SEATTLE HARBOR
NAVIGATION IMPROVEMENT PROJECT

APPENDIX G

Hazardous, Toxic, and Radioactive Waste

Final Integrated Feasibility Report and Environmental Assessment

US Army Corps of Engineers®
Seattle District

Port of Seattle®

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Seattle Harbor Navigational Improvement Project
East and West Waterways
Seattle, Washington

PHASE I
ENVIRONMENTAL SITE ASSESSMENT

May 2016

Updated: June 2017

Prepared By
U.S. Army Corps of Engineers
Seattle District
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ACRONYMS & ABBREVIATIONS

ASTM	American Society for Testing and Materials
BT	Bioaccumulation Trigger
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
COC	Contaminant of Concern
Corps	U.S Army Corps of Engineers, Seattle District
cPAHs	Carcinogenic Polycyclic Aromatic Hydrocarbons
CSL	Cleanup Screening Level
CY	Cubic Yards
DMMP	Dredged Material Management Program
DO	Dissolved Oxygen
Ecology	Washington Department of Ecology
ENR	Enhanced Natural Recovery
EPA	Environmental Protection Agency
ESA	Environmental Site Assessment
ESD	Explanation of Significant Difference
GI	General Investigation
HTRW	Hazardous, Toxic, or Radioactive Waste
MLLW	Mean Lower Low Water
MNR	Monitored Natural Recovery
NPL	National Priorities List
OU	Operable Unit
PCBs	Polychlorinated Biphenyls
REC	Recognized Environmental Conditions
RI	Remedial Investigation
ROD	Record of Decision
SCO	Sediment Cleanup Objectives
SHNIP	Seattle Harbor Navigational Improvement Project
SL	Screening Level
SMS	Sediment Management Standards
SVOC	Semi-volatile organic compound
TBT	Tributyltin
TSS	Total Suspended Solids
USGS	United States Geological Survey

1.0 INTRODUCTION

This Phase I Environmental Site Assessment (Phase 1 ESA) is part of the Seattle Harbor Navigational Improvement Project (SHNIP) General Investigation (GI). The U.S. Army Corps of Engineers, Seattle District (Corps) has prepared a final Integrated Feasibility Report and Environmental Assessment, which documents the process of developing potential solutions to evaluate the environmental impact of deepening the East and West Waterways of the Seattle Harbor. A critical part of the feasibility analysis is the evaluation of known and suspected hazardous, toxic, or radioactive waste (HTRW) conditions with potential to impact project planning, design, and implementation. This Phase 1 ESA identifies all known and suspected HTRW releases.

1.1 Purpose

The purpose of conducting this Phase 1 ESA is to determine the environmental condition of the proposed project area. This ESA fulfils the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by Community Environmental Response Facilitation Act (CERFA). This report identifies known and potential sources of environmental risk or liability on the proposed project site, and in the surrounding areas. This information will assist the Corps' design team to manage and avoid HTRW hazards at the project site.

1.2 Description of the Project Area and Proposal for Federal Action

The proposal for navigation improvements at Seattle Harbor triggered analysis under the National Environmental Policy Act. For analysis of potential environmental impacts of the range of alternatives, the Corps is assuming a maximum length, width, and depth of improvements, as well as an economically optimized plan that would require less total dredging than the maximum considered. The Recommended Plan is to deepen the East and West Waterways up to a maximum of -57 feet below mean lower low water (MLLW) for the authorized length of the channel, increase the authorized navigation channel width by 50 feet, and widen approach reaches to 700 feet for improving navigation safety at the entrance to each channel.

Deepening the East and West Waterways would require dredging up to a maximum proposed depth of -57 MLLW, an accumulation of approximately 10% of the material between the 2014 channel survey and the initiation of construction, and that the contractor removes all of the 2-foot allowable over depth while dredging the channels. Disposal of dredged material would occur at authorized open-water placement sites, with upland disposal of dredged material that does not meet criteria for open-water disposal. The resulting channel depths would accommodate the largest ships that are anticipated to call at the Port of Seattle over the 50-year study period.

1.3 Scope of Work

The scope of work for this assessment was in general accordance with the ASTM International (ASTM) Standard Practices for Environmental Site Assessments: Phase I Environmental Site Assessment Process (ASTM E1527 - 13). These methodologies are described as representing good commercial and customary practice for conducting a Phase I ESA of a property for the purpose of identifying *recognized environmental conditions* (RECs). The project effort includes the following tasks:

- Conduct a record search and review all reasonably attainable federal, state, and local government information and records to determine possible onsite sources of hazardous substances and environmental condition of the project area.
- Review of all reasonably attainable federal, state, and local government records of adjacent facilities with the potential to release contamination to determine possible offsite sources of hazardous substances.
- Analysis of historical data on prior uses of the project site(s) and the surrounding area.
- Interviews with adjacent property owners and/or tenants or other knowledgeable sources.
- Visual site inspection of the project area to identify possible hazardous substance sources.
- Identify contamination sources using data gathered and evaluate what risk they pose and the effect to the categorization of the environmental condition of the project area.
- Identify all ongoing actions that may affect the environmental conditions of the project area.
- Determine the environmental condition of the project area.
- Determine the extent to which *recognized environmental conditions* may impact, or pose a risk to, the proposed project

The scope of this report did not include an audit of environmental regulatory compliance issues or permits, wetland delineation, or collection and testing of environmental samples, including those for radon gas, lead-based paint, polychlorinated biphenyls (PCBs), asbestos, soil, and/or groundwater condition.

2.0 SITE DESCRIPTION & PHYSICAL SETTING

2.1 General Location

The federally authorized Seattle Harbor navigation project, consisting of the East, West, and Duwamish Waterways, is located in Puget Sound's Elliott Bay at Seattle, Washington. The authorized project is located from Elliott Bay upstream approximately five miles to the head of the Federal navigation channel which lies in the lower Duwamish Waterway. This waterway provides about 1 mile of deep draft navigation accessible from Elliott Bay, Puget Sound, and the Pacific Ocean. Authorization for deepening in the Lower Duwamish Waterway is not considered in the scope of this GI, and thus is not evaluated in the Phase I assessment.

Below is a summary of current authorized boundaries for the East and West Waterways:

> **East Waterway**: from the pier head line at Elliott bay, 6,500 feet long, effective width of 500 wide; from that point an additional 700 feet long and effective width of 500 feet wide and terminating at Spokane Street. In the area defined as "Stage I" in the East Waterway Channel Deepening Stage I Project Report, the authorized depth is -51 feet MLLW. In all other areas of the East Waterway, the authorized depth is -34 feet MLLW.
>
> **West Waterway**: from the pier head line at Elliott Bay, 5,200 feet long, effective width of 500 feet wide, -34 feet MLLW.

2.2 Site Description

West Waterway is used to access piers located east (Harbor Island) and west (T5) of the waterway, and as a navigation channel for access to the industrial sites in the Lower Duwamish Waterway. East Waterway is used for access to Harbor Island's container loading facility at Terminal 18 to the West. Both East and West Waterways are located in a heavily industrialized area, and provide ships access to these industrial sites.

