway along what is currently Harley Marine Services, which includes Olympic Tug and Barge as a subsidiary. At the northeast end, along T-18, tug and barge traffic utilize the Kinder Morgan petroleum products transfer facility. Additional navigation and berthing occur in Slips 27 and 36. Slip 27 is used by the Port of Seattle for temporary moorage of barges (along Pier 28), which are maneuvered by tugboats. The U.S. Coast Guard (USCG) vessels frequent Slip 36, which serves Pier 36 (south) and Pier 37 (north). USCG moors numerous vessels in Slip 36, including USCG icebreakers, cutters (longer than 65 feet), and gunboats. Only USCG vessels currently use this slip regularly, but the U.S. Navy occasionally uses Slip 36.

The East Waterway is an active port area and is intended to remain so. Land bordering it is zoned for industrial and manufacturing uses. The U.S. Army Corps of Engineers (USACE) has authorization from Congress to design and construct the Seattle Harbor Navigation Improvement Project (SHNIP) which includes deepening both the East and West Waterway. During alternatives development in the FS, channel deepening and widening was considered a probable future use for the EW OU, therefore all alternatives (including the selected remedy) would not impede, nor be impeded by, potential channel deepening. Following completion of the interim remedial action construction, USACE would be able to move forward with implementing the channel deepening project.

6.1.1 Tribal and Public Land Uses

Currently, the Suquamish and Muckleshoot Tribes operate a commercial net fishery for salmon in the East Waterway. Tribal fishermen may engage in clam harvesting in all intertidal areas of the East Waterway, as well as subtidal geoduck harvesting. Tribal members' potential exposure to contaminants in the EW OU is primarily through consumption of resident fish and seafood.

Fishing is a popular public activity, particularly from the Spokane Street Bridge and the riprapped slopes of the EW OU. The Spokane Street Bridge represents an important fishing and crabbing location for the local community. Fishing is particularly popular during summer and fall salmon runs and seasonal squid migration into Elliott Bay. Individuals are known to collect fish and crab from the EW OU despite existing fish advisories (no consumption is advised for resident seafood, limits are advised for certain salmon species, and no limits are posted for squid; Figure 11). In 2016 the Fisher's Study (LDWG 2016) was completed, to learn more about people who fish in the Lower Duwamish River and how best to communicate about the risk of eating resident seafood from the river. More information on the Fisher's Study can be found at <https://ldwg.org/our-work/fishing-for-safe-seafood/>. In-water public recreational uses, such as swimming and kayaking, are limited due to safety issues around commercial shipping activities. Jack Perry Park is the only public park adjacent to the EW OU.

Tribal uses and recreational fishing/clamming activities are anticipated to continue in the future. Recreational uses are likely to continue to be limited by the active commercial use of the EW OU, with limited public access due to security requirements of container terminals and the USCG facility, and the availability of nearby areas that provide superior recreational opportunities.

Figure 11. Fish and Shellfish Consumption Advisory for the Lower Duwamish Waterway

6.1.2 Habitat Characteristics

Ecological communities in the EW OU include wildlife dwelling in and on the sediment and in the water column, as well as birds and marine mammals at the water's surface. The EW OU is primarily marine, deepwater habitat with relatively little shallow subtidal and intertidal habitat, which is found primarily in the Junction Reach and Sill Reach, within Slip 27, and south of Slip 36. Approximately 6 acres have been identified as intertidal areas.

Numerous small benthic (bottom-dwelling) species typical of Puget Sound inhabit the subtidal substrates of the EW OU, including worms, crustaceans, and mollusks (for example, clams). Larger, more motile invertebrates (crabs) and bottom fish (such as sole) live in close association with bottom substrates. Brown rockfish are associated with structures such as riprap, piers, or submerged debris. The EW OU also has a diverse population of pelagic fish that live in the water column, including resident species (for example, shiner surfperch) and migratory species, such as salmon. Because the EW OU connects Puget Sound to the Green River/Duwamish River watershed, it is an important migratory pathway for both juvenile and adult salmon. Aquatic and semi-aquatic wildlife that use the EW OU include river otter, harbor seals, and a variety of marine birds and ducks.

Sixteen aquatic and aquatic-dependent species reported in the vicinity of Elliott Bay area are listed under either the Endangered Species Act or by the Washington Department of Fish and Wildlife as candidate species, threatened species, endangered species, or species of concern. Of these species, Chinook salmon, Coho salmon, steelhead salmon, and western grebe are commonly observed in or around the EW OU.

6.2 Surface Water and Groundwater Use

Surface water uses consist primarily of industrial and commercial shipping and container transport in the adjacent upland areas. Some discharge of surface water runoff is transported to the waterway via outfalls.

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Section 7 Summary of Site Risks

As part of the SRI/FS, baseline human health and ecological risk assessments were conducted to estimate the current and future effects of contaminants in sediments, surface water, and fish tissue on human health and the environment. A baseline risk assessment is an analysis of the potential adverse human health and ecological risk of releases of hazardous substances from a site in the absence of any actions or controls to mitigate such releases, under current and future land and resource uses. The baseline risk assessment includes a baseline human health risk assessment (BHHRA) and a baseline ecological risk assessment (BERA). They identify the COCs and exposure pathways that the remedial action should address and provide the basis for taking action. The BERA and BHHRA are included in the SRI report, in Appendices A and B, respectively.

7.1 Human Health Risk Assessment

The site-specific BHHRA estimated cancer risks and noncancer health hazards from exposures to contaminants in sediments, surface water, and fish tissues from the EW OU. A four-step process, listed below and further explained in the following sections, was utilized for assessing site-related human health risks:

1. **Hazard Identification** uses the analytical data collected to identify the contaminants of potential concern (COPCs) at the Site for each medium based on such factors as toxicity, frequency of occurrence, fate and transport of the contaminants in the environment, concentration, mobility, persistence, and bioaccumulation.
2. **Exposure Assessment** evaluates the different exposure pathways through which people might be exposed to contaminants based on media-specific contaminant concentrations, the frequency and duration of these exposures, and the pathways by which humans are potentially exposed.
3. **Toxicity Assessment** determines the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure (dose) and severity of adverse effects (response).
4. **Risk Characterization** summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related cancer risks and noncancer hazards. The risk characterization also identifies contamination with concentrations that exceed acceptable levels, identified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and EPA guidance as an excess lifetime cancer risk greater than 10^{-6} to 10^{-4} (1 in 1,000,000 to 1 in 10,000) or a noncancer Hazard Index (HI) greater than 1. Contaminants at these concentrations are considered COCs and are typically those that will require remediation. Section 7.1.4 includes a discussion of the uncertainties associated with these risk estimates.

7.1.1 Hazard Identification

In this step, the Contaminants of Potential Concern (COPCs) in each medium were identified based on such factors as toxicity, frequency of detection, fate and transport of the contaminants in the environment, concentration, mobility, persistence and bioaccumulation. COPCs were determined for each exposure area and medium by comparing the available analytical data to appropriate risked-based screening criteria. (See Table D1 in Appendix D).

The data used in the BHHRA by medium are summarized below:

- **Intertidal sediment**: Multi-increment sampling beach sediment samples to a depth of 25 cm.
- **Subtidal sediment**: Grab samples and grab composite samples collected from the subtidal areas within the EW OU to a depth of 10 cm.
- **Resident fish tissue**: Whole body and fillet (both with and without skin) composite samples of resident English sole; whole body individual brown rockfish; whole body composite samples of shiner surfperch, and fillet (both with and without skin) composite samples of striped perch.
- **Shellfish tissue**: Composite edible meat and hepatopancreas samples of Dungeness crab and red-rock crab. Composite soft tissues of mussels, butter clams, littleneck clams, cockles, and soft-shell clams, as well as edible tissues and the gut ball of geoduck clams.
- **Surface water**: Surface water samples collected from the EW OU.

cPAHs, PCBs, pesticides, and dioxins/furans were identified as COPCs.

7.1.2 Exposure Assessment

Cancer risks and noncancer hazard indices were calculated based on an estimate of the reasonable maximum exposure (RME) expected to occur under current and future conditions in the EW OU. The RME is defined as the highest exposure that is reasonably expected to occur.

Exposure to contaminants was estimated quantitatively or qualitatively for potential exposure scenarios considering the nature and extent of contamination, current and future potential land use, identification of potential receptors, and exposure pathways. The exposure area was generally assumed to be the entire EW OU; however, the exposure area for the habitat restoration worker and intertidal clamming scenarios was limited to the accessible intertidal portions of the EW OU.

The following exposure populations and pathways were evaluated in the BHHRA:

- Current/future Tribal exposures: Consumption of fish and shellfish by adults and children based on Tribal fish consumption rates for Puget Sound and direct exposure to sediment or water via incidental ingestion or skin contact while engaging in activities such as Tribal netfishing and clamming.
- Current/future ethnic community exposures: Consumption of fish and shellfish by adults as represented by members of the Asian & Pacific Islander (API) community.
- Current/future recreational exposures: Direct contact with surface waters for swimmers, including skin absorption and incidental ingestion of waters and sediments, and the consumption of fish and shellfish by recreational fishers, assuming one meal per month of each seafood category. A daily consumption rate of 7.5 grams per day (g/day) (EPA 2000d), of a given seafood category was used.

- Current/future occupational exposures: Direct contact with sediment for habitat restoration workers, including incidental sediment ingestion and dermal contact with sediment.

A summary of all the exposure pathways considered in the BHHRA are summarized on the conceptual site model (Figure 12), and exposure parameters are detailed in Tables D2 and D3 in Appendix D.

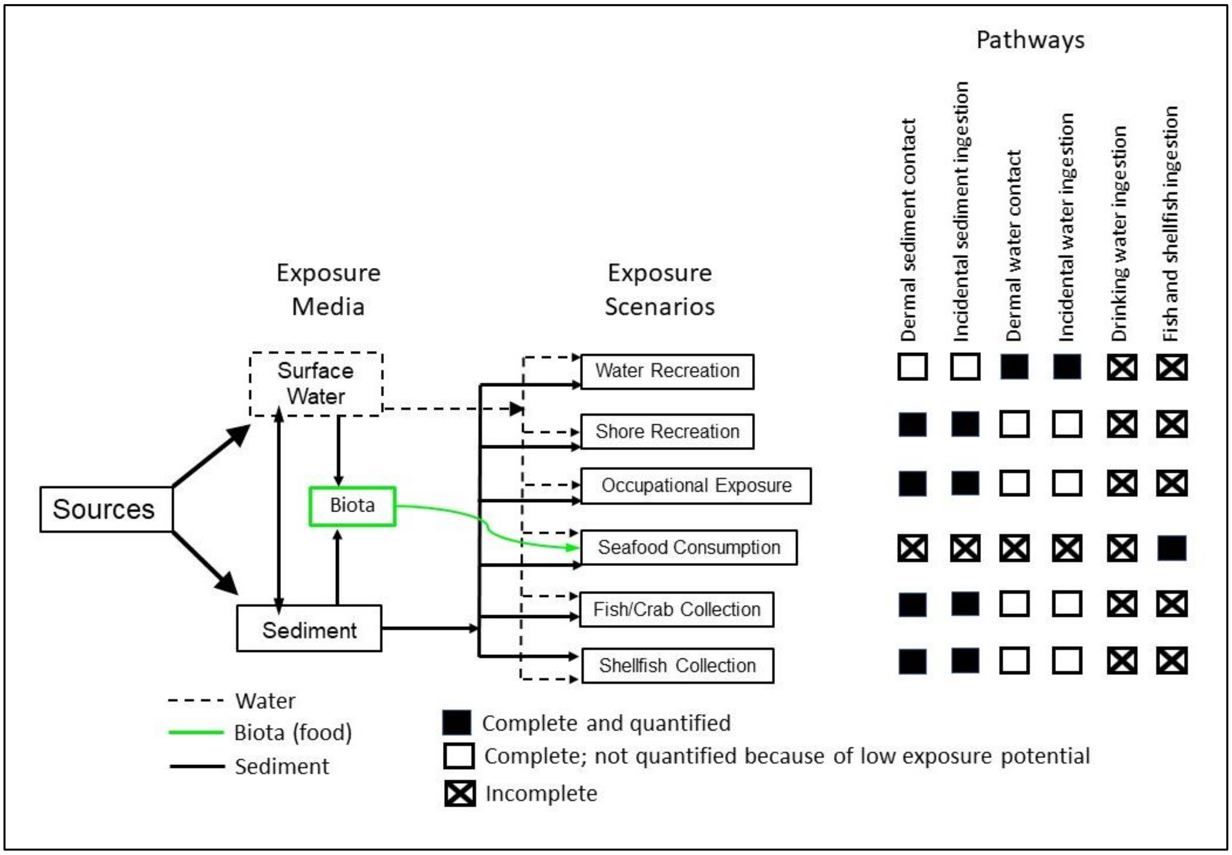

Figure 12. Conceptual Site Model for the BHHRA

Exposure estimates associated with the consumption of fish and shellfish by Tribal members were based on EPA Region 10 guidance (EPA, 2007). In areas such as the EW OU that are not dominated by shellfish habitat, seafood consumption rates were developed from a consumption survey of Tulalip Tribal practices (Toy et al., 1996). However, because the Suquamish Tribe's usual and accustomed fishing area includes the EW OU, the BHHRA also included a comparative assessment of Tribal fish and shellfish consumption risks based on a Suquamish Tribe's consumption survey (The Suquamish Tribe, 2000). This scenario was not used for remedy decisions.

Exposures associated with subsistence fishing by ethnic groups were based on fish consumption rates for the API community in King County (EPA, 1999; Kissinger, 2005) as described in Section B.3.3.1.3 of the BHHRA (Windward, 2012b).

There are no recreational fish consumption survey data of sufficient quality to assess risks to recreational anglers in the EW OU. Recreational fishing is known to occur on the EW OU, particularly at the Spokane Street Bridge (King County, 1999), but the actual consumption rate associated with this use is not known. Risks to recreational fishers were estimated based on one meal per month for different seafood categories: benthic fish (sole), pelagic fish (perch and rockfish), clams, and crabs. Totaling the risks from each of these scenarios provides an estimate of risk associated with four meals per month, one for each seafood category. Actual risk results for an individual depends on their number of meals per month.

Exposure factors for evaluating direct contact during swimming were based on information collected by King County (King County, 1999).

The exposure point concentration (EPC) is calculated as an upper-bound estimate of the average concentration for each contaminant. In instances where limited amounts of data or variability in the data make this impractical, the maximum detected concentration is used. EPCs for all COPCs can be found in the BHHRA.

EPCs for the seafood consumption scenarios were calculated separately for seafood tissue types available in the EW OU: fillets of benthic fish, whole bodies of benthic fish, perch (both fillets and whole body), whole bodies of rockfish, edible meat of crab, whole bodies of crab, clams, edible meat of geoduck, and whole bodies of geoduck and mussels. Only resident fish that spend most of their life in the EW OU were included in this evaluation. Migratory fish such as salmon were not considered because they spend very little of their lifespan in the EW OU and adult salmon do not accumulate a significant amount of contamination from the EW OU (Windward, 2007).

EPCs for the direct sediment exposure scenarios (netfishing, habitat restoration, and clamming) were calculated for the sediment area over which the exposure could potentially occur. Individuals engaged in commercial netfishing were assumed to be exposed to intertidal and subtidal sediment. Individuals engaged in habitat restoration or clamming were assumed to be exposed to intertidal sediment. EPCs for exposure to surface water while swimming were calculated on a site-wide basis.

7.1.3 Toxicity Assessment

In this step, the types of adverse health effects associated with contaminant exposures and the relationship between magnitude of exposure and severity of adverse health effects were determined. Potential health effects are contaminant-specific and may include the risk of developing cancer over a lifetime or non-cancer health effects, such as changes in the normal organ function. Some contaminants may cause both cancer and non-cancer health effects.

The following hierarchy of sources of toxicity values was used per EPA guidance (EPA 2003): Tier 1 is EPA's Integrated Risk Information System (IRIS) database, Tier 2 is EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs), and Tier 3 includes additional EPA and non-EPA sources of toxicity information, with priority is given to those sources of information that are the most current, transparent, and publicly available, and which have been peer reviewed. Toxicity information for all COPCs is presented in Tables D4 and D5 in Appendix D and the BHHRA for the EW OU and the cPAH Risk Assessment Addendum (Windward, 2019).

7.1.4 Risk Characterization

Risk characterization integrates information from the exposure and toxicity assessments to provide a quantitative assessment of risks. Risk characterization is performed separately for carcinogenic and noncarcinogenic effects. Carcinogenic risk is expressed as the probability that an individual will develop cancer over a lifetime as a result of exposure to a potential carcinogen. Noncarcinogenic hazards are evaluated by comparing an estimated exposure level or dose with a reference dose that is without appreciable risk of adverse health effects.

Cancer risks are expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a carcinogen under the conditions described in the exposure assessment. The risk is calculated as the dose multiplied by an estimate of toxicity using the cancer slope factor for oral and dermal exposures. Excess lifetime cancer risk for oral and dermal exposures is calculated from the following equation:

Equation 1: $Risk = LADD \times SF$

Where:

Risk	=	a unitless probability of an individual developing cancer
LADD	=	lifetime average daily dose averaged over 70 years (mg/kg-day)
SF	=	cancer slope factor, expressed as $(\text{mg/kg-day})^{-1}$

These estimated risks are probabilities, typically expressed in scientific notation (such as 1×10^{-4}). An excess lifetime cancer risk of 1×10^{-4} indicates that one additional incidence of cancer may occur in an exposed population of 10,000 people.

Noncarcinogenic hazard was assessed by comparing the dose, or contaminant intake to a reference dose (RfD) to yield a hazard quotient (HQ). RfDs are estimates of daily exposure levels for humans (including sensitive individuals) which are thought without adverse health effects over a lifetime of exposure. The key concept for a HQ is that a threshold exists at which non-cancer health effects are not expected to occur. A hazard index (HI) is calculated by adding the HQs from a particular exposure for all contaminants that that have similar health effects and similar modes of action.

The HQ is calculated as follows:

Equation 2: $\mathrm{HQ} = \frac{\mathrm{CDI}}{\mathrm{RfD}}$

Where:

HQ	=	hazard quotient
CDI	=	chronic daily intake (mg/kg-day)
RfD	=	reference dose (mg/kg-day)

The results of the risk characterization for cancer and non-cancer risks are summarized in Table D6 and D7 in Appendix D, respectively, and are summarized below by receptor and exposure scenario. Full results of the risk characterization are presented in the BHHRA Tables B.5-1 through B.5-16, and the cPAH Risk Assessment Addendum (Windward, 2019).

7.1.4.1 Tribal Subsistence Fishers

Estimated total excess cancer risk associated with the consumption of fish and shellfish is 1×10^{-3} for adults and 3×10^{-4} for children (Table D6, Appendix D). The majority of the risk is associated with PCBs in fish, with the remaining risk associated with PCBs in shellfish, arsenic in clams, and other COPCs in fish and shellfish tissue. Estimated non-cancer hazards from seafood consumption range from HI = 0.04 to 58 (Table D7, Appendix D). The primary contributor to non-cancer risk is PCBs.

Estimated total excess cancer risks based on the Suquamish adult seafood consumption rates are 1×10^{-2}; non-cancer hazards range from 2 to 214. The primary contributors are similar to those of the Tulalip exposure scenario; however, the percentage contribution from clams is higher due to the higher proportion of clams in the Suquamish diet.

Direct Contact: Estimated excess cancer risks for the direct sediment exposure scenarios (Table D8, Appendix D) are much lower than those for the seafood consumption scenarios, with total excess cancer risks of 5×10^{-6} for the netfishing RME scenario and 2×10^{-5} for the tribal clamming RME scenario. Cancer risks are highest for arsenic, which accounted for greater than 60 percent of the total excess cancer risk. PCBs, cPAHs, and dioxin/furan TEQ are lesser contributors.

The total HI for each exposure scenarios does not exceed 1. None of the EW OU COPCs have non-cancer HQs greater than 1 for any of the direct sediment exposure scenarios.

Cumulative Risks: Risks to Tribal subsistence fishers from multiple pathways are estimated as the sum of the total cancer risk from the adult seafood consumption, netfishing, and swimming pathways. The estimated total excess cancer risk is 1×10^{-3}.

7.1.4.2 Non-Tribal Subsistence Fishers

Risks for seafood consumption by ethnic subsistence fishers was based on seafood consumption rates for API adults to reflect rates by individuals who harvest seafood in King County. The total excess cancer risk from the consumption of fish and shellfish by adult API fishers is 5×10^{-4}. Total PCBs account for 76 percent of the total risk, with lesser contributions from arsenic, dioxin/furans, and cPAHs. The majority of the risk is associated with PCBs in fish.

Non-cancer risks from the consumption of seafood by API adults are HI are 0.06 to 24. The primary contributor to non-cancer risk is PCBs, with HQ values less than 1 for all other COPCs.

7.1.4.3 Recreational Fishers

Risks for seafood consumption for recreational fishers were calculated separately for different types of seafood, including benthic fish, pelagic fish, clams, and crab, and were based on one meal per month. Total excess cancer risk for fish and shellfish consumption by recreational fishers ranges from 2×10^{-5} to 4×10^{-4}. Risks from the consumption of fish are primarily associated with total PCBs, whereas risks from the consumption of clams and crab are associated with both total PCBs and arsenic.

HI values for recreational consumption of fish range from 0.1 to 21, with HQ values greater than 1 only for PCBs in benthic and pelagic fish. All HQ values are less than 1 for non-cancer risks in shellfish.

7.1.4.4 Occupational Workers

Risk to occupational workers from direct exposure to sediment was based on the habitat restoration worker due to their higher level of sediment exposure. The total excess cancer risk is 8×10^{-7}. The HQ values for direct exposure are less than 1 for all COPCs.

7.1.4.5 Recreational Users

Recreation in the EW OU is limited due to limited access and heavy ship traffic. Several exposure scenarios were developed varying frequency and duration of exposure. Total excess cancer risks and non-cancer risks for all scenarios based on total PCBs are less than 1 x 10^{-6}; all non-cancer risks are less than 1.

7.1.5 Contaminants of Concern

Table D9 in Appendix D summarizes the rationale for selecting human health COCs. Although bis(2-ethylhexyl) phthalate (BEHP), pentachlorophenol, vanadium, tributyltin, and several pesticides were found in the waterway at concentrations that exceeded risk thresholds, they were not selected as COCs due to low detection frequencies, low contribution to overall risk, or quality assurance concerns with analytical data. Information on whether a contaminant was historically used at the site was also considered in determining whether these contaminants should be selected as COCs. PCBs, inorganic arsenic, cPAHs, and dioxins/furans were identified as human health COCs based on an excess cancer risk greater than 1 x 10^{-6} for carcinogens, or an HQ greater than 1 for noncarcinogens. The incremental risk from the EW OU was estimated to be less than 1 x 10^{-6}. While inorganic arsenic was considered to be a primary COC for the direct contact pathway, it was not considered so for the seafood consumption pathway since concentrations in background tissues were similar to those found in the EW OU. Other COPCs that exceeded risk thresholds but were not designated as COCs were still evaluated in the FS to ensure that a cleanup based on the COCs would also address risk due to these other contaminants.

7.1.6 Human Health Risk Summary

Risks associate with the consumption of fish or shellfish were generally orders of magnitude greater than risks from direct contact with sediment or surface water The COCs identified for human health risk are indicated in Table D9 in Appendix D. The following subset of COCs were identified as the focus for the development and evaluation of alternatives:

- Seafood consumption scenarios – cPAHs, PCBs, and dioxins/furans.
- Direct sediment exposure scenarios – inorganic arsenic.

7.1.6.1 Uncertainties in Human Health Risk Assessment

The process used to assess risks in this evaluation is subject to a variety of uncertainties. In general, the main sources of uncertainty include:

- Environmental chemistry sampling and analysis.
- Environmental parameter measurement.
- Fate and transport modeling.
- Exposure parameter estimation.
- Toxicological data.

Uncertainty in environmental sampling arises in part from the potentially uneven distribution of chemicals in the media sampled. Consequently, there is uncertainty as to the actual levels present. Environmental chemistry-analysis error can stem from several sources, including the errors inherent in the analytical methods and characteristics of the matrix being sampled. Data collected in the SRI was considered to be of a sufficient frequency and quality to support the BHHRA and the development of remedial alternatives.

Uncertainties in the exposure assessment are related to estimates of how often an individual would actually come in contact with the COCs, the period of time over which such exposure would occur, and in the models used to estimate the concentrations of the COCs at the point of exposure. Conservative estimates of exposure were selected for the BHHRA to ensure protectiveness despite these uncertainties. Uncertainties associated with fish consumption rates are related to the representative populations used in the risk assessment. Fish consumption rates for Tribal subsistence fishers were based on the Tulalip fish consumption rates. While this was considered to provide a conservative estimate for Tribal seafood consumption from the EW OU, the rates may underestimate exposure for certain Tribal subsistence fishers. The Tribal subsistence risk assessments assume that all fish and shellfish come from the EW OU. This is consistent with EPA guidance (EPA 2007) but may result in a conservative estimate of exposure for individuals that consume fish for other areas of Puget Sound. The seafood consumption rates published by the Suquamish Tribe have higher consumption rates for both fish and shellfish and includes a higher proportion of shellfish in the overall diet. Fish consumption rates for the API community were used as a conservative exposure estimate for non-Tribal subsistence consumption practices; other ethnic communities may have a higher or lower fish consumption rates. Given the lack of seafood consumption rate estimates for recreational fishers, risks were estimated for one meal per month for each of four seafood types. Risks for each seafood group may then be totaled based on individual diets as the sum of the risk or hazard associated with specific types of seafood.

Risk estimates for subsistence fishers were calculated separately for adults and children. The cumulative lifetime risk for individuals that consume fish from the EW OU throughout their life would be additive to some degree.

Uncertainties in toxicological data occur in extrapolating from animals to humans and from high to low doses of exposure, as well as from the difficulties in assessing the toxicity of a mixture of chemicals. These uncertainties are addressed by making conservative assumptions concerning risk and exposure parameters throughout the assessment. As a result, the risk assessment provides upper-bound estimates of the risks to populations near the Site and is unlikely to underestimate actual risks.

7.2 Ecological Risk Assessment

The baseline ecological risk assessment (Windward, 2012a) estimated risks for the benthic invertebrate community, fish, crabs, and wildlife species that may be exposed to contaminants in sediment, water, and aquatic biota in the EW OU. This assessment was based on sediment and tissue chemistry data collected as part of the SRI. The BERA is an estimate of the likelihood of ecological risks if no cleanup action is taken.

The BERA evaluated risks to selected wildlife species that are representative of the communities living in the EW OU. Risks to different potentially exposed ecological receptors are quantified as HQs, the ratio of contaminant concentration to a given toxicological benchmark. If an HQ is calculated to be equal to or less than 1, then no adverse effects are expected as a result of exposure. If the HQ is greater than 1, adverse effects are possible. The BERA steps are listed below and described in the following sections:

1. **Problem Formulation** includes identification COPCs and exposure pathways, and determination of the ecological receptors and assessment endpoints (environmental values to be protected).
2. **Exposure Assessment** includes characterization of exposure pathways and receptors and measurement or estimation of EPCs.

3. **Ecological Effects Assessmen**t includes literature reviews, field studies, and toxicity tests that link contaminant concentrations to adverse effects on ecological receptors on a media-, receptor-, and chemical-specific basis.
4. **Risk Characterization** includes measurement or estimation of both current and future adverse effects as well as the overall degree of confidence in the risk estimates.

7.2.1 Problem Formulation

The problem formulation step includes the identification of those contaminants of potential concern that will be evaluated in the BERA, the pathways by which the ecological receptors might be exposed, and the identification of representative species that will be evaluated in the BERA. Species that were evaluated in the BERA included the benthic invertebrate community, fish, birds, and semi-aquatic mammals.

7.2.1.1 Identification of Contaminants of Potential Concern

Contaminants evaluated in the BERA were selected by comparing the analytical data for sediment, surface water, and tissues obtained from EW OU against conservative screening benchmarks. COPCs were identified for each of the receptors of concern (ROCs) and for each exposure pathway; COPCs identified for the EW OU are summarized in Table D10 in Appendix D.

COPCs were identified for each receptor of concern through a risk-based screening process that compared maximum detected concentrations to established sediment and water quality criteria, guidelines, or benchmarks or with toxicity reference values (TRVs) or sediment quality values (SQVs) derived from the scientific literature. When available, no observed adverse effects levels (NOAELs), the maximum concentration at which adverse effects have not been observed, were selected as the TRV. Where NOAELs were not available for contaminants of interest, the lowest observed adverse effects level (LOAEL) or median lethal concentration (LC50) was used to derive the TRVs using the following uncertainty factors, per EPA Region 10 guidance (EPA, 1997):

- Acute or subchronic LOAEL/10
- Chronic or critical life stage LOAEL/5
- LC_{50}

The COPCs identified for the benthic invertebrate community included 46 contaminants in sediment, one contaminant in porewater, and two contaminants based on tissue concentrations (Table D10). No COPCs were identified for benthic community exposure to surface water. Eight COPCs were identified for crab based on concentrations in tissue and three COPCs were identified based on concentrations in surface water. A total of 13 COPCs were identified for fish-based diet (six COPCs), tissue-residue (four COPCs), and surface water (three COPCs). Five COPCs were identified for birds and mammals based on diet.

Information on the contaminants that were considered as COPCs to be evaluated in the BERA, including statistical summary of the analytical results, screening benchmark values, and TRVs are presented in the BERA.

7.2.1.2 Identification of Exposure Pathways

The problem formulation included the development of a CSM that identifies and describes pathways through which receptors may be exposed to COPCs associated with EW OU sediment. The pathways evaluated in the BERA included both direct exposure through sediment and water and indirect exposure through the ingestion of prey from the EW OU. Pathways considered to be complete and significant for each of the receptors are shown in Figures 13 and 14 and summarized in the following sections.

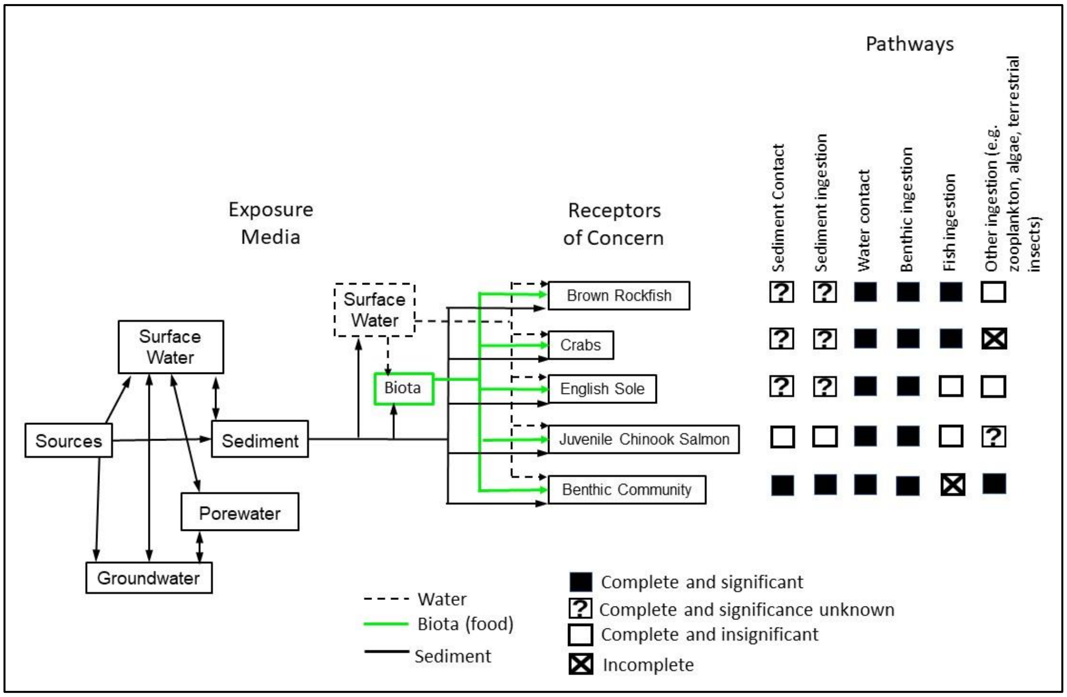

Figure 13. Conceptual Site Model for Invertebrates and Fish in the EW OU

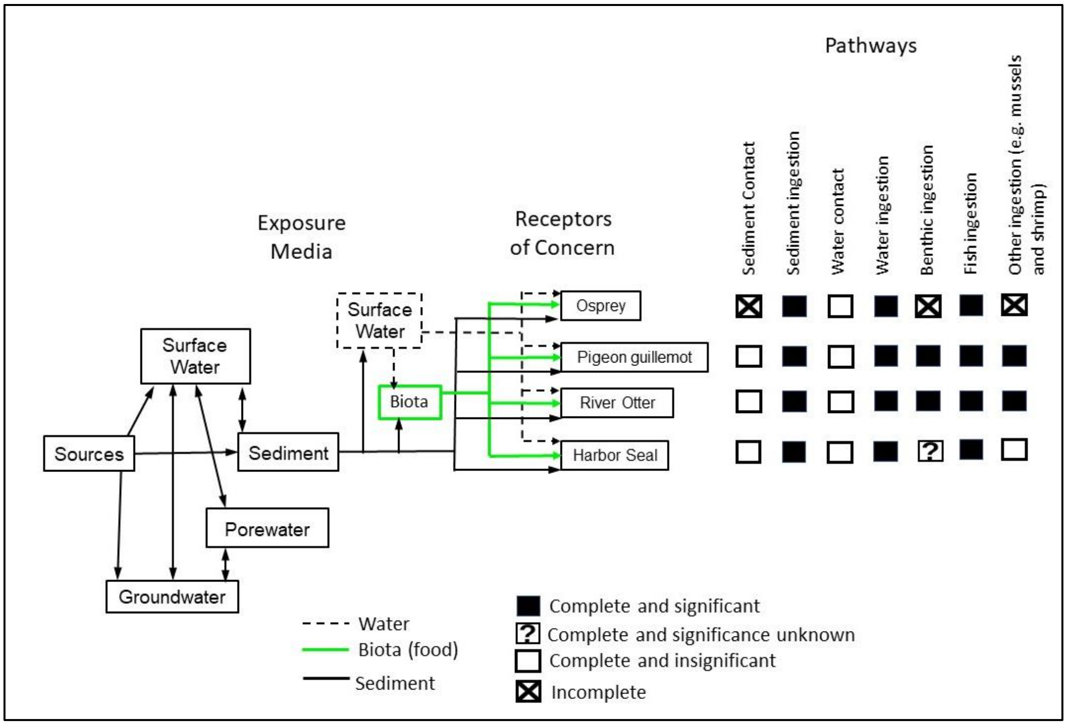

Figure 14. Conceptual Site Model for Wildlife in the EW OU

7.2.1.3 Identification of Receptors

The BERA evaluated the potential exposure of aquatic and aquatic-dependent ecological receptors that are present in the EW OU during baseline conditions, focusing on representative species that typify groups of similar organisms with specific exposure pathways.

The selection criteria for ecological receptors follow:

- They represent feeding guilds (a group of species that share similar feeding strategies or diets) present at the EW OU.
- They use the same habitat as other similar species.
- They are susceptible to contaminants and risk conclusions will be protective of other species not explicitly evaluated.
- They are ecologically, culturally, and/or economically significant.

Nine ecological receptors were selected for evaluation and are described below: the benthic invertebrate community, crab, three fish species (juvenile Chinook salmon, English sole, and brown rockfish), and four aquatic-dependent wildlife species (pigeon guillemot, osprey, river otter, and harbor seal). The receptors for the BERA are described below. The rationale, including its ecological and societal importance, site use, and sensitivity, is provided in Table D11 in Appendix D.

Benthic Invertebrate Community: This group includes invertebrates that live in or on the sediment, including clams and worms. Benthic invertebrates are food for larger predators, including fish, wildlife, and humans. Exposure pathways included direct contact with sediment and surface water, ingestion of biota and sediment, and direct contact with porewater.

Crab: Crab represent species that live on the sediment surface and move throughout the EW OU feeding on benthic invertebrates and detritus on the bottom of the waterway. Exposure pathways included direct contact with sediment and surface water, ingestion of biota and sediment, and direct contact with porewater.

Fish: Potential risk was evaluated for brown rockfish and English sole, two resident fish species that live and feed in close association with sediment, feeding on benthic invertebrates, small fish, and detritus. The BERA also evaluated the potential for effects to juvenile Chinook salmon, an endangered fish species that migrates through the waterway. Exposure pathways for fish included direct contact with sediment and surface water, ingestion of contaminated prey, incidental ingestion of contaminated sediment, and direct contact with contaminated porewater.

Birds and Mammals: Osprey, pigeon guillemot, river otter, and harbor seals represented larger wildlife potentially exposed to contamination in the EW OU. Exposure pathways evaluated included ingestion of contaminated prey and incidental ingestion of sediment.

7.2.2 Exposure Assessment

This section summarizes the ecological exposure pathways of concern evaluated in the BERA. Information on the exposure routes, assessment study objectives, and measurement specific lines of evidence used to evaluate objective endpoints are presented by exposure medium. This step also includes the determination of the EPCs for each COPC in each of the different media for each receptor and pathway. The lines of evidence and method of risk evaluation for each receptor group are summarized in Table D12 in Appendix D.

7.2.2.1 Pathways and Receptors

Exposure data were evaluated at the scale over which the receptors are likely to be exposed and, where pertinent, the variety of potentially contaminated prey the receptor may consume. Exposure areas of the least mobile receptors are no larger than the immediate area where samples were collected. The exposure areas for the most mobile receptors (fish, birds, and semi-aquatic mammals) encompass the entire EW OU.

Complete and significant pathways for the benthic invertebrate community includes sediment contact, sediment ingestion, prey ingestion, and surface water contact (Figure 13). Risks to the benthic invertebrate community from sediment and surface water contact were addressed directly in the BERA. Risks from sediment and prey ingestion were evaluated indirectly through the evaluation of bioaccumulative compounds in benthic tissue residue, which integrates all exposure pathways. Prey ingestion and surface water contact are complete and significant pathways for crab, but the significance of the sediment ingestion and sediment contact exposure pathways are unknown. All of these pathways were evaluated using the tissue-residue evaluation for crab.

The most important exposure pathway for fish to sediment-associated chemicals in the EW OU is ingestion (Figure 13), which was addressed through the evaluation of chemicals in prey items using a dietary approach. Water contact was also a complete and significant pathway for fish and was addressed in this BERA; sediment contact and sediment ingestion were complete but less important pathways for fish. All exposure pathways for fish were assessed through a tissue-residue evaluation, which integrates all forms of exposure, including from water, sediment, and diet.

Ingestion of prey, surface water, and sediment were all complete and significant pathways, although the surface water and sediment ingestion pathways were considered to be a very small portion of the overall exposure when compared with the prey ingestion pathway (Figure 14). The feathers and fur on birds and mammals limit direct exposure of their skin, although some areas are more exposed, such as the legs and feet, and under the wings for birds. Exposure to COPCs for wildlife in the EW OU was based on dietary exposure.

7.2.2.2 Exposure Concentrations

Exposure-point concentrations represent an estimate of the COPC concentration that each receptor is exposed to via each of the significant pathways.

Benthic Invertebrates: EPCs were developed for surface sediment, tissue residue, surface water, and porewater to characterize risk to the benthic invertebrate community. Benthic invertebrates have small home ranges; therefore, exposure to sediment was assessed based on the concentration of a COPC at a particular location. Summary statistics (concentrations and detection frequencies) for the 29 COPCs in the surface sediment dataset are presented in the BERA. Similarly, exposure to COPCs in surface water and porewater was based on samples collected from individual locations.

TBT and total PCBs were identified as COPCs for benthic invertebrates. The EPCs were represented by concentrations in the benthic invertebrate samples collected and composited from the EW OU.

Crab: EPCs for the five sediment and three surface water COPCs were calculated using nine composite crab samples collected throughout the EW OU, including both Dungeness and red rock crab. Crab composite samples were analyzed as edible meat and hepatopancreas tissues. Whole-body crab concentrations in each of the composite samples were calculated using the relative weights of and COPC concentrations in edible meat and hepatopancreas. Dungeness and red rock crab are relatively mobile, so exposure was evaluated using EPCs calculated on a site-wide basis.

Fish: Exposure of fish was estimated via three exposure approaches: tissue residue, dietary, and surface water. Exposure concentrations for these three types of evaluations were calculated as concentrations in whole-body tissue, diet, and surface water for each COPC identified for the three fish ROCs: juvenile Chinook salmon, English sole, and brown rockfish.

A tissue-residue evaluation was used for chemicals that bioaccumulate and persist in fish tissue. COPCs identified in the screening process for the tissue-residue evaluation were TBT and total PCBs for both English sole and brown rockfish. Mercury and beta endosulfan were also identified as COPCs for brown rockfish. Whole-body tissue EPCs integrated the exposure of a fish from all pathways (direct sediment and water contact and diet) within its foraging range. The English sole foraging range was assumed to be the entire EW OU. The home range for brown rockfish is more limited; therefore, brown rockfish data were evaluated on a site-wide basis (combining all individual brown rockfish data) and on a location-specific basis (using detected concentrations in each individual brown rockfish).

A dietary evaluation was used for chemicals that are highly regulated (most metals) or metabolized by fish. COPCs identified in the screening process were arsenic, cadmium, chromium, copper, mercury, and vanadium for all three fish ROCs. Benzo[*a*]pyrene was also identified as a COPC for English sole and brown rockfish. Dietary EPCs were calculated as the sum of the weighted EPCs for all prey items in the ROC diet. The weighted EPCs were calculated as the EPC for the prey item multiplied by the proportion of the ROC diet for that prey species. The dietary evaluation was conducted on a site-wide basis for all three fish ROCs, and thus site-wide EPCs were used for prey tissues and sediment in the dietary calculations. In addition, the dietary evaluation was conducted on a sample-specific basis for individual rockfish, using location-specific EPCs in the dietary calculations when available for benthic invertebrates and sediment).

A surface water evaluation was used for chemicals that were identified as COPCs in surface water during the screening process. The COPCs identified for all three fish ROCs were cadmium, mercury, and TBT. EPCs were calculated using the site-wide surface water data for each COPC to represent exposure throughout the site, thus accounting for a variety of seasons and water flow conditions. In addition, EPCs based on detected COPC concentrations in individual water samples were used to represent conditions at that location at the time of sampling as a more conservative analysis. Cadmium and mercury EPCs were based on the dissolved fraction because the TRVs were based on the dissolved fraction; TBT EPCs were based on total concentrations.

Wildlife: Exposure to COPCs by wildlife through the ingestion of prey, surface water, and surface sediment was estimated by calculating exposure doses for each ROC-COPC, expressed as mg COPC ingested per kg body weight per day. Estimates of dietary composition and site use were made using site-specific information, if available, along with general species life history information. Exposures as dietary doses based on the ingestion of prey, water, and sediment were estimated for each wildlife ROC based on the weighted sum of the EPCs for each prey item. Since the home range for each of the wildlife ROCs was assumed to be the entire EW OU, the prey EPCs were based on data collected throughout the EW OU.

7.2.3 Ecological Effects Assessment

The ecological effects assessment involved two general approaches. The effects of COPCs for most receptors were assessed by comparing contaminant concentrations in each medium with contaminant- and medium-specific TRVs or site-specific SQVs. The LOAEL TRVs were used for all receptors evaluated at the community or population level. NOAEL TRVs were used for species listed as threatened under the Endangered Species Act, such as the juvenile Chinook salmon. The second effects assessment approach used sediment toxicity bioassays as a direct measure of the effects of sediment contaminant mixtures on the survival and biomass of benthic invertebrates in the laboratory.

7.2.3.1 Effects of Contaminant Concentrations

The potential for toxicity associated with COPCs was assessed by comparing contaminant concentrations in each medium with contaminant- and medium-specific TRVs or site-specific SQVs. The LOAEL TRVs were used for all receptors evaluated at the community or population level. NOAEL TRVs were used for species listed as threatened under the Endangered Species Act, such as the juvenile Chinook salmon.

The SQVs used for the benthic invertebrate community were based on the SQS and the CSL chemical values developed by Ecology for use in Puget Sound (SMS; WAC 173-204). The screening level and maximum level guidelines of the Dredged Material Management Program (DMMP) were used for DDTs, the only COPC without SMS criteria. Chemical concentrations less than or equal to the SQS are defined as concentrations at which no acute or chronic adverse effects on biological resources are expected. Chemical concentrations between the SCO and CSL are defined as having the potential for minor adverse effects and chemical concentrations greater than the CSL are considered levels at which adverse effects are expected. A contaminant was selected as a COC if its concentration was found to be above the SCO criteria (or above the DMMP guidelines in the case of total DDTs) in one or more sediment samples from the EW OU.

7.2.3.2 Sediment Toxicity Tests

The effects assessment for the benthic community also included sediment toxicity bioassays as a direct measure of the acute and chronic effects of sediment contaminant mixtures on the survival, development, and biomass of benthic invertebrates in the laboratory (Table D10, Appendix D). The results of the toxicity tests were evaluated using the SMS criteria for marine toxicity tests. The biological effects criteria for designating either SCO or CSL effects levels are summarized in Table D13 in Appendix D. Test responses less than or equal to the SCO effects level indicate that COPCs in sediment are not expected to adversely affect benthic organisms, test responses greater than SCO and less than or equal to the CSL indicate minor adverse effects, and test responses greater than the CSL indicate that adverse effects are expected to occur.

7.2.4 Risk Characterization

Risk characterization combines information from the exposure and ecological effects assessments into descriptions of the likelihood of unacceptable ecological risk. The risk characterization included information on the contaminants posing potentially unacceptable risk, which receptors were at risk, the media and exposure pathways in which contaminants posing potentially unacceptable risks were found, the magnitude of the risks, and the location(s) of risks within the Site.

In addition to the quantitative calculations performed to estimate risks, the risk characterization also discusses the level of agreement among the multiple lines of evidence used to assess risks to the assessment endpoints, the relative strengths and weaknesses of each line of evidence, the ecological significance of identified risks, and the uncertainties associated with the risk assessment conclusions.

HQs that were calculated to determine risk to benthic invertebrates, crab, fish, and wildlife directly and indirectly exposed to COPCs in EW OU sediment and surface waters. An HQ shows how much the concentration of a contaminant exceeded its benchmark, CBR, or TRV. Risk was assumed possible if an HQ exceeded 1. HQs were calculated as follows:

Equation 3: $HQ = \frac{EPC}{benchmark,TRV}$

Where:

HQ = Hazard quotient

EPC = Exposure point concentration

TRV = Threshold response value

7.2.4.1 Risks to Benthic Invertebrates

Risks to benthic invertebrates based on COPCs in sediment are summarized in Table D14. A contaminant was selected as a COC if its concentration was found to be above the SCO criteria (or above the DMMP guidelines in the case of total DDTs) in one or more sediment samples from the EW OU. Surface sediment samples were collected from 243 locations within the EW OU; of those, 167 locations had one or more exceedances of the TRVs based on SCO or SL values. All 30 COPCs exceeded the SQS in at least one location and were considered to be COCs. Total PCBs most frequently (65 percent) exceeded its SCO criterion, followed by mercury (19 percent), and 1,4-dichlorobenzene (13 percent). All other COPCs exceeded their respective criteria in less than 10 percent of the locations.

Twenty-three COPCs exceeded their respective CSL in at least one location, with total PCBs being the most frequently detected above its CSL criterion (23 of 240 locations, or 9.6 percent) followed by mercury (10 of 239 locations, or 4.2 percent); all other chemicals were detected above their respective CSL criterion in less than 4 percent of the locations.

Sediment toxicity exceeded the SCO testing benchmarks (as defined in Table D13 in Appendix D) at half of the 51 locations tested during the SRI. Of these locations, 38 percent also exceeded the higher CSL criterion.

When both sediment chemistry and toxicity tests were used in combination, the potential for adverse effects to the benthic community from COPCs in sediment was predicted for sediments from approximately 61 percent (96 acres) of the EW OU (Figure 15). Approximately 39 percent of the EW OU (61 acres) was considered unlikely to have adverse effects on the benthic invertebrate community. Of the 96 acres with predicted sediment toxicity, 59 acres (38 percent of the EW OU) had contaminant concentrations or biological effects that exceeded the lower SCO criterion, but not the CSL. Sediment from approximately 37 acres (23 percent of the EW OU) had chemical concentrations or sediment toxicity that exceeded the higher CSL criterion, indicating a higher likelihood of adverse effects to the benthic community.

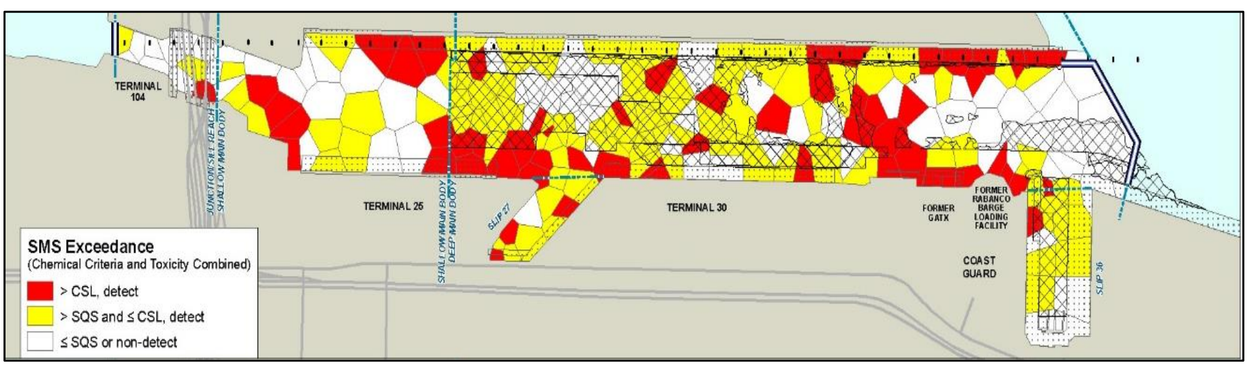

Figure 15. Areas posing potentially unacceptable risk to benthic receptors

Risks associated with TBT and PCBs in invertebrate tissues were evaluated in composites of a variety of infaunal and epifaunal species collected from 13 areas of the EW OU. Clam tissues were also evaluated separately based on a composite that included a variety of clam species. The LOAEL-based HQ values were less than 1 for both the invertebrate community and clam composites. The LOAEL HQ for PCBs for TBT were greater than 1 for 2 of the 13 area composites, as well as for the clam composite, indicating that in portions of the EW OU there is a potential for risk to the benthic invertebrate community from TBT in sediments.

