WORK PLAN FOR
REMEDIAL INVESTIGATION

South Park Marina
Seattle, Washington

Prepared for:

City of Seattle, Seattle City Light
The Port of Seattle
South Park Marina Limited Partnership

Project No. 190293-001-1.1 • February 2, 2021 • Final

Aspect
CONSULTING

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For submittal to the Washington State Dept of Ecology

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Abbreviations

Aspect	Aspect Consulting, LLC
AST	aboveground storage tank
ASTM	ASTM International
BEHP	bis(2-ethylhexyl)phthalate
BETX	benzene, ethylbenzene, toluene, and xylenes
BMP	best management practice
COC	chemical of concern
COPC	chemical of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbons
CSM	Conceptual Site Model
CUL	Cleanup Level
CWD	Commercial Water District #1 of King County
DDE	dichlorodiphenyldichloroethylene (4,4-DDE)
DDT	dichlorodiphenyltrichloroethane (4,4-DDT)
DOC	dissolved organic carbon
DQO	Data Quality Objectives
EAA	Early Action Areas
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management
EPA	U.S. Environmental Protection Agency
GAC	granular activated carbon
HASP	Health and Safety Plan
HCID	hydrocarbon identification
HPAH	heavy molecular weight PAHs
LAET	lowest apparent effects thresholds
LDW	Lower Duwamish Waterway
LPAH	lower molecular weight PAHs

MHHW	mean higher-high water
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MTCA	Model Toxics Control Act
NFA	No Further Action
NPDES	National Pollutant Discharge Elimination System
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PCE	tetrachloroethylene
PCUL	preliminary cleanup level
PID	photoionization detector
PLP	Potentially Liable Party
PQL	practical quantitation limit
QAPP	Quality Assurance Project Plan
RAL	Remedial action level
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RvAL	respective removal action level
SAP	Sampling Analysis Plan
SPM	South Park Marina
SVE	soil vapor extraction
SVOC	semivolatile organic compounds
TBT	tributyltin
TCDD	total 2,3,7,8-tetrachlorodibenzodioxin
TCE	trichloroethylene
TDS	total dissolved solids
TEF	toxic equivalency factor
TEQ	total toxic equivalent concentration

TOC	total organic carbon
TPH	total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
TSS	total suspended solids
USACE	United States Army Corps of Engineers
UST	underground storage tank
VOC	volatile organic compound

1 Introduction

This document is a Work Plan to conduct a Remedial Investigation (RI) for the South Park Marina Site (Site) located at 8604 Dallas Avenue South in Seattle, Washington (Figure 1.1). The RI Work Plan has been prepared to meet the requirements of Agreed Order No. DE 16185 (the Agreed Order; AO) executed on April 3, 2019, between the Washington State Department of Ecology (Ecology) and the Potentially Liable Parties (PLP) Group, which consists of South Park Marina Limited Partnership (SPM), the Port of Seattle (Port), and the City of Seattle (City). The purpose of the RI is to collect additional data and determine the nature and extent of contamination in environmental media at the Site to enable selection of a cleanup alternative in a feasibility study (FS) for the Site.

The Site is located on the west side of the Lower Duwamish Waterway (LDW) from River Mile 3.3 to 3.5, to the south of the South Park Bridge, and east of Dallas Avenue South (Figure 1.1). The Site includes three King County parcels: Parcel No. 2185600070, Parcel No. 2185600025, and Parcel No. 0001600001. In this RI Work Plan, these addresses are collectively referred to as the SPM Property, totaling approximately 3.7 acres. The Ecology Facility ID is 44653368, and the Ecology Cleanup Site ID is 2858.

In accordance with the Agreed Order, the "Site" is defined as the extent of contamination caused by release of hazardous substances from historical operations located on the SPM Property and is not limited by property boundaries. The areal extent of the Site may overlap with adjoining properties. The upland portion of the SPM Property, and the subject of this RI Work Plan, is defined as the portion of SPM Property above the mean higher-high water (MHHW). Waterward of MHHW is the LDW Superfund Site. The Site may extend beyond the MHHW to sediments and overlap with the LDW Superfund Site.

1.1 Purpose and Objectives

The RI will be conducted in accordance with the Revised Code of Washington (RCW) 70A.305.050(1) and the Washington State Model Toxics Control Act (MTCA) Cleanup Regulation, Chapter 173-340 of the Washington Administrative Code (WAC). The RI is intended to collect, develop, and evaluate sufficient information regarding a site to select a cleanup action under WAC 173-340-360 through 173-340-390. Additionally, this RI is intended to support Ecology's Source Control Strategy for the LDW by addressing existing, ongoing sources of contaminants to the LDW so as to minimize the risk of recontaminating sediments above levels requiring active remediation (in the near term) and to minimize the risk of recontaminating sediments above the sediment cleanup standards established in the LDW Record of Decision (in the long term) (Ecology, 2016). To that end, specific objectives of the RI are to:

- Obtain data of sufficient quality and quantity to describe the physical setting and physical properties of Site soil, groundwater, stormwater, catch basin solids, and soil vapor.

- Determine the nature and extent of contamination in Site soil, groundwater, and indoor air.
- Evaluate potential pathways of hazardous substances from the Site to the LDW.
- Characterize the fate and transport of identified contaminants, including how contaminants migrate between media and possibly between properties.
- Use the information collected to assess the potential risk to human health and the environment through complete exposure pathways under the current and potential future land use(s).
- Determine Site chemicals of concern (COCs) and unacceptable risks that will be carried forward into a future FS.
- Report the methods and findings of the RI to Ecology and project stakeholders, including the local community.
- Determine appropriateness of an Interim Action.

To accomplish these objectives, a phased investigation approach will be implemented: Phase 1 will focus on identifying and characterizing sources and their pathways to the LDW; and Phase 2 will characterize the site and define the nature and extent of contamination.

1.2 Project Team and Responsibilities

The RI is being conducted by Aspect Consulting, LLC (Aspect) on behalf of the PLP Group, in accordance with WAC 173-340-350. Ecology is providing regulatory oversight of the RI activities in accordance with the Agreed Order.

In accordance with the Agreed Order, the designated project coordinators are listed below.

The project coordinator for Ecology is:

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The project coordinator for the PLP Group is:

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Each project coordinator is responsible for overseeing the implementation of the scope of work under the Agreed Order.