2.3 Description of CERCLA Sites and Operable Units

There are many CERCLA sites that are located at or are in very close in proximity to the East and West Waterways. The names and the geographical locations of nearby CERCLA sites with respect to the Waterways can be seen in Figure 1. The CERCLA sites include Lockheed West Seattle (to the west), Lower Duwamish Waterway (to the south), and Harbor Island (encompassed by the SHNIP project area).

The Harbor Island CERCLA site contains multiple operational units (OUs); the OUs most relevant to West Waterway are the West Waterway Sediments OU, the Todd Shipyard Sediments OU, and the Lockheed Shipyard Sediments OU. The Harbor Island CERCLA site OU most relevant to the East Waterway is the East Waterway Sediments OU. The Harbor Island CERCLA site OUs are depicted in Figure 1.

East and West Waterway sediments are contaminated primarily by 5 types of contaminants of concern (COCs): PCBs, metals, dioxins/furans, tributyltin (TBT), and carcinogenic polycyclic aromatic hydrocarbons (cPAHs).

The following sections provide detailed summaries of CERCLA Sites and OUs in and adjacent to East and West Waterways.

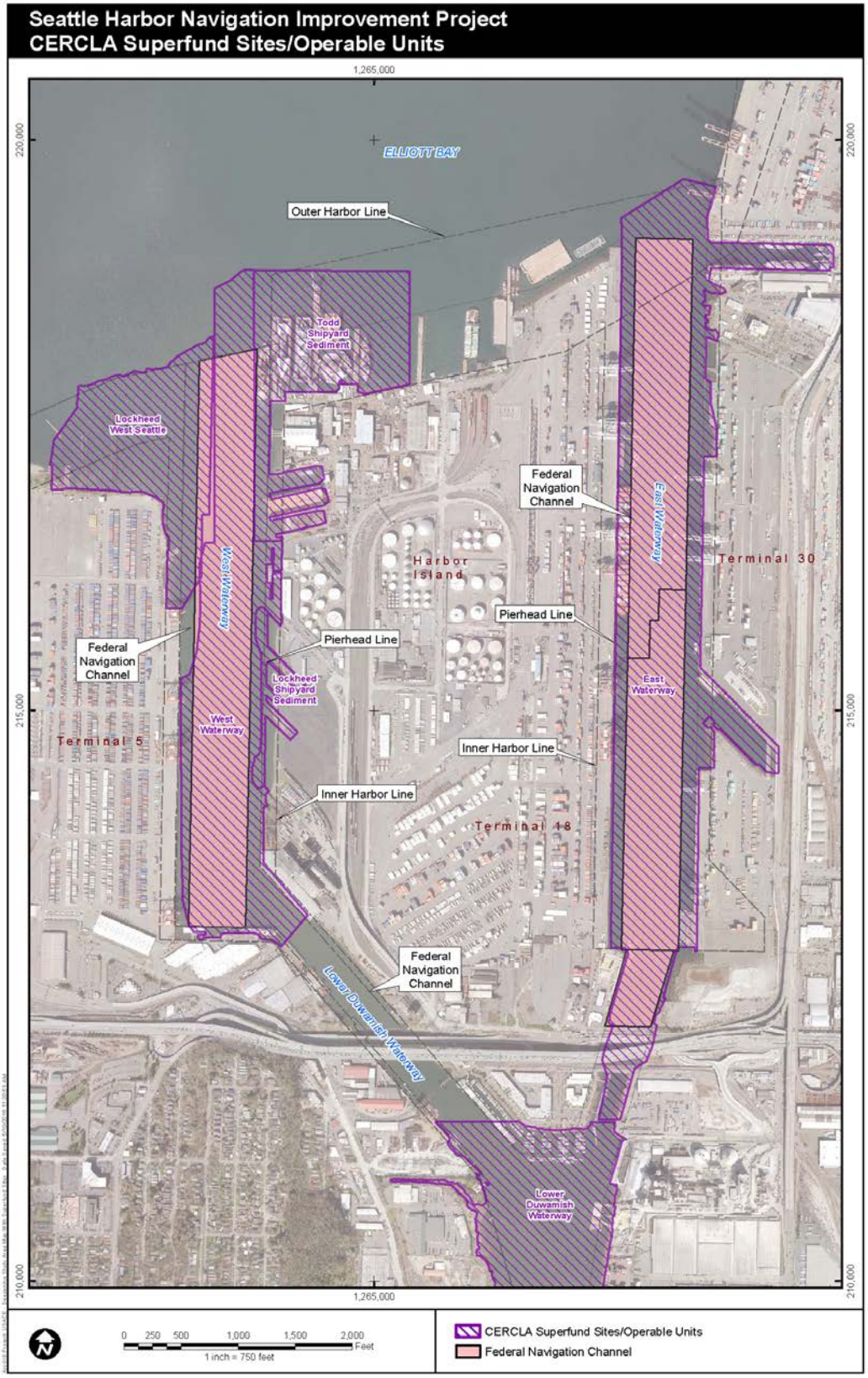

Figure 1. CERCLA Sites Adjacent to the Waterways.

2.3.1 West Waterway Sediments OU

When the Harbor Island CERCLA site was added to the NPL in 1983, the focus of investigations and enforcement activities were on the upland portion of the site. In 1985, as part of the EPA National Estuary Program (Urban Bay Action Program), sediment chemical and biological data were collected in the East and West Waterways, as well as throughout the Lower Duwamish Waterway and Elliott Bay. Although data collected in the West Waterway indicated potential adverse effects to biota, primarily at stations in or near the shipyards, only one sediment toxicity bioassay test was performed.

Subsequently, EPA initiated a fund-led sediment remedial investigation for the site in 1991, which sampled sediments around Harbor Island. In 1995, the sediment Remedial Investigation/Feasibility Study (RI/FS) was completed (EPA, 2003). The clear indication of sediment contamination associated with the shipyards led EPA to issue a Record of Decision (ROD) for the Shipyard Sediment OU (Todd and Lockheed Shipyards) in 1996. For the remainder of the Harbor Island sediments, however, additional sediment investigations were necessary because the RI/FS did not adequately define the extent of surface sediments that may potentially warrant cleanup based on the Washington State Sediment Management Standards (SMS) chemical and biological criteria. The primary data gap was that biological data (e.g., sediment toxicity tests) had not been collected and were necessary to accurately evaluate ecological risks. Other data gaps included the lack of information on how to evaluate TBT contaminated sediments.

A ROD for the West Waterway sediments OU was signed in 2003 and summarizes the nature and extent of sediment contamination. The selected remedy was the no action alternative. Sediments that required active remediation are located outside the boundaries of the West Waterway Sediments OU (i.e. in the Todd Shipyard and Lockheed Shipyard OUs).

While not specifically associated with the CERLCA project, a confined aquatic disposal (CAD) facility is present in the south end of the West Waterway. Based on best available information, the site is located at Station 12+50 (i.e. 1,250 feet from the south end of West Waterway) and is approximately 75 feet to the east of the channel centerline. The top of the cap for the CAD is at an estimated elevation of -56.8 feet MLLW and the highest elevation of contaminated material is approximately -58.1 feet MLLW. This CAD contains elevated concentrations of PCB contaminated sediments historically disposed of at this site.