Risk to the benthic community from exposure to cadmium, mercury, and TBT in surface water were evaluated at six to eight locations in the EW OU. Cadmium was detected as a concentration greater than the Washington State water quality criteria (WQC) in 1 of 131 samples collected from the EW OU, mercury was not detected at concentrations greater than the TRV in any of the surface water. TBT was detected at a concentration greater than the TRV in only 1 of 31 surface water samples from the bottom of the water column. TBT was undetected in the remaining 30 samples, although reporting limits were greater than the WQC.

7.2.4.2 Risk to shellfish (Crab)

Risks associated with COPCs in crab tissue were evaluated in composite of crab tissue collected from nine areas within the EW OU. LOAEL HQs for cadmium, copper, and zinc in crab tissue composites were greater than 1, indicating the potential for adverse effects in the EW OU. The LOAEL HQs for arsenic and total PCBs were less than 1. No unacceptable risk was identified for crab exposures to surface water.

7.2.4.3 Risk to Fish

Risks to fish were based on tissue residue and dietary evaluations, as well as exposure to surface water. Evaluations of tissue residues were based on composites from the entire EW OU for English sole and brown rockfish, as well as from brown rockfish samples representing each of 15 sampled locations. Tissue residue HQ values of greater than 1 were observed for TBT and PCBs; HQ values were below 1 for the tissue residues for all other COPCs. Based on the dietary evaluations, HQ greater than 1 were observed for cadmium, copper, and vanadium in brown rockfish and juvenile Chinook salmon; the concentration of cadmium in English sole tissues was also greater than the LOAEL TRV. None of the surface water COPCs had a HQ greater than 1.

7.2.4.4 Risk to other Wildlife

Risks to raccoon, pigeon guillemot, osprey, river otter and harbor seal were based on exposure to COPCs through dietary pathways and exposure to surface water. All LOAEL HQs were less than 1.

7.2.5 Identification of COCs

The identification of COCs for ecological receptors was based on the risk estimates and uncertainties associated with those estimates as discussed in the BERA. The COCs that were determined for each ROC and the rationale for that determination are presented in Tables D14 and D15 in Appendix D.

In the BERA, 30 contaminants were selected as COCs for benthic invertebrates. Of these, 29 contaminants were selected as COCs for benthic invertebrates because concentrations greater than the SCO were detected in at least one sediment sample. Total DDT was not selected as a COC because of the low detection frequency, known analytical uncertainties from PCB interference, and uncertainties in the effects data. TBT was identified as a primary COC for the benthic invertebrate community for the tissue evaluation because of two LOAEL-based HQs greater than 1 and low uncertainty in the exposure data. Total PCB was selected as a COC for English sole and brown rockfish because tissue PCB concentrations exceeded the higher LOAEL TRV.

7.2.6 Uncertainty Analysis

Uncertainties in the BERA are summarized below:

- Estimates of the areal extent of surface sediment with concentrations that exceed SMS criteria are uncertain because they were estimated by interpolating from individual points at which sediments were sampled.
- Data from field studies (many of them conducted in the Puget Sound region) were not included in the effects assessment and TRV development because of the difficulty in identifying the cause of toxicity associated with exposures involving multiple chemical and nonchemical stressors.
- The potential for adverse effects is uncertain for all exposure concentrations that are above the NOAEL but below the LOAEL due to lack of data on effects of concentrations between these values.
- Some LOAEL-based TRV values are more uncertain due to uncertainties in the studies reporting the lowest effects concentrations; for example, for the studies reporting PCB TRVs for English sole and osprey.
- Some EPCs are uncertain due to a small number of samples driving the estimate; for example, the HQ for lead in spotted sandpiper is driven by a high lead concentration in one benthic invertebrate tissue sample.

7.2.7 Ecological Risk Summary

The BERA quantified risk to different potentially exposed ecological receptors as an HQ, the ratio of contaminant concentration to a given toxicological benchmark. If an HQ is calculated to be equal to or less than 1, then no adverse effects are expected as a result of exposure. If the HQ is greater than 1, adverse effects are possible. The following presents the primary conclusions of the BERA:

- Twenty-nine chemicals or groups of chemicals were identified as COCs for the benthic community, with HQ values greater than 1 and confirmed toxicity based on acute and/or chronic toxicity tests. Approximately 61 percent of the waterway was predicted to have potential adverse effects to the benthic community based on sediment chemistry and confirmatory toxicity tests.
- Cadmium, copper, and zinc were identified as COCs in crab tissue. Total PCBs were identified as COCs for English sole and brown rockfish.
- No contaminants were found to pose unacceptable risk to bird or mammal receptors.

7.3 Basis for Taking Action

The response action selected in this IROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. This determination is based on the following:

- The cumulative human health risks associated with consumption of resident fish and shellfish pose unacceptable cancer risk and non-cancer hazards.
- The cumulative human health risks associated with direct contact with sediments during netfishing and clamming pose unacceptable cancer risk.
- COCs in sediment are present at concentrations that pose unacceptable risks to benthic organisms, crab, and resident fish.

Section 8 Remedial Action Objectives

In accordance with the NCP, EPA developed remedial action objectives (RAOs) to describe what the cleanup is expected to accomplish to protect human health and the environment. RAOs help focus the development and evaluation of remedial alternatives and are developed to address unacceptable risks associated with each COC, exposure pathway, exposure route, and receptor. Consistent with the anticipated final RAOs 1-4 below, EPA's long-term objective is to reduce sediment concentrations to be protective of both human health and the environment. What can be ultimately achieved with any CERCLA cleanup at the EW OU is, in large part, dependent on source-control actions occuring under various non-CERCLA Federal, State, and local regulatory programs. Therefore, EPA is selecting this action as an interim remedy. Implementing this action now and remediating the contaminated sediment will immediately reduce unacceptable risks through reduction of contaminant concentrations. This interim action will support and be consistent with a final ROD, and consistent with CERCLA and the NCP. Post-construction monitoring of the interim action as well as continued monitoring of upstream loading will provide data to better predict what a final remedy can achieve in the long-term.

- **RAO to be achieved by this Interim Action:** Reduce through active remediation concentrations of COCs in sediment greater than remedial action levels (see Section 9.1.2)**.**

The FS was based on the RAOs developed for an anticipated final cleanup of the EW OU. These objectives, presented below, represent the long-term objectives for the EW OU cleanup, and were the basis for development of the remedial alternatives. Although they are long-term objectives and not the objectives of this interim action, they are still relevant because the interim action will be consistent with the final action and its long-term objectives.

- **Anticipated Final RAO 1:** Reduce to protective levels risks associated with the consumption of contaminated resident EW OU fish and shellfish by adults and children with the highest potential exposure. PCBs, arsenic, cPAHs, and dioxin/furans are the primary COCs that contribute to the estimated unacceptable cancer risk and non-cancer hazard from the consumption of resident contaminated fish and shellfish.
- **Anticipated Final RAO 2:** Reduce to protective levels risks from direct contact (skin contact and incidental ingestion) by adults and children to contaminated sediments during netfishing and clamming. Arsenic is the primary COC that contributes to estimated unacceptable cancer risks from netfishing and clamming.
- **Anticipated Final RAO 3:** Reduce to protective levels risks to benthic invertebrates from exposure to contaminated sediments.
- **Anticipated Final RAO 4:** Reduce to protective levels risks to crabs and fish from exposure to contaminated sediment, surface water, and prey.

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Section 9 Description of Alternatives

This section provides a brief overview of each of the remedial alternatives that were retained following screening and were evaluated in the detailed analysis section of the June 2019 FS Report. These alternatives were developed by combining response actions and technologies to address the estimated exposure risks to human health and the environment. The alternatives were also developed, to the extent practical, to represent a range of effectiveness, time to achieve the interim RAO, and cost to implement.

9.1 Remedy Components

As required by CERCLA, a No Action Alternative is included for comparative purposes. The No Action Alternative would include only monitoring to evaluate changes in COC concentrations over time. All other alternatives include some type of active remediation and are comprised of common elements including the remedial technologies, waste disposal options, methods for managing dredge residuals, institutional controls, and monitoring requirements.

9.1.1 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d)[1] of CERCLA, 42 U.S.C. 9621(d), requires that, with respect to hazardous substances, pollutants or contaminants that will remain onsite, remedial actions achieve a level or standard of control for such hazardous substances, pollutants or contaminants that attains applicable or relevant and appropriate requirements (ARARs), which are comprised of Federal environmental law or more stringent and promulgated state environmental or facility siting law. CERCLA further provides that a remedy that does not attain an ARAR can be selected if the remedy assures protection of human health and the environment and meets one of six waiver criteria described in CERCLA Section 121(d)(4). At this time, EPA has no information to justify waiving any of the identified ARARs for the Site.

ARARs that apply for the interim remedy include certain provisions of the Resource Conservation and Recovery Act (RCRA), the Washington Water Quality Standards, Ambient Water Quality Criteria under the Clean Water Act (CWA), and dredge and fill requirements of the CWA. Endangered Species Act requirements may affect remedy implementation to protect Chinook salmon migrating through the EW OU during in-water construction. Generally, in-water construction is considered to be restricted to a period between July 16 to February 15 (about 150 working days; USACE, 2017). Additional reductions in construction windows to a period between October 1 and February 15 may be required to accommodate Tribal treaty fishing rights. The construction duration estimated for each alternative was based on the shorter construction window (100 days); however, coordination with the National Marine Fisheries Service and the Tribes may allow for a longer construction window. Portions of the Washington Model Toxics Control Act (MTCA) and the Washington Sediment Management Standards (SMS) will be considered by EPA when developing cleanup levels in a future decision document. A full list of ARARs for the EW OU interim remedial action can be found in Appendix B.

[1] 42 U.S.C.§ 9621(d)

9.1.2 Remedial Action Levels

Remedial action levels (RALs) are contaminant concentrations used to delineate areas and sediment depths that require active cleanup. The relative effect of remediating those areas exceeding RAL concentrations can be evaluated as part of the analysis of alternatives. RALs are not cleanup levels.

RALs were developed for each of the primary COCs posing unacceptable human health risk (total PCBs, arsenic, and dioxins/furans) and a subset of contaminants posing unacceptable ecological risk that represent the extent of COC concentrations greater than the SCOs.

Table 7 lists the RALs for the EW OU. The basis for the RALs is presented in the FS. PCBs were evaluated using either a RAL of 12 mg/kg organic carbon (OC) (equivalent to the remedial goals for RAO 3; the protection of benthic invertebrates) or 7.5 mg/kg OC to fully evaluate the use of a lower RAL on remedial area, decrease in the site-wide average concentration and associated risk reduction, level of effort and time to complete construction, and cost. The alternatives utilized either a PCB RAL of 12 mg/kg OC or 7.5 mg/kg OC, as further described in Section 9.2 of this IROD. The method by which specific RALs were developed is further explained in Section 6.1 of the FS.

RALs are applied at each discrete sampling location, not as averaged values applied over the surface area of the waterway sediments. While RALs were used in the FS to identify areas for each alternative requiring active remediation, it is anticipated that the areas of active remediation will be further defined through sampling conducted during remedial design.

Table 7. Remedial Action Levels

Contaminant of Concern	Remedial Action Level	
Total PCBs[a]	12 or 7.5	mg/kg OC
Arsenic	57	mg/kg
Dioxins/furans-TEQ	25	ng/kg
Tributyltin	7.5	mg/kg OC
1,4-Dichlorobenzene	3.1	mg/kg OC
Butyl benzyl phthalate	4.9	mg/kg OC
Acenaphthene	16	mg/kg OC
Fluoranthene	160	mg/kg OC
Fluorene	23	mg/kg OC
Mercury	0.41	mg/kg
Phenanthrene	100	mg/kg OC

Notes:

a. Alternatives were developed using two PCB RALs.

9.1.3 Remedial Technologies

With the exception of the No Action Alternative, each alternative includes one or more of the following remedial technologies that may be applied to one or more area of the EW OU:

- **Monitored natural recovery (MNR):** MNR relies on natural processes to reduce ecological and human health risks while monitoring natural recovery over time to determine remedy success. Within the EW OU, the primary natural recovery processes are sedimentation and mixing of incoming cleaner sediment.
- **Enhanced natural recovery (ENR)**: ENR refers to the placement of a thin layer of clean sand (or other suitable habitat material) on top of contaminated sediments and may include a sequestering amendment such as activated carbon. Over time, this cleaner surface material mixes with the underlying contaminated sediment to reduce contaminant concentrations more quickly than would occur with MNR. ENR may be used in conjunction with sediment dredging to maintain appropriate water depths for navigation. The alternatives include two types of ENR defined by location and thickness:
  - **ENR-sill:** ENR placed in the Sill Reach consists of a 9-inch layer of clean sand.
  - **ENR-nav:** ENR placed within the Deep Main Body and Berth Areas consists of an 18-inch layer of clean sand. A thicker layer of ENR is required due to propwash scour. Some ENR-nav areas would require partial dredging to accommodate navigational depths.
- **Removal of contaminated sediments:** All action alternatives include the removal of contaminated sediment due to the need to maintain the current and future use of EW OU as a navigable waterway. During the FS, the following assumptions were made to support cost estimates and the feasibility evaluation:
  - Mechanical dredging to remove contaminated sediment is assumed for open water areas, using either articulated fixed-arm or cable-operated dredges situated on a barge or from the shore.
  - Diver-assisted hydraulic dredging to remove contaminated sediment is assumed for Under-pier Areas.

The footprint and depth of dredging is determined by the RAL in open water areas. In nearshore habitat areas, dredged areas would be backfilled to existing contours to maintain elevations suitable for habitat. Dredging is limited by existing underground utilities in the Communication Cable Crossing of the Deep Main Body and Berth Areas. In this area, contaminated sediment removal would be conducted to the extent practicable, and the area backfilled to protect the existing utilities.

- **Engineered capping:** Engineered caps contain contaminants in sediment by placing layers of sand, gravel, or rock to isolate and prevent migration of contamination. Capping may be used in conjunction with dredging to maintain appropriate water depths for navigation or habitat. Caps are expected to have a thickness of about 5 feet, consisting of a nominal 2.5-foot chemical isolation layer, 1-foot filter layer, and 1.5-foot armor layer. Final cap composition and thickness will be determined during design and will consider maintaining habitat.
- **In situ treatment:** In situ treatment is the placement of a layer of activated carbon (or other sequestering agent) on top of the contaminated sediment. The activated carbon mixes with the underlying contaminated material through bioturbation and propwash to reduce contaminant bioavailability in the surface sediments; in situ treatment may not significantly change the bulk

contaminant concentration. In some cases, it may not be possible to treat all contaminated sediments in limited access areas due to obstructions or difficult to access areas. The impact of these untreated sediments will be evaluated during post-construction monitoring and may require additional treatment or other containment strategies to assure that cleanup objectives are attained.

- **Residuals management cover (RMC):** Dredge residuals are sediments and associated contamination that may be released during dredging and redeposit on the dredged surface. Potential exposure to contaminants in dredge residuals may be mitigated with the placement of a residuals management cover, consisting of approximately 9 inches of clean sand that would be applied as soon as possible following the completion of dredging. The final thickness would be determined based on concentrations measured during post-remediation sampling. The RMC would be placed in all open water dredged areas and locations adjacent to dredged areas where residuals may have settled, providing a cleaner surface material that would mix with the underlying contaminated sediment to reduce contaminant concentrations.

9.1.4 Sediment Disposal

Dredged material would be transported, most likely by barge and rail, to a permitted off-site upland disposal facility. Sediment dredged from the EW OU will require characterization to determine whether it should be classified as a hazardous waste under RCRA or Toxic Substances Control Act (TSCA) waste if PCB concentrations are greater than 50 mg/kg. Any such classified waste will be disposed of in a RCRA authorized hazardous waste landfill or TSCA authorized disposal facility, as appropriate. Dredged sediment determined not to be a hazardous waste under RCRA or TSCA will be disposed of in a non-hazardous municipal waste landfill. Some clean material may need to be dredged as part of the cleanup, for example, to maintain slope stability at the edges of the dredge area. Sediment that meets the DMMP criteria for the State of Washington may be disposed at an open water disposal site.

9.1.5 Institutional Controls

Institutional controls (ICs) are advisories, limitations, or restrictions put in place to protect human health and the environment by reducing exposure to contamination left in place, to ensure remedy protectiveness, and to protect the long-term integrity of the engineered components of the remedy. Below are potential institutional control mechanisms that may be used at the EW OU.

- **Seafood consumption advisories and educational outreach:** Advisories and educational outreach programs would be implemented to inform the public of the risks associated with the consumption of contaminated fish and shellfish. Consumption advisories specific to the EW OU would be implemented in coordination with WSDOH. Educational outreach programs may include informational meetings, development and distribution of informational materials such as brochures and maps, and installation and maintenance of advisory signs at known fishing locations. Educational outreach programs will be coordinated with the Lower Duwamish Waterway fishers outreach program.
- **Waterway use restrictions and regulated navigation areas:** Where engineered caps would be utilized to contain contamination in navigable areas, waterway use restrictions may be implemented to ensure the long-term integrity of the cap. These measures may include restrictions on boat anchoring and keel dragging, vessel groundings in shallow areas, the use of

spuds (shafts driven into sediment) to stabilize vessels, structure and utility maintenance, and future maintenance dredging and/or deepening. Notifications such as signs and buoys may also be used to notify and warn the public. These restrictions would be implemented in coordination with the USCG.

9.1.6 Monitoring

Monitoring is an integral component of all the alternatives and will be conducted to ensure that the selected remedy is constructed to design specifications and achieves RALs and the RAO; to evaluate short- and long-term effectiveness; and in this case to develop cleanup levels that are achievable and protective. Media monitored for these purposes include sediment, sediment porewater, surface water, stormwater, and fish and shellfish tissue.

The program will include monitoring the known and potential sources of contamination, and updates to sediment transport modeling to better understand sediment and contaminant transport in the Green River/Duwamish River watershed and direct inputs to the EW OU to inform final cleanup level development for the EW OU. The data from this monitoring program, along with other pertinent information, will be used to assess the short and long- term effects of these sources on the sediment in the EW OU and determine what can be achieved at the EW OU.

9.1.7 Remedial Technology Areas

In support of technology selection, the EW OU CMAs (refer to Table 1) were combined into technology areas as shown in Figure 16 and described below. This is consistent with how technologies were grouped in the FS (see FS Table 8-5).

- **Deep Main Body and Berth Areas**: This area consists of the Deep Main Body, the southern-end Junction Reach, and the eastern- and western-edge Berth Areas. This technology area includes the deeper portions of the EW OU that are maintained to accommodate deep-draft vessels and are therefore subject to periodic erosion due to vessel movement. It also includes shallower portions of the waterway that are used as berth areas. The Junction Reach is a short channel that connects the LDW to the EW OU and includes the eastern portion of the Harbor Island Marina and Terminal 104 that is used for work boat moorage. Remedial action in the Deep Main Body and Berth Areas must maintain the depths required for marine traffic. The Communication Cable Crossing, which traverses the EW OU, is a portion of the Deep Main Body where any deepening or remedial action is limited to protect buried cables.
- **Shallow Main Body**: This area includes the southern portion of the Federal navigation channel where the maintained navigation elevation becomes shallower; the former Pier 24 piling field, which is characterized by numerous old creosote-treated pilings in poor condition.
- **Nearshore Areas**: These areas consist of sediments and accessible sloped banks primarily in Slip 27, the Mound Area, and adjacent to Slip 36 operated by the USCG. The Mound Area is a shallow portion of the open water area with hardened substrate near the Slip 27 entrance.
- **Under-pier Areas**: This includes areas located under aprons, docks, and overwater structures (generalized here by the term piers) along the east and west shorelines. There are challenges for addressing contaminated sediment residing underneath and adjacent to these structures due to limited access, structure stability, and irregular substrate (riprap and pilings).

- **Sill Reach**: This reach is characterized by a naturally occurring shallow area, or "sill", at the southern end of the EW OU, with a hardened river bottom. The Sill Reach is divided into two technology areas, as follows:
  - *Sill Reach – West Seattle Bridge* is the area of the Sill Reach underneath the high-decked West Seattle Bridge.
  - *Sill Reach – Low Bridges* is the area in the Sill Reach underneath the low-decked Spokane Street and Railroad Bridges. Marine traffic is limited to small watercraft due to low overhead clearance.

The Under-pier Areas and Sill Reach – Low Bridges are considered limited access areas that will require unique remedial technologies to accommodate the access difficulties.

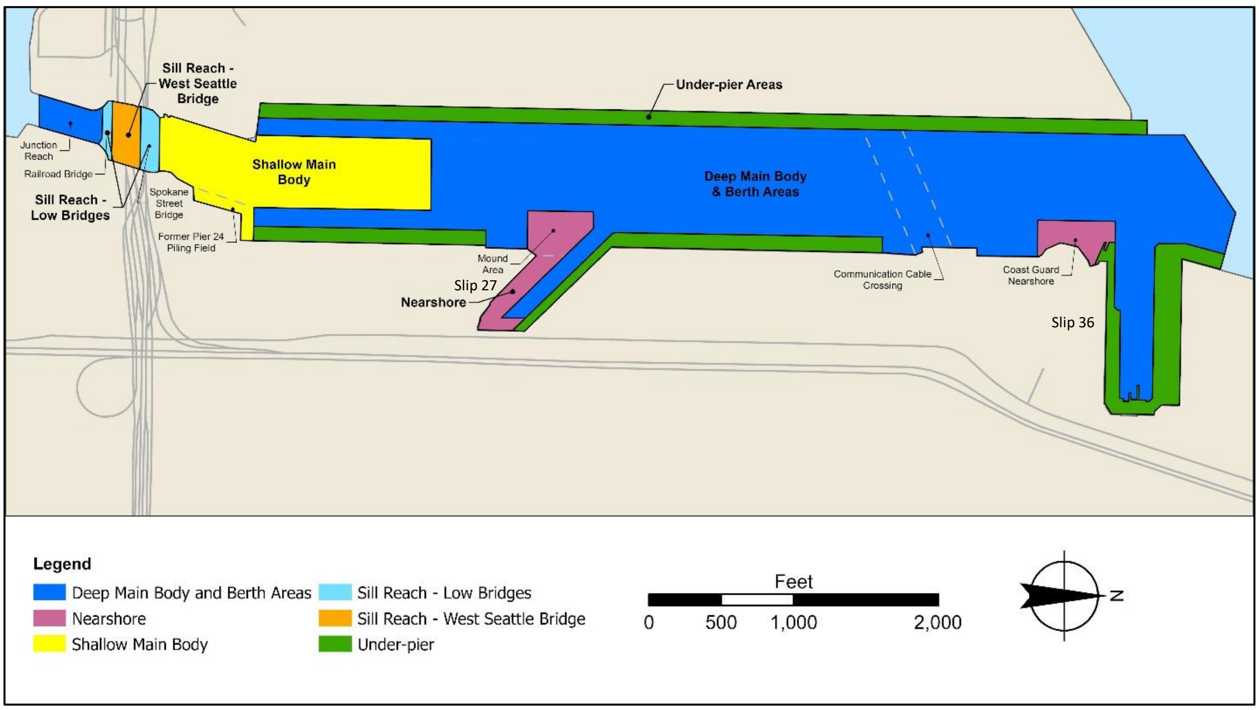

Figure 16. Technology Areas of the East Waterway Operable Unit

9.2 Description of Remedial Alternatives

The remedial action alternatives for the EW OU are presented in Table 8 and explained in the following sections. The following elements were considered in the development of the alternatives and the consideration of assigning appropriate remedial technologies (see Table 8):

Open water areas. Open water areas do not have access limitations and have increased potential for disturbance from marine vessel traffic (see Figure 16 and Table 8). The remedial technologies considered for areas above the RAL in the open water areas are as follows:

Option 1 Removal, capping, and ENR in the main body, berth areas, and Sill Reach-West Seattle Bridge.

Option 2 Removal, capping in the main body, berthing areas. ENR in the Sill Reach-West Seattle Bridge.

Option 3 Removal and capping.

Limited access areas. The remedial technologies under bridges and piers and the Sill reach are restricted by limited access. The remedial technologies considered for areas above the RAL in the limited access areas are summarized below:

Option A MNR in Under-pier Areas. MNR and ENR in the Sill Reach-Low Bridges.

Option B In situ treatment in Under-pier Areas. ENR in the Sill Reach-Low Bridges.

Option C+ Diver-assisted hydraulic dredging at Under-pier Areas where PCB or mercury concentrations are greater than the CSL, followed by in situ treatment for all Under-pier Areas. ENR in the Sill Reach-Low Bridges.

Option E Diver-assisted hydraulic dredging followed by in situ treatment in all Under-pier Areas. ENR in the Sill Reach-Low Bridges.

RAL for Total PCBs. The remedial footprint was developed using the following RALs for total PCBs to delineate the lateral and vertical extent of active remediation:

12 mg/kg OC

7.5 mg/kg OC

The areal extent of construction is 121 acres (representing 77 percent of the EW OU) when using the PCB RAL of 12 mg/kg OC. The areal extent of construction is 132 acres (representing 84 percent of the EW OU) when using the PCB RAL of 7.5 mg/kg OC.

9.2.1 Cost Estimates

In the FS, a present value analysis was performed for the anticipated expenditures over the life of each alternative to enable a comparison of total project costs, consistent with EPA guidance (EPA, 2000). This was done by using discount rates developed annually by the Office of Management and Budget. Typically, remedial action costs are discounted by 7 percent to account for economic growth. The EW OU project has been primarily funded by public entities, including King County, the City of Seattle, and the Port of Seattle; the project is unlikely to be transferred to private entities. The cost of capital for these local government entities was considered to be similar to of the cost of capital for the Federal government, and therefore a discount rate of zero percent is presented as a comparative sensitivity analysis. Costs based on a discount rate of 7 percent, consistent with OMB Circular A-94, were calculated for each alternative for comparative purposes and used for the analysis of the cost criteria. Operations and maintenance (O&M) costs for all alternatives were estimated assuming a duration of 20 years. All costs presented in this section are expressed in 2016 dollars.

Table 8. Remedial Alternatives

Alternative	Technologies for Open Water Areas[a,b]					Technologies for Limited Access Areas[a]			PCBs RAL (mg/kg OC)
	Option	Deep Main Body and Berth Areas	Shallow Main Body	Nearshore	Sill Reach – West Seattle Bridge	*Option*	Under-pier	Sill Reach – Low Bridges	
No Action	-	None				-	None		None
1A(12)	1	Dredging and ENR-nav	Dredging and Capping	Dredging and Capping	ENR-sill	A	MNR	ENR-sill and MNR	12
1B(12)						B	In situ treatment	ENR-sill	
1C+(12)						C+	Diver-assisted dredging in areas with PCBs or mercury greater than CSL. Then, in situ treatment in all areas.	ENR-sill	
2B(12)	2	Dredging	Dredging and Capping	Dredging and Capping	ENR-sill	B	In situ treatment	ENR-sill	
2C+(12)						C+	Diver-assisted dredging in areas with PCBs or mercury greater than CSL. Then, in situ treatment in all areas.	ENR-sill	
3B(12)	3	Dredging	Dredging	Dredging and Capping	Dredging	B	In situ treatment	ENR-sill	
3C+(12)						C+	Diver-assisted dredging in areas with PCBs or mercury greater than CSL. Then, in situ treatment in all areas.	ENR-sill	
2C+(7.5)	2	Dredging	Dredging and Capping	Dredging and Capping	ENR-sill				7.5
3E(7.5)	3	Dredging	Dredging	Dredging and Capping	Dredging	E	Diver-assisted dredging in all areas followed by in situ treatment.	ENR-sill	

Notes:

a. Technology areas are shown in Figure 16.

b. Technologies address areas above the RAL; MNR is considered in all areas where concentrations are less than the RAL.

ENR = enhanced natural recovery

RAL = remedial action limit

MNR = monitored natural recovery

9.2.2 Alternative 1: No Action

The No Action Alternative is required to be evaluated under the NCP as a baseline against which all other alternatives are compared. Under this alternative, no actions would be taken to address exposure to sediment or to reduce the toxicity, mobility, or volume of contaminated sediment at the Site. No construction would take place and RAOs would not be achieved. Estimated costs for the No Action Alternative were based on conducting a review of EW OU conditions at 5-year intervals and monitoring sediment, water, and fish.

Capital Costs:	$0
O&M Costs:	$950,000
Net Present Value (0%):	$950,000

Net Present Value (7%):	**$650,000**
Construction Timeframe:	N/A

Alternative 1A (PCB RAL = 12 mg/kg)

Alternative 1A(12) employs a combination of dredging, capping, ENR-nav and ENR-sill in open water areas; and ENR-sill and MNR in limited access areas, as shown on Figure 18. This alternative addresses 121 acres by dredging approximately 810,000 cy of contaminated sediment, placing of 290,000 cy of new clean material for capping, ENR, MNR, and placing an RMC layer. The total acres assigned to each technology is shown on Figure 17.

Capital Costs:	$254,000,000
O&M Costs:	$1,910,000
Net Present Value (0%):	$256,000,000
Net Present Value (7%):	**$192,000,000**
Construction Timeframe:	9 years

9.2.3 Alternative 1B (PCB RAL = 12 mg/kg OC)

Alternative 1B(12) employs a combination of dredging, capping, ENR-nav and ENR-sill in open water areas; and ENR-sill and in situ treatment in limited access areas, as shown on Figure 18. This alternative addresses 121 acres by dredging approximately 810,000 cy of contaminated sediment, placing 290,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total acres assigned to each technology is shown on Figure 17.

Capital Costs:	$261,000,000
O&M Costs:	$2,960,000
Net Present Value (0%):	$264,000,000
Net Present Value (7%):	**$199,000,000**
Construction Timeframe:	9 years

9.2.4 Alternative 1C+ (PCB RAL = 12 mg/kg OC)

Alternative 1C+(12) employs a combination of dredging, capping, ENR-nav and ENR-sill in open water areas; and ENR-sill, diver-assisted dredging, and in situ treatment in limited access areas, as shown on Figure 18. This alternative addresses 121 acres employing a combination of dredging, capping, and ENR in open water areas as shown on Figure 18. This alternative addresses 121 acres by dredging 820,000 cy of contaminated sediment, placing 290,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total area assigned to each technology is shown on Figure 17.

Capital Costs:	$274,000,000
O&M Costs:	$2,960,000
Net Present Value (0%):	$277,000,000
Net Present Value (7%):	**$209,000,000**
Construction Timeframe:	9 years

9.2.5 Alternative 2B (PCB RAL = 12 mg/kg OC)

Alternative 2B(12) employs a combination of dredging, capping, and ENR-sill in the open water areas; and ENR-sill and in situ treatment in limited access areas, as shown on Figure 19. This alternative addresses 121 acres by dredging approximately 900,000 cy of contaminated sediment, placing 280,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total area assigned to each technology is shown on Figure 17.

Capital Costs:	$281,000,000
O&M Costs:	$2,900,000
Net Present Value (0%):	$284,000,000
Net Present Value (7%):	**$210,000,000**
Construction Timeframe:	10 years

9.2.6 Alternative 2C+ (PCB RAL = 12 mg/kg OC)

Alternative 2C+(12) employs a combination of dredging, capping, and ENR-sill in the open water areas; and ENR-sill, diver-assisted dredging, and situ treatment in the limited access areas, as shown on Figure 19. This alternative addresses 121 acres by dredging 910,000 cy of contaminated sediment, placing 280,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total acres assigned to each technology is shown on Figure 17.

Capital Costs:	$294,000,000
O&M Costs:	$2,900,000
Net Present Value (0%):	$297,000,000
Net Present Value (7%):	**$220,000,000**
Construction Timeframe:	10 years

9.2.7 Alternative 3B (PCB RAL = 12 mg/kg OC)

Alternative 3B(12) employs primarily dredging in open water areas, except for capping in the Mound Area and USCG Slip 36; and ENR-sill and in situ treatment in limited access areas, as shown on Figure 19. This alternative addresses 121 acres by dredging approximately 960,000 cy of contaminated sediment, placing 270,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total acres assigned to each technology is shown on Figure 17.

Capital Costs:	$295,000,000
O&M Costs:	$2,870,000
Net Present Value (0%):	$298,000,000
Net Present Value (7%):	**$220,000,000**
Construction Timeframe:	10 years

9.2.8 Alternative 3C+ (PCB RAL = 12 mg/kg OC)

Alternative 3C+(12) employs primarily dredging in open water areas, except for capping in the Mound Area and USCG Slip 36; and ENR-sill, diver-assisted dredging, and situ treatment in the limited access areas, as shown in Figure 20. This alternative addresses 121 acres by dredging 960,000 cy of contaminated sediment, placing 270,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total acres assigned to each technology is shown on Figure 17.

Capital Costs:	$307,000,000
O&M Costs:	$2,870,000
Net Present Value (0%):	$310,000,000
Net Present Value (7%):	**$230,000,000**
Construction Timeframe:	10 years

9.2.9 Alternative 2C+ (PCB RAL = 7.5 mg/kg OC)

Alternative 2C+(7.5) employs a combination of dredging, capping, and ENR-sill in the open water areas; and ENR-sill, diver-assisted dredging, and situ treatment in the limited access areas, as shown on Figure 20. This alternative addresses 132 acres by dredging 1,010,000 cy of contaminated sediment, placing 290,000 cy of new clean material for capping, ENR, and in situ treatment, and placing an RMC layer. The total acres assigned to each technology is shown on Figure 17.

Capital Costs:	$323,000,000
O&M Costs:	$2,880,000
Net Present Value (0%):	$326,000,000
Net Present Value (7%):	**$235,000,000**
Construction Timeframe:	11 years

9.2.10 Alternative 3E (PCB RAL = 7.5 mg/kg OC)

Alternative 3E(7.5) is the most removal-focused alternative. It employs primarily dredging in open water areas, except for capping in the Mound Area and USCG Slip 36; and capping in most limited access areas except for ENR-sill under the low bridges, as shown on Figure 20. This alternative addresses 132 acres by dredging 1,080,000 cy of contaminated sediment, placing 270,000 cy of new clean material for capping and ENR, and placing an RMC. The total acres assigned to each technology is summarized on Figure 17.

Capital Costs:	$408,000,000
O&M Costs:	$2,850,000
Net Present Value (0%):	$411,000,000
Net Present Value (7%):	**$285,000,000**
Construction Timeframe:	13 years

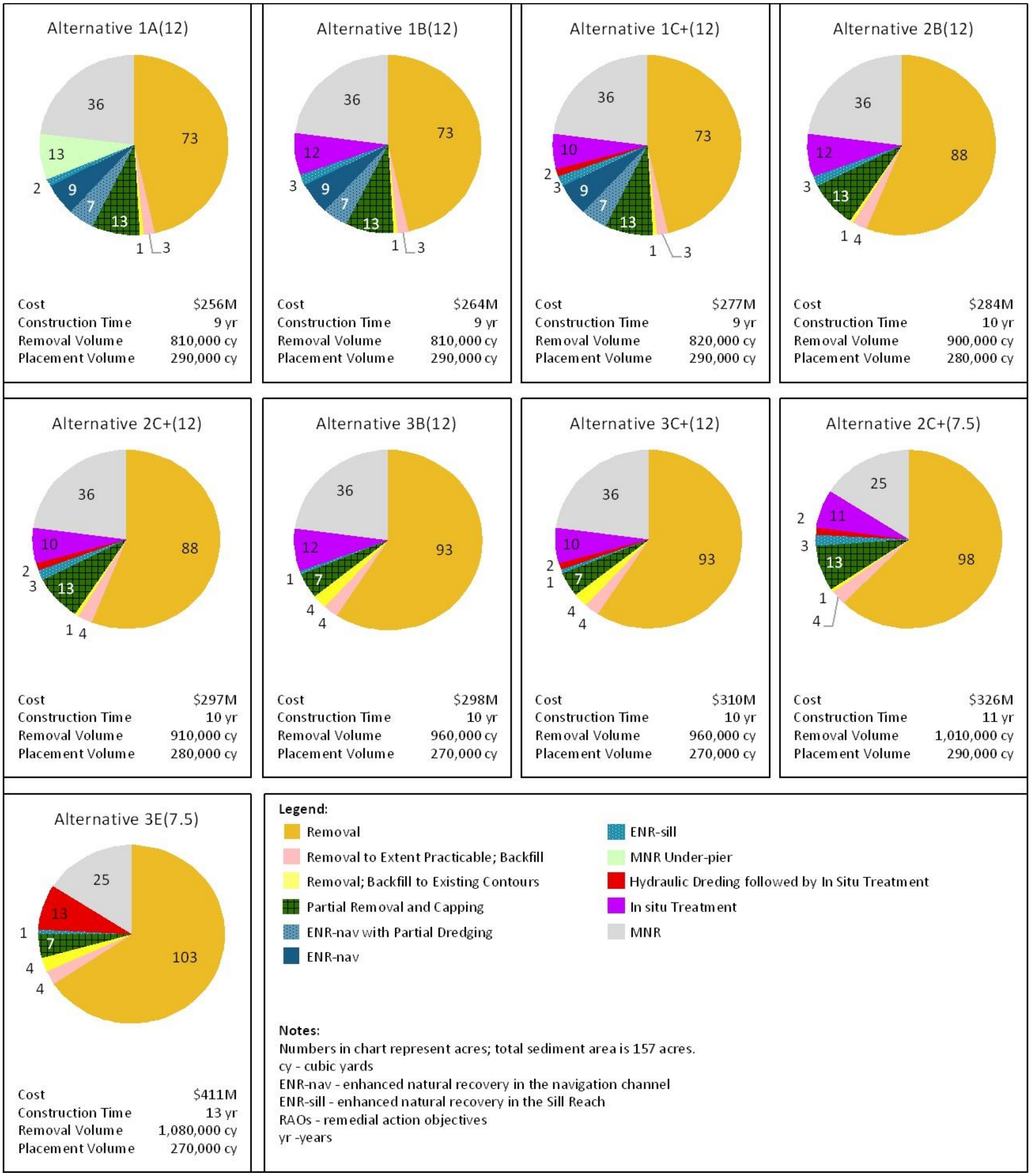

Figure 17. Areas, Volumes, and Costs for all Action Alternatives

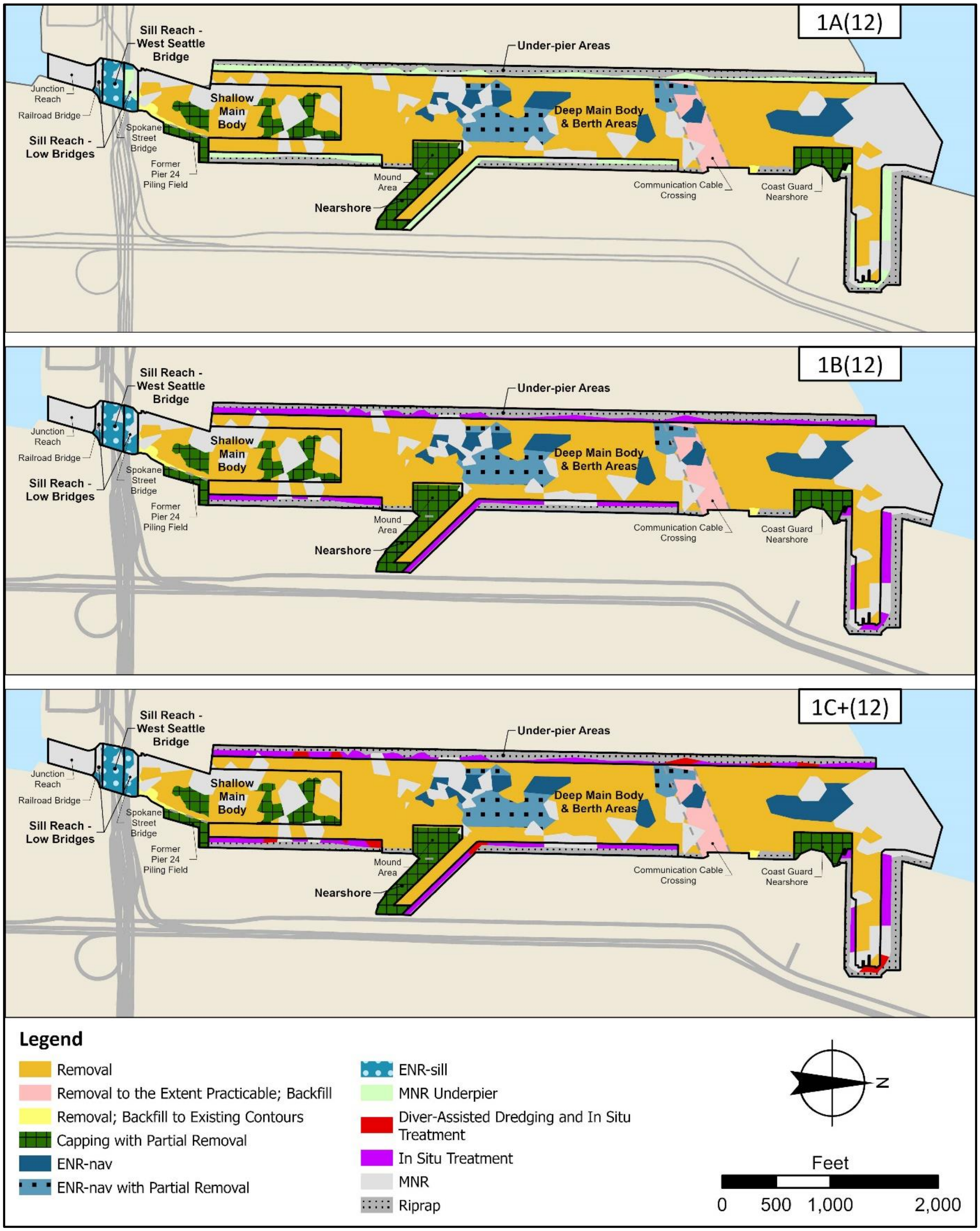

Figure 18. Map of Alternatives 1A(12), 1B(12), and 1C+(12)

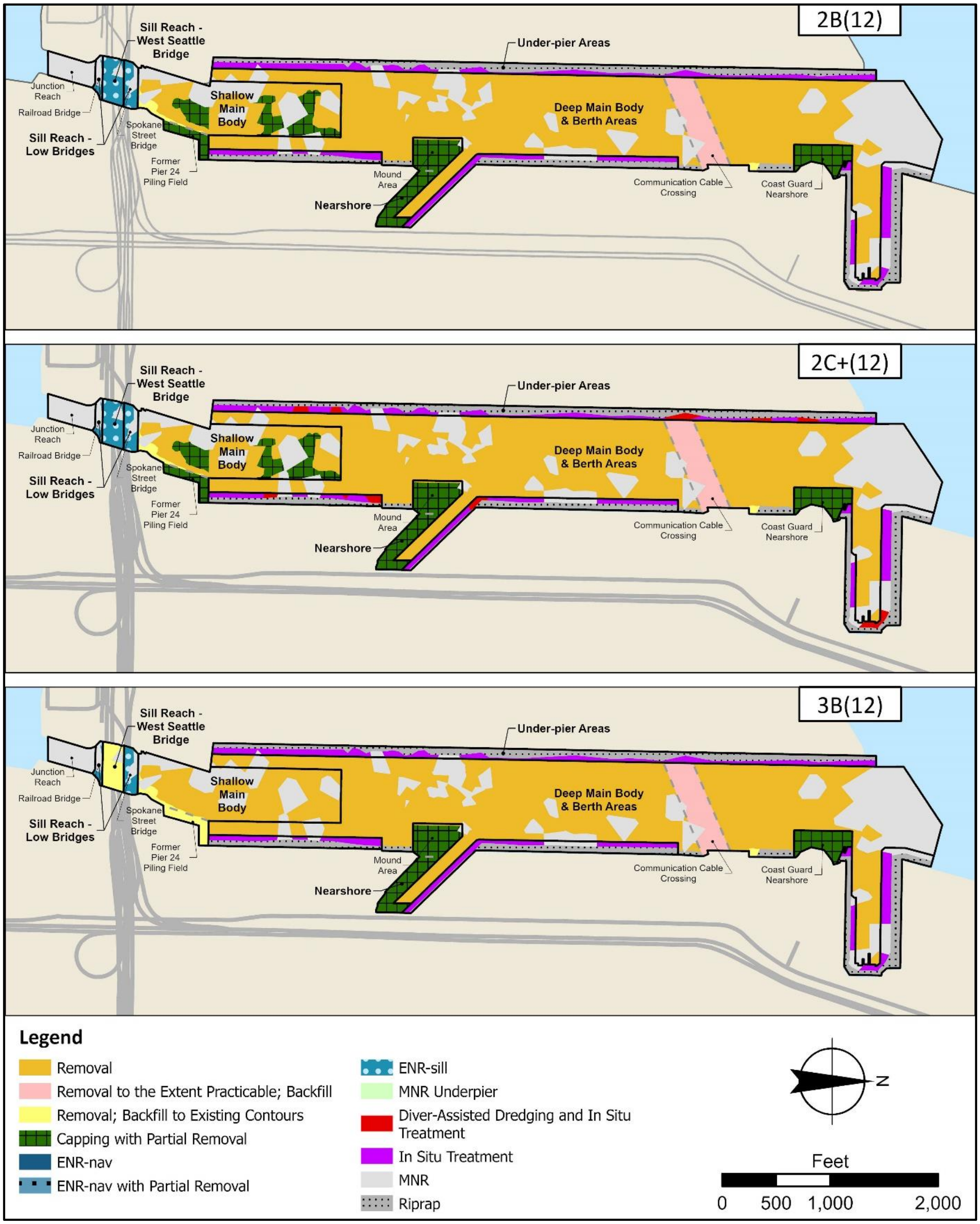

Figure 19. Map of Alternatives 2B(12), 2C+(12), and 3B(12)

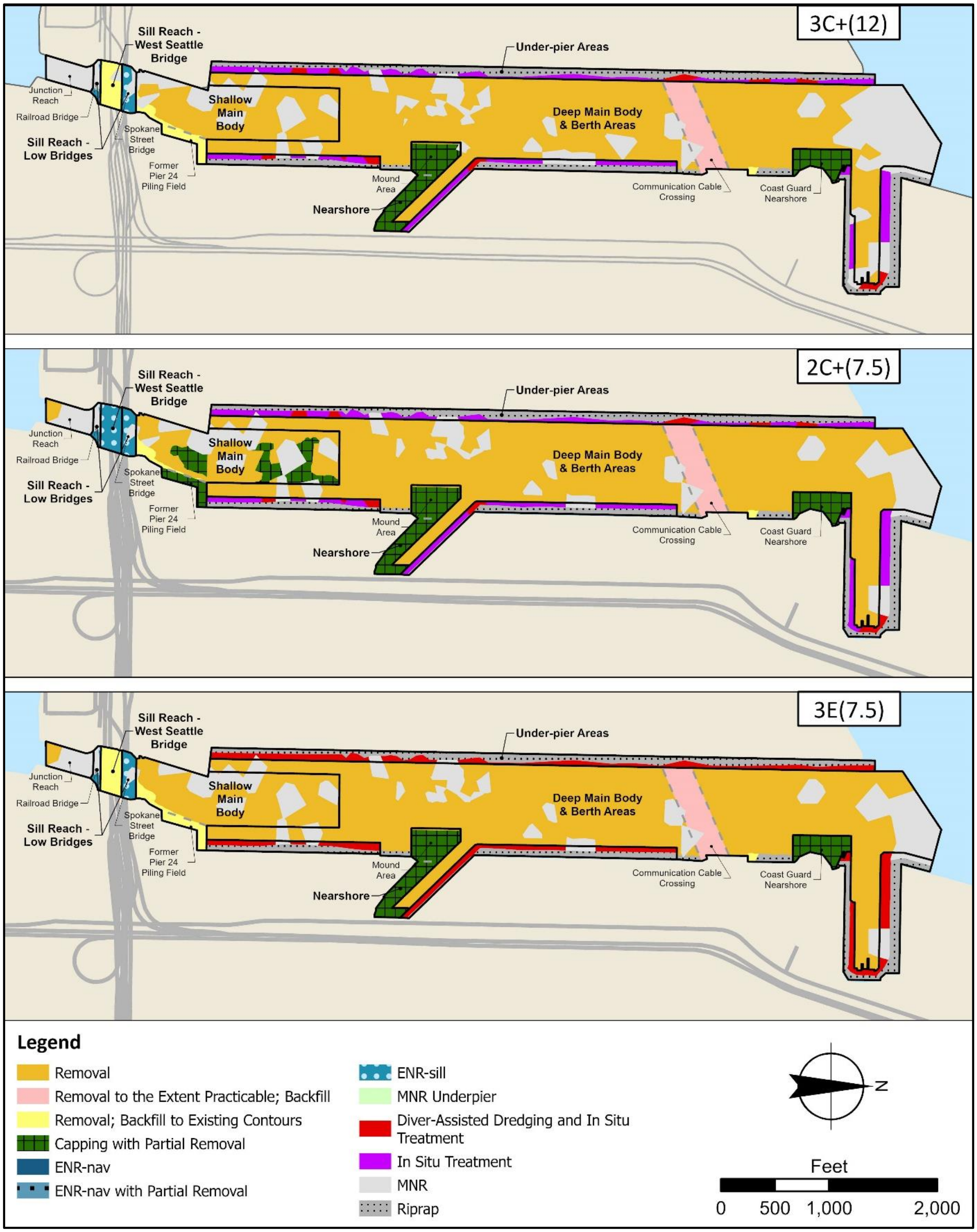

Figure 20. Map of Alternatives 3C+(12), 2C+(7.5), and 3E(7.5)

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Section 10 Comparative Analysis of Alternatives

This section provides a detailed analysis of individual alternatives against the evaluation criteria required by the NCP and a comparative analysis that focuses upon the relative performance of each alternative against those criteria. These are divided into three types and are summarized below.

Threshold Criteria

The two threshold criteria described below must be met for the alternatives to be eligible for selection, in accordance with the NCP.

1. **Overall protection of human health and the environment** addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.
2. **Compliance with ARARs** addresses whether a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria, or limitations, unless a waiver is invoked.

Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. **Long-term effectiveness and permanence** address the effectiveness and permanence of alternatives once cleanup levels are achieved, along with the degree of certainty that they will prove successful.
4. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to which alternatives employ recycling or treatment to reduce the toxicity, mobility, or volume of contaminants, including how treatment is used to address the principal threats posed by the site.
5. **Short-term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.
6. **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.
7. **Cost** includes estimated capital and O&M costs, as well as present-worth costs.