Representatives for the PLP Group include:

City of Seattle – Allison Crowley, PE

Port of Seattle – Roy Kuroiwa, PE

South Park Marina (SPM) – Betsy Wing, TIG Environmental – Environmental consultant for SPM

A chart showing the project team organization is presented as Figure 1.2.

1.3 Work Plan Organization

The remaining sections of this RI Work Plan are organized as follows:

- **Section 2 – Site Background** describes the property location and zoning, operational history, and current and future land use, as obtained from readily available existing information.
- **Section 3 – Environmental Setting** describes the topography, surface drainage, geology, hydrogeology, and climate of the Site.
- **Section 4 – RI Screening Levels** describes the derivation of numerical screening levels for soil, groundwater, stormwater, and catch basin solids that are proposed for evaluation of the environmental data collected during the RI.
- **Section 5 – Previous Remedial Actions** presents a summary of the environmental investigations and actions conducted at the Site.
- **Section 6 – Existing Data Evaluation** presents data collected at the Site to date.
- **Section 7 – Preliminary Conceptual Site Model** identifies the potential sources of contamination, the potential Site contaminants, the potential migration pathways, and the potential receptors and exposure pathways.
- **Section 8 – Data Gaps and Investigation Rationale** defines data quality objectives and describes the investigation approach to complete the RI.
- **Section 9 –Proposed Remedial Investigation Tasks** describes the field sampling implementation strategy, including phasing and prioritization of activities, and details regarding draft and final reports.
- **Section 10 – Schedule** provides a proposed schedule, including a timeline for completion of RI deliverables.
- **Section 11 – References** lists documents used or referenced in this RI Work Plan.
- **Section 12 – Report Limitations and Guidelines for Use** describes the limitations for use of this document.

Tables and figures are located at the end of the RI Work Plan text after Section 12 and before the Appendices. Appendices to the RI Work Plan support the analyses and discussions presented in the main body of the text and tables and include:

- **Appendix A – Historical Document Excerpts** includes pieces of historical documents referenced in this RI Work Plan to provide additional context to the work that will be performed.
- **Appendix B – Historical Boring Logs** available from previous subsurface investigations are presented in this appendix.
- **Appendix C – Screening Levels** includes a discussion of how RI screening levels were selected for preliminary screening of historical data and includes tables summarizing the pertinent screening criteria for each media.
- **Appendix D – Historical Analytical Results Summary and Data Evaluation** includes tables summarizing the historical analytical data utilized to derive the preliminary conceptual site model.
- **Appendix E – Sampling and Analysis Plan (SAP)** provides the details regarding sample collection and handling for soil, groundwater, and stormwater samples that will be collected during the proposed data collection. The SAP also includes the Quality Assurance Project Plan (QAPP) that provides analytical laboratory requirements for quality assurance/quality control (QA/QC) procedures related to execution of the proposed data collection and describes details on summing rules, reoccupation, and trumping of analytical data.
- **Appendix F – Site-Specific Health and Safety Plan (HASP)** prepared in accordance with WAC 173-340-810 to be used by Aspect employees during execution of the proposed RI field activities.
- **Appendix G – Archaeological Monitoring and Inadvertent Discovery Plan** provides guiding procedures for situations when cultural resources and human skeletal remains are discovered during subsurface investigations.
- **Appendix H – Report Limitations and Guidelines for Use** presents Aspect Consulting's standard limitations language governing the use of this report.

2 Site Background

This section presents an overview of the Site location, historical operations, utilities, and easements.

2.1 Site Location and Zoning

The Site is located in a mixed residential, commercial, and industrial neighborhood approximately 5.5 miles south-southeast of downtown Seattle. It borders the City of Seattle city limits and is part of unincorporated King County (Figure 1.1). The Site is located along the west side of the LDW between River Miles 3.3 and 3.5, south of the South Park Bridge, and east of Dallas Avenue South. The Site includes three current tax parcels from south to north: 8544, 8546, and 8604 Dallas Avenue South (Parcel No. 0001600001, a portion of which will be referred to as the South Parcel, and a portion of which will be referred to as the Historical A&B Barrel Parcel, as described below); 8510 and 8522 Dallas Avenue South (Parcel No. 2185600025; herein referred to as Central Parcel); and 8500 Dallas Avenue South (King County Parcel No. 2185600070; herein referred to as North Parcel). In this RI Work Plan, these three parcels are collectively referred to as the SPM Property. Table 2.1 presents a summary of the parcel names, parcel numbers, their physical address, and historical uses. Parcels are depicted on Figure 2.1. Parcel No. 0001600001 includes an area where the A&B Barrel Co. historically operated (herein referred to as the Historical A&B Barrel Parcel); the remainder of Parcel No. 0001600001 will be referred to as the South Parcel. The Ecology Facility ID is 44653368, and the Cleanup Site ID is 2858.

The SPM Property and the adjacent north and south properties are all zoned by King County as Industrial (I). Dallas Avenue South borders the SPM Property and east-adjacent properties to the south. The properties across Dallas Avenue South are within the limits of the City of Seattle and zoned as follows:

- Southwest: mixed-use residential and commercial – NCP-55(M)
- South: mixed-use residential and commercial – C1-55(M)
- Southeast: industrial – IG2 U/65

The SPM Property totals approximately 3.7 acres, and 71 percent of that area is impervious (roofs, asphalt, concrete, and brick). The remaining 29 percent of land area is pervious and generally covered with a combination of soil, grass, and/or gravel. A retaining wall made of ecology blocks runs north-south along the west bank of the LDW. At low tide, riprap and bank soils at the base of the ecology block wall are exposed. However, for the purposes of this RI Work Plan, the upland portion of the SPM Property is defined as the portion of SPM Property above the MHHW. Therefore, the riprap and bank soils on the waterward side of the ecology blocks are below MHHW and are considered part of the LDW Superfund Site. Depending on the results of the RI, the Site may overlap with the LDW Superfund Site in this area.

2.2 SPM Property History and Historical Land Use

This section provides a summary of the development and operational history of the SPM Property and adjacent properties, including a review of available historical records.

The development history of the Site and surrounding properties, including specific information regarding historical operations, facilities, and features, is described in detail in several previous environmental reports (Washington State Pollution Control Commission [WSPCC], 1955; Science Applications International Corporation [SAIC], 2004, 2007a, 2007b; Windward, 2010b). In addition to the previous environmental reports, a variety of historical information was reviewed during preparation of this RI Work Plan, including aerial photographs, facility diagrams, current and historical tax assessor records, deeds, and utility maps. Figure 2.1 depicts the locations of key historical features including former underground storage tanks (USTs), process areas, manufacturing areas, and shoreline configurations.