2.3.2 East Waterway Sediments OU

The East Waterway Sediments OU, another OU of the Harbor Island CERCLA Site, was added to EPA's NPL in September 1983. A draft feasibility study for the site was completed in January 2014, revised in 2016, and provided an evaluation of the contamination at the site and an array of remediation alternatives for potential implementation. Sediment in the East Waterway is primarily contaminated with PCBs, PAHs, and metals. Many other organic chemicals including semi-volatile organic compounds (SVOCs) and pesticides are present at the site, but are less frequently or rarely detected. The highest total PCB, cPAH, arsenic, mercury, and TBT concentrations are spatially varied throughout the waterway. Contaminants contributing the most to human health risks in the East Waterway include total PCBs, arsenic, cPAHs, and dioxins and furans. The feasibility study for the East Waterway proposes a range of alternatives to address the contamination present in the sediments. The alternatives vary in their emphasis and combinations of the types of technologies for remediation. There are several remedial technologies common to all the alternatives. Those technologies include the following:

- Physical removal (e.g., dredging) of contaminated sediments. It is assumed that dredged sediment would be disposed of in an off-site facility (e.g., in a permitted landfill). Based on site conditions, mechanical dredging is assumed in open-water areas and diver-assisted hydraulic dredging is assumed in under-pier areas,
- Containment (e.g., isolation capping) of contaminated sediments, using engineered layers of sand, gravel, or rock,
- Enhanced natural recovery (ENR) that uses a thin layer placement of material (e.g., sand) to accelerate natural recovery processes,
- In-situ treatment that adds activated carbon or other sequestering agents to sediments to reduce the bioavailability and toxicity of contaminants,
- Monitored natural recovery (MNR) that reduces surface sediment concentrations, primarily by the natural burial of contaminated sediments with cleaner sediments over time.

2.3.3 Todd Shipyard Sediments OU

The major components of the remedy selected in the ROD for Todd Shipyard Sediments OU of the Harbor Island CERCLA site included dredging of sediments exceeding the Cleanup Screening Level (CSL) of the State of Washington sediment management standards (SMS) and capping of all sediments that exceed the Sediment Cleanup Objective (SCO) of the SMS. The remedy also required creation of intertidal habitat bench. Subsequent to the ROD, pre-remedial design studies for Todd Shipyard OU better defined the nature and extent of contamination within the OU. The results of these studies indicated that certain elements of the ROD needed to be amended. EPA issued an Explanation of Significant Differences (ESD) on December 1999. The purpose of the ESD was to designate the Todd and Lockheed Shipyard Sites as independent OUs and to redefine the boundary of the OU identified in the November 1996 ROD based on additional information gathered during two remedial design investigations associated with this OU. In April 2003, EPA issued a second ESD. The primary changes documented in this ESD were to further define capping as the selected remedial action for the under-pier areas and adjust the OU boundary based on the use of confirmation samples. Remedial activities were conducted as planned during two phases of construction occurring from 2005 to 2006. Cleanup goals were determined to be achieved at the completion of construction (EPA 2010).

2.3.4 Lockheed Shipyard Sediments OU

The Remedial Action for the Lockheed Shipyard Sediments OU of the Harbor Island CERCLA site was conducted in two phases. Phase 1 was completed in March 2004, and Phase 2 was completed in February 2005. The major components of Remedial Action included dredging, capping, replacement of the deteriorated bulkhead, removal of all pier structures, and onsite habitat mitigation. The first phase of remedial construction efforts was focused on pier demolition and dredging of contaminated sediments. The second phase consisted of dredging, capping, and habitat enhancement. During this remedial action, 119,064 tons of contaminated sediments were dredged and transported to an approved upland facility for disposal. Capping was implemented using approximately 100,000 cubic yards of capping material. Along the offshore perimeter of the site, limited dredging was also performed and a sand cover was placed along the boundary line. In portions of the channel area, verification sampling proved the remedial action failed to meet cleanup numbers, thus an additional six inches of sand was placed to serve as enhanced natural recovery (ENR). For areas where there was an exceedance of PCBs only during verification sampling, no additional actions were taken because the exceedances were minor and were below the 90th percentile for PCBs present in the West Waterway based on bioassays. Remedial activities were conducted as planned, and cleanup goals were obtained for the first phase of the remedial action. EPA conducted a final inspection in March 2005. The final inspection concluded that

construction had been completed in accordance with the remedial design plans and specifications and did not result in the development of a list of uncompleted tasks for the remedial action (EPA 2010).

2.3.5 Lockheed West Seattle CERCLA Site

Prior to industrial development of the Lockheed West Seattle CERCLA site, the site and surrounding area consisted of an intertidal delta at the mouth of the Duwamish River. Most of the original wetlands and mudflats were lost during construction of the Lower Duwamish Waterway and Harbor Island and as result of the dredging of intertidal areas on the northern terminus of the current Port Terminal 5.

At the outset of World War II, a shipyard owned and operated by the Puget Sound Bridge and Dredge Company was constructed at the Site. The company conducted ship repair, maintenance, and vessel construction at five major piers (remnants of Piers 23 and 24 and all of Pier 25 remain today), three dry docks, and a shipway. Lockheed Shipbuilding and Construction Company purchased the Site assets in 1959, and continued shipyard operations until 1987. In 1988, the Port purchased the adjacent upland property and the harbor leases from Lockheed Martin, in 1996, the Port discontinued the harbor leases causing them to be returned to Washington State Department of Natural Resources management.

Industrial activities generated considerable quantities of sandblast grit and other industrial waste that discharged to sediments and accumulated beneath the dry docks and shipways and was disseminated into the underlying sediments.

The Site was placed on the NPL on March 7, 2007. Prior to this, the Site (then referred to as Lockheed Shipyard No. 2) was listed as a sediment cleanup priority project under State of Washington authority through the requirements of Washington State Model Toxics Control Act. A Record of Decision was issued in August 2013.

2.4 Hydraulics and Geomorphology

The East and West Waterways flank Harbor Island, which is a large artificial island constructed of dredge spoils on the delta of the Duwamish River in 1909. The Duwamish River has the seventh largest mean annual freshwater discharge into Puget Sound. At its mouth, the Duwamish River empties into Elliott Bay, which is a naturally deep bay situated within the Central Puget Sound. Depths in Elliott Bay reach over 400 feet and it is sheltered by Alki Point to the south and West Point to the north.

Tides in Puget Sound are mixed semidiurnal in type. The mean tidal range published by NOAA for Seattle, Washington is 7.66 feet. The great diurnal tidal range is 11.36 feet. Tidal data for Seattle, Washington are listed in Table 1. The strongest and most frequent winds at Seattle are oriented from the north and south due to the geography of the Central Puget Sound basin. However, due to the orientation of Elliott Bay, Seattle Harbor is predominantly sheltered from southerly winds and wind-generated waves.

Table 1. Tidal Data at Seattle NOS/CO-OPS station 9447130 (1983-2001 tidal epoch)

Datum	Value (feet)	Description
Maximum	14.48	Highest Observed Water Level
MHHW	11.36	Mean Higher-High Water
MHW	10.49	Mean High Water
MTL	6.66	Mean Tide Level
MSL	6.64	Mean Sea Level
MLW	2.83	Mean Low Water
NAVD88	2.34	North American Vertical Datum 1988
MLLW	0	Mean Lower-Low Water
Minimum	-5.04	Lowest Observed Water Level

Tidal currents in the West Waterway are stronger as the waterway conveys the majority of the tidal prism and Green/Duwamish freshwater discharge. West Waterway flows reach as high as 1.4 ft/sec in the upper water column and 0.2 ft/sec at the seabed.