Modifying Criteria

The modifying criteria are used as the final evaluation of remedial alternatives, generally after EPA has received public comment on the SRI/FS and the Proposed Plan:

8. **State acceptance** addresses the State's position and key concerns related to the preferred alternative and other alternatives described in the Proposed Plan and SRI/FS, and the State's comments on ARARs or the proposed use of waivers.
9. **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and SRI/FS.

Each of the remedial alternatives for the EW OU was evaluated using the nine evaluation criteria in order to select a remedy (Section 10 of the FS). The following sections summarize the FS alternative analysis with respect to the nine evaluation criteria.

10.1 Overall Protection of Human Health and the Environment

A requirement of CERCLA is that the selected remedial action be protective of human health and the environment. An alternative is protective if it reduces current and potential future risks associated with each exposure pathway at a site to acceptable levels. The No Action Alternative would not be protective of human health and the environment. Contaminants in the EW OU surface sediments, surface water, and biota would continue to pose unacceptable risks to human health and the environment for the foreseeable future. Natural recovery alone is unlikely to achieve all cleanup levels and meet the RAOs in a reasonable timeframe.

The remaining alternatives achieve the Interim Action RAO and are expected to result in declining contaminant concentrations in sediment following construction of the interim action through natural processes, such as sediment deposition. Except for the No Action Alternative, each of the alternatives achieve overall protection of human health and the environment by relying primarily on removing contaminated sediment from the EW OU. Remaining risks are addressed through a combination of capping, ENR, MNR, and institutional controls. Differences between these alternatives are the potential application of ENR or capping in open water areas, and the use of in situ treatment or diver-assisted hydraulic dredging in the limited access areas. The remedial footprint is identical for seven of the nine alternatives. Two of the remedial alternatives, 2C+(7.5) and 3E(7.5), apply a lower RAL for PCBs (7.5 mg/kg OC), resulting in a slightly larger remedial footprint, but do not result in different risk reduction overtime than the other seven alternatives utilizing a PCB RAL of 12 mg/kg OC.

10.2 Compliance with ARARs

Section 121(d) of CERCLA specifies, in part, that remedial actions for cleanup of hazardous substances must comply with requirements and standards under Federal or more stringent state environmental laws and regulations that are ARARs to the hazardous substances or particular circumstances at a site, unless such ARARs are waived under CERCLA section 121(d)(4). See also 40 C.F.R. § 300.430(f)(1)(ii)(B). In addition to ARARs, the lead and support agencies may, as appropriate, identify other advisories, criteria, or guidance to be considered for a particular release. The "to-be-considered" (TBC) category consists of advisories, criteria, or guidance that were developed by EPA, other Federal agencies, or states that may be useful in developing CERCLA remedies.

ARARs are typically divided into three categories as follows;

- Chemical-Specific: Chemical-specific ARARs are usually health- or risk-based values or methodologies that when applied to site-specific conditions, result in the establishment of numerical values that can be used as remediation goals or cleanup levels..
- Location-Specific: Location-Specific requirements establish restrictions on permissible concentrations of hazardous substances, pollutants, or contaminants, or establish requirements for how activities will be conducted because they are in special locations (such as wetlands, floodplains, critical habitats, or streams).

- Action-Specific: Action-Specific ARARs are usually technology-based or activity-based requirements or limitations that control actions taken at hazardous waste sites. Action-Specific requirements often include performance, design and controls, or restrictions on particular kinds of activities related to management of hazardous substances, pollutants, or contaminants. Action-specific ARARs are triggered by the types of remedial activities and types of wastes that are generated, stored, treated, disposed, emitted, discharged, or otherwise managed.

Potential ARARs are discussed in Sections 6.2.1 and 7.3 of the FS.

The No Action Alternative is not expected to comply with ARARs, and because the No Action Alternative does not meet either threshold criteria, is not discussed further. All other alternatives comply with ARARs as they relate to the interim remedial action.

10.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of an alternative to maintain reliable protection of human health and the environment over time. Key considerations for evaluating these criteria are long-term risks and magnitude of the residual risk, and the adequacy and reliability of controls for containing untreated waste left in place at depth or treatment residuals over time.

10.3.1.1 Magnitude of Residual Risk

Residual risk is the same for all the alternatives, as each alternative is expected to ultimately achieve the same sediment concentrations through natural processes, such as sediment transport and deposition from the Green River/Duwamish River.

10.3.1.2 Adequacy and Reliability of Controls

The adequacy and reliability of controls is a measure of the effectiveness of the controls needed to manage residual risks from contaminated sediment remaining following remediation. The magnitude and importance of those controls is driven primarily by the potential for exposure to contaminants left in place.

The alternatives differ in the long-term reliability of the methods used to contain contamination left in place. Alternative 1A(12) relies on MNR, particularly under docks and piers. Surface sediment contamination would remain in place untreated, resulting in ongoing exposures and risk for an extended period of time. Exposure to contamination is predicted to be lower for all other alternatives, primarily due to the contaminated sediment removal and the application of the RMC layer in open water areas and treatment or removal in the limited access areas.

The amount of subsurface contamination that is removed also provides an indication of the long-term permanence of the alternatives. Bottom disturbances, such as propwash from vessel traffic, can expose and redistribute contaminated subsurface sediments. The potential for exposing contaminated subsurface sediments is lowest for alternatives that include complete removal and capping.

In situ treatment in the under-pier areas would be less reliable than dredging or capping because it leaves contaminants in place. In situ treatment is expected to reduce bioavailability by 70 to 90 percent. ENR reduces risk from contaminated sediments by placing a 9- to 18-inch layer of sand/gravel over the sediment surface, lowering surface sediment concentrations. This cleaner material provides a protective layer that is mixed into the underlying sediment over time, but subsurface contaminants can be exposed through disturbance and mixing of the ENR layer.

Based on the amount of subsurface contamination left in place and the potential for that contamination to be exposed or redistributed, it is anticipated that those alternatives with the most extensive removal of contaminated sediments would provide the best long-term effectiveness. Alternatives that include the application of in situ treatment in under-pier areas and ENR in limited access areas have a lower potential for recontamination of the open water areas, while MNR provides no control for contaminated sediments remaining in the limited access areas.

The application of an RMC layer is included in each alternative as a means of controlling dredged residuals and is similar for each alternative. Further discussion of residuals management is presented in Sections 7.2.6.5 and 8.12 of the FS.

The extent of cap monitoring and maintenance is directly related to the areal extent where contamination is left in place. Alternatives that remove more of the contaminated sediments require less long-term monitoring. Alternatives with more capping require more monitoring than those that rely on a greater amount of dredging. Alternatives that rely more on MNR, ENR, and in situ treatment require more monitoring to ensure that sediment concentrations continue to decline.

Institutional controls will be required for all alternatives to maintain the integrity of all capped areas and in situ treatment areas. Seafood consumption advisories to protect human health are already in place and will continue into the future.

10.3.2 Summary

Long-term effectiveness and permanence were evaluated for each alternative based on long-term risk reduction and magnitude of the risk remaining and the adequacy and reliability of controls. This evaluation considers areas where contamination is permanently removed as well as areas that will require technology-specific monitoring and maintenance.

Alternative 3E(7.5) removes the greatest amount of contaminated sediment and would require the fewest long-term controls. Alternatives 2B(12), 2C+(12), 3B(12), 3C+(12), 2C+(7.5) each rely on either extensive contaminated sediment removal or other permanent actions that would require minimal maintenance and monitoring. Alternatives 1B(12) and 1C+(12) leave more contaminated sediment in place and would require more maintenance and monitoring to maintain long-term protectiveness. Alternative 1A(12) would leave the greatest amount of contaminated sediment in place, resulting in greater reliance on MNR and less reliance on engineered controls.

10.4 Reduction of Toxicity, Mobility and/or Volume through Treatment

Alternative 1A(12) does not include any treatment. All other action alternatives include in situ treatment using activated carbon or other sequestering agents as a remedial technology in the under-pier areas of the EW OU.

10.5 Short-Term Effectiveness

Short-term effectiveness evaluates the impacts of each alternative on human health and the environment during the construction phase of the interim remedial action. This criterion includes the following metrics:

- Community and worker protection during construction.
- Environmental impacts from construction, including those associated with dredge releases, transportation, air emissions, and carbon footprint during implementation.
- The time to construct the interim remedy.

10.5.1 Community and Worker Protection

Risks to workers from activities at the construction site, as well as exposure to EW OU-related contaminants, are generally low and are managed through established health and safety requirements for work at hazardous waste sites and best management practices. Nevertheless, the potential for worker injuries increases with a longer construction period. Consumption of shellfish and resident fish during and following construction represents a short-term risk to the community. Concentrations of COCs in resident fish are expected to remain constant or may increase during construction due to contaminated sediment resuspension but are expected to decline once construction activities cease.

Disruptions and inconveniences to the public and commercial community, such as increased traffic, temporary waterway restrictions, and fishing location limitations, can be expected during construction. These include the impacts of trucks, trains, and barges needed to transport materials to and from the EW OU.

Short-term risks to workers and the community are generally proportional to the duration of construction activities, volume of material handled, and transportation requirements.

Diver-assisted hydraulic dredging is a specialized worker category included in Alternatives 1C+(12), 2C+(12), 3C+(12), 2C+(7.5), and 3E(7.5). This activity has more risk for workers than any of the other construction activities, with risks increasing with greater duration and amount of this activity. Alternatives 1C+(12), 2C+(12), 3C+(12), 2C+(7.5) include 2 acres of hydraulic dredging activity. Alternative 3E(7.5) poses the highest risk to worker safety because of the amount of hazardous diver-assisted hydraulic dredging included (13 acres).

The relative impacts of trucks, trains, and barges needed to transport sediment were based on the total hauled miles, which included transporting sediment to off-site disposal facilities as well as transporting construction materials (sand, gravel, armor stone, and activated carbon) to the EW OU. Transportation impacts will be managed with traffic control plans developed during remedial design. Based on the volume of material removed and imported for caps and cover, duration of construction and transportation miles, Alternatives 1A(12), 1B(12), and 1C+(12) are predicted to have the lowest short-term community impacts. Alternatives 2B(12), 2C+(12), 3B(12), and 3C+(12) would have greater impacts, and Alternatives 2C+(7.5) and 3E(7.5) would have the greatest impacts.

10.5.2 Environmental Impacts

Environmental impacts considered in evaluating the alternatives included noise, air emissions, landfill capacity utilization, depletion of natural resources, ecological impacts, and energy consumption. As with impacts to the community, alternatives with longer durations and higher volumes of sediment to transport have greater environmental impacts. Remedial design will evaluate ways to lower environmental impacts when alternatives exist, following regional and national green remediation guidance (EPA, 2009).

10.5.3 Time to Achieve RAOs

The time to achieve RAOs is an evaluation of the time required from the start of construction until performance expectations are met. As cleanup goals will be established in a final ROD, this analysis evaluated the time to achieve the RAO for the interim remedial action, which is time to achieve the RAL. The time to achieve the RAL is equivalent to the construction timeframe for each alternative. The time to complete construction is presented in Section 9.2 and ranges from 9 years (Alternatives 1A, 1B, and 1C+) to 13 years (Alternatives 3C+).

10.5.4 Summary

Relative rankings for short-term effectiveness were based on community/worker protection and environmental impacts, as indicated by construction duration, volume removed, and time to achieve the interim RAO.

Alternatives 1B(12), 1C+(12), 2B(12), and 3B(12) have the fewest impacts to workers, the community, and the environment, with construction durations of 9 to 10 years, no diver-assisted hydraulic dredging, and low to moderate volumes of sediment removal. These alternatives achieve the interim RAO at the end of construction.

Alternatives 2C+(12) and 3C+(12) are expected to have greater short-term risks to workers, the community, and the environment than Alternatives 1B(12), 1C+(12), 2B(12), and 3B(12), with construction durations of 10 years for removal of 910,000 to 960,000 cy of sediment, and 2 years of diver-assisted hydraulic dredging.

Alternative 3E(7.5) has the greatest short-term risks to workers, the community, and the environment. This alternative includes extensive diver-assisted dredging, the largest volume of dredged sediment, and the longest construction timeframe (13 years).

10.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Technical feasibility encompasses the complexity and uncertainties associated with implementation of the alternative; the reliability of the technologies; the availability of materials, services, and equipment necessary for construction; and monitoring requirements. Administrative feasibility includes the activities required for coordination with other parties and agencies (such as obtaining permits for any off-site activities, access, or rights-of-way for construction).

All alternatives employ similar technologies in open water areas, including dredging, capping, and ENR. The construction activities required for the implementation of all open water technologies would be technically feasible and have been implemented at many Superfund sites around the country to address contaminated sediments. Materials, services, and equipment necessary for construction are readily available. Disposal facilities are also readily available and have adequate capacity for the volumes of contaminated material being removed.

The degree of technical challenges associated with the limited access areas vary more widely. MNR, as part of Alternative 1A(12), poses few technical challenges, with the lowest potential for difficulties, delays, and impacts to EW OU tenants and users. Placement of ENR in the low bridges was also considered to be implementable, though dredging in the low bridges area associated with ENR placement was considered to be more technically challenging. In situ treatment and diver-assisted hydraulic dredging in under-pier areas pose greater technical challenges than MNR. In situ treatment, included in all alternatives except 1A(12), requires the selection of effective treatment material that depends on site-specific chemical and physical factors. Placement of in situ treatment material in under-pier areas would be performed by conveyors, which is more complex than placement in open water areas.

Diver-assisted hydraulic dredging, included in all C+ and E alternatives, is a more difficult remedial technology to implement. Divers will be operating the dredge on steep slopes composed of large riprap. There are a number of factors that make the work more hazardous from a worker health and safety perspective, including divers working below overwater structures while anchoring sediment is removed, working in low visibility as a result of shade from the pier, working in deeper water, and working in sediments suspended due to dredging activities. Debris such as cables, large wood, and broken pilings will also make dredging more difficult and potentially physically more dangerous for workers implementing the interim remedy. Finally, hydraulic dredging generates large quantities of slurry (sediment and water mixture) that must be appropriately handled and treated as needed prior to disposal. The handling of this slurry requires large upland areas for storage, dewatering, and treatment.

Administrative feasibility factors for the EW OU include in-water construction windows, coordination with the maintenance and deepening of the navigation channel, and coordination with ongoing vessel activities. In-water construction is not anticipated to occur year-round in order to protect juvenile salmonids migrating through the EW OU and to avoid conflicts with tribal fishing. This affects all the alternatives requiring in-water work to a degree that is proportional to the estimated length of the construction timeframe for each alternative. Coordination with the Washington State Department of Natural Resources will be needed for all alternatives that include capping on State-owned aquatic land.

Construction activities associated with each alternative vary with respect to the compatibility with potential future dredging to maintain navigation depths in the waterway. Alternatives 1A(12), 1B(12), 1C+(12), 2B(12), 2C+(12), and 2C+(7.5) include capping in the southern Shallow Main Body Reach, where the cap would be placed at elevations shallower than the current authorized elevation. Such cap placements may interfere with future efforts to increase navigation depths in the Shallow Main Body Reach.

Compatibility with future channel deepening from the SHNIP and the amount of coordination required vary among the alternatives. Alternatives 1A(12), 1B(12), and 1C+(12) include areas of ENR and partial removal with ENR within the navigation channel that would result in final elevations shallower than the -57-foot MLLW authorized depth of the SHNIP deepening. ENR is assumed to involve placement of a sand layer with a thickness of 18 inches, which would have to be removed to deepen the navigation channel to -59 feet MLLW (-57 feet MLLW + 2 feet over depth allowance). The remaining Alternatives

2B(12), 2C+(12), 3B(12), 3C+(12), 2C+(7.5), and 3E(7.5) include full removal of contaminated sediment within the navigation channel boundaries. Therefore, these alternatives are unlikely to conflict with future SHNIP construction activities.

Alternatives 1A(12), 1B(12), 2B(12), and 3B(12) are considered to be the most implementable, balancing both technical and administrative implementability. Alternatives 1C+(12), 2C+(12), 3C+(12), 2C+(7.5), and 3E(7.5) were considered to be less implementable.

10.7 Cost

The estimated costs for the alternatives as presented in the FS (in 2016 dollars) were based on the best available information related to volumes, concentrations, and current market unit costs. Costs for each of the alternatives are presented in Section 9.2; detailed costs are presented in Appendix E of the FS. Using a 7 percent discount rate (and 2016 dollars) Alternative 1A(12) is the least expensive at $192 million, followed by alternatives 1B(12) 1C+(12), 2B(12), 2C+(12), and 3B(12), 3 C+(12), 2C+(7.5) in increasing order, with alternative 3E(7.5) being the most costly at $285 million.

10.8 State and Tribal Acceptance

The State of Washington, through its lead agency, the Department of Ecology, has expressed its support for EPA's preferred alternative presented in the April 2023 Proposed Plan and concurs with the selected remedy outlined in Section 12 of this IROD (see Appendix A for the State concurrence letter).

The Suquamish Tribe has indicated that they neither support nor oppose the preferred alternative, and the Muckleshoot Indian Tribe and Confederated Tribes of the Yakama Nation did not provide comments to EPA.

10.9 Community Acceptance

EPA's community engagement efforts at the EW OU included the publication of a Proposed Plan in April 2023, and public informational meetings, which are described in further detail above in Section 3. Oral and written comments were received at each of the public informational meetings: a virtual public meeting on May 25, 2023, and an in-person public meeting on June 3, 2023. A summary of the comments specific to the proposed alternatives for the EW OU and EPA's responses to the comments are included below in the Responsiveness Summary, Part 3 of this IROD.

Section 11 Principal Threat Waste

The NCP at 40 C.F.R. Section 300.430(a)(l)(iii) states that EPA expects to use “treatment to address the principal threats posed by a site, wherever practicable” and “engineering controls, such as containment, for waste that poses a relatively low long-term threat” to achieve protection of human health and the environment. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile, which generally cannot be reliably contained or would present a significant risks to human health or the environment should exposure occur. Wastes generally considered to be principal threats are liquid, mobile and/or highly toxic source material. Low-level threat wastes are source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Wastes that are generally considered to be low-level threat wastes include non-mobile contaminated source material of low to moderate toxicity, surface soil containing chemicals of concern that are relatively immobile in air or ground water, low leachability contaminants, or low toxicity source material.

The concept of principal threat and low-level threat wastes is applied on a site-specific basis when characterizing source material. Source material is defined as material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, air, or act as a source for direct exposure.

No principal threat waste has been identified within the EW OU.

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Section 12 Selected Remedy

This decision document presents the selected interim remedial action for the EW OU of the Harbor Island Superfund Site in Seattle, Washington, which was chosen in accordance with CERLCA, also commonly referred to as Superfund), 42 U.S.C. § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986, and, to the extent practicable, the NCP, 40 C.F.R. Part 300 et seq., as amended.

EPA is adopting a modified version of Alternative 3B(12) as the interim remedy for this IROD. It follows the technology assignments of Alternative 3B(12) (see Section 9.2.6), except for the limited access area in the Sill Reach, under the West Seattle Bridge. In this area, EPA is implementing ENR rather than dredging of contaminated sediment and backfill due to the technical limitations of mechanical dredging near the low clearance bridges. During remedial design, EPA will optimize the ENR layer, including consideration of ENR amendments such as activated carbon. The components of Alternative 3B(12) are described in Section 12.2.

12.1 Rationale for the Selected Remedy

The selected interim remedy meets the threshold criteria, provides the best balance of tradeoffs among the balancing criteria, and will be consistent with the expected final remedy. It will reduce sediment contaminant concentrations contributing to human health and ecological risks, it will provide for long-term reliability by actively remediating 121 acres of contaminated sediment, and is implementable, cost-effective, and consistent with current and future uses of the EW OU.

The remedy is being proposed as an interim remedy and will result in substantial near- and long-term reductions of COC concentrations in sediment through dredging, capping, and treating the most contaminated sediments, resulting in reductions in risk to human health and the environment. The selected interim remedy actively remediates contaminated sediments, and then relies on MNR to achieve further reductions in contaminant concentrations for COCs, including PCBs and dioxins/furans. Ultimately, contaminant concentrations in the EW OU sediments will equilibrate to the concentrations in the incoming sediments, which for inorganic arsenic may be higher than that achieved directly after active remediation. EPA has determined that an interim remedy will initiate the reduction of risks and allow time to evaluate the performance of the implemented interim action and the effectiveness of source control actions before selecting cleanup levels for the EW OU in a final ROD.

The selected interim remedy provides the best tradeoffs compared to the other alternatives. Remediation of the EW OU will reduce contaminant concentrations in sediments within the waterway. In addition to implementation of the selected interim remedy, effective control of sources of contamination throughout the Green/Duwamish River Watershed, including as regulated or otherwise addressed under non-CERCLA authorities implemented by federal, state, and local governments, and the adjacent CERCLA cleanup of the Lower Duwamish Waterway will be essential to achieving EPA's long-term objective of reducing sediment concentrations to be protective of both human health and the environment. These combined efforts may allow the Washington State Department of Health to minimize associated seafood consumption advisories and will advance the possibility of reaching concentrations of PCBs in sediments that are at or near concentrations measured in non-urban background for Puget Sound (2 µg/kg).

12.2 Key Elements of the Selected Interim Remedy

The key elements of the selected interim remedy, as described here and depicted in Figure 21, are:

- Open water areas: Option 3 Modified

  Dredging in the Deep Main Body and Berth Areas
  Dredging or dredging with backfill in the Shallow Main Body Reach
  Capping in Nearshore areas
  ENR in the Sill Reach

- Limited access areas: Option B.

  In situ treatment in Under-Pier Areas
  ENR in the Sill Reach – Low Bridges

- PCB RAL: 12 mg/kg OC.

A list of all RALs for the selected interim remedy is shown in Table 7. As described in the FS, the RALs determine the horizontal and vertical extent of remediation.

A summarized in Figure 22, the selected interim remedy actively remediates 121 acres of the EW OU and includes the following:

- Dredging 99 acres of contaminated sediment in the open water portions of the EW OU, equivalent to approximately 940,000 cy of contaminated sediment removal. This includes 93 acres of dredging without backfill, 2 acres of dredging with backfill to existing contours, and up to 4 acres of dredging and backfilling in the Communication Cable Crossing.
- Capping 7 acres in the two Nearshore Areas, which may require some dredging to accommodate navigation and habitat elevation requirements.
- Placement of approximately 3 acres of a 9-inch ENR layer in the Sill Reach under the Spokane Street, West Seattle, and Railroad Bridges. Access in this area is limited by low-clearance bridges that restrict access by mounted dredges. The ENR design will be optimized, including consideration of an amendment such as activated carbon.
- Placement of in situ treatment for contaminated sediments on over 12 acres of limited access space in Under-pier Areas.
- MNR in 36 acres, where contaminant concentrations are below the RALs.
- The estimated time for construction is 10 years, assuming a 4.5-month construction window each year.

Additional components of the remedy are as follows:

Dredging Depth: Figure 23 depicts the approximate depth of dredging in the Shallow and Deep Main Body Areas, based on estimates in the FS. Final dredge depths and areas will be determined during remedial design depth and areal footprint of the remedial action based on the RALs. Dredging will occur down to the deepest depth of contaminated sediment (defined as contaminant concentrations greater than the RAL), which is generally 5-10 feet deep in the Shallow and Deep Main Body Areas, and as deep as 14 feet in some areas.

Pile and Debris Removal: Most existing dolphins, piles, and other in-water structures will remain in place during remediation. Construction offsets will be used to avoid any structural damage. Some derelict piling and piers, along with debris, may be removed during remediation, as determined during remedial design.

Water Management: Dredged sediment will initially be dewatered on the dredge scows within the dredge area. Scows will be equipped with appropriate best management practices necessary to maintain compliance with applicable water quality criteria. If water quality criteria cannot be maintained, construction operations may be suspended until adequate best management practices are in place or additional water management strategies are implemented.

Sediment Disposal: An estimated 940,000 cy of contaminated sediment will be removed from the EW OU. This material will be transloaded from barge to either truck or rail at a nearby EPA-approved facility (or at a newly constructed facility if an existing EPA-approved facility is not available). Once transloaded to truck or rail, the removed material will, depending on the hazardous nature of the material, either be transported to a permitted upland off-site disposal facility that accepts non-hazardous waste or to a facility that is permitted to accept hazardous waste.

Residuals Management Cover: An RMC layer will be placed in dredge areas and in areas adjacent to dredged areas where residuals may have settled. It will be placed as soon as possible following completion of dredging activities for each dredging season. The RMC will consist of clean sand and is expected to be between 4 to 12 inches thick, with the final thickness to be determined based on post-remediation sediment bed elevation and sampling.

Institutional Controls: Non-engineered measures (administrative and legal controls) are included in the selected interim remedy, which will help protect the constructed interim remedy and minimize potential for human exposure. These ICs are summarized in Table 9.

Table 9. Summary of Planned Institutional Controls

Media, engineered controls, and areas that do not support UU/UE based on current conditions	IC objective	Type of ICs that would achieve the objective	Other information
Fish and shellfish tissue	Reduce human consumption of contaminated fish and shellfish	WSDOH fish and shellfish consumption advisory	Consumption advisories are currently in place
Fish and shellfish tissue	Reduce human consumption of contaminated fish and shellfish	Fun to Catch, Toxic to Eat program	This community education program is ongoing and will be updated to include EW OU outreach activities
Engineered sediment caps	Prevent disturbance of the cap	Restrict use of anchors, spuds, keel dragging, and similar activities that may disturb a cap	Will be implemented in coordination with USCG

Monitoring: Pre-construction baseline monitoring will be conducted prior to start of remedial construction. This will serve as the baseline to compare future data from monitoring during and after construction completion. Baseline sampling will include media associated with the interim and final RAOs for the EW OU.

Construction monitoring and confirmation sampling will be conducted during remedial implementation to ensure that the interim remedy is built according to specifications. This will include, but is not limited to, ensuring the required dredge depth was achieved, verifying that all technically achievable sediment exceeding RALs was removed, and ensuring required placed material thicknesses or elevation were achieved. During construction activities, contaminant concentrations and water quality will also be monitored in the water column to ensure that best management practices for controlling resuspension of contaminated sediment during dredging are effective.

Short-term sediment monitoring will be conducted during and after construction to measure the progress and effectiveness of the interim remedy in reducing concentrations of COCs in sediment. Monitoring in the areas where activated carbon will be applied will include pore water COC concentrations and an assessment of the carbon to ensure it remains present at levels that are effective Contaminant concentrations in sediment in open-water areas will be sampled immediately post-construction Additionally, fish and shellfish tissue will be monitored to identify trends in tissue levels over time and inform existing consumption advisories in the future. Short-term monitoring will include the measurement of COC concentrations in sediment, sediment porewater, and fish and shellfish tissues to evaluate concentration trends. These data will be incorporated in the sediment transport models for the waterway to better understanding sediment and contaminant transport.

12.2.1 Cleanup Levels

This IROD does not select cleanup levels. EPA anticipates selecting cleanup levels in a future final ROD, based on data collected during and after construction of the interim remedial action. This data will include information on the effect of upstream and lateral contamination sources on the EW OU, and the effectiveness of the interim remedial action in reducing sediment contamination. Sediment transport models will be updated with monitoring data to update loading predictions. Upstream and non-site-related lateral source control actions are being conducted separately by public and private entities. EPA will involve the public, State, Tribes, and EWG in developing cleanup levels for the EW OU.

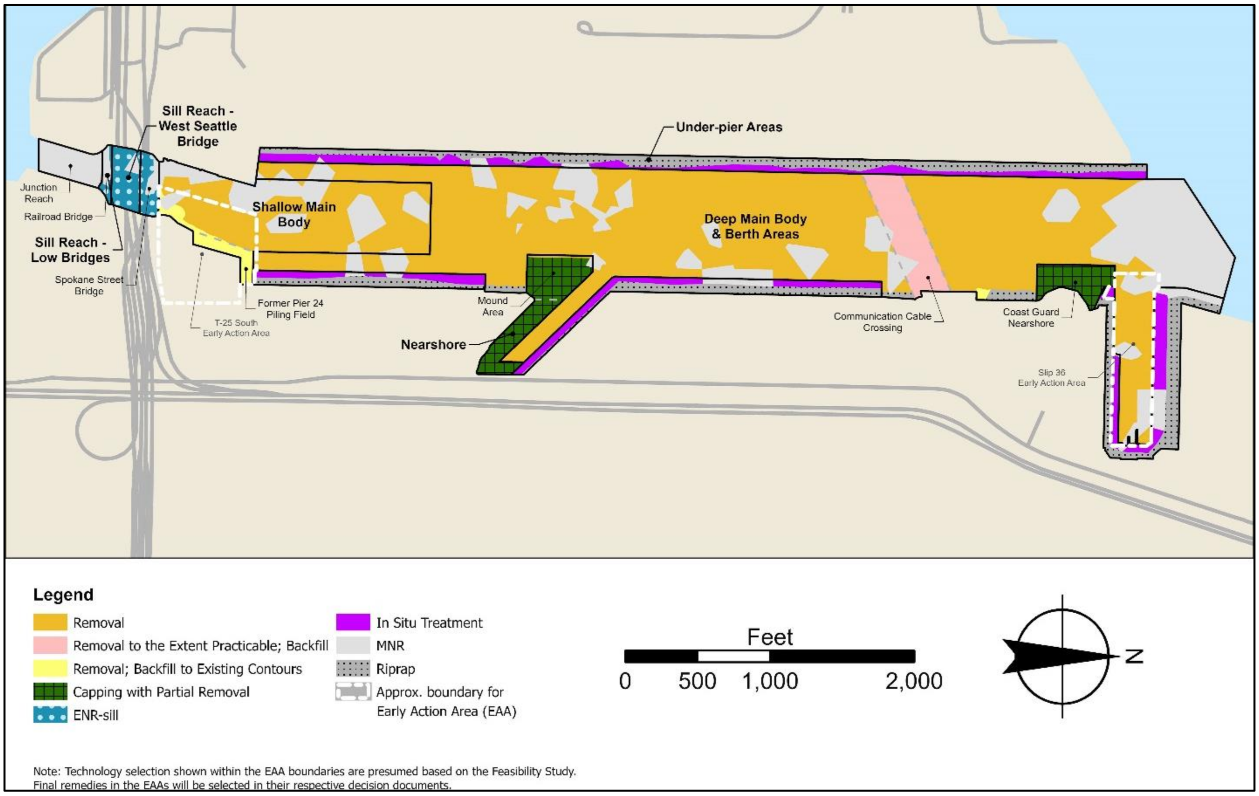

Figure 21. Selected Interim Remedy Technology Assignment Map

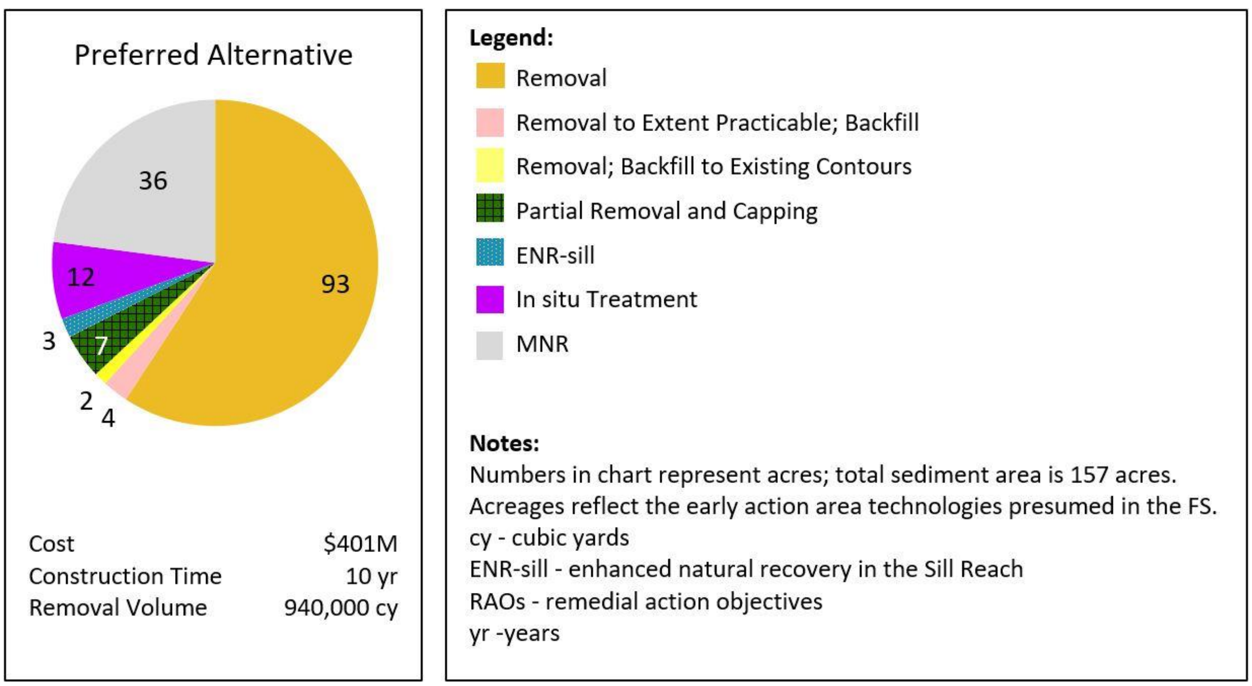

Figure 22. Area, Volume, and Cost Summary for the Selected Interim Remedy

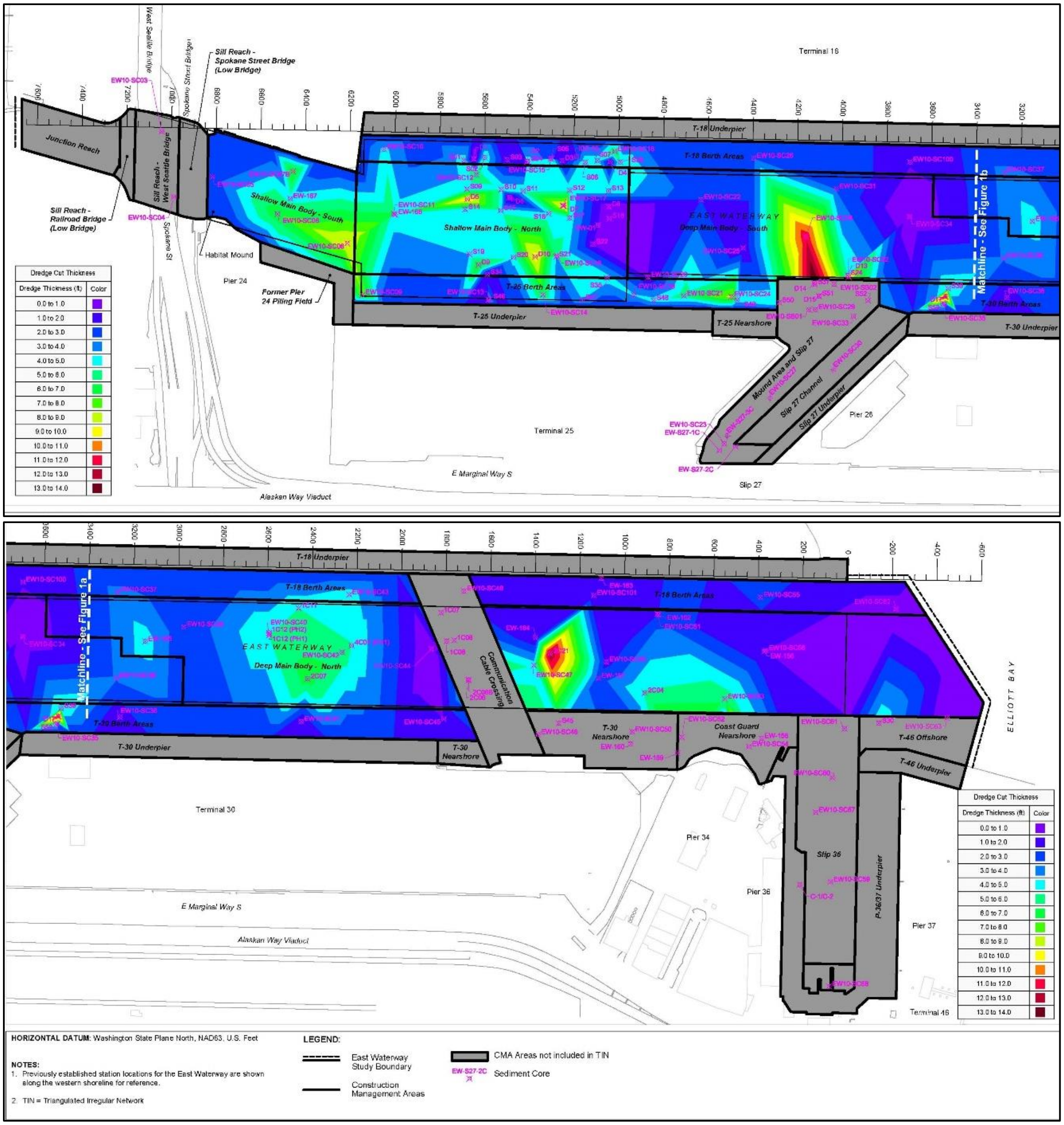

Figure 23. Approximate Removal Depths

12.3 Summary of Estimated Remedy Costs

The total estimated cost (in 2023 dollars) to construct the selected interim remedy is $401 million ($223 million in net present value based on a 7 percent discount rate). This cost estimate was updated from the Proposed Plan 2016 estimate of $214 million net present value to reflect current prices and 2023 dollars. A cost breakdown of the selected interim remedy is provided in Table 10. Costs were not updated for the other alternatives evaluated in the FS since cost increases would affect all alternatives proportionally, and would not change the conclusion of the comparative analysis.

Table 10. Selected Interim Remedy Cost Summary

Element	Unit Costs	Unit	Quantity	Subtotal
1. Mobilization/Demobilization				
Mobilization/Demobilization	$800,000	Annual	10	$8,000,000
Insurance and Bonding	$1,900,000	Project	1	$1,900,000
Initial Transload Site Setup	$1,385,800	Project	1	$1,385,800
Annual Transload Site Setup and Maintenance	$692,900	Annual	9	$6,236,100
2. Pre-Construction Activities				
Pre-Construction Activities	$1,309,680	Annual	10	$13,096,800
3. Removal, Dewatering, offloading, and Disposal				
Open-Water Dredging	$25	cy	938,455	$23,034,796
Transload, Transportation, and Disposal	$95	Tons	1,407,682	$133,729,789
4. Pile Removal and Disposal				
Removal and Disposal	$3,540	Each	1,718	$6,081,720
5 Engineered Capping and Residuals Management Cover				
Furnished Sand	$43	cy	214,431	$9,300,438
Furnished Gravel	$59	cy	11,769	$691,073
Furnished Armor Material	$51	cy	17,654	$907,057
Furnished In Situ Treatment Material	$527	cy	4,867	$2,562,407
Place Sand – Unrestricted Access	$22	cy	210,680	$4,706,684
Place Gravel – Unrestricted Access	$22	cy	11,769	$262,932
Place Armor Material – Unrestricted Access	$38	cy	17,654	$622,026
Place In Situ Material in Difficult to Access Areas – Under-pier	$350	cy	4,867	$1,703,405
Place ENR Material in Difficult to Access Areas – Low Bridge	$350	cy	3,751	$1,312,850
6. Surveys and Monitoring				
Payment Surveys	$46,600	Site-Wide Event	20	$932,000
Contractor Daily Progress Surveys	$3,000	Day	972	$2,916,023
7. Sales Tax and Contingency				
Sales Tax	10.25%	--	1	$20,845,081
Contingency	30.0%	--	1	$72,080,094
8. Indirect Costs Pre-Construction				
Design and Permitting	5%	--	1	$15,617,354
Pre-Construction Baseline Monitoring	$892,971	Lump Sum	1	$892,971
Project Management	1%	--	1	$3,123,471
Agency Review and Oversight	$692,900	Annual	3	$2,078,700
9. Indirect Costs During Construction				
Construction Management Support	10%	--	1	$18,880,320
Water Quality Monitoring	$4,157	Day	972	$4,041,033
Confirmational Sampling	$775,220	Lump Sum	1	$775,220
Project management	4%	--	1	$12,493,883
Agency Review and Oversight	$692,900	Annual	10	$6,929,000
10. Indirect Post-Construction Costs				
Monitoring 1 through 20 years post-construction	$5,121,423	Lump Sum	1	$5,121,423
Contingency Remediation – Open Water	$1,400,000	Acres	0.3	$399,000
Contingency Remediation – Under-pier and Under Low Bridges	$5,700,000	Acres	2.0	$11,321,337
Project Management	1%	--	1	$3,123,471
Agency Review and Oversight	$166,300	Annual	25	$4,157,500
			Total Project Cost:	**$401,301,759**
			Total Net Present Value (discounted at 7%)	**$222,538,447**

12.4 Expected Outcomes of the Selected Interim Remedy

This interim remedy will result in substantial near- and long-term reductions of contaminant concentrations in sediment resulting in reductions in risk to human health and the environment. This action will allow the EW OU to continue to be used for commercial and industrial purposes, including potential future deepening.

Section 13 Statutory Determinations

The interim remedial action selected for implementation in the EW OU of the Harbor Island Superfund Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected interim remedy will be protective of human health and the environment, will comply with ARARs, will be cost-effective, and will be consistent with the final remedy. In addition, the selected interim remedy utilizes permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable, and partially satisfies the statutory preference for treatment that permanently and significantly reduces the mobility, toxicity, or volume of hazardous substances as a principal element to the maximum extent practicable.

13.1 Protection of Human Health and the Environment

The selected interim remedy will adequately protect human health and the environment until a final remedy is selected. It does so by eliminating, reducing, or controlling exposures to human and environmental receptors through excavation, treatment, engineering controls, long-term monitoring, and institutional controls.

The selected interim remedy will significantly reduce risk to human and ecological receptors by primarily removing contaminated sediment. Following remedial construction, additional contaminant concentration reductions is expected through natural processes, such as sedimentation from cleaner upstream sources.

13.2 Compliance with ARARs

Section 121(d) of CERCLA, specifies, in part, that remedial actions for cleanup of hazardous substances, pollutants, and contaminants must comply with requirements and standards under Federal laws or more stringent state environmental laws and regulations that are applicable or relevant and appropriate (ARARs) to the hazardous substances, pollutants or contaminants, or particular circumstances at a site, unless such ARARs are waived in accordance with Section 121(d)(4) of CERCLA, 42 U.S.C. 9621(d)(4). ARARs include only Federal and state environmental or facility siting laws/regulations

Under Section 121(e)(1) of CERCLA, 42 U.S.C. 9621(e)(1), Federal, state, or local permits are not required for the portion of any removal or remedial action conducted entirely on-site, as defined in 40 C.F.R. § 300.5. Also, CERCLA actions must only comply with the "substantive requirements," not the administrative requirements of a regulation. Administrative requirements include permit applications, reporting, record keeping, and consultation with administrative bodies.

Applicable requirements, as defined in 40 C.F.R. § 300.5, means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site. Only those state standards that are identified by the state in a timely manner and that are more stringent than Federal requirements may be applicable.

Relevant and appropriate requirements, as defined in 40 C.F.R. § 300.5, means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site.

Per 40 C.F.R. § 300.400(g)(5), only those state standards are promulgated, are identified in a timely manner and that are more stringent than Federal requirements may be applicable or relevant and appropriate. For purposes of identification and notification of promulgated state standards, the term promulgated means that the standards are of general applicability and are legally enforceable. State ARARs are considered more stringent where there is no corresponding Federal ARAR, where the state ARAR provides a more stringent concentration of a contaminant, or where a state ARAR is broader in scope than a Federal requirement.

In addition to ARARs, the lead and support agencies may, as appropriate, identify other advisories, criteria, or guidance to be considered for a particular release. The TBC category consists of advisories, criteria, or guidance that were developed by EPA, other Federal agencies, or states that may be useful in developing CERCLA remedies. See 40 C.F.R. § 300.400(g)(3).

Only the requirements that are pertinent to the scope and purpose of this interim remedial action will be considered ARARs. Final ARARs will be included in a future final ROD. The selected interim remedy will comply will all Federal and any more stringent state ARARs identified for the EW OU, shown in Appendix B, Tables B1 through B3. Invoking a waiver under CERCLA Section 121(d)(4) of any of these identified requirements is not necessary at this time. See 40 C.F.R. § 300.430(f)(1)(ii)(B), which states "On-site remedial actions selected in a ROD must attain those ARARs that are identified at the time of ROD signature or provide grounds for invoking a waiver under § 300.430(f)(1)(ii)(C)."

13.3 Cost Effectiveness

The selected interim remedy is cost-effective because the remedy costs are proportional to its overall effectiveness (see 40 C.F.R. 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (that are protective of human health and the environment and comply with all Federal and any more stringent ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria—long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's cost to determine cost-effectiveness. The relationship of the overall effectiveness of the selected interim remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

As detailed in the FS, Section 11, remedial alternatives that implemented more expensive remedial technologies (such as diver-assisted dredging) and more extensive remedial area did not achieve substantially more long-term risk reduction. The selected interim remedy represents a cost-effective approach to maximize long-term risk reduction.

13.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that the selected interim remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner in the EW OU. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected interim remedy provides the best balance of tradeoffs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element, bias against offsite treatment and disposal, and considering State and community acceptance.

The selected interim remedy maximizes the use of permanent and treatment technologies by using permanent removal over 82 percent of the active remediation area, and in situ treatment over 10 percent of the active remediation area.

13.5 Preference of Treatment as a Principal Element

The NCP at 40 C.F.R. §300.430(a)(I)(iii)(A) establishes an expectation that treatment be used to address principal threats posed by a site wherever practicable. In general, the priority for treatment of "principal threat" is placed on source materials considered to be liquid, highly toxic, or highly mobile, which generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. Highly contaminated sediment can also be principal threat waste when considered highly toxic or would present significant risk to human health should exposure occur, or it acts as reservoir for mobile contaminants. No principal threat waste has been identified within the EW OU. However, the Selected Interim Remedy does include potential treatment through ENR/in situ treatment using activated carbon or other sequestering agents in areas beneath the piers where access for dredging or capping is sufficiently restricted to make application of those technologies impractical.

13.6 Five-Year Reviews

Because the interim remedy will result in hazardous substances, pollutants, or contaminants remaining in the EW OU above levels that would allow for UU/UE, under CERCLA a review is required at least once every 5 years after initiation of the interim remedial action to ensure that the interim remedy remains protective of human health and the environment, inclusive of the applicable institutional controls. The EW OU will be evaluated as part of the Harbor Island Superfund Site Wide Five Year Review. The statutory Five-Year Reviews will be conducted in accordance with EPA policy and guidance.

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Section 14 Documentation of Significant Changes

EPA released the Proposed Plan for the EW OU to the public for review and comment on April 20, 2023. The Proposed Plan described the alternatives considered and EPA's preferred alternative for the selected interim remedy.

EPA reviewed all hand-delivered, written, and verbal comments submitted during the public comment period, which began on April 28 and ended on August 11, 2023. EPA received numerous public comments concerned that ENR was not sufficient for the Sill Reach, where public fishing is a common activity. In this IROD, EPA has clarified that during remedial design EPA will be refining several engineering design considerations including limited dredging, and will evaluate different amendments to enhance the effectiveness of ENR including consideration of activated carbon or other sequestering agent.

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Appendix A: State Letter of Concurrence

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May 13, 2024

Casey Sixkiller, Regional Administrator
U.S. Environmental Protection Agency
1200 Sixth Avenue
Seattle, WA 98101

RE: East Waterway CERCLA Site Record of Decision, State Concurrence

Dear Regional Administrator Sixkiller:

This letter communicates the Washington State Department of Ecology's concurrence with the selected remedy for the in-waterway portion of the East Waterway Site, as described in the United States Environmental Protection Agency's Interim Record of Decision (ROD).

The Interim ROD approach is to remove as much of the contaminated sediment from the waterway as is technically feasible, and to use other technologies to manage the remaining areas of contamination. The Interim ROD represents a significant step forward in the restoration of East Waterway's environment. However, it does not encompass the full extent of activities required of EPA or Ecology to entirely address contamination in the waterway.

As the long-term goal of this cleanup is to achieve cleanup for contaminants of concern that are consistent with sediment natural background levels, Ecology looks forward to a partnership with EPA on issues concerning the remedy. Ecology intends to be involved with EPA in the review, and to comment on the remedial design for various aspects of the waterway cleanup – for example, ongoing performance monitoring of the selected remedy and a rigorous five-year review process to ensure long-term effectiveness. It is our expectation and understanding that work on East Waterway will strive to meet EPA's goals, Ecology's requirements, and be responsive to the environmental justice concerns for the community.

Ecology understands that EPA, in a future transition from an Interim ROD to a Final ROD, may adjust the approach set out in this document. However, Ecology expects that EPA will not make significant changes to the cleanup actions in East Waterway without first consulting with

Ecology and providing sufficient assurances that any selected remedy will meet state Applicable or Relevant and Appropriate Requirement(s).

We have appreciated working in partnership with you on issues concerning the selected remedy for the Interim ROD and look forward to seeing progress made.

If you have any questions or would like to discuss any aspect of this letter further, please contact Barry Rogowski at (360) 485-3738, or via email at barry.rogowski@ecy.wa.gov.