Shoreline modifications along the parcels comprising the SPM Property generally involved the dredging and removal of material from the bank (Figure 2.1). Based on aerial photographs, modifications appear to have been conducted around at least 1952, 1959, 1961, 1981, and 1992 (Appendix A). There were also modifications to the LDW channel in this area that predate the earliest available aerial photographs (1936, Appendix A). Available records suggest that the 1981 dredging event involved disposal of 26,742 cubic yards of material at a deep-water disposal site and that the 1992 dredging event involved disposal of 5,688 cubic yards of material at a deep-water disposal site. It is unknown if any material from shoreline modification/dredging events in 1952, 1959, or 1961 was placed on the upland SPM Property.

Historically, the SPM Property comprised approximately six individual tax parcels with a variety of operational uses. Several of these parcels, as indicated by the Sanborn and Kroll maps (Appendix A.2), were subdivided into smaller residential lots. By approximately 1981/1982, the parcels were consolidated to their current three parcels configuration. The following is a summary of the operational history on each of the parcels, with discussion of the southern-most current parcel separated into the South Parcel and Historical A&B Barrel Parcel. A series of historical aerial photos and other curated historical documents are available in Appendix A.

2.2.1 South Parcel

Based on the historical information reviewed, the South Parcel was historically used for residential, boat manufacturing, and marina purposes.

An aerial photograph from 1936 indicates limited land use on the South Parcel (Appendix A). The 1950/1951 Sanborn Map depicts houseboats off the shore of the South Parcel in the LDW, along with several dwellings, and a boat manufacturing building.

During shoreline reconfiguration in 1981, a UST from the Historical A&B Barrel Parcel was reportedly moved to a location on the South Parcel near the current dock. The UST was in operation in this area until 1991 (Figure 2.1). Further information about the UST is provided in Sections 2.2.2 and 5.2.2.

Marina activities began on the South Parcel in the 1940s and operated as South Park Boat Haven beginning in 1961. In 1970, Willard Crow acquired the business and changed the name of the marina from South Park Boat Haven to South Park Marina (SAIC, 2004). Since the 1960s, the South Parcel has been used continuously for marine activities as well as leases to other industries. Historical activities included boat washing, boat maintenance, and boat manufacturing (SAIC, 2004). Historical boat maintenance activities included limited outdoor sandblasting (reportedly 10 events; TIG Environmental, 2020). Vacuum sanders were implemented in approximately 2005.

2.2.2 Historical A&B Barrel Parcel

A Sanborn Map from 1950/1951 (Appendix A) and historical tax assessor records indicate that the southernmost parcel was not in its current configuration; the southern end of the South Parcel at that time was included as part of the parcel historically associated with the Duwamish Manufacturing Company (currently the Port's Terminal 117 [T-117 Upland Property] parcel; Section 2.4.2). By 1959, a parcel had been subdivided from the Duwamish Manufacturing Company parcel and identified as the "C.W.D. Lease" area, totaling 0.71 acres and included an easement for access to the South Park Boat Haven docks. This "C.W.D. Lease" area is referred to herein as the Historical A&B Barrel Parcel, as identified in the AO (Figure 2.1). The Historical A&B Barrel Parcel was subsequently combined with adjacent parcels to form the current southernmost tax parcel.

An aerial photograph from 1946 (Appendix A) depicts a small dock associated with LDW marina usage extending from the southeast corner of the Historical A&B Barrel Parcel. In 1946, the Historical A&B Barrel Parcel was purchased by John R. Angle and R.W. Butz (Ecology, 2019a). From 1946 to 1960, the A&B Barrel Co., a drum reconditioning facility, operated on the Historical A&B Barrel Parcel. Historical operations at the A&B Barrel Co. facility included a waste disposal pond (herein referred to as the Pond area), which is first identifiable in an aerial photograph from 1956 but was present prior to 1955 (WSPCC, 1955). Figure 2.1 depicts the former location of the A&B Barrel Co. building and an approximated location of the Pond area. According to the WSPCC report (1955), A&B Barrel Co. used approximately 1 ton per month of sodium hydroxide as a cleaning agent. Liquid waste, including oils, grease, and sodium hydroxide, was discharged to the waste disposal pond on the property and subsequently into the LDW.

In 1959, the Historical A&B Barrel Parcel was purchased in fee simple by the Commercial Waterway District #1 of King County (CWD) and leased back to A&B Barrel Co. In September 1960, a large fire destroyed the A&B Barrel Co. building, barrels, and nearby utility poles. In 1961, the Pond area was reportedly filled and regraded using a combination of anthropogenic debris and soil fill from an unknown source (SAIC, 2008a; Ecology, 2019a). In the 1961 aerial photograph, a few small structures are present adjacent to the dock ramp at the northeast corner of the Historical A&B Barrel Parcel, while the remainder of the parcel appears to have recently been graded. In 1963, the Port passed a resolution accepting the CWD's assets, liabilities, and functions, including the 0.7-acre Historical A&B Barrel Parcel.

In 1978, the Port sold the Historical A&B Barrel Parcel to the Gary Merlino Construction Company, who subsequently sold the parcel to Willard and Rose Marie Crow in 1980. In 1993, the Historical A&B Barrel Parcel was quitclaimed to SPM and merged with adjacent parcels to form the current southernmost parcel of the SPM Property, which is currently owned by SPM (Ecology, 2019a).

Since the 1960s, the Historical A&B Barrel Parcel has been used continuously for marine activities as well as leases to other industries. Historical activities included boat washing, boat maintenance, and boat manufacturing (SAIC, 2004). Until 1993, vessel pressure washing was conducted in the outdoor area southeast of the historical boat manufacturing building (Figure 2.1), and washwater was discharged (untreated) to the LDW. Vessel pressure washing continued after 1993 but used a washwater recycling system, which by 2016 was a fully closed-loop system (discussed further in Section 5.3.1). Historical boat maintenance activities included limited outdoor sandblasting (reportedly 10 events; TIG Environmental, 2020). Vacuum sanders were implemented in approximately 2005.

