FIFTH FIVE-YEAR REVIEW REPORT FOR
WYCKOFF CO./EAGLE HARBOR SUPERFUND SITE
KITSAP COUNTY, WASHINGTON

Prepared by

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LIST OF ABBREVIATIONS & ACRONYMS

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
BMP	Best Management Practice
CDF	Confined Disposal Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLARC	Cleanup Levels and Risk Calculations
COC	Contaminant of Concern
cPAH	Carcinogenic Polycyclic Aromatic Hydrocarbon
CSM	Conceptual Site Model
CW	Community Well
DNAPL	Dense Non-Aqueous Phase Liquid
EBS	Exposure Barrier System
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FFS	Focused Feasibility Study
FPA	Former Process Area
FYR	Five-Year Review
HPAH	High Molecular Weight PAH
HQ	Hazard Quotient
IC	Institutional Control
ISS	In-Situ Soil Solidification/Stabilization
LAET	Lowest Apparent Effects Threshold
LNAPL	Light Non-Aqueous Phase Liquid
LPAH	Low Molecular Weight PAH
MCL	Maximum Contaminant Level
MCUL	Minimum Cleanup Level
mg/kg	Milligrams per Kilogram
µg/kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
MNR	Monitored Natural Recovery
MTCA	Washington State Model Toxics Control Act
NAPL	Non-Aqueous Phase Liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OMMP	Operations, Maintenance and Monitoring Plan
OU	Operable Unit
OWS	Oil-Water Separators
PAH	Polycyclic Aromatic Hydrocarbon
PCP	Pentachlorophenol
PPA	Prospective Purchasers Agreement
PRP	Potentially Responsible Party
PZ	Piezometer
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager

RSL	Regional Screening Level
SCO	Sediment Cleanup Objective
SMS	Washington State Sediment Management Standard
SSC	Superfund State Contract
SQS	Washington State Sediment Quality Standard
TEQ	Toxicity Equivalent
UAO	Unilateral Administrative Order
UU/UE	Unlimited Use and Unrestricted Exposure
WAC	Washington Administrative Code
WSDOT	Washington State Department of Transportation
WSF	Washington State Ferries

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii)) and considering EPA policy.

This is the fifth FYR for the Wyckoff Co./Eagle Harbor Superfund site (the Site). The triggering action for this statutory review is the completion date of the previous FYR. The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of four operable units (OUs), all of which are addressed in this FYR Report (Table 1). OU2 and OU4 are referred to collectively as OU2/4, or the Soil and Groundwater OUs.

Table 1: OU Description

OU	Description
OU1, East Harbor	Contaminated intertidal and subtidal sediments in the eastern portion of Eagle Harbor associated with wood-treating operations at the former Wyckoff facility
OU2/4, Soils and Groundwater	Contaminated surface soil and structures associated with the Former Process Area (FPA) of the Wyckoff facility Contaminated subsurface soil and groundwater associated with operations at the Wyckoff facility
OU3, West Harbor	Upland areas, and intertidal and subtidal contaminated sediments associated with former shipyard operations on the north shore of Eagle Harbor
Notes: Subtidal ecosystems are always submerged due to tidal influence, whereas intertidal ecosystems are found between the high tide and low tide. *Source:* 2019 Record of Decision Amendment.	

The Wykoff Co./Eagle Harbor Superfund Site Five-Year Review was led by Helen Bottcher, the EPA remedial project manager (RPM). Participants included Sam Meng from the Washington State Department of Ecology (Ecology), and EPA support contractor Skeo. The PRPs were notified of the initiation of the FYR. Alex McEwan and Adrienne Stutes from the Washington Department of Transportation / Washington State Ferries (WSDOT / Ferries) participated in the inspection of the West Harbor Operable Unit (OU3). The review began on 11/19/2021.

Site Background

The Site is on the east side of Bainbridge Island in central Puget Sound, Washington (Figure C-1 in Appendix C). The Site includes the upland area of the former Wyckoff facility (Former Process Area [FPA]) (OU2/4), the upland areas and intertidal and subtidal sediments associated with the former shipyard (OU3), and the subtidal and intertidal sediments in Eagle Harbor (OU1) (Figure 1). The 54-acre former Wyckoff wood-treating facility is located on the south shore of Eagle Harbor. The offshore portion of the Site consists of intertidal beaches and subtidal areas of Eagle Harbor.

Eagle Harbor was used as a Suquamish Tribal village and burial site prior to non-tribal development. Starting in 1903, a major shipyard was established on the north shore of Eagle Harbor and continued operations until 1961

when the property was sold and subdivided. Wood-treating operations began on the harbor's south shore in 1905. From 1905 through 1988, a succession of companies treated wood for use as railroad ties, utility poles, pier pilings and wood stave pipes. Operation of the former Wyckoff facility led to soil, groundwater, and sediment contamination by wood-treatment compounds, including polycyclic aromatic hydrocarbons (PAHs) and pentachlorophenol (PCP). Operation of the former shipyard on the north shore of Eagle Harbor led to soil and sediment contamination by heavy metals, primarily mercury. Mercury releases from this facility, combined with PAHs released from the Wykoff facility, are the primary focus of the West Harbor operable unit (OU3).

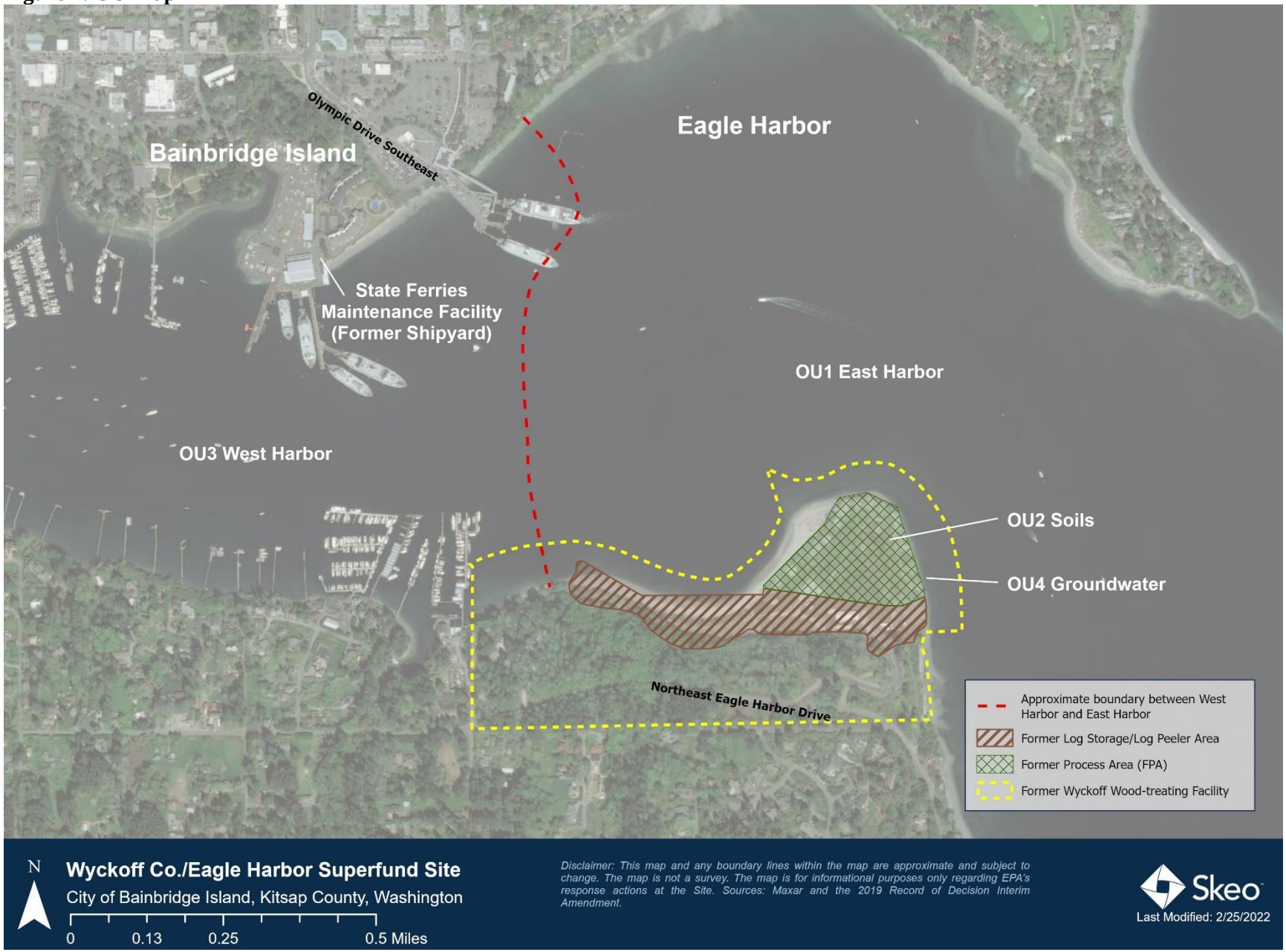
Current land use on Bainbridge Island is principally residential, with some commercial and light industrial use. Shorelines around Eagle Harbor include residences, city parks, marinas, the Washington State Ferries (WSF) maintenance facility and Bainbridge Island WSF terminal. Land use is not expected to change in the near future. Eagle Harbor is heavily used by recreational boaters, house boats and the ferry to and from Seattle. Eagle Harbor is also within the adjudicated usual and accustomed fishing area of the Suquamish Tribe, whose reservation is located on the Kitsap Peninsula north of Bainbridge Island. EPA recognizes that the Suquamish Tribe has treaty-reserved or other fishing rights in the areas affected by the Site and expects cleanup efforts to continue to improve habitat. The city of Bainbridge Island and the Bainbridge Island Metro Park & Recreation District are co-owners of the former Wyckoff wood-treating facility and have incorporated most of the OU2/4 area into Pritchard Park. When cleanup activities are complete, most if not all the remaining land in OU2/4 will be incorporated into the park. The westernmost entrance to the park leads to the Bainbridge Island Japanese American Exclusion Memorial (the memorial), which is part of the Minidoka Internment National Monument.

Groundwater beneath the Site consists of the upper aquifer and the lower aquifer. The unconfined upper aquifer consists primarily of sand and gravel. The flow in the upper aquifer in the FPA is influenced by the presence of a perimeter barrier wall (referred to as the sheet pile wall) as well as containment pumping. Outside the FPA, groundwater flow in the upper aquifer is toward Eagle Harbor and Puget Sound. The upper and lower aquifer are separated by an aquitard, which ranges in thickness from 10 to 50 feet. The lower aquifer consists of sand with small amounts of silt, clay, and gravel. The horizontal flow direction in the lower aquifer is not influenced by the perimeter wall or pumping and is toward Eagle Harbor and Puget Sound.

Both upper aquifer and lower aquifer groundwater quality within the FPA have been impacted by non-aqueous phase liquid (NAPL) and dissolved contaminants. In the upper aquifer, transport of contaminants beyond the FPA is limited by the sheet pile wall, hydraulic containment pumping and the aquitard. The aquitard slows but does not completely prevent contaminant transport from the upper aquifer into the lower aquifer. The upper aquifer is considered non-potable due to saltwater intrusion and low yield. The lower aquifer is considered potable (except in the northern tip of the FPA due to saltwater intrusion). All potable water-bearing geologic units underlying Bainbridge Island are considered part of an island-wide aquifer system, designated by EPA in 2013 as a Sole Source (Class I) Aquifer. The aquifer system supplies drinking water to the island's more than 25,000 residents. The nearest operating municipal production well is about 1,000 feet south and upgradient of the FPA, and there is an on-site community well (CW-01) near the western edge of Pritchard Park in the area of the memorial. Monitoring wells located between these wells and the lower aquifer contaminant plume are sampled annually to confirm the plume is not spreading toward groundwater production wells.

Appendix A provides a reference list for this FYR Report. Appendix B provides a chronology of major site events.

Figure 1: OU Map



FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Wyckoff Co./Eagle Harbor		
EPA ID: WAD009248295		
Region: 10	**State:** Washington	**City/County:** Bainbridge Island/Kitsap County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the Site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA		
Author name: Helen Bottcher, with additional support provided by Skeo		
Author affiliation: EPA Region 10		
Review period: 11/19/2021 – 7/1/2022		
Date of site inspection: 1/11/2022		
Type of review: Statutory		
Review number: 5		
Triggering action date: 9/26/2017		
Due date *(five years after triggering action date)*: 9/26/2022		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Following reports of oil observed on beaches, EPA began investigating the Site in 1971. In 1984, EPA issued a Unilateral Administrative Order requiring the Wyckoff Company to conduct environmental investigations under the Resource Conservation and Recovery Act (RCRA). Investigation results revealed the presence of significant soil and groundwater contamination. In July 1987, EPA listed the Site on the Superfund program's National Priorities List (NPL) and conducted a sitewide remedial investigation (RI) in 1989. Table 2 shows the main contaminants of concern (COCs) for each media and OU.

Table 2: Site COCs, by OU and Media

OU	COC	Media	Receptor/pathway
1	Mercury PAHs PCP	Sediment	Humans/fish and shellfish ingestion, sediment ingestion

OU	COC	Media	Receptor/pathway
2/4	PAHs PCP Dioxins	Soil and groundwater	Humans/soil and groundwater ingestion, inhalation of soil vapor
3	Mercury PAHs	Sediment	Humans/fish and shellfish ingestion

OU1, East Harbor

The 1989 RI report revealed extensive PAH contamination of surface and shallow subsurface sediments in Eagle Harbor. To address this contamination, EPA implemented a time-critical removal action to cap more than 54 acres of contaminated sediments. The 1994 human health risk assessment found that the highest human health risks at OU1 were from consumption of fish and shellfish with the highest risk associated with consumption of clams collected adjacent to the Wyckoff facility. Ecological risk for Eagle Harbor sediments was evaluated through several means. First, acute bioassays of benthic organisms showed toxicity in many sampling locations with locations nearest the Wyckoff facility showing the most severe responses. Of 55 sediment sampling stations across Eagle Harbor, 27 were acutely toxic to amphipods, with mortality ranging from 11 to 100 percent. Second, 80 percent of fish in Eagle Harbor had liver lesions, compared to only 7 percent of fish from other parts of Puget Sound. Lastly, mercury and PAHs were present in fish and shellfish tissue indicating sediment contamination was bioaccumulated in the food chain. Excess cancer risks from eating shellfish were between 2×10^{-6} and 3×10^{-3}. The results indicated unacceptable risk due to the contamination in OU1 sediments.

OU2/4, Soil and Groundwater

The OU2 1997 RI Report assessed the resulting risk to human health and the environment. OU2 includes the former Log Storage/Log Peeler Area, the FPA and CW01. OU4 includes the soil and groundwater in the saturated zone beneath OU2. The soil exposure scenario evaluated in the human health risk assessment was residential exposure, which was the most conservative scenario and represented the most likely future land use for much of the Wyckoff property including the FPA. Specifically, ingestion of surface and shallow subsurface soil, ingestion of groundwater and inhalation of groundwater vapors were evaluated.

For ingestion of surface and shallow subsurface soil, cancer risks above EPA's acceptable risk range were observed with more than 70% of the exceedances located in the northern portion of OU2. All surface and shallow subsurface samples with a non-cancer hazard quotient (HQ) greater than the threshold of 1 were associated with samples with an excess cancer risk greater than 1×10^{-6}. The primary contributor to cancer risk was benzo[a]pyrene, whereas naphthalene drove non-cancer risk.

For upper-aquifer groundwater south and west of the FPA, the 1997 risk assessment found excess cancer risk from ingestion of contaminated groundwater by future residents and non-cancer HQs greater than 1. For lower-aquifer groundwater, cancer risk ranged from 1×10^{-5} to 1×10^{-4}, and one of four groundwater monitoring wells exceeded a non-cancer HQ of 1.

The ecological risk assessment did not include scenarios for soil at the FPA, because it was assumed the soil would be remediated based on human health concerns. Also, the area was heavily developed at the time of the risk assessment and therefore little suitable habitat was available for wildlife. An ecological evaluation, completed for soil adjacent to the FPA, showed HQs greater than 1. Ecological receptors evaluated included plants, invertebrates, mammals, and birds. The primary risk drivers were PAHs.

OU3, West Harbor

The 1989 RI found that past shipyard operations, including the application, use, and removal (by sandblasting) of bottom paints and antifoulants were clearly associated with elevated concentrations of metals in sediments in and around the shipyard. Mercury was a particular concern. Subtidal mercury concentrations exceeded maximum background values by between two and twenty times throughout the harbor and were particularly high near the former shipyard. Ongoing operations at the time, which included a bulkhead construction business, a yacht repair yard, and a ferry maintenance facility, were cited as continuing sources of metals. Combustion sources, minor

spills and creosote-treated pilings and piers were found to be sources of PAHs, but the report noted that the Wyckoff wood treating facility was the major source of PAHs to Eagle Harbor.

The 1992 OU3 risk assessment showed that local residents and the general public were potentially exposed to contamination, including children and adults who consume contaminated fish and/or shellfish, and individuals who might be exposed to contaminated intertidal sediments through dermal exposure or incidental ingestion. Waterfront residences, public parks and fishing piers provide access to potentially contaminated intertidal beaches and harvestable seafood. The evaluation did not consider tribal members, who may have higher fish and shellfish consumption rates than members of the general public.

Marine organisms potentially exposed to contaminated sediments include sediment-dwelling organisms. Marine animals such as bottom-feeding fish and crabs are exposed to both contaminated sediments and contaminated prey organisms. Animals higher in the food chain may in turn be exposed. In sediment samples from Eagle Harbor collected for the 1989 sitewide RI, subtidal mercury concentrations exceeded maximum background values by between 2 and 20 times throughout the harbor and were particularly high near the former shipyard (OU3). Samples from locations adjacent to the former shipyard contained concentrations up to 95 milligrams per kilogram (mg/kg) mercury, over 100 times higher than concentrations acutely toxic to oyster larvae. EPA defined sediments containing concentrations of 5 mg/kg or more mercury as the principal threat in the West Harbor.

PAH concentrations were highest in intertidal sediments adjacent to the Wyckoff facility (OU1) and, to a lesser extent, near the ferry terminal (OU3). In comparison, sediment adjacent to the former shipyard in the West Harbor had lower concentrations of PAH, but the levels were higher than concentrations measured at intertidal background stations. Subtidal samples showed several high PAH values near the former shipyard in the West Harbor.

Response Actions

OU1, East Harbor

In 1993 and 1994, EPA conducted a non-time-critical cleanup action to cap more than 54 acres of sediments in Eagle Harbor, to cover areas that had been shown to cause significant adverse biological effects. This would be later termed the "Phase I" cap (Figure 2). The cap covered contaminated sediments under a 1-to-5-foot-thick layer of clean sand.

In September 1994, EPA signed the OU1 Record of Decision (ROD). The 1994 OU1 ROD described the following long-term goals (now considered the remedial action objectives [RAOs]):

- Achievement of the Washington State Sediment Management Standards (SMS) minimum cleanup levels (MCULs) (for protection of benthic invertebrates).
- Reduction of contaminants in fish and shellfish to levels protective of human health and the environment.

The remedy selected in the 1994 ROD was capping in subtidal areas and monitored natural recovery (MNR) in intertidal areas. Subtidal areas with COC concentrations above the MCULs were to be capped with an approximately 3-foot-thick sand cap (Table 3). The Washington State Sediment Quality Standards (SQS) represent conceptual target conditions, but the MCULs are considered the measurable site-specific objective. For intertidal sediments, monitoring was required to determine if the top 10 centimeters would achieve the MCULs and the PAH objective within 10 years. Institutional controls, such as a health advisory, and use and access restrictions were also required.

After complaints from citizens in 2005, EPA discovered creosote contamination in beach sediments at the Site. In 2007, EPA released an Explanation of Significant Differences (ESD) requiring the construction of an exposure barrier system (EBS) to cover the recently discovered contaminated sediments of the West Beach, and construction of a subtidal cap extension to cover nearby sediments not previously capped. The ESD also expanded the cleanup levels to include the Washington State Model Toxics Control Act (MTCA) soil cleanup levels to

address potential human direct contact exposure to sediments at low tide. The MTCA cleanup levels were only applicable to intertidal sediment along West Beach.[1]

In 2018, EPA amended the remedy for intertidal areas because MNR had not attained MCULs within the required 10 years. The 2018 Interim ROD Amendment included dredging, off-site disposal and capping to contain NAPL seepage. The MTCA Sediment Management Standards require developing cleanup levels in sediment to protect fish and shellfish consumers. The 2018 ROD Amendment is an Interim ROD because it did not meet this requirement. Because there was no clear relationship between contaminant concentrations in sediment and shellfish tissue, a protective carcinogenic polycyclic aromatic hydrocarbon (cPAH) concentration in sediment could not be derived. Therefore, EPA selected a target tissue concentration for shellfish. Shellfish tissue concentrations are expected to decline following cleanup, but whether the target tissue concentration will be achieved is uncertain. Compliance with MTCA will be addressed in a future CERCLA decision document.

The 2018 Interim ROD Amendment specifies the following RAOs for intertidal sediments in OU1:

- Reduce to protective levels the risk to human health posed by dermal contact and incidental ingestion of contaminated sediments in intertidal beach areas.
- Reduce levels of COCs in sediments to concentrations that protect benthic community health.
- Reduce levels of COCs in shellfish tissue to concentrations that protect Tribal shellfish consumers and prevent risks from consumption of shellfish until protective levels are achieved.

The 2018 Interim ROD Amendment specifies the following remedy components:

- Dredging about 6,600 cubic yards of contaminated sediment from select areas.
- Backfilling dredged areas with a multilayer cap, including placing reactive materials (such as oleophilic clay or other reagents) at the base of the cap to retard upward NAPL seepage, then restoring dredged areas to grade with clean, imported materials.
- Disposing of dredged sediments off site (landfill).
- Monitoring to confirm dredged and backfilled areas remain clean.
- Monitoring outside active cleanup areas to confirm natural recovery effectiveness.
- Implementing institutional controls to prohibit marine construction activities that could disturb the capped areas of the beach.

The 2018 Interim ROD Amendment updated the sediment cleanup goals for the intertidal area as shown in Table 4.

Table 3: OU1 Subtidal Sediment COC Cleanup Goals

Sediment COC	SQS Chemical Criteria 1994 ROD	MCUL Chemical Criteria 1994 ROD
Mercury	0.41 mg/kg (dry weight)	0.59 mg/kg (dry weight)
Individual PAHs and PAH groups	units = mg/kg organic carbon	
LPAHs	370	780
Naphthalene	99	170
Acenaphthylene	66	66
Acenaphthene	16	57
Fluorene	23	79

[1] These levels were replaced by the 2018 ROD Amendment, which established new cleanup levels for all intertidal areas of OU1 (Table 4).

Sediment COC	SQS Chemical Criteria 1994 ROD	MCUL Chemical Criteria 1994 ROD
Phenanthrene	100	480
Anthracene	220	1,200
2-Methylnaphthalene	38	64
HPAHs	960	5,300
Fluoranthene	160	1,200
Pyrene	1,000	1,400
Benz(a)anthracene	110	270
Chrysene	110	460
Total benzofluoranthenes	230	450
Benzo(a)pyrene	99	210
Indeno(1,2,3-c,d)pyrene	34	88
Dibenzo(a,h)anthracene	12	33
Benzo(g,h,i)perylene	31	78

Notes:
PAH = polycyclic aromatic hydrocarbon
LPAH = low molecular weight PAH
HPAH = high molecular weight PAH
SQS = Sediment Quality Standards
MCUL = Minimum Cleanup Level
Source: Table 8, 1994 ROD based on Washington State SMSs

Table 4: OU1 Intertidal Sediment COC Cleanup Goals

Sediment COC	Human Health Direct Contact	Benthic Community		Basis for Cleanup Level
	Risk-based Concentration (µg/kg) dry weight[a]	SMS SCO mg/kg organic carbon[b,c]	LAET µg/kg dry weight[b,c]	
LPAHs	NA	370	5,200	SMS
Naphthalene	NA	99	2,100	SMS
Acenaphthylene	NA	66	5,600	SMS
Acenaphthene	NA	16	500	SMS
Fluorene	NA	23	540	SMS
Phenanthrene	NA	100	1,500	SMS
Anthracene	NA	220	960	SMS
2-Methylnaphthalene	NA	38	670	SMS
HPAHs	NA	960	12,000	SMS
Fluoranthene	NA	160	1,700	SMS
Pyrene	NA	1,000	2,600	SMS
Benz(a)anthracene	3,660	110	1,300	Risk-based/SMS[d]
Chrysene	365,966	110	1,400	Risk-based/SMS[d]
Total benzofluoranthenes	NA	230	3,200	SMS

Sediment COC	Human Health Direct Contact	Benthic Community		Basis for Cleanup Level
	Risk-based Concentration (µg/kg) dry weight[a]	SMS SCO mg/kg organic carbon[b,c]	LAET µg/kg dry weight[b,c]	
Benzo(b)fluoranthene	3,660	NA	NA	Risk-based
Benzo(k)fluoranthene	36,597	NA	NA	Risk-based
Benzo(a)pyrene	366	99	1,600	Risk-based/SMS[d]
Indeno(1,2,3-c,d)pyrene	3,660	34	600	Risk-based/SMS[d]
Dibenzo(a,h)anthracene	366	12	230	Risk-based/SMS[d]
Benzo(g,h,i)perylene	NA	31	670	SMS
cPAHs (sum TEQ)	366	NA	NA	Risk-based
PCP	519	NA	360	Risk-based/SMS[d]

Notes:
NA = cleanup level not available
PAH = polycyclic aromatic hydrocarbon
cPAH = carcinogenic PAH
LPAH = low molecular weight PAH
HPAH = high molecular weight PAH
LAET = lowest apparent effects threshold
SCO = Sediment Cleanup Objective
TEQ = toxicity equivalent
µg/kg = micrograms per kilogram

a. Based on 1 x 10^{-6} excess cancer risk or HQ of 1, based on a tribal shellfish collector scenario as the reasonable maximum exposure.
b. Based on the benthic sediment cleanup objective (SCO) in the SMS (Washington Administrative Code [WAC] 173-204-562). The SCO numerical criteria may be overridden by the SCO biological criteria in the SMS (WAC 173-204-562, Table IV).
c. Carbon-normalized SCO values apply where sediment total organic carbon content is within the range of 0.5 % to 3.5 %. For sediment with total organic carbon less than 0.5 % or greater than 3.5 %, the dry-weight LAET values apply.
d. The human health-based cleanup levels are risk-based threshold concentrations for COCs resulting in a 1 x 10^{-6} excess lifetime cancer risk for individual carcinogens and a noncancer HQ of less than 1. Sediment cleanup levels are based on the SMS which are defined by chemical and biological criteria for specific hazardous substances.