Yours truly,

Laura Watson
Director

Appendix B: ARAR Tables

ARARs/TBCs for the East Waterway Operable Unit of the Harbor Island Superfund Site

Statute/Regulation/Guidance/Policy	Description of Requirement/Approach	Rationale for Including	Recognized Status
Surface Water			
State Antidegradation and Designated Use Policies WAC 173-204-120	Provides for best management practices during activities that may impact sediment quality.	To the extent practicable employ these best management practices during performance of the remedial action.	To be Considered
Toxic Substances Control Act Section 6(e) 15 U.S.C. § 2605(e) 40 CFR §§ 761.61(a)(4), 761.61(a)(5); or § 761.61(b)	Authorizes cleanup and disposal of sediments contaminated by polychlorinated biphenyls (PBCs).	Provides requirements for cleanup and disposal of PCB-contaminated sediments.	Applicable
State Hydraulic Code Rules WAC 220-660-330, Table 4; 220-660-360; 220-660-370; 220-660-410; 220-660-450(1), (2), (3)(b), (3)(c).	State law provides for authorized work times, construction techniques, shoreline stabilization requirements, and test boring requirements in saltwater areas of the state of Washington.	Adhere to the directions in these provisions of State law during implementation of the remedial action.	Applicable
Rivers and Harbors Act of 1899 Section 14(a) 33 U.S.C. § 408(a)	Assures that alteration or use of a federal civil works project will not impair the usefulness of that project or be injurious to the public.	Should it be determined that any portion of the remedial action may impair the usefulness of a structure or project of the United States Army Corps of Engineers, there will be consultation with the Corps to determine how to best avoid or mitigate such impairment.	Applicable

ARARs/TBCs for the East Waterway Operable Unit of the Harbor Island Superfund Site

Statute/Regulation/Guidance/Policy	Description of Requirement/Approach	Rationale for Including	Recognized Status
Solid and Dangerous Waste			
Resource Conservation and Recovery Act a.k.a. Solid Waste Disposal Act Sections 3002, 3003, 3004 42 U.S.C. §§ 6922, 6923, 6924 40 C.F.R. Part 262, Subparts A-D, L, M (generators) 40 C.F.R. Part 263, Subparts A-C (transporters) 40 C.F.R. Parts 264 to 270 (owners and operators)	Provides regulatory requirements for generators and transporters of hazardous waste. Also provides regulatory standards for owners and operators of hazardous waste treatment, storage or disposal facilities.	Comply with the generator and transporter requirements for all hazardous waste generated and transported as part of the remedial action. Confirm there is compliance with owner and operator regulations for each hazardous waste treatment, storage, or disposal facility which is to receive hazardous waste as a result of implementation of the remedial action. See, also, Section 121(d)(3) of CERCLA, 42 U.S.C. § 9621(d)(3), which requires that each treatment, storage or disposal facility which is to receive hazardous waste must first be deemed to be in compliance with the Solid Waste Disposal Act.	Applicable as to onsite generator and transporter requirements, and otherwise CERCLA requires that a receiving facility be in compliance with the owner and operator standards of RCRA.

ARARs/TBCs for the East Waterway Operable Unit of the Harbor Island Superfund Site

Statute/Regulation/Guidance/Policy	Description of Requirement/Approach	Rationale for Including	Recognized Status
State Dangerous or Extremely Hazardous Waste Regulations WAC 173-303-010, 173-303-016, 173-303-020, 174-303-040, 173-303-060, 173-303-070, 173-303-071, 173-303-072, 173-303-073, 173-303-075, 173-303-077, 173-303-080, 173-303-081, 173-303-082, 173-303-083, 173-303-090, 173-303-100, 173-303-140, 173-303-141, 173-303-145, 173-303-150, 173-303-1600, 173-303-161, 173-303-169, 173-303-170, 173-303-171, 173-303-172, 173-303-173, 173-303-174, 173-303-180, 173-303-190, 173-303-200, 173-303-201, 173-303-210, 173-303-220, 173-303-230, 173-303-240, 174-303-250, 173-303-260, 173-303-270, 173-303-355, 173-303-630, 173-303-280(6)	Provides requirements for handling, management, transport, and disposal of dangerous waste and extremely hazardous waste.	Comply with these regulations to the extent they are more stringent than federal Resource Conservation and Recovery Act requirements for the designated waste.	Applicable
State Solid Waste Handling Standards WAC 173-350-300	Provides requirements for onsite storage, collections and transportation of solid waste.	Adhere to these requirements during performance of the remedial action.	Applicable
Air/Noise			
State Noise Control RCW 70A.20.010, 70A.20.020 WAC 173-60-010, 173-60-020, 173-60-030, 173-60-040,173.60-050, 173-60-120	Establishes maximum permissible noise levels in identified environments at specified times.	Protect workers and others from experiencing excessive noise during remedial activities.	Applicable

ARARs/TBCs for the East Waterway Operable Unit of the Harbor Island Superfund Site

Statute/Regulation/Guidance/Policy	Description of Requirement/Approach	Rationale for Including	Recognized Status
Archaeologically or Historically Sensitive Resources			
Native American Graves Protection and Repatriation Act 25 U.S.C. §§ 3001-3006, 3009, 3011	Requires federal agencies which have possession of or control over Native American cultural items (including human remains, associated and unassociated funerary objects, sacred objects and objects of cultural patrimony) located on federal land or tribal lands to compile an inventory of such items and consult with affected tribes. Prescribes when federal agencies must return such Native American cultural items.	Should Native American items be discovered during remedial activities, an inventory will be created to document these items and, if possible, the items will be secured. In addition, upon such discovery, the Muckleshoot and Suquamish Tribes and Yakama Nation will be informed of the discovery and consulted as to the handling and disposition of such items.	Relevant and Appropriate
American Indian Religious Freedom Act 42 U.S.C. § 1996	It is the policy of the United States protect and preserve for American Indians certain rights, including but not limited to, access to sites and use and possession of sacred objects.	Should American Indian sacred objects to discovered at the EW OU, an effort will be made to safely secure these objects, and the Muckleshoot and Suquamish Tribes and Yakama Nation will be notified of the discovery and provided an opportunity to obtain possession of the objects.	To be Considered

ARARs/TBCs for the East Waterway Operable Unit of the Harbor Island Superfund Site

Statute/Regulation/Guidance/Policy	Description of Requirement/Approach	Rationale for Including	Recognized Status
National Historic Preservation Act 16 U.S.C. § 470f 36 CFR §§ 60.2(a), 60.3, 60.4, 800.2(c)(1)(i), 800.2(c)(2)(ii), 800(c)(3), 800(c)(4), 800(c)(5), 800.2(d), 800.3(c), 800.3(e), 800.3(f),800.3(g), 800.4(d)(2), 800.5(a), 800.6(a), 800.6(b)	Requires a federal agency to: (1) identify historic properties potentially affected by an agency undertaking; (2) assess the potential effects on such properties from the undertaking; (3) provide the Advisory Council on Historic Preservation an opportunity to comment on the agency decision regarding the properties; and (4) consider ways to avoid, minimize or mitigate potential effects on the properties. Historic properties include any district, site, building, structure, archaeological site, traditional cultural landscape, traditional cultural property, or object included in or eligible for the National Register of Historic Places, including artifacts, records, and material remains related to such properties.	Although no historic properties have been identified at the EW OU, should such properties be encountered during remedial activities, assess the potential effects on the properties from the remedial activities, provide the Advisory Council on Historic Preservation or its designee (often the State Historic Preservation Officer), and perhaps other interested parties, an opportunity to comment on the potential effects, and decide how to proceed in a way that, if possible, avoids, minimizes or mitigates the potential effects on the properties.	Applicable
Sensitive Habitats and Protect Species			
U.S. Fish and Wildlife Service Mitigation Policy, as revised 81 FR 83440 (November 21, 2016)	Provides for obtaining recommendation from U.S. Fish and Wildlife Service on avoiding, minimizing, and mitigating adverse impacts of land and water development projects on fish, wildlife, plants, and habitats.	Consult with U.S. Fish and Wildlife Service in order to obtain recommendations on ways to avoid, minimize, and mitigate damage to natural resources, including fish, wildlife, plants, and habitats, during implementation of the remedial action.	To be Considered

ARARs/TBCs for the East Waterway Operable Unit of the Harbor Island Superfund Site

Statute/Regulation/Guidance/Policy	Description of Requirement/Approach	Rationale for Including	Recognized Status
U.S. Fish and Wildlife Coordination Act 16 U.S.C. §§ 661, 662(a)	Provides U.S. Fish and Wildlife Service with authority to investigate and report on proposed federal action that affects a stream or other body of water, and to provide recommendations to minimize impacts to fish and wildlife resources. Channel deepening or other modifications to a body of water are subject to this law.	Consult with U.S. Fish and Wildlife Service and obtain its recommendations on how to conserve wildlife resources and prevent loss or damage to such resources during implementation of the remedial action.	Applicable
Migratory Bird Treaty Act of 1918, as amended. 16 U.S.C. §§ 703, 704, 705 50 CFR § 10.13 (provides list of protected migratory bird species)	Prohibits the killing, capturing, selling, trading or transporting of protected migratory bird species without prior authorization of the U.S. Fish and Wildlife Service. Applies to migratory birds native to the U.S. or U.S. territories, and to any part, nest, egg, or product associated with such migratory birds.	Consult with U.S. Fish and Wildlife Service to identify protected migratory bird species and their nests which may be present during implementation of the remedial action, and to obtain recommendations for protecting such species and their nests.	Applicable
Endangered Species Act of 1973 Sections 2(c), 3, 7(a)(1)-(4), 7(b)(1)(A), 7(b)(3), 7(b)(4), 7(c), 9 16 U.S.C. §§ 1531(c), 1532, 1536(a)(1)-(4), 1536(b)(1)(A), 1536(b)(3), 1536(b)(4), 1536(c), 1538 50 CFR §§ 17.3, 17.11, 17.12, 17.21(c), 17.21(d), 17.31, 17.51, 17.61(c), 17.71(a), 17.71(c)	Provides a program for conservation of threatened and endangered plants and animals and their habitats. Requires consultation by a federal agency with U.S. Fish and Wildlife Service and National Oceanic Atmospheric Administration Fisheries Service to ensure action taken by such agency is not likely to jeopardize the continued existence of listed endangered or threatened species or result in destruction or adverse modification of their critical habitat.	Consult with U.S. Fish and Wildlife Service and National Oceanic Atmospheric Administration Fisheries Service to ensure remedial action does not jeopardize threatened or endangered species or destroy or adversely modify the habitat of such species. May include the preparation of a biological assessment which assesses such remedial action and its effects on protected species and their habitats.	Applicable

ARARs/TBCs for the East Waterway Operable Unit of the Harbor Island Superfund Site

Statute/Regulation/Guidance/Policy	Description of Requirement/Approach	Rationale for Including	Recognized Status
Magnuson-Stevens Fishery Conservation and Management Act Sections 305(b)(1)(D); 305(b)(2-4) 16 U.S.C. §§ 1855(b)(1)(D), 1855 (b)(2-4) 50 CFR § 600.920	Promotes the protection of essential fish habitat through coordination and consultation between the National Marine Fisheries Service, the Regional Fishery Management Council, and each federal agency whose action or proposed actions may adversely affect such habitat.	Provide notice to the National Marine Fisheries Service and Regional Fishery Management Council of the planned remedial action and consider their comments and recommendations for conserving essential fish habitat. Implement measures to conform to the recommendations designed to avoid, mitigate, or otherwise offset any adverse effects on essential fish habitat or provide reasons for not following the recommendations.	Applicable
Coast and Shoreline			
Shoreline Management Act of 1971 WAC 173-18-020, -030, -040 WAC 173-27-060 King County Shoreline Management Master Program Ordinance 3688 Sections 325, 412, 413, 414	Establishes regulations, goals, policies and objectives for protecting and enhancing state of Washington shoreline areas.	Consider the implications of the King County preferred practices and restrictions in undertaking remedial action that may impact shoreline areas.	To be Considered
Executive Order 11988—Floodplain management 42 Fed. Reg. 26951, 3 CFR 1977 Comp. p. 77	Federal agencies need to evaluate actions and impacts on flood plains and mitigate such impacts. Criteria established for best management of flood prone areas.	If EW OU is determined to be within a floodplain or flood prone area, actions should be take to prevent the risk of floods due to remedial activities.	To be Considered

Appendix C: Administrative Record Index

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
1113215	03/01/2000	Terminal 18 Deepening Project Post-Dredging Monitoring: Sampling and Analysis Plan.	Report	140	EPA and Port of Seattle	Windward Environmental, LLC
1151989	11/27/2002	Recency Memorandum, Port of Seattle East Waterway, Harbor Island Superfund Site: Nature and Extent of Sediment Contamination.	Report	9	EPA	Anchor Environmental, LLC; Windward Environmental, LLC
100230654	05/25/2005	IC29, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	61		Analytical Resources, Incorporated
1217307	07/28/2005	Report on Post-Dredge Sediment Characterization: Integrated Support Command Seattle Pier 36 Facility, U.S. Coast Guard Facilities Design and Construction Center.	Report	326	John Zantek (U.S. Coast Guard)	Hart Crowser, Inc.
100230658	09/13/2005	Letter, IL49, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Letter	40	Savina Uzunow (City of Seattle Public Utilities)	Mark Harris (Analytical Resources, Incorporated)
1217315	09/30/2005	East Waterway Operable Unit Phase 1 Removal Action Completion Report: Appendix C - Post-Dredge Monitoring Data Report (includes CD ROM).	Report	92	EPA	Anchor Environmental, LLC; Port of Seattle; Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
1217312	10/04/2005	East Waterway Phase I Removal Action: Recontamination Monitoring Plan - Final.	Report	78	EPA	Port of Seattle; Windward Environmental, LLC
100354207	01/01/2006	Memorandum of Agreement Between the Port of Seattle, the City of Seattle, and King County Regarding the East Waterway Operable Unit of the Harbor Island Superfund Site Supplemental Remedial Investigation, Feasibility Study.	Report	12		Port of Seattle
1429875	04/01/2006	Sampling and Analysis Plan for Port of Seattle Terminal 30 Sediment Characterization.	Report	92	Port of Seattle	Anchor Environmental, LLC
885483	05/01/2006	Appendix B of the Final Initial Source Evaluation and Data Gaps Memorandum: King County CSO Discharge Data, June 1999-May 2006.	Analytical Data Document	2		King County
1239605	09/21/2006	Data Report: Recontamination Monitoring 2006 Draft.	Report	19	EPA	Windward Environmental, LLC
1258209	10/01/2006	Report regarding Sediment Characterization Report for Port of Seattle Terminal 30.	Report	334	Port of Seattle	Anchor Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
1239604	10/20/2006	Administrative Settlement Agreement and Order on Consent for Supplemental Remedial Investigation/Feasibility Study for the Harbor Island East Waterway OU, CERCLA Docket No. 10-2007-0030.	Correspondence	64		
100230534	12/05/2006	DV Report Right of Way RCB1, RCB32, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	13		Pyron Environmental, Inc.
100229008	12/05/2006	DV Report On-Site Catch Basin CB37, CB64, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	15		Pyron Environmental, Inc.
100230535	12/05/2006	DV Report Right of Way RCB33, RCB51, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	15		Pyron Environmental, Inc.
100228901	12/20/2006	DV Report Full Validation GK68, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	18		Pyron Environmental, Inc.

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
1258046	01/10/2007	Report regarding Final Slip 27 Sediment Sampling Plan.	Report	71	Ravi Sanga (EPA)	Windward Environmental, LLC
1426237	01/31/2007	Email regarding 2006 Recontamination Monitoring Data Report Approval.	Correspondence	1	Douglass Hotchkiss (Port of Seattle); Susan McGroddy (Windward Environmental, LLC)	Ravi Sanga (EPA)
1258189	02/23/2007	Report regarding East Waterway Phase 1 Removal Action: Recontamination Monitoring 2006 Data Report.	Report	261	EPA	Windward Environmental, LLC
1258183	03/06/2007	Letter regarding Government-to-Government Consultation with the Muckleshoot Indian Tribe for the East Waterway Operable Unit of the Harbor Island Superfund Site.	Correspondence	2	John Daniels, Jr. (Muckleshoot Indian Tribal Council)	Elin Miller (EPA)
1254411	07/06/2007	Report regarding East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study Final Workplan.	Report	95	EPA	Anchor Environmental, LLC; Windward Environmental, LLC
1459034	08/24/2007	East Waterway Phase 1 Removal Action: Recontamination Monitoring 2007 Data Report.	Report	22	EPA	Windward Environmental, LLC
100229005	09/27/2007	DV Report On-Site Catch Basin CB1- CB36, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	17		Pyron Environmental, Inc.

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100228920	09/27/2007	DV Report On Site Catch Basin, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	23		Integral Consulting, Inc.
100228904	09/27/2007	DV Report In Line Sediment, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	12		Pyron Environmental, Inc.
1273970	09/28/2007	Email approving the Slip 27 Data Memorandum.	Correspondence	2	Susan McGroddy (Windward Environmental, LLC)	Ravi Sanga (EPA)
1273948	10/09/2007	Quality assurance review of Historical Data Sets for Determination of Suitability for East Waterway SRI Nature and Extent of Contamination.	Correspondence	11		Gina Grepo-Grove (EPA)
718179	10/18/2007	Appendices A-D of the Slip 27 Sediment Sampling Results Report.	Report	298	EPA	Windward Environmental, LLC
1273971	10/18/2007	Report: Slip 27 Sediment Sampling Results.	Report	44	EPA	Windward Environmental, LLC
885487	12/31/2007	Appendix F of the Final Initial Source Evaluation and Data Gaps Memorandum: Harbor Island Soil and Groundwater Operable Unit 2006-2007 Groundwater Monitoring Report and letter of transmittal.		40	Ravi Sanga (EPA)	David Heineck (Summit Law Group, PLLC); RETEC Group, Inc.

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
1285916	01/11/2008	Memo regarding proposal for 2008 recontamination monitoring for the East Waterway.	Correspondence	5	Ravi Sanga (EPA)	Douglas Hotchkiss (Port of Seattle) Susan McGroddy (Windward Environmental, LLC)
1273966	01/11/2008	Email approving the final sampling memo for 2008 recontamination monitoring.	Correspondence	1	Susan McGroddy (Windward Environmental, LLC)	Ravi Sanga (EPA)
1273972	01/24/2008	East Waterway Phase 1 Removal Action: Recontamination Monitoring 2007 Data Report.	Report	57	EPA	Windward Environmental, LLC
1285921	02/15/2008	Quality Control & Dredging Plan for Pier 91 and Terminal 30 Upgrade for Dredge Season 1, January 2008 through February 15, 2008.	Report	10		General Construction Company
1441443	02/15/2008	Final East Waterway T-30 Post Dredge Monitoring Plan.	Report	77	EPA	Anchor Environmental, LLC); Windward Environmental, LLC
859668	03/01/2008	East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study (RI/FS) Existing Information Summary Report (Appendices on CD in Records Center).	Repot	281	EPA	Anchor Environmental, LLC); Windward Environmental, LLC
1278895	03/12/2008	Letter approving the Existing Information and Summary Report for the SRI/SFS.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
1278899	04/01/2008	Letter transmitting Muckleshoot Indian Tribe's comments on the Draft Conceptual Site Model and Data Gaps Analysis Report dated February 2008.	Correspondence	5	Ravi Sanga (EPA)	Glen St. Amant (Muckleshoot Indian Tribe)
885482	05/08/2008	Appendix A of the Final Initial Source Evaluation and Data Gaps Memorandum: East Waterway Phase 1 Removal Action: Recontamination Monitoring 2008 Data Report.	Report	56	Port of Seattle	Windward Environmental, LLC
100354183	06/01/2008	Source Control Evaluation Approach Memorandum, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, June 2008, Harbor Island.	Report	34		Anchor Environmental, LLC; Windward Environmental, LLC
500013266	06/01/2008	Source Control Evaluation Approach Memorandum for the East Waterway SRI/FS.	Report	34	Douglas Hotchkiss (Port of Seattle); EPA	Anchor Environmental, LLC); Windward Environmental, LLC)
1278896	06/25/2008	Letter approving the Source Control Evaluation Approach Memorandum for the East Waterway SRI/SFS with report attached.		37	Douglas Hotchkiss (Port of Seattle); EPA	Ravi Sanga (EPA); Anchor Environmental, LLC; Windward Environmental, LLC
1441444	06/25/2008	Email regarding EPA issues for East Waterway Clam/Fish QAPPs and field sampling.	Email	2	Douglas Hotchkiss (Port of Seattle); Susan McGroddy (Windward Environmental, LLC)	Ravi Sanga (EPA)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100353435	07/01/2008	Clam Studies July 2008, Supplemental Remedial Investigation, Feasibility Study, Appendix E Data Management, East Waterway Operable Unit Harbor Island.	Report	7		Windward Environmental, LLC
100353438	07/01/2008	Clam Studies July 2008, Supplemental Remedial Investigation, Feasibility Study, Map 3-1, East Waterway Operable Unit Harbor Island, Quality Assurance Project Plan.	Report	1		Windward Environmental, LLC
100353433	07/01/2008	Clam Studies July 2008, Supplemental Remedial Investigation, Feasibility Study, Appendix C Clam Analytical Concentration Goals, East Waterway Operable Unit Harbor Island.	Report	27		Windward Environmental, LLC
100353432	07/01/2008	Clam Studies July 2008, Supplemental Remedial Investigation, Feasibility Study, Appendix B Collection Forms, East Waterway Operable Unit Harbor Island.	Report	3		Windward Environmental, LLC
100353436	07/01/2008	Clam Studies July 2008, Supplemental Remedial Investigation, Feasibility Study, Map 2-1, East Waterway Operable Unit Harbor Island, Quality Assurance Project Plan.	Report	1		Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100353437	07/01/2008	Clam Studies July 2008, Supplemental Remedial Investigation, Feasibility Study, Map 2-2, East Waterway Operable Unit Harbor Island, Quality Assurance Project Plan.	Report	1		Windward Environmental, LLC
100353434	07/01/2008	Clam Studies July 2008, Supplemental Remedial Investigation, Feasibility Study, Appendix D Sediment Clam Analytical Concentration Goals Revised, East Waterway Operable Unit Harbor Island.	Report	20		Windward Environmental, LLC
1397156	07/03/2008	Memorandum regarding Fish, Crab, Shrimp, and Mussel Sampling Design.		19	Ravi Sanga (EPA)	Windward Environmental, LLC
1278900	07/15/2008	Letter regarding People for Puget Sound's comments on the East Waterway Clam Survey Technical Memo dated 06/30/08.	Correspondence	1	Ravi Sanga (EPA)	Heather Trim (People for Puget Sound)
1278901	07/23/2008	Letter transmitting EPA comments on the East Waterway Clam Approaches Technical Memo.	Correspondence	4	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
1278902	07/23/2008	Email regarding additional comments on the East Waterway revised draft Conceptual Site Model and Data Gaps Report dated June 2008.	Correspondence	2	Ravi Sanga (EPA)	Glen St. Amant (Muckleshoot Indian Tribe)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
1278894	07/23/2008	Letter transmitting EPA comments on and approving the Quality Assurance Project Plan - Clam Studies for the East Waterway.	Correspondence	6	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
1426241	08/04/2008	Suquamish Tribe comments on the Fish, Crab, Shrimp and Mussel Sampling Design.	Letter	5	Ravi Sanga (EPA)	OAlison 'Sullivan (Suquamish Indian Tribe); Denice Taylor (Suquamish Tribe - Fisheries Dept.)
1285917	08/08/2008	Memo regarding proposed intertidal clam compositing approach for East Waterway.	Correspondence	7	Ravi Sanga (EPA)	Douglas Hotchkiss (Port of Seattle); Susan McGroddy (Windward Environmental, LLC); Peter Rude (City of Seattle Public Utilities); Jeff Stern (King County); Thomas Wang (Anchor Environmental, LLC); Debra Williston (King County)
100353446	08/11/2008	2008 Fish and Shellfish Quality Assurance Project Plan Supplemental Remedial Investigation, Feasibility Study, Appendix D Analytical Concentration Goals, East Waterway Operable Unit Harbor Island.	Report	47		Windward Environmental, LLC
100353443	08/11/2008	2008 Fish and Shellfish Quality Assurance Project Plan Supplemental Remedial Investigation, Feasibility Study, Appendix C Data Management, East Waterway Operable Unit Harbor Island.	Report	7		Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100353442	08/11/2008	2008 Fish and Shellfish Quality Assurance Project Plan Supplemental Remedial Investigation, Feasibility Study, Appendix B Field Forms, East Waterway Operable Unit Harbor Island.	Report	7		Windward Environmental, LLC
100353447	08/11/2008	2008 Fish and Shellfish Quality Assurance Project Plan Supplemental Remedial Investigation, Feasibility Study, Map 2-1 Vicinity Map, East Waterway Operable Unit Harbor Island.	Report	1		Windward Environmental, LLC
100353449	08/11/2008	2008 Fish and Shellfish Quality Assurance Project Plan Supplemental Remedial Investigation, Feasibility Study, Map 3-1 Proposed Fish and Crab Survey Sampling Areas, East Waterway Operable Unit Harbor Island.	Report	1		Windward Environmental, LLC
100354592	08/18/2008	Surface Water Quality Assurance Project Plan Appendix B-C-D Field Collection Forms, East Waterway Operable Unit Supplemental Remedial Investigation Feasibility Study Final, December 2008, Harbor Island.	Report	19		Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100354591	08/18/2008	Surface Water Quality Assurance Project Plan Appendix A Heath and Safety Plan, East Waterway Operable Unit Supplemental Remedial Investigation Feasibility Study Final, August 2008, Harbor Island.	Report	31		Windward Environmental, LLC
1426242	09/05/2008	Suquamish Tribe comments on the East Waterway RI/FS Draft Surface Water Collection and Chemical Analysis.	Letter	2	Ravi Sanga (EPA)	Alison O'Sullivan (Suquamish Indian Tribe); Denice Taylor (Suquamish Tribe - Fisheries Dept.)
100228912	09/05/2008	DV Report MR59 DQE, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	26		EcoChem, Incorporated
100228909	09/05/2008	DV Report MN32 DQE, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	29		EcoChem, Incorporated
100230539	09/05/2008	DV Report MR83 DQE, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	10		EcoChem, Incorporated
100228917	09/09/2008	DV Report NJ10 DQE, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	10		EcoChem, Incorporated

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100228915	09/09/2008	DV Report MY01 DQE, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	29		EcoChem, Incorporated
100228914	09/09/2008	DV Report MU59 DQE, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	29		EcoChem, Incorporated
100228911	09/10/2008	DV Report MQ33 DQE, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	29		EcoChem, Incorporated
100228916	09/10/2008	DV Report ND79 DQE, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	35		EcoChem, Incorporated
1307985	10/01/2008	Final Quality Assurance Project Plan - Clam Studies for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Report	159	EPA	Windward Environmental, LLC
100354179	10/01/2008	Final Quality Assurance Project Plan Clam Studies, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, October 2008, Harbor Island.	Report	61		Windward Environmental, LLC

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100353402	10/10/2008	East Waterway Operable Unit Supplemental Remedial Investigation, Feasibility Study Health and Safety Plan Benthic Invertebrate Tissue, Gastropod Collection, October 2008, Quality Assurance Project Plan, Appendix A HSP.	Report	28		Windward Environmental, LLC
100353406	10/10/2008	East Waterway Operable Unit Supplemental Remedial Investigation, Feasibility Study Health and Safety Plan Benthic Invertebrate Tissue, Gastropod Collection, October 2008, Quality Assurance Project Plan, Appendix E Data Management.	Report	7		Windward Environmental, LLC
100353407	10/10/2008	East Waterway Operable Unit Supplemental Remedial Investigation, Feasibility Study Health and Safety Plan Benthic Invertebrate Tissue, Gastropod Collection, October 2008, Quality Assurance Project Plan, Appendix F Gastropod Forms.	Report	2		Windward Environmental, LLC
100353408	10/10/2008	East Waterway Operable Unit Supplemental Remedial Investigation, Feasibility Study Health and Safety Plan Benthic Invertebrate Tissue, Gastropod Collection, October 2008, Quality Assurance Project Plan, Map 2-1, Vicinity Map.	Report	1		Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100353405	10/10/2008	East Waterway Operable Unit Supplemental Remedial Investigation, Feasibility Study Health and Safety Plan Benthic Invertebrate Tissue, Gastropod Collection, October 2008, Quality Assurance Project Plan, Appendix D Sediment ACGs Revised.	Report	14		Windward Environmental, LLC
100353409	10/10/2008	East Waterway Operable Unit Supplemental Remedial Investigation, Feasibility Study Health and Safety Plan Benthic Invertebrate Tissue, Gastropod Collection, October 2008, Quality Assurance Project Plan, Map 3-1, Proposed Infaunal Tissue Collection Areas.	Report	1		Windward Environmental, LLC
100353403	10/10/2008	East Waterway Operable Unit Supplemental Remedial Investigation, Feasibility Study Health and Safety Plan Benthic Invertebrate Tissue, Gastropod Collection, October 2008, Quality Assurance Project Plan, Appendix B Forms.	Report	3		Windward Environmental, LLC
100353404	10/10/2008	East Waterway Operable Unit Supplemental Remedial Investigation, Feasibility Study Health and Safety Plan Benthic Invertebrate Tissue, Gastropod Collection, October 2008, Quality Assurance Project Plan, Appendix C Tissue ACG.	Report	6		Windward Environmental, LLC

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100230793	11/26/2008	Letter, NR17-Seattle Public Utilities-EWW, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Letter	73	Brian Robinson (City of Seattle Public Utilities)	Mark Harris (Analytical Resources, Incorporated)
100443608	12/01/2008	REDACTED Final Quality Assurance Project Plan Surface Water Collection and Chemical Analysis, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, December 2008, Harbor Island.	Report	56		Windward Environmental, LLC
100030309	12/01/2008	REDACTED Quality Assurance Project Plan - Fish and Shellfish Tissue Collection and Chemical Analysis for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Report	179	EPA	Windward Environmental, LLC
100354182	12/01/2008	Final Conceptual Site Model and Data Gaps Analysis Report, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, December 2008, Harbor Island.	Report	182		Anchor Environmental, LLC; Windward Environmental, LLC
100321551	12/01/2008	REDACTED Quality Assurance Project Plan - Fish and Shellfish Tissue Collection and Chemical Analysis for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Report	186	EPA	Windward Environmental, LLC

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1307986	12/01/2008	Final Quality Assurance Project Plan - Benthic Invertebrate Tissue/Gastropod Collection for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Report	118	EPA	Windward Environmental, LLC
100443606	12/01/2008	REDACTED Quality Assurance Project Plan Fish and Shellfish Tissue Collection and Chemical Analysis, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Final, December 2008, Harbor Island.	Report	73		Windward Environmental, LLC
500013218	12/01/2008	Final Quality Assurance Project Plan - Benthic Invertebrate Tissue/Gastropod Collection for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Report	130	EPA	Windward Environmental, LLC
100354177	12/01/2008	Final Quality Assurance Project Plan Benthic Invertebrate Tissue Gastropod Collection, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, December 2008, Harbor Island.	Report	54		Windward Environmental, LLC

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1307331	12/01/2008	Final Sediment Transport Evaluation Approach Memorandum for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Report	74	EPA	Anchor Environmental, LLC; Windward Environmental, LLC
100354185	12/01/2008	Final Sediment Transport Evaluation Approach Memorandum, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, December 2008, Harbor Island.	Report	74		Anchor Environmental, LLC; Battelle Seattle Research Center
1307330	12/01/2008	Final Conceptual Site Model and Data Gaps Analysis Report for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Report	182	EPA	Anchor Environmental, LLC; Windward Environmental, LLC
1308000	12/03/2008	PCB Aroclor Analyses Memorandum.	Correspondence	1	Ginna Grepo-Grove (EPA)	Windward Environmental, LLC
1307332	12/06/2008	Letter approving the Sediment Transport Evaluation Approach Memo for the East Waterway SRI/FS.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
100354196	01/01/2009	Fish and Shellfish Data Report Appendix G Chain-of-Custody Forms, East Waterway Operable Unit, 2009, Harbor Island.	Report	64		Windward Environmental, LLC

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1306007	01/12/2009	Suquamish comments on the East Waterway Proposed Geoduck Tissue Compositing and Analysis Scheme.	Correspondence	3	Ravi Sanga (EPA)	Alison O'Sullivan (Suquamish Tribe - Fisheries Dept.); Denice Taylor (Suquamish Tribe - Fisheries Dept.)
1307317	01/14/2009	Letter regarding EPA approval of the Quality Assurance Project Plan, Benthic Invertebrate Tissue/Gastropod Collection for the East Waterway SRI/FS.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
100354186	02/01/2009	Addendum to the Final Quality Assurance Project Plan Clam Studies, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, February 2009, Harbor Island.	Report	12		Windward Environmental, LLC
1307318	02/12/2009	Letter regarding EPA approval of the Quality Assurance Project Plan, Surface Water Collection and Chemical Analysis for the East Waterway SRI/FS.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
100030306	03/01/2009	REDACTED Quality Assurance Project Plan - Sediment Transport Characterization for East Waterway.	Report	86	EPA	Battelle Memorial Institute; Anchor QEA, LLC
100228918	03/25/2009	DV Report OB35 CVR, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	31		EcoChem, Incorporated

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100228919	03/25/2009	DV Report OE55 CVR, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	30		EcoChem, Incorporated
1398431	04/03/2009	Memo regarding Selection of Tissue Samples for PCB Congener and Dioxin and Furan Analysis.	Correspondence	8	Ravi Sanga (EPA)	Windward Environmental, LLC
100231093	04/07/2009	OS88-II EW Report-2, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	82		Analytical Resources, Incorporated
100231104	04/16/2009	OV11 EW Report-2, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	75		Analytical Resources, Incorporated
100231105	04/24/2009	Letter, OV26-Seattle Public Utilities-East Waterway, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Letter	11	Beth Schmoyer (Seattle Public Utilities)	Mark Harris (Analytical Resources, Incorporated)
1306782	05/01/2009	Quality Assurance Project Plan: Juvenile Chinook Salmon Tissue Collection and Chemical Analysis for the East Waterway Operable Unit.	Report	46	Port of Seattle	Windward Environmental, LLC

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100231108	05/14/2009	Letter, OX49 EWW Report, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Letter	102	Beth Schmoyer (Seattle Public Utilities)	Mark Harris (Analytical Resources, Incorporated)
1307993	05/18/2009	EPA approval of the Sediment Transport Characterization QAPP for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
100229017	05/20/2009	DV Report OS88 CVR, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	32		EcoChem, Incorporated
100229011	05/20/2009	DV Report OQ58 CVR, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	35		EcoChem, Incorporated
100229016	05/20/2009	DV Report OS70 CVR, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	29		EcoChem, Incorporated
1307996	05/29/2009	EPA approval of the Juvenile Chinook Salmon Tissue Collection and Chemical Analysis QAPP for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)

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100030303	06/01/2009	REDACTED Final Quality Assurance Project Plan: Surface Water Collection and Chemical Analysis for the East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study.	Report	109	Port of Seattle	Windward Environmental, LLC
100354181	06/01/2009	Quality Assurance Project Plan Juvenile Chinook Salmon Tissue Collection and Chemical Analysis, June 2009, Harbor Island.	Report	37		Windward Environmental, LLC
100458462	06/19/2009	REDACTED Final Quality Assurance Project Plan: Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the East Waterway for the East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study.	Report	174	Port of Seattle	Windward Environmental, LLC
1342004	07/29/2009	EPA Approval: Quality Assurance Project Plan: Surface Sediment Sampling for Chemical Analyses and Toxicity Testing of the East Waterway, Supplemental Remedial Investigation and Feasibility Study.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)

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1306785	08/01/2009	Addendum to the Final Quality Assurance Project Plan Clam Studies for the East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study.	Report	36	Port of Seattle	Windward Environmental, LLC
500013188	08/01/2009	Announcement regarding Lockheed West Seattle and Harbor Island/East Waterway Community Involvement Plan.	Publication	8		EPA
1342017	08/05/2009	Final Environmental Assessment for Replacement of Pier 36 Berth Bravo: United States Coast Guard Integrated Support Command (with transmittal letter).	Report	70	U.S. Coast Guard	Exponent, Inc.
1342011	08/27/2009	EPA Approval: Addendum to the Final Quality Assurance Project Plan Clam Studies, Supplemental Remedial Investigation and Feasibility Study.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
100353861	09/01/2009	EW STER Appendix B, Currents and Salinity Data Collection, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Harbor Island.	Report	44		Anchor QEA, LLC
100229139	09/15/2009	DV Report PH65 CVR, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	35		EcoChem, Incorporated

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100229143	09/15/2009	DV Report PI60 CVR, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	31		EcoChem, Incorporated
100231119	09/21/2009	PR27 East Waterway-Sediment Traps Report-2, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	81		Analytical Resources, Incorporated
1402912	09/29/2009	Terminal 18 Post-Dredge Monitoring Results.	Report	39	Port of Seattle	Windward Environmental, LLC
1306786	10/01/2009	Quality Assurance Project Plan: Intertidal MIS Sediment Sampling for the East Waterway Operable Unit.	Report	28	Port of Seattle	Windward Environmental, LLC
100231115	10/12/2009	PQ98 East Waterway-Sediment Traps Report-2, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	68		Analytical Resources, Incorporated
1306817	10/19/2009	Letter regarding additional analysis of archived surface sediment to support evaluation of anti-degradation at Port of Seattle, Terminal 18.	Correspondence	2	Stephanie Stirling (U.S. Army Corps of Engineers)	Tad Deshler (Windward Environmental, LLC)

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100353396	11/01/2009	Benthic Invertebrate Data Report November 2009, Appendix C Data Validation Reports, Harbor Island East Waterway.	Report	70		Port of Seattle
100353394	11/01/2009	Benthic Invertebrate Data Report November 2009, Appendix A Data Management, Harbor Island East Waterway.	Report	7		Port of Seattle
100354176	11/01/2009	Final Data Report Benthic Invertebrate Tissue and Co-located Sediment Samples, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, November 2009, Complete, Harbor Island.	Report	51		Windward Environmental, LLC
100353397	11/01/2009	Benthic Invertebrate Data Report November 2009, Appendix D Raw Lab Data, Harbor Island East Waterway.	Report	135		(Port of Seattle
100353395	11/01/2009	Benthic Invertebrate Data Report November 2009, Appendix B TBT Memorandum, Harbor Island East Waterway.	Report	10		Port of Seattle
100353400	11/01/2009	Benthic Invertebrate Data Report November 2009, Benthic Data Report Appendix G SPI Report, Harbor Island East Waterway.	Report	88		Port of Seattle

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896245	11/01/2009	Final Data Report Benthic Invertebrate Tissue and Co-Located Sediment Samples, East Waterway Supplemental Remedial Investigation/Feasibility Study.	Report	457	EPA; Port of Seattle	Windward Environmental, LLC
100353399	11/01/2009	Benthic Invertebrate Data Report November 2009, Appendix F CoCs, Harbor Island East Waterway.	Report	19		Port of Seattle
100353398	11/01/2009	Benthic Invertebrate Data Report November 2009, Appendix E Field Notes, Collection Forms, and Protocol Mod, Harbor Island East Waterway.	Report	77		Port of Seattle
100353401	11/01/2009	Benthic Invertebrate Data Report November 2009, Map 2-1, Sampling Locations and Results for PCBs, Mercury, and TBT in Sediment, Study Area, Harbor Island East Waterway.	Report	1		Port of Seattle
100231121	11/02/2009	PS79 RE SVOA 20091103152849, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	8		Analytical Resources, Incorporate)

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100228905	11/05/2009	DV Report January October 2009 All Samples MTL, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	16		Pyron Environmental, Inc.
1306798	11/06/2009	Memorandum regarding estimated risk associated with pesticide tissue concentrations.	Correspondence	2		Nancy Judd (Windward Environmental, LLC); Susan McGroddy (Windward Environmental, LLC)
1306801	11/24/2009	EPA approval for the Benthic Invertebrate Tissue and Co-located Sediment Samples Data Report for the East Waterway SRI/FS.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
100354587	12/01/2009	Surface Water Data Report Appendix C Data Validation Report, East Waterway Operable Unit Supplemental Remedial Investigation Feasibility Study Final, December 2009, Harbor Island.	Report	96		Port of Seattle
885486	12/01/2009	Appendix E of the Final Initial Source Evaluation and Data Gaps Memorandum: Tables of Harbor Island Groundwater Quality Data.	Analytical Data Document	21	Port of Seattle	(Windward Environmental, LLC
1306820	12/01/2009	Final East Waterway Source Tracing Data Report for Samples Collected in the Combined Sewer System from January 2008 to April 2009.	Report	175		King County Dept. of Natural Resources and Parks

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885490	12/01/2009	Appendix I of the Final Initial Source Evaluation and Data Gaps Memorandum: Summary of Spill Reports in the Vicinity of the East Waterway (Last 20 Years: 1988 to 2007).		10	Port of Seattle	Windward Environmental, LLC
885485	12/01/2009	Appendix D of the Final Initial Source Evaluation and Data Gaps Memorandum: Hanford #2 CSO Effluent Data.	Analytical Data Document	255		
896246	12/01/2009	Final Surface Water Data Report for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Report	1,259	EPA; Port of Seattle	Windward Environmental, LLC
100354586	12/01/2009	Surface Water Data Report Appendix B Data Management, East Waterway Operable Unit Supplemental Remedial Investigation Feasibility Study Final, December 2009, Harbor Island.	Report	7		Port of Seattle
100354234	12/01/2009	East Waterway Operable Unit Supplemental Remedial Investigation Feasibility Study Final Surface Water Data Report, December 2009, Harbor Island.	Report	28		Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
885488	12/01/2009	Appendix G of the Final Initial Source Evaluation and Data Gaps Memorandum: King County atmospheric deposition monitoring results for the Duwamish (CE/CER), Georgetown (DZ), and South Park Community Center (SPCC) stations.	Analytical Data Document	10	Port of Seattle	Windward Environmental, LLC
100354590	12/01/2009	Surface Water Data Report Appendix E Field Forms, East Waterway Operable Unit Supplemental Remedial Investigation Feasibility Study Final, December 2009, Harbor Island.	Report	40		Port of Seattle
100354585	12/01/2009	Surface Water Data Report Appendix A Data Tables, East Waterway Operable Unit Supplemental Remedial Investigation Feasibility Study Final, December 2009, Harbor Island.	Report	136		Port of Seattle
885489	12/01/2009	Appendix H of the Final Initial Source Evaluation and Data Gaps Memorandum: EPA and Ecology 1,4-DCB and metals data.	Analytical Data Document	18		EPA; Washington Department of Ecology
885484	12/01/2009	Appendix C of the Final Initial Source Evaluation and Data Gaps Memorandum: Hanford #2 CSO Effluent Data.	Analytical Data Document	278		

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100354589	12/01/2009	Surface Water Data Report Appendix E Field Forms, East Waterway Operable Unit Supplemental Remedial Investigation Feasibility Study Final, December 2009, Harbor Island.	Report	38		Port of Seattle
100354588	12/01/2009	Surface Water Data Report Appendix D Lab Data Sheets, East Waterway Operable Unit Supplemental Remedial Investigation Feasibility Study Final, December 2009, Harbor Island.	Report	1		Port of Seattle
100353823	12/14/2009	Initial Source Evaluation and Data Gaps Memorandum, East Waterway Operable Unit Feasibility Study December 2019 Final, Harbor Island.	Report	201		Anchor QEA, LLC
100229144	12/23/2009	DV Report PQ98PR27, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	36		EcoChem, Incorporated
100229145	12/23/2009	DV Report PS79, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	31		EcoChem, Incorporated

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100229244	12/29/2009	DV Report PX36 CVR, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	39		EcoChem, Incorporated
100229246	12/29/2009	DV Report PY33 CVR, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	33		EcoChem, Incorporated
1306806	12/29/2009	EPA approval for the Surface Water Data Report for the East Waterway SRI/FS.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
100229247	12/30/2009	DV Report QA76 CVR, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	10		EcoChem, Incorporated
100458466	01/01/2010	REDACTED Quality Assurance Project Plan: Subsurface Sediment Sampling for Chemical Analyses in the East Waterway for the East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study.	Report	382	Port of Seattle	Windward Environmental, LLC
100353415	01/01/2010	Juvenile Chinook Salmon Data Report 2010 Appendix E Field Collection Forms and Field Notes, East Waterway Operable Unit Harbor Island.	Report	30		Windward Environmental, LLC

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100353413	01/01/2010	Juvenile Chinook Salmon Data Report 2010 Appendix C Data Validation Report, East Waterway Operable Unit Harbor Island.	Report	50		Windward Environmental, LLC
100458464	01/01/2010	REDACTED, Quality Assurance Project Plan: Subsurface Sediment Sampling for Chemical Analyses in the East Waterway for the East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study.	Report	357	Port of Seattle	Windward Environmental, LLC
100354211	01/01/2010	Subsurface Sediment Data Report Appendix D Data Validation, 2010, East Waterway Operable Unit, Harbor Island.	Report	253		Port of Seattle
100354232	01/01/2010	Surface Sediment Data Report Appendix E Field Forms, 2010, East Waterway Operable Unit, Harbor Island.	Report	192		Port of Seattle
100353412	01/01/2010	Juvenile Chinook Salmon Data Report 2010 Appendix B Data Management, East Waterway Operable Unit Harbor Island.	Report	8		Windward Environmental, LLC
100354226	01/01/2010	Surface Sediment Data Report Appendix A Data Tables, 2010, East Waterway Operable Unit, Harbor Island.	Report	168		Port of Seattle

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100354198	01/01/2010	Fish and Shellfish Data Report Appendix I Congener Selection Memo, Selection of Tissue Samples for PCB Congener and Dioxin and Furan Analysis, East Waterway Operable Unit, 2010, Harbor Island.	Report	9		Windward Environmental, LLC
100354227	01/01/2010	Surface Sediment Data Report Appendix B Data Management, 2010, East Waterway Operable Unit, Harbor Island.	Report	6		Port of Seattle
100353414	01/01/2010	Juvenile Chinook Salmon Data Report 2010 Appendix D Laboratory Report Forms, East Waterway Operable Unit Harbor Island.	Report	54		Windward Environmental, LLC
100354178	01/01/2010	Final Data Report Clam Surveys and Sampling of Clam Tissue and Sediment, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, January 2010, Harbor Island.	Report	81		Windward Environmental, LLC
100354195	01/01/2010	Fish and Shellfish Data Report Appendix E Laboratory Report Forms, East Waterway Operable Unit, 2010, Harbor Island.	Report	786		Windward Environmental, LLC
100354197	01/01/2010	Fish and Shellfish Data Report Appendix H Low Level BEHP and PCP Data Summary, East Waterway Operable Unit, 2010, Harbor Island.	Report	3		Windward Environmental, LLC

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100354228	01/01/2010	Surface Sediment Data Report Appendix C Validation Reports, 2010, East Waterway Operable Unit, Harbor Island.	Report	287		Port of Seattle
100354229	01/01/2010	Surface Sediment Data Report Appendix D-1 Chemistry Data, 2010, East Waterway Operable Unit, Harbor Island.	Report	1,103		Port of Seattle
100354233	01/01/2010	Surface Sediment Data Report Appendix F CoCs, 2010, East Waterway Operable Unit, Harbor Island.	Report	48		Port of Seattle
100353410	01/01/2010	Juvenile Chinook Salmon Data Report 2010 Appendix A Chinook Compositing Memo, East Waterway Operable Unit Harbor Island.	Report	11		Windward Environmental, LLC
100353416	01/01/2010	Juvenile Chinook Salmon Data Report 2010 Appendix F CoCs and Compositing Forms, East Waterway Operable Unit Harbor Island.	Report	26		Windward Environmental, LLC
100353417	01/01/2010	Juvenile Chinook Salmon Data Report 2010 Map 2-1, Chinook Sampling Location, East Waterway Operable Unit Harbor Island.	Report	1		Windward Environmental, LLC

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100336204	01/01/2010	REDACTED Quality Assurance Project Plan: Subsurface Sediment Sampling for Chemical Analyses in the East Waterway for the East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study.	Report	357	Port of Seattle	Windward Environmental, LLC
896247	01/01/2010	Final Data Report Clam Surveys and Sampling of Clam Tissue and Sediment for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Report	646	EPA; Port of Seattle	Windward Environmental, LLC
100354230	01/01/2010	Surface Sediment Data Report Appendix D-2 Bioassay Reports, 2010, East Waterway Operable Unit, Harbor Island.	Report	409		Port of Seattle
1306795	01/28/2010	Terminal 18 Post-Dredge Monitoring Results.	Report	50	Port of Seattle	Windward Environmental, LLC
1306809	02/04/2010	EPA approval for the Clam Surveys and Sampling of Clam Tissue and Sediment Data Report for the East Waterway SRI/FS.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
1306811	03/01/2010	EPA approval of the Human Health Technical Memorandum for the East Waterway SRI/FS.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100354190	03/01/2010	HHRA Technical Memorandum Final, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, March 2010, Harbor Island.	Report	109		Windward Environmental, LLC
1313666	03/01/2010	Final HHRA Technical Memorandum for the East Waterway Operable Unit for the Supplemental Remedial Investigation/Feasibility Study.	Report	109	Ravi Sanga (EPA)	Windward Environmental, LLC
1306794	03/03/2010	East Waterway Sediment Transport Characterization - Core Collection and Processing Summary Memorandum.	Report	6	Ravi Sanga (EPA)	DSan Berlin (Anchor Environmental, LLC); Thomas Wang (Anchor Environmental, LLC)
1306791	03/09/2010	EPA approval of the Quality Assurance Project Plan: Subsurface Sediment Sampling for Chemical Analysis in the East Waterway for the SRI/FS.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
1306813	03/22/2010	EPA approval for the Quality Assurance Project Plan: Subsurface Sediment Sampling for Chemical Analysis in the East Waterway (for the East Waterway SRI/FS).	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
1306793	03/22/2010	EPA approval of the Quality Assurance Project Plan: Intertidal MIS Sediment Sampling for the SRI/FS at Eat Waterway.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
1306815	04/01/2010	EPA approval for the Final Data Report for Fish and Shellfish Tissue Collection for the East Waterway SRI/FS.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
100354199	04/01/2010	Final Data Report Fish and Shellfish Tissue Collection, East Waterway Operable Unit Supplemental Remedial Investigation, April 2010, Harbor Island.	Report	57		Windward Environmental, LLC
100354191	04/01/2010	Fish and Shellfish Data Report Appendix A Data Tables, East Waterway Operable Unit, April 2010, Harbor Island.	Report	41		Windward Environmental, LLC
100354192	04/01/2010	Fish and Shellfish Data Report Appendix B Fish Compositing Memo, East Waterway Operable Unit, April 2010, Harbor Island.	Report	18		Windward Environmental, LLC
896248	04/01/2010	Final Data Report Fish and Shellfish Tissue Collection for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Report	1144	EPA; Port of Seattle	Windward Environmental, LLC
100354194	04/01/2010	Fish and Shellfish Data Report Appendix D Data Validation Report, East Waterway Operable Unit, April 2010, Harbor Island.	Report	92		Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100354193	04/01/2010	Fish and Shellfish Data Report Appendix C Data Management, East Waterway Operable Unit, April 2010, Harbor Island.	Report	6		Windward Environmental, LLC
1404645	04/16/2010	EPA approval of the revised memorandum for Additional Analysis for Fish and Crab Tissue Samples.	Correspondence	1	Susan McGroddy (Windward Environmental, LLC)	Ravi Sanga (EPA)
100353419	05/01/2010	May 2010 Final Data Report Juvenile Chinook Salmon Tissue Collection, Intertidal Clam Data Appendix A Data Tables, East Waterway Operable Unit Harbor Island.	Report	22		Windward Environmental, LLC
100353428	05/01/2010	May 2010 Final Data Report Juvenile Chinook Salmon Tissue Collection, Intertidal Clam Data Appendix I Geoduck Compositing Memo, East Waterway Operable Unit Harbor Island.	Report	4		Windward Environmental, LLC
100353420	05/01/2010	May 2010 Final Data Report Juvenile Chinook Salmon Tissue Collection, Intertidal Clam Data Appendix B Data Management, East Waterway Operable Unit Harbor Island.	Report	5		Windward Environmental, LLC
100353425	05/01/2010	May 2010 Final Data Report Juvenile Chinook Salmon Tissue Collection, Intertidal Clam Data Appendix G Photos, East Waterway Operable Unit Harbor Island.	Report	22		Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100353426	05/01/2010	May 2010 Final Data Report Juvenile Chinook Salmon Tissue Collection, Intertidal Clam Data Appendix H Clam Compositing Memo, East Waterway Operable Unit Harbor Island.	Report	8		Windward Environmental, LLC
100353423	05/01/2010	May 2010 Final Data Report Juvenile Chinook Salmon Tissue Collection, Intertidal Clam Data Appendix E Field Forms, East Waterway Operable Unit Harbor Island.	Report	69		Windward Environmental, LLC
100353418	05/01/2010	May 2010 Final Data Report Juvenile Chinook Salmon Tissue Collection, East Waterway Operable Unit Harbor Island.	Report	32		Windward Environmental, LLC
100353421	05/01/2010	May 2010 Final Data Report Juvenile Chinook Salmon Tissue Collection, Intertidal Clam Data Appendix C Data Validation, East Waterway Operable Unit Harbor Island.	Report	96		Windward Environmental, LLC
100353430	05/01/2010	May 2010 Final Data Report Juvenile Chinook Salmon Tissue Collection, Intertidal Clam Data Appendix Maps, East Waterway Operable Unit Harbor Island.	Report	5		Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100353424	05/01/2010	May 2010 Final Data Report Juvenile Chinook Salmon Tissue Collection, Intertidal Clam Data Appendix F COCs, East Waterway Operable Unit Harbor Island.	Report	24		Windward Environmental, LLC
646582	05/01/2010	Final East Waterway Operable Unit SRI/FS Data Report: Juvenile Chinook Salmon Tissue Collection.	Report	211	EPA	Windward Environmental, LLC
100353422	05/01/2010	May 2010 Final Data Report Juvenile Chinook Salmon Tissue Collection, Intertidal Clam Data Appendix D Lab Report Forms, East Waterway Operable Unit Harbor Island.	Report	308		Windward Environmental, LLC
100353427	05/01/2010	May 2010 Final Data Report Juvenile Chinook Salmon Tissue Collection, Intertidal Clam Data Appendix I Geoduck Compositing Memo, East Waterway Operable Unit Harbor Island.	Report	5		Windward Environmental, LLC
100231133	05/07/2010	QV28 EWW Sediment Traps Report-2, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	88		Analytical Resources, Incorporated

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500002117	06/01/2010	Port of Seattle East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study (RI/FS) Surface Sediment Data Report: Appendix A - Chemistry Data Tables.		162	EPA	Windward Environmental, LLC
500002121	06/01/2010	Port of Seattle East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study (RI/FS) Surface Sediment Data Report: Appendix D-1 - Laboratory Reports.		1103	EPA	Windward Environmental, LLC
100353863	06/01/2010	EW STER Appendix D, Draft Sedflume Data Report, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Harbor Island.	Report	61		Anchor QEA, LLC
1469686	06/01/2010	CD Containing Appendices A-F for the Port of Seattle East Waterway OU Supplemental RI/FS Surface Sediment Data Report.		1	EPA	Windward Environmental, LLC
500002122	06/01/2010	Port of Seattle East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study (RI/FS) Surface Sediment Data Report: Appendix D-2 - Bioassay Reports and Results.		409	EPA	Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
500002120	06/01/2010	Port of Seattle East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study (RI/FS) Surface Sediment Data Report: Appendix C - Data Validation Reports.		287	EPA	Windward Environmental, LLC
500002118	06/01/2010	Port of Seattle East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study (RI/FS) Surface Sediment Data Report: Appendix B - Data Management		6	EPA	Windward Environmental, LLC
500002123	06/01/2010	Port of Seattle East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study (RI/FS) Surface Sediment Data Report: Appendix E - Collection Forms and Field Notes.		192	EPA	Windward Environmental, LLC
100354180	06/01/2010	ERA Technical Memorandum Final, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, June 2010, Harbor Island.	Report	72		Windward Environmental, LLC
1313667	06/01/2010	Final ERA Technical Memorandum for the East Waterway Operable Unit for the Supplemental Remedial Investigation/Feasibility Study.	Report	72	Ravi Sanga (EPA)	Windward Environmental, LLC

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100353859	06/15/2010	EW STER Appendix A, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Harbor Island.	Report	6		Anchor QEA, LLC
100231139	06/25/2010	QX90 EW Package, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	144		Analytical Resources, Incorporated
1404647	06/25/2010	EPA Approval of the Ecological Risk Assessment Technical Memorandum for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
100354204	07/01/2010	PCB Congener Data Report Appendix D Form 1s, East Waterway Operable Unit, July 2010, Harbor Island.	Report	130		Windward Environmental, LLC
619653	07/01/2010	Data Report: Final Clam Survey, Geoduck Survey, Fish and Shellfish Tissue Collection PCB Congener and Dioxin/Furan Results for the Supplemental Remedial Investigation/Feasibility Study of the East Waterway Operable Unit.	Report	263	Ravi Sanga (EPA)	Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100353450	07/01/2010	July 2010 Porewater Study Final Quality Assurance Project Plan Supplemental Remedial Investigation, Feasibility Study, Combined, East Waterway Operable Unit Harbor Island.	Report	83		Windward Environmental, LLC
1313665	07/01/2010	Quality Assurance Project Plan: Final Porewater Study for the East Waterway Operable Unit for the Supplemental Remedial Investigation/Feasibility Study.	Report	83	Ravi Sanga (EPA)	Windward Environmental, LLC
100354206	07/01/2010	PCB Congener Data Report Appendix F PCB Plots, East Waterway Operable Unit, July 2010, Harbor Island.	Report	4		Windward Environmental, LLC
100354189	07/01/2010	Data Report: Clam Survey, Geoduck Survey, Fish and Shellfish Tissue Collection PCB Congener and Dioxin, Furan Results Final, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, July 2010, Harbor Island.	Report	30		Windward Environmental, LLC
100354203	07/01/2010	PCB Congener Data Report Appendix C Data Validation Report, East Waterway Operable Unit, July 2010, Harbor Island.	Report	41		Windward Environmental, LLC
100354202	07/01/2010	PCB Congener Data Report Appendix B Data Management, East Waterway Operable Unit, July 2010, Harbor Island.	Report	6		Windward Environmental, LLC

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100354205	07/01/2010	PCB Congener Data Report Appendix E Memo, East Waterway Operable Unit, July 2010, Harbor Island.	Report	9		Windward Environmental, LLC
100354201	07/01/2010	Appendix A PCB Congener and Dioxin and Furan Data Tables, East Waterway Operable Unit, July 2010, Harbor Island.	Report	43		Windward Environmental, LLC
1404648	07/02/2010	EPA Approval of Data Report - Clam Survey, Geoduck Survey, Fish and Shellfish Tissue Collection and Dioxin/Furan Results for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
1404643	07/15/2010	EPA approval of the Quality Assurance Project Plan Porewater Study for the East Waterway Supplemental Remedial Investigation/Feasibility Study.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
100228884	08/06/2010	2010-08-06 DVR EWW SDS Combined Report, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	34	Seattle Public Utilities	Integral Consulting, Inc.
100228891	08/06/2010	Dioxin 2010-08-06 DVR EWW SDS Combined Report, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	34		Integral Consulting, Inc.