Ecology's UST database indicates that a leaded gasoline UST was installed along the shoreline in the Historical A&B Barrel Parcel and subsequently removed. Based on anecdotal evidence, the UST was installed around 1970 and was presumed to support the marina activities (TIG Environmental, 2020). During shoreline reconfiguration in 1981, the UST from the Historical A&B Barrel Parcel was reportedly moved to a location on the South Parcel near the current dock (Figure 2.1).

2.2.3 Central Parcel

The earliest available records for the Central Parcel include an aerial photo from 1936 and historical tax assessment records dated as early as 1937, which show the Central Parcel developed with a service station, a café, and residential buildings (see Appendix A.10). Additionally, a restaurant and a radiator repair shop operated in the building to the south of the service station. The locations of historical operations are depicted on Figure 2.1.

2.2.3.1 Residential

A mobile home park (referred to as a trailer camp on the 1950/1951 Sanborn Map) occupied the majority of the Central Parcel from as early as 1946 (SAIC, 2007a; Port, 2003) until 2010 based on review of aerial photographs. Historical tax assessor records for the residential homes did not indicate the presence of heating oil tanks. The residential homes and trailers may or may not have had associated septic systems.

2.2.3.2 Service Station and Repair Shop

Historical tax assessment records indicate that the service station and repair shop were built in 1919 at the northwest corner of the parcel. The Polk City Directories list the gasoline service station as Luard A. Spurlock's gas station in 1942, Crow South Park Service in 1954, March's South Park Service from 1954 to 1956, and Pumphrey's Flying A Service from 1958 to 1962 (Environmental Coalition of South Seattle [ECOSS], 2016). According to tax assessor records, the gasoline station had two 550-gallon tanks and a hydraulic hoist. Beginning in 1966, the building began operating as the Big "O" Tire Store. By 1972, the building containing the radiator repair shop and gasoline service station buildings had been removed. The current building was constructed in 1974 and has operated as the Big "O" Tire Store and South Park Tire Factory (Tire Factory) to present (SAIC, 2007a).

Two USTs that may have been associated with the former gasoline service station were reportedly encountered and subsequently removed in 2014 during preparations to replace the South Park Bridge. Reports related to the removal action for the USTs have been requested from King County but not yet been provided for review at the time of this report. These USTs are discussed further in Section 5.2.2.

2.2.3.3 Boat Storage and Maintenance

A review of historical aerial photographs and knowledge of site operations indicate that some limited boat storage had begun on the Central Parcel as early as 1946 (SAIC, 2007a). The gradual transition of parcel use from primarily residential to recreational boat storage and maintenance began in 1980 and continued until 2010, when the remaining mobile homes were removed, and predominant parcel use became marina-related activities.

2.2.4 North Parcel

As evidenced by aerial photographs, Kroll Maps, and Sanborn Maps (Appendix A.2), the North Parcel was historically developed beginning in approximately 1913 with residential buildings and used as part of the mobile home park through approximately 1987 (SAIC, 2007a). According to King County tax assessor records, the current structure on the parcel was built in 1987. Rick's Master Marine, a boat and marine supply retailer and boat repair facility, leases this parcel and building from SPM and has operated continuously since building construction in 1987 (SAIC, 2004). Rick's Master Marine specializes in marine engine (both gasoline and diesel) installation, maintenance, and repair. These activities primarily occur inside the building. A significant portion of the North Parcel not occupied by the building is used for boat storage.

2.3 Current and Future Land Use of the SPM Property

Current SPM Property features are shown on Figure 2.2. SPM's marina facilities include secured docks, parking, dry boat storage, a boat ramp, restrooms and laundry facilities, and a boat wash area. The current uses of the SPM Property include boat storage, bottom cleaning of boats, and do-it-yourself boatyard maintenance activities. The boatyard is capable of storing between 80 and 100 boats (based on available aerial photography). In addition to the boatyard area, buildings at the south end of the Historical A&B Barrel Parcel are leased by various tenants and are used for woodworking, boat repairs, and lumber storage; a portion of the Central Parcel is leased by the Tire Factory; and the North Parcel is leased by Rick's Master Marine. Currently, no changes in future use or zoning are planned. Additional detail on the current use of each parcel is provided below.

2.3.1 Land Use

The following subsections describe the current land use of the SPM Property.

2.3.1.1 South Parcel

The primary use of the South Parcel is for boat storage and do-it-yourself maintenance activities. Additionally, this parcel includes the access to the SPM dock and parking; the east residential duplex (the main residence); the main SPM shop; the SPM office; and the restroom, shower, and laundry building that is used by tenants of SPM.

Do-it-yourself boatyard maintenance activities include bottom scraping and sanding; refinishing including the use of solvents, thinners, and acetone; and engine maintenance and repair (SAIC, 2004). SPM reports that maintenance activities are performed on top of plastic tarps and in temporary plastic tents to reduce fugitive dust and liquid emissions.

2.3.1.2 Historical A&B Barrel Parcel

The primary use of the Historical A&B Barrel Parcel is for boat haul-outs, bottom cleaning of boats, dry storage in a storage shed, a woodworking shop, and lumber storage building that are leased for do-it-yourself maintenance activities. This parcel is also the location of marina operations facilities such as the boat wash and the StormwateRx™ treatment system. The StormwateRx™ treatment system is discussed below in Sections 2.3.2.2.4 and 5.3.2 and a diagram of the treatment system is presented in Appendix A.3.

In the southeastern corner of the Historical A&B Barrel Parcel, a 35-ton crane is used for hoisting boats into the water or onto transportation trailers for either transport or dry storage in the boatyard. The marina's current policy, which has reportedly been in place since 1992 or 1993, requires that boats are pressure-washed by authorized marina personnel only in the dedicated boat wash area located east of the SPM shop using a high-pressure, closed-loop washwater system. Abrasives are not used. Two catch basins are located in the boat wash area: one serves as a vault for the boat washwater (that then discharges into a closed-loop system) and the other is a catch basin (CB-08), which is connected to the StormwateRx™ treatment system prior to discharge to the LDW. During boat wash activities, the catch basin is covered with a plywood cover intended to prevent boat washwater from entering the stormwater system. The boat washwater is pumped from the vault to a treatment system which removes suspended solids through a system of weirs prior to treating the water with a flocculent to help further bind solids and remove metals. Solids are collected, dried, and disposed as regulated waste; washwater is recycled into the system. A diagram of the treatment system is included in Appendix A.3. It is important to note that the washwater recycling system was not installed until 1993 (King County, 1993; SAIC, 2007a) and until 2016, it was not a closed-loop system, as a portion of the partially treated washwater discharged via a small drain line to an unnamed outfall to the LDW (TIG Environmental, 2019). This is discussed further in Section 5.3.1.