Source: Table 2-3, 2018 Interim ROD Amendment

OU2/4, Soil and Groundwater

Pre-ROD Response Actions

Under a 1988 Administrative Order on Consent, Wyckoff Company installed a groundwater extraction and treatment system and began extracting and treating groundwater at selected wells in 1990. In 1993, EPA assumed responsibility for operation and maintenance (O&M) of the groundwater extraction and treatment system because the company was financially unable to do so. Between 1992 and 1994, EPA conducted a time-critical removal action, removing and disposing of creosote sludge, contaminated soils and asbestos; constructing a new bulkhead; and removing and recycling materials left in the retorts and tanks.

ROD Response Actions

In September 1994, EPA issued an interim ROD for groundwater to prevent contaminated groundwater and NAPL from moving off site into Eagle Harbor and from reaching deeper aquifers. The RAOs focused solely on containment and the interim ROD did not include groundwater cleanup levels. The interim ROD required

replacing the existing groundwater treatment plant and sealing and abandoning on-site water supply wells. In 1996 and 1997, most remaining above-grade structures were demolished, and the debris was removed and disposed of offsite.

In February 2000, EPA issued a final ROD for OU2/4. The RAOs replaced the containment-focused RAOs from the 1994 interim ROD. The 2000 RAOs were divided into soil and groundwater RAOs. These RAOs were replaced with updated RAOs in the 2019 interim ROD Amendment. Both the previous and current RAOs are shown in Table 5.

Table 5: OU2/OU4 2000 ROD RAOs

Media	Previous RAOs from 2000 ROD	Current RAOs Established in 2019 interim ROD Amendment
Soil	• Prevent human exposure through direct contact (ingestion, inhalation, or dermal contact) with contaminated soil. • Prevent stormwater runoff containing contaminated soil from reaching Eagle Harbor.	• Reduce human health risks associated with direct contact, ingestion, or inhalation of contaminated soils to levels that are protective of outdoor recreational use.
Groundwater	• Reduce the NAPL source, and the quantity of NAPL leaving the upper aquifer beneath the FPA, sufficiently to protect marine water quality, surface water and sediments (e.g., ensure the quantity of NAPL leaving the Site will not adversely affect aquatic life and sediments). Site-specific groundwater contaminant concentration limits will be met at the mudline [the points where groundwater flows into surface water]. • Ensure contaminant concentrations in the upper aquifer groundwater leaving the FPA will not adversely affect marine water quality, and aquatic life in surface water and sediment. • Protect humans from exposure to groundwater containing contaminant concentrations above maximum contaminant levels (MCLs). • Protect the groundwater outside the FPA and in the lower aquifers, which are potential drinking water sources.	• Prevent human exposure to contaminated upper aquifer groundwater. • Reduce risks associated with discharge of contaminated upper aquifer groundwater to Eagle Harbor and Puget Sound to levels that protect aquatic life and human consumption of resident fish and shellfish. • Prevent further degradation of the lower aquifer and prevent exposure to lower aquifer groundwater that would result in unacceptable risk to human health.

Key features of the 2000 ROD included:

- Thermal remediation to remove contamination from soil and groundwater.
- A pilot study to test the applicability and effectiveness of thermal remediation.
- A contingency remedy – containment – to be implemented if the pilot study was unsuccessful.
- Capping of soil in the Former Log Storage/Peeler Area and the FPA.

Because the pilot study was not successful, the contingency remedy was invoked, which included:

- Consolidation of contaminated hot spots from the Former Log Storage/Peeler Area and the well CW-01 area within the FPA (originally included as part of the unsuccessful pilot study remedy but was retained).
- Construction of a sheet pile wall around the entire FPA for soil containment.
- Construction of a new groundwater pump and treat system in the upper aquifer, designed to contain contamination by drawing groundwater and precipitation inward, away from the perimeter sheet pile wall and upward, away from the aquitard separating the upper and lower aquifers.
- Capping of soil in the Former Log Storage/Peeler Area. (The soil cap over the FPA was not constructed.)
- Monitoring contaminant concentrations in both the upper aquifer outside the FPA and the lower aquifer beneath OU2/4 to verify continued containment and identify any trends in groundwater contaminant data.

- Establishment of institutional controls to:
    - Ensure that the upper aquifer groundwater outside the FPA and the lower aquifer remain unused for drinking water until protective levels are reached.
    - Ensure that the upper aquifer groundwater within the FPA remains unused due to contaminants that may remain after thermal treatment or will remain as part of the contingency remedy; this portion of the upper aquifer is also not potable due to high salinity levels.
    - Restrict site use to reduce the risk of direct exposure to surface soil, as necessary.

The 2000 ROD established groundwater cleanup levels for the upper aquifer based on the most stringent of state and federal marine water quality standards/criteria, risk-based surface water standards for human consumption of organisms, and calculated pore-water maximums based on SMSs for marine sediments (Table 6).[2] The 2000 ROD did not establish cleanup levels for the lower aquifer but indicated that Safe Drinking Water Act Maximum Contaminant Levels (MCLs) are relevant and appropriate. The soil cleanup levels, established for the vadose zone (unsaturated soil to a depth of 15 feet below ground surface), and based on MTCA, are presented in Table 7.

Table 6: OU2/4 Upper Aquifer Groundwater Cleanup Levels

COC	Previous Groundwater Cleanup Levels from 2000 ROD (µg/L)	Current Groundwater Cleanup Levels in 2019 Interim ROD Amendment
Naphthalene	83[a]	There are no cleanup levels for upper aquifer groundwater in the 2019 Interim ROD Amendment. There will be little groundwater left in the FPA after remedial construction to stabilize soil and groundwater. Any groundwater discharged from the upper aquifer will be treated to meet discharge criteria, which will be established during remedial design / construction. Groundwater in the lower aquifer will be addressed in a future CERCLA decision document.
Acenaphthene	3[a]	
Fluorene	3[a]	
Anthracene	9[a]	
Fluoranthene	3[a]	
Pyrene	15[a]	
Benzo(a)anthracene	0.0296[b]	
Chrysene	0.0296[b]	
Benzo(b)fluoranthene	0.0296[b]	
Benzo(k)fluoranthene	0.0296[b]	
Benzo(a)pyrene	0.0296[b]	
Dibenzo(a,h)anthracene	0.007[a]	
Indeno(1,2,3-cd)pyrene	0.0296[b]	
HPAHs	0.254[a]	
PCP	4.9[b]	

Notes:
µg/L = micrograms per liter
a. Calculated pore-water concentrations based on SMS or human health
b. Based on MTCA Method B surface water, human consumption of organisms (173-340 WAC)
Source: Table 13, 2000 ROD

In 2012, Ecology assumed operation of the groundwater extraction and treatment system under a Superfund State Contract (SSC) for a period of two years, while EPA performed focused feasibility studies to evaluate permanent source reduction technologies. In 2013, EPA investigated the extent of NAPL contamination in soil and groundwater in the FPA. Based on the results of this investigation and ongoing groundwater monitoring, EPA determined additional actions were needed to address principal threat waste in OU2/4. Ecology has continued to operate the groundwater extraction and treatment system under multiple extensions of the SSC.

In 2018 and 2019 EPA issued two interim ROD Amendments applicable to OU2/4. The 2018 Interim ROD Amendment selected remedy for OU2/4 included the following:

[2] The MCLs were not deemed relevant or appropriate for the upper aquifer. Alternate Concentration Limits were used since upper aquifer groundwater discharges into surface water, there was no statistically significant increase in contamination in the surface water at the entry point, and institutional controls would preclude human exposure to contaminated groundwater.

- Constructing a new reinforced concrete wall, to be built adjacent to the outboard/seaward side of the existing wall.
- Making improvements to the existing access road to reduce the steep grade over a portion of the road and straighten a sharp curve, which was needed to transport large construction equipment and materials to the work area.

The 2018 Interim ROD Amendment did not update RAOs or cleanup levels for OU2/4. The 2019 Interim ROD Amendment replaced the RAOs selected in the 2000 ROD, as shown in Table 5 (above).

The 2019 Interim ROD Amendment selected remedy included:

- Demolishing and removing or decontaminating and reusing remaining concrete building foundations and debris, including the steam extraction pilot test equipment that remains on site from the previous remedial action.
- Installing an underground "cutoff" wall along the south side of the former wood-treating area to divert upgradient groundwater around contaminated soil and groundwater.
- Treating an estimated 267,000 cubic yards of NAPL-contaminated soil and groundwater through in-situ soil solidification/stabilization (ISS), to be accomplished by blending a cement-based reagent with NAPL-contaminated soil and groundwater in situ through a combination of jet grouting in the deepest treatment areas, auger mixing in the center of the Site where contamination is thickest, and excavator mixing in shallow treatment areas.
- Installing a low permeability cap over treated and untreated soil within the FPA.
- Constructing a new outfall pipe to drain future stormwater from the capped area.
- Using passive discharge drains, with treatment as needed, to manage groundwater levels in the area enclosed by the perimeter wall and slurry wall and areas south of the slurry wall following ISS treatment.
- Using institutional controls (for example, under the Washington Uniform Environmental Covenants Act) to prohibit activity that could disturb the cap or result in human exposure to contaminated soil and groundwater that remain below the cap.

The 2019 Interim ROD Amendment updated the soil cleanup levels, as shown in Table 7. The 2019 Interim ROD Amendment did not establish cleanup levels for the upper aquifer because groundwater within the FPA will be contained by the perimeter wall and a new southern groundwater "cutoff" wall. Because groundwater in this area is considered non-potable, drinking water standards are not applicable. This Interim ROD Amendment does not establish cleanup levels for groundwater within the containment area. Discharge criteria will be developed for any discharge of groundwater from the containment area to ensure compliance with the substantive requirements of Section 402 of the Clean Water Act and Washington Administrative Code (WAC) 173-220-130.

The 2019 Interim ROD Amendment also does not include cleanup measures in the lower aquifer. The objective of preventing further degradation will be met if lower aquifer groundwater contaminated above MCLs does not spread to monitoring wells between the FPA and nearby drinking water wells. Contamination of lower aquifer groundwater will be addressed in a future cleanup decision for OU2/4.

Table 7: OU2 Soil Cleanup Levels

COC	Previous Soil Cleanup Levels[a] from 2000 ROD (mg/kg)	Current Soil Cleanup Levels from 2019 Interim ROD Amendment[b] (mg/kg)
Naphthalene	3,200	3.8[c]
Acenaphthene	4,800	4,800[d]
Fluorene	3,200	3,200[d]
Anthracene	24,000	24,000[d]
Fluoranthene	3,200	3,200[d]
Pyrene	2,400	2,400[d]
cPAHs		
Benzo(a)anthracene	0.137	1.9[e]
Chrysene	0.137	19[e]
Benzo(b)fluoranthene	0.137	1.9[e]
Benzo(k)fluoranthene	0.137	1.9[e]
Benzo(a)pyrene	0.137	0.19[e]
Indeno(1,2,3-c,d)pyrene	0.137	1.9[e]
Dibenzo(a,h)anthracene	0.137	1.9[e]
Total cPAH (summed TEQ for 7 cPAHs listed above), adjusted based on potency relative to benzo(a)pyrene	--	0.19[e]
PCP	8.33	2.5[f]
Dioxin (2,3,7,8- Tetrachlorodibenzo-p-dioxin) TEQ[g]	0.000007	--
Dioxin (2,3,7,8-Tetrachlorodibenzo-p-dioxin)	--	0.000013[g]

Notes:
-- = Not applicable/none specified
CLARC = Cleanup Levels and Risk Calculation
cPAH = carcinogenic PAHs
mg/kg = milligrams per kilogram
MTCA = Model Toxics Control Act
TEQ = toxic equivalency

a. Table 14, 2000 ROD
b. Table 2-4, 2019 Interim ROD Amendment
c. Based on EPA regional screening levels (2019)
d. Based on MTCA Method B noncancer direct contact (2015)
e. Based on MTCA Method B cancer direct contact (2019)
f. Based on MTCA Method B cancer direct contact (2015)
g. Chlorinated dioxin/furan toxicity equivalency factors (expressed as 2,3,7,8- tetrachlorodibenzo-p-dioxin or dioxin TEQ)

OU3, West Harbor

EPA selected the OU3 remedy in the 1992 ROD and 1995 ROD Amendment. The 1992 OU3 ROD described the primary site-specific goal and objective as the "achievement of the sediment quality standard (SQS) and reduction of contaminants in fish and shellfish to levels protective of human health and the environment." To define areas requiring remedial action, the following additional objectives were specified:

- To address sediments containing 5 mg/kg (dry weight) or more of mercury ("Mercury Hotspot"), as a means of source control.
- To address intertidal sediments containing 1,200 micrograms per kilogram (µg/kg) (dry weight) or more of high molecular weight PAH (HPAH) ("Intertidal HPAH Areas"). Shellfish in such areas contained carcinogenic HPAH above EPA acceptable levels for protection of human health.
- To address predicted biological impacts, minimize potential sediment resuspension, and limit biological uptake in areas where sediment concentrations of mercury exceed 2.1 mg/kg mercury dry weight ("Mercury High Apparent Effects Threshold Areas").

The major components of the selected remedy included:

- Source control measures at the former shipyard to comply with MTCA soil cleanup standards for protection of human health, based on current and future industrial land use, or for protection of surface water, whichever was more stringent (1995 ROD Amendment).[3]
- Disposal of about 7,000 cubic yards of mercury hot spot sediments in a nearshore confined disposal facility (CDF) adjacent to the former shipyard. The CDF was constructed on 0.9 acres of intertidal land adjacent to the former shipyard (1995 ROD Amendment).
- Placement of at least 39 inches (1 meter) of clean sediment over areas of high concern for adverse biological effects and potential contaminant resuspension and bioaccumulation.
- Thin-layer placement of clean sediments to enhance sediment recovery in areas of moderate concern.
- Natural recovery and monitoring in areas predicted to achieve the long-term sediment cleanup objective without sediment remedial action.
- Continued institutional controls to protect human health from exposure to contaminated fish and shellfish.
- Long-term environmental monitoring to evaluate the effectiveness of the remedy.

Table 8 lists soil cleanup standards that must be achieved by source control and soil cleanup as required in the 1995 ROD Amendment. Soil cleanup standards were derived based on site-specific data and State of Washington surface water quality standards or SMS. For contaminants that are less leachable, MTCA human health (industrial) standards for a given contaminant were selected.

Sediment cleanup levels set in the 1992 ROD are the same as for OU1, except PCP is not a COC in OU3 (see Table 3 for sediment cleanup levels). The SQS represent conceptual target conditions, but the MCULs are considered the measurable site-specific objective. The 1992 ROD specified that MCULs should be achieved in the top 10 centimeters in OU3 within 10 years from construction completion.

Table 8: OU3 Upland Soil Action Levels

Contaminant	Soil Stabilization Action Level (mg/kg)	Soil Capping Action Level (mg/kg)
Total Metals		
Antimony	1,400[a]	--
Arsenic	188[a]	--
Copper	10,000[b]	250[c]
Lead	1,000[d]	--
Mercury	10[e]	2[b]
Zinc	6,000[b]	--

Notes:
a. Based on MTCA Method C Soil Cleanup Levels for Industrial Sites
b. Based on worst-case soil erosion and sediment transport assumptions
c. Based on water quality criteria and the reasonable worst-case field-scale partition coefficient
d. Based on MTCA Method A Soil Cleanup Levels for Industrial Sites (WAC 173-340-745)
e. Based on worst case soil erosion and sediment transport assumptions
Source: Table 1, 1995 ROD Amendment

[3] The 1995 ROD Amendment added measures for control of sources in the former shipyard which were identified during remedial design. These measures include treatment of surface soil hot spots and physical barriers to minimize groundwater, surface water and seawater flow through underlying soils. These measures will also protect human health and the environment for current and future industrial uses of the former shipyard area. To minimize administrative burdens on the property owner and to ensure a comprehensive cleanup, this ROD Amendment required contaminant source control actions at the former shipyard to achieve soil cleanup standards for industrial uses under MTCA.

Status of Implementation

OU1, East Harbor

The OU1 subtidal and intertidal caps required in the 1994 ROD were completed in three phases between 1994 and 2002 (Figure 2). The Phase I cap was completed in 1994 (pre-ROD) as a non-time critical removal action and covered 54 acres of subtidal sediment. In 2000, Phase II extended the original cap by an additional 15 acres toward the former Wyckoff facility. This area was not remediated during Phase I, due to lack of upland source control at the time. The Phase III cap was completed in 2001 and placed in shallow subtidal and intertidal areas to create intertidal habitat and a continuous beach along the shoreline.

In 2001, construction was completed on a habitat mitigation beach, offsetting habitat loss associated with the sheet pile wall installation for OU2/4. The mitigation beach was renamed West Beach and is considered part of OU1. Construction of the EBS was completed in 2008 on the West Beach. Final construction included a bottom geotextile layer, a 1-foot-thick cobble layer and a 2-foot-thick habitat fill layer, in accordance with the 2007 ESD requirements.

In 2012, EPA sampled the East Beach and North Shoal sediments to determine whether cleanup levels had been achieved. These beaches were the focus of the investigation because they were the only areas where MNR, in lieu of active remedial measures (capping and the EBS), had been implemented, and the potential for exposure to contaminated sediments remained. Significant improvements were seen, including sharp declines in PAH concentrations and a decrease in the number and severity of NAPL seeps. However, cleanup levels had not been achieved everywhere on the beaches and some NAPL seeps remained (Figure H-1 in Appendix H). An additional investigation to map the extent of NAPL beneath the beaches in 2013 revealed the following:

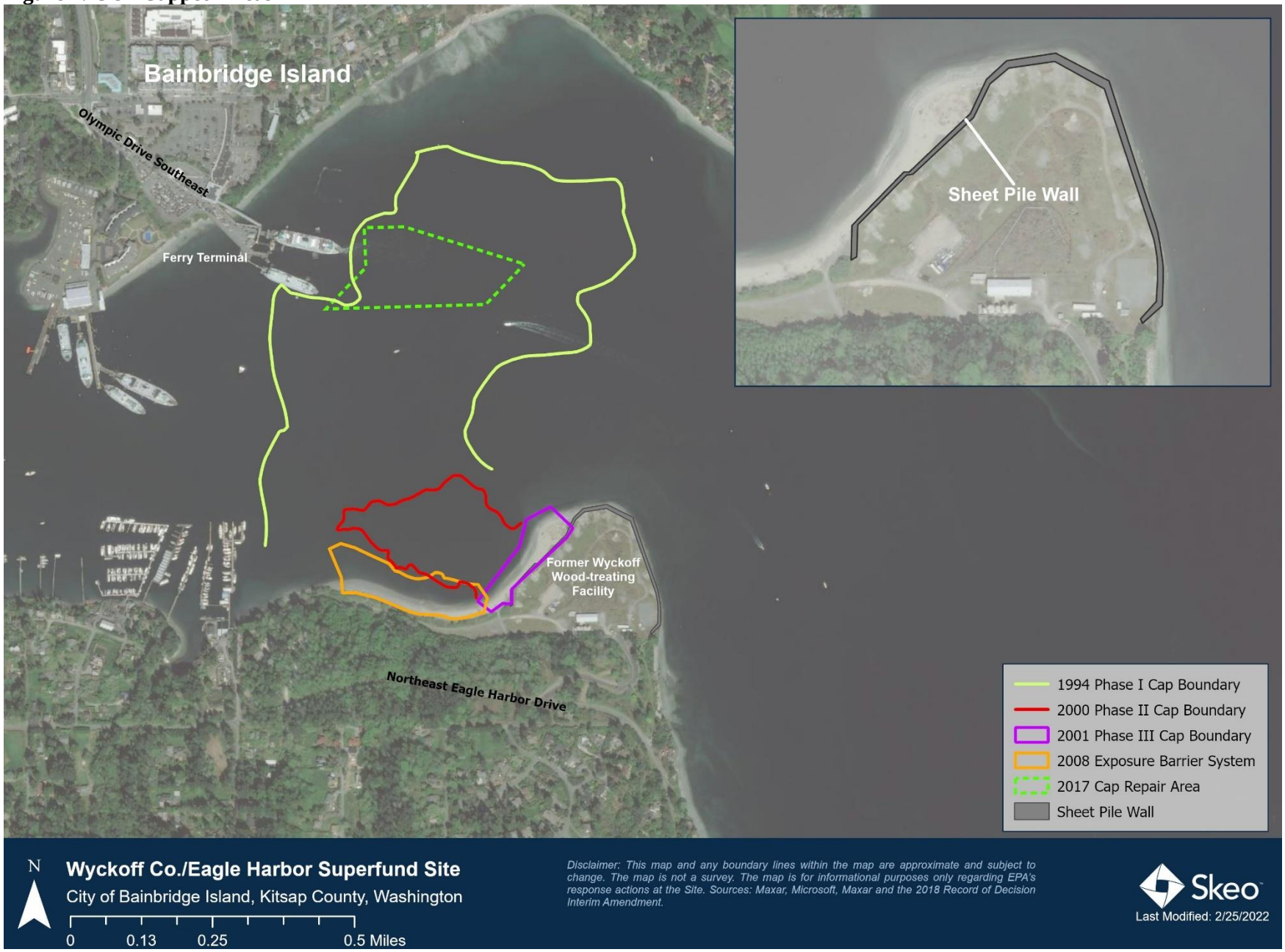
- NAPL is present in both East Beach and North Shoal subsurface sediments.
- NAPL is not uniformly distributed. Most NAPL is in the central part of East Beach and the North Shoal. The thickest total NAPL accumulations occur near the perimeter sheet pile wall. The volume of NAPL and the thickness of the NAPL layers decrease with increasing distance away from the wall.
- NAPL seeps occur in a few locations. Several of the seeps are persistent and can be found in the same location year after year. The largest seep is on East Beach.

In addition, material loss was seen on the northern portion of the subtidal Phase I cap, along the ferry lane, particularly at the approach to the Winslow terminal. In early 2017, repairs were made to the subtidal cap in this area (Figure 2). To restore necessary isolation, 1 foot of clean sand was added over the exposed area (9.3 acres). The high impact center of the ferry lane (3.5 acres) also received an additional 2-foot-thick rock/armor layer to prevent future erosion of the clean sand cap. In September 2017, a Remedial Action Report was issued detailing the subtidal sediment cap repair work completed. In April 2021, EPA and Ecology agreed that the remedy in the subtidal portion of OU1 is complete and functioning as intended. EPA transferred responsibility for O&M of subtidal sediments in OU1 to Ecology. EPA remains responsible for the intertidal areas of OU1 and areas that may be needed for construction of the remedy selected in the 2018 Interim ROD Amendment.

In 2018, EPA completed the intertidal sediment predesign investigation in OU1. The 2018 Predesign Investigation Report findings caused changes to the design of the beach remedy. During the 2018 investigation, contaminant concentrations in sediments exceeded SMS in the West Beach just outside of the EBS and in the North Shoal and East Beach sediments. Based on these observations, the areal extent of the capped areas will be larger than envisioned in the 2018 Interim ROD Amendment.

The study also demonstrated that NAPL continues to discharge from upland soil and groundwater to the intertidal beaches through seams and possibly other leaks in the sheet pile wall. This finding impacted and delayed the design of the new sediment caps. The preliminary (35%) design was produced in August 2020. After review and comment, the intermediate (50%) design was issued in August 2021.

Figure 2: OU1 Capped Areas



OU2/4, Soil and Groundwater

Sheet Pile Wall

The sheet pile wall around the full FPA was installed in 2001 (Figure 3). The wall is about 1,870 feet long and extends to a depth of 20 to 90 feet below grade. In December 2013 a Technical Memorandum evaluated construction methods, exposure scenarios, tidal profiles, and life-span evaluations for the sheet pile wall. Additional investigations, conducted in 2016, indicated the sheet pile wall was corroding rapidly. In December 2019, EPA decided to build the replacement perimeter wall inside the current wall. This minor change to the 2018 Interim ROD Amendment was recorded as a memorandum. In 2020, a predesign investigation was completed, focusing on the nature and extent of subsurface debris in upland soils as well as refining the cost estimate and debris handling and disposal plan. The investigation also informs the design of the replacement perimeter wall, which uses a concrete soil mix as a primary technology. Design of the replacement perimeter wall is ongoing.

Improvements to Existing Access Road

Construction to implement the improvements to the existing access road began in May 2020. The work included realigning a portion of the road to lessen a steep grade and soften a tight curve. The primary construction was completed in November 2020, beginning a one year warranty period. The final inspection was completed in November 2021. The Remedial Action Completion Report was not issued during this FYR period. It will be included in the next review.

Soil Removal

Contaminated soils from the area around well CW-01 were excavated and consolidated with contaminated soils in the FPA in 2002. As indicated in the 2019 Interim ROD Amendment, soil cleanup levels have been achieved in this area, and no further remediation is required.