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100231142	08/18/2010	RF96 RG11 RG85 RH95 Seattle Public Utilities Report, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	275		Analytical Resources, Incorporated
1313673	08/25/2010	Responses to comments on the Revised Surface Sediment Data Report.	Correspondence	2	Ravi Sanga (EPA)	Susan McGroddy (Windward Environmental, LLC)
619652	09/01/2010	Data Report: Final Surface Sediment Sampling for Chemical Analyses and Toxicity Testing for the Supplemental Remedial Investigation/Feasibility Study of the East Waterway Operable Unit.	Report	2307	San Ravi Sanga (EPA)	Windward Environmental, LLC
100354187	09/01/2010	Data Report: Surface Sediment Sampling for Chemical Analyses and Toxicity Testing, Final, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, September 2010, Harbor Island.	Report	94		Windward Environmental, LLC
1313668	09/01/2010	EPA Approval of the Data Report Surface Sediment Sampling for Chemical Analyses and Toxicity Testing for the Supplemental Remedial Investigation/Feasibility Study of the East Waterway Operable Unit.	Correspondence	3	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)

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100229318	09/07/2010	DV Report QV59 EWW Seattle City Light, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	32		EcoChem, Incorporated
1313669	09/10/2010	Additional PAH Analysis for Intertidal Surface Sediment Samples from East Waterway Memorandum.	Report	7	Ravi Sanga (EPA)	Susan McGroddy (Windward Environmental, LLC)
100354200	09/10/2010	Memorandum regarding Additional PAH Analysis for Intertidal Surface Sediment Samples From East Waterway, Harbor Island.	Memorandum	7	Ravi Sanga (EPA)	Susan McGroddy (Windward Environmental, LLC)
100229250	09/14/2010	DV Report QV39 EWW 4th and 6th Avenue South, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	31		EcoChem, Incorporated
100229248	09/17/2010	DV Report QV28 EWW Sediment Traps Plus T25 Plus Harbor Island, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	32		EcoChem, Incorporated

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100230532	09/20/2010	DV Report QX90 EWW Seattle City Light, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	29		EcoChem, Incorporated
1387447	10/01/2010	Final East Waterway Operable Unit SRI/FS Porewater Data Report.	Report	96	EPA	Windward Environmental, LLC
100354214	11/01/2010	Subsurface Sediment Data Report Appendix H Photographs of Sediment Cores, November 2010, East Waterway Operable Unit, Harbor Island.	Report	167		Port of Seattle
646580	11/01/2010	Final East Waterway Operable Unit SRI/FS Data Report: Subsurface Sediment Sampling for Chemical Analyses.	Report	1,879	EPA	Windward Environmental, LLC
1313671	11/01/2010	EPA Approval of the Porewater Data Report for the Supplemental Remedial Investigation/Feasibility Study of the East Waterway Operable Unit.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
100321558	11/12/2010	REDACTED Email regarding EPA Approval of the ERA Water Data Memo.	Correspondence	2	Susan McGroddy (Windward Environmental, LLC)	Ravi Sanga (EPA)

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100353869	11/19/2010	Data Report: Subsurface Sediment Sampling for Chemical Analyses, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Final, November 2010, Harbor Island.	Report	96		Windward Environmental, LLC
100354216	12/01/2010	Subsurface Sediment Data Report Appendix I Geotech Report Tables and Figures December 2010, East Waterway Operable Unit, Harbor Island.	Report	12		Anchor QEA, LLC
646581	02/14/2011	Memorandum: Results of the additional PAH analysis for intertidal surface sediment samples from East Waterway with attached Intertidal PAH data package and Intertidal PAH data validation.	Report	258	Ravi Sanga (EPA)	Susan McGroddy (Windward Environmental, LLC)
1387448	03/01/2011	East Waterway Operable Unit SRI/FS Addendum to the Final Data Report: Fish and Shellfish Tissue Collection.	Report	119	EPA	Windward Environmental, LLC
100354223	04/08/2011	Subsurface Sediment Data Report Map Folio A April 2011, East Waterway Operable Unit, Harbor Island.	Report	10		Windward Environmental, LLC
100354225	04/08/2011	Subsurface Sediment Data Report Map Folio B April 2011, East Waterway Operable Unit, Harbor Island.	Report	8		Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
646623	05/01/2011	Final East Waterway Operable Unit SRI/FS Data Report: Results of Dioxin and Furan Analyses of Archived Surface and Subsurface Sediment Samples.	Report	168	EPA	Windward Environmental, LLC
1402940	05/13/2011	East Waterway, Seattle Public Utilities pollutant source characterization/tracing data.	Report	68	Ravi Sanga (EPA)	Mary Beth Schmoyer (City of Seattle Dept. of Public Works)
1398439	05/26/2011	Data Review for East Waterway - Seattle Public Utilities Source Control Memo.	Correspondence	4	Ravi Sanga (EPA)	Donald Brown (EPA)
100329806	06/02/2011	REDACTED Email regarding EPA approval of the Revised Pesticide Data Addendum.	Email	2	Susan McGroddy (Windward Environmental, LLC)	Ravi Sanga (EPA)
100353868	06/14/2011	EW STER Appendix H, Sediment Transport Evaluation, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Harbor Island.	Report	44		Anchor QEA, LLC
100353862	07/01/2011	EW STER Appendix C, Sediment Transport Evaluation Report, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Harbor Island.	Report	81		Anchor QEA, LLC

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1402914	07/15/2011	Letter regarding EPA Approval on Data Report: Subsurface Sediment Sampling for Chemical Analysis Supplemental Remedial Investigation and Feasibility Study for the East Waterway Operable Unit.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
1429255	05/21/2012	Technical Memorandum: East Waterway SRI IDW Interpolations.	Report	3		Craig Hansen (Windward Environmental, LLC); Susan McGroddy (Windward Environmental, LLC)
1429178	08/01/2012	Final Sediment Transport Evaluation Report for the East Waterway Operable Unit SRI/FS.	Report	605	EPA	Anchor QEA, LLC
100354171	08/01/2012	Appendix A: Baseline Ecological Risk Assessment Final, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Final, August 2012, Combined, Harbor Island.	Report	586		Windward Environmental, LLC
100353453	08/01/2012	Final Sediment Transport Evaluation Report, Text Only, August 2012, East Waterway Operable Unit Harbor Island.	Report	121		Windward Environmental, LLC
1459207	08/01/2012	Final East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study: Appendix A: Baseline Ecological Risk Assessment.	Report	580	EPA	Windward Environmental, LLC

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100353451	08/01/2012	Final Sediment Transport Evaluation Report, Figures August 2012, East Waterway Operable Unit Harbor Island.	Report	103		Windward Environmental, LLC
100353824	08/01/2012	Appendix A: Baseline Ecological Risk Assessment, East Waterway Operable Unit Feasibility Study August 2012 Final, Harbor Island.	Report	95		Anchor QEA, LLC
1398432	08/03/2012	Approval of the Final Sediment Transport Evaluation Report for the East Waterway Supplemental RI/FS.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
1398433	08/08/2012	Memo regarding Comparison of Sediment Data Summary Table from the East Waterway Baseline HHRA and HHRA Technical Memorandum.	Correspondence	7	Ravi Sanga (EPA)	Susan McGroddy (Windward Environmental, LLC)
703270	08/17/2012	Final East Waterway Supplemental Remedial Investigation Ecological Risk Assessment Maps.	Report	24	EPA	Windward Environmental, LLC
100353827	08/17/2012	Appendix A Ecological Risk Assessment Maps, East Waterway Operable Unit Feasibility Study August 2012 Final, Harbor Island.	Report	24		Anchor QEA, LLC
100353825	08/17/2012	Appendix A Ecological Risk Assessment, East Waterway Operable Unit Feasibility Study August 2012 Final, Harbor Island.	Report	398		Anchor QEA, LLC

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100353826	08/17/2012	Appendix A Ecological Risk Assessment Attachments, East Waterway Operable Unit Feasibility Study August 2012 Final, Harbor Island.	Report	158		Anchor QEA, LLC
1429256	08/27/2012	EPA Approval of the Final Ecological Risk Assessment Report for the SRI/FS at East Waterway Operable Unit.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
100354172	09/01/2012	Appendix B: Baseline Human Health Risk Assessment Final, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Final, September 2012, Combined, Harbor Island.	Report	651		Windward Environmental, LLC
1429257	09/28/2012	EPA Approval of the Final Appendix B Baseline Human Health Risk Assessment Report, SRI/FS, East Waterway Operable Unit.	Correspondence	2	Douglas Hotchkiss (Port of Seattle)	Ravi Sanga (EPA)
1429177	10/01/2012	Final Remedial Alternative and Disposal Site Screening Memorandum for the East Waterway Operable Unit SRI/FS.	Report	204	EPA	Anchor QEA, LLC
699101	10/11/2012	Final East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study: Appendix B: Baseline Human Health Risk Assessment.	Report	660	EPA	Windward Environmental, LLC

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100353832	10/11/2012	Appendix B Human Health Risk Assessment, Maps, East Waterway Operable Unit Feasibility Study October 2012 Final, Harbor Island.	Report	12		Anchor QEA, LLC
100353829	10/11/2012	Appendix B Human Health Risk Assessment, Attachments, East Waterway Operable Unit Feasibility Study October 2012 Final, Harbor Island.	Report	250		Anchor QEA, LLC
703271	10/11/2012	Final East Waterway Supplemental Remedial Investigation Human Health Risk Assessment Maps.	Report	12	EPA	Windward Environmental, LLC
100353828	10/11/2012	Appendix B Human Health Risk Assessment, East Waterway Operable Unit Feasibility Study, October 2012, Final, Harbor Island.	Report	397		Anchor QEA, LLC
1429258	11/02/2012	Technical Memorandum: Sediment TBT RBTC for East Waterway.	Report	5	Erika Hoffman (EPA); Ravi Sanga (EPA)	Susan McGroddy (Windward Environmental, LLC)
100354170	12/01/2012	Final Remedial Alternative and Disposal Site Screening Memorandum, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Final, October 2012, Harbor Island.	Report	201		Anchor QEA, LLC

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100442447	06/05/2013	REDACTED Email regarding Suquamish Tribe's comments on the Draft Final East Waterway Supplemental Remedial Investigation (SRI).	Email	2	Ravi Sanga (EPA)	Alison O'Sullivan (Suquamish Indian Tribe)
1426028	01/01/2014	Final East Waterway Operable Unit SRI/FS Final Supplemental Remedial Investigation Report - Appendix Maps.	Report	58	EPA	Anchor QEA, LLC; Windward Environmental, LLC
1426027	01/01/2014	Final East Waterway Operable Unit SRI/FS Final Supplemental Remedial Investigation Report - Maps.	Report	206	EPA	Anchor QEA, LLC; Windward Environmental, LLC
1441741	01/07/2014	EPA Approval of the East Waterway Supplemental Remedial Investigation Report.	Correspondence	2	Hotchkiss,Douglas,A. (Port of Seattle)	Ravi Sanga (EPA)
100353854	01/31/2014	Map Folio, Section 4 Part 2, Final, East Waterway Operable Unit Supplemental Remedial Investigation, January 2014, Harbor Island.	Report	53		Anchor QEA, LLC
699111	01/31/2014	Final East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study: Appendix L: Inspections.	Report	41	EPA	Windward Environmental, LLC
100354169	01/31/2014	Map Folio Part 5, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Final, January 2014, Harbor Island.	Report	17		Windward Environmental, LLC

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699099	01/31/2014	Final Supplemental Remedial Investigation Report for the East Waterway Operable Unit.	Report	739	EPA	Anchor QEA, LLC; Windward Environmental, LL)
699107	01/31/2014	Final East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study: Appendix H: CSO and Stormwater Whole Water Data.	Report	290	EPA	Windward Environmental, LLC
699102	01/31/2014	Final East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study: Appendix C: Food Web Model and Dioxin BSAF.	Report	129	EPA	Windward Environmental, LLC
699103	01/31/2014	Final East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study: Appendix D: Data Management and Interpolation Parameters.	Report	17	EPA	Windward Environmental, LLC
699108	01/31/2014	Final East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study: Appendix I: Storm Drain and CSO Solids Data.	Report	13	EPA	Windward Environmental, LLC
699109	01/31/2014	Final East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study: Appendix J: Groundwater Data Summary Tables.	Report	86	EPA	Windward Environmental, LLC

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699112	01/31/2014	Final East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study: Map Folio.	Report	202	EPA	Windward Environmental, LLC
699110	01/31/2014	Final East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study: Appendix K: Compiled Source Control Maps.	Report	6	EPA	Windward Environmental, LLC
699105	01/31/2014	Final East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study: Appendix F: Status of Source Control Activities Within Storm Drainage Basins and CSO Basins.	Report	31	EPA	Windward Environmental, LLC
699100	08/17/2012	Final East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study: Appendix A: Baseline Ecological Risk Assessment.	Report	586	EPA	Windward Environmental, LLC
100353842	01/31/2014	Appendix J Groundwater Data Summary Tables, East Waterway Operable Unit Feasibility Study Final, January 2014, Harbor Island.	Report	86		Anchor QEA, LLC
100353856	01/31/2014	Map Folio, Sections 5 and 7, Final, East Waterway Operable Unit Supplemental Remedial Investigation, January 2014, Harbor Island.	Report	15		Anchor QEA, LLC

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100353850	01/31/2014	Map Folio, Section 1, Final, East Waterway Operable Unit Supplemental Remedial Investigation, January 2014, Harbor Island.	Report	4		Anchor QEA, LLC
100354168	01/31/2014	Map Folio Part 4, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Final, January 2014, Harbor Island.	Report	64		Windward Environmental, LLC
100353852	01/31/2014	Map Folio, Section 3, Final, East Waterway Operable Unit Supplemental Remedial Investigation, January 2014, Harbor Island.	Report	20		Anchor QEA, LLC
100353874	01/31/2014	Map Folio Part 3 of 5, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Final, January 2014, Harbor Island.	Report	51		Windward Environmental, LLC
100353858	01/31/2014	Master, Final, East Waterway Operable Unit Supplemental Remedial Investigation, January 2014, Harbor Island.	Report	739		Anchor QEA, LLC
100353853	01/31/2014	Map Folio, Section 4 Part 1, Final, East Waterway Operable Unit Supplemental Remedial Investigation, January 2014, Harbor Island.	Report	56		Anchor QEA, LLC

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100353848	01/31/2014	Map Folio, Final, East Waterway Operable Unit Supplemental Remedial Investigation, January 2014, Harbor Island.	Report	202		Anchor QEA, LLC
100353836	01/31/2014	Appendix D Data Management and Interpolation Parameters, East Waterway Operable Unit Feasibility Study Final, January 2014, Harbor Island.	Report	17		Anchor QEA, LLC
100353837	01/31/2014	Appendix E Spill Documentation, East Waterway Operable Unit Feasibility Study Final, January 2014, Harbor Island.	Report	11		Anchor QEA, LLC
100353839	01/31/2014	Appendix G Listed Properties Documentation, East Waterway Operable Unit Feasibility Study Final, January 2014, Harbor Island.	Report	22		Anchor QEA, LLC
100353833	01/31/2014	Appendix C Food Web Model and Dioxin BSAF, East Waterway Operable Unit Feasibility Study Final, January 2014, Harbor Island.	Report	128		Anchor QEA, LLC
1441788	01/31/2014	CD-ROM with Final Supplemental Remedial Investigation Report for the East Waterway Operable Unit.	Report	1	EPA	Anchor QEA, LLC; Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100353838	01/31/2014	Appendix F Status of Source Control Activities Within Storm Drainage Basins and CSO Basins, East Waterway Operable Unit Feasibility Study Final, January 2014, Harbor Island.	Report	31		Anchor QEA, LLC
100353851	01/31/2014	Map Folio, Section 2, Final, East Waterway Operable Unit Supplemental Remedial Investigation, January 2014, Harbor Island.	Report	24		Anchor QEA, LLC
100353841	01/31/2014	Appendix I Storm Drain and CSO Solids Data, East Waterway Operable Unit Feasibility Study Final, January 2014, Harbor Island.	Report	14		Anchor QEA, LLC
100353844	01/31/2014	Appendix L Inspections, East Waterway Operable Unit Feasibility Study Final, January 2014, Harbor Island.	Report	41		Anchor QEA, LLC
100353840	01/31/2014	Appendix H CSO and Stormwater Whole Water Data, East Waterway Operable Unit Feasibility Study Final, January 2014, Harbor Island.	Report	291		Anchor QEA, LLC
100353843	01/31/2014	Appendix K Compiled Source Control Maps, East Waterway Operable Unit Feasibility Study Final, January 2014, Harbor Island.	Report	6		Anchor QEA, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100353871	01/31/2014	Map Folio Part 1 of 5, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Final, January 2014, Harbor Island.	Report	25		Windward Environmental, LLC
100353857	01/31/2014	Map Folio, Sections 9 and 10, Final, East Waterway Operable Unit Supplemental Remedial Investigation, January 2014, Harbor Island.	Report	30		Anchor QEA, LLC
100353872	01/31/2014	Map Folio Part 2 of 5, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Final, January 2014, Harbor Island.	Report	45		Windward Environmental, LLC
100353849	02/24/2014	Map Folio, Appendices, Final, East Waterway Operable Unit Supplemental Remedial Investigation, February 2014, Harbor Island.	Report	55		Anchor QEA, LLC
1516700	07/01/2015	Sediment Sampling Beneath Pier 36B Data Report	Report	114	U.S. Coast Guard	Amec Foster Wheeler Environment & Infrastructure, Inc.
100043507	10/01/2016	Lockheed West Seattle and East Waterway Community Involvement Plan Autumn 2016 Update.	Publication	12		EPA

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100045854	01/10/2017	Washington State Department of Ecology Comments on the East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study Draft Final Feasibility Study. (October 2016)	Correspondence	28		Washington State Department of Ecology
100150429	03/08/2017	REDACTED Email Regarding Suquamish Tribe Comments on the Final Draft East Waterway Feasibility Study	Email	2	Ravi Sanga (EPA)	Alison O'Sullivan (Suquamish Indian Tribe)
100291554	11/01/2017	Table B-45 for National Remedy Review Board Feasibility Study Table 10-1, Comparative Evaluation and Ranking of Alternatives, East Waterway Operable Unit Harbor Island Superfund Site.	Report	9		U.S. Army Corps of Engineers
100291555	11/01/2017	Tables for National Remedy Review Board Package 2 12, East Waterway Operable Unit Harbor Island Superfund Site.	Report	69		U.S. Army Corps of Engineers
100103987	11/01/2017	Appendix A - Supplemental Information for Selection of PRGS, East Waterway Operable Unit Feasibility Study.	Report	29	Port of Seattle	Anchor QEA, LLC
100126204	11/01/2017	Appendix A - Supplemental Information for Selection of PRGs, East Waterway Operable Unit Feasibility Study.	Report	30	Port of Seattle	Anchor QEA, LLC

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100222030	11/03/2017	Harbor Island East Waterway Feasibility Study Comment Response Table, November 2017.	Report	52		
1516697	02/07/2018	Letter regarding the Identification of EPA's Preferred Remedy: Harbor Island Superfund Site, East Waterway Operable Unit with Attached East Waterway Remedy Selection Recommendations Dated 2/14/2018.	Letter	21	Ravi Sanga (EPA)	MJadeline Fong Goddard (Seattle Public Utilities)
100291556	02/12/2018	Figures for National Remedy Review Board February 2018, East Waterway Operable Unit Harbor Island Superfund Site.	Report	58		U.S. Army Corps of Engineers
100380541	02/20/2018	Transmittal Letter regarding Re: East Waterway Operable Unit of the Harbor Island Superfund Site, Potentially Responsible Parties Technical Comment Submission to the National Remedy Review Board.	Letter	34	Ravi Sanga (EPA)	Port of Seattle
100093931	03/19/2018	Letter containing Comments on the East Waterway Operable Unit Preferred Remedial Alternative.	Email	1	Ravi Sanga (EPA)	Erika Shaffer (Washington Department of Natural Resources)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100089876	03/20/2018	Letter Containing the Suquamish Tribe's Preliminary Comment on the EPA Preferred Alternative 3(b)12/2(b)12 to the National Remedy Review Board and Contaminated Sediments Technical Advisory Group (NRRB/CSTAG).	Letter	3	Ravi Sanga (EPA)	Alison O'Sullivan (Suquamish Indian Tribe); Denice Taylor (Suquamish Tribe - Fisheries Dept.)
100126275	11/01/2018	Quality Assurance Project Plan: Soil and Subsurface Sediment Characterization, Port of Seattle T-25 South Design Characterization.	Work Plan	114	Ravi Sanga (EPA)	Anchor QEA, LLC; Windward Environmental, LLC
100141200	11/01/2018	Port of Seattle T-25 South Design Characterization, Quality Assurance Project Plan: Soil and Subsurface Sediment Characterization.	Work Plan	114	EPA	Anchor QEA, LLC; Windward Environmental, LLC
100126170	11/01/2018	Letter regarding the Administrative Settlement Agreement and Order on consent for Supplemental Remedial Investigation/Feasibility Study in CERCLA Docket No. 10-2007-0030; Dispute Resolution.	Letter	1	Richard Mednick (EPA)	Elizabeth Black (Port of Seattle)
100126216	12/01/2018	Letter regarding the request for an Engineering Evaluation/Cost Analysis (EE/CA) for the Wharf and Pier at Slip 36 Located in Seattle, Washington.	Letter	2	Sheryl Bilbrey (EPA)	Steven Osgood (U.S. Coast Guard)

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100126206	12/11/2018	Memorandum regarding the National Remedy Review Board and Contaminated Sediments Technical Advisory Board Recommendations for the East Waterway Operable Unit of the Harbor Island Superfund Site.	Memorandum	9	James Woolford (EPA)	Karl Gustavson (EPA); Christine Poore (EPA)
100151552	02/14/2019	Updated Feasibility Study for the East Waterway Operable Unit SRI/FS.	Report	617	EPA	Anchor QEA, LLC; Windward Environmental, LLC
100354173	04/01/2019	Appendix B: Baseline Human Health Risk Assessment Final, Addendum: CPAH TEQ Updates, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Final, August 2012, Harbor Island.	Report	24		Windward Environmental, LLC
100160904	04/01/2019	Draft East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study, Appendix B: Baseline Human Health Risk Assessment, Addendum: cPAH TEQ Updates.	Report	26	EPA	Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100160896	05/29/2019	Statement by the United States Environmental Protection Agency of Sediment Management Standards and the East Waterway Operable Unit as Discussed on May 29, 2019 with the Port of Seattle, City of Seattle, and King County.	Correspondence	1		EPA
100189772	06/01/2019	East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study – Final Feasibility Study: Appendix B - Sediment Modeling Memoranda.	Report	148	EPA	Anchor QEA, LLC; Port of Seattle; Windward Environmental, LLC
100189768	06/01/2019	East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study – Final Feasibility Study: Executive Summary.	Report	39	EPA	Anchor QEA, LLC; Port of Seattle; Windward Environmental, LLC
100189784	06/01/2019	East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study – Final Feasibility Study: Appendix I - Short-Term Effectiveness Metrics.	Report	83	EPA	Anchor QEA, LLC; Port of Seattle; Windward Environmental, LLC
100189767	06/01/2019	East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study – Final Feasibility Study less Appendices and Executive Summary.	Report	679	EPA	Anchor QEA, LLC; Port of Seattle; Windward Environmental, LLC

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100189627	06/01/2019	East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study – Final Feasibility Study.	Report	1,308	EPA	Anchor QEA, LLC; Port of Seattle; Windward Environmental, LLC
100189789	06/01/2019	East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study – Final Feasibility Study: Appendix L - Alternatives Screening.	Report	43	EPA	Anchor QEA, LLC; Port of Seattle; Windward Environmental, LLC
100189785	06/01/2019	East Waterway Operable Unit Supplemental Remedial Investigation/Feasibility Study – Final Feasibility Study: Appendix J - Detailed Calculation and Sensitivity Analyses for Predictive Evaluation of Site Performance over Time and Recontamination Potential	Report	106	EPA	Anchor QEA, LLC; Port of Seattle; Windward Environmental, LLC
100353815	06/28/2019	Appendix K Direct Atmospheric Deposition Evaluation, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	23		Anchor QEA, LLC
100353806	06/28/2019	Appendix C Remediation Area Evaluation, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	23		Anchor QEA, LLC
100353809	06/28/2019	Appendix F Volume Calculations, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	30		Anchor QEA, LLC

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100353807	06/28/2019	Appendix D Cap Modeling, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	22		Anchor QEA, LLC
100353812	06/28/2019	Appendix H Remaining Subsurface Contamination, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	29		Anchor QEA, LLC
100353818	06/28/2019	Complete Executive Summary, Body and Appendices, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	1,308		Anchor QEA, LLC
100353808	06/28/2019	Appendix E Cost Estimate, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	28		Anchor QEA, LLC
100353820	06/28/2019	Executive Summary, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	39		Anchor QEA, LLC
100353454	06/28/2019	Appendix A Supplemental Information for Selection of PRGs East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	44		Anchor QEA, LLC)

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100353814	06/28/2019	Appendix J Detailed Calculations and Sensitivity Analyses for Predictive Evaluation of Site Performance Over Time and Recontamination Potential, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	106		Anchor QEA, LLC
100353455	06/28/2019	Appendix B Sediment Modeling Memoranda, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	148		Anchor QEA, LLC
100353821	06/28/2019	Sections 1 to 11, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	679		Anchor QEA, LLC
100353810	06/28/2019	Appendix G Monitoring, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	11		Anchor QEA, LLC
100353817	06/28/2019	Appendix L Alternatives Screening, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	43		Anchor QEA, LLC
100353813	06/28/2019	Appendix I Short-Term Effectiveness Metrics, East Waterway Operable Unit Feasibility Study June 2019 Final, Harbor Island.	Report	83		Anchor QEA, LLC

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100167757	08/06/2019	Letter regarding the Meeting with Representatives of the Port of Seattle, City of Seattle, and King County on May 29 to Discuss EPA's Proposed Approach to Defining a "Final" Remedy for the East Waterway Operable Unit of the Harbor Island Superfund.	Letter	12	Christopher Hladick (EPA)	Elizabeth Leavitt (Port of Seattle)
100403746	08/07/2019	Email regarding East Waterway Operable Unit of the Harbor Island Superfund Site, Letter and Attachment from Senior Director, Environment and Sustainability at the Port of Seattle; Attachment Indexed Separately.	Email	1	Christopher Hladick (EPA)	Brenda Marshall (Port of Seattle)
100291551	08/07/2019	Memorandum regarding Region 10 Response to National Remedy Review Board and Contaminated Sediments Technical Advisory Group Recommendations for the East Waterway Operable Unit of the Harbor Island Superfund Site.	Memorandum	15	Karl Gustavson (EPA); Christine Poore (EPA)	Robert David Allnutt (EPA)
100403747	08/07/2019	Letter regarding Meeting with Representatives of Port of Seattle, City of Seattle, and King County, on May 29 to Discuss EPA Proposed Approach to Defining Final Remedy.	Email	12	Christopher Hladick (EPA)	Brenda Marshall (Port of Seattle)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100167790	08/12/2019	Letter regarding the Meeting with Representatives of King County along with Representatives of the Port of Seattle and City of Seattle on May 29, to Discuss how Finality can best be Achieved for the East Waterway Operable Unit of the Harbor Island Site.	Letter	4	Christopher Hladick (EPA)	Christie True (King County)
100355897	12/12/2019	Letter regarding RE: Harbor Island Superfund Site, Shared Goals for Expediting the Cleanup and Redevelopment, East Waterway Operable Unit, Seattle, Washington.	Letter	2	Peter Wright, (EPA)	Stephen Metruck (Port of Seattle)
100245039	02/01/2020	Attachment, Ecology Review Comments, East Waterway Operable Unit Proposed Plan, Agency Review Draft, February 2020.	Report	14	Ravi Sanga (EPA	Richard Thomas (Washington Department of Ecology
100249550	02/19/2020	King County Website Map, 2020 February 19, Base Seattle Only Parcel Map.	Figure/Map/ Drawing	1		King County
100249556	03/19/2020	Site Map of Base Seattle, Investigation Area, Site Investigation Pier 36 USCG Base Seattle, Figure 1-2, AECOM, March 2020.	Figure/Map/ Drawing	1		AECOM

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100224168	04/15/2020	Letter regarding Signed R10-19-000-7595 True EPA Response 04152020, Expressing Views of Port of Seattle on Upcoming Remedial Action Decision by EPA for East Waterway.	Letter	2	Elizabeth Leavitt (Port of Seattle); Stephen Metruck (Port of Seattle)	Christopher Hladick (EPA)
100224162	04/15/2020	Letter regarding Signed R10-19-000-7497 Leavitt EPA Response 04152020, Expressing Views of Port of Seattle on Upcoming Remedial Action Decision by EPA for East Waterway.	Letter	2	Elizabeth Leavitt (Port of Seattle); Stephen Metruck (Port of Seattle)	Christopher Hladick (EPA)
100242704	04/23/2020	Memorandum regarding Harbor Island Superfund Site, East Waterway Operable Unit, EPA has the Authority Under CERCLA to Waive an ARAR in a Final Record of Decision Without Including a Replacement Numeric Standard, Attachment Only.	Letter	7	Mednick, Richard (EPA)	Elizabeth Black, (Port of Seattle); Kristie Elliott (Washington State Office of the Attorney General); Laura Wishik (City of Seattle)
100311217	06/17/2020	Attachment, Ecology Review Comments 06-17-20 Final, Email regarding RE Harbor Island East Waterway Stakeholder Review, Opportunity to Review and Comment on EPA Stakeholders Draft East Waterway Proposed Plan.	Email	14	Ravi Sanga (EPA)	Richard Thomas (Washington Department of Ecology))

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100458237	08/12/2020	REDACTED Email regarding RE: East Waterway Background Data Meeting, Attached Presentation from Meeting, Additional Studies Listed, Associated References with Links.	Email	4	Elizabeth Allen (EPA); Kathy Bahnick (Port of Seattle); Shawn Blocker (EPA); Greg Brunkhorst (Anchor QEA, LLC); Merv Coover (Environmental Resources Management); Allison Crowley (City of Seattle); Joana Florer (Port of Seattle) Silvina Fonseca. (EPA); William Gardiner. (U.S. Army Corps of Engineers); Karl Gustavson (EPA) Elly Hale (EPA); Erika Hoffman (EPA); Kira Lynch (EPA); Kayla Patten, (US Army Corps of Engineers); Pete Rude (City of Seattle); Ravi Sanga. (EPA); Brick Spangler (Port of Seattle); Jeff Stern (King County); Debra Williston (King County)	Dan Berlin (Anchor Environmental, LLC)

100458244	09/03/2020	REDACTED Email regarding RE: AB Meeting Number 1, Materials for First Anthropogenic Background Meeting.	Email	3	Elizabeth Allen (EPA); Shawn Blocker (EPA); Greg Brunkhorst (Anchor QEA, LLC); Ally Chopic (Anchor QEA, LLC); Merv Coover (Environmental Resources Management); Allison Crowley (City of Seattle); Joana Florer (Port of Seattle) Silvina Fonseca. (EPA); William Gardiner. (U.S. Army Corps of Engineers); Karl Gustavson (EPA) Erika Hoffman (EPA); Kira Lynch (EPA); Kayla Patten, (US Army Corps of Engineers); Christine Poore (EPA); Pete Rude (City of Seattle); Ravi Sanga (EPA); Brick Spangler (Port of Seattle); Glen St. Amant (Muckleshoot Indian Tribe); Jeff Stern (King County); Alison O’Sullivan (Suquamish Indian Tribe); Denice Taylor (Suquamish Tribe - Fisheries Dept.); Rick Thomas (Washington Department of Ecology); Debra Williston (King County)	Dan Berlin (Anchor Environmental, LLC)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100286282	11/24/2020	Attachment, Base Seattle Pier 36 Site Investigation Report Final, Email regarding CG Final Data Report, East Waterway Post Feasibility Study.	Email	475	Ravi Sanga (EPA)	Erika Hoffman (EPA)
100288317	12/08/2020	Attachment, EW AB Small Group Meeting 5, 12-8-2020, Email regarding East Waterway Anthropogenic Background Small Group Meeting Number 5.	Email	17	Elizabeth Allen (EPA); Greg Brunkhorst (Anchor QEA, LLC); D. Chiavelli (Anchor QEA, LLC); Ally Chopic (Anchor QEA, LLC); Merv Coover (Environmental Resources Management); Allison Crowley (City of Seattle); Joana Florer (Port of Seattle) William Gardiner. (U.S. Army Corps of Engineers); Pete Rude (City of Seattle); Ravi Sanga (EPA); Brick Spangler (Port of Seattle); Glen St. Amant (Muckleshoot Indian Tribe); Jeff Stern (King County); Alison O'Sullivan (Suquamish Indian Tribe); Denice Taylor (Suquamish Tribe - Fisheries Dept.); Debra Williston (King County)	Dan Berlin (Anchor Environmental, LLC)

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100289279	12/16/2020	Email regarding Modification to EWOU Administrative Settlement Agreement and Order on Consent for Supplemental Remedial Investigation and Feasibility Study for Background Work.	Email	1	Brick Spangler (Port of Seattle)	Ravi Sanga (EPA)
100319604	04/23/2021	Email regarding Offer of Government-to-Government Consultation on the Remedial Action Decision for the East Waterway Operable Unit of the Harbor Island Superfund Site in Seattle, Washington, with Attachments.	Email	1	Leonard Anthony Forsman (Suquamish Indian Tribe)	Sarah Felton (EPA)
100319601	04/23/2021	Email regarding Offer of Government-to-Government Consultation on the Remedial Action Decision for the East Waterway Operable Unit of the Harbor Island Superfund Site in Seattle, Washington.	Email	1	Jaison Elkins (Muckleshoot Indian Tribe)	Sarah Felton (EPA)
100319610	04/23/2021	Final Inwater May 2021 Technical Memorandum, Email regarding RE Terminal 25 Quality Assurance Project Plan Addendum 2 Subsurface Sediment Characterization EPA Comments.	Email	9	Ravi Sanga (EPA)	Julia Fitts (Anchor QEA, LLC)

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100319600	04/23/2021	Email regarding Offer of Government-to-Government Consultation on the Remedial Action Decision for the East Waterway Operable Unit of the Harbor Island Superfund Site in Seattle, Washington, with Attachments.	Email	1	Jaison Elkins (Muckleshoot Indian Tribe)	Sarah Felton (EPA)
100319606	04/23/2021	Letter of April 22 on Email regarding Offer of Government-to-Government Consultation on the Remedial Action Decision for the East Waterway Operable Unit of the Harbor Island Superfund Site in Seattle, Washington.	Email	1	Leonard Anthony Forsman (Suquamish Indian Tribe)	Sarah Felton (EPA)
100336182	04/30/2021	REDACTED Email regarding RE Draft East Waterway Anthropogenic Background Evaluation Memo, Suquamish Tribe Comments.	Email	5	Ravi Sanga (EPA)	Alison O'Sullivan (Suquamish Indian Tribe)
100324472	06/01/2021	Email regarding EPA Response to Suquamish Tribe Comments Correct Version.	Email	1	Alison O'Sullivan (Suquamish Indian Tribe); Denice Taylor (Suquamish Tribe - Fisheries Dept.);	Ravi Sanga (EPA)
100358893	06/03/2021	Memorandum regarding Engineering Evaluation/Cost Analysis for Slip 36 of the East Waterway Operable Unit of the Harbor Island Superfund Site, King County, Seattle, Washington, Electronically Signed.	Memorandum	5	Calvin Terada (EPA)	Ravi Sanga (EPA)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100334171	07/21/2021	Email regarding Lower Duwamish CERCLA Site, Harbor Island East Waterway Operable Unit, Yakama Nation Consultation; Attachment Indexed Separately.	Email	2	Ravi Sanga (EPA)	Shira Laura Klasner (Yakama Nation Fisheries)
100334173	07/21/2021	Letter regarding Early Action Area, Final Lower Duwamish Cleanup, Email regarding Lower Duwamish CERCLA Site, Harbor Island East Waterway Operable Unit, Yakama Nation Consultation.	Email	2	Ravi Sanga (EPA)	Shira Laura Klasner (Yakama Nation Fisheries)
100335458	07/22/2021	Email regarding RE: Tribal Consultation Letter Status, Fine with Updates from Staff.	Email	1	Ravi Sanga (EPA)	Alison O’Sullivan (Suquamish Indian Tribe)
100336344	08/02/2021	Final Clean Memo with Agreed Language, Harbor Island Superfund Site, East Waterway Anthropogenic Background Technical Memorandum, Attached.	Email	96	Ravi Sanga (EPA)	Greg Brunkhorst (Anchor QEA, LLC)
100336343	08/02/2021	Email regarding RE: Harbor Island Superfund Site, East Waterway Anthropogenic Background Memo, Attached Final Clean Memo with Agreed Language; Attachment Indexed Separately.	Email	4	Ravi Sanga (EPA)	Greg Brunkhorst (Anchor QEA, LLC)

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100422349	08/04/2021	REDACTED Email regarding RE: Harbor Island Superfund Site, East Waterway Anthropogenic Background Memo, Review of Memo, All Comments Addressed, EPA Hereby Approving Memo.	Email	5	Greg Brunkhorst (Anchor QEA, LLC)	Ravi Sanga (EPA)
1570040	09/20/2021	Administrative Agreement and Order on Consent for Engineering Evaluation, Cost Analysis, CERCLA Docket Number 10-2021-0217, Slip 36.	Report	25		EPA
100350809	09/21/2021	Administrative Settlement Agreement and Order on Consent for Engineering Evaluation, Cost Analysis, Harbor Island East Waterway, Pier 36.	Email	25	Shawn Blocker (EPA); Richard Mednick (EPA); Ravi Sanga (EPA)	Alonzo Alday (EPA)
100350818	09/21/2021	Administrative Settlement Agreement and Order on Consent, USCG Slip 36, Signed.	Email	25	Andrew Haley (U.S. Coast Guard)	Richard Mednick (EPA)
100350819	09/21/2021	2021 May Administrative Settlement Agreement and Order on Consent Appendix A, USCG Slip 36.	Email	1	Andrew Haley (U.S. Coast Guard)	Richard Mednick (EPA)
100355864	10/08/2021	Letter regarding EPA Proposed Approach to Defining a Final Remedy for the East Waterway Operable Unit of the Harbor Island Superfund Site.	Email	16	Shawn Blocker (EPA); Sheila Fleming (EPA); Kira Lynch (EPA); Ravi Sanga (EPA)	Alonzo Alday (EPA)

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100355862	10/08/2021	Letter regarding How Finality Can Best Be Achieved for the East Waterway Operable Unit of the Harbor Island Superfund Site.	Email	4	Shawn Blocker (EPA); Sheila Fleming (EPA); Kira Lynch (EPA); Ravi Sanga (EPA)	Alonzo Alday (EPA)
100355863	10/08/2021	Letter regarding Views of the Port of Seattle on the Upcoming Remedial Action Decision by the United States Environmental Protection Agency for the East Waterway Operable Unit of the Harbor Island Superfund Site, Signed Response.	Email	2	Shawn Blocker (EPA); Sheila Fleming (EPA); Kira Lynch (EPA); Ravi Sanga (EPA)	Alonzo Alday (EPA)
100355861	10/08/2021	Letter regarding Views of the King County Department of Natural Resources on the Upcoming Remedial Action Decision by the United States Environmental Protection Agency for the East Waterway Operable Unit of the Harbor Island Superfund Site.	Email	2	Shawn Blocker (EPA); Sheila Fleming (EPA); Kira Lynch (EPA); Ravi Sanga (EPA)	Alonzo Alday (EPA)
100355860	10/08/2021	Letter regarding Shared Goals for the Cleanup and Redevelopment of the East Waterway Operable Unit of the Harbor Island Superfund Site.	Email	20	Shawn Blocker (EPA); Sheila Fleming (EPA); Kira Lynch (EPA); Ravi Sanga (EPA)	Alonzo Alday (EPA)
100355890	10/09/2021	East Waterway Group Letter to EPA, Status of the Proposed Plan For the Cleanup, Final With Attachments, Signed.	Email	18	Ravi Sanga (EPA)	Kira Lynch (EPA)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100355874	10/09/2021	Letter regarding Writing to Re-Enlist Your Involvement in Moving Ahead the Regulatory Process for the East Waterway Operable Unit of the Harbor Island Superfund Site.	Email	2	Ravi Sanga (EPA)	Kira Lynch (EPA)
100422351	10/09/2021	REDACTED East Waterway Group Letter to EPA, Status of the Proposed Plan For the Cleanup, Final With Attachments, Signed.	Email	18	Ravi Sanga (EPA)	Kira Lynch (EPA)
100355886	10/09/2021	Letter Regarding Cleanup Approaches, EPA Appreciates the East Waterway Group Shared Commitment to an Expeditious Cleanup, East Waterway, Harbor Island.	Email	3	Sheila Fleming (EPA); Ravi Sanga (EPA)	Kira Lynch (EPA)
100355876	10/09/2021	Letter Regarding Cleanup Approaches, EPA Appreciates the East Waterway Group Shared Commitment to an Expeditious Cleanup, East Waterway, Harbor Island.	Email	3	Ravi Sanga (EPA)	Kira Lynch (EPA)
100355889	10/09/2021	Email regarding FW: East Waterway Group Letter to EPA Regarding East Waterway Remedy, Harbor Island.	Email	2	Ravi Sanga (EPA)	Kira Lynch (EPA)
100447646	01/19/2022	REDACTED Email regarding FW: Letter to Administrator Regan on East Waterway, FYI.	Email	1	Lucy Edmondson (EPA); Marianne Holsman (EPA); Michelle Pirzadeh (EPA); Calvin Terada. (EPA)	Bill Dunbar (EPA)

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100383793	02/10/2022	Letter regarding East Waterway Remediation, Harbor Island Superfund Site, CERCLA Requires That EPA Develop a Remediation Plan For the East Waterway That Is Inclusive of Affected Communities.	Email	96	Kira Lynch (EPA); Michelle Pirzadeh (EPA); Ravi Sanga (EPA); Matthew Tejada (EPA); Calvin Terada. (EPA)	Paulina Lopez (Duwamish River Cleanup Coalition)
100383791	02/10/2022	Email regarding East Waterway Remediation, Harbor Island Superfund Site, Asking for an Inclusive Community Engagement in the Remedial Investigation or Selection of Alternatives; Attachment Indexed Separately.	Email	2	Lynch Kira Lynch (EPA); Michelle Pirzadeh (EPA); Ravi Sanga (EPA); Matthew Tejada (EPA); Calvin Terada. (EPA)	Paulina Lopez (Duwamish River Cleanup Coalition)
100387903	03/10/2022	Letter regarding Letter Outlining Concerns and Recommendations for Ensuring Full and Robust Community Engagement as the EPA Develops a Proposed Plan For the East Waterway Cleanup.	Email	2	DRCC; EarthJustice	Sarah Felton (EPA)
100387902	03/10/2022	Email regarding East Waterway Remediation, Harbor Island Superfund Site, Attached Letter; Attachment Indexed Separately.	Email	1	DRCC; EarthJustice	Sarah Felton (EPA)
100388847	03/10/2022	Email regarding RE: East Waterway Remediation Harbor Island Superfund Site, Attachment Indexed Separately.	Email	3	Dustan Bott (EPA); Dean Ingemansen (EPA); Kira Lynch (EPA); Richard Mednick (EPA); Ravi Sanga (EPA)	Sarah Felton (EPA)