2.5 Regional Climate

Seattle is situated on a series of hills in a lowland area on Puget Sound's eastern shore between the Olympic Mountains to the west and the Cascade Mountains to the east. Westerly air currents from the ocean and the shielding effects of the Cascade Range produce a mild and moderately moist climate, with warm winters and cool summers. Extremes in temperature are rare and of short duration, and the daily fluctuation is slight. While Seattle is known for its pronounced rainy season and frequent cloudy weather, the average annual rainfall is actually less than that of many other cities in the United States, including New York and Atlanta. Average Temperatures: January, 40.8°F; August, 66.1°F; annual average, 52.4°F. Average Annual Precipitation: 36.6 inches. (City-Data 2015).

2.6 Water Quality and Salinity

The Washington Department of Ecology (Ecology) monitors physical parameters of water such as temperature, pH level, and dissolved oxygen concentrations because they serve as indicators of pollution. In estuaries such as the study area, salinity is measured to determine the area and depth of fresh and saltwater mixing, and turbidity is regulated as it pertains to healthy habitat for fish, invertebrates, and aquatic plants. Waters that do not meet standards are considered “polluted waters” and placed on a 303(d) list that Ecology publishes regularly (in reference to Section 303(d) of the Clean Water Act). Waters that have signs of diminished health but not enough to fail the criteria and be deemed “polluted” are “waters of concern” on the 303(d) list. Elliott Bay and the Duwamish Waterway remain on Ecology’s 303(d) list of threatened and impaired waters, although the trend for water quality in the action area is one of overall improvement.

Turbidity refers to the clarity or clearness of the water. The greater the amount of total suspended solids (TSS) in the water, the murkier it appears and the higher the measured turbidity. The East and West Waterways experience occasional high levels of suspended sediment typically occurring during the late spring, which are likely due to intense precipitation of seasonal storm events. Data from USGS monitoring show that the Duwamish Waterway reaches its maximum TSS levels generally from December through March.

Dissolved oxygen (DO) in marine waters is essential for most healthy aquatic life. If levels are too low it can be a sign of human induced impacts such as excessive runoff of nutrients or natural causes such as seasonal variations. Healthy conditions for aquatic life exist when dissolved oxygen are above 5.0 milligrams per liter (mg/L). Concentrations between 5.0 mg/L and 3.5 mg/L are generally healthy, except for the most sensitive species. When concentrations fall below 3.5 mg/L, conditions become unhealthy. Dissolved oxygen levels in the lower Duwamish do not always meet Ecology's standards. Excursions occur in middle and late summer when DO concentration drops below the criterion of 6.5 mg/L. In the winter months, DO is typically well over 9 mg/L.

The Green/Duwamish estuary has highly stratified salinity. A distinct freshwater lens routinely flows over a saltwater wedge of higher density. The upstream excursion of the saltwater wedge varies based on the tidal stage and freshwater discharge on the Green/Duwamish River. Recent Conductivity-Temperature-Depth profiles (McKeon et al., 2015) observed the toe of the saltwater wedge to from River mile 3.75 (upstream of the 1st Avenue Bridge) to river mile 6.5 (near the Duwamish River Turning Basin).

3.0 ENVIRONMENTAL DATA BASE REVIEW

3.1 Regulatory Agency Databases Records Search

A search of *Standard Environmental Records Sources* as defined in ASTM E-1527 - 13 was performed to identify *recognized environmental conditions.* Reviews of records related to the Property and nearby properties kept by both Federal and State regulatory agencies were conducted. This review was used to help identify known or potential sources of contamination that could adversely impact the Property. Table 2 provides a summary of the ASTM standard environmental records sources databases searched and corresponding radii and quantitative results of the record search corresponding to databases. Findings may be listed in more than one database.

Table 2. Source Lists and Associated Number of Sites

Agency	Description	Search Radius (miles)	Results
US EPA	National Priorities List (NPL)	1	3 sites
US EPA	Delisted NPL Sites	0.5	0 sites
US EPA	CERCLIS	0.5	5 sites
US EPA	RCRA Generators	Property and adjoining properties only	43 sites
US EPA	RCRA Treatment, Storage, or Disposal Facilities	0.5	57 sites
US EPA	RCRA Corrective Action Sites	1	0 sites
US EPA	Institutional Controls Registry	Property only	0 sites
US EPA	Toxic Release Inventory	0.5	5 sites
USCG	Emergency Response Notification System	Property only	0 sites
WA Ecology	State and Tribal Cleanup Sites[1]	0.5	59 sites
WA Ecology	State Landfills and Waste Treatment/Disposal Plants	0.5	0 sites
WA Ecology	State and Tribal Brownfield's	0.5	3 sites
WA Ecology	State and Tribal Leaking Underground Storage Tanks	0.5	12 sites
WA Ecology	State and Tribal Registered Underground Storage Tanks[2]	Property and adjoining properties only	106 sites
WA Ecology	State and Tribal Environmental Covenants Registry	Property and adjoining properties only	7 sites

[1] Includes active cleanups, either started or awaiting cleanup. Does not include No Further Action (NFA) sites.
[2] Includes USTs classified as operational, closed in place, or temporarily closed.

3.2 Known Environmental Conditions

Sediments in the East Waterway has been determined to be contaminated and require clean-up actions under CERCLA. Sediments in the West Waterway OU were evaluated under CERCLA but found to pose no risk to human health or the environment, thus a No Action ROD was issued in September 2013. Other OUs in the vicinity of West Waterway, including Todd and Lockheed Shipyard Sediment OUs, were remediated under CERCLA in order to reduce risk to human health and the environment. The Lockheed West Seattle Site, adjacent to the West Waterway, was also determined to require cleanup action under CERCLA, and a ROD was subsequently issued in August 2013. At this time, pre-design investigations are currently underway.

The most recent sampling event was in February 2015, focused only on the West Waterway vicinity. Fifty samples were analyzed for Dredged Material Management Program (DMMP) standard COCs, including metals, pesticides, SVOCs, PAHs, TBT, and PCBs. All concentrations were screened against DMMP 2014 marine screening levels (SLs), maximum levels, and bioaccumulation triggers (BTs). Eighteen samples (16 surface and 2 subsurface) had a detection that exceeded at least one DMMP marine evaluation criterion. In the Surface A Interval (0-4 ft), exceedance of SLs and/or BTs occurred in 16 of 23 total samples, with the northern portion of the navigation channel generally containing lower concentrations than the southern portion. In the Subsurface B Interval (4-8 ft), exceedance of SLs occurred in 2 of 20 samples. Both exceedances were in the southern portion of the navigation channel. There were no SL or BT exceedances in the seven Subsurface C (8-13 ft) samples. Any sample that is above at least one DMMP marine evaluation criterion is not considered suitable for open water disposal. This then shows the 18 exceedances in this sampling event would mean those areas of the West Waterway would not suitable for open water disposal (Anchor QEA 2015).