In 2002, the wooden bulkhead along the shoreline west of the FPA was demolished and contaminated soils from the log storage/log peeler area were excavated and consolidated with contaminated soils in the FPA; this action converted upland soil to intertidal beach habitat. Thereafter, the area was managed as part of OU1 East Harbor. As indicated in the 2019 Interim ROD Amendment, soil cleanup levels have been achieved in this area, and no further remediation is required.

Although required in the 2000 ROD as part of the contingency remedy, capping of soil in the Former Log Storage/Peeler Area and the FPA was not completed and has now been amended by the remedy selected in the 2019 Interim ROD Amendment. Remedial design of the remedy selected in the 2019 Interim ROD amendment is ongoing.

Groundwater Treatment

The thermal treatment pilot study, conducted between October 2002 and April 2003, determined that performance expectations could not be met due to numerous technical challenges. A contingency remedy, initiated in 2004, uses carbon adsorption for groundwater treatment. The new (and current) groundwater treatment plant was constructed in 2010 and has been operating since. A water supply well is located at the southwest corner outside the fenced FPA. Groundwater from this well is pumped on an as needed basis to support backwash of the groundwater treatment plant's granular activated carbon vessels.

Long-term groundwater monitoring of water levels and contaminant concentrations began in March 2004 and is ongoing. Engineering controls implemented include fencing, signage, and other site access controls.

Extraction and treatment of groundwater began in 1990. In 1995, replacement wells were installed, and the original groundwater treatment plant was upgraded. In April 2010, construction of the replacement groundwater treatment plant was completed. In 2012, Ecology assumed O&M of the groundwater extraction and treatment system, pursuant to an SSC. In the same year, EPA began reevaluating whether additional source removal actions may be needed at OU2/4.

An uplands NAPL site investigation was completed in September of 2013 and an update to the conceptual site model (CSM) was completed in February 2014 (Figure H-2 in Appendix H). The CSM update incorporated new information from the uplands NAPL site investigation, groundwater characterizations from the upper and lower aquifers and other site-related activities. A focused feasibility study was completed in April 2016.

2019 Interim ROD Amendment

The updated remedy selected in the 2019 Interim ROD Amendment will be implemented after completion of the replacement sheet pile wall design. The planned remedy is shown in Figure H-3 in Appendix H.

OU3, West Harbor

In November 1993, EPA and PACCAR, Inc. (the potentially responsible party [PRP] at OU3) signed an Administrative Order on Consent (AOC), which set forth the requirements for remedial design of those actions described in the 1992 ROD. Sediment cleanup areas initially selected in the 1992 ROD were refined during remedial design, using a combination of sediment chemistry and sediment toxicity testing results.

The initial OU3 remedial construction finished during summer 1997. The tidal barrier system, which includes the seep remediation cap, was added in 2006 in response to seeps draining from the upland area to the adjacent creek during low tide events (Figure 4). The seeps were discovered during remedy inspection events, and sampling confirmed the seeps were contaminated with metals. The total implemented remedy consisted of the following activities:

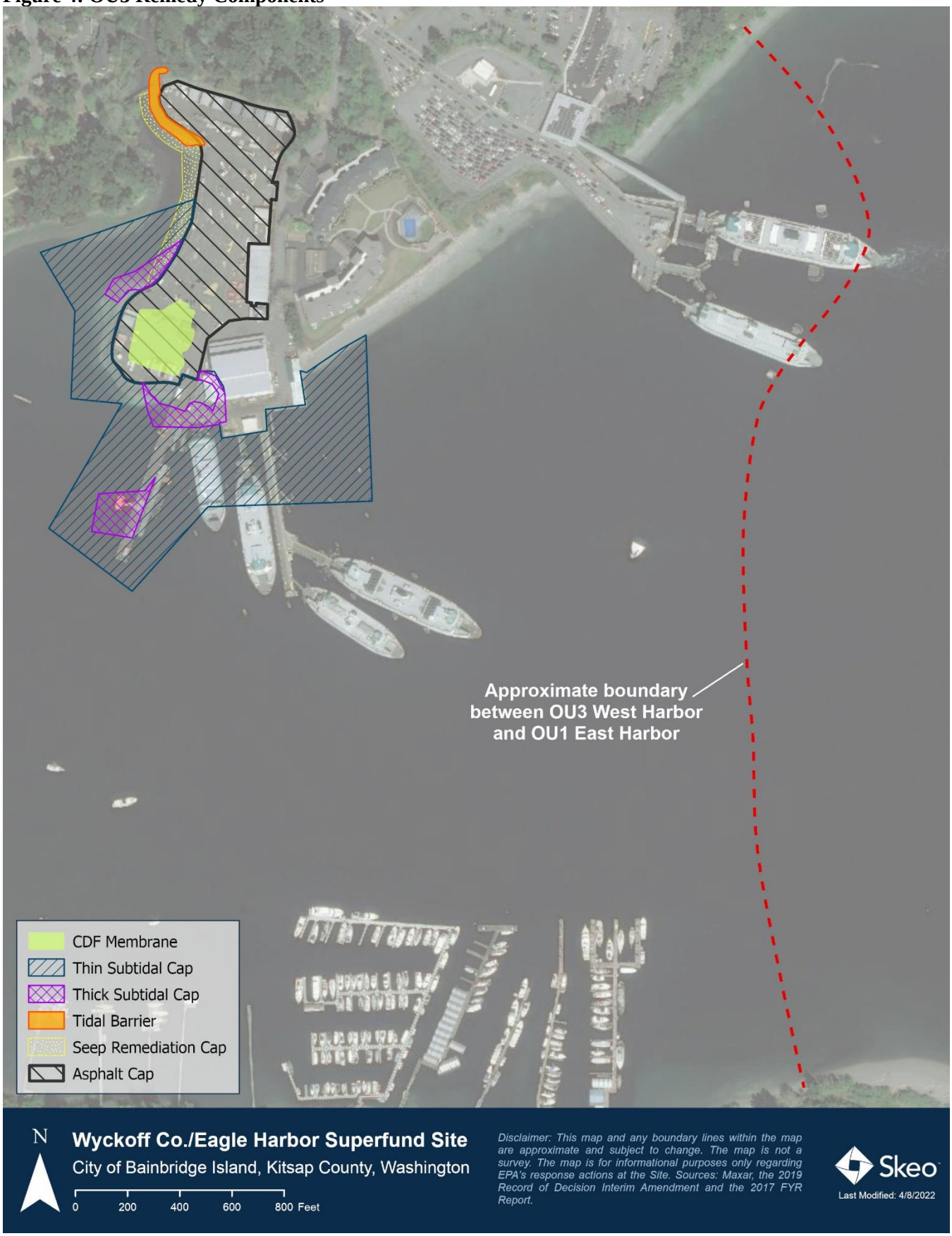
- Source control through soil stabilization of two upland "hot spot" areas.
- Installation of a drainage system along the northern boundary of the Site (known as the Northern Cutoff Drainage System) to intercept and cut off surface and shallow subsurface water run-on.
- Installation of an asphalt concrete cap across the upland area.
- Implementation of upland best management practices, including stormwater treatment.
- Institutional controls including deed restrictions and site-access controls for the active WSF maintenance yard.
- Construction of the CDF.
- Dredging of hot spot sediments (mercury concentrations greater than 5 mg/kg dry weight) and placement in the CDF.
- Construction of 39-inch "thin caps" over three areas of sediment with mercury concentrations between 2.1. and 5.0 mg/kg dry weight.
- Construction of a 6-inch cap over sediment with mercury concentrations between 0.59 and 2.1 mg/kg dry weight.
- Installation of a tidal barrier system along the western portion of the CDF to minimize the potential for seeps that could impact capped sediments.
- Continued monitoring of intertidal sediments and shellfish.

To compensate for 0.9 acres of habitat lost during the construction of the CDF, the following mitigation measures were implemented in 1997:

- Enhanced the face of the CDF berm and tidal barrier with gravel/cobble habitat layers.
- Attempted to establish an eelgrass meadow in a 0.6-acre planting site located immediately west of the sediment cap.
- Constructed the 2-acre Schel-chélb Estuary at the south shore of Bainbridge Island.
- Provided the Suquamish Tribe with $110,000 for clam enhancement or other restoration projects performed by the Tribe.

Figure 3: OU2 Remedy Components

Figure 4: OU3 Remedy Components



Institutional Control (IC) Review

Table 9 summarizes the institutional controls required for each OU. The 1994 OU1 ROD and the 2018 OU1 Interim ROD Amendment required institutional controls to restrict beach access and provide additional warnings regarding the harvest and consumption of contaminated seafood and include restrictions on anchoring, dredging or other sediment disturbance. These institutional controls are in place. Anchoring, dredging or any activity that could potentially disturb the seabed is prohibited over a large area in the eastern part of Eagle Harbor (referred to as the Regulated Navigation Area, Figure 5). EPA has posted signs along the fence throughout the Wyckoff beach areas and Prichard Park notifying the public of the beach areas closed due to contamination. North Shoal and East Beach remain closed to the public. The Kitsap Public Health District implements the shellfish harvest advisories for Eagle Harbor. They maintain an interactive map with all shellfish advisories.[4] Eagle Harbor is shown as "Closed Due to Pollution" (see closure area in Figure 5).

The 2000 OU2/4 ROD required institutional controls to restrict the use of groundwater and restrict site use to prevent exposure to surface soils, if necessary. The 2019 ROD Amendment replaced these requirements with more specific institutional control measures to protect the final site cap from future construction activities, prohibit installation of groundwater wells in the FPA, prohibit installation of groundwater wells within the lower aquifer outside the FPA as needed to prevent plume migration, and protect any habitat constructed or enhanced as compensatory mitigation for remedial construction efforts. The final cap is not yet constructed, and restrictive covenants have not been prepared. However, the 2004 Prospective Purchaser Agreement (PPA) between EPA and the city of Bainbridge Island prevents groundwater access and excavation. To restrict access, the FPA is completely fenced.

The 1992 OU3 ROD required the continuation of harvest advisories for fish and shellfish as well as additional warning signs. These institutional controls overlap with the OU1 controls and have been implemented. The 1995 ROD Amendment required physical restrictions to limit public access. This requirement was met by fencing the entire upland area. An additional institutional control is in place in the form of an electronic survey of site topography and key features, which WSF uses to determine environmental requirements and land use restrictions for any proposed excavation actions. These requirements and restrictions will be reiterated in any lease agreements administered by WSF. WSF has not entered into any lease agreements on the Eagle Harbor property since remedial actions were implemented at the Site (Table 9).

[4] Located at: https://kitsappublichealth.org/environment/shellfish_advisories.php (accessed on 2/1/2022).

Table 9: Summary of Planned and/or Implemented Institutional Controls (ICs)

Media, Engineered Controls, and Areas That Do Not Support UU/UE Based on Current Conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Fish and shellfish tissue	Yes	Yes	OU1 and OU3 – intertidal and subtidal areas	Advise against harvesting fish or shellfish from Eagle Harbor.	Kitsap Public Health District currently maintains shellfish advisories for Eagle Harbor.
Subtidal and intertidal sediment	Yes	Yes	OU1 – intertidal and subtidal areas	Restrict use and access to ensure protection of the completed remedy.	PPA, 2004 Health advisories, beach closure notifications, "no anchor" area notifications (Regulated Navigation Area)
Groundwater	Yes	Yes	OU2/4 – former Wyckoff facility (parcel number 35250210012001, 35250210342002 and 35250210352001)	Restrict use of upper and lower aquifer groundwater.	PPA, 2004 restrictive covenant (planned)
Soil	Yes	Yes	OU2/4 – former Wyckoff facility (parcel number 35250210012001, 35250210342002 and 35250210352001)	Restrict site use to reduce direct exposure to surface soil.	PPA, 2004 restrictive covenant (planned)
Land use	Yes	Yes	OU3 – ferry maintenance facility (parcel numbers 26250231122004 and 26250231132003)	Restrict land use to industrial uses.	electronic survey provided by PACCAR, Inc. in May 1998

Figure 5: Institutional Control Map

Systems Operations/Operation and Maintenance (O&M)

OU1, East Harbor

EPA conducted long-term monitoring of the subtidal and intertidal areas of the East Harbor according to the Operations, Maintenance and Monitoring Plan (OMMP) approved by EPA in July 1994, and most recently amended in December 2016. The primary activities associated with the OMMP include:

- Subtidal sediment cap monitoring.
- Intertidal area monitoring.
- EBS monitoring.

Subtidal Sediment Cap

Following construction of the Phase 1 subtidal cap in 1993, both chemical (surface and subsurface sediment chemistry) and physical monitoring (bathymetry and cap thickness measurements) were conducted to ensure the cap remained in place and continued to isolate contaminated sediments beneath it. The cap has been mostly stable since then except for the area immediately in front of the ferry terminal, where scour from prop wash eventually eroded away the cap, exposing sediments with contaminant concentrations above the 1994 ROD cleanup level. The cap in this area was repaired in 2017. The overall stable condition of the cap supported a shift to less frequent monitoring events, and to more reliance on physical monitoring with fewer sediment chemistry samples to confirm the surface of the cap remains clean. EPA has deferred fish tissue monitoring until the remedy in OU1 is complete. However, the Washington Department of Fish and Wildlife monitors the condition of English sole in Eagle Harbor. Their research documented a significant decline in PAH-induced liver disease between 1995 and 1998 and a continually low incidence of disease since 2005.

The OMMP was updated in 2016, but there have been no O&M activities at OU1 during this FYR period. EPA and Ecology discussed transfer of O&M responsibilities for the subtidal sediment remedies in 2018 and January 2021. In April 2021, EPA notified Ecology that the subtidal portion of the OU1 remedy is considered operational and functional and Ecology is now responsible for O&M activities. Ecology will conduct subtidal sediment cap monitoring in 2022 or 2023.

Intertidal Area

EPA is in the design phase of implementing the updated remedy in the intertidal area and there are currently no O&M activities.

EBS

O&M activities include surveying the beach and/or measuring the thickness of the sand cover layer and replenishing as needed. To date, the sand layer has not required replenishment. Visual inspections and a topographic survey of the beach were conducted during this FYR period. No areas of exposed cobbles were observed, except for a small area at the outfall.

OU2/4, Soil and Groundwater

O&M activities for OU2/4 consist of the operation of the groundwater extraction and treatment plant, which has been in operation since 2010, and annual sampling of the lower aquifer. The extraction system is operated to maintain an upward vertical gradient to prevent contaminated groundwater migration to the lower aquifer or Puget Sound. NAPL is recovered during the extraction process, stored in an on-site tank, and eventually shipped off site for disposal. The extraction and treatment system generally operates seven days a week, 24 hours per day all year round, except for maintenance. Ecology's contractor collects continuous groundwater elevation data from paired wells in the upper and lower aquifers to evaluate continuing hydraulic containment, as well as influent and effluent data to track the effectiveness of the groundwater treatment plant and extraction system. Plant effluent is sampled weekly to ensure compliance with the discharge criteria established in the 2000 ROD. Finally, effluent samples undergo quarterly bioassay testing to confirm the effluent is not toxic to aquatic biota.

EPA samples the lower aquifer annually to ensure the plume is stable and not spreading toward drinking water wells to the south and west of the FPA. During this FYR period, the lower aquifer was sampled in 2018, 2019, 2020, and 2021.

During this FYR period, the groundwater extraction and treatment plant was shut down for routine maintenance, power outages or weather conditions. From June 11 through September 13, 2021, the groundwater extraction and treatment plant was shut down for planned summer maintenance and groundwater level recovery.

OU3, West Harbor

WSF conducted long-term monitoring of upland, subtidal and intertidal areas of the West Harbor from 1997 to 2007 (Years 1 through 10) in accordance with the 1997 OMMP. In 2008, the OMMP was updated for use from 2008 to 2017 (Years 11 through 20). Current monitoring occurs annually under the 2018 OMMP (Years 21 through 30). Monitoring has occurred each year according to the updated OMMP.[5]

The primary activities associated with the OMMP include:

- Annual inspections of the upland area (i.e., asphalt cap), shoreline and sediment cap area, and the stormwater drainage system.
- Groundwater and intertidal seep monitoring once every five years.

Upland Area – Asphalt Cap

During the previous FYR period, asphalt cracking was a persistent problem at OU3. Several long cracks along the construction joints were originally discovered in 2009 and were sealed with asphalt the same year. Additional repairs were made in 2011 and 2012. In 2011, a pavement engineer evaluated the asphalt cap surface and found it in overall good structural condition, though showing signs of aging. In 2013, the cracks were resealed using a new method. Evaluations of the cap condition in 2016 and 2017 found it in sound structural condition despite the signs of aging. It was decided to continue monitoring semi-annually to determine when a full asphalt overlay is needed. During this FYR period, asphalt repairs were conducted in 2018 and 2019. In 2020, a 6-foot-long crack of medium severity (1/4 to 1/2 inch wide) was observed in the subsidence area adjacent to the southern edge of the asphalt concrete cap. In addition, a minor crack of low severity (less than 1/4 inch wide) was observed near the fence west of the CDF. The observed asphalt cracks were not repaired in 2020 due to work constraints associated with COVID-19, but WSDOT pavement repair crew completed the repairs in spring 2021.

In 2018, WSF installed more fencing and a gate immediately south of the footbridge that crosses the creek along the west side of the Site. WSF also added fencing along the north side of the footbridge to restrict public access from the footpath to the tidal barrier.

In May 2014, under-pier elevation markers were installed at Pier A to monitor scour and settlement of material near this subsidence area. These markers are now monitored during annual site inspections. The change in sediment surface elevation did not exceed the threshold of 0.5 feet at any of the markers during this FYR period. These results indicate that significant erosion or settlement of materials adjacent to the subsidence repair at Pier A has not occurred since the markers were installed in May 2014.

Shoreline and Sediment Cap

The shoreline areas inspected include (from north to south) the tidal barrier, rockery, sediment cap, berm face and the shoreline under Pier A. These areas were examined for the presence of erosion and seepage during the annual shoreline inspection. In March 2019, WSF covered two exposed areas of the concrete-filled geotextile mat with quarry spalls (rock) that included a small area under the footbridge and a larger area north of the footbridge. WSF completed covering a small portion of the north area in July 2019. A small (1-square-foot) area was observed to be exposed and then subsequently covered during the 2020 shoreline inspection.

[5] OMMP is currently in draft form. A final, approved OMMP is expected in 2022.

Intertidal Seeps

WSF observed intertidal seeps in multiple locations during the FYR period. In 2017, 20 seeps were observed flowing. In 2018, 23 seeps were observed. In 2019, 20 seeps were observed and in 2020, 15 seeps were observed. Clear water was observed flowing from the seeps and no discolored sediment was observed.

During this FYR period, intertidal seeps were sampled in 2021. The previous monitoring event was in 2016. The 2016 intertidal seep monitoring indicated no exceedances of water quality criteria. The 2021 intertidal seep monitoring results were not available to review for this FYR report but will be included in the next FYR.

Stormwater Treatment Systems and Monitoring

In accordance with the 2018 OMMP, stormwater treatment systems at the Site requiring annual inspection include two outfalls (Outfall 1 and Outfall 2), four catch basins (CB-1 through CB-4), one junction box and three oil-water separators (OWS-1 through OWS-3). All stormwater treatment system components were inspected and appeared to be functioning properly during the annual inspections. Stormwater best management practices (BMPs) at the Eagle Harbor maintenance facility are inspected, monitored, maintained, and reported to Ecology quarterly according to the 2019 industrial stormwater general permit and the associated 2021 Stormwater Pollution Prevention Plan and 2020 Water Quality Monitoring Plan.

During the 2018, 2019 and 2020 annual inspections, all stormwater treatment system components were inspected and appeared to be functioning properly. During the inspections, sediment depths in the grit/sludge chamber of the oil-water separators were measured to ensure they do not exceed 4 inches maximum depth established in the 2018 OMMP. During the September 2019 inspection, sediment depths in OWS-1 and 2 exceeded the 4-inch maximum (Table 10). A cleanout was scheduled for February 2020; however, the contractor did not have the appropriate equipment. The cleanout occurred in October 2020. In December 2020, sediments accumulated to at least 50% of the maximum allowed within two months of the cleaning. As reported in the 2020 Annual Report, there were no unusual sediment-generating activities occurring during this period. It is possible that the contractor did not remove all sediments in October 2020, or the sediment depth measurements were overestimated in December 2020. To address this issue, WSF will continue to conduct annual inspections, with follow-up cleanouts as needed.

Table 10: OWS Sediment Depths

OWS	Sediment Depth (inches)			
	June 2018	**September 2019**	**October 2020**	**December 2020**
1	2.0	**5.5**	Cleanout	3
2	4.0	**6.0**		3
3	3.0	3.0		2

Notes:
Bold = Exceeds the 4-inch maximum sediment depth specified in the 2018 OMMP.
Source: 2018, 2019, 2020 Annual Report – West Harbor OU

There was no blockage or sediment in either outfall. The outfall gates were fully operational. WSF investigated different types of storm drain outlet valves to prevent tidal waters from entering the OWSs and whether to repair or replace the OWSs because of damage to coalescing plates in the separators caused by saltwater corrosion. WSF plans to clean the tanks and clean or replace the OWS coalescing plates as needed in 2022.

In accordance with their National Pollutant Discharge Elimination System (NPDES) permit, WSF conducts stormwater quality monitoring quarterly at two outfalls. Sample analysis results are compared to benchmarks established by the permit and are reported to Ecology quarterly. Analytes include turbidity, pH, total zinc, total copper, and total suspended solids. Except for a total copper exceedance in the third quarters in 2018 and 2019, no other analyte exceeded their respective benchmark. In 2020, WSF added diesel-range total petroleum hydrocarbons and bacteria. There were no benchmark exceedances in 2020.

Piezometer Monitoring

In accordance with the draft 2018 OMMP, the annual upland area inspections included measurements of water levels in piezometers PZ-02 and PZ-03 (located in the CDF) during a low tide. Water levels were measured with a water level indicator before the upland inspection and after the shoreline inspection to verify they exceed 8.7 feet mean low-low water, which is the elevation deemed necessary to facilitate geochemical immobilization of metal contaminants present in sediments deposited in the CDF.[6] During the 2018, 2019 and 2020 monitoring events, the water levels at both locations exceeded this threshold as required and were within the range historically observed at each piezometer.

CERCLA Coordination Efforts

During this FYR period, property owners, including the city of Bainbridge Island, the Bainbridge Island Metro Park & Recreation District and WSF, have applied for Clean Water Act 404 and Section 10 permits from the Seattle District Corps of Engineers for projects within the Wyckoff Co./Eagle Harbor Superfund Site. The proposed activities have the potential to impact monitoring and the remedial components implemented at the Site. Per agreement with the Seattle District Corps of Engineers, EPA is provided the opportunity to review and provide general and specific permit conditions for these permits prior to issuance by the Corps The most recent of these related to the thick-cap area at OU3. WSF is conducting a Slip F Drive-on Improvement Project starting in fall 2022. This project will occur within the OU3 thin-layer cap area and has the potential to impact two of the thick-layer cap areas. The project includes the removal of a timber pile trestle and relocation of existing piers and dolphins. EPA, Ecology, the Seattle District Corps of Engineers, and WSF are coordinating to ensure appropriate water quality monitoring is conducted, and that best management practices are employed to ensure the remedy remains intact during the construction project.

III. PROGRESS SINCE THE PREVIOUS REVIEW

This section includes the protectiveness determinations and statements from the 2017 FYR Report as well as the recommendations from the 2017 FYR Report and the status of those recommendations (Table 11 and Table 12).

Table 11: Protectiveness Determinations/Statements from the 2017 FYR Report

OU #	Protectiveness Determination	Protectiveness Statement
1	Not Protective	The remedy at OU-1 is not protective in intertidal areas because of the following issues: • NAPL seeps are observed in the intertidal areas, where public access does occur despite beach closure notifications; and • contaminant concentrations in shellfish tissue remain above levels safe for human consumption. The following actions need to be taken to ensure protectiveness: • additional beach closure notifications or barriers need to be implemented; • additional evaluation of the exposure barrier system (EBS) cover thickness to inform replenishment need and timing; and • additional action is required to stop intertidal NAPL seeps and mitigate residual contamination above the cleanup levels.

[6] Mean low-low water is the average height of the lowest tide recorded at a tide station each day during a 19-year recording period, known as the National Tidal Datum Epoch as used by the United States' National Oceanic and Atmospheric Administration.

OU #	Protectiveness Determination	Protectiveness Statement
2/4	Short-term Protective	The remedy at OU-2/OU-4 currently protects human health and the environment because contamination is contained by a sheet pile wall, site access is restricted, and ICs are in place to prevent use of groundwater. However, in order for the remedy to be protective in the long-term, the following actions need to be taken: • the remedy needs to be modified to minimize contaminant migration to the lower aquifer; • the soil cap needs to be constructed; • monitoring of the lower groundwater aquifer needs to be implemented on a regular schedule; and • the sheet pile wall needs significant improvement or replacement.
3	Protective	The remedy at OU-3 is protective of human health and the environment. The asphalt cap continues to prevent exposure to the contaminated dredged sediment and recent seep water quality monitoring shows concentrations below surface water criteria.