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100388849	03/14/2022	EWW DRCC Response Letter regarding Outlined Concerns and Recommendations for Ensuring Full and Robust Community Engagement as the EPA Develops a Proposed Plan For the East Waterway Cleanup, Signed.	Email	2	Dustan Bott (EPA); Dean Ingemansen (EPA); Kira Lynch (EPA); Richard Mednick (EPA); Ravi Sanga (EPA)	Sarah Felton (EPA)
100388846	03/14/2022	Email regarding RE: East Waterway Remediation Harbor Island Superfund Site, Completed; Attachments Indexed Separately.	Email	2	Dustan Bott (EPA); Dean Ingemansen (EPA); Kira Lynch (EPA); Richard Mednick (EPA); Ravi Sanga (EPA)	Sarah Felton (EPA)
100388852	03/17/2022	Letter regarding RE: East Waterway Remediation, Harbor Island Superfund Site, Submitted on Behalf of the Duwamish River Cleanup Coalition Technical Advisory Group, The Duwamish Valley Is a Near Port and Environmental Justice Community Along the Duwamish.	Email	96	Elizabeth Allen (EPA); Dustan Bott. (EPA); Kathy Cerise (EPA); Elly Hale (EPA); Ravi Sanga (EPA)	Kira Lynch (EPA)
100388964	03/21/2022	Administrative Settlement Agreement and Order on Consent for Removal Action Engineering Evaluation and Cost Analysis, EPA Region 10, CERCLA Docket Number 10-2022-0159.	Report	49		EPA

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100389067	03/22/2022	Email regarding FW: East Waterway Remediation, Harbor Island Superfund Site, Received a Reply to Message to Councilmember.	Email	4	Dustan Bott (EPA); Sheila Fleming (EPA); Ravi Sanga (EPA)	Kira Lynch (EPA)
100429818	12/06/2022	Letter regarding Re: Offer for Government-To-Government Consultation With the Yakama Nation Regarding the Proposed Plan For Remedial Action, Final; Signed.	Letter	1	Gerald Lewis (Yakama Nation)	Calvin Terada (EPA)
100430594	12/13/2022	Email regarding Re: Offer for Consultation on the Proposed Plan for Remedial Action at the EW OU, Formal Government to Government Letter to the Yakama Indian Nation Tribal Chair.	Email	1	Ravi Sanga (EPA)	Shira Laura Klasner (Yakama Nation Fisheries)
100441348	02/13/2023	Email regarding East Waterway Proposed Plan, Suquamish Tribe Neither Supports nor Opposes the Proposed Plan, Interim Remedy, as Presented by EPA.	Email	1	Ravi Sanga (EPA)	Alison O'Sullivan, Alison (Suquamish Indian Tribe)
100459786	04/01/2023	KHMER Final EPA East Waterway Proposed Plan Fact Sheet (April 2023).	Report	5		EPA
100459787	04/01/2023	SPANISH Final EPA East Waterway Proposed Plan Fact Sheet (April 2023).	Report	5		EPA

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100459788	04/01/2023	VIETNAMESE Final EPA East Waterway Proposed Plan Fact Sheet (April 2023).	Report	5		EPA
100459781	04/01/2023	ENGLISH Final EPA East Waterway Proposed Plan Fact Sheet (April 2023).	Report	5		EPA
100458793	04/16/2023	Proposed Plan for the East Waterway Operable Unit, Harbor Island Superfund Site, April 2023.	Report	51		EPA
100528499	02/05/2024	Tribal Consultation letters Muckleshoot Indian Tribe EW IROD	Letter	2	Chairman Elkins Muckleshoot Indian Tribe	EPA
100528502	02/05/2024	Tribal Consultation letters Suquamish Tribe EW IROD	Letter	2	Chairman Forsman Suquamish Tribe	EPA
100528503	02/05/2024	Tribal Consultation Letters Yakama Nation EW IROD	Letter	2	Chairman Lewis Yakama Nation	EPA
100549877	5/13/2024	Letter regarding East Waterway CERCLA Site Record of Decision, State Concurrence, Communicates Washington State Department of Ecology's Concurrence with the Selected Remedy, East Waterway Site.	Letter	2	Sixkiller, Casey (EPA Regional Administrator)	Watson, Laura (Washington State Department of Ecology)

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100549882	5/13/2024	Email regarding FW: East Waterway Concurrence Letter, Message Blank, Thread Mentions, Attached Is Correspondence Regarding Ecology's Concurrence with Selected Remedy for the In-Waterway Portion of East Waterway Site: Attachment Indexed Separately.	EML/Email	2	Bott, Dustan (EPA); Edmonson, Lucy (EPA); Ingemansen, Dean (EPA); Mednick, Richard (EPA); Sanga, Ravi (EPA)	Lynch, Kira (EPA)
100549886	1/17/2024	Memorandum regarding Updated Cost Estimate for Feasibility Study Alternative 3B12 and EPA's Preferred Alternative Modified 3B12 for the East Waterway Operable Unit of the Harbor Island Superfund Site.	MEMO / Memorandum	28	Sanga, Ravi, (EPA)	Berlin, Dan (Anchor QEA, LLC)
100549889	5/10/2024	Email regarding RE: East Waterway IROD, Would Like a Meeting, Did Attempt to Call, Opportunity for Tribes to Discuss ROD with EPA.	EML/Email	2	Bott, Dustan, (EPA)	O'Sullivan, Alison (Suquamish Indian Tribe)
100549896	4/15/2024	Email regarding East Waterway IROD, Thanks for Chat Today, As Discussed, Let Know if Yakima Nation Is Interested in Consultation or Discussing the East Waterway IROD	EML/Email	1	Shira-Klasner, Laura (Yakama Indian Nation)	Bott, Dustan, (EPA)
1397163	Undated	East Waterway Harbor Island Source Control Evaluation.	Meeting Document	25		Ravi Sanga (EPA)

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100291553	Undated	Table B-4, Summary of Potential Sources, Transport Pathways, and Source Control Programs in the East Waterway, East Waterway Operable Unit Harbor Island Superfund Site.	Report	1		
100354208	Undated	Subsurface Sediment Data Report Appendix A Chemistry Sample Results, East Waterway Operable Unit, Harbor Island.	Report	148		Port of Seattle
100353866	Undated	EW STER Appendix F, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Harbor Island.	Report	107		Anchor QEA, LLC
100353867	Undated	EW STER Appendix G, Sediment Transport Evaluation Report, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Harbor Island.	Report	18		Anchor QEA, LLC
100354209	Undated	Subsurface Sediment Data Report Appendix B Sediment Core Logs, East Waterway Operable Unit, Harbor Island.	Report	125		Port of Seattle
100337340	Undated	East Waterway Supplemental Remedial Investigation/Feasibility Study Final Anthropogenic Background Technical Memorandum, July 2021.	Report	96	EPA	Anchor QEA, LLC

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100354175	Undated	Administrative Settlement Agreement and Order On East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, CERCLA Docket Number 10-2007-0030, Harbor Island.	Report	63		Port of Seattle
100228894	Undated	Dioxin V32739DX Data Summary 1 Validated, East Waterway SPU Source Data, Data Validation Reports, Lab Reports, Excel Data Files, and Data Summary Report.	Report	11		Axys Analytical Services Ltd.
100354213	Undated	Subsurface Sediment Data Report Appendix G Chain-of-Custody Forms, East Waterway Operable Unit, Harbor Island.	Report	16		Port of Seattle
100354212	Undated	Subsurface Sediment Data Report Appendix F Field Forms and Logs, East Waterway Operable Unit, Harbor Island.	Report	298		Port of Seattle
100353865	Undated	EW STER Appendix E, Sediment Transport Evaluation Report, East Waterway Operable Unit Supplemental Remedial Investigation and Feasibility Study, Harbor Island.	Report	12		Anchor QEA, LLC
100484674	07/10/2023	Letter regarding US EPA Proposed Plan for East Waterway Operable Unit Remedial Action.	Letter	3	Sixkiller, Casey (EPA Regional Administrator)	Denike, Edward (SSA Terminals, LLC)

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100484678	07/28/2023	Letter regarding Opportunity to Comment on the US EPA Proposed Plan for the East Waterway Operable Unit Remedial Action.	Letter	2	EPA	(Unknown)
100485322	08/02/2023	Email regarding Duwamish Tribe Comments on EW Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Davis, Elizabeth (Duwamish Tribe)
100485323	08/02/2023	Letter regarding Duwamish Tribe Is Keenly Interested in the EPA Plan For Cleanup of the Waterway.	Letter	2	EPA	Davis, Elizabeth (Duwamish Tribe)
100485324	08/04/2023	Email regarding ILWU Local 19, East Waterway, Communication; Attachment Indexed Separately.	Email	1	EPA	Etchamendy, Felicia (International Longshoremen's and Warehousemen's Union)
100485325	08/02/2023	Letter regarding Threat to Derailing Congressionally Approved Harbor Deepening Project.	Letter	1	Sixkiller, Casey (EPA Regional Administrator)	Ugles, Herald (International Longshoremen's and Warehousemen's Union)
100485968	08/04/2023	Email regarding Deeping Channels, East Waterway Cleanup, Northwest Seaport Alliance.	Email	1	EPA	Harris, Matt (Washington State Potato Commission)
100485969	08/02/2023	Email regarding Duwamish Tribe Comments on EW Proposed Plan.	Email	1	EPA	Duwamish Tribe

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100485972	08/04/2023	Letter regarding Concern That the Process That Has Been Proposed for the Cleanup Threatens to Indefinitely Delay the Planned Deepening of the East Waterway.	Letter	2	EPA	Harris, Matt (Washington State Potato Commission)
100485973	08/02/2023	Letter regarding Tribe Is Keenly Interested in the EPA Plan For Cleanup of the Waterway, Notes.	Letter	2	EPA	Davis, Elizabeth (Duwamish Tribe)
100486373	08/09/2023	Email regarding East Waterway Proposed Plan Comments; Attachment Indexed Separately.	Email	1	EPA	Sidell, Alan (Seattle Iron and Metals Corporation)
100486374	08/11/2023	Letter regarding East Waterway Proposed Plan, Impracticability of Achieving EPAs Cleanup Goals.	Letter	6	EPA	Sidell, Alan (Seattle Iron and Metals Corporation)
100486376	08/11/2023	Draft Letter regarding East Waterway Proposed Plan, Impracticability of Achieving EPAs Cleanup Goals, Version 1.	Letter	6	EPA	Sidell, Alan (Seattle Iron and Metals Corporation)
100486378	08/10/2023	Letter regarding RE: EPAs Proposed Plan on East Waterway Operable Unit of Harbor Island Superfund Site; Digitally Signed.	Letter	14	EPA	True, Christie, J. (King County), Khan, Faisal (King County)

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100486441	08/10/2023	Letter regarding Concern That the Process That Has Been Proposed for the Cleanup Threatens to Indefinitely Delay the Planned Deepening of the East Waterway.	Letter	2	EPA	Friedman, Peter (AgTC Agriculture Transportation Coalition)
100486443	08/11/2023	Letter regarding Re: Comments on the East Waterway Proposed Plan, Support for the Preferred Alternative.	Letter	19	EPA	True, Christie, J. (King County), Kilroy, Sandra (Port of Seattle), Lee, Andrew (City of Seattle)
100486445	08/10/2023	Letter regarding Concerned That the Process That Has Been Proposed for the Cleanup Threatens to Indefinitely Delay the Planned Deepening of the East Waterway.	Letter	2	EPA	Ross, Shawn (SBS Transportation)
100486450	08/10/2023	Letter regarding NWSA Supports the EPAs Objective of Reducing Contaminants in the East Waterway to the Maximum Extent Practical, Do Not Support the Concept of an Interim Process to Achieve These Ends.	Letter	5	EPA	Wolfe, John (The Northwest Seaport Alliance)
100486452	08/11/2023	Letter regarding Significant Concerns about Implementing Remedy through Interim Record of Decision.	Letter	5	EPA	Metruck, Stephen (Port of Seattle)
100486457	08/04/2023	Letter regarding Re East Waterway Superfund Proposed Plan, Comments on the Interim Remedies Proposed in the East Waterway Proposed Plan.	Letter	3	EPA	Susewind, Kelly (Washington Department of Ecology (ECY))

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100486636	08/11/2023	Letter regarding Re: Comments on Superfund Proposed Plan for East Waterway Operable Unit of Harbor Island Superfund Site, Comments of the General Electric Company on EPAs Proposed Plan.	Letter	3	EPA	Dunn, Loren (Beveridge & Diamond, P.C.)
100486637	08/11/2023	Email regarding DRCC East Waterway Proposed Plan Comment Letter.	Email	1	EPA	Hearn, Jamie (Duwamish River Community Coalition)
100486661	08/11/2023	Letter regarding Re: Ecology Comments on Proposed Plan for the East Waterway Operable Unit Cleanup.	Letter	3	Terada, Calvin, J. EPA	Buroker, Tom (Washington State Department of Ecology)
100486662	08/11/2023	Email regarding FW: EW Proposed Plan Comments; Attachment Indexed Separately.	Email	1	EPA	Sanga, Ravi, N. (EPA)
100486663	08/09/2023	Letter regarding Re: East Waterway Proposed Plan, History and Comments.	Letter	3	Sanga, Ravi, N. EPA	O'sullivan, Alison, T. (Suquamish Indian Tribe)
100486665	08/11/2023	Email regarding Puget Soundkeeper Comments on East Waterway Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Gonzalez, Emily (Puget Soundkeeper Alliance)
100486666	08/11/2023	Letter regarding Source Control, Preferred Alternative and Timelines, Conclusion.	Letter	3	Knudsen, Laura EPA, Sanga, Ravi, N. EPA	Gonzalez, Emily (Puget Soundkeeper Alliance)

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100486667	08/11/2023	Email regarding The Boeing Companys Comments on the East Waterway Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Whidbee, Paige, L. (Perkins Coie LLP)
100486668	08/11/2023	Letter regarding The Boeing Companys Comments on the East Waterway Proposed Plan.	Letter	8	EPA	Shestag, Steven (The Boeing Company)
100486669	08/11/2023	Email regarding WSHGA East Waterway Cleanup; Attachment Indexed Separately.	Email	1	EPA	Nolan, Sheri (Washington State Hay Growers Association)
100489168	08/02/2023	Letter regarding Threat to Derail Congressionally Approved Harbor Deepening Project, Deepening is Vital for Terminals to Serve Larger Container Ships Calling Gateway More Effectively.	Letter	2	Sixkiller, Casey (EPA Regional Administrator)	Ugles, Herald (International Longshoremen's and Warehousemen's Union)
100489620	08/10/2023	Letter regarding Concerned That the Process That Has Been Proposed for the Cleanup Threatens to Indefinitely Delay the Planned Deepening of the East Waterway, Part of the Seattle Harbor Navigation Improvement Project.	Letter	2	Sixkiller, Casey (EPA Regional Administrator)	Friedman, Peter (AgTC Agriculture Transportation Coalition)
100489624	08/11/2023	Letter regarding Re: East Waterway Group Comments on the East Waterway Proposed Plan, Support for the Preferred Alternative.	Letter	19	Knudsen, Laura EPA	True, Christie, J. (King County), Kilroy, Sandra (Port of Seattle), Lee, Andrew (City of Seattle)

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100489625	08/04/2023	Email regarding Deeping Channels, East Waterway Cleanup, Northwest Seaport Alliance; Attachment Indexed Separately.	Email	1	EPA	Harris, Matt (Washington State Potato Commission)
100489626	08/04/2023	Letter regarding Concerned That the Process That Has Been Proposed for the Cleanup Threatens to Indefinitely Delay the Planned Deepening of the East Waterway.	Letter	2	EPA	Harris, Matt (Washington State Potato Commission)
100489630	08/10/2023	Letter regarding Concerned That the Process That Has Been Proposed for the Cleanup Threatens to Indefinitely Delay the Planned Deepening of the East Waterway.	Letter	2	Sixkiller, Casey (EPA Regional Administrator)	Ross, Shawn (SBS Transportation)
100489631	08/09/2023	Email regarding East Waterway Proposed Plan Comments; Attachment Indexed Separately.	Email	1	EPA	Sidell, Alan (Seattle Iron and Metals Corporation)
100489632	08/11/2023	Letter regarding Impracticability of Achieving EPA Cleanup Goals, Problem with Characterizing Cleanup as Interim Remedial Action.	Letter	6	Knudsen, Laura EPA	Sidell, Alan (Seattle Iron and Metals Corporation)
100489633	08/09/2023	Email regarding East Waterway Comment Letter; Attachment Indexed Separately.	Email	1	EPA	Sidell, Alan (Seattle Iron and Metals Corporation)

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100489634	08/11/2023	Letter regarding Impracticability of Achieving EPA Cleanup Goals, Problem with Characterizing Cleanup as Interim Remedial Action.	Letter	6	Knudsen, Laura EPA	(Unknown)
100489635	08/11/2023	Email regarding East Waterway Proposed Plan Response to Comment; Attachment Indexed Separately.	Email	1	EPA	Christie, Emerson, C. (Washington Department of Health)
100489636	08/11/2023	Letter regarding RE: East Waterway Proposed Plan for Public Comment, Proposed Interim Action Demonstrates a Proactive Step Towards Cleanup, Particularly Pleased to See That the Intention Is for the East Waterway Cleanup Goals to Mirror.	Letter	2	Knudsen, Laura EPA	Christie, Emerson (Washington State Department of Health)
100489638	08/11/2023	Letter regarding Re: Ecology Comments on Proposed Plan for the East Waterway Operable Unit Cleanup, Support for the Proposed Plan Preferred Alternative.	Letter	3	Terada, Calvin, J. EPA	Buroker, Tom (Washington State Department of Ecology)
100489639	08/11/2023	Email regarding FW: EW Proposed Plan Comments; Attachment Indexed Separately.	Email	1	EPA	Sanga, Ravi, N. (EPA)
100489654	08/02/2023	Letter regarding Concern that Process Proposed Threatens to Indefinitely Delay Planned Deepening of the East Waterway.	Letter	2	Sixkiller, Casey (EPA Regional Administrator)	Mckisson, Dan (International Longshoremen's and Warehousemen's Union)

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100489656	08/10/2023	Letter regarding RE: EPA Proposed Plan on East Waterway Operable Unit of Harbor Island Superfund Site, Reduction in Unnecessary Risk to Public Agencies and Ratepaying Customers, Communicating a Clear and Transparent Message to the Public.	Letter	14	Knudsen, Laura EPA	True, Christie, J. (King County), Khan, Faisal (King County)
100489663	08/11/2023	Letter regarding Significant Concerns on Implementing Remedy through Interim Record of Decision.	Letter	5	Knudsen, Laura EPA	Metruck, Stephen (Port of Seattle)
100489667	07/28/2023	Letter regarding Concern that the Proposed Cleanup Process May Delay the Planned Deepening of the East Waterway, a Critical Element of the SHNIP.	Letter	2	Sixkiller, Casey (EPA Regional Administrator)	Costanzo, Charles (Puget Sound Pilots)
100489669	08/11/2023	Email regarding Puget Soundkeeper comments on East Waterway Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Gonzalez, Emily (Puget Soundkeeper Alliance)
100489671	08/11/2023	Letter regarding Soundkeeper Urges the EPA to Use Its Authorized Discretion to the Maximum Capacity for Overseeing Source Control Affecting the East Waterway Operable Unit.	Letter	3	Knudsen, Laura EPA, Sanga, Ravi, N. EPA	Gonzalez, Emily (Puget Soundkeeper Alliance)

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100489673	08/11/2023	Email regarding The Boeing Company Comments on the East Waterway Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Whidbee, Paige, L. (Perkins Coie LLP)
100489674	08/11/2023	Letter regarding Re: The Boeing Company Comments on the East Waterway Proposed Plan, Urge EPA to Carefully Consider These Comments, Issue a Revised Proposed Plan, and Then Issue a Record of Decision That Selects a Final Remedy.	Letter	8	Knudsen, Laura EPA	Shestag, Steven (The Boeing Company)
100489680	08/04/2023	Letter regarding WDFW Supports and Applauds EPA Decision to Use This Interim Plan, WDFW Generally Supports the Aggressive Sediment Remediation Plan Described in the Preferred Alternative, but Have Several Concerns.	Letter	3	Knudsen, Laura EPA	Susewind, Kelly (Washington Department of Ecology (ECY))
100489681	08/11/2023	Email regarding WSHGA, East Waterway Cleanup; Attachment Indexed Separately.	Email	1	EPA	Nolan, Sheri (Washington State Hay Growers Association)

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100489683	08/08/2023	Letter regarding Concern That the Process That Has Been Proposed for the Cleanup Threatens to Indefinitely Delay the Planned Deepening of the East Waterway, Part of the Seattle Harbor Navigation Improvement Project	Letter	2	Sixkiller, Casey (EPA Regional Administrator)	Eddie, Andrew (Washington State Hay Growers Association)
100490022	06/03/2023	Translated Vietnamese Comment, Looking Forward to More Info Sessions on Duwamish Waterway Cleanup.	RPT / Report	2	EPA	(Unknown)
100490030	06/03/2023	Public Meeting, Harbor Island Superfund Site, East Waterway Proposed Plan, June 2023.	RPT / Report	35	(Unknown)	Buell Realtime Reporting
100491914	08/07/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community	Email	1	EPA	(Unknown)

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100491915	08/07/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community	Email	1	EPA	(Unknown)
100491916	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491917	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100491918	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491919	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491920	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491922	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491923	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491925	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491926	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491927	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491928	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100491929	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491930	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491931	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100491932	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491933	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491934	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491935	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491936	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491937	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491938	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491939	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491940	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491941	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491957	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491959	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491960	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491961	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491962	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491963	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491964	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491965	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491966	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491967	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491968	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491970	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491971	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491972	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491973	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491975	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491976	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491977	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491978	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491979	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491980	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491981	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491982	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491983	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491984	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491985	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100491986	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491988	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491989	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

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100491990	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491991	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491992	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100491993	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491994	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100491995	08/08/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100492000	08/07/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community	Email	1	EPA	(Unknown)
100492001	08/07/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community	Email	1	EPA	(Unknown)
100492004	08/07/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community	Email	1	EPA	(Unknown)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100492005	08/07/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community	Email	1	EPA	(Unknown)
100492014	05/31/2023	REDACTED Email regarding Communication Channel Harbor Island Follow Up, Questions.	Email	1	EPA	Knudsen, Laura (EPA)
100492015	06/19/2023	REDACTED Email regarding Duwamish, Public Comment.	Email	1	EPA	Knudsen, Laura (EPA)
100492016	07/26/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492017	07/26/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492018	07/26/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492019	07/26/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100492020	07/26/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492021	07/26/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492022	07/26/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492024	06/19/2023	REDACTED Email regarding Proposed Plan East Waterway Cleanup, Public Comment.	Email	1	EPA	(Unknown)
100492025	07/11/2023	REDACTED Email regarding Proposed Plan for the East Waterway, Public Comment.	Email	1	EPA	(Unknown)
100492026	05/10/2023	REDACTED Email regarding Public Comment on Proposed Plan for the East Waterway.	Email	1	EPA	(Unknown)
100492028	08/03/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Concerned With the Current State of the Duwamish River and Its Restoration.	Email	1	EPA	(Unknown)

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100492029	08/03/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration.	Email	1	EPA	(Unknown)
100492031	08/09/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Comment.	Email	1	EPA	(Unknown)
100492032	08/09/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Comment.	Email	1	EPA	(Unknown)
100492033	08/09/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Comment.	Email	1	EPA	(Unknown)
100492034	08/09/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Comment.	Email	1	EPA	(Unknown)
100492035	08/09/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Comment.	Email	1	EPA	(Unknown)
100492036	08/09/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Comment.	Email	1	EPA	(Unknown)

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100492118	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492120	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	2	EPA	(Unknown)
100492122	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492123	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492126	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492127	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492129	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492131	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)

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100492132	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492133	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492135	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492136	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492138	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492139	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492141	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492142	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)

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100492143	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492144	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492145	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492146	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492150	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492151	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492152	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	2	EPA	(Unknown)
100492154	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)

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100492155	07/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Anonymous Public Comment.	Email	1	EPA	(Unknown)
100492169	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492216	05/25/2023	REDACTED Email regarding Strongly Support the EPA Cleanup of the East Waterway in the Duwamish River.	Email	1	EPA	(Unknown)
100492217	05/02/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Please Please Use This Opportunity to Aid in the Repair and Restoration of This Incredible Resource.	Email	1	EPA	(Unknown)
100492218	08/11/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Support the Preferred Alternative Cleanup Plan for the East Waterway on the Duwamish River.	Email	1	EPA	(Unknown)

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100492219	08/11/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Prefer the Preferred Alternative Cleanup Plan for the East Waterway on the Duwamish River, and Support Tribal Sovereignty of the Duwamish People.	Email	1	EPA	(Unknown)
100492221	08/10/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Support the Preferred Alternative to Address Legacy Toxics Cleanup.	Email	1	EPA	(Unknown)
100492222	08/10/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Support the Proposed Cleanup Plan, Proposed Plan, for the East Waterway Operable Unit, Which Is Part of the Harbor Island Superfund Site in Seattle, Washington.	Email	1	EPA	(Unknown)
100492223	08/11/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Support the Preferred Alternative Cleanup Plan for the East Waterway on the Duwamish River.	Email	1	EPA	(Unknown)

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100492224	08/14/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Support the Preferred Alternative Cleanup Method and Urge the EPA to Support This Method.	Email	1	EPA	(Unknown)
100492230	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492231	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492232	08/10/2023	REDACTED Email regarding Supporting the Cleanup Goals Proposed for the East Waterway Superfund Site and to Request That EPA Expand Its Cleanup Plan to Include Active Removal of Contaminated Sediments.	Email	1	EPA	(Unknown)

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100492237	08/15/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Urging to Implement the Cleanup Plan That Most Ambitiously Protects Health and the Environment, in Support Of Preferred Alternative, Suggested Incorporations.	Email	1	EPA	(Unknown)
100492238	06/03/2023	REDACTED Translated Vietnamese Comment, Concern that Communication Channel Poses Ongoing Source of Pollution, Cable is Buried into Containment Sediment.	Email	2	EPA	(Unknown)
100492239	08/10/2023	REDACTED Email regarding USACE Comments on the East Waterway Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Schultz, Bradford, L. (U.S. Army Corps of Engineers (USACE))
100492240	06/03/2023	REDACTED Official EPA Comment Card, Public Comment Period Starting April 2023, Please Make Room for Locals to be Able to Help.	Email	2	EPA	(Unknown)

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100492269	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492270	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492272	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492273	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100492274	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492275	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492276	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492277	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100492278	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492286	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492295	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492301	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100492310	08/14/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100492387	07/28/2023	REDACTED Email regarding Puget Sound Pilots, East Waterway Cleanup Comment Letter, East Waterway Cleanup Comment July 2023; Attachment Indexed Separately.	Email	1	EPA	(Unknown)
100492388	08/02/2023	REDACTED Email regarding ILWU Washington Area District Council Comments on The East Waterway; Attachment Indexed Separately.	Email	1	EPA	(Unknown)
100492389	08/09/2023	REDACTED Email regarding King County Comment Letter on East Waterway Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Kinlow, Lester (King County)
100492391	08/10/2023	REDACTED Email regarding Comments on the East Waterway Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Ogier, Sarah (Port of Seattle)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100492392	08/10/2023	REDACTED Email regarding East Waterway, Regional Administrator Doc File; Attachment Indexed Separately.	Email	1	EPA	Ross, Shawn (SBS Transportation)
100492393	08/10/2023	REDACTED Email regarding Port of Seattle Comments on East Waterway Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Ogier, Sarah (Port of Seattle)
100492395	08/10/2023	REDACTED Email regarding WDFW Comments on East Waterway Cleanup Plan; Attachment Indexed Separately.	Email	1	EPA	West, James, E. (Washington Department of Fish and Wildlife)
100492396	08/11/2023	REDACTED Email regarding FW: East Waterway Proposed Plan Comments; Attachment Indexed Separately.	Email	1	EPA	Sanga, Ravi, N. (EPA)
100492397	07/28/2023	REDACTED DRCC East Waterway Proposed Plan Comment Letter regarding Support for Cleanup Goal of 2 ppb for PCBs.	Letter	135	Knudsen, Laura EPA, Sanga, Ravi, N. EPA	Hearn, Jamie (Duwamish River Community Coalition)
100492398	08/11/2023	REDACTED Email regarding Comments on Proposed Plan, General Electric Company Comments; Attachment Indexed Separately.	Email	1	EPA	Dunn, Loren (Beveridge & Diamond, P.C.)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100492399	08/10/2023	REDACTED Email regarding NWSA Comments on East Waterway Cleanup Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Mcfarland, Ryan (The Northwest Seaport Alliance)
100492400	05/25/2023	REDACTED Virtual Public Meeting on EPA East Waterway Cleanup May 2023 Zoom Meeting Transcript.	RPT / Report	39	(Unknown)	(Unknown)
100493120	08/10/2023	REDACTED Letter regarding Comments on USEPA Proposed Plan for Cleanup of East Waterway.	Letter	4	Sanga, Ravi, N. EPA	Reese, Amy (Department of the Army)
100528499	02/05/2024	Offer for Government-to-Government Consultation with the Muckleshoot Indian Tribe regarding the Interim Record of Decision for Remedial Action at the East Waterway Operable Unit of the Harbor Island Superfund Site.	CORR / Correspondence	1	Elkins, Jaison (Muckleshoot Indian Tribe)	Terada, Calvin, J. (EPA)
100528502	02/05/2024	Offer for Government-to-Government Consultation with the Suquamish Tribe regarding the Interim Record of Decision for Remedial Action at the East Waterway Operable Unit of the Harbor Island Superfund Site.	Correspondence	1	Forsman, Leonard, Anthony (Suquamish Indian Tribe)	Terada, Calvin, J. (EPA)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100528503	02/05/2024	Offer for Government-to-Government Consultation with the Yakama Nation regarding the Interim Record of Decision for Remedial Action at the East Waterway Operable Unit of the Harbor Island Superfund Site.	Correspondence	1	Lewis, Gerald (Yakama Nation)	Terada, Calvin, J. (EPA)
100549877	05/13/2024	Letter regarding East Waterway CERCLA Site Record of Decision, State Concurrence, Communicates Washington State Department of Ecologys Concurrence with the Selected Remedy, East Waterway Site.	Letter	2	Sixkiller, Casey (EPA Regional Administrator)	Watson, Laura (Washington State Department of Ecology)
100551182	05/10/2024	REDACTED Email regarding RE: East Waterway IROD, Would Like a Meeting, Did Attempt to Call, Opportunity for Tribes to Discuss ROD with EPA.	Email	2	Bott, Dustan, L. EPA	Osullivan, Alison (Suquamish Indian Tribe)
100551184	04/15/2024	REDACTED Email regarding East Waterway IROD, Thanks for Chat Today, As Discussed, Let Know if Yakima Nation Is Interested in Consultation or Discussing the East Waterway IROD.	Email	1	Klasner Shira, Laura (Yakama Indian Nation)	Bott, Dustan, L. (EPA)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100551186	05/13/2024	REDACTED: Email regarding FW: East Waterway Concurrence Letter, Message Blank, Thread Mentions, Attached Is Correspondence Regarding Ecology's Concurrence with Selected Remedy for the In-Waterway Portion of East Waterway Site.	Email	2	Mednick, Richard EPA, Sanga, Ravi, N. EPA, Ingelmansen, Dean EPA, Bott, Dustan, L. EPA, Edmonson, Lucy EPA	Lynch, Kira, P. (EPA)
100551196	08/07/2023	REDACTED Email regarding Comment on Proposed Plan, Current State of the Duwamish River and Invested in Its Restoration, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100551246	08/10/2023	REDACTED Email regarding NWSA Comments on East Waterway Cleanup Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Mcfarland, Ryan (The Northwest Seaport Alliance)
100551249	08/11/2023	REDACTED Email regarding Comments on Proposed Plan; General Electric Company; Attachment Indexed Separately.	Email	1	EPA	Dunn, Loren (Beveridge & Diamond, P.C.)
100551250	08/11/2023	REDACTED Email regarding Fwd: Harbor Island Superfund Site, Alternatives and Comments.	Email	2	EPA	Benjamin, John (KEY2GROUP USA, LLC)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100551255	08/07/2023	REDACTED Email regarding Comment on the East Waterway Proposed Plan, Cleanup Is Long Overdue to Protect Fish and Wildlife, Water Quality, and the Health of Tribal Nations and Community Members.	Email	1	EPA	(Unknown)
100551259	08/10/2023	REDACTED Email regarding East Waterway Proposed Plan Comment Form, Please Keep Your Proposed Plan, Immigrants and Refugee Communities Often Do Not Understand Complex Environmental Issues on Pollution and Will Continue Fishing.	Email	1	EPA	(Unknown)
100551263	06/20/2023	REDACTED Email regarding FW: East Waterway Proposed Plan Voice Mail, Audio Recording, No Content in Recording; Attachment Indexed Separately.	Email	1	EPA	Knudsen, Laura (EPA)
100551270	08/10/2023	REDACTED Email regarding Agriculture Transportation Coalition Comments on East Waterway Cleanup Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Young, Spencer (AgTC Agriculture Transportation Coalition)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100551279	08/10/2023	REDACTED Email regarding Comments on the East Waterway Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Ogier, Sarah (Port of Seattle)
100551284	08/10/2023	REDACTED Email regarding East Waterway; Attachment Indexed Separately.	Email	1	EPA	Ross, Shawn (SBS Transportation)
100551294	08/11/2023	REDACTED Email regarding FW: East Waterway Proposed Plan Comments; Attachment Indexed Separately.	Email	1	EPA	Sanga, Ravi, N. (EPA)
100551295	08/02/2023	REDACTED Email regarding ILWU Washington Area District Council Comments on The East Waterway; Attachment Indexed Separately.	Email	1	EPA	(Unknown)
100551298	08/09/2023	REDACTED Email regarding King County Comment Letter on East Waterway Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Kinlow, Lester (King County)
100551302	08/10/2023	REDACTED Email regarding Port of Seattle Comments on East Waterway Proposed Plan; Attachment Indexed Separately.	Email	1	EPA	Ogier, Sarah (Port of Seattle)
100551305	07/28/2023	REDACTED Email regarding Puget Sound Pilots East Waterway Cleanup Comment Letter; Attachment Indexed Separately.	Email	1	EPA	Costanzo, Charles (Puget Sound Pilots)

Doc. ID	Doc. Date	Title	Resource Type	Pages	Addressee Name or Organization	Author Name or Organization
100551306	08/10/2023	REDACTED Email regarding WDFW Comments on East Waterway Cleanup Plan; Attachment Indexed Separately.	Email	1	EPA	West, James, E. (Washington Department of Fish and Wildlife)

Appendix D: Risk Assessment Tables

Table D1. COPCs Identified for EW OU BHHRA

COPC	Detection Frequency (Percent)			Selected as a COPC?				
				Seafood Consumption Scenarios	Direct Sediment Exposure			Surface Water Exposure Scenarios
	Tissue[a]	Sediment[b]	Surface Water[c]		Netfishing	Habitat Restoration	Clamming[d]	
Detected in All Exposure Media								
Antimony	35 (34/98)	2 (3/185)	39 (11/28)	X	X		X[ND]	
Arsenic[e]	88 (83/94)	70 (161/231)	100 (28/28)	X	X	X	X	X
Cadmium	58 (57/98)	70 (161/231)	96 (27/28)	X				
Chromium	86 (84/98)	100 (231/231)	68 (19/28)	X				X
Cobalt	47 (45/95)	100 (105/105)	21 (6/28)	X			X	
Copper	100 (98/98)	100 (231/231)	100 (28/28)	X				
Lead[f]	18 (18/98)	99 (228/231)	68 (19/28)	X	X		X[g]	
Mercury	87 (107/123)	97 (233/239)	75 (21/28)	X				
Molybdenum	85 (78/92)	62 (68/110)	ND	X				
Vanadium	61 (56/92)	100 (105/105)	96 (27/28)	X	X	X	X	X
Zinc	100 (98/98)	100 (231/231)	68 (19/28)	X				
cPAHs	71 (68/96)	97 (233/241)	11 (3/28)	X	X	X	X	
Naphthalene	21 (20/96)	49 (118/241)	29 (8/28)					X
1,4-Dichlorobenzene	1 (1/98)	64 (149/232)	4 (1/28)	X	X			
Total PCBs	98 (121/124)	94 (227/241)	100 (28/28)	X	X	X	X	X
PCB TEQ	100 (28/28)	100 (17/17)	100 (28/28)	X	X[h]	X[h]	X	X[h]
Total DDTs	78 (18/23)	9 (13/152)	ND	X				
Total chlordane	70 (16/23)	2 (2/95)	ND	X				
Heptachlor	4 (1/23)	1 (1/100)	ND	X				
Dioxin/furan TEQ	100 (28/28)	100 (17/17)	ND	X	X		X	
Detected in at Least One of the Three Exposure Media								
Selenium	100 (92/92)	0 (0/117)	100 (28/28)	X				

Table D1. COPCs Identified for EW OU BHHRA

COPC	Detection Frequency (Percent)			Selected as a COPC?				
				Seafood Consumption Scenarios	Direct Sediment Exposure			Surface Water Exposure Scenarios
	Tissue[a]	Sediment[b]	Surface Water[c]		Netfishing	Habitat Restoration	Clamming[d]	
Dibutyltin as ion	9 (9/98)	44 (26/59)	0 (0/28)	X				
TBT as ion	75 (82/110)	95 (63/66)	0 (0/28)	X				
Aldrin	0 (0/23)	2 (2/100)	ND	X_{ND}				
Aniline	0 (0/92)	1 (1/143)	0 (0/24)	X_{ND}				
BBP	0 (0/98)	46 (106/232)	0 (0/28)	X_{ND}				
Benzo[*a*]pyrene	50 (48/96)	93 (225/241)	0 (0/28)					X_{ND}
BEHP	0 (0/57)	88 (203/232)	7 (2/28)	X_{ND}				
alpha-BHC	17 (4/23)	0 (0/95)	ND	X				
beta-BHC	9 (2/23)	0 (0/95)	ND	X				
Dieldrin	48 (11/23)	0 (0/100)	ND	X				
2,4-Dinitrotoluene	0 (0/98)	1 (1/175)	0 (0/28)	X_{ND}				X_{ND}
Heptachlor epoxide	9 (2/23)	0 (0/95)	ND	X				
Mirex	43 (10/23)	0 (0/81)	ND	X				
N-Nitroso-di-n-propylamine	0 (0/98)	1 (1/175)	0 (0/28)	X_{ND}				X_{ND}
N-Nitrosodiphenylamine	0 (0/98)	1 (2/232)	0 (0/28)	X_{ND}				
Pentachlorophenol	4 (2/57)	5 (11/232)	0 (0/28)	X				
1,2,4-Trichlorobenzene	0 (0/98)	5 (12/232)	0 (0/28)	X_{ND}				
Not Detected in Any of the Exposure Media								
Bis(2-chloroethoxy)methane	0 (0/98)	0 (0/175)	0 (0/28)	X_{ND}				
Bis(2-chloroethyl)ether	0 (0/98)	0 (0/175)	0 (0/28)	X_{ND}				X_{ND}
4-Chloroaniline	0 (0/88)	0 (0/163)	0 (0/28)	X_{ND}				X_{ND}
2,4-Dichlorophenol	0 (0/98)	0 (0/175)	0 (0/28)	X_{ND}				
3,3'-Dichlorobenzidine	0 (0/87)	0 (0/167)	0 (0/28)					X_{ND}
2,4-Dinitrophenol	0 (0/98)	0 (0/175)	0 (0/28)	X_{ND}				
2,6-Dinitrotoluene	0 (0/98)	0 (0/175)	0 (0/28)	X_{ND}				
4,6-Dinitro-o-cresol	0 (0/98)	0 (0/175)	0 (0/28)	X_{ND}				X_{ND}
1,2-Diphenylhydrazine	0 (0/6)	0 (0/5)	ND	X_{ND}				

Table D1. COPCs Identified for EW OU BHHRA

COPC	Detection Frequency (Percent)			Selected as a COPC?				
				Seafood Consumption Scenarios	Direct Sediment Exposure			Surface Water Exposure Scenarios
	Tissue[a]	Sediment[b]	Surface Water[c]		Netfishing	Habitat Restoration	Clamming[d]	
Hexachlorobenzene	0 (0/98)	0 (0/232)	0 (0/28)	X_{ND}				X_{ND}
Hexachlorobutadiene	0 (0/98)	0 (0/232)	0 (0/28)	X_{ND}				
Hexachlorocyclopentadiene	0 (0/98)	0 (0/164)	0 (0/28)	X_{ND}				
Hexachloroethane	0 (0/98)	0 (0/175)	0 (0/28)	X_{ND}				
2-Nitroaniline	0 (0/98)	0 (0/175)	0 (0/28)	X_{ND}				
4-Nitroaniline	0 (0/94)	0 (0/174)	0 (0/28)	X_{ND}				
N-Nitrosodimethylamine	0 (0/88)	0 (0/158)	0 (0/24)	X_{ND}			X_{ND}	X_{ND}
Nitrobenzene	0 (0/98)	0 (0/175)	0 (0/28)	X_{ND}				
Toxaphene	0 (0/95)	0 (0/86)	ND	X_{ND}			X_{ND}	
2,4,6-Trichlorophenol	0 (0/98)	0 (0/175)	0 (0/28)	X_{ND}				

Notes:

X – Indicates that the chemical was selected as a COPC and was detected in the scenario exposure media.

X_{ND} – Indicates that the chemical was selected as a COPC but was not detected in the scenario exposure media.

a. The detection frequency for tissue was based on all tissue types included in the EW BHHRA.
b. The detection frequency for sediment was based on both subtidal and intertidal sediment samples.
c. The detection frequency for surface water was based on total water concentrations for metals.
d. Based on both the tribal clamming and 7-day-per-year clamming scenarios.
e. For the seafood consumption scenarios, the arsenic assessment was based on inorganic arsenic exposure and toxicity data.
f. No SL was available for lead. An alternative modeling method recommended by EPA was used instead to screen lead data (see the BHHRA, Section B.3.3.5).
g. Lead was identified as a COPC for only the tribal clamming scenarios (not the 7-day-per-year clamming scenario).
h. PCB TEQ did not screen in as a COPC for these scenarios, but because total PCBs did screen in, PCB TEQ risks were evaluated.

BBP – butyl benzyl phthalate
BEHP – bis(2-ethylhexyl) phthalate
BHC – benzene hexachloride
COPC – contaminant of potential concern
cPAH – carcinogenic polycyclic aromatic hydrocarbon
DDT – dichlorodiphenyltrichloroethane
EPA – US Environmental Protection Agency
ND – no data
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
SL – screening level
TEQ – toxic equivalent

Table D2. Exposure Values for the Seafood Consumption Scenarios

Scenario	Consumption Rate (g/day)								Meals per Month[d]	Exposure Duration (years)
	Benthic Fish[a]	Crab	Mussel	Clam	Geoduck[b]	Perch[c]	Rockfish[c]	Total		
Adult tribal RME (Tulalip data)	7.5	34.4	0.8	39.3	7.4	7.1	1.0	97.5	13.1	70
Adult tribal CT (Tulalip data)	1.2	5.3	0.1	6.0	1.1	1.1	0.2	15	2.0	30
Child tribal RME (Tulalip data)	3.0	13.7	0.3	15.7	3.0	2.8	0.4	39.0	13.1	6
Child tribal CT (Tulalip data)	0.48	2.1	0.04	2.4	0.44	0.44	0.08	6.0	2.0	6
Adult tribal (Suquamish data)	25.9	49.8	5.0	393.7	49.8	0.6	55.4	583.5	78	70
Adult API RME	2.4	10.6	4.6	29.1	na	0.5	4.4	51.5	6.9	30
Adult API CT	0.24	1.1	0.5	3.0	na	0.05	0.45	5.3	0.7	9
Adult one meal per month	7.5	7.5	na	7.5	na	7.5	7.5	na	1.0	30

Notes:

a. Includes both fillet and whole-body consumption.

b. Includes both edible-meat and whole-body consumption (soft-tissue plus gutball).

c. Both perch (fillet and whole body) and rockfish (whole body) were classified as pelagic fish in this risk assessment.

d. It was assumed that one adult meal was equal to 227g (8 oz). Child consumption rates were 40 percent of adult rates. For the purpose of calculating meals per month for children, this 40 percent conversion was assumed to represent a smaller meal size (40 percent of the adult meal size, which is equal to 91 g or 3.2 oz).

API – Asian and Pacific Islander

CT – central tendency

EPA – US Environmental Protection Agency

Table D3. Exposure Values for the Direct Sediment Exposure Scenarios

Scenario	Incidental Sediment IR (g/day)	Exposure Frequency (days/yr)	Exposure Duration (years)	Skin Surface Area Exposed (cm^2)	Body Weight (kg)
Netfishing RME	0.050	119	44	3,600[a]	81.8
Netfishing CT	0.050	63	29	3,600[a]	81.8
Habitat restoration worker	0.1	15	20	6,040[b]	71.8
Tribal clamming RME	0.1	120	64	6,040[b]	81.8
Tribal clamming, 183-day-per-year	0.1	183	70	6,040[b]	81.8
Clamming, 7-day-per-year	0.1	7	30	6,040[b]	71.8

Notes:

a. Recommended skin surface area value for commercial/industrial worker. Assumes that head, hands, and forearms are uncovered (exposed).
b. Assumes that 39 percent of the total adult body surface area is exposed.