Table 2 identifies 300 sites within the immediate area of the Seattle Harbor East and West Waterways known to contain the potential for HTRW. The majority of these sites have not had a known or suspected release of HTRW into the groundwater. Some of the above sites haven't released any contamination or have only released HTRW into the soil or air, which is presumed to not cause a release of contaminated material into the East and West Waterways. Additionally, some of the sites accounted for in Table 2 have completed the cleanup of the contamination.

For the remainder of the sites, Appendix A shows the 47 sites within the specified proximity where a known or suspected release of contaminants has occurred to groundwater. As seen in Appendix A, 40 of the sites are currently in the process of a cleanup for the contaminated material that has been released and 7 of the sites are still awaiting for a cleanup to start. It is reasonable to infer that these sites have relatively limited impact on sediment quality in East and West Waterways. Existing contamination in East and West Waterways is due to historical sources, as documented in CERCLA records and documents listed in the References section.

4.0 PROPERTY HISTORY

4.1 Property History

The Waterways were created in the early 20th century by dredging. Dredge spoils were used to build up Harbor Island and the area now occupied by shipping terminals located adjacent to the waterways. Shipyard activities began at the site during World War II. In the following decades, activities included ship berthing, repair and maintenance at dry docks, moorage along piers, construction in the shipway, and associated upland activities. Decades of shipyard activities and related discharges resulted in many contaminants accumulating in the mud along the shoreline in East and West Waterways, immediately offshore, and in Elliott Bay that posed a risk to people and the environment. Numerous studies describing the nature and location of harmful contaminants in the sediment have been performed since the Harbor Island CERCLA site was listed on the National Priorities List (NPL) in 1983. Contaminants that are primary risk drivers include PCBs, metals, dioxins/furans, TBT, and cPAHs.

As seen in Figure 2 and Photographs 1 - 5, no significant changes in geography or landscape has occurred to East or West Waterways since 1919.