Table 12: Status of Recommendations from the 2017 FYR Report

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
1	The exposure barrier system (EBS) habitat layer is eroding in places and may not meet the design depth in all areas.	Additional evaluation of sediment depth is needed to inform replenishment needs and timing.	Completed	EPA conducted a new topographic survey of the beaches, including the West Beach, in 2018. Visual survey of the beaches found no cobble areas. The lower portion of beach appears to have steepened. EPA will inspect the EBS in 2022 prior to transition of O&M to Ecology.	7/13/2018
1	Recent and past intertidal data show that cleanup levels were not achieved within the ten year recovery period required by the Record of Decision. In addition, NAPL seeps continue to be observed in the intertidal areas and it is known that the public does access these areas of the beach despite current beach closure notifications.	Additional beach closure notifications or barriers need to be added to areas known to be accessed by the public. In addition, evaluate the need for additional remedial action to address NAPL seeps.	Completed	In 2018, EPA published a new fact sheet, placed fact sheets in boxes on the information kiosks at the Site, added new laminated signs to fences on both sides of the Site, and used the city manager's newsletter to remind citizens of creosote on the beaches. The 2018 OU1 Interim ROD Amendment updated the remedy to include backfilling dredged areas with a multilayer cap, including placing reactive materials (such as oleophilic clay or other reagents) at the base of the cap to retard upward NAPL seepage, then restoring dredged areas to grade with clean, imported materials.	5/14/2018

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
2/4	The soil cap has not been constructed as required under the ROD contingency remedy.	Construct a soil cap to minimize surface water infiltration.	Ongoing	In May 2019, EPA issued an Interim ROD Amendment, selecting a new remedy for upland soil and groundwater. The new ROD calls for in-situ stabilization of upland soils, an upgradient groundwater cutoff wall and upland cap with perimeter drains to convey surface water off the cap. Design of the new cap is deferred until design of the 2018 Interim ROD Amendment elements (replacement perimeter wall and beach remedy) is complete.	Not applicable
2/4	Groundwater monitoring in the lower aquifer is not occurring on a regular basis.	Implement regularly scheduled monitoring to obtain a comprehensive assessment of hydraulic containment and long-term concentration trends.	Completed	Lower aquifer sampling was conducted in 2018, 2019, 2020 and 2021. Hydraulic containment is attained on an annual basis and no significant change in lower aquifer concentrations or NAPL thickness has been observed.	9/25/2018
2/4	The sheet pile wall has experienced significant corrosion reducing its life span.	Perform repairs, or replace, the sheet pile wall to prevent leaks and other failures.	Ongoing	In 2018 an interim ROD amendment was signed selecting a replacement wall. In 2020, a predesign investigation was completed, focusing on the nature and extent of subsurface debris in upland soils and soil/reagent mix design tests to compare different mix designs for the new perimeter wall, which will use a concrete soil mix as a primary technology. This investigation will help inform the design of the replacement perimeter wall. It will also help refine the cost estimate and debris handling and disposal plan. Design of the replacement perimeter wall is ongoing.	Not applicable
2/4	Recent groundwater data has shown increasing PAH concentrations in the lower aquifer, which is considered a potential drinking water source.	Evaluate opportunities to limit migration of contamination to the lower aquifer.	Completed	The May 2019 Interim ROD Amendment selected a new remedy for upland soil and groundwater that will solidify NAPL in upland soil, preventing further migration to the lower aquifer. The remedy will also reinforce portions of the aquitard that are thin, further limiting contaminant transport to the lower aquifer.	5/10/2019

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Community Involvement and Site Interviews

A public notice was made available in the *Kitsap Sun* on 1/14/2022 and the Bainbridge Island City Manager newsletter on 1/21/2022. In addition, a public notice was published in a digital notice to *Kitsap Sun* online subscribers. EPA also emailed over 800 people on the Wyckoff listserv. The notifications stated that the FYR was underway and invited the public to submit any comments to EPA. The results of the review and the report will be made available at the Site's information repository, Bainbridge Public Library, located at 1270 Madison Avenue in Bainbridge Island, Washington.

EPA received two comments related to the FYR. The first comment was from a local contractor inquiring about the need for geomembrane or geosynthetic components on the Site. The second comment was from a local resident. The resident is a frequent user of Pritchard Park and inquired on the status of the cleanup and the areas of the beach that are safe to access. EPA responded indicating the areas of the beach that have been cleaned up and those that have not. EPA referred the resident to the laminated maps and kiosks. The resident responded that the laminated maps are faded and not easily read.

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date**.** The interviews are summarized below, and interview forms are included in Appendix E.

EPA ecologist Justine Barton indicated that, overall, the site work related to intertidal and subtidal sediments is progressing. Ms. Barton feels the habitat components and natural landscape of the Site are physically and biologically important to the functioning ecosystem. The eelgrass beds located in the intertidal zone of OU1 are thriving and serve as habitat for a variety of diverse organisms. Ms. Barton would like to see future remedial actions at OU1 take into account the natural systems and determine how the flow of water and sediment transport along the shoreline may impact the future effectiveness of any implemented remedies in the intertidal areas. Sediment transport should also be taken into account when proposing maintenance of intertidal remediation features, such as the EBS and for any work in East Beach and the North Shoal. In addition, any implemented remedy will likely impact the eelgrass beds and this should be accounted for as best as possible in the remedy design. Ms. Barton also pointed out that the Site includes two compensatory mitigation areas. One at West Beach, including a riparian zone (for impacts to OU1), and one at Schel-Chelb on the south shore of Bainbridge Island (for impacts at OU3). Both sites were constructed to compensate for remedial activities that occurred at Wyckoff Eagle Harbor. Any compensatory mitigation should be included in OMMPs, long-term monitoring plans and FYRs for the Site, and continue to be monitored and maintained in perpetuity.

Ecology representatives Hun Seak Park, Sam Meng and Bonnie Brooks think the project team is consistently making progress with cleanup work at OU1 and OU2/4. They noted that several brush removal efforts have been conducted at the Site to eliminate weeds that can spread and lead to issues from nearby residents. They also observed that the EBS has been eroding and sediment in some areas of West Beach observed during the 2018 predesign are in excess of SMS. The Ecology representatives indicated that a resident had complained about potential site contamination in the tidelands within their property. Ecology researched the available information and feels it is unlikely contamination would reach the property and likely the resident was observing normally occurring anoxic sediment.

Ben McKenna with the USACE's Seattle District has been assisting with the design of the replacement perimeter sheet pile wall. Mr. McKenna feels the remedial activities at OU2/4 have been successful in meeting RAOs. The groundwater pump-and-treat system continues to maintain the negative gradient in the upper aquifer and protect the lower aquifer. The system also continues to remove free product and COCs from groundwater at the Site. The sheet pile wall continues to contain impacted soils from migrating off site and impacting local receptors. Mr. McKenna noted that the public regularly uses the West Beach Area and has been observed accessing the closed East Beach and North Shoal areas. Mr. McKenna also observed that the sheet pile wall is degrading but remedial

actions are underway to mitigate any impacts. Mr. McKenna observed the transition of site management from EPA to Ecology has been smooth and efficient. The state and contractor issue regular reporting on the system and site conditions and can provide in-depth analytical data when needed via the extensive automated monitoring system.

The OU2/4 O&M contractor, Richard Walker from Jacobs Engineering, indicated an overall positive impression of the cleanup activities and that the current remedy is functioning as intended. He reported no NPDES permit violations and that O&M of the groundwater extraction system is going well. Currently, two staff members operate the groundwater extraction system during the week and the system is operated remotely on weekends. Mr. Walker indicated that it would be good to have an extra employee to man the groundwater extraction system on weekends.

A representative from WSF indicated that the cleanup at OU3 was effective and the current use does not negatively impact the Site. They also believe that the remedy at OU3 is performing well. Rob Zisette, O&M contractor at OU3, believes that cleanup activities to date, including the 1997 cleanup activities and the 2006 seep remediation are effective. The OMMP is being effectively implemented and the OU3 remedies are performing well. Piezometer water level data show stable water levels in the CDF and groundwater quality data show no metals contamination by the CDF. Intertidal seep water quality data show no metals contamination from the upland fill materials in the tidal barrier area. Sediment erosion monitoring and modeling indicate that there has been no significant erosion of the intertidal or subtidal sediments, and the sediment capping has effectively contained underlying contaminants. Mr. Zisette indicated that sediment erosion monitoring has been added to annual inspections and results show that there has been no substantial erosion to date.

Denise Taylor from the Suquamish Tribe indicated the Tribe is supportive of the remedial actions in the 2018 and 2019 Interim ROD Amendments and feels that when the new remedies are implemented, additional progress will be made toward meeting compliance goals and achieving RAOs. Contamination at the Site has impacted treaty-protected resources and rights to harvest which has had wide reaching impacts to health and well-being of the tribal community. The Tribe will continue to participate in the site project team and work to upgrade shellfish growing area conditions and restore eelgrass beds and habitats. Overall, the Tribe feels well-informed regarding site activities and remedial progress.

Data Review

During this FYR period, data were collected at OU1 and OU2/4. At OU3, intertidal seeps were sampled in 2021; however, the results were not available to review for this FYR report but will be included in the next FYR.

At OU1, intertidal data were collected as part of the 2018 pre-design investigation. During the 2018 investigation, contaminant concentrations in sediments exceed SMS in the West Beach just outside of the EBS and in the North Shoal and East Beach sediments. The study also identified that NAPL continues to discharge from upland soil and groundwater to the intertidal beaches through seams and possibly other leaks in the sheet pile wall. Routine OU1 monitoring has not occurred during this FYR period due to ongoing remedial design efforts in the intertidal area and transfer of O&M responsibilities in the subtidal area. Ecology will conduct subtidal sediment cap monitoring in 2023. These results will be assessed during the next FYR due in 2027.

At OU2/4, EPA's contractor collected groundwater samples annually from the lower aquifer in 2018, 2019, 2020 and 2021. Data from the 2021 sampling event was not available in time to inform this review; it will be included the next (2027) FYR. No upper aquifer data were collected. The remedy currently in place is containment. The next upper aquifer sampling event will take place in 2022 or 2023 to inform the design of the new remedy selected in the 2019 Interim ROD Amendment. This Data Review section presents the 2018, 2019 and 2020 lower aquifer data as well as a summary of the groundwater data from both aquifers, as presented in the 2019 OU2/4 Interim ROD Amendment CSM.

Ecology's contractor collects groundwater elevation data to evaluate continuing hydraulic containment as well as influent and effluent data to track the effectiveness of the groundwater treatment plant and extraction system. These data are also presented in this section.

OU2/4 CSM

EPA currently monitors groundwater contamination in the lower aquifer annually. The upper aquifer is sampled infrequently (last sampled in 2014). As summarized in the 2019 OU2/4 Interim ROD Amendment, groundwater data indicate:

- Groundwater in the upper aquifer remains heavily contaminated with PAHs. Although it is no longer relevant because it was eliminated in the 2019 ROD Amendment, the cleanup level for HPAHs in the 2000 ROD helps illustrate just how contaminated groundwater in the upper aquifer remains. The cleanup levels from the 2000 ROD for HPAHs is 0.254 micrograms per liter (µg/L). During the most recent (2014) sampling event, this cleanup level was exceeded in 15 of the 18 wells sampled. The maximum concentration was more than 3,000 times the cleanup level. A summary of the 2014 upper aquifer sampling data is provided in Table 2-1 of the 2019 Interim ROD Amendment.
- In 2015, the PCP concentration in upper aquifer groundwater exceeded the 2000 ROD cleanup level of 4.9 µg/L in 6 of the 18 wells sampled. PCP was not detected in dense NAPL (DNAPL), but it was measured in light NAPL (LNAPL).
- Groundwater contamination in the lower aquifer is not extensive. Both DNAPL and dissolved contaminant concentrations above cleanup levels occur in the northern tip of the FPA, impacting less than ten percent of the area of the FPA. Acenaphthene occurs at concentrations above the cleanup level of 3.0 µg/L consistently over time and across a larger area than any other COC. Groundwater in this portion of the lower aquifer is affected by saltwater intrusion and is non potable. A summary of the most recent (2018, 2019 and 2020) lower aquifer sampling data is provided below.
- The contaminant plume in the lower aquifer currently appears stable. There are periods of the year where full containment of the contaminant plume in the upper aquifer is not demonstrated, typically in the wet winter months.

Lower Aquifer Groundwater Monitoring Data

The results of the 2018, 2019 and 2020 sampling events of the lower aquifer were presented in technical memoranda and are summarized below.

In May 2018, May 2019 and July 2020, EPA's contractor sampled 17 monitoring wells and piezometers for PAHs, PCP, and general chemistry parameters (Figure H-4 in Appendix H). In 2020, COC concentrations at 12 locations were not detected or were below cleanup levels. The five remaining locations contained one or more COCs at concentrations above the cleanup levels. Four (CW05, CW15, P-3L and VG-2L) of the five wells lie in the far north portion of the FPA while the fifth well (99CD-MW02A) is in the interior portion of the FPA (Figure H-5 in Appendix H). DNAPL or sheen was detected at each of these four wells. The COC concentrations observed at the 17 wells sampled in 2020 were generally comparable to levels observed in 2016, 2018 and 2019 with the following exceptions:

- CW05 – Acenaphthene, fluorene, and phenanthrene concentrations detected in July 2020 were approximately one-third to one-half the concentrations observed in 2016, 2018, and 2019.
- CW15 and VG-2L – Naphthalene concentrations in July 2020 are one to two orders of magnitude greater than concentrations observed in 2016, 2018, and 2019, but are but consistent with pre-2016 levels.
- 99CD-MW02A – Four COCs (benzo(a)anthracene, benzo(a)pyrene, dibenz(a,h)anthracene, and indeno[1,2,3-cd)pyrene) were detected above their respective groundwater cleanup levels in July 2020. Two of these COCs, dibenz(a,h)anthracene and indeno[1,2,3-cd)pyrene, were detected for the first time since routine monitoring began in November 2002, while anthracene was detected for the first time since June 2004. Although four COCs were present at concentrations above cleanup levels for the first time, a consistent history of PAH detections have occurred at this well. Future monitoring will reveal whether the concentrations observed during July 2020 indicate an upward trend.

During the 2018 sampling event, three of the 17 wells were sampled at both high and low tides to assess the potential effects of tidal fluctuations on COC concentrations. Based on comparison of the results, the 2018 Annual Report noted the following findings:

- Fluorene, naphthalene and phenanthrene were present at much higher concentrations in the high tide samples collected at well VG-2L while naphthalene was present at a much higher concentration in the high tide sample collected at CW05. The sample from the third well (99CD-MW02A), located in the interior portion of the FPA, showed non-detect PAH concentrations in both the high and low tide samples, except for naphthalene, which was detected at 0.66 µg/L in the low tide sample.
- The total dissolved solid concentration was about 1,000 milligrams per liter (mg/L) greater in the high tide samples collected at wells CW05 and VG-2L but 36 mg/L lower in the high tide sample collected at well 99CD-MW02A.
- During high tide conditions, the horizontal hydraulic gradient across the FPA is flatter than present under low tide conditions. The lower gradient present under high tide conditions may allow for more contact time between NAPL and groundwater thus promoting higher concentrations. However, because the magnitude of the concentration differences observed between the low and high tide samples was not consistent between wells CW05 and VG-2L, whether the concentration differences are attributable to tidal fluctuations, spatial variations in PAH distribution within the lower aquifer plume or subtle differences in purging and sampling methods is unclear.

In 2018, 2019 and 2020, DNAPL was detected at wells VG-2L, P-3L, CW05 and CW15, with visual evidence observed on the tape. The July 2020 measurements at VG-2L, P-3L and CW15 are consistent with the May 2019, May 2018, July 2016 measurements, October 2014 observations and June 2012 measurements. Wells VG-2L, P-3L and CW15 are in the northern portion of the FPA where PAHs have been consistently detected in lower aquifer groundwater samples at concentrations near or above the cleanup levels. Acenaphthene, a PAH contaminant indicator for the Site, was detected above the cleanup level of 3 µg/L with concentrations between 19 and 65 µg/L (Figure H-6 in Appendix H).

LNAPL absence/presence and thickness measurements were performed on July 17, 2020. No evidence of LNAPL was observed at any lower aquifer monitoring wells. Because the well screen intervals are fully submerged, at significant depths below the potentiometric surface, the primary mechanism for LNAPL to form in a lower aquifer well would be through DNAPL-phase separation or for DNAPL to become positively buoyant due to saltwater intrusion.

Based on the PAH constituents detected above their corresponding cleanup levels, EPA's contractor selected acenaphthene as an indicator constituent to define the spatial distribution of PAH constituents in the lower aquifer. Acenaphthene was selected as the most appropriate indicator constituent because it was detected at the highest concentration relative to its cleanup level.

A time-series plot of acenaphthene concentration trends for wells CW05, CW15 and P-3L, which are located on the north side of the FPA, and wells VG-2L and CW09, which are located on the east side of the FPA, and upgradient well PZ-11 are provided in Figure H-7 in Appendix H. Acenaphthene has been consistently detected above the cleanup level at wells CW15, P-3L and VG-2L since 2009 and as far back as 1995 at CW15 (Figure H-7 in Appendix H). Between 2018 and 2020, the concentration of acenaphthene increased about 130% at CW-15 and 35% at P-3L and dropped about 30% at VG-2L.

Groundwater Treatment and Containment

Hydraulic Containment

Ecology's contractor evaluated upper aquifer hydraulic containment using water level data from 10 upper and lower aquifer well pairs. This FYR reviewed the quarterly reports from 2017 through 2021 Quarter 3. The well pairs are shown in Figure H-8 in Appendix H.

As shown in Table 13, for the 2017 through 2021 Quarter 1 period, hydraulic containment is maintained at all well pairs during the Quarter 2, Quarter 3 and Quarter 4 periods. When hydraulic containment is not maintained at all well pairs, this occurs most often at well pairs CW13/VG-4L and CW08/P-4L during the Quarter 1 period. Short-term negative (downward) hydraulic gradient events occur during every monitoring period and generally correspond to low tide elevations.

Table 13: Groundwater Elevation Ratios, 2017 through 2021

Well Pair	Ratio Summary				
	Quarter 1, 2017	**Quarter 1, 2018**	**Quarter 1, 2019**	**Quarter 1, 2020**	**Quarter 1, 2021**
MW14/CW05	1.07	1.16	1.25	1.11	1.13
MW18/02CD-MW01	1.33	1.53	2.47	NC	2.41
PO03/99CD-MW02A	1.12	1.24	1.37	1.22	1.31
CW03/CW02	1.13	1.20	1.30	1.21	1.23
VG-2U/VG-2L	1.10	1.14	1.21	NC	1.15
VG-3U/VG-3L	1.27	1.36	1.44	1.33	1.47
VG-5U/VG-5L	**0.98**	1.03	1.05	NC	1.12
PO13/VG-1L	1.04	1.12	1.22	1.09	1.10
CW13/VG-4L	**0.85**	**0.89**	**0.93**	**0.88**	**0.86**
CW08/P-4L	**0.90**	**0.95**	1.01	NC	**0.95**

Notes:
Bold = ratio less than 1.
NC = not calculated because of transducer recording error.
Source: Table 4, Evaluation of Wyckoff Groundwater Level Data, July 1 through September 30, 2021

Groundwater Extraction Treatment System Effluent

During this FYR period, the groundwater treatment plant discharged effluent to Puget Sound via a discharge pipe. Ecology's contractor collects effluent samples weekly. The results are compared to discharge standards. Based on a review of the effluent data, there have been no exceedances of the discharge standards during this FYR period.

Ecology's contractor also conducted quarterly toxicity testing using a groundwater composite sampling collected from the treatment plant effluent. The purpose of the test is to determine if the effluent concentrations would have a negative ecological effect. The chronic bioassay is conducted using the bivalve *Mytilus galloprovincialis* (Mediterranean mussel). Testing was performed at Enthalpy Analytical located in San Diego, California. There were no statistically significant effects detected in any effluent concentration tested for the survival or development endpoint of the bivalve test.

Site Inspection

The site inspection took place on 1/11/2022. The purpose of the inspection was to assess the protectiveness of the remedies implemented at OU1, OU2/4 and OU3. The inspection was led by EPA RPM Helen Bottcher.

OU1, East Harbor

OU1 inspection participants included EPA RPM Helen Bottcher, Jeffree Fetters and Justine Barton from EPA, and staff from EPA support contractor Skeo. The inspection participants walked along the West Beach and observed the capped beach areas, including the Phase III cap and the EBS. The other capped portions of OU1 (North Shoal and East Beach) were not accessible due to the high tide conditions. No seeps or signs of cap degradation were observed, except for a small area on the EBS at the outfall that drains water from the hillside. Exposed cobbles were observed in this area. The no-anchoring buoys and no-anchoring signs were observed, and beach closure and shellfish notices were present along the fence at access points.

OU2/4, Soil and Groundwater
OU2/4 inspection participants included EPA RPM Helen Bottcher, Jeffree Fetters and Justine Barton from EPA, Sam Meng from Ecology, Dick Walker from Jacobs Engineering, and staff from EPA support contractor Skeo. Site inspection participants observed the groundwater treatment plant building and extraction system which was operational and in good condition. After observing the treatment system, participants observed the inner side of the sheet pile wall, several extraction wells, and the tank area. Due to high levels of precipitation during the previous weeks, the ground was saturated, there was standing water and several extraction wells were partially submerged at the base. The sheet pile wall, specifically the eastern sheet pile wall, was in very poor condition consistent with observations made during the 2017 FYR inspection.

OU3, West Harbor
OU3 inspection participants included EPA RPM Helen Bottcher, Jeffree Fetters and Justine Barton from EPA, Adrienne Stutes and Alex McEwan from WSDOT, and staff from EPA support contractor Skeo. The site inspection team observed the asphalt cap, the CDF, the piezometers, the northern cutoff drainage system footpath, and the northern portion of the tidal barrier. The asphalt cap was in fair condition. Many cracks were present, but all had been sealed; no new cracks were observed. The stormwater system was in good condition. The fence showed no damage or signs of unauthorized access. There was considerable water present on the asphalt cap due to heavy rain in recent weeks. One pooled area near the CDF was greater than 10 feet across and several inches deep. Ponding was also observed on two areas of the northern cutoff drainage system. These conditions are likely due to the heavy rain. However, they will continue to be monitored under the OMMP. These areas are being tracked and will be addressed as needed.

The inspection checklists for each OU and the photos are included in Appendices G and H, respectively.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

OU1, East Harbor
The OU1 subtidal remedy is functioning as intended. In April 2021, EPA and Ecology agreed that the remedy in the subtidal portion of OU1 is complete and EPA transferred responsibility for O&M of subtidal sediments in OU1 to Ecology. In early 2017, repairs were made to the subtidal cap in the area where previous studies revealed ferry propeller wash had displaced portions of the existing Phase I cap, along the ferry lane. Since 2017, there has not been any subtidal monitoring. Monitoring of the subtidal sediment cap should be conducted to track the effectiveness of the OU1 subtidal remedy. Ecology will conduct subtidal sediment cap monitoring in 2023.

The OU1 intertidal remedy is not functioning as intended by the 1994 and 2007 decision documents. Chemistry data from the intertidal area have shown that the cleanup criteria were not met within the 10-year recovery period as required by the 1994 ROD. The 2018 predesign investigation determined that sediments above SMS are present in the West Beach, East Beach and North Shoal areas. During the FYR inspection, exposed cobbles were observed in a small area on the EBS at the outfall that drains water from the hillside. EPA will continue to observe this area and repair if the erosion deepens. NAPL seeps are still observed in portions of the intertidal sediment. EPA issued an amended ROD in 2018 for OU1 to address these issues. The preliminary (35%) design was produced in August 2020. After review and comment, the intermediate (50%) design was issued in August 2021. The intermediate design is currently under review by EPA and project partners.

Shellfish tissue was collected and analyzed from intertidal beaches in 2002, 2011, 2014, and 2016. Data from these events showed that the 2008 construction of the EBS on the West Beach greatly reduced shellfish tissue contaminant concentrations, but that shellfish on the East Beach and North Shoal remain contaminated. Shellfish tissue concentrations in these areas are expected to decline following construction of the remedy in the 2018 ROD Amendment.

The 1994 OU1 ROD and the 2018 OU1 Interim ROD Amendment required institutional controls to restrict beach access and provide additional warnings regarding the harvest and consumption of contaminated seafood and include restrictions on anchoring, dredging or other sediment disturbance to protect capped areas. These institutional controls are in place. Most of these institutional controls are effective; however, the public still accesses the closed beach areas. EPA should evaluate other mechanisms to inform the public that access to these areas is prohibited.

OU2/4, Soil and Groundwater

The OU2/4 remedy is not functioning as intended. The containment remedy from the 2000 ROD has prevented large-scale releases of contaminants into Eagle Harbor; however, the sheet pile wall and groundwater extraction system has not stopped contaminants from moving downward from the upper aquifer to the lower aquifer beneath the FPA and into intertidal sediments along East Beach and North Shoal through seeps. In addition, the soil cap required as part of the contingency remedy was never constructed, so soil containment is not occurring as intended by the remedy. In May 2019, EPA issued an Interim ROD Amendment, selecting a new remedy for upland soil and groundwater. The new ROD calls for in-situ stabilization of upland soils, an upgradient groundwater cutoff wall and an upland cap with perimeter drains to convey surface water off the cap. Once implemented, the remedy is expected to be protective of human health and the environment.

During this FYR period, contaminant concentrations in the lower aquifer were variable. Generally, hydraulic containment of upper aquifer groundwater is being demonstrated for most of the year, but there are periods of the year where full containment is not demonstrated, typically in the wet winter months. Although still functioning, the sheet pile wall is showing signs of significant corrosion. Several studies of the sheet pile wall since 2013 have recommended repair or full replacement of the wall. The 2018 Interim ROD Amendment required replacement of the sheet pile wall. Once implemented, the remedy is expected to be protective of human health and the environment.

The groundwater treatment plant is maintained in excellent condition and is treating groundwater to concentrations that are below ROD cleanup levels for COCs. Institutional controls are in place to prevent drinking water well installation. Fencing and warning signs help limit site access. Drinking water wells that service Bainbridge Island remain uncontaminated.

OU3, West Harbor

The OU3 remedy is functioning as intended. The CDF continues to contain the dredged sediment and the tidal barrier system minimizes seep impact to capped sediments. In 2016, copper and zinc concentrations in the seeps were below surface water criteria. During this FYR period, intertidal seeps were sampled in 2021; however, the results were not available to review for this FYR report but will be included in the next FYR. Although the asphalt cap is showing signs of aging, it is currently in good structural condition and is repaired in a timely manner when needed. Ponded areas were observed during the site inspection. WSF should evaluate if this low area needs to be repaired. Although there are no plans to replace the asphalt cap in the near future, WSDOT is aware that a new surface will be needed eventually. The northern drainage cutoff wall appears to be functioning; however, there were a few ponded areas along the path that indicate there may be an issue with the French drain and/or the slope of the asphalt path during high precipitation events. Continued monitoring of these areas, especially during heavy rainfall events, is recommended.