IR – ingestion rate
RME – reasonable maximum exposure
CT – central tendency

Table D-4. Non-cancer toxicity data (oral) for chemicals of potential concern

Chemical[a]	Oral RfD (mg/kg day)	Endpoint (Critical Effect)	Uncertainty Factor	RfD Source	Source Date[b]	Notes
Detected COPCs						
Antimony	0.0004	endocrine and hematologic systems (adverse effects on longevity, blood glucose, and cholesterol)	1,000	IRIS	6/29/2010	
Arsenic	0.0003	cardiovascular and integumentary systems (hyperpigmentation, keratosis, and possible vascular complications)	3	IRIS	6/29/2010	surrogate = inorganic arsenic
Cadmium (in food)	0.001	kidney (significant proteinuria)	10	IRIS	6/29/2010	
Chromium	0.003	digestive system (irritation of and ulcers in the stomach and small intestine, anemia, male reproductive damage [ATSDR])	300	IRIS	6/29/2010	surrogate = hexavalent chromium
Cobalt	0.0003	endocrine system (thyroid – decreased iodine uptake)	3,000	PPRTV	8/15/2011	
Copper	0.04[c]	digestive system (irritation)	na	HEAST	5/2010	
Lead	na[d]	nervous system (neurotoxicant)	na	na	na	
Mercury	0.0001	development and nervous system (developmental neuropsychological impairment)	10	IRIS	6/29/2010	surrogate = methylmercury
Molybdenum	0.005	kidney (increased uric acid levels)	30	IRIS	6/29/2010	
Selenium	0.005	hematologic, nervous, and integumentary systems (clinical selenosis)	3	IRIS	6/29/2010	selenium and compounds
Vanadium	0.009	integumentary system (decreased hair cystine)	100	IRIS	6/29/2010	vanadium pentaoxide
Zinc	0.3	hematologic system (decreases in erythrocyte copper, zinc-superoxide dismutase activity in healthy adults)	3	IRIS	6/29/2010	zinc and compounds
Dibutyltin as ion	0.0003	Immune system (immunotoxicity and reduced body weight)	1,000	PPRTV	8/15/2011	dibutyltin compounds
Tributyltin as ion	0.00015	Immune system (immunosuppression)	100	IRIS	6/30/2010	surrogate = by conversion from tributyltin oxide (multiply IRIS oral RfD by 0.49)
1,4-Dichlorobenzene	0.07	Liver (adverse effects on liver, kidney, and blood, nervous system during development, skin blotches and anemia from regular exposure over long periods)	na	ATSDR	5/2010	

Table D-4. Non-cancer toxicity data (oral) for chemicals of potential concern

Chemical[a]	Oral RfD (mg/kg day)	Endpoint (Critical Effect)	Uncertainty Factor	RfD Source	Source Date[b]	Notes
Pentachlorophenol	0.03	Kidney and liver (adverse effects on liver and kidney pathology)	100	IRIS	6/29/2010	
Naphthalene	0.02	Body weight (decreased mean terminal body weight in males)	3,000	IRIS	6/29/2010	
Total PCBs[e]	0.00002	Immune and integumentary systems, eyes (ocular exudate, inflamed and prominent Meibomian glands, distorted nail growth, decreased antibody response)	300	IRIS	6/29/2010	surrogate = Aroclor 1254, the lowest and most protective RfD available for PCBs in IRIS. Note that this RfD was also applied for calculation of nervous system effects (see Table 4-3).
	0.00007	Development (reduced birth weights)	100	IRIS	8/16/2011	surrogate = Aroclor 1016
PCB TEQ	na	An RfD for 2,3,7,8-TCDD (the chemical upon with the toxicity of PCB TEQ is based) was made available by EPA on IRIS in February 2012 as the EW HHRA was nearing completion. Thus, non-cancer hazards were not incorporated into this document, but will be presented as part of the SRI.				
alpha-BHC	0.008	liver	na	ATSDR	5/2010	
Dieldrin	0.00005	liver (liver lesions)	100	IRIS	6/29/2010	
Heptachlor	0.0005	liver (liver weight increases in males)	300	IRIS	8/27/2010	
Heptachlor epoxide	0.000013	liver and body weight (increased liver-to- body weight ratio in both males and females)	1,000	IRIS	8/27/2010	
Mirex	0.0002	liver (liver cytomegaly, fatty metamorphosis, angiectasis; thyroid cystic follicles)	300	IRIS	8/27/2010	
Total DDTs	0.0005	liver (liver lesions)	100	IRIS	6/29/2010	surrogate = 4,4'-DDT; total includes DDDs, DDEs, and DDTs
Total chlordane	0.0005	liver (hepatic necrosis)	300	IRIS	6/29/2010	surrogate = chlordane (technical); total includes alpha- chlordane, gamma-chlordane, oxychlordane, cis-nonachlor, and trans-nonachlor
Dioxin/furan TEQ	na	An RfD for 2,3,7,8-TCDD (the chemical upon with the toxicity of Dioxin/furan TEQ is based) was made available by EPA on IRIS in February 2012 as the EW HHRA was nearing completion. Thus, non-cancer hazards were not incorporated into this document, but will be presented as part of the SRI.				
Non-Detected COPCs						
BEHP	0.020	liver (liver weight increases)	1,000	IRIS	9/28/2010	
Butyl benzyl phthalate	0.200	liver (significantly increased liver-to-body weight and liver-to-brain weight ratios)	1,000	IRIS	9/28/2010	
1,2,4-Trichlorobenzene	0.01	endocrine system (adrenal weight increases; vacuolization of zona fasciculata in the cortex)	1,000	IRIS	9/27/2010	

Table D-4. Non-cancer toxicity data (oral) for chemicals of potential concern

Chemical[a]	Oral RfD (mg/kg day)	Endpoint (Critical Effect)	Uncertainty Factor	RfD Source	Source Date[b]	Notes
1,2-Diphenylhydrazine	na	na	na	na	na	
2,4,6-Trichlorophenol	0.001	development (decreased litter size)	3,000	PPRTV	8/15/2011	
2,4-Dichlorophenol	0.003	immune system (decreased delayed hypersensitivity response)	100	IRIS	9/27/2010	
2,4-Dinitrophenol	0.002	eyes (cataract formation)	1,000	IRIS	9/27/2010	
2,4-Dinitrotoluene	0.002	liver, nervous system, hematologic system (neurotoxicity, Heinz bodies and biliary tract hyperplasia)	100	IRIS	9/28/2010	
2,6-Dinitrotoluene	0.001	liver, nervous system, hematologic system (neurological, hematological, and liver histopathology)	3,000	PPRTV	8/15/2011	
2-Nitroaniline	0.01	na	10,000	PPRTVappendix	8/15/2011	screening value
3,3'-Dichlorobenzidine	na	na	na	na	na	
4,6-Dinitro-o-cresol	0.00008	na	10,000	PPRTVappendix	8/15/2011	screening value
4-Chloroaniline	0.004	hematologic system (non-neoplastic lesions of splenic capsule)	3,000	IRIS	9/28/2010	
4-Nitroaniline	0.004	hematologic system (increases in methemoglobin and hemosiderosis)	100	PPRTV	8/15/2011	
Aniline	0.007	hematologic system (spleen/blood effects)	1,000	PPRTV	8/15/2011	
Bis(2- chloroethoxy)methane	0.003	liver (liver lesions)	3,000	PPRTV	8/15/2011	
Bis(2-chloroethyl)ether	na	na	na	na	na	
Hexachlorobenzene	0.0008	liver (liver effects)	100	IRIS	9/28/2010	
Hexachlorobutadiene	0.001	kidney (tubule regeneration)	100	PPRTV	8/15/2011	
Hexachlorocyclopentadiene	0.006	digestive system (chronic irritation such as forestomach lesions)	1,000	IRIS	9/28/2010	
Hexachloroethane	0.001	kidney (atrophy and degeneration of the renal tubules)	1,000	IRIS	9/28/2010	
Nitrobenzene	0.002	hematologic system (increased methemoglobin levels)	1,000	IRIS	9/28/2010	
N-Nitroso-di-n-propylamine	na	na	na	na	na	
N-Nitrosodimethylamine	0.000008	development (weanling sex ration and perinatal mortality)	3,000	PPRTV	8/15/2011	
N-Nitrosodiphenylamine	na	na	na	na	na	
Benzo(a)pyrene	na	na	na	na	na	
Aldrin	0.00003	liver (liver toxicity)	1,000	IRIS	9/28/2010	
Toxaphene	na	na	na	na	na	

Table D-4. Non-cancer toxicity data (oral) for chemicals of potential concern

Chemical[a]	Oral RfD (mg/kg day)	Endpoint (Critical Effect)	Uncertainty Factor	RfD Source	Source Date[b]	Notes

a. Chemicals for which no RfDs were available were excluded from this table. These chemicals include beta-BHC, cPAH TEQ, dioxin/furan TEQ, and PCB TEQ.

b. For IRIS and PPRTV, the source date represents the date that the database was searched; for ATSDR and HEAST, the source dates represent the dates that the RSL tables (EPA 2010a) (the sources of these values) were updated.

c. The source of the RfD for copper is HEAST, which per EPA has not been updated since 1997. The HEAST document provides a drinking water criteria value for copper (EPA 1997b), which was converted into a provisional RfD by EPA for use in the RSL tables (EPA 2010a). Although uncertain, this provisional RfD was considered acceptable for use in the HHRA based on its inclusion in EPA's RSL tables.

d. No RfD is available for lead because existing toxicity information for lead indicates adverse effects even at very low concentrations (RfDs are established as the concentration below which studies have found there to be no adverse effects). The method used to evaluate risks associated with exposure to lead is discussed in detail in Section B.3.3.5.

e. Two RfDs are listed for total PCBs. HQs based on both of these RfDs are presented in Section B.5 to allow for an evaluation of the effects of exposure to PCBs on different endpoints.

ATSDR – Agency for Toxic Substance and Disease Registry
BHC – benzene hexachloride
BEHP – bis(2-ethylhexyl) phthalate
cPAH – carcinogenic polycyclic aromatic hydrocarbon
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethylene
DDT – dichlorodiphenyltrichloroethane
EPA – US Environmental Protection Agency
HEAST – Health Effects Assessment Summary Tables
HHRA – human health risk assessment
IRIS – Integrated Risk Information System
na – not available
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PPRTV – Provisional Peer-Reviewed Toxicity Values
RfD – reference dose
RSL – regional screening level
SVOC – semivolatile organic compound
TEQ – toxic equivalent
TOC – toxic equivalency

Table D-5. Cancer toxicity data (oral/dermal) for chemicals of potential concern

Chemical[a]	Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Cancer Description Guideline[b]	Source	Source Date[c]	Notes
Detected COPCs					
Metals					
Arsenic	1.5	A	IRIS	6/29/2010	surrogate = inorganic arsenic
Cobalt	na	B1 (RAIS)	na	6/29/2010	
Copper	na	D	IRIS	6/29/2010	
Mercury	na	C	IRIS	6/29/2010	surrogate = methylmercury
Selenium	na	D	IRIS	6/29/2010	selenium and compounds
Zinc	na	D	IRIS	6/29/2010	zinc and compounds
Organic compounds					
alpha-BHC	6.3	B2	IRIS	8/27/2010	
beta-BHC	1.8	C	IRIS	8/27/2010	
1,4-Dichlorobenzene	0.0054	C (RAIS)	Cal EPA	5/2010	Surrogate = chlordane (technical); Total includes alpha-chlordane, gamma-chlordane, oxychlordane, cis-nonachlor, and trans-nonachlor
Dieldrin	16	B2	IRIS	6/29/2010	
Total DDTs	0.34	B2	IRIS	6/29/2010	Surrogate = 4,4′-DDT; total includes DDDs, DDEs, and DDTs
Dioxin/furan TEQ	150,000[d]	B2 (RAIS)	HEAST	4/2006	Slope factor based on 2,3,7,8-TCDD; consistent with the slope factor used in the LDW HHRA
Heptachlor	4.5	B2	IRIS	8/27/2010	
Heptachlor epoxide	9.1	B2	IRIS	8/27/2010	
Mirex	18	B2 (RAIS)	Cal EPA	5/2010	
Naphthalene	na	C	IRIS	6/29/2010	
cPAH	7.3	B2	IRIS	6/29/2010	slope factor based on benzo(a)pyrene
Total PCBs	2	B2	IRIS	6/29/2010	upper-bound slope factor used for this risk estimate; total includes Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260
PCB TEQ	150,000[d]	B2 (RAIS)	HEAST	4/2006	slope factor based on 2,3,7,8-TCDD; consistent with the slope factor used in the LDW HHRA
Pentachlorophenol	0.12	B2	IRIS	6/29/2010	
Non-Detected COPCs					
Aldrin	17	B2	IRIS	9/28/2010	
Aniline	0.006	B2	IRIS	9/28/2010	
BEHP	0.01	B2	IRIS	9/28/2010	
Benzo(a)pyrene	7.3	B2	IRIS	9/28/2010	
Butyl benzyl phthalate	na	C	IRIS	9/28/2010	
4-Chloroaniline	na	C (RAIS)	na	9/28/2010	

Table D-5. Cancer toxicity data (oral/dermal) for chemicals of potential concern

Chemical[a]	Oral Cancer Slope Factor (mg/kg-day)$^{-1}$	Cancer Description Guideline[b]	Source	Source Date[c]	Notes
Bis(2-chloroethoxy)methane	na	D	IRIS	9/28/2010	
Bis(2-chloroethyl)ether	1.1	B2	IRIS	9/28/2010	
1,2-Diphenylhydrazine	0.8	B2	IRIS	9/27/2010	
3,3'-Dichlorobenzidine	0.45	B2	IRIS	9/28/2010	
2,4-Dichlorophenol	na	na	na	na	
2,4-Dinitrophenol	na	na	na	na	
2,4-Dinitrotoluene	0.31	na	Cal EPA	5/2010	
2,6-Dinitrotoluene	0.68	B2	IRIS	9/28/2010	Surrogate = 2,4-/2,6-dinitrotoluene mixture
4,6-Dinitro-o-cresol	na	D (RAIS)	na	9/28/2010	
Hexachlorobenzene	1.6	B2	IRIS	9/28/2010	
Hexachlorobutadiene	0.08	C	IRIS	9/28/2010	
Hexachloroethane	0.01	C	IRIS	9/28/2010	
2-Nitroaniline	na	D (RAIS)	na	na	
4-Nitroaniline	0.02	C (RAIS)	PPRTV	8/2011	
Nitrobenzene	na	likely human carcinogen	IRIS	9/28/2010	
N-Nitroso-di-n-propylamine	7.0	B2	IRIS	8/15/2011	
N-Nitrosodimethylamine	51	B2	IRIS	9/28/2010	
N-Nitrosodiphenylamine	0.005	B2	IRIS	9/28/2010	
1,2,4-Trichlorobenzene	na	D	IRIS	9/27/2010	
2,4,6-Trichlorophenol	0.01	B2	IRIS	9/27/2010	
Toxaphene	1.1	B2	IRIS	9/28/2010	

[a] Chemicals included in this table are either Class A, B, or C chemicals with regard to their cancer-causing potential, with available cancer slope factors, or are Class D chemicals (see Footnote b). Cadmium and chromium, although known carcinogens, have been excluded from this table because they are carcinogens only via the inhalation pathway, which is not a pathway of concern for this HHRA.

[b] Classifications are as follows: A = known human carcinogen; B1 = probable human carcinogen (based on limited evidence of carcinogenicity in humans); B2 = probable human carcinogen (sufficient evidence in animals and inadequate or no evidence in humans); C = possible human carcinogen (limited evidence from animal studies and inadequate or no data in humans); D = not classifiable as to human carcinogenicity.

[c] For IRIS and PPRTV, the source date represents the date that the database was searched; for Cal EPA and HEAST, the source date represents the dates that the RSL tables (the sources of these values) was updated.

[d] Although HEAST has not been updated recently, the HEAST slope factor for 2,3,7.8-TCDD was used per EPA comments for consistency with the LDW HHRA (Windward 2007c). However, it should be noted that there is uncertainty associated with this value. Several alternate value slope factors are available for dioxins (e.g., EPA's past dioxin slope factor of 156,000 [mg/kg-day]$^{-1}$ or Cal EPA's slope factor of 130,000 [mg/kg-day]$^{-1}$), and EPA is currently in the process of completing a reassessment of the toxicity of dioxins (EPA 2012).

Table D-5. Cancer toxicity data (oral/dermal) for chemicals of potential concern

Chemical[a]	Oral Cancer Slope Factor (mg/kg-day)$^{-1}$	Cancer Description Guideline[b]	Source	Source Date[c]	Notes

BHC – benzene hexachloride
BEHP – bis(2-ethylhexyl) phthalate
Cal EPA – California Environmental Protection Agency
cPAH – carcinogenic PAH
DDD – dichlorodiphenyldichloroethane DDE – dichlorodiphenyldichloroethylene
DDT – dichlorodiphenyltrichloroethane
EPA – Environmental Protection Agency
HEAST – Health Effects Assessment Summary Tables
HHRA – human health risk assessment
IRIS – Integrated Risk Information System
LDW – Lower Duwamish Waterway
na – not applicable
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PPRTV – Provisional Peer-Reviewed Toxicity Values
RAIS – Risk Assessment Information System
SVOC – semivolatile organic compound
TCDD – tetrachlorodibenzo-*p*-dioxin
TEQ – toxic equivalent

Table D6. Estimated Excess Cancer Risks for the BHHRA Seafood Consumption Scenarios

	Estimated Excess Cancer Risk											
								Adult One Meal per Month				
COPC[a]	Adult Tribal RME (Tulalip Data)	Adult Tribal CT (Tulalip Data)	Child Tribal RME (Tulalip Data)	Child Tribal CT (Tulalip Data)	Adult Tribal (Suquamish Data)	Adult API RME	Adult API CT	Benthic Fish	Clam	Crab	Pelagic Fish, Rockfish	Pelagic Fish, Perch
Arsenic[b]	2×10^{-4}	1×10^{-5}	4×10^{-5}	4×10^{-6}	2×10^{-3}	8×10^{-5}	2×10^{-6}	3×10^{-7}[c]	1×10^{-5}	2×10^{-6}	7×10^{-7}	2×10^{-6}
cPAHs BaP-eq	1×10^{-5}	6×10^{-7}	1×10^{-5}	1×10^{-6}	1×10^{-4}	7×10^{-6}	1×10^{-7}	2×10^{-8}	1×10^{-6}	5×10^{-8}	1×10^{-8}	7×10^{-8}
1,4-Dichlorobenzene	1×10^{-6}[e]	7×10^{-8}[e]	2×10^{-7}[e]	3×10^{-8}[e]	7×10^{-6}[e]	4×10^{-7}[e]	8×10^{-9}[e]	4×10^{-8}[c]	4×10^{-8}[c]	4×10^{-8}[c]	4×10^{-8}[c]	2×10^{-7}[c]
Pentachlorophenol	2×10^{-6}[e]	4×10^{-8}[e]	4×10^{-7}[e]	2×10^{-8}[e]	2×10^{-5}[e]	3×10^{-7}	4×10^{-9}	1×10^{-8}[c]	4×10^{-8}	1×10^{-8}[c]	1×10^{-8}[c]	3×10^{-8}[c]
Total PCBs	1×10^{-3}	5×10^{-5}	2×10^{-4}	2×10^{-5}	9×10^{-3}	4×10^{-4}	7×10^{-6}	2×10^{-4}	6×10^{-6}	1×10^{-5}	4×10^{-4}	1×10^{-4}
PCBs (TEQ)[f]	7×10^{-4}	4×10^{-5}	1×10^{-4}	2×10^{-5}	6×10^{-3}	3×10^{-4}	8×10^{-6}	1×10^{-4}	5×10^{-6}	1×10^{-5}	3×10^{-4}	9×10^{-5}
Total DDTs	1×10^{-6}	9×10^{-8}	2×10^{-7}	4×10^{-8}	1×10^{-5}	6×10^{-7}	1×10^{-8}	2×10^{-7}	2×10^{-8}	2×10^{-8}[c]	5×10^{-7}	2×10^{-7}
alpha-BHC	4×10^{-6}[e]	2×10^{-7}[e]	7×10^{-7}[e]	1×10^{-7}[e]	2×10^{-5}[e]	9×10^{-7}[e]	3×10^{-8}[e]	1×10^{-7}[c]	1×10^{-7}[c]	1×10^{-7}[c]	2×10^{-7}	1×10^{-7}[c]
beta-BHC	1×10^{-6}[e]	7×10^{-8}[e]	2×10^{-7}[e]	3×10^{-8}[e]	7×10^{-6}[e]	3×10^{-7}[e]	8×10^{-9}[e]	4×10^{-8}[c]	4×10^{-8}[c]	3×10^{-8}[c]	4×10^{-8}[c]	3×10^{-8}[c]
Dieldrin	8×10^{-6}[e]	5×10^{-7}[e]	1×10^{-6}[e]	2×10^{-7}[e]	5×10^{-5}[e]	2×10^{-6}[e]	7×10^{-8}[e]	2×10^{-7}	3×10^{-7}[c]	3×10^{-7}[c]	4×10^{-7}	5×10^{-7}
Total chlordane	2×10^{-6}	9×10^{-8}	3×10^{-7}	4×10^{-8}	1×10^{-5}	7×10^{-7}	1×10^{-8}	4×10^{-8}	8×10^{-8}	2×10^{-8}[c]	1×10^{-7}	5×10^{-8}
Heptachlor	1×10^{-6}[e]	7×10^{-8}[e]	2×10^{-7}[e]	3×10^{-8}[e]	7×10^{-6}[e]	3×10^{-7}[e]	1×10^{-8}[e]	4×10^{-8}[c]	4×10^{-8}[c]	4×10^{-8}[c]	5×10^{-8}[c]	4×10^{-8}[c]
Heptachlor epoxide	2×10^{-6}[e]	2×10^{-7}[e]	4×10^{-7}[e]	7×10^{-8}[e]	1×10^{-5}[e]	7×10^{-7}[e]	2×10^{-8}[e]	9×10^{-8}[c]	9×10^{-8}[c]	9×10^{-8}[c]	1×10^{-7}	9×10^{-8}[c]
Mirex	4×10^{-6}[e]	3×10^{-7}[e]	8×10^{-7}[e]	1×10^{-7}[e]	3×10^{-5}[e]	1×10^{-6}[e]	4×10^{-8}[e]	2×10^{-7}[c]	2×10^{-7}[c]	2×10^{-7}[c]	4×10^{-7}	2×10^{-7}[c]
Dioxin/furan (TEQ)f	1×10^{-4}	6×10^{-6}	2×10^{-5}	3×10^{-6}	7×10^{-4}	4×10^{-5}	1×10^{-6}	5×10^{-6}	3×10^{-6}	3×10^{-6}	2×10^{-5}	9×10^{-6}
Total TEQ (dioxins/furans and coplanar PCBs)	8×10^{-4}	5×10^{-5}	1×10^{-4}	2×10^{-5}	7×10^{-3}	3×10^{-4}	9×10^{-6}	1×10^{-4}	8×10^{-6}	1×10^{-5}	3×10^{-4}	1×10^{-4}
Total excess cancer risk (excluding PCB TEQ)[g]	1×10^{-3}	7×10^{-5}	3×10^{-4}	3×10^{-5}	1×10^{-2}	5×10^{-4}	1×10^{-5}	2×10^{-4}	2×10^{-5}	2×10^{-5}	4×10^{-4}	1×10^{-4}
Total excess cancer risk (excluding total PCBs)[h]	1×10^{-3}	6×10^{-5}	2×10^{-4}	3×10^{-5}	9×10^{-3}	4×10^{-4}	1×10^{-5}	1×10^{-4}	2×10^{-5}	2×10^{-5}	3×10^{-4}	1×10^{-4}

Notes:

a. Only those COPCs with an excess cancer risk greater than 1×10^{-6} for one or more scenarios are included in this table.
b. Arsenic exposure point concentrations and risk estimates are based on inorganic arsenic.
c. There were no detected values of this COPC for this seafood category. Risk estimate was based on one-half the maximum RL.
d. Greater than 50 percent of the risk associated with this COPC was derived from seafood categories with no detected values.

Table D6. Estimated Excess Cancer Risks for the BHHRA Seafood Consumption Scenarios

	Estimated Excess Cancer Risk											
								Adult One Meal per Month				
COPC[a]	Adult Tribal RME (Tulalip Data)	Adult Tribal CT (Tulalip Data)	Child Tribal RME (Tulalip Data)	Child Tribal CT (Tulalip Data)	Adult Tribal (Suquamish Data)	Adult API RME	Adult API CT	Benthic Fish	Clam	Crab	Pelagic Fish, Rockfish	Pelagic Fish, Perch

e. No mussel data were available for this COPC. When the CDI and risk values were calculated, the portion of seafood consumption that had been assigned to mussels was divided proportionally among the remaining consumption categories.
f. Total risk values include the risks associated with all COPCs. Total PCBs is included in the total, and total PCBs TEQ is not included to avoid double-counting risks due to PCBs.
g. Total risk values include the risks associated with all COPCs. Total PCBs TEQ is included in the total, and total PCBs not included to avoid double-counting risks due to PCBs.

API – Asian and Pacific Islander
BHC – benzene hexachloride
CDI – chronic daily intake
COPC – contaminant of potential concern
cPAH – carcinogenic polycyclic aromatic hydrocarbon
CT – central tendency
DDT – dichlorodiphenyltrichloroethane
EPA – U.S. Environmental Protection Agency
FS – Feasibility Study
BHHRA – human health risk assessment
PCB – polychlorinated biphenyl
RL – reporting limit
RME – reasonable maximum exposure
TEQ – toxic equivalent

Table D7. Estimated Non-cancer Hazards for the BHHRA Seafood Consumption Scenarios

COPC[a]	Estimated Excess Non-Cancer Hazard											
	Adult Tribal RME (Tulalip Data)	Adult Tribal CT (Tulalip Data)	Child Tribal RME (Tulalip Data)	Child Tribal CT (Tulalip Data)	Adult Tribal (Suquamish Data)	Adult API RME	Adult API CT	Adult One Meal per Month				
								Benthic Fish	Clam	Crab	Pelagic Fish, Rockfish	Pelagic Fish, Perch
Arsenic[b]	0.4	0.05	0.9	0.1	4	0.4	0.03	0.002	0.08	0.01	0.004	0.009
Cadmium	0.7	0.08	2	0.2	2	0.4	0.03	0.01	0.01	0.09	0.004	0.004
Cobalt	0.6	0.07	1	0.2	4	0.5	0.04	0.01	0.07	0.05	0.02	0.02
Mercury	0.6	0.07	1	0.2	3	0.4	0.04	0.05	0.02	0.09	0.2	0.04
TBT as ion	0.3	0.03	0.7	0.07	4	0.4	0.03	0.007	0.05	0.003	0.2	0.04
Total PCBs[c]	27	3	58	6	214	24	1	13	0.4	0.8	21	8
Total PCBs[d]	8	0.8	17	2	61	7	0.4	4	0.1	0.2	6	2
PCB TEQ[e]	7	0.9	14	2	58	7	0.6	2	0.1	0.3	6	2
Dioxin/furan TEQ[e]	1	0.1	2	0.3	7	0.9	0.07	0.1	0.06	0.07	0.4	0.2
HI by Endpoint:												
Hematological [f]	0.3	0.05	0.8	0.1	2	0.2	0.02	0.01	0.02	0.04	0.03	0.02
Immunological [g]	27	3	59	6	218	24	1	13	0.5	0.8	21	8
Kidney [h]	0.8	0.1	2	0.2	3	0.5	0.04	0.02	0.02	0.1	0.01	0.01
Liver [i]	0.06	0.008	0.1	0.02	0.3	0.04	0.003	0.007	0.006	0.004	0.01	0.008
Neurological [j]	28	3	59	6	218	25	1	13	0.4	0.9	21	8
Endocrine [k]	0.6	0.08	1	0.2	4	0.5	0.04	0.01	0.08	0.05	0.02	0.02
Integumentary [l]	28	3	59	6	219	25	1	13	0.5	0.8	21	8
Digestive system [m]	0.5	0.06	1	0.1	2	0.3	0.03	0.005	0.04	0.04	0.02	0.02
Developmental [n]	10	1	20	3	72	8	0.7	4	0.2	0.5	7	2

Notes:

a. Only those COPCs with HQs greater than 1 for one or more scenarios are included in this table.
b. Arsenic exposure point concentrations and risk estimates are based on inorganic arsenic.
c. HQ used for the calculation of the immunological, integumentary, and neurological endpoint HIs (Table B.4-1 of the BHHRA, Windward, 2012b).
d. HQ used for the calculation of the developmental endpoint HI (Table B.4-1 of the HHRA; Windward, 2012b).
e. HQs for PCB and dioxin/furan TEQs were not presented in the EW BHHRA because no RfD was available to calculate these values. The recently released RfD for 2,3,7,8-TCDD has since been used to calculate the HQs presented in this table. Additional information regarding these new HQs are presented in Attachment 7 to the BHHRA (Appendix B of the SRI; Windward and Anchor QEA, 2014).
f. Hematological endpoint includes the following chemicals: antimony, selenium, and zinc.
g. Immunological endpoint includes the following chemicals: dibutyltin, total PCBs, and TBT.
h. Kidney endpoint includes the following chemicals: cadmium, molybdenum, and pentachlorophenol.
i. Liver endpoint includes the following chemicals: 1,4-dichlorobenzene, alpha-BHC, total chlordane, total DDTs, dieldrin, heptachlor, heptachlor epoxide, mirex, and pentachlorophenol.

Table D7. Estimated Non-cancer Hazards for the BHHRA Seafood Consumption Scenarios

	Estimated Excess Non-Cancer Hazard											
								Adult One Meal per Month				
COPC[a]	Adult Tribal RME (Tulalip Data)	Adult Tribal CT (Tulalip Data)	Child Tribal RME (Tulalip Data)	Child Tribal CT (Tulalip Data)	Adult Tribal (Suquamish Data)	Adult API RME	Adult API CT	Benthic Fish	Clam	Crab	Pelagic Fish, Rockfish	Pelagic Fish, Perch

j. Neurological endpoint includes the following chemicals: mercury, total PCBs, and selenium. Neurological effects associated with exposure to lead are discussed in the BHHRA, Section B.5.4 (Windward 2012b).

k. Endocrine endpoint includes the following chemicals: antimony and cobalt.

l. Integumentary endpoint includes the following chemicals: arsenic, total PCBs, selenium, and vanadium.

m. Digestive system endpoint includes the following chemicals: chromium and copper.

n. Developmental endpoint includes the following chemicals: mercury, PCBs (the higher of either the total PCB HQ based on the developmental RfD or the PCB TEQ HQ), and dioxin/furan TEQ

API – Asian and Pacific Islander
BHC – benzene hexachloride
COPC – contaminant of potential concern
CT – central tendency
DDT – dichlorodiphenyltrichloroethane
BHHRA – human health risk assessment
HI – hazard index
HQ – hazard quotient
PCB – polychlorinated biphenyl
RfD – reference dose
RME – reasonable maximum exposure
SRI – Supplemental Remedial Investigation
TBT – tributyltin
TEQ – toxic equivalent

Table D8. Estimated Excess Cancer Risks for the BHHRA Direct Sediment Exposure Scenarios

COPC	Estimated Excess Cancer Risk					
	Netfishing		Habitat Restoration Worker	Clamming		
	RME	CT		Tribal RME	Tribal – 183 Days per Year	7 Days per Year
Arsenic	3×10^{-6}	7×10^{-7}	5×10^{-7}	1×10^{-5}	2×10^{-5}	4×10^{-7}
cPAHs	3×10^{-7}	2×10^{-8}	1×10^{-7}	2×10^{-6}	3×10^{-6}	8×10^{-8}
Total PCBs	6×10^{-7}	6×10^{-8}	2×10^{-7}	3×10^{-6}	6×10^{-6}	1×10^{-7}
PCBs (TEQ)	3×10^{-7}	4×10^{-8}	5×10^{-8}	1×10^{-6}	2×10^{-6}	3×10^{-8}
Dioxin/furan (TEQ)	6×10^{-7}	1×10^{-7}	NA	1×10^{-6}	2×10^{-6}	4×10^{-8}
Total TEQ excess cancer risk for dioxins/furans and coplanar PCBs	9×10^{-7}	1×10^{-7}	NA	2×10^{-6}	4×10^{-6}	7×10^{-8}
Total excess cancer risk (excluding PCB TEQ)[a]	5×10^{-6}	9×10^{-7}	8×10^{-7}	2×10^{-5}	3×10^{-5}	6×10^{-7}
Total excess cancer risk (excluding total PCBs)[a]	4×10^{-6}	9×10^{-7}	7×10^{-7}	1×10^{-5}	3×10^{-5}	6×10^{-7}

Notes:

a. Total risk values include the risks associated with all COPCs. However, only those COPCs with excess cancer risks greater than 1×10^{-6} for at least one scenario are listed in this table.

COPC – contaminant of potential concern
cPAH – carcinogenic polycyclic aromatic hydrocarbon
CT – central tendency
NA – not applicable (not a COPC)
PCB – polychlorinated biphenyl
RME – reasonable maximum exposure
TEQ – toxic equivalent

Table D9. Contaminants of Concern and Primary COCs for Human Health Risk Assessment

COC	Maximum Risk Estimate: Cancer	Maximum Risk Estimate: Hazard Quotient	Rationale	Primary COC
Seafood Consumption Pathway				
Arsenic	2 x10^{-4}	0.9	Cancer risks s greater than upper threshold (10^{-4}) for cancer risk; however concentrations similar to or lower than samples from background areas.	No
Cadmium	na[a]	2	HQ equal to 2 for child non-cancer risk; minor contributor to non-cancer risk.	No
Total PCBs	1 x 10^{-3}	17	Cancer risks greater than the upper end of EPA's acceptable risk range (1 × 10^{-4}); 55 to 70 percent of total cancer risk; non-cancer risk >1; high detection frequency (98 percent)	Yes
Pentachlorophenol	2 x 10^{-6}	na	Cancer risks slightly greater than 1 × 10^{-6} threshold for one of three RME scenarios; contribution to the total excess cancer risk was <1 percent; COC was detected in less than 4 percent of EW OU samples	No
Alpha-BHC	4 x 10^{-6}	na	Cancer risks for each pesticide less than 1 × 10^{-5}, and each COC contributed less than 1 percent to the total excess cancer risk (combined contribution was less than 1.5 percent of the total)	No
Dieldrin	8 x 10^{-6}	na		No
Total chlordane	2 x 10^{-6}	na		No
Heptachlor	1 x 10^{-6}	na		No
Heptachlor epoxide	2 x 10^{-6}	na		No
Mirex	4 x 10^{-6}	na		No
cPAH as BaP-eq	1 x 10^{-5}	0.1	Cancer risks greater than 10^{-6} threshold; represents 5 percent of child cancer risk; high detection frequency in tissue (71 percent)	Yes
Dioxin/Furans	1 x 10^{-4}	2	Cancer risks equal to the upper end of EPA's acceptable risk range (1 × 10^{-4}); high detection frequency (100 percent)	Yes
Direct Sediment Exposure				
Arsenic	2 x 10^{-5}	0.01	Cancer risks greater than the 10^{-6} threshold, 29 percent to 43 percent contribution to the total risk, high detection frequency (70 percent)	Yes
cPAH as BaP-eq	2 x 10^{-6}	na	Cancer risks slightly greater than 10^{-6} threshold for clamming: risk for netfishing <10^{-6}	No
Total PCBs	6 x 10^{-7}	0.03	Cancer risks were only slightly greater than the 1 × 10^{-6} threshold and had a relatively low contribution to the total risk (8 to 9 percent)	No
PCB TEQ	3 x 10^{-7}	na	Cancer risks were only slightly greater than the 1 × 10^{-6} threshold and had a relatively low contribution to the total risk (6 to 13 percent)	No

Notes:
COC – contaminant of concern
PCB – polychlorinated biphenyl
an: not applicable
cPAH – carcinogenic polycyclic aromatic hydrocarbon
RME – reasonable maximum exposur
HQ – hazard quotient
TEQ – toxic equivalent

Table D10. COPCs Identified for BERA Receptors

Receptor	Evaluation Type	COPCs
Benthic invertebrate community	sediment	29 chemicals, including metals, PAHs, total PCBs, phthalates, other SVOCs, total DDTs[a]
	tissue residue	TBT, total PCBs
	surface water	cadmium, mercury, TBT
	porewater	naphthalene
Crab	tissue residue	arsenic, cadmium, copper, zinc, total PCBs
	surface water	cadmium, mercury, TBT
Fish	dietary	arsenic, cadmium, chromium, copper, vanadium, benzo[*a*]pyrene
	tissue residue	beta-endosulfan, total PCBs, TBT
	surface water	cadmium, mercury, TBT
Birds	dietary dose	mercury, total PCBs, PCB TEQ
Mammals	dietary dose	mercury, selenium, total PCBs, PCB TEQ

Notes:

a: The 29 COPCs were arsenic, cadmium, mercury, zinc, acenaphthene, benzo[*a*]anthracene, benzo[*a*]pyrene, benzo[*g,h,i*]perylene, chrysene, dibenzo[*a,h*]anthracene, fluoranthene, fluorene, indeno[1,2,3,-*c,d*]pyrene, phenanthrene, pyrene, total benzofluoranthenes, HPAH, LPAH, BEHP, BBP, di-n-butyl phthalate, 1,4-dichlorobenzene, 2-methylnaphthalene, 2,4-dimethylphenol, dibenzofuran, N-nitrosodiphenylamine, phenol, total PCBs, and total DDTs. All COPCs had exceedances of SMS chemical criteria except total DDTs, which was based on exceedances of the DMMP guideline.

BBP – butyl benzyl phthalate
BERA – baseline ecological risk assessment
BEHP – bis(2-ethylhexyl) phthalate
COPC – contaminant of potential concern
DDT – dichlorodiphenyltrichloroethane
DMMP – Dredge Material Management Program
HPAH – high-molecular-weight polycyclic aromatic hydrocarbon
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
SMS – Washington State Sediment Management Standards
TBT – tributyltin
TEQ – toxic equivalent

Table D11. Receptors of Concern Selected for the EW and Summary of Rationale for Selection

Receptors of Concern	Ecological Significance	Societal Significance	Site Use	Sensitivity
Benthic invertebrate community	food source for other invertebrates, fish, birds, and mammals; nutrient cycling; sediment oxygenation	valued as food source to other species of high societal value	present year-round; multiple life stages, diverse phyla	range of contaminant sensitivities represented
Cancrid crab	higher-trophic-level benthic invertebrate; food for other invertebrates, fish, birds, and mammals	recreational and commercial value	multiple life stages (gravid females, juveniles)	effects data available for decapods; sensitivity relative to other decapods unknown
Brown rockfish	higher-trophic-level fish; important prey item for fish, birds, and mammals	some commercial (though not in EW) and recreational value	adults and juveniles present year-round; may spawn in the EW	effects data available for other fish species; relative sensitivity of brown rockfish unknown; potential for elevated exposure via bioaccumulation because of trophic position; long-lived
English sole	important prey item for fish, birds and mammals; key benthic invertebrate predator	some commercial and recreational value (though not in EW)	juveniles present year-round; adults present except during spawning migration to Puget Sound	NMFS data suggest they are as sensitive as other flatfish species
Juvenile Chinook salmon	important prey item for fish, birds and mammals; seasonally one of the most abundant juvenile salmonids in the EW	T&E species; returning adults important to tribal, commercial, and sport fisheries	generally present April to July; individuals likely present in EW for a few days to couple of weeks; most estuary-dependent juvenile salmonid	sensitive to a wide range of contaminants
Osprey	high trophic level	highly valued and well-studied bird of prey; protected under the Migratory Bird Treaty Act	nests along the EW and likely forages in the EW	effects data available for other bird species; relative sensitivity of osprey unknown; potential for elevated exposure via bioaccumulation because of trophic position
Pigeon guillemot	high trophic level	valued in general as wildlife species; protected under the Migratory Bird Treaty Act	nests observed along the EW	effects data available for other bird species; relative sensitivity of pigeon guillemot unknown; potential for elevated exposure via bioaccumulation because of trophic position

Table D11. Receptors of Concern Selected for the EW and Summary of Rationale for Selection

Receptors of Concern	Ecological Significance	Societal Significance	Site Use	Sensitivity
River otter	high trophic level	highly valued by society	limited data, although anecdotal information indicates year-round presence of a river otter family on Kellogg Island	mink are sensitive to some contaminants, such as PCBs, although the relative sensitivity of river otter is unknown; potential for elevated exposure via bioaccumulation because of trophic position
Harbor Seal	High trophic level	protected under Marine Mammal Protection Act	occasional use based on a survey in the EW	Seals suspected to be sensitive to some contaminants; the relative sensitivity of harbor seal is unknown; elevated exposure due to trophic position

Notes:
EW – East Waterway
NMFS – National Marine Fisheries Service
PCB – polychlorinated biphenyl
T&E – threatened and endangered

Table D12. Lines of Evidence and Methods of Risk Evaluation for the Selected Ecological Receptors of Concern

Receptor of Concern	Assessment Endpoint	Line of Evidence		
		Measure of Exposure	**Measure of Effect**	**Method of Evaluation**
Benthic Invertebrates				
Benthic invertebrate community[a]	Maintenance of the benthic invertebrate community in EW sediment	Contaminant concentrations in surface sediment	Washington State SMS and toxicity-based regional guidelines (where no standards are available)	Compare measured contaminant concentrations in sediment with SMS or DMMP guidelines
			Site-specific sediment toxicity tests (survival, development, and growth) relative to reference area sediment toxicity tests	Compare 10-day amphipod survival in site sediment with amphipod survival in reference area sediment
				Compare 48-hour echinoderm embryo or bivalve larvae normal survival in site sediment elutriates with normal embryo/larval survival in reference area sediment
				Compare 20-day polychaete growth in site sediment with polychaete growth in reference area sediment
		VOC concentrations in porewater	WQC or other water TRVs based on survival and growth	Compare contaminant concentrations in porewater with WQC or other relevant TRVs
		PCB, mercury, and TBT concentrations in benthic invertebrate tissue (field-collected)	Tissue-residue TRVs based on survival, growth, and reproduction	Compare measured tissue burdens with tissue-residue TRV
		Contaminant concentrations in surface water	WQC or other water TRVs based on survival, growth, and reproduction	Compare contaminant concentrations in surface water with WQC or other relevant TRVs
Cancer crab	Maintenance of crab populations in the EW	Concentrations of contaminants in cancer crab whole-body tissue	Tissue-residue TRVs based survival, growth, and reproduction	Compare contaminant concentrations measured in tissue with tissue-residue-based TRVs for crab or other decapods
		Contaminant concentrations in surface water	WQC or other water TRVs based on survival, growth, and reproduction	Compare contaminant concentrations in surface water with WQC or other relevant TRVs

Table D12. Lines of Evidence and Methods of Risk Evaluation for the Selected Ecological Receptors of Concern

Receptor of Concern	Assessment Endpoint	Line of Evidence		
		Measure of Exposure	**Measure of Effect**	**Method of Evaluation**
Juvenile Chinook salmon	Survival and growth of individual juvenile anadromous salmon in the EW	Contaminant concentrations in juvenile Chinook salmon whole-body tissue	Tissue-residue TRVs based on survival and growth	Compare contaminant concentrations in juvenile Chinook tissue with fish tissue-residue TRVs
		Contaminant concentrations in prey (benthic invertebrate) tissue	Dietary prey tissue TRVs based on survival and growth	Compare contaminant concentrations in juvenile Chinook salmon prey and juvenile Chinook salmon stomach contents with diet-based prey tissue TRVs for fish
		Contaminant concentrations in juvenile Chinook salmon stomach contents		
		Contaminant concentrations in surface water	WQC or other water TRVs based on survival and growth	Compare contaminant concentrations in surface water with WQC or other relevant TRVs
English sole	Maintenance of benthivorous and planktivorous fish populations in the EW	Contaminant concentrations in English sole whole-body tissue	Tissue-residue TRVs based on survival, growth, and reproduction	Compare contaminant concentrations in English sole tissue with fish tissue-residue TRVs
		Contaminant concentrations in prey (benthic invertebrate) tissue and surface sediment	Dietary prey tissue TRVs based on survival, growth, and reproduction	Compare contaminant concentrations in English sole prey and incidentally ingested surface sediment collected throughout the EW with diet-based prey tissue TRVs for fish
		Contaminant concentrations in surface water	WQC or other water TRVs based on survival, growth, and reproduction	Compare contaminant concentrations in surface water with WQC or other relevant TRVs
Brown rockfish	Maintenance of upper- trophic-level fish populations in the EW	Contaminant concentrations in brown rockfish whole-body tissue	Tissue-residue TRVs based on survival, growth, and reproduction	Compare contaminant concentrations in brown rockfish tissue with tissue-residue TRVs for fish
		Contaminant concentrations in prey tissue (benthic invertebrate, shrimp, juvenile Chinook salmon, shiner surfperch) and surface sediment	Dietary prey tissue TRVs based on survival, growth, and reproduction	Compare contaminant concentrations in brown rockfish prey and incidentally ingested surface sediment collected throughout the EW with diet-based prey tissue TRVs for fish
		Contaminant concentrations in surface water	WQC or other water TRVs based on survival, growth, and reproduction	Compare contaminant concentrations in surface water with WQC or other relevant TRVs

Table D12. Lines of Evidence and Methods of Risk Evaluation for the Selected Ecological Receptors of Concern

Receptor of Concern	Assessment Endpoint	Line of Evidence		
		Measure of Exposure	Measure of Effect	Method of Evaluation
Wildlife				
Osprey	Maintenance of piscivorous bird populations in the EW	Contaminant concentrations in prey fish tissue and surface water	Dietary TRVs based on survival, growth, and reproduction of birds	Compare dietary dose calculated from contaminant concentrations in fish, surface water, and incidentally ingested sediment with dietary dose-based TRVs for birds
Pigeon guillemot	Maintenance of piscivorous/ benthivorous bird populations in the EW	Contaminant concentrations in prey (fish tissue, shrimp, crab, and mussels), surface sediment, and surface water	Dietary TRVs based on survival, growth, and reproduction of birds	Compare dietary dose calculated from contaminant concentrations in fish, invertebrates, incidentally ingested surface sediment, and surface water with dietary dose-based TRVs for birds
River otter	Maintenance of piscivorous semi-aquatic mammal populations in the EW	Contaminant concentrations in prey (fish tissue, clams, crab, and mussels), surface sediment, and surface water	Dietary TRVs based on survival, growth, and reproduction of mammals	Compare dietary dose calculated from contaminant concentrations in fish, invertebrates, incidentally ingested surface sediment, and surface water with dietary dose-based TRVs for mammals
Harbor seal	Maintenance of piscivorous marine mammal populations in the EW	Contaminant concentrations in prey fish tissue, surface sediment, and surface water	Dietary TRVs based on survival, growth, and reproduction of mammals	Compare dietary dose calculated from contaminant concentrations in fish, incidentally ingested surface sediment, and surface water with dietary dose-based TRVs for mammals

Notes:

a. The benthic invertebrate community consists of both infaunal invertebrates (those that live within the sediment, including clams) and epifaunal invertebrates (those that live on the sediment surface).

DMMP – Dredge Material Management Program
EW – East Waterway
PCB – polychlorinated biphenyl
ROC – receptor of concern
SMS – Washington State Sediment Management Standards
TBT – tributyltin
TRV – toxicity reference value
VOC – volatile organic compound
WQC – water quality criteria

Table D13. Biological effects criteria for marine sediment toxicity tests.

Toxicity Test	Biological Effects Criteria	
	SCO	CSL
Amphipod	Mean mortality is > 25% on an absolute basis and statistically different from the reference sediment ($p \leq 0.05$)	Mean mortality greater than the response in the reference sediment plus 30 percent and statistically different from the reference sediment ($p \leq 0.05$)
Bivalve larvae	Mean normal survivorship[a] < 85 percent of that of the reference sediment and statistically different ($p \leq 0.10$)	Mean normal survivorship[a] < 70 percent of that of the reference sediment and statistically different ($p \leq 0.10$)
Polychaete[b]	Mean individual growth rate < 70 percent of that of the reference sediment and statistically different ($p \leq 0.05$)	Mean individual growth rate < 50 percent of that of the reference sediment and statistically different ($p \leq 0.05$)

Notes:

a. Mean normal survivorship is a combined measure of mortality and abnormality (i.e., the number of normal larvae relative to the initial number of organisms).

b. The mortality endpoint for the polychaete toxicity test is not used for the determination of SMS compliance.

SCO – sediment cleanup objective
CSL – cleanup screening level

Table D14 Summary of COCs and Selection of Primary COCs for Benthic Invertebrates Based on Surface Sediment Exposure

COC	SMS Values			No. of Detected Concentrations in Surface Sediments		Primary COC
	Units	SQS	CSL	> SQS ≤ CSL	> CSL	
Arsenic	mg/kg	57	93	0	3	Yes
Cadmium		5.1	6.7	1	1	Yes
Mercury		0.41	0.59	41	10	Yes
Zinc		410	960	4	2	Yes
Acenaphthene	mg/kg OC	16	57	11	13	Yes
Anthracene		220	1,200	5	2	Yes
Benzo[*a*]anthracene		110	270	7	7	Yes
Benzo[*a*]pyrene		99	210	7	8	Yes
Benzo[*g,h,i*]perylene		31	78	7	8	Yes
Total benzofluoranthenes		230	450	9	3	Yes
Chrysene		110	460	9	6	Yes
Dibenzo[*a,h*]anthracene		12	33	15	7	Yes
Dibenzofuran		15	58	10	9	Yes
Fluoranthene		160	1,200	14	9	Yes
Fluorene		23	79	2	5	Yes
Indeno[1,2,3-*cd*]pyrene		34	88	10	7	Yes
2-Methylnaphthalene		38	64	0	3	Yes
Phenanthrene		100	480	6	9	Yes
Pyrene		1,000	1,400	0	3	Yes
Total HPAH		960	5,300	11	13	Yes
Total LPAH		370	780	5	2	Yes
Bis(2-ethylhexyl) phthalate	mg/kg OC	47	78	4	5	Yes
Butyl benzyl phthalate		4.9	64	16	0	Yes
Di-n-butyl phthalate		220	1,700	0	1	Yes
1,4-Dichlorobenzene	mg/kg OC	3.1	9	21	9	Yes
2,4-Dimethylphenol	µg/kg	29	29	0	9	Yes
N-Nitrosodiphenylamine	mg/kg OC	11	11	0	3	Yes
Phenol	µg/kg	420	1,200	5	0	Yes
Total PCBs	mg/kg OC	12	65	137	23	Yes
Total DDTs	µg/kg	6.9[a]	69[a]	2	0	No

Notes:

a. This table is derived from Table A.6-1 of the BERA (Windward, 2012a), updated with 8 surface sediment samples from Slip 36 (see Section 2.10).

b. No SQS or CSL values are available for total DDTs. Thus, the comparison is with the DMMP SL and ML.

µg/kg – micrograms per kilogram
COC – contaminant of concern
CSL – cleanup screening level
DDT – dichlorodiphenyltrichloroethane
DMMP – Dredged Material Management Program
dw – dry weight
HPAH – high-molecular-weight polycyclic aromatic hydrocarbon
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
mg/kg – milligrams per kilogram
ML – maximum level
OC – organic carbon
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
RI – remedial investigation
SL – screening level
SMS – Washington State Sediment Management Standards
SQS – sediment quality standard
SVOC – semi-volatile organic compound

Table D15. Summary of COCs and Selection of Primary COCs for Ecological Receptors[a]

Receptor of Concern – Type of Evaluation	COC[b]	LOAEL-based HQ	Primary COC	Rationale for Selection or Exclusion as Primary COC
Benthic invertebrate community – tissue	TBT	3.3	Yes	LOAEL-based HQs greater than 1.0 in two areas of the EW; low uncertainty in exposure data
Benthic invertebrate community – surface water	TBT	1.4	No	High uncertainty in surface water dataset; only one detected value; low LOAEL-based HQ
Benthic invertebrate community – porewater	Naphthalene	6	No	High uncertainty in effects data; only one porewater sample had a concentration exceeding the low- effect HQ; naphthalene did not exceed the SMS in any sediment samples
Crab – tissue	Cadmium	1.4	No	Three COCs identified for crab were not selected as primary COCs because site sediment concentrations were similar to PSAMP rural Puget Sound concentrations (cadmium and copper) and because of uncertainties in the effects data for all three COCs, including the lack of toxicity data for crabs
	Copper	1.1	No	
	Zinc	1.5	No	
English sole – tissue	Total PCBs	1.6 – 7.9[c]	Yes	HQ based on higher LOAEL TRV, which was associated with significant effects, was >1.0; low uncertainty in exposure data
Brown rockfish – tissue	Total PCBs	2.3 – 12[c]	Yes	
	TBT	1.4	No	High uncertainty in toxicity dataset; exposure concentration representing the population of rockfish did not exceed LOAEL; low LOAEL-based HQ
Juvenile Chinook salmon – diet	Cadmium	1.0	No	Three dietary COCs for fish were not selected as primary COCs because the site sediment concentrations were similar to PSAMP rural Puget Sound concentrations and because of uncertainties in exposure or effects data
English sole – diet	Cadmium	2.4	No	
	Vanadium	1.9	No	
Brown rockfish – diet	Cadmium	2.5	No	

Notes:

a. No COCs were identified for birds and mammals. Benthic primary COCs are presented separately in the text below.

b. A contaminant was identified as a COC if the LOAEL-based HQ was greater than or equal to 1.0; however, for juvenile Chinook salmon, NOAEL-based HQs were used because it is a listed species.

c. HQs were calculated from a range of effects concentrations because of uncertainty in the TRVs.

COC – contaminant of concern
HQ – hazard quotient
LOAEL – lowest-observed-adverse-effect level
NOAEL – no-observed-adverse-effect level
PCB – polychlorinated biphenyl
PSAMP – Puget Sound Ambient Monitoring Program
RI – remedial investigation
TBT – tributyltin

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Part 3 – Responsiveness Summary

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Table of Contents

Section 1 Introduction

This Responsiveness Summary provides a summary of the significant comments submitted by the public on the U.S. Environmental Protection Agency's (EPA's) April 2023 Proposed Plan for the East Waterway Operable Unit (EW OU) of the Harbor Island Superfund Site, and EPA's responses to those comments. This Responsiveness Summary is required by the Comprehensive Environmental Response, Compensation, and Livability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 40 C.F.R. § 300.430(f)(3)(F). All comments summarized in this document have been considered in EPA's selection of the interim remedy to address the contamination in the EW OU.

EPA has worked closely with federally recognized Tribes, community members, and other stakeholders throughout the development of the Remedial Investigation (RI), Feasibility Study (FS), and Proposed Plan for the EW OU. Community participation played an essential role in the development of the Proposed Plan and interim Record of Decision (interim ROD) for the EW OU.

EPA published a notice of availability of the Proposed Plan and Administrative Record in the Seattle Times on April 20, 2023, at which time the Proposed Plan was posted on a publicly accessible link on EPA's website. Public notices of the availability of the Proposed Plan and Administrative Record were also placed in El Siete Dias (translated into Spanish), the Georgetown Gazette, the South Seattle Emerald, the West Seattle Blog, and the Vietnamese Today Weekly News (translated into Vietnamese). A radio ad in Spanish was run on both Amigos de Seattle and El Rey 1360.