4.2 Aerial Photographs and Maps

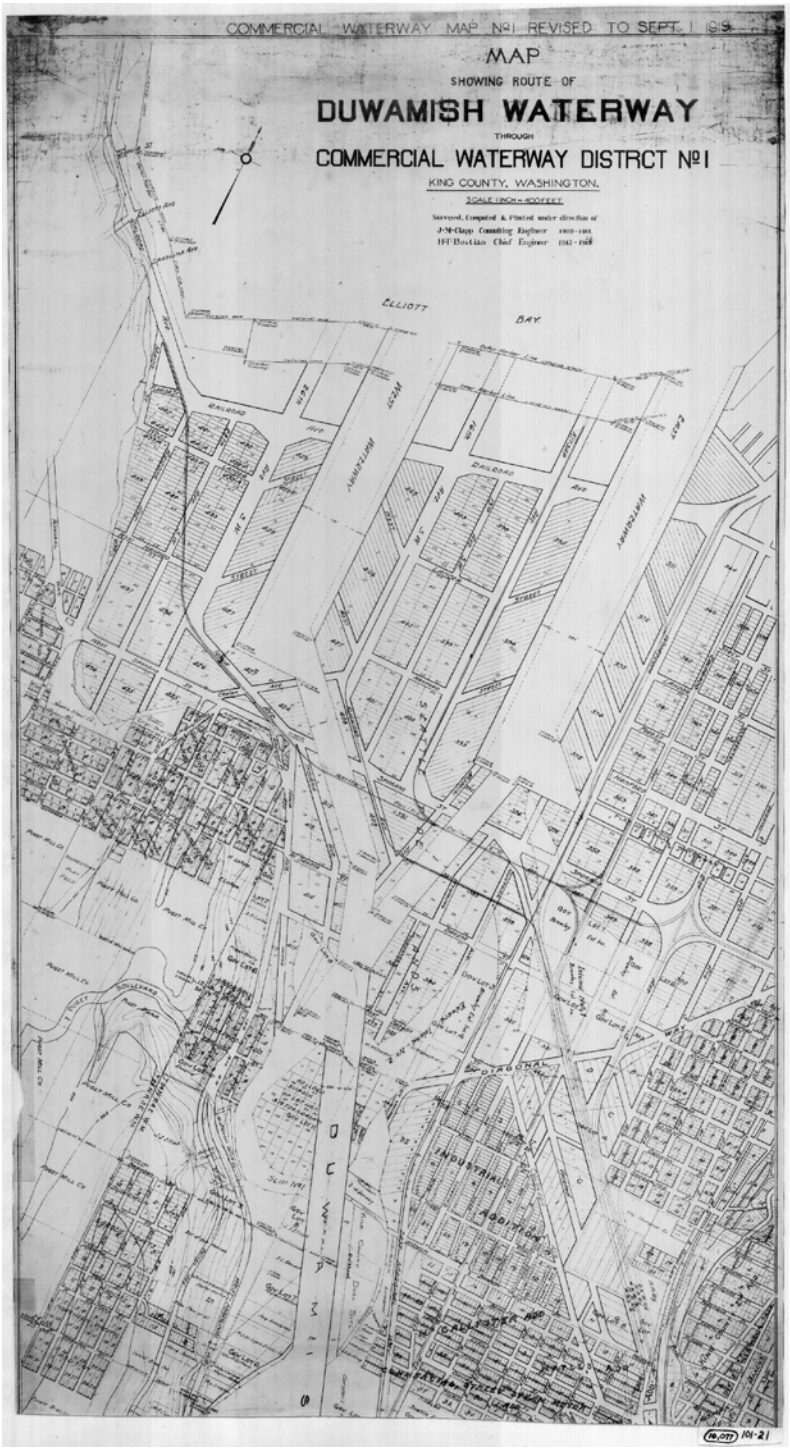

Figure 2. 1919 Map of Seattle Harbor

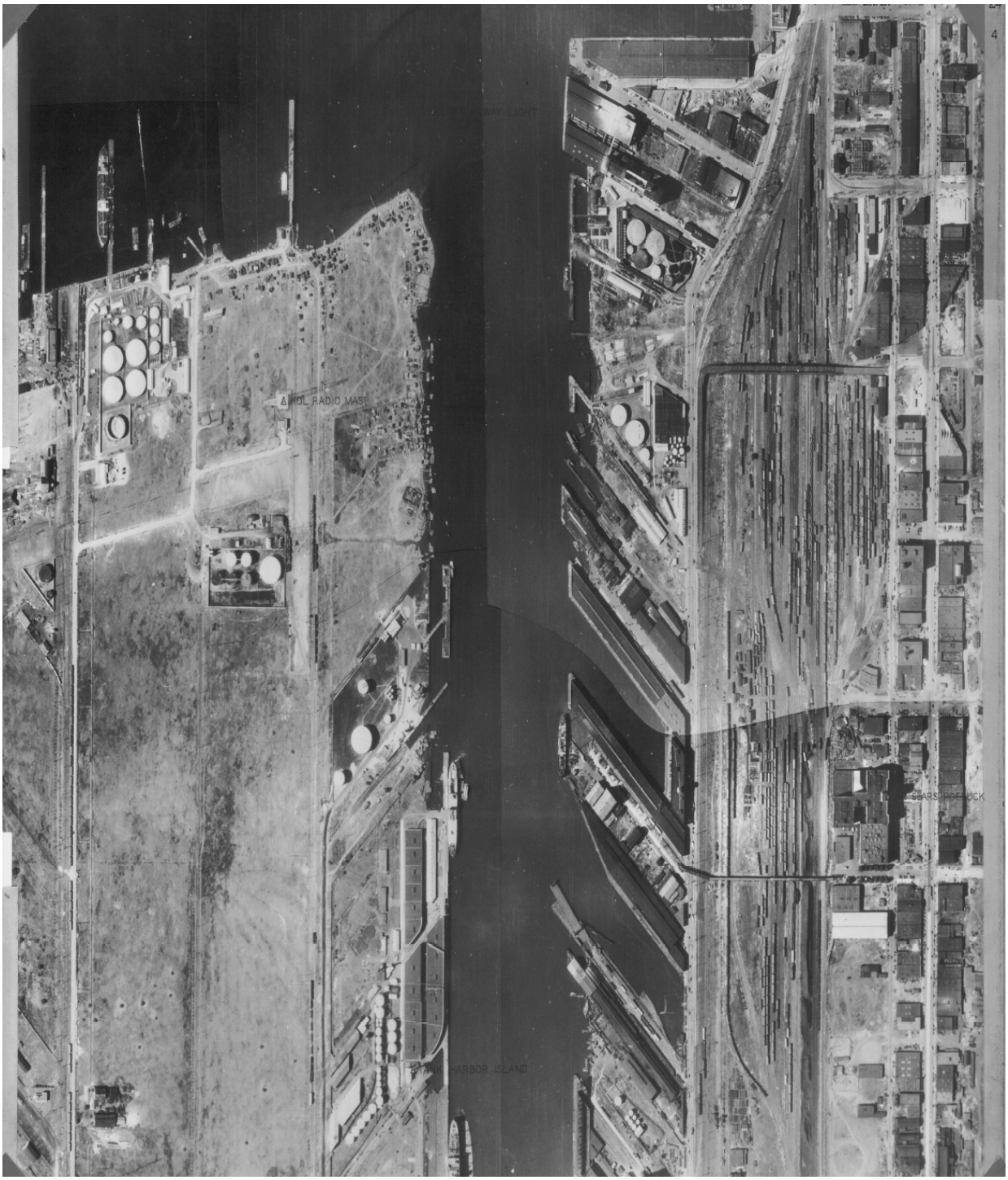

Photo 1. 1937 Aerial Photograph of East Waterway

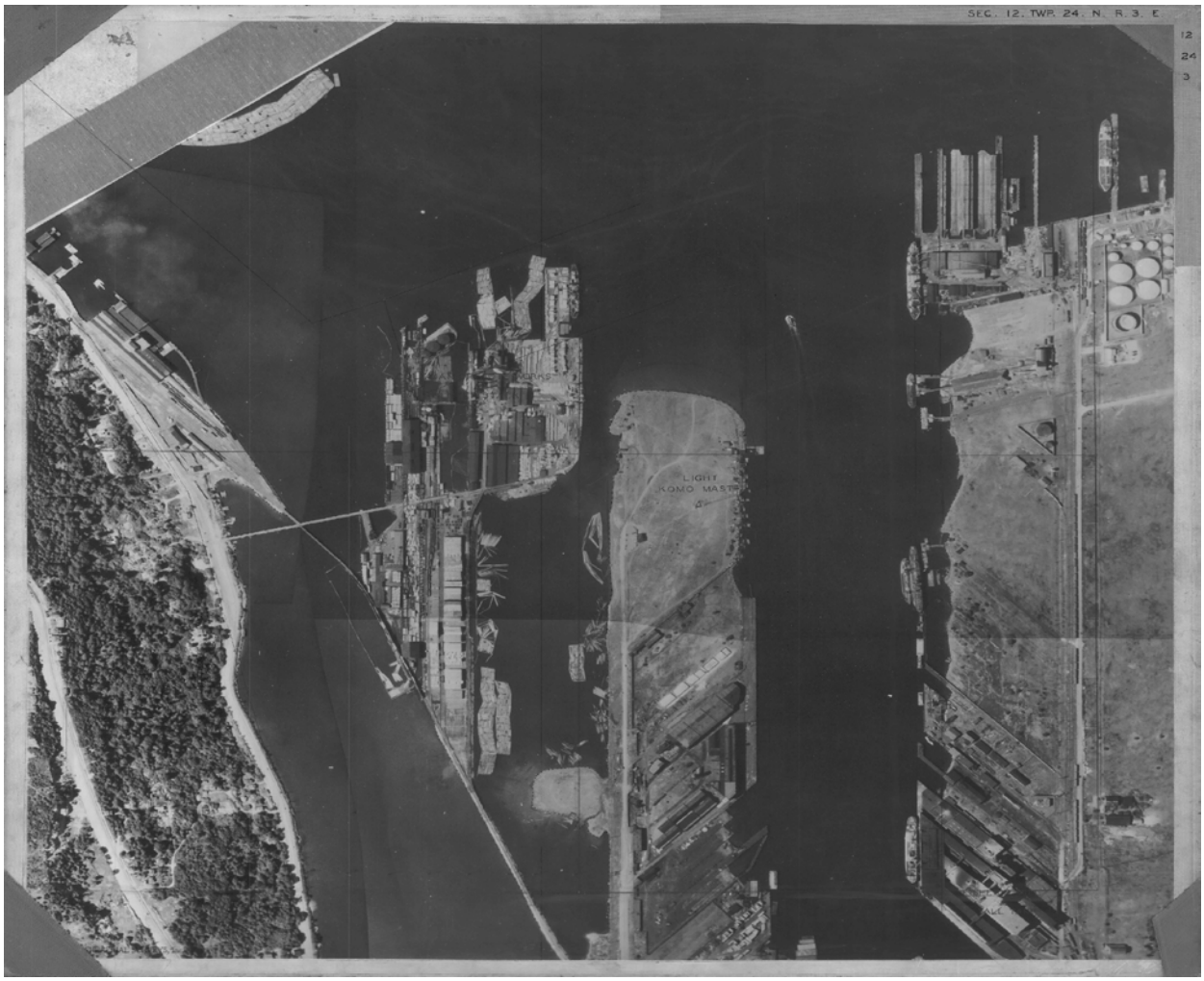

Photo 2. 1937 Aerial Photograph of West Waterway

Photo 3. 1969 Aerial Photograph of Elliot Bay, Harbor Island, and East and West Waterways

Photo 4. 1969 Aerial Photograph of East and West Waterways, and Lower Duwamish Waterway