The locations of the thick caps in OU3 were surveyed during construction. The caps are shown on facility maps and operating procedures to prevent erosion of the thick caps (for example, limiting the prop wash generated during engine testing) are in place and appear to be functioning as intended.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy selection still valid?

Question B Summary:

OU1, East Harbor

The exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy selection are still valid.

Chemical-specific ARARs identified in the 1994 ROD and the 2018 Interim ROD Amendment for sediment at OU1 were based on the Washington State Department of Ecology SMS. Ecology amended the SMS rule with an effective date of September 1, 2013. The SMS amendments integrate SMS and MTCA cleanup requirements, clarify requirements for protection of human health and higher trophic level species from sediment contamination, and promulgate numeric chemical and biological criteria for freshwater sediment to protect the benthic community. The current standards are provided in Table I-1 (subtidal areas) and Table I-2 (intertidal areas). There have been no updates to the standards.

The 2018 OU1 Interim ROD Amendment updated the cleanup levels for intertidal sediment based on the chemical-specific ARAR (SMS) as well as human health, risk-based cleanup levels under a direct contact exposure scenario. The risk-based cleanup goals were based on exposure during shellfish collection. These are site-specific cleanup goals and were not evaluated as part of the FYR process.

The exposure pathways including consumption of fish and shellfish, direct contact with sediments during shellfish collection and ecological exposure to contaminated sediment remain valid. The RAOs used at the time of the 1994 and 2018 remedy selection are still valid. Harbor-wide sampling in 2011 showed that contaminant concentrations in subtidal sediments were progressing toward meeting the 1994 ROD cleanup levels; however, no monitoring has occurred during this FYR period so continued progress is unknown. Subtidal sediment monitoring should be conducted and analyzed prior to the next FYR. Intertidal sediment concentrations remain above the cleanup levels beyond the 10-year recovery period. EPA selected an updated remedy in the 2018 Interim ROD Amendment to address remaining contamination in the intertidal sediment. The updated remedy is expected to meet RAOs when implemented; construction is currently scheduled for 2026-2027.

OU2/4, Soil and Groundwater

The exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy selection are still valid. The 2019 Interim ROD Amendment updated the soil cleanup levels based on MTCA Method B (except for naphthalene). There have been no changes to the standards that impact the validity of the cleanup goals (Table I-3 in Appendix I).

The naphthalene cleanup goal was based on EPA's regional screening level (RSL) for recreational use. There have not been any updates to naphthalene toxicity or risk assessment that call into question the validity of the naphthalene cleanup goal.

The 2019 Interim ROD Amendment did not establish cleanup levels for the upper aquifer because groundwater within the FPA will be contained by the perimeter wall and a new southern groundwater "cutoff" wall. Because groundwater in this area is considered non-potable, drinking water standards are not applicable. Discharge criteria will be developed for any discharge of groundwater from the containment area to ensure compliance with the substantive requirements of Section 402 of the Clean Water Act and WAC 173-220-130. The 2019 Interim ROD Amendment also does not include cleanup measures in the lower aquifer. The objective of preventing further degradation will be met if lower aquifer groundwater contaminated above MCLs does not spread to monitoring wells between the FPA and nearby drinking water wells. Contamination of lower aquifer groundwater will be addressed in a future cleanup decision for OU2/4 if warranted.

Exposure assumptions and RAOs at the time of the remedy remain valid and progress is being made toward meeting many, but not all, of the RAOs. For soil, direct contact with contaminated soil is limited by fencing and other access restrictions at the Site. The RAO to prevent stormwater runoff to Eagle Harbor is being achieved with the sheet pile wall surrounding the Site. For groundwater, the extraction system is reducing the volume of NAPL, and the extraction system combined with the sheet pile wall are preventing upper-aquifer groundwater from leaving the Site. The human exposure RAO is being achieved by institutional controls that prevent exposure to groundwater. The RAO to protect groundwater outside the Site and in the lower aquifers is not being achieved; groundwater data continue to show PAH concentrations in the lower aquifer above MCLs, indicating that the remedy is not achieving the RAO of protecting this potential future drinking water source. The remedy selected in the 2019 Interim ROD Amendment is expected to meet RAOs once implemented.

OU3, West Harbor

The exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy selection are still valid. Sediment cleanup levels are based on promulgated numerical ARARs that have not changed (see discussion under OU1, Question B and Table I-1 in Appendix I). The 1995 ROD Amendment specified soil cleanup levels based on MTCA cleanup requirements as well as site-specific erosion and transport scenarios. The current standards were reviewed, and cleanup goals remain valid except for arsenic. The MTCA Method C direct contact cancer-based value changed from 188 mg/kg to 88 mg/kg. This change does not impact the remedy because the upland area is covered in asphalt and there is no direct contact with soil.

Exposure assumptions and cleanup objectives at the time of remedy selection remain valid. To evaluate if the objective for sediment quality and shellfish has been met, additional monitoring is required. Sediment data have not been collected since 2005. Additional sediment sampling should be conducted and assessed prior to the next FYR.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the FYR:
None

Issues and Recommendations Identified in the FYR:

OU(s): 1	Issue Category: Monitoring			
	Issue: Since 2017, there has not been any subtidal monitoring to track the integrity and effectiveness of the cap.			
	Recommendation: Assess the subtidal sediment cap to ensure it is continuing to meet cleanup goals established in the 1994 ROD.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA	9/30/2024

OU(s): 1	Issue Category: Institutional Controls			
	Issue: The public still accesses the closed beach areas.			
	Recommendation: Evaluate other mechanisms to inform the public that access to the closed beach areas is prohibited.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	EPA	EPA	9/26/2023

OU(s): 3	Issue Category: Monitoring			
	Issue: Sediment data have not been collected since 2005.			
	Recommendation: Conduct sediment sampling to ensure the remedy meets cleanup goals established in the 1992 ROD.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA	9/30/2025

OTHER FINDINGS

Additional recommendations were identified during the FYR. These recommendations do not affect current and/or future protectiveness.

- Consider replacing laminated maps in Pritchard Park.
- Ponded areas were observed during the site inspection at OU3. WSF should evaluate if these low areas need to be repaired.
- Add habitat mitigation monitoring to the O&M plans for intertidal sediments (West Beach/ the EBS) and OU3 (Shel-Chelb restoration project).
- Observe the small area on the EBS at the outfall and repair if the erosion deepens.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
Operable Unit:	*Protectiveness Determination:*
1	Not Protective
Protectiveness Statement:	
The remedy at OU1 is not protective in intertidal areas because of the following issues: NAPL seeps are observed in the intertidal areas. These beach areas are currently closed to the public, but people do still choose to access these areas. In addition, subtidal sediment monitoring has not been conducted during this FYR period. The following actions need to be taken to ensure protectiveness: implement the updated remedy as described in the 2018 OU1 Interim ROD Amendment, and evaluate other mechanisms to inform the public that access to the closed beach areas is prohibited. Additionally in order to ensure the remedy is protective in the long term, the subtidal sediment cap must be assessed to ensure it remains intact and is continuing to meet cleanup goals established in the 1994 ROD.	

Protectiveness Statement(s)	
Operable Unit:	*Protectiveness Determination:*
2/4	Will be Protective
Protectiveness Statement:	
The remedy at OU2/4 is expected to be protective of human health and the environment upon completion of the remedy component outlined in the 2018 and 2019 Interim ROD Amendments. In the interim, remedial activities conducted to date have adequately addressed all exposure pathways that could result in unacceptable risks in those areas. Additionally, the groundwater extraction and treatment system is operating to contain contaminated groundwater within the upper aquifer and prevent migration. The sheet pile wall, although significantly corroded, along with the groundwater treatment plant are still functioning to prevent contaminated groundwater from migrating to Eagle Harbor.	

Protectiveness Statement(s)	
Operable Unit:	*Protectiveness Determination:*
3	Short-term Protective
Protectiveness Statement:	
The remedy at OU3 currently protects human health and the environment because the CDF continues to contain the dredged sediment and the tidal barrier system minimizes seep impact to capped sediments. However, for the remedy to be protective over the long term, the following action needs to be taken to ensure protectiveness: conduct sediment sampling to ensure the remedy meets cleanup goals established in the 1992 ROD.	

VIII. NEXT REVIEW

The next FYR Report for the Wyckoff/Eagle Harbor Superfund site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

2019 Record of Decision Amendment, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington. EPA Region 10. May 2019.

Data Summary Report Wyckoff Intertidal Sediment Predesign Investigation, East Harbor OU1, Bainbridge Island, Washington. Prepared by CH2M. December 2020.

Explanation of Significant Differences, Wyckoff/Eagle Harbor Superfund Site, East Harbor OU1. EPA Region 10. September 2007.

Final Background Clam Tissue Data Characterization Report in Support of Wyckoff/Eagle Harbor Superfund Site. Prepared by U.S. Army Corps of Engineers. October 2019.

Fourth FYR Report for Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington. Prepared by U.S. Army Corps of Engineers. September 2017.

Interim Record of Decision, Wyckoff Groundwater Operable Unit, Wyckoff/Eagle Harbor Superfund Site. EPA Region 10. September 1994.

Lower Aquifer Groundwater Quality Sampling Results for Wyckoff/Eagle Harbor Superfund Site – May 2018. Prepared by CH2M Hill Engineers, Inc. September 2018.

Lower Aquifer Groundwater Quality Sampling Results for Wyckoff/Eagle Harbor Superfund Site – May 2019. Prepared by CH2M Hill Engineers, Inc. September 2020.

Minor Change to May 2018 Record of Decision Amendment, Wyckoff Eagle Harbor Superfund Site, Operable Units 1, 2 and 4: Beaches and Perimeter Wall, Bainbridge Island, Washington. EPA Region 10. December 2019.

Operational and Functional Determination for the Subtidal Sediments Portion of the East Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington. EPA Region 10. April 2021.

Perimeter Wall Replacement Geotechnical Data and Soil-Mix Design Report, Wyckoff/Eagle Harbor Superfund Site, Bainbridge Island, Washington. EPA Region 10. June 2021.

Record of Decision, East Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site. EPA Region 10. October 1997.

Record of Decision, West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site. EPA Region 10. September 1992.

Record of Decision, Wyckoff/Eagle Harbor Superfund Site, Soil and Groundwater Operable Units, Bainbridge Island, Washington. EPA Region 10. February 2000.

Record of Decision Amendment, Wyckoff/Eagle Superfund Site, Operable Units 1, 2, and 4, Beaches and Perimeter Wall, Bainbridge Island, Washington. EPA Region 10. May 2018.

Remedial Action Report, Sub-Tidal Cap Repair Wyckoff/Eagle Harbor (Superfund Site), Bainbridge Island, Washington. Prepared by FPM-CTI Joint Venture, LLC. September 2017.

Third FYR Report for Wyckoff/Eagle Harbor Superfund Site, Kitsap County, Washington. Prepared by U.S. Army Corps of Engineers. September 2012.

Year 20 (2017) Annual Report, West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site. Prepared by Herrera Environmental Consultants. April 2018.

Year 21 (2018) Annual Report, West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site. Prepared by Herrera Environmental Consultants. April 2019.

Year 22 (2019) Annual Report, West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site. Prepared by Herrera Environmental Consultants. July 2020.

Year 23 (2020) Annual Report, West Harbor Operable Unit, Wyckoff/Eagle Harbor Superfund Site. Prepared by Herrera Environmental Consultants. April 2021.

Wyckoff Sheet Pile Wall – Thickness Testing, 2017. Prepared by CH2M. October 2017.

APPENDIX B – SITE CHRONOLOGY

Table B-1: Site Chronology

OU(s)	Event	Date
All	Wyckoff property used for wood treatment via burlap and asphalt, or creosote/bunker oil	1905 – 1988
OU3	The former shipyard used for shipbuilding and ship repair	1903 – 1959
All	Pollution Control Commission reported direct discharge of oily material from the Wyckoff wood-treating facility to Puget Sound; oil observed on beach adjacent to the facility	December 1952
All	EPA began investigating the property due to reports of oil observed on the beach adjacent to the Wyckoff property	1971
All	EPA and Ecology reported oil seepage to Eagle Harbor and required the Wyckoff Company to take immediate action to determine the source and reduce or eliminate seepage	April 1972
All	U.S. Coast Guard issued a Notice of Violation for oil discharge from the facility to Puget Sound	May 1975
All	National Oceanic and Atmospheric Administration advised EPA and Ecology that samples of sediments, fish and shellfish from Eagle Harbor contained elevated levels of PAHs in both sediments and biota.	March 1984
All	EPA issued a Unilateral Administrative Order (UAO) requiring the Wyckoff Company to conduct environmental investigation activities under the RCRA Section 3013 (42 USC §6924), and Ecology issued an Order requiring immediate action to control stormwater runoff and seepage of contaminants. Data collected at the time revealed the presence of significant soil and groundwater contamination.	August 1984
All	EPA proposed the Site for listing on the NPL	September 1985
All	National Oceanic and Atmospheric Administration completed a study relating the presence of PAHs in sediment to the high rate of liver lesions in English Sole from Eagle Harbor	1985
All	The Wyckoff Company entered an AOC with EPA for further investigation of the wood treatment facility	March 1987
All	EPA listed the Site on the NPL	July 1987
All	Under an AOC, the Wyckoff Company agreed to conduct an Expedited Response Action, intended to minimize releases of oil and contaminated groundwater to Eagle Harbor, called for a groundwater extraction and treatment system and other source control measures	July 1988
All	Wyckoff Company ceased wood-preserving operations	December 1988
All	EPA completed the RI for Eagle Harbor	November 1989
OU2/4	Groundwater extraction and treatment system began operating at select wells	January 1990
OU2/4	EPA issued a UAO requiring the Wyckoff Company (renamed and currently known as Pacific Sound Resources, Inc.) to continue the Expedited Response Action with enhancements. The UAO called for increased groundwater extraction and treatment rates, improved system monitoring, and removal of sludge stored or buried at the Wyckoff facility.	June 1991
All	EPA completed the FS for Eagle Harbor	November 1991

OU(s)	Event	Date
OU2/4	EPA conducted a time-critical removal action at the Wyckoff facility removing creosote sludges and contaminated oils, disposing of asbestos, installing steel sheet pile, repairing and constructing bulkhead, recycling materials from retorts, tanks, and other on-site steel	June 1992 – April 1994
OU3	EPA signed the ROD for West Harbor	September 1992
OU1	EPA placed about 209,000 cubic meters of clean sediment materials over a 54-acre area of contaminated sediments in Eagle Harbor (Phase I cap)	September 1993 March 1994
OU2/4	EPA assumed responsibility for O&M of the groundwater extraction and treatment system	November 1993
OU3	EPA issued an AOC for remedial design for the West Harbor issued to PACCAR Inc., DOT, and Bainbridge Marine Services	November 1993
OU2/4	A time-critical removal action was conducted at the groundwater extraction system and treatment plant to repair/replace failing equipment, upgrade system parts, and perform clean-out of system units.	May – December 1994
OU2/4	Pacific Sound Resources, Inc., and their principals settled their CERCLA liability with EPA and the federal and tribal natural resource trustees in a Consent Decree	August 1994
OU2/4	EPA completed the focused RI/FS for the Groundwater OU	July 1994
OU2/4	EPA issued the Interim ROD for the Groundwater OU	September 1994
OU1	EPA issued the ROD for the East Harbor	September 1994
OU2/4	EPA signed a SSC with Ecology for the Groundwater OU interim remedial action.	November 1994
OU2/4	RI field investigations were conducted for the Soil and Groundwater OUs	1994 and 1995
OU2/4	EPA sealed and abandoned 12 on-site wells, including two deep drinking water wells, due to concerns that they could provide conduits for migration of contaminants to the deep aquifers	January – June 1995
OU2/4	Seven original extraction wells were abandoned and replaced by eight new groundwater extraction wells; additional treatment plant upgrades including piping replacement, carbon handling and installation of dewatering press occurred	June – December 1995
OU3	EPA completed the West Harbor ROD Amendment	December 1995
OU2/OU4	Non-time-critical removal action in the Soil and Groundwater OUs: Site structures were demolished, and debris was removed and disposed of off site	January – June 1996
OU3	West Harbor PRPs constructed the remedy at the old shipyard in accordance with the December 1995 ROD Amendment	March – December 1997
OU3	EPA issued a Water Quality Certification for the West Harbor remedial work	April 1997
OU3	West Harbor PRPs provided the Suquamish Tribe with $110,000 for clam enhancements and other restoration projects performed by the Tribe	Summer 1997
OU3	West Harbor PRPs constructed the 2-acre Schel-chelb Estuary restoration at the south shore of Bainbridge Island (South Bainbridge Estuarine Wetland and Stream Restoration Site)	Summer 1997 – Spring 1998
OU2/4	Completed removal of upland subsurface structures, such as process piping, utility lines, foundations, concrete pads, and asphaltic concrete	November 1997
OU2/4	EPA issued a “final” Proposed Plan, which preferred containment as the cleanup strategy for soil and groundwater	November 1997
OU2/4	Due to concern over long-term O&M associated with the containment strategy, EPA evaluated thermal technologies for possible application at Wyckoff	1998 – 1999

OU(s)	Event	Date
OU2/4	Region 10 presented thermal technologies evaluation activities and proposed a new remedy for removal of contaminants in the soil and groundwater at Wyckoff to the National Remedy Review Board	July 1998
OU3	West Harbor PRPs established a 0.6-acre eelgrass planting site immediately west of the West Harbor CDF and cap	September – October 1998
OU2/4	Completed Focused Feasibility Study Comparative Analysis of Containment and Thermal Technologies	April 1999
OU3	West Harbor PRPs repaired a long depression that developed in the surface of CDF during March and April 1999	June 1999
OU2/4	Completed the conceptual design for thermal remediation of the Soil and Groundwater OUs	September 1999
OU2/4	EPA issued a second Proposed Plan for the Wyckoff Soil and Groundwater OUs. This Proposed Plan replaced the November 1997 Proposed Plan and presented a change in the cleanup strategy. EPA's preferred remedy in this plan (now the selected cleanup remedy) focused on an innovative technology, called steam injection, to actively remove contaminants from the soil and groundwater. The Proposed Plan presented a contingent containment remedy if it was found through a treatability study that thermal treatment could not meet RAOs.	September 1999
OU1	Completed removal of the West Dock in the East Harbor	December 1999
OU2/4	EPA issued the ROD for Wyckoff Soil and Groundwater OUs	February 2000
OU2/4	EPA signed a SSC with Ecology for the Soil and Groundwater OUs	May 2000
OU2/4	EPA completed the following construction activities in the Soil and Groundwater OUs: installed a sheet pile containment wall around the FPA, installed a sheet pile wall within a highly contaminated 1-acre area of the Site for the steam injection pilot study, created 2 acres of habitat beach to mitigate for habitat loss resulting from construction of the outer sheet pile wall	February 2001
OU2/4	EPA completed the following construction activities in the Soil and Groundwater OU: modifications to the existing groundwater treatment plant for treatment of new waste streams extracted from the steam injection pilot area; installation of boiler, water softening equipment, heat exchangers, thermal oxidizer, compressor, injection and extraction pumps and associated conveyance pumps and piping, and other pilot system equipment in the boiler building and within the pilot area; and start-up for all new equipment	September 2002
All	EPA completed the Site's first FYR Report	September 2002
OU2/4	EPA completed a thermal remediation pilot study	October 2002 – April 2003
OU2/4	EPA implemented the Soils and Groundwater OUs contingent containment remedy	April 2004
OU2/4	EPA completed the upgradient cutoff wall soil and groundwater investigation	September 2004
OU2/4	EPA completed the Engineering Evaluation for Thermal and Containment Alternatives Report	April 2005
OU2/4	EPA completed the South Hillside soil investigation	October 2005
OU2/4	The city of Bainbridge purchased the Soil and Groundwater OU property	February 2006
OU3	EPA completed the West Harbor tidal barrier and seep remediation cap	August 2006
OU2/4	EPA completed the Thermal Pilot Study Summary Report	October 2006
OU1	EPA completed the West Beach sediment investigation	November 2006

OU(s)	Event	Date
All	EPA completed the Site's second FYR Report	September 2007
OU1	EPA signed the ESD for the West Beach EBS	September 2007
OU1	EPA completed the West Beach EBS	2008
OU2/4	EPA completed the replacement groundwater treatment plant	April 2010
OU1	EPA completed the OMMP Addendum for East Harbor	May 2011
OU1	EPA completed Year 17 monitoring for East Harbor	July – November 2011
OU2/4	Ecology took over O&M of the groundwater treatment plant until April 2014. EPA agreed to conduct a focused feasibility study (FFS) to evaluate additional source removal options for the Soils and Groundwater OUs.	April 2012
All	EPA completed the Site's third FYR Report	September 2012
OU2/4	EPA completed the upland NAPL field investigation	September 2013
OU2/4	EPA completed the sheet pile wall effectiveness evaluation	December 2013
OU1	EPA completed the East Harbor FFS	April 2016
OU2/4	EPA completed the Soil and Groundwater OU NAPL FFS	April 2016
All	EPA completed the Site's fourth FYR Report	September 26, 2017
OU1 OU2/4	EPA issued the OU1, OU2 and OU4 Interim ROD Amendment	May 2018
OU2/4	EPA issued the OU2/4 Interim ROD Amendment	May 2019

APPENDIX C – SITE VICINITY MAP

Figure C-1: Site Vicinity Map

APPENDIX D – PRESS NOTICE

United States Environmental Protection Agency

EPA to Review Cleanup at Wyckoff/Eagle Harbor Superfund Site on Bainbridge Island
We Invite Your Input by February 14, 2022

EPA has started its fifth Five-Year Review of the Wyckoff/Eagle Harbor Superfund Site. The Wyckoff/Eagle Harbor Superfund Site is on the east side of Bainbridge Island. We are required to review Superfund cleanups at least every five years at sites where contaminants remain in place. EPA uses the review to make sure that cleanup actions are protecting human health and the environment.

You may have information and ideas to share about the site that will assist us with this review. We invite you to share your input by **February 14, 2022**. EPA added the Wyckoff site to the Superfund list in 1987. Extensive cleanup actions at the site have controlled or eliminated much of the exposure risks from creosote. Additional cleanup actions are needed in the soil and groundwater at the former Wyckoff wood treating facility, and in the adjacent beach sediments. We encourage you to send your input to Helen Bottcher, EPA, by telephone at 206-553-6069 or 800-424-4372; or by email: **bottcher.helen@epa.gov**.

For more information: www.epa.gov/superfund/wyckoff-eagle-harbor

BR-28382218

APPENDIX E – INTERVIEW FORMS

WYCKOFF EAGLE HARBOR SUPERFUND SITE FIVE-YEAR REVIEW INTERVIEW FORM	
Site Name: Wyckoff Eagle Harbor	
EPA ID: WAD009248295	
Interviewer name:	**Interviewer affiliation:**
Subject name: Hun Seak Park, Sam Meng, Bonnie Brooks	**Subject affiliation:** WA Ecology
Subject contact information: hpark461@ecy.wa.gov; same461@ecy.wa.gov; bonnie.brooks@ecy.wa.gov	
Interview date: Jan 25th, 2022	**Interview time:**
Interview location: Home Office (work from home)	
Interview format (circle one): In Person Phone Mail **Email** Other:	
Interview category: WA Department of Ecology	

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   The project team is consistently making progress with the cleanup work at the Site.

   Since 2017, EPA has completed two critical site documents: ROD Amendments for OU1 (2018 RODA) and OU2/OU4 (2019 RODA). After that, EPA has been moving forward with developing the design documents, including the Intertidal Sediment Remedy Basis of Design for the OU1 cleanup, and engineering designs for a new wall that will replace the existing sheet pile wall.

   EPA continues to monitor the water quality in the Site's lower and upper aquifers, and shares the information with stakeholders and the public. EPA worked together with WA Ecology to maintain the existing remedy at OU2/OU4. Ecology took over the groundwater extraction and treatment system (GETS) is 2012. Since then, Ecology has been responsible for the daily operation and maintenance. EPA and Ecology discuss plant operation and other site activities during biweekly meetings, which also involve the Suquamish Tribe, Ecology's plant operation contractor, EPA's consultant, and a representative from the City of Bainbridge Island.

   Several brush removals have been conducted at the Site to eliminate weeds that could spread and lead to complaints from nearby residents.

2. What is your assessment of the current performance of the remedy in place at the Site?

   At OU-1, the existing remedy includes a subtidal and intertidal caps as well as the Exposure Barrier System. The subtidal cap is north of West Beach and the west of North Shoal. The intertidal cap and the Exposure Barrier System are both on West Beach. Per

the 1994 ROD, the rest of the beach was expected to undergo natural recovery and within a 10 year time frame meet Washington State's Sediment Management Standards (SMS) which would result in contaminant levels in fish and shellfish protective of human health.

Subtidal caps include the 1994 Phase I and the 2000 Phase II caps. Areas of erosion in the subtidal cap close to the ferry terminal were observed during an inspection conducted in 2005. This 9.3 acre area was repaired by EPA in 2017. Repair activities included replacement of portions of the existing sand cap where propeller wash and ferry wake from the Seattle-Bainbridge Island Ferry had damaged the existing cap. In addition, a targeted armor layer was placed to protect the portions of the cap most likely to experience erosion from ferry operation. EPA conducted monitoring of the subtidal cap in 2016 and did not find any issues. The subtidal cap is now considered operational and functional. Washington Department of Ecology became responsible for the operation and maintenance of the subtidal cap on April 1, 2021. No additional monitoring of the cap has taken place to date.