2.3.1.3 Central Parcel

The Central Parcel contains two residential structures and a shed used for storage by tenants but is primarily used for boat storage and boatyard maintenance activities as described above for the South Parcel. The northwest corner of the Central Parcel houses the Tire Factory, which operates as an auto repair service station. Activities associated with the Tire Factory include tire and wheel services, brake service, suspension repairs, transmission repairs, oil changes, and automobile electric repairs. The Tire Factory building houses a used oil aboveground storage tank (AST) in the northeast area of the building in addition to several in-ground hydraulic hoists.

2.3.1.4 North Parcel

The North Parcel has been occupied by Rick's Master Marine continuously since the construction of the building in 1987. Rick's Master Marine primarily operates as a marine motor maintenance, service, and repair shop, providing service of outboard, inboard, and sterndrive marine engines. Service is performed on both gasoline and diesel engines. The building and the fenced boat parking area occupy the majority of this parcel.

2.3.2 Existing Infrastructure

2.3.2.1 Structures

Structures on the SPM Property are shown on Figure 2.2. Ten structures are currently present on the South Parcel and the Historical A&B Barrel Parcel: a storage shed, a woodworking shop, a lumber storage building, the harbormaster shop, a storage container, the main SPM shop, the SPM office, a residential structure, a small shed, and the restrooms/laundry building. The Central Parcel contains the two additional residential structures as well as the building occupied by the Tire Factory. The North Parcel is developed with the building associated with Rick's Master Marine.

2.3.2.2 Utilities

The following section describes utilities observed by Aspect during a site walk on November 21, 2019, as well as utilities identified in previous reports. Figure 2.3 depicts utility information gathered from the City of Seattle (City Development Service Office's [DSO], 2020) and as modified by TIG Environmental through camera and topographic surveys and a dye tracer investigation (2019).

2.3.2.2.1 Power

Electricity to the SPM Property is provided via overhead power lines with pole-mounted transformers. The pole-mounted transformers contain less than 1 part per million (ppm) total polychlorinated biphenyls (PCBs) according to their labels (The Intelligence Group [TIG], 2016). Generally, the buildings on the South, Historical A&B Barrel, and Central Parcels (with the exception of the Tire Factory) are serviced by overhead lines from Dallas Avenue South. The Tire Factory and Rick's Master Marine (on the North Parcel) are serviced through overhead power lines from South Thistle Street.

2.3.2.2.2 Water Supply

Water service to the SPM Property is provided through Seattle Public Utilities. According to the City's DSO web viewer, the water main for the SPM Property enters from Dallas Avenue South near the middle driveway before splitting into service lines which run to the west toward the Tire Factory and Rick's Master Marine (City DSO, 2020). The water service lines for all of the residences, the restroom/laundry building, the SPM office, and the individual service lines throughout the boatyard have not been mapped.

2.3.2.2.3 Sanitary Sewer & Former Septic

Subsurface features of the former septic systems and sanitary sewers associated with the historical mobile home park, historical residences, current residences, and current restroom, laundry, and shower building have not been completely mapped (TIG Environmental, 2019). However, readily apparent surface features, such as some historical sanitary sewer hook ups, are mapped throughout the Central and South Parcels (Figure 2.3). During the PLP site walk on November 21, 2019, Aspect noted several additional unmarked sewer/septic features, which will require further mapping during the RI. A septic tank may have been historically present near the center shoreline of the Central Parcel, as depicted on Figure 2.3. The location of this potential septic tank was noted from a 1968 King County permit, but the tank could not be located using ground-penetrating radar (TIG Environmental, 2017).

Two floor drains, which contain surface packers, are present in Rick's Master Marine shop. It is presumed that these floor drains are connected to the sanitary sewer system, but this has not been confirmed through dye testing (TIG Environmental, 2020). Further investigation to verify this assumption will be conducted during the RI. During the November 21, 2019, PLP site walk, it was noted that the floor drains were covered with hydrophobic adsorbent pads to capture minor spills of fuel and oil.

2.3.2.2.4 Stormwater

The age of the stormwater catch basin system is unknown. The original National Pollution Discharge Elimination System (NPDES) permit for SPM was issued in February 1993. Based on a review of available information, the stormwater system has existed in its current configuration since at least 2007 (SAIC, 2007a; Leidos, 2015). Upgrades and modifications to the stormwater system included installation of the StormwateRx™ treatment system in 2009 (Section 5.3.2; Appendix A.3), installation of catch basin CB-10 in 2014 to 2015, decommissioning of Unnamed Outfall No. 2 in 2016, and decommissioning of catch basin CB-01 in 2019 (TIG Environmental, 2018a and 2019).

As shown on Figure 2.4, the stormwater system at the SPM Property is generally divided into four main catchment areas and three smaller areas, which are based on the topographic survey performed by Axis Survey and Mapping in 2017 and dye tracer testing performed by TIG Environmental (2019). TIG Environmental also performed video camera surveys of the catch basins and stormwater lines to aid in identifying the drainage pathways; however, some blockages and broken pipes prevented identifying all connections (TIG, 2019). The drainage connections that remain unknown are depicted in dashed lines on Figure 2.4. The TIG Environmental report detailing the mapping of the stormwater system is included in Appendix A.

Stormwater drainage on the property and on adjacent streets will be confirmed through observation during the RI during a wet-weather site walk. The following is a general discussion of the stormwater drainage at the SPM Property based on information provided by TIG Environmental and observations Aspect made during the PLP site walk conducted on November 21, 2019[1].

- The majority of the central portion of the entire SPM Property drains to the SPM Outfall. Stormwater on this portion of the SPM Property flows overland to a series of catch basins (CB-04, CB-03, CB-02, CB-05, and CB-06) that then discharge to the SPM Outfall. The SPM Outfall is inaccessible, and its general discharge location has only been determined by dye testing. The end of the outfall pipe is buried under the shoreline riprap, which is submerged during high tide.

  CB-01, also located within this portion of the SPM Property, was formerly connected to a sanitary sewer vault that drained to the municipal sewer system near the restroom facility but has since been decommissioned; based on the topography, stormwater from CB-01 now flows overland to CB-05. A topographic survey is provided in Appendix A.9. The roof drain in the southeast corner of Rick's Master Marine discharge to the ground surface, where it infiltrates; during high intensity rain events, some of this discharge may flow overland to CB-03 and subsequently

[1] No precipitation was observed during the November 21, 2019, site walk, so observations were limited to physical features and not flow patterns.

to the SPM Outfall (TIG Environmental, 2019). Approximately 61 percent of the total SPM Property is serviced by the SPM Outfall (Figure 2.4).