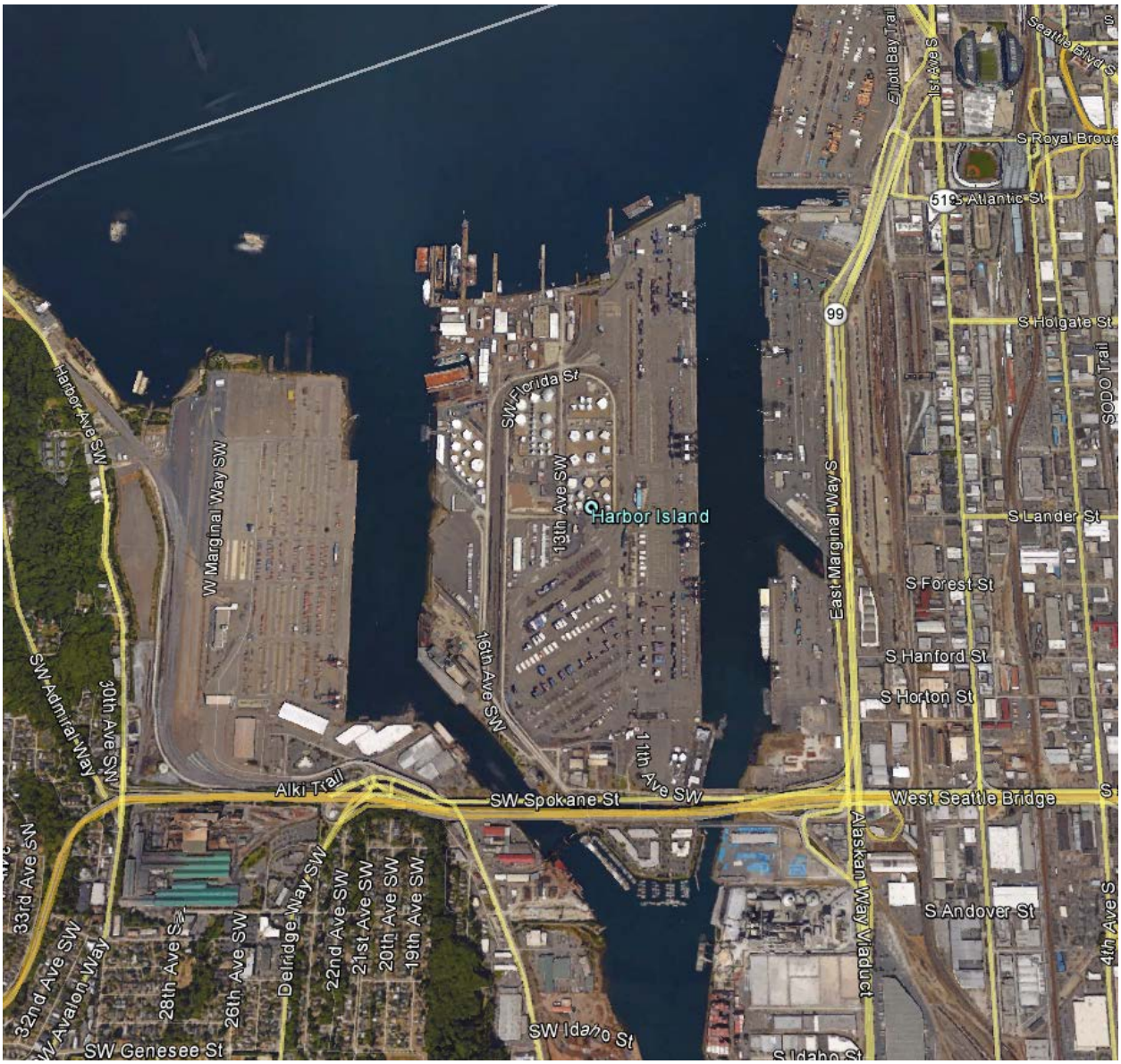

Photo 5. 2016 Aerial Photograph Seattle Harbor

4.3 Records Review

The East and West Waterways are located in a highly industrialized area that has served industrial and marine purposes since the early 20th century. Records pertaining to the East and West Waterway sites were reviewed in order to help determine current environmental conditions. All sites adjacent to the Waterways are also included in a heavily industrialized area. Records for all adjacent properties were not practical to review due to the number of adjacent properties. However, a document review was performed for the following CERCLA sites located at or adjacent to the Waterways: Harbor Island CERCLA Site, including the East and West Waterway Sediments OUs, Todd Shipyard Sediments OU, Lockheed Upland OU, and Lockheed Shipyard Sediments OU; and the Lockheed West Seattle CERCLA Site. Information pertaining to these sites has a direct impact on the sediment quality in the East and West Waterways. A list of all documents reviewed can be found in the reference section of this report. Information from these sources pertaining to this Phase 1 ESA was used in section 3.2 and 7.0 in order to better describe environmental conditions and conclusions made.

5.0 ADJOINING PROPERTY

Many of the adjoining properties to East and West Waterways are Port of Seattle terminal facilities (Figure 3). Harbor Island is positioned directly between the East and West Waterways, and contains Port of Seattle (POS) Terminal 18 and Terminal 10, as well as a number of industrial properties. To the North, the site is adjoined by Elliot Bay, which receives Duwamish River water flowing through the East and West Waterways. To the west of West Waterway is POS Terminal 5. To the east of East Waterway is POS Terminal 30 and Terminal 46.

On the northern side of the West Waterway are the Lockheed Shipyard Sediments Operable Unit and Todd Shipyard Sediments Operable Unit of the Harbor Island CERCLA Site (Figure 1). Lockheed West CERCLA Site is adjacent to the site towards the northwest. Lastly, to the south of both Waterways is the Lower Duwamish Waterway CERCLA site.

6.0 RESULTS OF VISUAL RECONNAISSANCE

A site visit was not conducted for this site. The East and West Waterway sediment that is contaminated is subtidal and not possible to observe from shore. Adjacent sites are already known to be very industrial and the significant amount of information about these sites is summarized in section 3.1 and 3.2. Due to the great volume of information already known about the characteristics of the East and West Waterways and the difficulty of directly observing the sediments of interest, visual reconnaissance would not add significant new information. Therefore, a site visit was determined to be not needed to complete this Phase 1 ESA.

Figure 3. Port of Seattle Terminal Locations

7.0 SUMMARY OF FINDINGS AND CONCLUSIONS

A Phase I ESA of the project area was performed in conformance with the scope and limitations of ASTM Standard E1527 - 13. Due to the significant amount of existing data about contamination in the East and West Waterways, additional sampling will not provide new information that affects the project. Because the environmental condition of the project area sediments are extensively documented in CERCLA and other documents, the Corps does not recommend that a Phase II Environmental Site Assessment be completed.

APPENDIX A

A summary of sites near East and West Waterways with a known or suspected release of contaminants to groundwater is provided in the table below.