Intertidal caps include the 2001 Phase III cap and 2008 Exposure Barrier System, both located on the West Beach. Areas of the ESB have been observed to be eroding with less than 1 foot of habitat layer remaining.

Contamination in sediments left to recover naturally have not decreased to levels below the SMS. Clam tissue contaminant concentrations from 2014 and 2016 sampling events were at levels that presents a risk to human health. During both the 2016 monitoring event and the 2018 pre-design beach investigation, contaminant concentrations in sediments exceeded SMS in the West Beach just outside of the Exposure Barrier System to the west and in the North Shoal and East Beach sediments. During the 2016 monitoring event the habitat layer in the exposure barrier system was eroded to below 1 foot in 2 locations that were sampled. During the 2016 monitoring event, carcinogenic PAH (cPAH) concentrations at J7, J8, J9, J10, K7, K8 and L8 ranged from 38.59 to 932.7 µg/kg, exceeding Ecology's cPAH natural background value of 21 µg/kg used to evaluate potential risks to human health. No cap was observed in areas located near sampling locations J9 and J10 during the 2011 monitoring event. Since this area is not inside the 2000 Phase II or 2001 Phase III cap area, it was hypothesized that it was not covered adequately during the 1994 Phase I cap installation. EPA agreed to evaluate this area further to determine if action is necessary. This area was not transferred to Ecology for ongoing operation and maintenance.

At OU2/OU4, The existing remedy is containment including:

1) GETS: to reduce the downward flow (the more contaminated upper aquifer not to contaminate the less contaminated lower aquifer) and the outward flow (the contaminated site groundwater not to contaminate the Eagle Harbor).

   Groundwater is extracted from the upper aquifer, and sent to the treatment plant before discharging to the Eagle Harbor. The hydraulic containment result is evaluated quarterly using water level monitoring data collected at ten well pairs, of which each pair are screened in lower aquifer and upper aquifer respectively. Overall the hydraulic containment goal were met is the past five years, i.e. the

cumulative time duration of upward flow is greater than that of downward flow. However, in two areas (represented by well pairs CW13/VG-4L and CW08/P-4L), the hydraulic containment goal was usually not met during the 1st quarter of each year due to rainfall.

The treatment plant is capable of eliminating contaminants from the groundwater. Water samples were collected and analyzed weekly to: 1) guide the plant operation, 2) demonstrate compliance with the discharge limits established in the QAPP for Groundwater Treatment Plant Operations and Maintenance. The contaminants were rarely detected in the effluent, and the concentrations were always under the discharge limits.

2) Sheet pile wall: In addition to reducing the outward groundwater flow, it also prevents NAPL in the upland (OU2/OU4) from migrating to the sediment (OU1) then to the surface water and marine animals. Significant corrosion to the wall has been found in many areas on the eastern side. During the beach remediation design study in 2018, breakthrough of NAPL was discovered at several locations at the east beach and north shoal. EPA has incorporated the findings into plans for the new remedy that includes a new non-metal wall with a greater depth.

Ecology is not involved in the OU3 remedy.

3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities from residents in the past five years?

   A resident, who owns a property immediately south adjacent to the site, reported to Ecology that the contaminants from the Site might have reached the tideland within the property. No analytical data was presented to Ecology. The resident's concern is based on visual observation of dark sediment below the beach surface. Ecology's Wyckoff team researched the available information, including historical photos/maps, news report, property transaction record, and environmental data collected from the nearby areas, and concluded that 1) the presence of contaminant is not confirmed, 2) it is unlikely that the wood treatment, Wyckoff operation-related hazardous substances could reach the subject property, and 3) what the resident is observing is likely anoxic sediments which are normal in Puget Sound.

4. Has your office conducted any site-related activities or communications in the past five years? If so, please describe the purpose and results of these activities.

   In Aug 25th, 2018, *Kitsap Sun* coordinated a story walk at Wyckoff, to help the citizens and Kitsap Sun readers to understand and learn more about the history of the site, the cleanup efforts there, the community's involvement in that work and the future envisioned for the park. The speakers are representatives from a local citizen group (Association of Bainbridge Communities), Ecology, and EPA.

   Ecology representatives covered items below:

   - Operation and maintenance of the groundwater extraction and treatment system

- State's role in maintaining the current remedy, developing and implementing the new, and more permeant remedy, and after the new remedy is implemented
- How Ecology and EPA collaborate

The story walk went well, as about 60 citizens showed up. Many good questions were asked during Ecology's presentation, which was held in front of the treatment plant.

5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy?

   Updates to the human and upper trophic level ecological risk narratives that occurred as part of the 2013 Sediment Management Standards rule revision may impact the protectiveness. This update generally results in lower cleanup levels for bioaccumulative chemicals. For example, there is no value to evaluate cPAHs for potential risks to human health although Ecology uses a natural background value of 21 µg/kg to do this. During the 2016 monitoring event, carcinogenic PAH (cPAH) concentrations at J7, J8, J9, J10, K7, K8 and L8 ranged from 38.59 to 932.7 µg/kg, exceeding Ecology's cPAH natural background value of 21 µg/kg.

6. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues?

   The upland portion of the site, where the trespassers could be exposed to contaminated material (soil, groundwater, and vapor), is surrounded by chain-link fence. Warning signs are posted outside the fence and on the gate to inform people it's a superfund cleanup site and what the hazards are. EPA had a security alarm system and cameras installed to monitor the site after hours.

7. Are you aware of any changes in projected land use(s) at the Site?

   No.

8. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   No.

9. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?

   Yes.

WYCKOFF EAGLE HARBOR SUPERFUND SITE FIVE-YEAR REVIEW INTERVIEW FORM	
Site Name: Wyckoff Eagle Harbor	
EPA ID: WAD009248295	
Interviewer name:	**Interviewer affiliation:**
Subject name: Benino McKenna	**Subject affiliation: U.S. Army Corps of Engineers Seattle District**
Subject contact information: benino.p.mckenna@usace.army.mil**, (206) 764-3803**	
Interview date: February 7, 2022	**Interview time: N/A**
Interview location: N/A	
Interview format (circle one): In Person Phone Mail **Email** Other:	
Interview category: U.S. Army Corps of Engineers	

1. What is your overall impression of the remedial activities at the Site?

   I have limited knowledge on the remedial activities at OU1 and 3. But my impression is that the remedial activities have been successful. The cap at OU3 experienced some damage in the last 10 years due to propeller washout from the ferries, but corrective actions were taken to repair the cap and armor up that area and it is now protective.

   Regarding OU2/4 I feel that the remedial activities have been successful in meeting the RAOs. The groundwater pump-and-treat system continues to maintain the negative gradient in the upper aquifer and protect the lower aquifer. The system also continues to remove free product and COCs from groundwater at the Site. The sheet pile wall continues to contain impacted soils from migrating off site and impacting local receptors.

2. What have been the effects of the Site on the surrounding community, if any?

   For OU1 and 3 a regulatory advisory was issued from the Kitsap Public Health District regarding the consumption of shellfish from Eagle Harbor. While this does have an effect on the surrounding community, I can't speak to the level of effect on the community before and after the implementation of the health advisory. From general observation and interaction over the years the local community continues to enjoy unrestricted watersport recreation throughout Eagle Harbor.

   For OU2/4 the local community cannot access the upland Site itself per Hazardous Waste Operations and Emergency Response regulations, but the West Beach area is accessible to the public and is regularly used. EPA has posted beach closure notification of the East Beach and North Shoal areas citing contamination concerns, but the public has been observed to still access these areas. Previous community complaints about noise during remedial operations were factored into work windows that were established for the August 2020 site investigations.

3. What is your assessment of the current performance of the remedy in place at the Site?

   For OU1 and OU3, please see my response to question 1.

For OU2/4 the groundwater pump-and-treat system is functioning well and continues to remove COCs from the Site and maintain containment of COCs to the upper aquifer. Removal rate projections show the timeline for meeting the cleanup goals are in excess of 100 years so while the system is doing the job it was intended for, meeting the cleanup goals in a more timely manner may require a more robust alternative. The sheet pile wall continues to effectively contain site impacts to the upland area and minimize off site migration of COCs. The degradation of sections of the sheet pile wall appears to be limiting its duration of effectiveness but through proactive investigations and analysis, there are already remedial actions underway that will mitigate site impacts for the foreseeable future.

4. Are you aware of any complaints or inquiries regarding environmental issues or the remedial action from residents since implementation of the cleanup?

   While I am aware that there have been previous complaints and inquiries from residents and the local community, I am not aware of any current complaints or inquiries regarding implementation of the cleanup at the Site.

5. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   I do not. The contractor that has overseen the remedy at the Site has done an exemplary job of maintaining the operations of the system. The transition of site management from EPA to Ecology has been smooth and efficient. The state and contractor issue regular reports on the system and site conditions and can provide in-depth analytical data when needed via the extensive automated monitoring system. I believe this level of transparency contributes to the healthy dialogue between EPA, Ecology and the community.

6. Do you consent to have your name included along with your responses to this questionnaire in the FYR Report?

   I consent.

WYCKOFF EAGLE HARBOR SUPERFUND SITE FIVE-YEAR REVIEW INTERVIEW FORM	
Site Name: Wyckoff Eagle Harbor	
EPA ID: WAD009248295	
Interviewer name: Skeo staff	**Interviewer affiliation: Skeo**
Subject name:	**Subject affiliation: Washington State Ferries**
Subject contact information:	
Interview date: 2/14/2022	**Interview time: 1:00 pm**
Interview location: Seattle, WA	
Interview format (circle one): In Person Phone Mail Email Other:	
Interview category: DOT	

1. What is your overall impression of the remedial activities at the Site?

   The original cleanup was effective and use by WSDOT has not negatively impacted the Site.

2. What have been the effects of the Site on the surrounding community, if any?

   The Site does not impact the surrounding community.

3. What is your assessment of the current performance of the remedy in place at the Site?

   The current performance of the remedy is good and it is performing well.

4. Are you aware of any complaints or inquiries regarding environmental issues or the remedial action from residents since implementation of the cleanup?

   No.

5. Do you feel well-informed regarding the Site's activities and remedial progress? If not, how might EPA convey site-related information in the future?

   Yes.

6. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   Yes.

7. Do you consent to have your name included along with your responses to this questionnaire in the FYR Report?

   No.

WYCKOFF EAGLE HARBOR SUPERFUND SITE FIVE-YEAR REVIEW INTERVIEW FORM	
Site Name: Wyckoff Eagle Harbor	
EPA ID: WAD009248295	
Interviewer name: Skeo staff	**Interviewer affiliation: Skeo**
Subject name: Rob Zisette	**Subject affiliation: Herrera Environmental Consultants**
Subject contact information: rzisette@herrerainc.com	
Interview date: February 15, 2022	**Interview time: 10:30 am**
Interview location: Herrera Seattle office	
Interview format (circle one): In Person Phone Mail Email Other:	
Interview category: O&M Contractor	

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   The original 1997 cleanup was very effective except that contaminated intertidal seepage was not completely contained by the tidal barrier between the footbridge and 50 feet south of Outfall 1. The 2006 seep remediation cap has effectively prevented that contaminated seepage. WSDOT has effectively implemented the OMMP and updated it over the years to ensure continued effectiveness of the cleanup and source control actions. Use of the Site by WSDOT has not negatively impacted cleanup or maintenance effectiveness.

2. What is your assessment of the current performance of the remedy in place at the Site?

   Ongoing inspections and monitoring conducted according to the OMMP have shown that the site remedies are currently performing very well.

3. What are the findings from the monitoring data? What are the key trends in contaminant levels that are being documented over time at the Site?

   Piezometer water level data show stable water levels in the CDF and groundwater quality data show no metals contamination by the CDF. Intertidal seep water quality data show no metals contamination from the upland fill materials in the tidal barrier area. Sediment erosion monitoring and modeling indicate that there has been no significant erosion of the intertidal or subtidal sediments, and the sediment capping has effectively contained underlying contaminants.

4. Is there a continuous on-site O&M presence? If so, please describe staff responsibilities and activities. Alternatively, please describe staff responsibilities and the frequency of site inspections and activities if there is not a continuous on-site O&M presence.

   WSDOT continuously occupies the Site and frequently conducts routine inspections of site conditions and remedy effectiveness according to OMMP requirements and NPDES permit requirements. Herrera has assisted WSDOT with inspections and monitoring required by the OMMP and reports results to EPA annually.

5. Have there been any significant changes in site O&M requirements, maintenance schedules or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

   Sediment erosion monitoring has been added to annual inspections to monitor long-term stability of sediments adjacent to a repair of the asphalt-concrete cap at Pier A and in each of the three thick cap areas. These monitoring results indicate that there has been no substantial erosion to date in either area.

6. Have there been unexpected O&M difficulties or costs at the Site since start-up or in the last five years? If so, please provide details.

   The contaminated seepage and resulting 2006 seep remediation cap noted above was the only significant O&M issue and cost since start-up in 1997.

7. Have there been opportunities to optimize O&M activities or sampling efforts? Please describe changes and any resulting or desired cost savings or improved efficiencies.

   Inspection efforts have been optimized by inspecting the stormwater system separate from the upland and shoreline inspections that have reduced the consultant effort and allowed more time to supplement the shoreline inspections with sediment erosion monitoring.

8. Do you have any comments, suggestions or recommendations regarding O&M activities and schedules at the Site?

   No.

9. Do you consent to have your name included along with your responses to this questionnaire in the FYR Report?

   Yes.

WYCKOFF EAGLE HARBOR SUPERFUND SITE FIVE-YEAR REVIEW INTERVIEW FORM	
Site Name: Wyckoff Eagle Harbor	
EPA ID: WAD009248295	
Interviewer name:	**Interviewer affiliation:**
Subject name: Denice Taylor	**Subject affiliation: Suquamish Tribe project manager**
Subject contact information: dtaylor@suquamish.nsn.us**; 360-981-0102**	
Interview date: 2/9/2022	**Interview time: NA**
Interview location: NA	
Interview format (circle one): In Person Phone Mail Email x Other:	
Interview category: Suquamish Tribe	

1. What is your overall impression of the remedial activities at the Site?

   Ecology and EPA continue to operate and maintain the current remedies while designing elements of the new remedies for the intertidal area and the uplands. The Tribe has expressed support for the remedial actions as described in the 2018 and 2019 ROD Amendments. I feel that when the new remedies are implemented, there will be additional progress towards meeting compliance goals and achieving RAOs to protect human health and the environment.

2. What have been the effects of the Site on the surrounding community, if any?

   Contamination from the Site has impacted treaty-protected resources and rights to harvest from usual and accustomed places. Over time, the presence of contaminated sites in the Tribe's usual and accustomed harvest area has wide reaching additive and cumulative impacts to the health and well-being of the tribal community. The Suquamish Tribe continues to invest in efforts that support the full expression of treaty rights, including ongoing participation in the Wyckoff Eagle Harbor project team, working to upgrade shellfish growing area conditions, and restoring eelgrass beds and habitats.

3. What is your assessment of the current performance of the remedy in place at the Site?

   As documented in the previous FYR, the current remedy for OU1 (East Harbor) was found to be not functioning as intended and the remedy was determined to be not protective of human health and the environment. The current remedy for OU2/4 was also found to be not functioning as intended; the remedy was determined to be protective in the short term but not in the long term. The current remedy for OU3 (West Harbor) was found to be functioning as intended and protective of human health and the environment.

   New or modified remedies have been approved for OU1 and OU2/4.

4. Are you aware of any complaints or inquiries regarding environmental issues or the remedial action from residents since implementation of the cleanup?

No.

5. Do you feel well-informed regarding the Site's activities and remedial progress? If not, how might EPA convey site-related information in the future?

   I feel well-informed regarding the site activities and remedial progress. The EPA RPMs are available for staff-to-staff consultation as needed and I am participating in ongoing project team meetings. The Tribe continues to provide review and comment on remedial planning and reporting documents.

6. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   Not at this time.

7. Do you consent to have your name included along with your responses to this questionnaire in the FYR Report?

   Yes.

WYCKOFF EAGLE HARBOR SUPERFUND SITE FIVE-YEAR REVIEW INTERVIEW FORM	
Site Name: Wyckoff Eagle Harbor	
EPA ID: WAD009248295	
Interviewer name:	**Interviewer affiliation:**
Subject name: Richard A. Walker	**Subject affiliation: Jacobs Engineering**
Subject contact information: 5350 Creosote Pl Ne, Bainbridge Island WA 98110	
Interview date: February 15, 2022	**Interview time: 0633**
Interview location: Wyckoff Site	
Interview format (circle one): In Person Phone Mail Email X Other:	
Interview category: O&M Contractor	

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   Going well.

2. What is your assessment of the current performance of the remedy in place at the Site?

   I believe that it is working well for what it is supposed to be doing.

3. What are the findings from the monitoring data? What are the key trends in contaminant levels that are being documented over time at the Site?

   From what I can see, we are doing just what we are supposed to be doing, discharging water to the Sound which meets NPDES permit requirements and as far as I know there have not been permit violations from plant discharge.

4. Is there a continuous on-site O&M presence? If so, please describe staff responsibilities and activities. Alternatively, please describe staff responsibilities and the frequency of site inspections and activities if there is not a continuous on-site O&M presence.

   The Site is staffed by two O&M personnel Monday through Friday, 7:30 AM to 4:00 PM. Saturday and Sunday the plant is monitored remotely by computer for observation of plant parameters and conduct of evolutions. Monitoring on the weekends consists of morning and evening plant rounds, pumping of the storm water tank, dirty backwash tank and froth tank as needed.

5. Have there been any significant changes in site O&M requirements, maintenance schedules or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

   There have been no significant changes in site O&M requirements, maintenance schedules or sampling routines in the last five years.

6. Have there been unexpected O&M difficulties or costs at the Site since start-up or in the last five years? If so, please provide details.

   I have been doing O&M for 45 years and I can say that although we have had to replace both DAF feed pumps due to failure and rebuild multiple pumps in the well field, this is nothing out of the ordinary and even with a good maintenance program, equipment failures occur.

7. Have there been opportunities to optimize O&M activities or sampling efforts? Please describe changes and any resulting or desired cost savings or improved efficiencies.

   Not that I have been a party to.

8. Do you have any comments, suggestions or recommendations regarding O&M activities and schedules at the Site?

   In my opinion there should be a minimum of three personnel on staff here, so there could be somebody here at least eight hours every day, including weekends.

9. Do you consent to have your name included along with your responses to this questionnaire in the FYR Report?

   Yes.

APPENDIX F – SITE INSPECTION CHECKLISTS

OU1, East Harbor

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Wyckoff Eagle Harbor, OU1	**Date of Inspection:** 1/11/2022
Location and Region: Bainbridge Island, Washington, Region 10	**EPA ID: WAD009248295**
Agency, Office or Company Leading the Five-Year Review: EPA	**Weather/Temperature:** Rainy, 40s

Remedy Includes: (check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other: Sediment capping
- ☒ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems, suggestions ☐ Report attached: _____

2. **O&M Staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone : _____
   Problems/suggestions ☐ Report attached: _____

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

   Agency Ecology
   Contact Hun Seak Park, Sam Meng and Bonnie Brooks (Name) _____ (Title) January 25, 2022 (Date) _____ (Phone)
   Problems/suggestions ☐ Report attached: _____

   Agency _____
   Contact _____Name _____ (Title) _____ (Date) _____ (Phone)
   Problems/suggestions ☐ Report attached:_____

   Agency _____
   Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone)
   Problems/suggestions ☐ Report attached:_____

   Agency _____
   Contact _____ _____ _____ _____

Name	Title	Date	Phone
Problems/suggestions ☐ Report attached: _____			
Agency _____			
Contact _____	_____	_____	_____
Name	Title	Date	Phone
Problems/suggestions ☐ Report attached: _____			

4. **Other Interviews** (optional) ☐ Report attached: _____

Denice Taylor, Suquamish Tribe project manager

III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date ☒ N/A

☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits: _____	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

7. **Groundwater Monitoring Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

9. **Discharge Compliance Records**

☐ Air	☐ Readily available	☐ Up to date	☒ N/A
☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☒ Contractor for state

☐ PRP in-house ☐ Contractor for PRP

☐ Federal facility in-house ☐ Contractor for Federal facility

☐ _____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date

☐ Funding mechanism/agreement in place ☒ Unavailable

Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From: _____ To: _____ _____ ☐ Breakdown attached
Date Date Total cost

From: _____ To: _____ _____ ☐ Breakdown attached
Date Date Total cost

From: _____ To: _____ _____ ☐ Breakdown attached
Date Date Total cost

From: _____ To: _____ _____ ☐ Breakdown attached
Date Date Total cost

From: _____ To: _____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs during Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☐ Gates secured ☒ N/A

Remarks: _____

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☐ N/A

Remarks: Signs were mounted on the fence and at access points indicating beach closures and shellfish contamination notifications.

C. Institutional Controls (ICs)

1. **Implementation and Enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive by): Self-reporting

Frequency: _____

Responsible party/agency: _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up to date ☐ Yes ☐ No ☒ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☒ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☒ No ☐ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: Several of the no-anchor buoys could be seen from the shoreline. Other signs including the beach closure and shellfish consumption restrictions were mounted on the fence and at access points.

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: _____

2. **Land Use Changes On Site** ☒ N/A

Remarks: _____

3. **Land Use Changes Off Site** ☒ N/A

Remarks: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads Damaged** ☐ Location shown on site map ☐ Roads adequate ☒ N/A

Remarks: _____

B. Other Site Conditions

Remarks: The beach sediment appeared to be in good condition. No chemical seeps were observed. It was clear that the public uses this beach often; several people were observed walking their dogs during the site visit.

VII. SEDIMENT CAP ☒ Applicable ☐ N/A

A. Sediment/Beach Surface

1. **Erosion** ☐ Location shown on site map ☒ Erosion not evident

Area extent: _____ Depth: _____

Remarks: Erosion was not evident on the EBS, and the Phase III caps and the sand was thick and uneven due to heavy use. The other caps were not observed due to the high tide conditions.

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mats, riprap, grout bags or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

D. Cover Penetrations ☐ Applicable ☒ N/A

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

F. Cover Drainage Layer ☐ Applicable ☒ N/A

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

H. Retaining Walls ☐ Applicable ☒ N/A

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

X. OTHER REMEDIES

If there are remedies applied at the site and not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions).

The purpose of the remedy is to prevent human exposure until cleanup levels are achieved through monitored natural recovery. The beach/sediment cap is preventing exposure to the public. There is no evidence of chemical seeps along the beach. The institutional controls (i.e., no-anchor buoys and signs) appear to be working. The 2018 OU1 ROD Amendment required additional sediment removal and capping. These elements are in the design phase.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M includes chemical monitoring and cap depth measurements. These have not occurred during this FYR period; however, a monitoring event is planned in 2022.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

None.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None at this time.

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Wyckoff Eagle Harbor, OU2/4	**Date of Inspection:** 1/11/2022
Location and Region: Bainbridge Island, Washington, Region 10	**EPA ID: WAD009248295**
Agency, Office or Company Leading the Five-Year Review: EPA	**Weather/Temperature:** Rainy, 40s

Remedy Includes: (check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Other: In-situ solidification/stabilization
- ☐ Monitored natural attenuation
- ☒ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** Richard A. Walker (Name) | Jacobs Engineering (Title) | 2/15/2022 (Date)
   Interviewed ☐ at site ☐ at office ☒ by email
   Problems, suggestions ☐ Report attached: _____

2. **O&M Staff** _____ (Name) | _____ (Title) | _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems/suggestions ☐ Report attached: _____

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone)
   Problems/suggestions ☐ Report attached: _____

   Agency _____
   Contact _____Name | _____ (Title) | _____ (Date) | _____ (Phone)
   Problems/suggestions ☐ Report attached:_____

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone)
   Problems/suggestions ☐ Report attached:_____

   Agency _____
   Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone)
   Problems/suggestions ☐ Report attached: _____

   Agency _____

Contact _____ _____ _____ _____
Name Title Date Phone
Problems/suggestions ☐ Report attached: _____

4. **Other Interviews** (optional) ☐ Report attached: _____

Benino McKenna

DOT Representative

Denice Taylor, Suquamish Tribe project manager

III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)

1. **O&M Documents**

☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
☒ As-built drawings	☐ Readily available	☐ Up to date	☐ N/A
☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A

☒ Contingency plan/emergency response plan ☒ Readily available ☒ Up to date ☐ N/A

Remarks: _____

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: _____

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits: _____	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

7. **Groundwater Monitoring Records** ☐ Readily available ☒ Up to date ☐ N/A

Remarks: _____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

9. **Discharge Compliance Records**

☐ Air	☐ Readily available	☐ Up to date	☒ N/A
☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A

Remarks: Discharge effluent samples are collected weekly and reported to Ecology. There is no permit

regulating discharge.

10. **Daily Access/Security Logs** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: The gate is locked when no one is present at the groundwater treatment plant. There is a kiosk for visitors to check in.

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☒ Contractor for state

☐ PRP in-house ☐ Contractor for PRP

☐ Federal facility in-house ☐ Contractor for Federal facility

☐ _____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date

☐ Funding mechanism/agreement in place ☒ Unavailable

Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs during Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: Fencing was generally in good condition.

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☐ N/A

Remarks: Warning signs were present at regular intervals along the fence and at access points.

C. Institutional Controls (ICs)

1. **Implementation and Enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive by): Reported by Ecology contractor

Frequency: Annual

Responsible party/agency: Contractor to Ecology

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up to date ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☒ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☒ No ☐ N/A

Violations have been reported ☐ Yes ☐ No ☒ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☒ ICs are adequate ☒ ICs are inadequate ☐ N/A

Remarks: A restrictive covenant required under the OU2/4 ROD Amendment has not been implemented, but the 2004 PPA applies to the OU2/4 property and restricts excavation and use of groundwater.