- The majority of the South Parcel and Historical A&B Barrel Parcel drains to a series of catch basins near the boat wash area (CB-07 through CB-09) and into a stormwater vault before being pumped into the StormwateRx™ system for treatment. CB-07 is located upgradient of the boat wash pad, CB-08 is located in the boat wash pad, and CB-09 is located near the StormwateRx™ system (Figure 2.4). The StormwateRx™ system was installed in 2009 (Appendix A.3). After treatment, the stormwater in this area discharges through Unnamed Outfall No. 1 (UOF-1) to the LDW. During large storm events, stormwater bypasses the treatment system via an overflow pipe and discharges to a separate outfall (OF-2214) adjacent to UOF-1 as untreated stormwater. Additionally, stormwater from the main SPM office building roof discharges to the ground surface and enters CB-08 as sheet flow, before being treated by the StormwateRx™ system and discharged to Outfalls UOF-1 and/or OF-2214 (TIG Environmental, 2019). Approximately 21 percent of the total SPM Property is serviced by Outfalls UOF-1 and OF-2214 (Figure 2.4).

- The northern side of the Central Parcel drains to CB-10, which is connected to a stormwater system operated by King County that flows north down South Thistle Street before discharging through Outfall OF-2215. Similarly, roof drains from the Tire Factory discharge to CB-10 and subsequently Outfall OF-2215 (TIG Environmental, 2019). Approximately 9 percent of the total SPM Property is serviced by Outfall OF-2215 (Figure 2.4).

- The shoreline portion of the SPM Property immediately bordering the LDW is generally unpaved gravel, and stormwater is assumed to infiltrate through this pervious surface. The roof drains in the northeast corner of Rick’s Master Marine discharge to the subsurface, where water is allowed to infiltrate; during high intensity rain events, some of this discharge may daylight at the ground surface before flowing overland and reinfiltrating at the gravel shoreline area (TIG Environmental, 2019). Approximately 8 percent of the total SPM Property infiltrates through this pervious surface (Figure 2.4).

- Stormwater in the southwest corner of the Central Parcel along Dallas Avenue South and South Thistle Street flows into an unnamed catch basin on the SPM Property line, which is connected to the private sanitary sewer and discharges to the City’s combined sewer system in Dallas Avenue South (City DSO, 2020). Approximately 0.5 percent of the total SPM Property drains to the City’s combined sewer (Figure 2.4).

- TIG Environmental reported that a sliver of land in the southwest corner of the SPM Property along Dallas Avenue South drains off the property and into the stormwater project associated with T-117 EAA (2019). Based on available data, it appears the land surface elevation in this corner of the SPM Property may be higher than and slopes to the Dallas Avenue South roadway. If this is the case, overland flow would be captured by the green stormwater infrastructure (bioretention/infiltration) installed in Dallas Avenue South, with overflow discharging to LDW through the newly installed 17th Avenue South Storm Drain Outfall located on the T-117 Upland Property. This drainage pathway is based on available topographic information but has not been confirmed via observation. This sliver of land represents approximately 0.3 percent of the total SPM Property (Figure 2.4).

- The boat ramp in the northeast corner of the North Parcel drains directly to the LDW and represents approximately 0.1 percent of the total SPM Property (Figure 2.4).

The SPM facility discharges stormwater under a Boatyard General Permit (Permit No. WAG030045), which is both a NPDES Permit and State Waste Discharge General Permit. The Boatyard General Permit sets forth the requirements for stormwater runoff monitoring, boat washwater monitoring, discharge limits, reporting, and best management practices (BMPs). The current version of Boatyard General Permit was issued on July 6, 2016; it became effective August 8, 2016 and expires on July 31, 2021.

2.3.3 Easements and Property Access

Presently, the South Parcel, the Historical A&B Barrel Parcel, and the majority of the Central Parcel can be accessed through three driveways connected to Dallas Avenue South or through a driveway that traverses the east side of the North Parcel from South Thistle Street. These portions of the SPM Property are not secured. Parking and roll-up doors for garage bays for the Tire Factory are accessible from both Dallas Avenue South and South Thistle Street. Additionally, a small, chain-link fenced area is present on the south side of the Tire Factory building, which can be accessed through a gate from Dallas Avenue South.

A driveway off South Thistle Street on the north side of the North Parcel provides access to the front door and parking area associated with Rick’s Master Marine. The remainder of the North Parcel is enclosed with a locking chain-link fence, which can be accessed through a gate from the driveway present in the east portion of this parcel.

The boat ramp is accessible from South Thistle Street at the north corner of the North Parcel. The docks associated with the SPM are accessible through a locked gate from the South Parcel.

Easements are filed in the legal property descriptions for the Central and North Parcels. On the North Parcel, an easement for King County roads (South Thistle Street) is provided. The Central Parcel contains a similar easement for South Thistle Street, as well as an easement provided to CWD for an unspecified use (King County, 2020).

The Port and SPM entered into an agreement in 2015 regarding care and maintenance of the granular activated carbon geocomposite mat, the sheet pile wall, riprap slope and fencing at the southeast corner of the SPM Property. The agreement states that the following activities at the Property corner shall be prohibited:

- Construction of new structures or uses causing surface surcharge loads exceeding 220 pounds per square feet (psf) applied to the area on, around, and upland of the embankment, especially on the portion of the sheet pile wall exposed above ground surface

- Construction of permanent or occupied structures without additional seismic assessment
- Vertical loads on protruding portions of the sheet pile wall exceeding 500 pounds
- Soil stockpiling

2.4 Adjacent Sites

Based on review of historical environmental data and records for nearby properties, four adjacent sites were identified as having potential relevance to the Site. These sites are shown on Figure 2.5 and discussed below.

2.4.1 Lower Duwamish Waterway

The LDW Superfund Site borders the SPM Property to the east. The LDW is the receiving body for groundwater, stormwater, and soil discharging or migrating from the Site. Evaluating the Site as a potential source of contamination to the LDW is a primary objective of this investigation, as defined in Ecology's Source Control Strategy for the LDW (Ecology, 2016). The LDW has been the subject of numerous environmental investigations and characterization efforts. A detailed analysis of the contamination associated with the LDW can be found in the Windward Environmental, LLC's (Windward) "Lower Duwamish Waterway Remedial Investigation" (Windward, 2010b).