Cleanup Site ID	Facility Site ID	Cleanup Site Name	Address	City	Site Status
11842	17823	Pacific Sheet Metal	115 S SPOKANE ST	SEATTLE	Awaiting Cleanup
1404	11415	Alaskan Copper Works	3600 E MARGINAL WAY S	SEATTLE	Awaiting Cleanup
1825	2313	Port of Seattle Terminal 106 NW	3629 DUWAMISH AVE S	SEATTLE	Awaiting Cleanup
18	2142	Ash Grove Cement West Inc	3801 E MARGINAL WAY S	SEATTLE	Awaiting Cleanup
11766	51375317	BNSF Seattle International Gateway Yard	44 S HANFORD ST	SEATTLE	Awaiting Cleanup
4141	8748379	SR 519 Street Improvement	ALASKAN WAY S	SEATTLE	Awaiting Cleanup
12027	20793	E Marginal Way S Bridge Rehabilitation	E Marginal Way S at S Horton St	SEATTLE	Awaiting Cleanup
8802	34525399	HARBOR MARINA CORPORATE CENTER	1001 1011 SW KLICKITAT AVE	SEATTLE	Cleanup Started
4465	2034	Asahipen America Inc	1128 SW SPOKANE ST	SEATTLE	Cleanup Started
10816	85392668	DONCO	1137 SW HANFORD ST	SEATTLE	Cleanup Started
4463	2025	SEATTLE PORT LECKENBY CO	11TH AVE SW TERMINAL 18D	SEATTLE	Cleanup Started
9056	41668943	PORT OF SEATTLE TERMINAL 37	1201 ALASKAN WAY S	SEATTLE	Cleanup Started
10181	68879649	US COAST GUARD PIER 35	1519 ALASKAN WAY S	SEATTLE	Cleanup Started
8173	17535113	COAST CRANE	1531 UTAH AVE S	SEATTLE	Cleanup Started
6842	91231465	Federal Warehouse	1555 ALASKAN WAY S	SEATTLE	Cleanup Started
4427	2031	TODD SHIPYARD	1801 16TH AVE SW	SEATTLE	Cleanup Started
10233	71252794	Port of Seattle Terminal 18	2400 11TH AVE SW SITE B	SEATTLE	Cleanup Started
5051	2030	Shell Oil Harbor Island Terminal	2555 13TH AVE SW	SEATTLE	Cleanup Started
3690	2384	SW Harbor Project BN Buckley Yard	26TH AVE SW & SW SPOKANE ST	SEATTLE	Cleanup Started
3271	2385	SW Harbor Project Salmon Bay	26TH SW & SW SPOKANE	SEATTLE	Cleanup Started
4071	2037	Seafab Metals Co	2700 16TH AVE SW	SEATTLE	Cleanup Started
4392	2038	SEAFAB METAL SURFACE IMPOUNDMENT	2700 16TH AVE SW	SEATTLE	Cleanup Started
4394	2055	Port of Seattle Terminal 30	2715 E MARGINAL WAY S	SEATTLE	Cleanup Started
6811	88394523	Kinder Morgan Liquids Terminals LLC	2720 13TH AVE SW	SEATTLE	Cleanup Started
4287	2026	NON FERROUS METALS	2905 13th Ave SW / 2906 16th Ave SW	SEATTLE	Cleanup Started
4391	2036	LOCKHEED SHIPBLDG CO YARD 1	2929 16TH AVE SW	SEATTLE	Cleanup Started
4070	2035	General Transport Co 13th Ave SW	2937 13TH AVE SW	SEATTLE	Cleanup Started
5050	2027	SEATTLE IRON & METALS MAIN YRD	2955 11TH AVE SW	SEATTLE	Cleanup Started
4462	2023	PACIFIC MOLASSES CO PM AG PRODUCTS SEA	3200 11TH AVE SW	SEATTLE	Cleanup Started
4464	2032	VALUE PLATING & METAL POL	3207 11TH AVE SW	SEATTLE	Cleanup Started
4727	2039	WEYERHAEUSER LAB	3233 11TH AVE SW	SEATTLE	Cleanup Started
7980	13266447	FISHER MILLS HARBOR ISLAND	3235 16TH AVE SW	SEATTLE	Cleanup Started
4288	2033	INDUSTRIAL OFFICE COMPLEX	3400 11TH AVE SW	SEATTLE	Cleanup Started
7817	2313	Port of Seattle Terminal 106NW	3629 DUWAMISH AVE S	SEATTLE	Cleanup Started
1685	97358381	MCE Technologies Inc	3670 E MARGINAL WAY S	SEATTLE	Cleanup Started
3221	8613035	Ponchos Legacy Property	3685 DUWAMISH AVE S	SEATTLE	Cleanup Started

Cleanup Site ID	Facility Site ID	Cleanup Site Name	Address	City	Site Status
7005	99728255	Seattle Port Terminal 46	401 ALASKAN WAY S TERMINAL 46	SEATTLE	Cleanup Started
10580	79931991	Griffin Envelope	4301 E MARGINAL WAY S	SEATTLE	Cleanup Started
7816	8781589	Port of Seattle Terminal 106 W	44 S NEVADA ST	SEATTLE	Cleanup Started
3274	2417	Irish Foundry	45 S SPOKANE ST	SEATTLE	Cleanup Started
6717	82766892	EMERALD CITY DISPOSAL MASSACHUSETTS	9 S MASSACHUSETTS	SEATTLE	Cleanup Started
7664	5735798	Riedel International	910 SPOKANE ST	SEATTLE	Cleanup Started
4105	8257245	E Marginal Way Grade Separation Proj ROW	DUWAMISH WAY S & S SPOKANE ST	SEATTLE	Cleanup Started
4390	2021	HARBOR ISLAND	HARBOR ISLAND	SEATTLE	Cleanup Started
3856	2028	SHELL OLD TERM 18 PORT OF SEATTLE	TERMINAL 18	SEATTLE	Cleanup Started
3158	2387	SW Harbor Project Wyckoff	W MARGINAL WAY SW & FLORIDA ST SW	SEATTLE	Cleanup Started
1372	989871	Harbor Island East Waterway		SEATTLE	Cleanup Started

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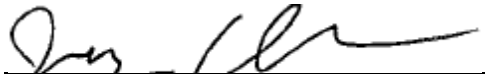
SIGNATURE & QUALIFICATION PAGE

I declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in 312.10 of 40 Code of Federal Register (CFR) 312 and the ASTM Standard.

I have the specific qualifications, based on education, training, and experience to assess a property of the nature, history, and setting of the Property. I have developed and performed the Phase I ESA in conformance with the ASTM and CERCLA standards and practices set forth in 40 CFR 312 and the ASTM standard.

PREPARED BY:



JAYSON OSBORNE
Remediation Biologist

KRISTEN KERNS
Environmental Scientist

ASSESSORS PROFESSIONAL EXPERIENCE

Jayson B. Osborne, Remediation Biologist

Education:

Washington State University, MS, Biology 2006
Brigham Young University, BS, Conservation Biology 2003

Brief Summary of Relevant Experience:

Mr. Osborne has worked as a Remediation Biologist for the Environmental Engineering and Technology section of the Seattle District, US Army Corps of Engineers since 2007. He is an AHERA Building Inspector and Project Designer, and has been registered as a tank Site Assessor in the state of Washington (2008-2014). His duties have included all phases of work in the ESA process including field work, interviews with knowledgeable parties, database searches, and document review. Mr. Osborne has been the primary or assistant author of numerous environmental documents such as Phase I Environmental Site Assessments, Environmental Baseline Surveys, AHERA Building Surveys, CERCLA 5-Year Reviews, and Environmental Condition of Property Reports.

Kristen Kerns, Environmental Scientist

Education:

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Brief Summary of Relevant Experience:

Ms. Kerns's career includes nine years working for the U.S. Army Corps of Engineers - Seattle District. As an Environmental Scientist for the Environmental Engineering and Technology branch, Ms. Kerns provides technical expertise in guidance, design, and execution of projects including: sediment remediation, soil remediation, risk assessment, and preliminary site assessments.

Ms. Kerns's specific areas of expertise include large scale sediment remediation and risk assessment. Ms. Kerns has overseen all aspects of sediment remediation from remedial investigation through to construction and monitoring. Ms. Kerns also focuses on human health and ecological risk assessment for contaminated sediment sites, with specific application of CERCLA and Washington SMS guidance.