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: Some trash was observed along the inner side of the fence line. Indications of site access were not observed. Monitoring wells outside the fence along the walking path did have graffiti. Wells were locked and showed no signs of access.

2. **Land Use Changes On Site** ☒ N/A

Remarks: _____

3. **Land Use Changes Off Site** ☒ N/A

Remarks: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads Damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: _____

B. Other Site Conditions

Remarks: Due to high levels of precipitation during the previous weeks, the ground was extremely wet and several extraction wells were partially submerged at the base. Ponded water with some geese, ducks, and other avian wildlife were observed. The sheet pile wall, specifically the eastern sheet pile wall was in very poor condition, consistent with what was observed during the previous FYR inspection.

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

The impermeable cap required under the OU2/4 ROD Amendment has not been implemented.

VIII. VERTICAL BARRIER WALLS ☒ Applicable ☐ N/A

1. **Settlement** ☐ Location shown on site map ☒ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Performance Monitoring** Type of monitoring: Visual inspection of the sheet pile wall and quarterly monitoring of containment

☐ Performance not monitored

Frequency: Weekly (visual)/quarterly (containment) ☐ Evidence of breaching

Head differential: See the Data Review section of this FYR Report.

Remarks: The sheet pile wall, specifically the eastern sheet pile wall was in very poor condition, consistent with what was observed during the previous FYR inspection.

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps and Pipelines ☒ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing and Electrical**

☒ Good condition ☐ All required wells properly operating ☐ Needs maintenance ☐ N/A

Remarks: _____

2. **Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☒ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

B. Surface Water Collection Structures, Pumps and Pipelines ☐ Applicable ☒ N/A

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☒ Carbon adsorbers

☐ Filters: _____

☐ Additive (e.g., chelation agent, flocculent): _____

☐ Others: _____

☐ Good condition ☐ Needs maintenance

☒ Sampling ports properly marked and functional

☒ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☐ Quantity of groundwater treated annually: _____

☐ Quantity of surface water treated annually: _____

Remarks: The treatment system was in good condition and well maintained.

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs maintenance

Remarks: _____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs maintenance

Remarks: _____

4. **Discharge Structure and Appurtenances**

☐ N/A ☐ Good condition ☐ Needs maintenance

Remarks: Discharge is offshore and not assessed.

5. **Treatment Building(s)**

☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair

☐ Chemicals and equipment properly stored

Remarks: _____

6. **Monitoring Wells** (pump and treatment remedy)

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition

☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: _____

D. Monitoring Data

1. **Monitoring Data**

☐ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring Data Suggests:**

☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs maintenance ☒ N/A

Remarks: _____

X. OTHER REMEDIES

The 2019 OU2/4 ROD Amendment called for excavation and in situ solidification/stabilization, however these remedies components have not been implemented. The 2018 ROD Amendment called for constructing a new barrier wall. This remedy component has also not yet been implemented.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions).

The implemented remedy includes the sheet pile wall, groundwater extraction and treatment in the FPA and institutional controls. The remedy is functioning; however, the sheet pile wall is degrading and needs to be replaced. Additional remedial actions including a new barrier wall, excavation and in-situ stabilization/solidification are planned.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O&M of the monitoring wells and groundwater treatment plant are adequate. The area around the wells was recently cleared of vegetation, making it easy to access all the wells.

C. Early Indicators of Potential Remedy Problems

	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. Other than the degradation of the sheet pile wall, there are no early indicators of problems with the implemented remedy.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None observed.

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Wyckoff Eagle Harbor, OU3	**Date of Inspection:** 1/11/2022
Location and Region: Bainbridge Island, Washington, Region 10	**EPA ID: WAD009248295**
Agency, Office or Company Leading the Five-Year Review: EPA	**Weather/Temperature:** Rainy, 40s

Remedy Includes: (check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☒ Surface water collection and treatment
- ☒ Other: Confined disposal facility, tidal barrier
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** Rob Zisette (Name) Herrera (Title) 2/15/2022 (Date)
   Interviewed ☐ at site ☐ at office ☒ by email Phone: _____
   Problems, suggestions ☐ Report attached: _____

2. **O&M Staff** _____ (Name) _____ (Title) _____ (Date)
   Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
   Problems/suggestions ☐ Report attached: _____

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

   Agency _____
   Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone)
   Problems/suggestions ☐ Report attached: _____

   Agency _____
   Contact _____Name _____ (Title) _____ (Date) _____ (Phone)
   Problems/suggestions ☐ Report attached:_____

   Agency _____
   Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone)
   Problems/suggestions ☐ Report attached:_____

   Agency _____
   Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone)
   Problems/suggestions ☐ Report attached: _____

   Agency _____

Contact _____ _____ _____ _____
Name Title Date Phone
Problems/suggestions ☐ Report attached: _____

4. **Other Interviews** (optional) ☐ Report attached: _____

Denice Taylor, Suquamish Tribe project manager

III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)

1. **O&M Documents**

☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date ☒ N/A

☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits: _____	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

7. **Groundwater Monitoring Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

9. **Discharge Compliance Records**

☐ Air	☐ Readily available	☐ Up to date	☒ N/A
☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

10. **Daily Access/Security Logs** ☐ Readily available ☒ Up to date ☐ N/A

Remarks: Site visitors are required to sign in at the main office.

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for state

☐ PRP in-house ☒ Contractor for PRP

☐ Federal facility in-house ☐ Contractor for Federal facility

☐ _____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date

☐ Funding mechanism/agreement in place ☐ Unavailable

Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs during Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: _____

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☐ N/A

Remarks: Signage present and in good condition.

C. Institutional Controls (ICs)

1. **Implementation and Enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive by): Self-reporting

Frequency: _____

Responsible party/agency: WSDOT, WSF

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up to date ☒ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☐ No ☒ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks: _____

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: _____

2. **Land Use Changes On Site** ☒ N/A

Remarks: _____

3. **Land Use Changes Off Site** ☒ N/A

Remarks: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☒ N/A

1. **Roads Damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A

Remarks: _____

B. Other Site Conditions

Remarks: The paved asphalt lot is used for employee parking and equipment and material storage. Over this FYR period, WSF has added covered storage areas and added steel plates under the footing of large storage boxes, etc. to minimize damage to the cap. There was ponding on the cap due to the heavy rains in recent weeks. One ponded area on the CDF was larger than 10 feet across and should be addressed.

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (low spots) ☐ Location shown on site map ☒ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident

Lengths: _____ Widths: _____ Depths: _____

Remarks: Numerous repaired cracks were observed. WSF indicated that a full repaving event may be needed in the near future.

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident

Area extent: _____ Depth: _____

Remarks: _____

4. **Holes** ☐ Location shown on site map ☒ Holes not evident

Area extent: _____ Depth: _____

Remarks: _____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established

☐ No signs of stress ☐ Trees/shrubs (indicate size and locations on a diagram)

Remarks: _____

6. **Alternative Cover** (e.g., armored rock, concrete) ☒ N/A

Remarks: Asphalt cover, see previous observations.

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident

Area extent: _____ Height: _____

Remarks: _____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident

☐ Wet areas	☐ Location shown on site map	Area extent: _____
☒ Ponding	☐ Location shown on site map	Area extent: _____
☐ Seeps	☐ Location shown on site map	Area extent: _____
☐ Soft subgrade	☐ Location shown on site map	Area extent: _____

Remarks: Numerous ponded areas were observed consistent with findings from the annual inspections. One ponded area was large (~10 feet across) and should be addressed.

9. **Slope Instability** ☐ Slides ☐ Location shown on site map

☒ No evidence of slope instability

Area extent: _____

Remarks: _____

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mats, riprap, grout bags or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

D. Cover Penetrations ☐ Applicable ☒ N/A

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

F. Cover Drainage Layer ☐ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☒ Functioning ☐ N/A

   Remarks: _____

2. **Outlet Rock Inspected** ☒ Functioning ☐ N/A

   Remarks: _____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

H. Retaining Walls ☐ Applicable ☒ N/A

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps and Pipelines ☐ Applicable ☒ N/A

B. Surface Water Collection Structures, Pumps and Pipelines ☐ Applicable ☒ N/A

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (check components that apply)

   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

   ☐ Air stripping ☐ Carbon adsorbers

   ☒ Filters: Filter sock at CB-1 and 4 for sediment and oil, metal-absorbing sock at CB-2, 3 and 5

   ☐ Additive (e.g., chelation agent, flocculent): _____

   ☐ Others: _____

   ☐ Good condition ☐ Needs maintenance

   ☐ Sampling ports properly marked and functional

   ☐ Sampling/maintenance log displayed and up to date

   ☐ Equipment properly identified

   ☐ Quantity of groundwater treated annually: _____

   ☐ Quantity of surface water treated annually: _____

   Remarks: _____

2. **Electrical Enclosures and Panels** (properly rated and functional)

   ☒ N/A ☐ Good condition ☐ Needs maintenance

   Remarks: _____

3. **Tanks, Vaults, Storage Vessels**

   ☒ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs maintenance

   Remarks: _____

4. **Discharge Structure and Appurtenances**

   ☒ N/A ☐ Good condition ☐ Needs maintenance

   Remarks: _____

5. **Treatment Building(s)**

☒ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair

☐ Chemicals and equipment properly stored

Remarks: _____

6. **Monitoring Wells** (pump and treatment remedy)

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition

☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: _____

D. Monitoring Data

1. **Monitoring Data**

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring Data Suggests:**

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs maintenance ☒ N/A

Remarks: _____

X. OTHER REMEDIES

If there are remedies applied at the site and not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions).

The remedy is a confined disposal facility intended to prevent human exposure and leaching into the adjacent waterway. The asphalt cap is preventing exposure as intended. Cracks are repaired promptly. There is no evidence that seeps from the contaminated material are occurring at the Site.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Regular inspection of the cap is catching cracks as they occur. Repairs are made promptly. Catch basins are cleaned regularly to prevent sediment accumulation.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

Cracking and ponding continue to be issues at OU3.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None at this time.

APPENDIX G – SITE INSPECTION PHOTOS

OU1, East Harbor

West Beach and EBS

Cobbles downgradient from the outfall that drains onto the EBS

No anchor buoy

Sediment cap

Eagle Harbor looking toward the 2017 cap repair

Signage and entrance gate

Groundwater treatment plant building and tank farm

FPA, extraction and production wells visible with ponding

Interior sheet pile wall with West Beach visible in background

Western sheet pile wall and extraction wells with standing water

Degraded eastern sheet pile wall

Signage at Pritchard Park


Bainbridge Island Japanese American Exclusion Memorial

Asphalt crack repair

Piezometer

Asphalt cap

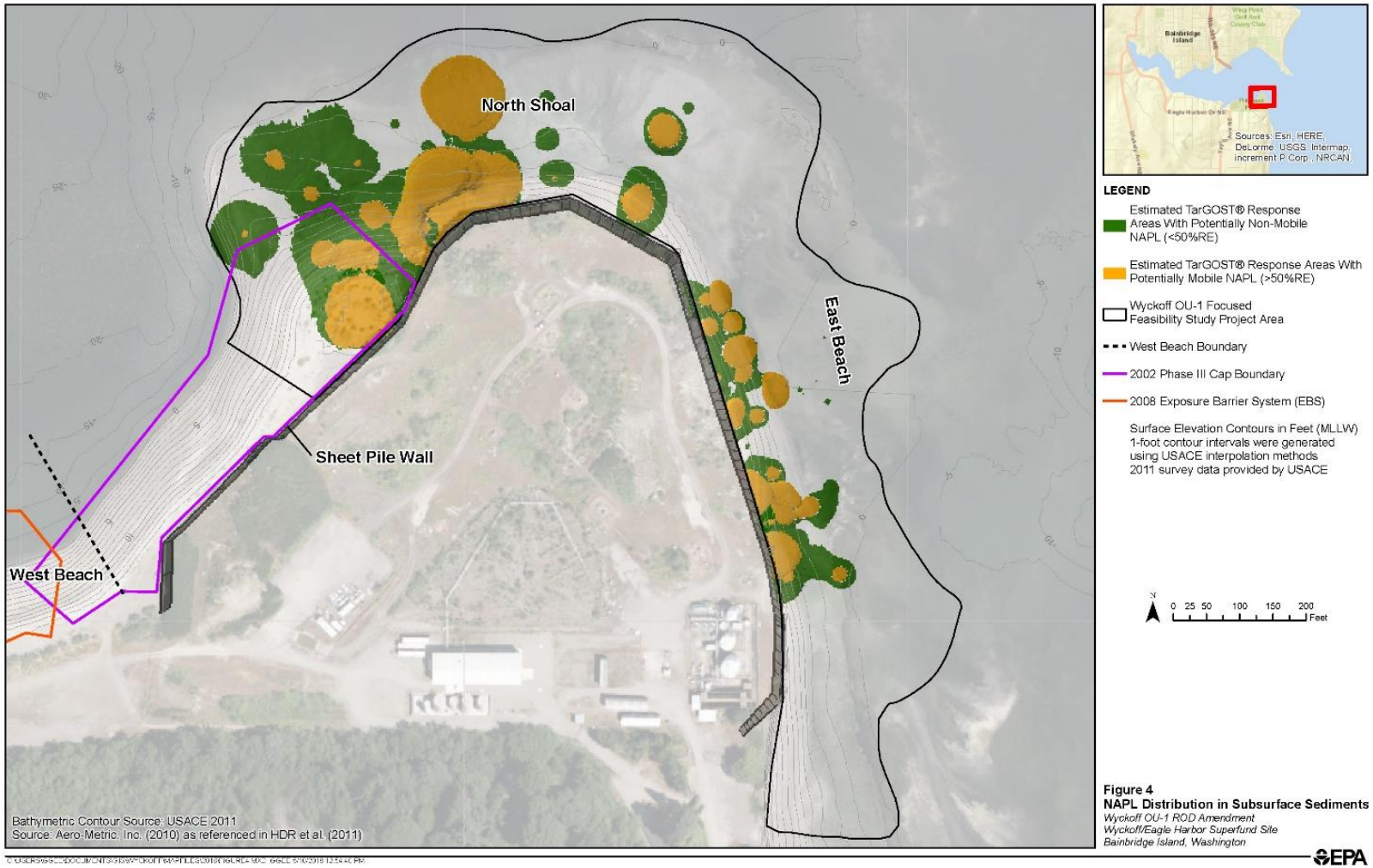
Signage at entrance to OU3

Tidal barrier

Ponded water near the northern drainage cutoff wall

APPENDIX H – ADDITIONAL DATA FIGURES

Figure H-1: NAPL Distribution in Subsurface Sediments[7]



[7] Source: Figure 4, 2018 ROD Amendment

Figure H-2: 2019 CSM[8]

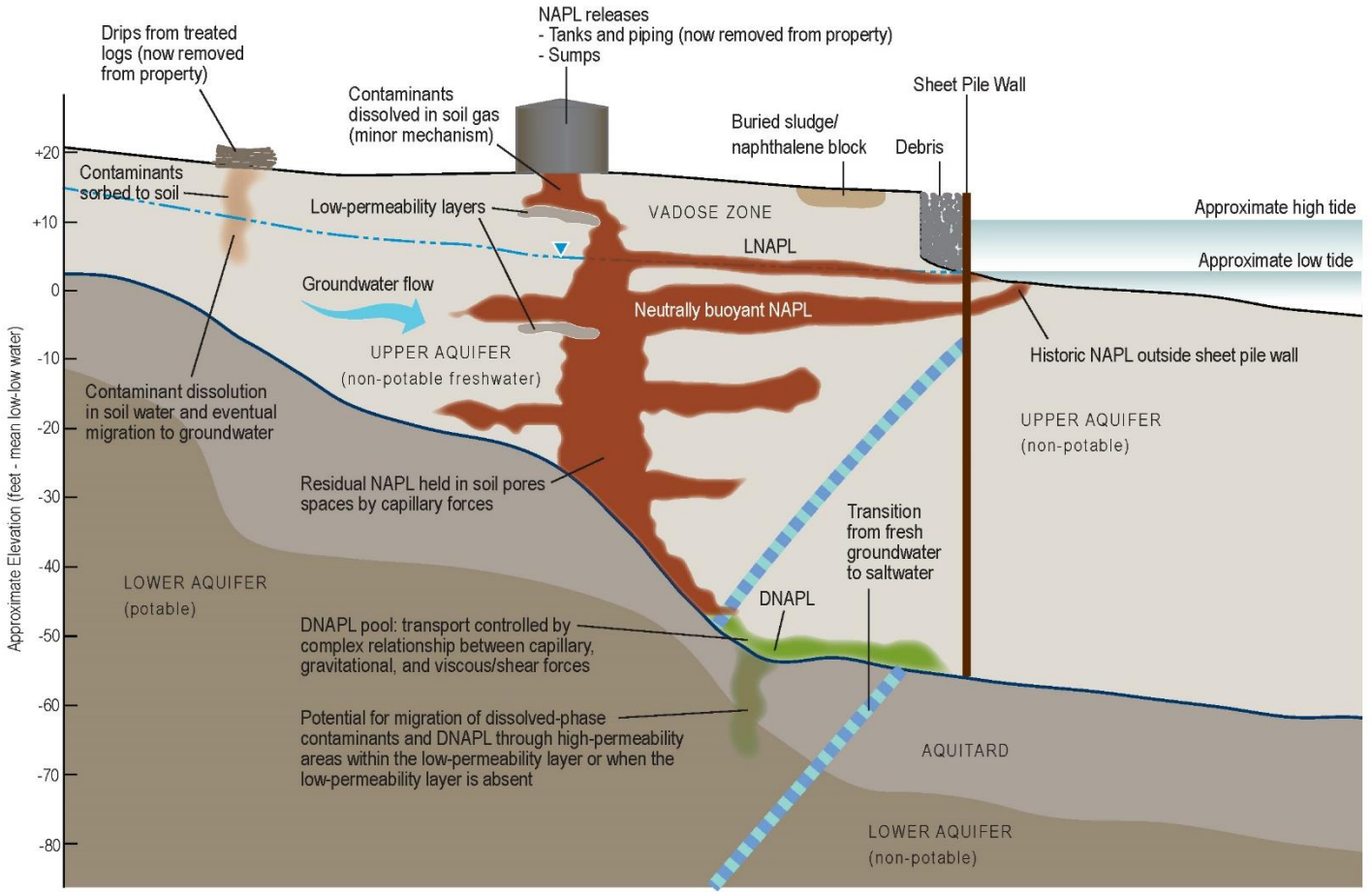


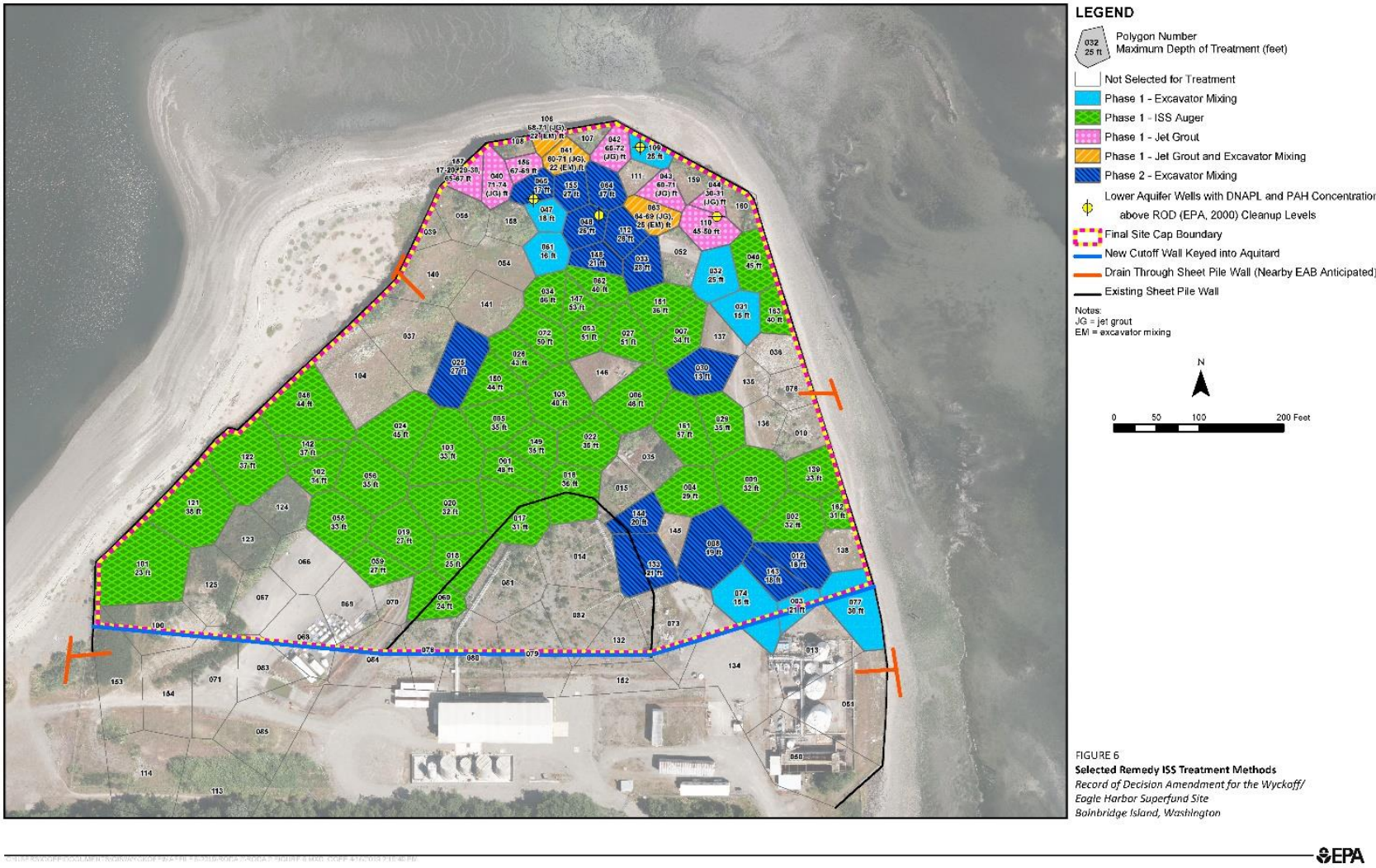
FIGURE 2-3
Conceptual Site Model
Record of Decision Amendment for the Wyckoff/ Eagle Harbor Superfund Site
Bainbridge Island, Washington

ESN0021200338SEA

EPA

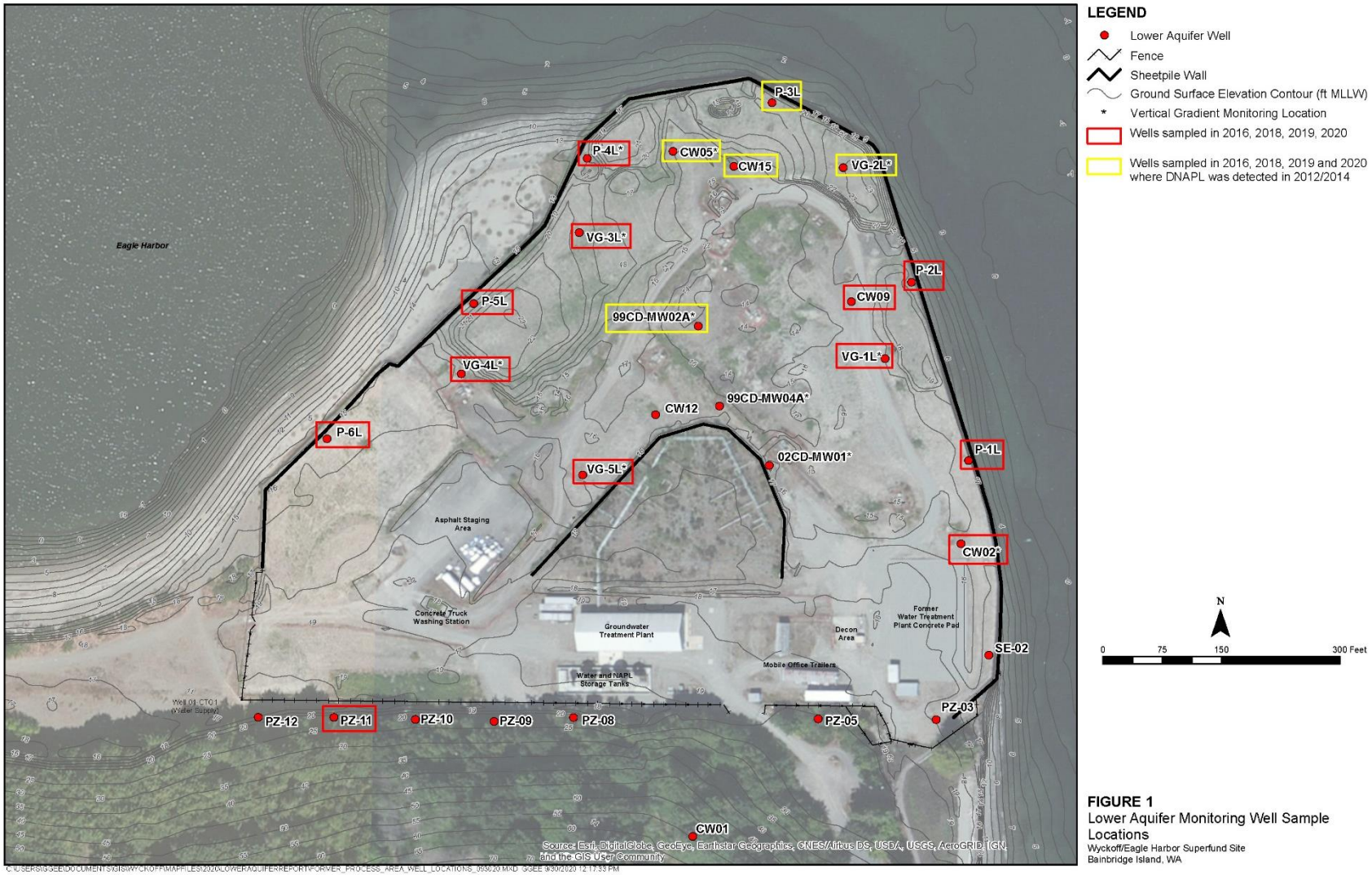
[8] Source: Figure 2-3, 2019 ROD Amendment