The information contained in this subsection is a summary of the work prepared by the LDW Group (LDWG) as part of the "Lower Duwamish Waterway Remedial Investigation" (Windward, 2010b). Before the 1850s, the LDW was historically occupied by Native American tribes who used the LDW for fishing, hunting, gathering, and some limited farming. As nonnative settlers moved to the area in the 1850s, the LDW shorelines were cleared and wetlands drained for agricultural and industrial purposes.

A cultural resource assessment for the south-adjacent T-117 Upland Property was performed by Cultural Resource Consultants, Inc. [CRC] in 2011. This area of the LDW was traditional territory for the Duwamish Tribe of Southern Lushootseed speakers. Archaeological artifacts in this area may include basketry; wood; foodstuffs; fish weirs and other permanent constructions; hunting, fishing, and food processing tools; bone and shell implements; and midden deposits (CRC, 2011). There is a record of a Lushootseed place name in the wide flat of the abandoned river channel between Dallas Ave South and the LDW shoreline, which is named *hwa'pitc1d*, translated as "where one throws something" (CRC, 2011). The nearest recorded Duwamish Tribe village is ^{Tu}*qwe'Ltid* (translated as "large open space" or "place of the fish spear"), which consisted of two longhouses located approximately 1 mile north of the SPM Property.

Dredging of the LDW to facilitate navigation began in the early 1900s, including the dredging of the historical tide flats where the mouth of the Duwamish meets Puget Sound. Dredged material from the tide flats and LDW was used to create Harbor Island and as part of channelization efforts along the waterway. The first stage of dredging, which included deepening the channel to 50 feet from the mouth of the LDW to River Mile 4.5, was completed by 1920. The upland areas along the LDW underwent heavy industrialization during the Industrial Revolution in the late 1800s to early 1900s as railroad and shipping improvements were made to service surrounding areas. During this time, many of the historical LDW mudflats were filled with soil from hills throughout Seattle. By the mid-1900s, heavy industry became the dominant land use in the vicinity of the LDW. In the vicinity of the SPM Property, the LDW had been channelized by the time of the 1936 aerial photograph, and the bank on the west side of the LDW appears to be unreinforced (Appendix A.1).

The LDW was formally added to the Superfund National Priorities List by the United States Environmental Protection Agency (EPA) in September 2001. Ecology subsequently listed the LDW under the authority of MTCA in February 2002 (LDWG, 2010). The Phase 1 RI for the LDW consisted of synthesizing existing environmental data and identifying candidate early action areas (EAAs) for targeted cleanup. The sediment area adjacent to the Port’s T-117 Upland Property, the T-117 uplands, and an area of streets and yards adjacent to T-117 were identified as the “T-117 EAA” and subsequently remediated via a Comprehensive Environmental Response, Compensation, and Liability Act non-time-critical removal action (NTCRA) (Section 2.4.2).

2.4.2 T-117 Early Action Area

The T-117 EAA borders the SPM Property to the south. The Duwamish Manufacturing Company and Malarkey Asphalt businesses operated on what is today the Port’s T-117 Upland Property from 1937 to 1978 and 1978 to 2000 (respectively), and manufactured asphalt roof materials and tar from around 1937 through 1993. The Port acquired the property in 2000 and designated it “T-117” (see Figure 2.5 and label denoting the location of the “Port T-117 Upland Property”). During Duwamish Manufacturing’s operation of the asphalt manufacturing facility from the late 1960s through the mid-1970s, used oils, some of which contained PCBs, were used as fuel for the asphalt manufacturing process. Some used oils came from Seattle City Light. During the use of T-117 Upland Property as an unpaved industrial site by Malarkey Asphalt, trucks exiting the property tracked PCB-contaminated dust and dirt onto Dallas Avenue South, as well as adjacent rights of way, roadways (some unpaved), and residential properties (Windward, 2010a). Characterization and remedial activities at the T-117 EAA were conducted from 1997 through 2017.

T-117 EAA (the Port’s property in combination with the adjacent streets and yards) was one of the sites identified as an EAA for cleanup within the LDW Superfund Site in 2003 to address PCB-contaminated LDW sediments and upland PCB sources impacting those sediments. The T-117 EAA NTCRA was performed as a joint response by the Port and the City in accordance with an Administrative Settlement Agreement and Order of Consent and under oversight by EPA with assistance from the United States Army Corps of Engineers (USACE). The NTCRA was completed in two coordinated phases, Phase 1 and Phase 2, as briefly described below, and focused on actions adjacent to the Site.

2.4.2.1 Phase 1 Sediment and Upland Area Removal Action

The Port’s Phase 1 removal action, completed between March 2013 and January 2015, encompassed a 2.1-acre in-water Sediment Area and a 3.3-acre Upland Area. The in-water sediment area was subdivided into three dredge units (DUs): DU1, DU2, and DU3 from south to north. The bank area was subdivided into three sub-areas: South Bank, Mid Bank, and North Bank from south to north. The North Bank borders the southern boundary of the SPM Property.

The Phase 1 Removal Action included the removal and offsite disposal of approximately 76,000 tons of upland soil and debris and 22,000 tons of in-water sediment and debris. Performance standards included bathymetric and topographic surveying, sediment confirmation sampling, soil confirmation sampling, and groundwater monitoring. Following excavation of soils and sediments (including localized overexcavation and resampling), concentrations of COCs detected in soil and sediment confirmation samples complied with respective removal action levels (RvALs). In addition, based on statistical evaluation of groundwater quality data collected from the T-117 EAA upland area between 2008 and 2012 and from monitoring wells located upgradient of it, groundwater concentrations at T-117 EAA were determined to meet groundwater RvALs (Integral Consulting, Inc. [Integral], 2018). Section 5.2.3 describes installation of a sheet pile wall, and sampling and analysis conducted, along the southeast corner of the SPM Property during the Phase 1 removal action.