An initial sixty-day public comment period was provided from April 28 through June 27, 2023, during which public comments were accepted on the alternatives presented in the Proposed Plan, including EPA's preferred alternative. Upon request, EPA granted a 45-day extension of the comment period through August 11, 2023. Two public meetings were held during the public comment period: a virtual public meeting on May 25, 2023, and an in-person public meeting on June 3, 2023. Written and oral comments were received during the public meetings. All written and oral comments received during the comment period have been included in the Administrative Record.

1.1 Activities Before Issuing the Proposed Plan

Tribal Consultation

The East Waterway is within the usual and accustomed fishing areas for the Muckleshoot Indian Tribe, the Suquamish Tribe, and the Yakama Nation. The Suquamish Tribe actively manages aquatic resources north of the Spokane Street Bridge, within the East Waterway Operable Unit. EPA met regularly with tribal technical staff, and shared draft documents with them for review and feedback throughout the development of the RI, FS, Proposed Plan. Prior to the release of the Proposed Plan, EPA offered formal government to government consultation to all three Tribes from December 12, 2022 – January 10, 2023. Letters were sent to each Tribe. No request for formal government to government consultation was made from any of the three tribes.

Community Involvement

In advance of the release of the East Waterway Proposed Plan, EPA conducted a Harbor Island 101 webinar in February 2023 where an overview of the Harbor Island Superfund Site was provided, including information on the upcoming public comment period. This webinar was pre-recorded in Spanish, Vietnamese, and Khmer.

Prior to the release of the East Waterway Proposed Plan, EPA initiated an update to the Harbor Island Community Involvement Plan (CIP). The CIP provides an overview of the outreach tools and techniques that EPA will use throughout the cleanup of the Site, including the EW OU, and also serves as a guide for meaningfully involving community members in the cleanup. In 2022, EPA conducted over 90 interviews with community members to guide an update of the CIP and issued a draft updated CIP for public feedback in January 2023. The updated CIP is planned to be released in late Spring or Summer 2024.

Activities After Issuing the Proposed Plan

A notice of the availability of the Proposed Plan was published on April 20, 2023 in the Seattle Times, El Siete Dias (translated into Spanish), the Georgetown Gazette, the South Seattle Emerald, the West Seattle Blog, and the Vietnamese Today Weekly News (translated into Vietnamese). A radio ad in Spanish was run in both Amigos de Seattle and El Rey 1360.

EPA provided the option for informal information sessions (between April 21 – April 27) for community members in advance of the public comment period for the Proposed Plan, The Duwamish River Community Coalition, the Community Health Advocates, and the East Waterway Group were the only community members to request these sessions. During the sessions, EPA provided a general overview of the preferred alternative and the public comment process and answered questions about the Proposed Plan. EPA did not accept formal comments during these sessions.

Two public meetings were held during the public comment period: a virtual public meeting on May 25, 2023, and an in-person public meeting on June 3, 2023. A fact sheet, presentation materials (also shared at the public meetings), and pre-recorded videos of the presentation content were also shared in English, Spanish, Vietnamese, and Khmer. EPA also attended four availability sessions during the public comment period to provide a brief overview of the Proposed Plan and answer questions. Only written public comments were to be accepted at these availability sessions, but none were received.

Section 2 Public Comments and Responses

This section provides summaries of significant comments received during the public comment period and EPA's responses. A total of 228 individual comment submissions were received by mail, email, submission of written comments at public meetings, and submission of oral comment at public meetings (stenographer's transcript). Many comments were form submissions that were part of mailing or email campaigns. Any comments that were received in another language (oral or written) were translated. Names of individuals who submitted comments were recorded and tracked but are not available to the public due to EPA's Privacy Policy and commitment to protect personally identifiable information. Names of businesses, organizations, and government entities submitting comments are listed below:

Businesses and Potentially Responsible Parties

AgTC Agriculture Transportation Coalition
The Boeing Company
Comeback Farm Organic Produce
The General Electric Company
The Northwest Seaport Alliance
Puget Sound Pilots
SBS Transportation
Seattle Iron and Metals Corporation
Seattle Iron and Metals Corporation
SSA Terminals, LLC
Washington State Hay Growers Association
Washington State Potato Commission

Tribes

Suquamish Indian Tribe

State and Other Government Entities

Washington Department of Fish and Wildlife
Washington State Department of Ecology
Washington State Department of Health
U.S. Army Corps of Engineers
City of Seattle
King County
Port of Seattle

Groups and Organizations

Adopt A Stream Foundation
Duwamishhistory.com
Duwamish River Community Coalition
Duwamish Valley Safe Streets
Duwamish Tribe Cultural Preservation
International Longshoremen's and Warehousemen's Union
Peace Lutheran West Seattle
Puget Soundkeeper Alliance
Volunteer Forest Shore Steward

2.1 Support for Cleanup in the East Waterway

Many commentors emphasized the importance of a clean waterway to the surrounding communities. They stated that the health and well-being of the people who live and work around the Duwamish River, including the EW OU, should be a high priority as the EPA moves forward with the EW OU cleanup. Commenters requested that the EPA move beyond studies and start cleanup actions in the EW OU. They stated that they are reluctant to allow their children to play on the beaches or fish in the river due to the contamination. Others were concerned for the health of the animals that live in the EW OU. Several comments specifically cited the importance of the Spokane Street Bridge area for recreational and subsistence fishing, and that the cleanup should specifically address this area.

The Suquamish Tribe did not support or oppose the preferred alternative, they stated that the Tribe has traditionally harvested and consumed fish and shellfish from the East Waterway and intends to do so in the future, and that Risk management decisions should be protective of tribal rights to access and harvest and should not limit or restrict future expression of those rights based on current contaminated condition.

EPA Response

EPA acknowledges the importance of the East Waterway and the Duwamish River to the region. The East Waterway is the last operable unit of the Harbor Island Superfund Site to have a cleanup action selected. This action will result in extensive cleanup activities throughout the East Waterway, and along with the cleanup activities being implemented at the adjacent Lower Duwamish Waterway Superfund Site will substantially reduce the risks to human health and the environment associated with the contamination in these areas.

2.1.1 Support for Preferred Alternative

Members of the public, and business groups provided comments specifically supporting EPA's preferred alternative presented in the Proposed Plan.

The majority of comments from the community were in support of proceeding with cleanup as described in the Proposed Plan. Commenters cited support for the comprehensive nature of the preferred alternative, specifically the extensive removal of contaminated sediment. A number of comments suggested that the cleanup should be strengthened by accompanying the Interim ROD with a source control strategy/action plan, and reconsidering the use of enhanced natural recovery (ENR) in the areas around the Spokane Street Bridge.

Comments were received from King County, the City of Seattle, and the Port of Seattle in support of the preferred alternative, noting that it:

- Provides for a comprehensive sediment cleanup that will substantially reduce risks to human health and the environment, achieves this through active remediation of the vast majority of the East Waterway, followed by natural recovery for the rest of the East Waterway.
- Is the maximum cleanup practicable for this OU and has been shown through the Feasibility Study to be the most efficient approach to cleanup.

Some comments specifically provided support for the use of ENR in the area under the West Seattle Bridge due to the technical limitations of dredging in this area. They also supported the use of in-situ treatment in the under-pier areas due to the danger and technical challenges of dredging sediments under piers. Other comments supported the use of a remedial action level (RAL) of 12 milligrams per kilogram organic carbon (mg/kg OC) for total polychlorinated biphenyls (PCBs) to be consistent with the RAL used at the Lower Duwamish Waterway (LDW) Superfund Site.

EPA Response

EPA has worked with community members, Tribes, the Port, County, City, and State agencies to develop an interim remedy that is projected to reduce risks to human health and the environment by remediating more that 80 percent of sediments throughout the EW OU. It has selected technologies that are effective and can be implemented in the different portions of the EW OU.

Multiple lines of evidence available to EPA at the time of the Interim ROD demonstrate that inputs of contamination from other sources (upstream inputs to the waterway) are continuing despite ongoing efforts by the Washington State Department of Ecology (Ecology), the Port of Seattle, City of Seattle, King County, and other parties to reduce sources of contamination discharging to the East Waterway. Source control efforts are being conducted through a number of programs in the Green/Duwamish watershed. EPA will complete a source control sufficiency assessment for the EW OU during the design phase of this interim cleanup.

2.1.2 Opposition to the Preferred Alternative

Comments were received from selected local businesses regarding the alternatives presented in the Proposed Plan. These comments state that EPA did not follow the CERCLA process and arbitrarily selected the preferred alternative that resulted in cleanup of the largest area. The commenters also noted that EPA did not fully consider alternatives that rely on remedial technologies other than dredging, such as capping, enhanced natural recovery, and monitored natural recovery.

EPA Response

EPA followed the CERCLA process as specified in Section 40 C.F.R. § 300.430 of NCP for the development and evaluation of remedial alternatives and the selection of a preferred alternative, including each of the elements required for the RI and FS. Section 7 of the FS describes the identification and screening of remedial technologies suitable for different construction management areas based on the characteristics of each area. Table 7.1 in the FS presented the technologies that were considered. Following the identification of suitable technologies, 10 remedial alternatives were developed that considered a combination of different remedial technologies, including dredging, capping, in-situ treatment, enhanced natural recovery, and monitored natural recovery. The FS fully evaluated each of these alternatives using the nine CERCLA criteria. Among the factors considered was that the East Waterway is an active commercial/industrial port, and the possible effect on the different remedial alternatives on the need for maintenance of existing navigable depths and potential future deepening of the Federal navigation channel. The selected interim remedy will substantially reduce risks to human health and the environment.

2.1.3 Implement the cleanup as soon as possible

Many comments expressed the need to implement the cleanup as soon as possible. Commenters cite their concern for the continued exposure to contamination and the urgent need to protect communities in the area. Some commenters were unclear as to why this cleanup would require 10 years, while other large construction projects only take several years to complete.

EPA Response

EPA understands the importance of a timely cleanup for protecting human health and ecological resources in the area. The need to initiate and complete the cleanup as quickly as possible is one of the primary reasons EPA is proceeding with an interim remedial action. Cleanup of the East Waterway will continue to follow the CERCLA process, which includes collecting additional data to inform the remedial design of the interim remedy. Actual construction of the interim remedy will need to consider factors such as the availability and production rates of dredges, transport and disposal of dredged materials, import of clean material, balancing of construction activities within an active port, engineering constraints associated with dredging near infrastructure, and potential disruptions to nearby communities. The cleanup actions will also adhere to construction windows to protect migrating salmon, which may limit the length of time construction activities can take place within the East Waterway each construction season.

2.2 Interim ROD vs Final ROD

2.2.1 EPA should release a final ROD with cleanup goals

Several commenters expressed the view that a final ROD would provide certainty regarding EPA's expectations for a remedy and how the EW OU will reach site closure. The comments state that a final ROD can establish cleanup levels now, but also include language that cleanup levels can be revised later based on the success of upstream source control efforts. Due to the comprehensive nature of the preferred alternative, it is appropriate for implementation of this remedy to be considered a final action and EPA can set cleanup goals that it deems appropriate and include those in a final ROD.

A final ROD would provide clarity to the community and responsible parties and clarify that this remedy is the complete sediment cleanup action to be performed. Some commenters expressed concerns that the public will presume this is a partial remedy and that additional remedial actions are needed, lengthening the cleanup time and increasing costs, and that a partial cleanup that is not sufficiently robust to be considered final. This lack of clarity would also make responsible parties reluctant to commit funding to an open-ended cleanup action. A final ROD would deliver the same environmental and public health improvement as an interim ROD, while eliminating uncertainty.

EPA Response

EPA does not anticipate that additional remedial actions will be required given the comprehensive nature of the Selected Remedy. The effort to control sources of contamination to the EW OU will have a substantial effect on the derivation and selection of achievable cleanup levels. While that process unfolds, EPA views selection and implementation of an interim remedy as a means for remediating a substantial portion of the EW OU and advancing the protection of public health and the environment. Transport of contaminated sediment to the East Waterway is dominated by upstream sources, particularly areas of the Green/Duwamish River. Following implementation of the interim remedy, contaminant concentrations in surface sediment within the East Waterway are expected to equilibrate with the contaminant concentrations of the incoming sediment from the Green/Duwamish River. Once the components of the interim remedy have been completed and source control efforts implemented, EPA expects to have the information upon which to develop and select cleanup levels.

2.2.2 Lack of a final remedy will delay or prevent the channel deepening project in the East Waterway.

Members of the business community and the Port of Seattle stressed the importance of the channel deepening stating that the project is important to maintain the Port of Seattle's competitiveness among other North American ports. They noted that Congress has authorized the Seattle Harbor Navigation Improvement Project (SHNIP), which enables the U.S. Army Corps of Engineers (USACE) to deepen both the east and west waterways in the Seattle Harbor to -57 ft mean lower low water (MLLW), and are concerned that the USACE will not, proceed with the channel deepening under an Interim ROD and that the Proposed Plan does not explain how EPA's assessment of the effectiveness of the interim remedial action may affect the channel deepening project.

EPA Response

EPA understands the economic importance of the East Waterway to the businesses and people of the region. The evaluation of alternatives in the FS considered reasonable future uses of the East Waterway compatible with the maintenance of the currently authorized depths in the Federal navigational channel, as well as the proposed deepening. With the exception of the cable crossing, the interim remedial action in the navigation channel is limited to removal or monitored natural recovery and does not include any capping or in-situ treatment that could limit future deepening. While USACE has not indicated that it requires a final ROD to proceed with the channel deepening project, it did request EPA consider a buffer for any caps within authorized navigational areas, resulting in a total depth to the cap surface of -63 feet MLLW. EPA has been and will continue to coordinate with USACE during remedial design.

2.2.3 An interim ROD implies that additional remedial actions may be needed.

Comments were received expressing concerns that an Interim ROD implies that EPA will require additional actions, which will strongly discourage responsible parties from committing to pay the cleanup costs. The cleanup is a significant public investment that will be funded by the taxpayers of King County through the Port property tax levy, King County property tax, King County and Seattle City Light/Seattle Public Utilities rates. Without clear language in the ROD describing that the action is intended to be the final action and that no further action could improve site conditions, the interim designation implies to the public and stakeholders that more sediment cleanup actions will be performed in the future. Shifting to a final action is necessary out of respect for the funding parties, which are largely represented by public agencies.

EPA Response

Regardless of whether the selected remedy is interim or final, Five Year Reviews will be required to assess the protectiveness of the remedy, and any assessment of the need for additional remediation will be based on the conclusions of those reviews. EPA does not anticipate that further construction will be needed following implementation of the selected remedy, as the FS analyses clearly demonstrated that further increase in the cleanup footprint would not result in any further risk reduction.

2.2.4 An interim ROD can include final components.

The interim ROD should clearly state that the interim status relies solely on the lack of development of cleanup levels for specific contaminants of concern, and that the final ROD will establish cleanup levels and that further active remediation is not necessary. Some commenters requested that EPA make the active remediation component of the remedy a final action and establish cleanup levels for protection of ecological receptors while deferring establishment of cleanup levels for the protection of human health until a final ROD.

EPA Response

The interim ROD is clear that the development of cleanup levels is deferred subsequent to the completion of the this selected action There is no distinction between the areas within East Waterway that need to be remediated for the protection of human health versus areas that will be protective of ecological receptors. As such, the threshold criteria of protection of human health and the environment is not achieved until the cleanup levels are achieved.

2.3 Tribal Coordination

2.3.1 EPA should consider cultural resources during cleanup, including the development of an inadvertent discovery plan.

Some commenters raised concerns about the potential for cultural resources to be encountered during dredging, and would prefer that archaeological monitoring occur during activities that disturb sediment below fill to the extent that doing so is safe and feasible. In the cases that archaeological monitoring is impossible or unsafe given the contamination, the Tribe would accept an inadvertent discovery plan in case an artifact is encountered. If any archaeological work occurs, the Tribe would like notification and the opportunity to be present on site during the work.

EPA Response

EPA will seek to identify cultural resources and avoid, minimize, or otherwise mitigate any harm to such resources, and will comply with the provisions of the National Historic Preservation Act including its implementing regulations, the Native American Graves Protection and Repatriation Act, and the American Indian Religious Freedom Act. As part of remedial design, a monitoring and inadvertent discovery plan will be developed. EPA will also continue regular coordination with tribal staff, as well as formal Government-to-Government Consultation where appropriate.

2.4 Environmental Justice & Community Involvement

2.4.1 EPA should complete the Community Involvement Plan for the Harbor Island Superfund Site

Commenters expressed concerns with the timeline for the completion of the updates to the Community Involvement Plan, and that community members need to understand how they can expect the EPA to engage with them during the cleanup process. They requested more information on the timeline of the Community Involvement.

EPA Response

EPA is working to update the Harbor Island Superfund Site CIP, while ensuring that all the feedback received during both community interviews and the public feedback session are integrated into the document. EPA anticipates releasing the updated CIP in late Spring or Summer 2024.

2.4.2 EPA should integrate environmental justice into the cleanup plan.

Community members commented that EPA should include environmental justice components throughout the cleanup process since economically disadvantaged communities are disproportionally affected by the contaminated sediments in the East Waterway.

EPA Response

Executive Order 12898 directs federal agencies, including EPA, to identify and address environmental justice concerns for minority populations and low-income populations to the maximum extent feasible. EPA is committed to engaging with the community regarding specific recommendations as remedial design and construction move forward in culturally appropriate ways and will continue public engagement actions by working with the community. The Harbor Island Superfund Site CIP describes the specific ways in which the local community can engage with EPA throughout the cleanup process and will include a specific environmental justice chapter.

2.4.3 EPA should acknowledge the importance of the Spokane Street fishing pier to the local community.

Members of the community commented on the importance of the Spokane Street Bridge fishing pier to the local community and that this importance was understated in the Proposed Plan. King County commented that the Proposed Plan was misleading, giving the impression that risks at the site were associated with recreational fishing, noting that risks in the East Waterway Operable Unit are associated with the consumption of contaminated resident fish. Fishing for salmon is common practice at the Spokane Street Bridge and salmon do not have a do not eat advisory. The County added that the Proposed Plan should have explained that the fish advisories for migratory species are similar in adjacent water bodies (the LDW and Elliott Bay) but differ for resident seafood.

EPA Response

Health risks associated with the consumption of contaminated resident fish are one of the primary reasons for remediating the East Waterway. The human health risk assessment did not assume that fishing is occurring in any specific location, and EPA recognizes that the Spokane Street Bridge area may be the primary location where the local community is fishing.

2.4.4 The Plan does not accurately represent the recreational use of the East Waterway.

Comments were received that the Proposed Plan overstated the recreational use of the East Waterway and that only fishing from Spokane Street Bridge is where actual recreational use of the of the East

Waterway occurs. King County further stated that swimming and kayaking are not occurring at any frequency due to safety issues around commercial shipping activities.

EPA Response

The interim ROD recognizes the commercial shipping activities and limited shoreline access constrain recreational activities in the East Waterway, and that in-water recreational activities are limited due to vessel movements in the container port.

2.4.5 EPA should compensate fishers for lost fishing opportunity during cleanup.

One commenter asked EPA to provide compensation for fishers during the remedial process, as the possibility of public access closure, particularly popular fishing spots was not mentioned in the Proposed Plan and should be accounted for and discussed. EPA should engage with community members who fish to assess what sorts of accommodations can be made including seafood vouchers and transportation to other local fishing sites.

EPA Response

EPA acknowledges that there may be temporary closures of certain areas during construction of the remedy. The type of funding and actions requested are not within EPA's authority under CERCLA. We will work with the affected community, the parties implementing the cleanup, Tribes and other interested parties to find an equitable and workable approach to mitigating or minimizing disruptions from construction activities associated with the remedial action.

2.5 Basis for Cleanup Levels

2.5.1 Cleanup levels should be based on natural background.

Several comments expressed support for establishing cleanup levels based on natural background when that is greater than risk-based values, and cleanup levels should be based on the risk-based concentrations for the tribal exposure scenario or natural background to ensure protection for tribal fishers.

EPA Response

The selected remedy in the interim ROD provides for the construction of remedial actions to be based on remedial action levels (RALs), which are intended to achieve the anticipated final remedial action objectives through the active remediation in areas where contaminant concentrations are greater than the RALs, followed by monitored natural recovery. The CERCLA program normally does not set cleanup levels below anthropogenic background concentrations, the reasons include cost-effectiveness, technical practicability, and the potential for recontamination of remediated areas by surrounding areas. In cases where area-wide contamination may pose risks but is beyond the authority provided under CERCLA, EPA may be able to help identify other programs or regulatory authorities that are able to address the sources of area-wide anthropogenic contamination. Following implementation of the interim remedy, EPA will evaluate the effectiveness of the active remediation in reducing contaminant concentrations, along with the progress of ongoing source control efforts.

2.5.2 Cleanup levels for the East Waterway should be similar to those of the Lower Duwamish Waterway.

Several commenters stated that cleanup levels for the East Waterway should be similar to those of the Lower Duwamish Waterway. The comments suggest that by using the same cleanup levels across all of the sites in the Duwamish River will result in a consistent level of protection for people and wildlife, which use the entire Duwamish River system.

EPA Response

EPA understands the interconnectedness of users for the East Waterway and the Lower Duwamish Waterway. EPA must evaluate and respond to each waterway based on the unique characteristics of each one and the associated sources of contamination. The East Waterway RALs are consistent with the Lower Duwamish Waterway RALs .

2.5.3 Cleanup levels should not be based on natural background.

The East Waterway Group and businesses that use the East Waterway commented that it is not appropriate to use natural background concentrations for PCBs when establishing cleanup levels in an urban waterway. They recommended honest communication to the public and PRPs on the challenges and the likelihood of attaining concentrations representative of non-urban areas of Puget Sound in an industrial area of Seattle that is situated at the mouth of an urban watershed. They supported working towards the vision of lowest possible PCBs levels in the Duwamish River. They expressed concern about the ability to meet this goal in one of Washington State's most urban areas. While EPA's Preferred Alternative will make substantial progress in reducing PCB concentrations, as noted earlier, watershed wide source control efforts will be needed to make further progress.

EPA Response

EPA has carefully worked through the CERCLA process to develop a comprehensive cleanup for the East Waterway that will actively address contaminated sediment in over 80 percent of the waterway. EPA will continue to carefully work through this process to evaluate, develop, and select cleanup levels that can be anticipated to be achieved under CERCLA for the EW OU. The assessment of background and the on-going source control work will be important in the determination of cleanup levels.

2.5.4 The ROD should include information about anthropogenic background and its implications to the East Waterway cleanup.

Several commenters stated that they believe that the ROD should include the anthropogenic background values developed for the East Waterway in 2021 and discuss its implications on the East Waterway. Providing this information would give the public a better understanding of the magnitude of incoming sediment concentrations compared to non-urban concentrations, providing context about how much work is needed, and whether it is reasonable to expect the site to ever achieve non-urban concentrations.

EPA Response

The Proposed Plan and interim ROD rely on data from the RI/FS that was used to evaluate risk, calculate RALs, and develop and evaluate remedial alternatives, the interim ROD notes that sediment concentrations in East Waterway are influenced by ongoing upstream sources of contamination. While the derivation of anthropogenic background values is included in the site file and public record, this information is not included in the interim ROD because there is no need to compare risk-based cleanup goals to background concentrations at this time. However, the existing information regarding anthropogenic back and additional information collected during and after implementing the interim remedy will be used in assessing the effectiveness of the interim remedy and the development of cleanup levels.

2.5.5 EPA should provide clearer timelines at which cleanup levels will be met.

Several comments requested that EPA provide clearer timelines for when background levels would be attained, and that the Proposed Plan did not include timelines for when EPA would decide whether additional remedial measures would be needed. They noted that responsible parties won't be able to determine whether to participate in performing or funding the cleanup until the results of the monitoring are known.

EPA Response

Estimates in the FS of recovery times are that concentrations will equilibrate consistent with upstream concentrations within 20 years. However, experience at other sediment sites indicate that recovery times to achieve equilibrium concentrations are often shorter. At this time, it is not possible to definitely determine when post-remedy contaminant concentrations in East Waterway will reach equilibrium with concentrations in sediment transported from the Green River watershed. Following the construction activities outlined in the interim ROD the EPA will continue to evaluate site wide progress through monitoring and conducting Five Year Reviews.

2.6 Remedial Action Levels

2.6.1 Calculation of RALs

The Washington State Department of Ecology commented that the dry weight value for the PCB RAL is not consistent with the State's guidance, noting that the Sediment Management Standards benthic criteria for PCBs of 12 mg/kg (organic carbon normalized) is equivalent to 192 ug/kg dry weight. If benthic dry weight values are to be used as Remedial Action Levels, they should be the Apparent Effects Threshold values. For example, the appropriate dry weight functional equivalent for PCBs 12 mg/kg (organic carbon normalized) is 130 ug/kg dry weight. Refer to the Sediment Cleanup User's Manual, Table 8-1 to understand the appropriate dry weight values to use that are the functional equivalent of the total organic carbon normalized benthic criteria.

EPA Response

The PCB RALS are presented as OC-normalized concentrations in the interim ROD. The lowest-apparent-effect threshold was used in the FS as the dry weight equivalent with organic carbon-normalized criteria for samples outside of the appropriate total organic carbon range. Cleanup levels protective of benthic receptors will be provided in the final ROD, and EPA will use an appropriate methodology for calculating those cleanup levels.

2.6.2 Clarify the use of two RALs for PCBs

Some community members commented that the purpose of using two different RALs for PCBs to develop the remedial alternatives was unclear. This information should be made clearer and more accessible to the public.

EPA Response

The purpose of developing alternatives using two RALs for PCBs was to compare the estimated decrease in the site-wide average concentration and associated risk reduction against construction time and cost. Use of a PCB RAL of 7.5 mg/kg OC was estimated to result in a small increase in the area to be remediate while providing a negligible change in the post construction site-wide average concentration and reduction in risk relative to the RAL of 12 mg/kg OC.

2.6.3 Depth Intervals for the Remedial Action Levels

The Proposed Plan does not specify the depth to which RALs will apply for determining the horizontal extent of the cleanup. The alternatives developed in the FS, including Alternative 3B(12), applied the RALs to the top 10 centimeters (cm) and the top 60 cm to determine horizontal extent of contamination, which formed the basis for the associated dredge volumes and costs (FS Section 6.2). Information about the depth interval associated with the RALs to determine horizontal extent of contamination should be clearly identified in the interim ROD to facilitate design of the cleanup.

EPA Response

The RALs delineate both the horizontal and vertical extent of the area to be remediated. The FS evaluated the performance of using different RALs by calculating post-construction surface-weighted area concentrations (SWACs). During remedial design, the depth of contamination will need to be determined and material removed such that contaminant concentrations at the final dredge depth do not exceed the RALs, or a cap will be needed. Figure 22 of the interim ROD shows the approximate depth that would need to be removed to achieve the different RALs.

2.7 Analysis of Alternatives

2.7.1 EPA did not thoroughly evaluate the No Action alternative.

Concerns were raised that EPA did not adequately evaluate the No Action alternative and requested information comparing the risk reduction and protectiveness of the No Action alternative to the preferred alternative, and what the effect of dredging to clean would be on achieving cleanup levels.

EPA Response

As described in the Proposed Plan, the No Action Alternative would not meet the threshold criteria of being protective of human health and the environment and compliance with ARARs. Contaminants in surface sediments and biota would continue to pose unacceptable risks to human health and the environment for the foreseeable future. Summaries of estimated risk reduction for the No Action Alternative and Alternative 3B(12), which is representative of the selected interim remedy, and are presented in Sections 9.4.1 and 9.10.1 of the FS, respectively.

2.7.2 EPA did not thoroughly evaluate all remedial technologies.

Some commentors expressed concerns that EPA failed to consider alternatives that rely on remedial technologies other than dredging, such as capping, enhanced natural recovery, and monitored natural recovery, and claimed that such failure was inconsistent with CERCLA, the NCP, EPA guidance, and is arbitrary and capricious. The Proposed Plan did not acknowledge the increased short-term risks and other negative impacts that may result from dredging; such as remobilization of contaminants, increased fish tissue concentrations following construction, and increased construction-related air emissions. The commenter cited several EPA and guidance documents that emphasize the need for risk-based cleanup decisions and claimed that EPA ignored this guidance in its use of alternatives that primarily relied on removal of contaminated sediment.

EPA Response

The information provided in the Proposed Plan was a summary of the alternatives fully developed and evaluated in the FS, according to the requirements of the NCP and CERCLA. Section 7 of the FS identified and screened a comprehensive set of general response actions, technology types, and process options that are potentially applicable to cleanup of contaminated sediments in the East Waterway Operable Unit.

Although risk-based decisions are important in the remedy selection process, many other factors must also be considered. Dredging formed the basis for the alternatives evaluated in the FS due to the sediment bed elevation constraints associated with the current use of East Waterway as an active port, and the proposed deepening of the federally authorized navigation channel. Technologies such as capping, enhanced natural recovery, and monitored natural recovery were determined to not be compatible with navigational uses within certain areas of the East Waterway, and EPA is required to consider current and the reasonably anticipated future use of a site in remedy selection. The evaluation of alternatives considered the benefits and limitations of various remedial technologies during the balancing criteria analysis .

2.7.3 EPA needs to provide more evidence and justification for supporting the Proposed Remedy.

One individual business expressed concern that the Proposed Plan did not provide enough evidence to support the proposed remedy. They specifically indicated the need for EPA to quantify the substantive risk reduction the Preferred Alternative will achieve, and verify assumptions used to develop sediment transport estimates.

EPA Response

The Proposed Plan did not include all specific quantitative details for brevity and clarity. Detailed quantitative estimates of the performance of the different alternatives are presented in Section 9 of the FS. A summary of the estimated risk reduction for each alternative is presented in FS Table 10-1. EPA is confident that the information presented in the RI/FS, administrative record and PP is sufficient to justify the selected remedy.

2.8 Remedial Technologies

2.8.1 The effects of earthquakes and tsunamis should be considered during remedial design.

Preference should be given to alternatives that reduce the potential for exposure to contaminated sediment left in place in the event of earthquake or tsunamis. The remedial design should consider the latest modeling and should include a plan to respond as needed following such events.

EPA Response

EPA will ensure that the remedial design considers current earthquake and tsunami modeling predictions. Because the remedy includes extensive removal, the potential impacts to the remedy from catastrophic events are expected to be minimized.

2.8.2 Concerns about cap resiliency in the East Waterway.

Some comments expressed concerns about the resiliency of the proposed sediment caps to erosive forces such as propwash, floods, tides, and tsunamis, as well as the impact on adjacent areas in the event cap material is eroded and deposited elsewhere.

EPA Response

Analyses presented in the FS determined that propwash resulted in the greatest erosive forces compared to river flows, tides, and a 100-year flood. Modeling was conducted to determine an aggregate size sufficient to resist erosive force due to propwash for the areas where engineered sediment caps are proposed. During remedial design, cap design will be further refined based on specific locations and conditions.

All material placed as caps will be clean. The caps will be designed with an isolation layer that is expected to have a design life of more than 100 years. In the event of an extreme disruptive event such as an earthquake or tsunami, EPA will assess cap integrity and develop appropriate response actions, if needed.

2.8.3 Provide additional information on the disposal of dredged material.

Comments were received requesting additional information about disposal of dredged sediment and requested clarification of the waste definitions under CERCLA versus the Resource Conservation and Recovery Act (RCRA), so the public can better understand why material from a Superfund site may be considered non-hazardous.

EPA Response

The definitions of hazardous waste under RCRA and TSCA is different than the definition of hazardous substance under CERCLA. Although all hazardous wastes are by definition hazardous substances, not all hazardous substances are hazardous wastes. Disposal of dredged sediment is dependent on the contaminant concentrations in the dredged material because in part it determines whether or not material is considered hazardous waste, which determines the how and where the material can be disposed of off-site.

2.8.4 Concerns that in-situ treatment may not be effective in limited access areas.

A comment expressed concern about the effectiveness of in-situ treatment using activated carbon, citing the results of the enhanced natural recovery (ENR) pilot study conducted for the Lower Duwamish Waterway, which showed that activated carbon with ENR did not perform significantly better than ENR alone. The comment expressed concern about the amendment being disturbed by vessel traffic, reducing its effectiveness.

EPA Response

The LDW pilot study evaluated the benefit of amended ENR versus regular ENR, which is typically a layer of sand. The LDW study used granular activated carbon mixed in with ENR material applied to open-water areas (mid-channel, scour areas, and intertidal areas).

The LDW study is not directly applicable to the proposed use of in-situ treatment in the East Waterway, as activated carbon is being proposed as a direct in-situ treatment rather than an amendment to ENR. EPA has proposed in-situ treatment for use in the under-pier areas because of the limited access and the steep slopes, which are less exposed to channel currents and vessel. Additionally, the LDW ENR pilot study was conducted in areas where PCB concentrations in sediment were relatively low, and the low baseline concentrations made it difficult to discern the effects of the activated carbon. Experience at other sites has demonstrated that in-situ sequestration to be effective at reducing PCB concentrations in porewater and in benthic organisms. The type of sequestering agent and application methods used for the East Waterway will be determined during remedial design.

2.8.5 Enhanced Natural Recovery should not be used around the Spokane Street and West Seattle Bridges where community members fish.

Several comments were received that expressed concern about the use of enhanced natural recovery in the Sill Reach around the Spokane Street and West Seattle bridges versus removing the contaminated material. They noted that this area is commonly used for fishing and clamming and were concerned that not removing the material may pose continued health risks from fish and shellfish consumption. There was also concern that not removing the material would limit the area's ability to recover in the long-term.

EPA Response

The FS evaluated several cleanup options for the Sill Reach area. There are several bridges in this area that pose technical limitations on the feasibility of different cleanup options. Access to the water must be from shore, as equipment can't traverse under the low clearance bridges, smaller equipment must be used due to the limited overhead clearance, access to sediment under bridges is limited by bridge support pilings, and remedial actions must not affect the structural stability of the bridges. These restrictions limit the areas that could actually be dredged.

Removal of sediment under the low bridges was not considered in the FS due to the significant access limitations, structural stability concerns, and extremely low clearance (just a few feet). Although removal under the West Seattle bridge was retained in the FS, it was not selected by EPA due to anticipated structural limitations and feasibility during design. Sediment removal cannot be implemented directly against bridge (and other structural) supports. A structural offset is likely to be several feet, beyond which there would be a slope down to the dredge depth. As this area is very small, this alone significantly reduces the amount of material that can be realistically removed. EPA also has concerns about mobilizing and operating dredge equipment in this limited area near sensitive structures.

Equipment required to apply enhanced natural recovery material can be smaller and operations are less likely to potentially damage the structure. Contaminant concentrations in this area are moderate, and enhanced natural recovery has been proven to be effective at reducing exposure in similar conditions, and by definition, will not interfere will natural recovery processes. The extent of dredging that can be completed safely in proximity to the bridge structures will be evaluated during Remedial Design. Further to specifically address this comment, EPA has clarified in the interim ROD that during remedial design, several engineering design considerations will be evaluated, including limited dredging, and the use of different amendments to enhance the effectiveness of ENR, including consideration of activated carbon or other sequestering agent.

2.9 Costs

2.9.1 EPA should minimize cleanup costs.

The EWG and other responsible parties expressed concerns about the overall estimated cost of the cleanup at $290 million in 2016 dollars, which they indicated could potentially be $580 million or more in current dollars. As public entities, much of this cost would ultimately be funded by taxpayers through taxes and utility rates. Commenters expressed concern that the proposed interim ROD would result in additional future costs, further burdening taxpayers, and requested EPA consider a final ROD to reduce overall costs.

Additional comments expressed concern that EPA did not fully evaluate the proposed remedy's cost effectiveness, with specific concern that focusing on mass removal did not appropriately consider costs, risk management, and overall remedy performance.

EPA Response

EPA determined that the selected interim remedy is cost effective while still achieving substantial risk reduction. However, cost effectiveness is only one of nine CERCLA criteria used to evaluate alternatives. Removal was a primary technology selected due to the navigational needs in the East Waterway, other technologies were determined to not substantially reduce risk without interfering with the navigational depth requirements. The interim remedy is required to comply with other federal laws that prevent it from interfering with vessel navigation.

While EPA understands the responsible parties' concerns about being absolved of future liabilities and is aware that public entities may need to bear the costs of cleanup. EPA cannot determine at this time whether the performance of future activities may be needed for the EW OU.

2.9.2 EPA should update costs to reflect current dollars and discount rates.

Several commenters requested that the interim ROD be clear that the cost estimates for the evaluated alternatives are in 2016 dollars. They also requested that the cost estimate for the preferred alternative be updated to current (2023) dollars, and a detailed cost breakdown be included in Section 9.2 of the interim ROD.

Several responsible parties also expressed support for including a 0 percent discount rate in the Proposed Plan and requested that this rate be used going forward. At least one commenter requested that the EPA-standard discount rate of 7 percent not be included.

EPA Response

Estimated costs for the selected interim remedy were updated to reflect 2023 dollars and the current Office of Management and Budget (OMB) discount rate of 7 percent. Table 10 of the interim ROD also includes a detailed cost break down for the selected interim remedy.

2.10 Source Control

2.10.1 Support for a holistic, watershed approach to stormwater management.

The responsible parties and several members of the community asked EPA to include a holistic stormwater management approach in the selected remedy. They requested that a stormwater management plan include all sources, such as outfalls, tributary streams, upstream stormwater systems, and other upstream sources.

EPA Response

As described in the interim ROD, the control of upstream sources in the Green River/Duwamish River watershed is occurring under various non-CERCLA Federal, State, and local regulatory programs. EPA’s long-term expectation for the source control program is to prevent recontamination of sediments in the East Waterway.

2.10.2 EPA needs to clarify how they will evaluate if source control is sufficient to initiate cleanup and prevent recontamination.

Several commenters requested additional information on how source control would be addressed upstream to ensure that the proposed cleanup action would be protective in the long-term. One comment specifically referenced the early action in 2004-2005 where contaminated material was removed and replaced with clean sand, noting that that some recontamination has been observed, and requested information about the current sediment concentrations relative to the remedial action levels. Other comments requested additional information regarding the potential of recontamination and EPA’s assertion that ongoing contaminant sources are minor.

EPA Response

This interim remedial action will reduce risks to human and ecological receptors as soon as possible. Prior to starting construction on the East Waterway cleanup, EPA will ensure that sources discharging directly to the East Waterway are controlled, and that upstream source control efforts conducted by Ecology are underway. This assessment will be completed as part of the Remedial Design process to determine if the interim remedial action can proceed without risk of recontamination Control of sources of contamination adjacent to the EW OU and throughout the Green/Duwamish River Watershed, including as regulated or otherwise addressed under non-CERCLA authorities implemented by federal, state, and local governments, and the adjacent CERCLA cleanup of the Lower Duwamish Waterway will be essential to achieving the long-term goals of the selected remedial action.

Specific to the question regarding the previously dredged area, this comment refers to the Phase 1 dredging event conducted in 2004-2005. The Phase 1 area was initially dredged; however, some contamination remained after dredging and the dredged surface was covered with clean sand. When evaluated in the 2019 FS, concentrations greater than some RALs were observed in the Phase 1 area. A comparison of FS Figures 2-22 and 6-6 shows that contaminant concentrations in several areas within the Phase 1 dredge area are greater than at least one RAL and will require cleanup. EPA understands the potential for recontamination from upstream sources and resuspension of contaminated sediment from within the East Waterway.

EPA noted in the Proposed Plan that upland on-site sources, including upland contaminated sites, are considered minor relative to upstream Green/Duwamish River sources. The King Street outfall was specifically questioned by commenters regarding its contribution to EW OU contaminated sediments. The King Street outfall discharges into Elliott Bay, and as described in the FS contaminated sediment inputs from all of Elliott Bay are considered small compared to upstream inputs.

2.10.3 Sediment transport modeling needs to be updated.

Two commenters expressed concern that the sediment transport modeling was outdated and not appropriately calibrated. Ecology requested to work collaboratively with EPA to address data gaps and uncertainties with respect to sediment transport-related sources of contamination, and that EPA clearly distinguish between sediment transport and contaminant transport.

EPA Response

EPA acknowledges that the sediment transport modeling was completed in 2012. During the FS, EPA ensured that modeling inputs were accurate, and a sensitivity analysis was completed to better understand how modeling inputs may affect the results. During remedial design, EPA will ensure that modeling is updated as needed, particularly as more information about upstream sources, including the LDW cleanup is known. EPA will continue to work with Ecology with regards to information about upstream sources, anticipated source control, and sediment transport.

2.11 Human Health Risk

2.11.1 EPA Does Not Objectively Characterize the Risk to Human Health

Some comments raised concerns regarding the fish and shellfish consumption rates used in the human health risk assessment. They specifically noted that based on the definition of reasonable maximum exposure, the consumption rates used in the risk assessment may not be valid. Since the East Waterway is industrialized, is does not provide the subtidal habitat nor fishing access to support the assumed consumption rates. They were additionally concerned that the Proposed Plan did not acknowledge the overestimation and uncertainty in using Tribal consumption rates for developing the human health risk assessment.

EPA Response

Despite the commercial nature of the East Waterway, it is within the usual and accustomed fishing areas for the Muckleshoot Indian Tribe, the Suquamish Tribe, and the Yakama Nation. These tribes have reserved treaty rights and EPA is obligated to consider their tribal fishing practices in the risk assessment. The East Waterway also represents an important fishing area for the local community, and consumption of fish and shellfish caught in the East Waterway has been documented. EPA estimated reasonable maximum exposures, including tribal subsistence fisher exposures as a reasonably anticipated future use of the East Waterway and has used this information to determine potential risks to human health. In consultation with the Tribes, EPA used a respected published study of the Tulalip Tribe seafood consumption rates as reflecting reasonably anticipated tribal seafood consumption rates for the three federally recognized tribes associated with the EW OU.

2.11.2 Institutional Controls should not be used as a long-term solution and need to be developed with the community.

The Suquamish Tribe requested that long-term institutional controls not be used. They asserted that institutional controls limit treaty rights to harvest in usual and accustomed areas, and that the institutional controls described in the Proposed Plan are not enforceable by the responsible parties. Institutional controls should only be used as temporary measures until cleanup is complete. The Tribe requested that an institutional control plan be completed in coordination with affected tribes. Two commenters noted that existing fish consumption advisories are in place, but that without publicly available metrics it is not possible to determine how successful they have been.

EPA Response

Since the selected remedy is an interim action, at this time EPA does not intend to rely on fish consumption advisories as a long-term mechanism and only requires advisories until cleanup levels are achieved. The Washington Department of Health independently issues the advisories for its own purposes.

2.12 Fish Studies

2.12.1 EPA should conduct a home range study for resident fish in the East Waterway, particularly near the Spokane Street Bridge.

Comments from the community and the Washington State Department of Fish and Wildlife (WDFW) requested that EPA conduct home range studies for resident fish in the East Waterway, particularly in the Spokane Street Bridge area. Commenters state that since the Spokane Street Bridge is the primary location where subsistence fishers catch resident fish, and that enhanced natural recovery is proposed near the low bridges, if resident fish have small home ranges, local fishers may be exposed to higher PCB concentrations that are not removed by dredging.

EPA Response

There is already sufficient information regarding the home ranges of various resident species in the East Waterway. All of the technologies specified in the interim ROD will meet the threshold requirement of protection of human health and the environment. Contaminant concentrations in sediment and in fish tissue will be similar regardless of the technology applied, and monitoring of concentrations in sediment in all areas and fish tissue will continue throughout the remedial process.

2.12.2 EPA should measure contaminant concentrations in the tissues of resident and migratory aquatic life in East Waterway.

WDOH commented that the fish tissue sampling for the East Waterway should be coordinated with that of the LDW cleanup, and requested that EPA monitor both resident species, as well as migratory salmonids due to their importance as an exposure pathway for humans.

EPA Response

The baseline human health risk assessment concluded that consumption of resident fish was responsible for the majority of the risk. Going forward, EPA will measure contaminant concentrations in tissues of resident fish and shellfish to assess the effectiveness of the sediment cleanup in reducing contaminant concentrations in resident species. Because the degree to which contaminant concentrations in migratory species are attributable to contamination in the East Waterway is not known EPA will not require sampling of migratory species.

2.12.3 EPA should update tissue concentrations using current status and trends monitoring data.

WDFW commented that the Information sources cited in the references regarding contaminant conditions in aquatic organisms in the East Waterway and LDW are outdated and recommended that EPA review current status and trends monitoring data and results to better inform the Proposed Plan.

EPA Response

EPA understands there has been additional tissue contaminant data collected from the East Waterway since the publication of the RI/FS. The Proposed Plan and interim ROD include data that were used in the baseline risk assessments, the development of the remedial action levels, and the development and evaluation of the remedial alternatives. The additional data cited here would not change the conclusion that sediment contamination in the EW OU poses unacceptable risk to human health and the environment, and would not change the selected interim remedy. EPA will consider more recently collected data as it develops the baseline monitoring plan for the East Waterway prior to the interim remedy construction.

2.13 Long-term Monitoring and Site Management

2.13.1 EPA should clarify what types of monitoring are included in long-term monitoring versus short-term monitoring.

Several commenters were concerned about how EPA defined short-term and long-term monitoring in the Proposed Plan and how this impacts costs. They noted that the Proposed Plan assumes that short-term monitoring will be conducted until cleanup levels are achieved; however, the Proposed Plan also states that cleanup levels will be established in a final ROD. In addition, short-term monitoring is usually associated with construction actions whereas long-term is post-construction (post-remedial action). Commentors requested clarification on short-term monitoring timelines.

EPA Response

EPA defines short-term monitoring as occurring during implementation of the remedy and until cleanup levels are attained. The selected interim remedy for East Waterway relies on monitored natural recovery post construction of this selected interim remedy to further reduce contaminants concentrations in the EW OU. Monitoring will be conducted post construction of the interim remedy to ensure effectiveness of the interim action, maintain the integrity of the interim action (capped areas), and inform the development of the cleanup levels and final remedy. Once cleanup levels are attained, long-term monitoring will ensure that the final remedy is effective and remains protective. Costs of the monitoring associated with the interim action will likely be similar to those needed for the final action, especially if no further active remediation is needed. Monitoring will include chemical analysis of resident benthic and pelagic organisms.

WDFW recommended that EPA require monitoring of PCB levels in benthic organisms to achieve the Puget Sound background tissue level, and to begin monitoring plankton in the East Waterway, LDW, and Elliott Bay to evaluate impacts of PCBs originating in the East Waterway and LDW. The comment also recommended that EPA provide ongoing fish tissue monitoring data to WDOH and community advocacy groups.

EPA Response

The performance standard for the remedial action will be based on contaminant concentrations in sediment, not concentrations in benthic organisms. Any data collected as required by EPA during the remedial action and subsequent monitoring will be publicly available.

2.13.2 Long-term monitoring should include the chemical analysis of juvenile Chinook salmon.

WDFW recommended that EPA monitor out-migrating juvenile Chinook salmon in the East Waterway to track effectiveness of the remedial action in recovering Chinook health in the Duwamish River.

EPA Response

Contamination concentrations in Chinook salmon and other migratory species cannot be attributed solely to contamination associated with the East Waterway. For this reason, monitoring out-migrating juvenile Chinook is not effective in assessing the efficacy of the interim remedial action, and EPA will not require it.

2.14 Coordination with Nearby Projects

2.14.1 EPA needs to coordinate the EW Interim Action with the Lower Duwamish Waterway cleanup.

Two commenters requested that more information be provided regarding the timing of the East Waterway interim remedial action relative to the LDW cleanup. Of particular concern was that the cleanup of the LDW may mobilize contamination that could move downstream and impact the East Waterway. Specifically, there was concern about how the potentially resuspended LDW material may impact the Sill Reach, where public fishing primarily occurs.

EPA Response

Based on estimated schedules for the East Waterway and the LDW remedial actions, it is possible that construction on East Waterway will commence before the full completion of the LDW remedial action. Existing data from the SRI indicate that the Junction and Sill reaches are less depositional than other areas of the East Waterway, which is consistent with the higher flow velocities in these areas and limits the recontamination potential in this area. However, EPA will continue to coordinate the LDW and EW cleanup actions and may adjust sequencing of the construction or employ other best management practices to reduce potential recontamination in the EW OU.

2.14.2 EPA needs to continue coordination to prevent a hinderance to authorized navigation channel maintenance.

USACE provided several comments outlining concerns about how the cleanup project may impact USACE's Federal navigation authority, and to ensure that the project follows substantive requirements of Section 14 of the Rivers and Harbors Act of 1899, 33 U.S.C. §408 . They presented concerns regarding the potential for the project to alter authorized boundaries or depths, increase maintenance and repair costs, and impose waterway use restrictions in the authorized channel.

EPA Response

As required under CERCLA, EPA will ensure that the project meets substantive requirements for all ARARs, including 33 U.S.C. §408. EPA will coordinate with USACE to ensure that the cleanup action minimizes impacts to the future deepening project and ongoing maintenance of the waterway.

2.14.3 The interim ROD needs to include those ARARs that apply to the interim action.

One comment requested that additional information about ARARs be included in the ROD.

Response

As specified in the NCP, the ARAR information provided in the Proposed Plan was a brief summary. Section 9.9.1 of the interim ROD provides a detailed description of ARARs for the selected interim remedy.

2.14.4 The Proposed Plan is inconsistent with CERCLA

One comment stated that the Proposed Plan was not consistent with CERCLA guidance, citing the lack of risk-based goals supported by federal and state guidance. They expressed concern that a long-term vision of achieving natural background was inconsistent with EPA and State guidance, which state that when natural background levels cannot be reliably maintained over time, that regional background levels should be used instead.

EPA Response

EPA followed the CERCLA process outlined in the NCP, 40 CFR §300.430, for the purpose of reaching this cleanup decision. The information used to support the Proposed Plan is fully described in the SRI/FS and is available in the Administrative Record. EPA considered multiple pathways to move forward with this project, ultimately determining that the interim remedy outlined in the Proposed Plan would best address current risks to human health and the environment in a timely manner while allowing time for evaluating data to develop cleanup levels. Selecting an interim remedy is consistent with EPA's Contaminated Sediment Guidance, which notes that it may be appropriate to take early or interim actions, followed by a period of monitoring. As noted in the interim ROD, EPA has not selected any final cleanup levels, background or otherwise. Consistent with the Contaminated Sediment Guidance, EPA is selecting an interim remedy and will evaluate both the performance of the implemented remedy and the effectiveness of ongoing source control efforts before developing and proposing achievable cleanup levels.