Figure H-3: OU2/4 Selected Remedy[9]



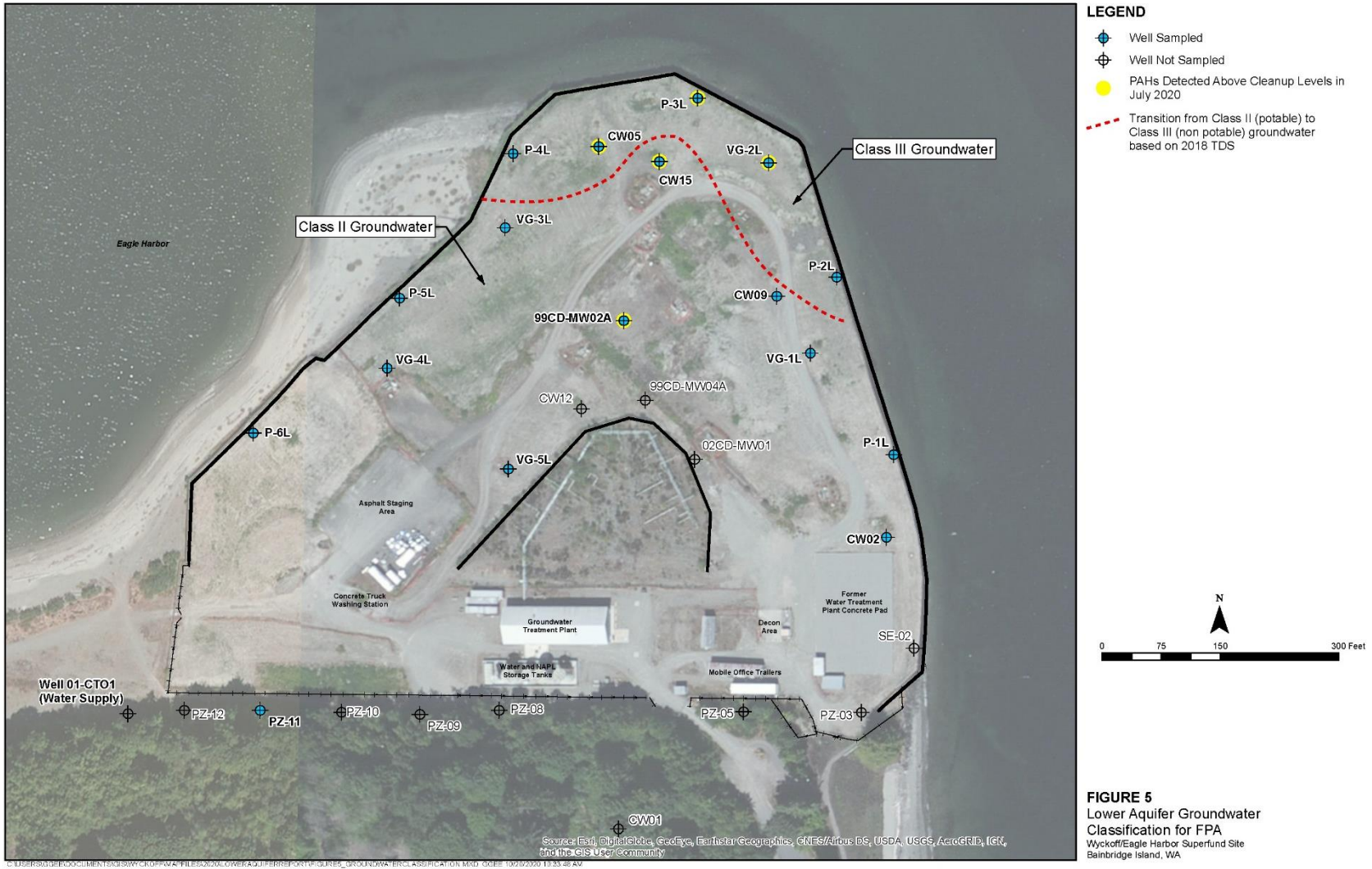
[9] Source: Figure 6, 2019 ROD Amendment

Figure H-4: Lower Aquifer Monitoring Wells[10]



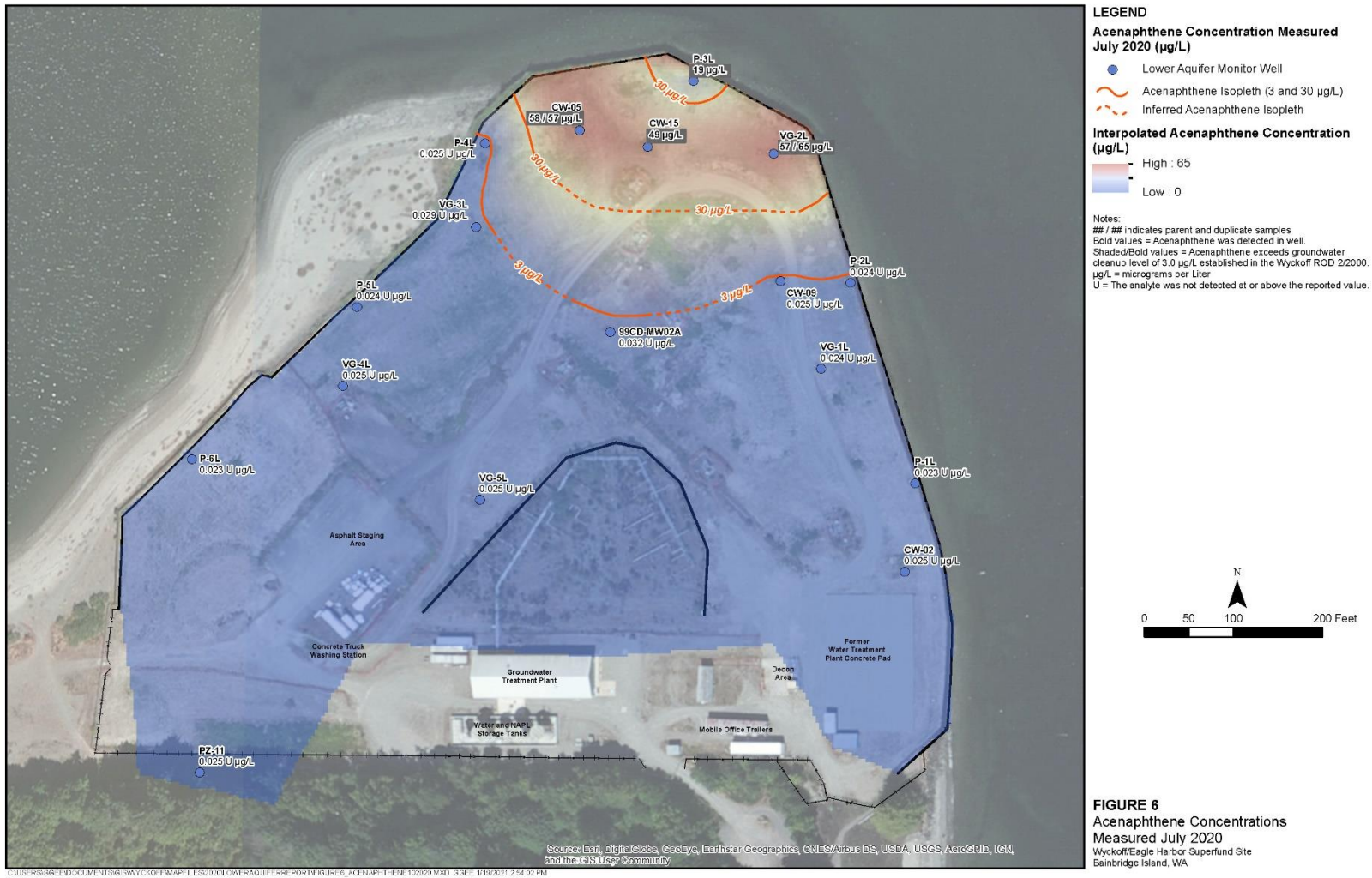
[10] Source: Lower Aquifer Groundwater Quality Sampling Results for Wyckoff/Eagle Harbor Superfund Site – July 2020

Figure H-5: 2020 PAH Detections – Lower Aquifer[11]



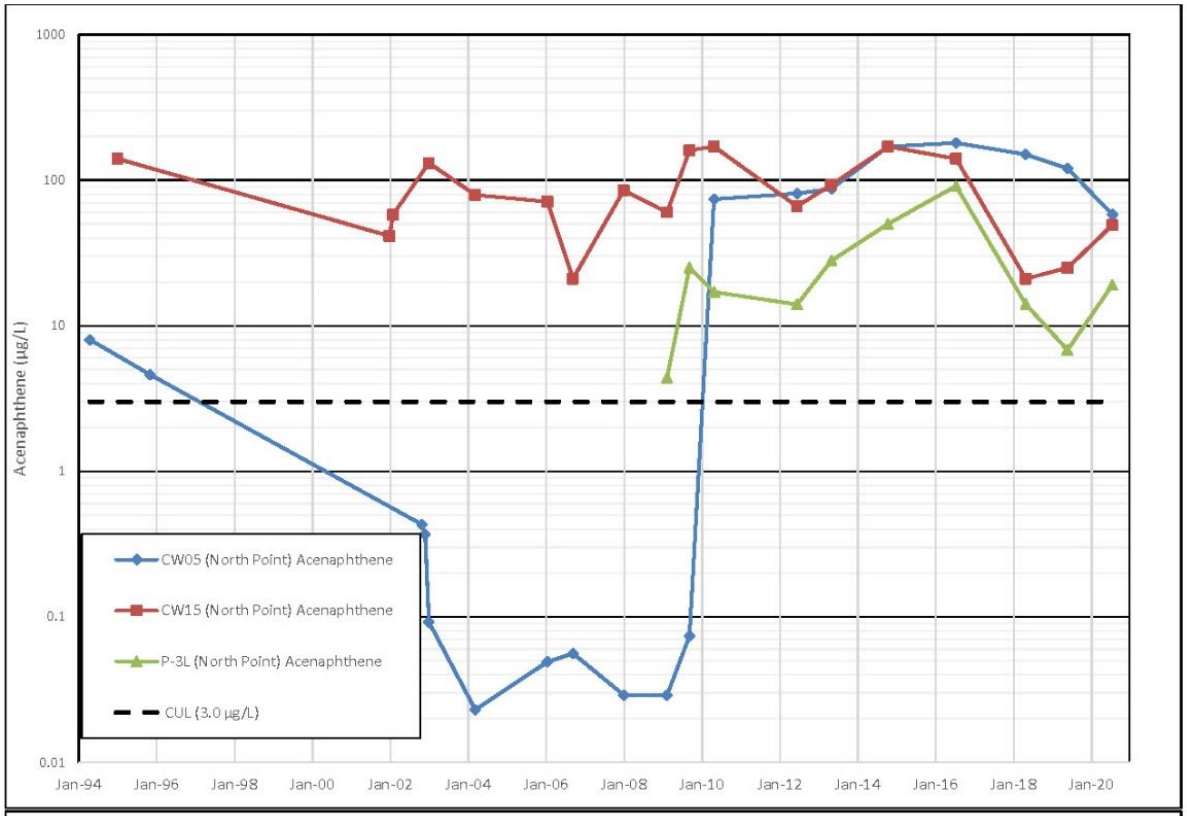
[11] Source: Lower Aquifer Groundwater Quality Sampling Results for Wyckoff/Eagle Harbor Superfund Site – July 2020

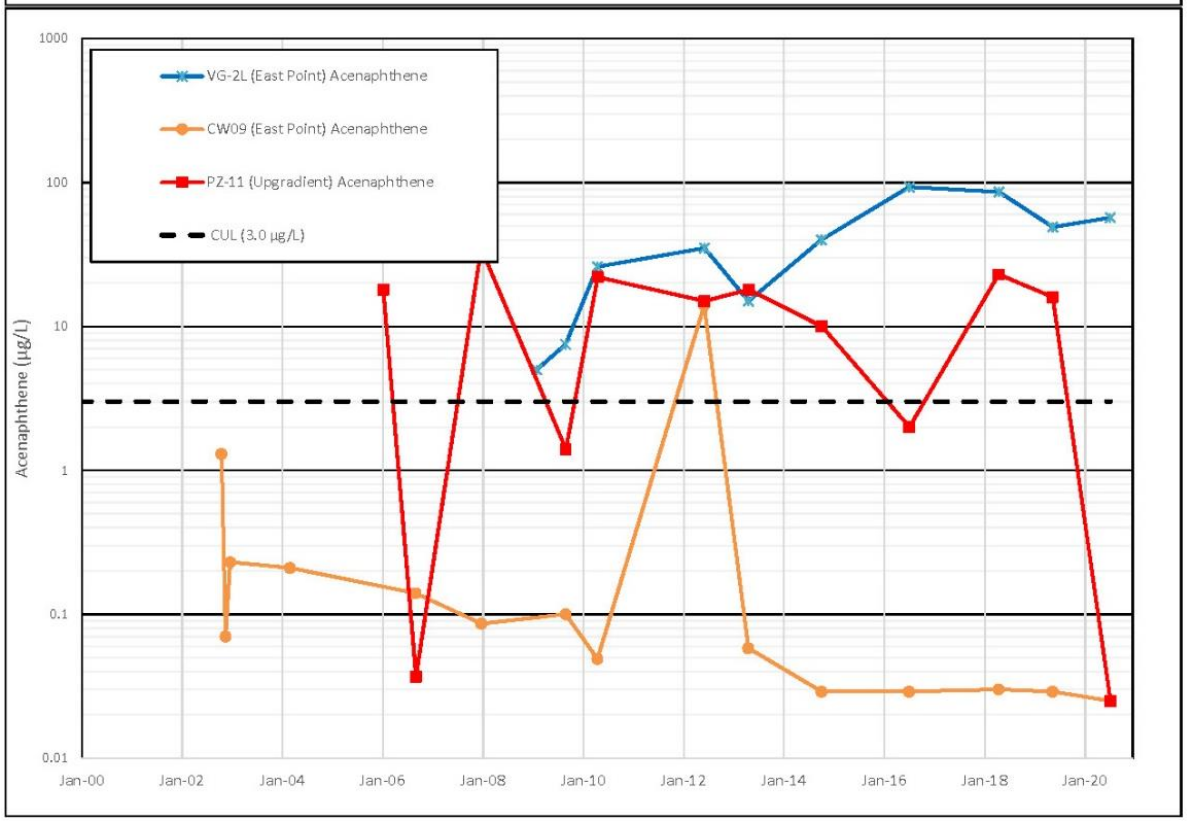
Figure H-6: 2020 Acenaphthene Concentrations[12]



[12] Source: Lower Aquifer Groundwater Quality Sampling Results for Wyckoff/Eagle Harbor Superfund Site – July 2020

Figure H-7: Acenaphthene Trend Charts[13]





[13] Source: Lower Aquifer Groundwater Quality Sampling Results for Wyckoff/Eagle Harbor Superfund Site – July 2020

Figure H-8: FPA Paired Well Locations[14]

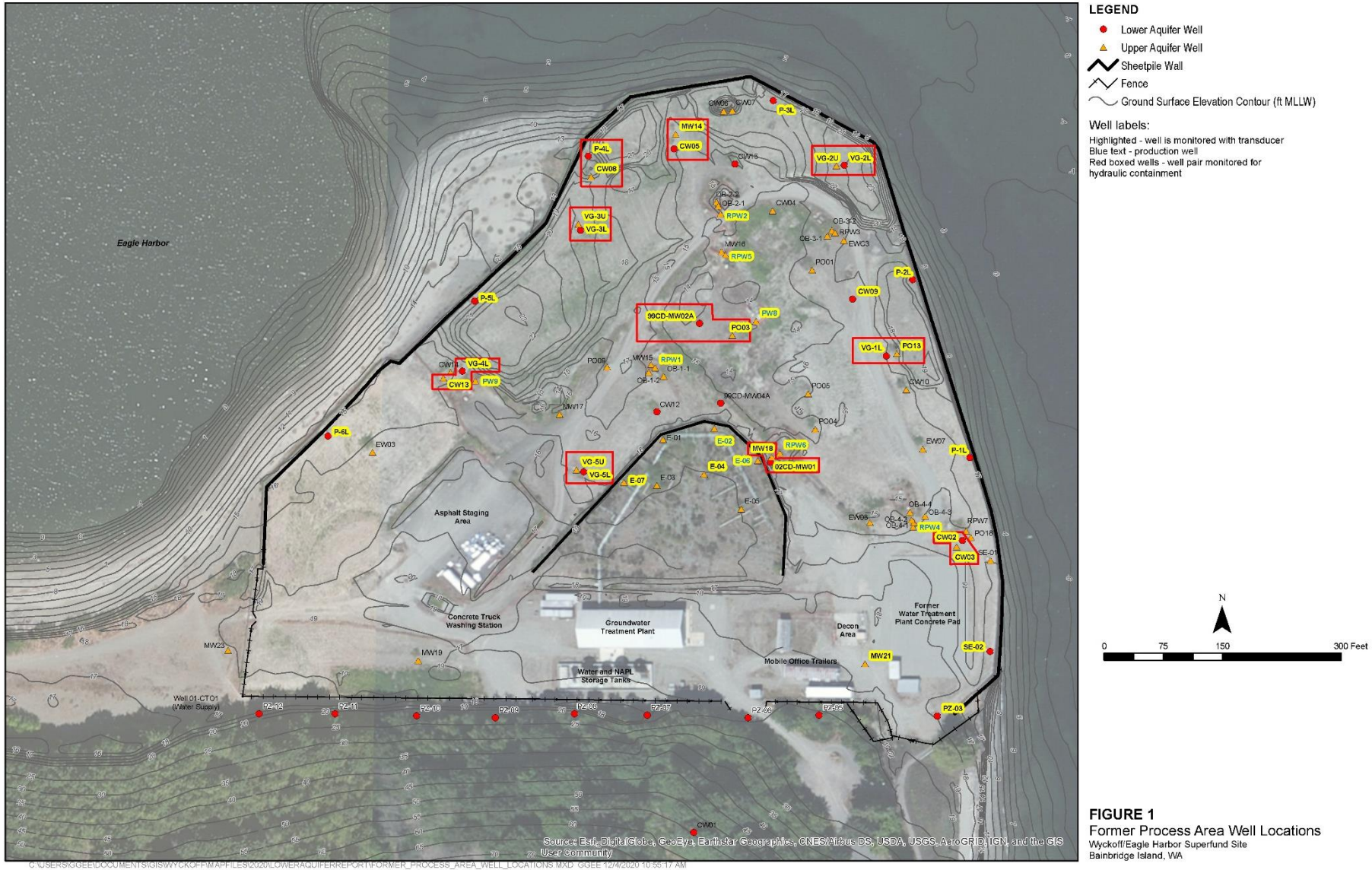


FIGURE 1
Former Process Area Well Locations
Wyckoff/Eagle Harbor Superfund Site
Bainbridge Island, WA

[14] Figure 1, Evaluation of Wyckoff Groundwater Level Data, July 1 through September 30, 2021

APPENDIX I – DETAILED ARARS REVIEW

Section 121(d)(2)(A) of CERCLA specifies that Superfund remedial actions must meet any federal standards, requirements, criteria or limitations that are determined to be legally ARARs. ARARs are those standards, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site.

OU1, East Harbor

The subtidal and intertidal cleanup goals were based on Washington State SMSs. The current standards are provided in Table I-1 (subtidal areas)and Table I-3 (intertidal areas). There have been no updates to the standards.

Table I-1: OU1 Sediment Subtidal ARAR Review

Sediment COC	1994 ROD ARARs		Current Standard[a]		Change
	SQS Chemical Criteria	MCUL Chemical Criteria	Marine Sediment Cleanup Objective	Cleanup Screening Level	
Mercury	0.41 mg/kg (dry weight)	0.59 mg/kg (dry weight)	0.41 mg/kg (dry weight)	0.59 mg/kg (dry weight)	No change
Individual PAHs and PAH groups	units = mg/kg organic carbon				
LPAHs	370	780	370	780	No change
Naphthalene	99	170	99	170	No change
Acenaphthylene	66	66	66	66	No change
Acenaphthene	16	57	16	57	No change
Fluorene	23	79	23	79	No change
Phenanthrene	100	480	100	480	No change
Anthracene	220	1,200	220	1,200	No change
2-Methylnaphthalene	38	64	38	64	No change
HPAHs	960	5,300	960	5,300	No change
Fluoranthene	160	1,200	160	1,200	No change
Pyrene	1,000	1,400	1,000	1,400	No change
Benz(a)anthracene	110	270	110	270	No change
Chrysene	110	460	110	460	No change
Total benzofluoranthenes	230	450	230	450	No change
Benzo(a)pyrene	99	210	99	210	No change
Indeno(1,2,3-c,d)pyrene	34	88	34	88	No change
Dibenzo(a,h)anthracene	12	33	12	33	No change
Benzo(g,h,i)perylene	31	78	31	78	No change

Notes:

a. Washington State SMSs (WAC 173-204-562), Table III (https://www.epa.gov/sites/default/files/2014-12/documents/wa-chapter173-204.pdf, accessed 1/17/2022).

PAH = polycyclic aromatic hydrocarbon
LPAH = low molecular weight PAH
HPAH = high molecular weight PAH

Table I-2: OU1 Intertidal Sediment COC ARAR Review

Sediment COC	2018 ROD Amendment Cleanup Goal (mg/kg)	Current Standard[a] (mg/kg)	Change
LPAHs	370	370	No change
Naphthalene	99	99	No change
Acenaphthylene	66	66	No change
Acenaphthene	16	16	No change
Fluorene	23	23	No change
Phenanthrene	100	100	No change
Anthracene	220	220	No change
2-Methylnaphthalene	38	38	No change
HPAHs	960	960	No change
Fluoranthene	160	160	No change
Pyrene	1,000	1,000	No change
Benz(a)anthracene	110	110	No change
Chrysene	110	110	No change
Total benzofluoranthenes	230	230	No change
Benzo(b)fluoranthene	NA	NA	No change
Benzo(k)fluoranthene	NA	NA	No change
Benzo(a)pyrene	99	99	No change
Indeno(1,2,3-c,d)pyrene	34	34	No change
Dibenzo(a,h)anthracene	12	12	No change
Benzo(g,h,i)perylene	31	31	No change
cPAHs (sum TEQ)	NA	NA	No change
PCP	NA	NA	No change

Notes:

a. Washington State SMSs (WAC 173-204-562), Table III (https://www.epa.gov/sites/default/files/2014-12/documents/wa-chapter173-204.pdf , accessed 1/17/2022).

PAH = polycyclic aromatic hydrocarbon
LPAH = low molecular weight PAH
HPAH = high molecular weight PAH

OU2/4, Soil and Groundwater

The 2019 ROD Amendment updated the soil cleanup levels based on MTCA Method B (except for naphthalene), which remain valid (Table I-3 in Appendix I). The naphthalene cleanup goal was based on EPA's RSL based on recreational use.

Table I-3: OU2 Soil COC ARAR Review

COC	2019 Interim ROD Amendment Soil Cleanup Levels (mg/kg)	Current Standard[a] (mg/kg)	Change
Naphthalene	3.8	1,600	Less stringent
Acenaphthene	4,800	4,800	No change
Fluorene	3,200	3,200	No change
Anthracene	24,000	24,000	No change
Fluoranthene	3,200	3,200	No change

COC	2019 Interim ROD Amendment Soil Cleanup Levels (mg/kg)	Current Standard[a] (mg/kg)	Change
Pyrene	2,400	2,400	No change
Benzo(a)anthracene	1.9	1.9	No change
Chrysene	19	19	No change
Benzo(b)fluoranthene	1.9	1.9	No change
Benzo(k)fluoranthene	1.9	1.9	No change
Benzo(a)pyrene	0.19	0.19	No change
Indeno(1,2,3,c,d)pyrene	1.9	1.9	No change
Dibenzo(a,h)anthracene	1.9	1.9	No change
Total cPAH (summed TEQ for 7 cPAHs listed above), adjusted based on potency relative to benzo(a)pyrene	0.19	0.19	No change
PCP	2.5	2.5	No change
Dioxin (2,3,7,8-TCDD) TEQ[g]	--	--	No change
Dioxin (2,3,7,8-Tetrachlorodibenzo-p-dioxin)	0.000013	0.000013	No change

Notes:

a. Washington State MTCA Method B (https://fortress.wa.gov/ecy/ezshare/tcp/CLARC/CLARC_SoilMethodABandGWP_unrestricted.pdf, accessed 1/18/2022).

OU3, West Harbor

The upland soil cleanup levels were based on MTCA Method A and C (industrial use) or based on site-specific erosion and transport scenarios. The current ARARs were compared to the original cleanup levels (Table I-4). The current ARARs were reviewed and cleanup goals remain valid except for arsenic. The MTCA Method C direct contact cancer value changed from 188 mg/kg to 88 mg/kg. This change does not impact the remedy because the upland area is covered in asphalt and there is no direct contact with soil.

Table I-4: OU3 Upland Soil ARAR Review

Contaminant	Soil Stabilization Action Level (mg/kg)	Basis	Current Standard[a] (mg/kg)	Change
Antimony	1,400[a]	MTCA Method C	1,400	No change
Arsenic	188[a]	MTCA Method C	88	More stringent
Lead	1,000[d]	MTCA Method A	1,000	No change

Notes:

a. Washington State MTCA Method C and A, Industrial Use (https://www.ezview.wa.gov/Portals/_1987/Documents/Documents/CLARC_SoilMethodAandC_indust.pdf, accessed 1/18/2022).