2.4.2.2 Phase 2 Residential Yards and Adjacent Streets Removal Action

The City completed the T-117 EAA Phase 2 removal action with an objective to reduce soil PCB concentrations in upland soils to ensure protection of LDW sediment. The Phase 2 cleanup was accomplished in two parts: the Residential Yards cleanup completed in 2013, and the Adjacent Streets and Stormwater cleanup completed in 2016. For both projects, the lateral and vertical extents of soil excavation for the Phase 2 removal action were determined and approved by EPA based on an extensive pre-design sampling program conducted to support the removal action design, which is summarized in the “Removal Action Construction and Completion Report for Phase 2 Streets and Stormwater Cleanup” (Integral, 2017). Soil excavation occurred where total PCB concentrations exceeded a 1 milligram per kilogram (mg/kg) RvAL. For removal area decision units that had been characterized using multi-incremental sampling, a remediation level of 0.5 mg/kg total PCBs was used to define soils to be removed. The pre-defined lateral and vertical extents of excavation units were confirmed by survey with acceptance by USACE or EPA on-site representative. Post-excavation confirmation sampling was not conducted within the excavations. The completed excavations were backfilled with imported granular backfill to restore grades; import material analytical test results were approved by EPA prior to use (Integral, 2013 and 2017). Post-excavation site restoration was specific to residential yards and streets. Additional information specific to each the T-117 EAA Phase 2 projects is provided below.

2.4.2.2.1 Residential Yards Cleanup

The Residential Yards removal action included removal of PCB-contaminated soils from eight residential properties, from the planting strips along South Cloverdale Street, and from the alleyway between South Cloverdale Street and South Donovan Street located west and south of the SPM Property (Figure 2.5). The primary construction elements of the removal action included stripping and removal of residential sod, vegetation, and structures within the removal area footprint, excavation and off-site disposal of residential yard and alleyway soil and debris, placement of clean backfill and topsoil materials, and restoration and landscaping of all disturbed areas. The removal action achieved the removal goals within the boundaries and depths of all the designated yards, planting strips, and the southern alleyway. In total, approximately 2,187 tons of PCB-contaminated soil were removed and disposed of during this removal action.

Restoration of the properties included placement of sod in lawn areas, planting of trees, shrubs and other plants in designated locations, and the construction of fences, sidewalks, and other hardscape features in accordance with the contract documents (Integral, 2013).

2.4.2.2.2 Adjacent Streets and Stormwater Cleanup

The Adjacent Streets cleanup removed PCB-contaminated soil from portions of the City rights-of-way (ROWs) of 16th Avenue South, 17th Avenue South, Dallas Avenue South, and South Donovan Street. In total, the Adjacent Streets cleanup permanently removed approximately 28,000 tons of non-Toxic Substances Control Act (TSCA)-regulated soil (total PCB concentrations less than 50 mg/kg) and approximately 240 tons of TSCA-regulated soil and debris (greater than 50 mg/kg total PCBs).

This project also included construction of new stormwater infrastructure for the Adjacent Streets area of the EAA. The new stormwater management system comprises structures such as catch basins and maintenance holes, storm drainpipe, an outfall to the LDW on T-117 Upland Property just south of the SPM Property (17th Avenue South Storm Drain Outfall; Figure 2.3), bioretention cells, Filterra® tree box units, and a vegetated bioretention cell. The City is monitoring and maintaining the new stormwater system in accordance with an EPA-approved Long-Term Monitoring and Maintenance Plan (Integral and AECOM, 2016).

At the conclusion of the removal action, restoration of the streets included installation of curbs and gutters, asphalt pavement, sidewalks, plantings, and other features in accordance with the construction documents (Integral, 2017).

2.4.3 Dry Cleaners

A dry cleaner historically operated west of the SPM Property (across Dallas Avenue South) at the address listed as 8500 14th Avenue South. Property records indicate the building was constructed in 1940 (King County, 2020). A historical photograph from 1941 shows the building branded as Night Cap Tavern (ECOSS, 2016). The address is listed as Kleen Rite Cleaners from 1951 to 1955 and vacant in 1956 in the Polk Directories. The space is listed as a Payday Loan office in the 1958 Polk Directory. Information between 1958 and 2006 was not available for review. From 2006 through 2014, the building was operated as a Regency II Cleaners (ECOSS, 2016). In late 2014, the building was operated by Washington Medical, a marijuana grow facility (Seattle Times, 2014). The space was rented to SST Enterprises, a home security company, in 2015 (ECOSS, 2016). The building is currently vacant, and the owner is listed as Spectrum Family Irrevocable Trust (King County, 2020).

2.4.4 South Park Bridge

The new South Park Bridge north of the Site was constructed between August 2011 and June 2014, which involved substantial earthwork and regrading along 16th Avenue South between Dallas Avenue South and the LDW. Environmental sampling of soil and groundwater was conducted to support bridge construction activities, and two USTs were encountered and removed in the vicinity of the SPM Property (see Section 2.2.4). The project also included installation of a large-scale rain garden and other new stormwater infrastructure along the 16th Avenue South corridor, providing stormwater infiltration north of the SPM Property.

Other nearby properties not listed in this report were deemed unlikely sources to the upland Site.

2.5 Regulatory Site History

Ecology's LDW Source Control Strategy (updated in 2016) involves "removing or reducing contaminants from identifiable sources within a defined area that end in surface water and sediments of the LDW" (Ecology, 2016). The near-term goal for source control is to address existing, ongoing sources of contaminants to the LDW sufficiently to allow active in-waterway remediation to start, minimizing the likelihood that sediments will be recontaminated at levels that trigger additional active in-waterway remediation (i.e., concentrations above LDW Record of Decision [ROD] remedial action levels RALs). The long-term goal is to control sources sufficiently to minimize the risk of recontaminating sediments above the sediment cleanup standards established in the LDW ROD (EPA, 2014). Source control "sufficiency" determinations, to be completed before active in-water remediation begins, require only meeting the near-term goal RALs for the LDW. In 2004, the SPM Property was identified for further investigation because of concern that it could potentially recontaminate sediments in the LDW (SAIC, 2004).

Windward performed the first environmental investigations of the SPM Property in 2002, beginning with the collection of limited surface soil samples in the area of the former A&B Barrel operation (Windward, 2006). On behalf of Ecology, SAIC performed subsequent environmental investigations of the SPM Property in 2007 and 2008, specifically for the former A&B Barrel operation as a Recontamination Assessment Area (SAIC, 2008a). Those investigations documented contamination of soil and groundwater on that portion of the SPM Property exceeding the applicable MTCA cleanup levels. The Site Discovery/Release Report was submitted to Ecology in 2007. Due to the documented soil and groundwater contamination on the SPM Property, Ecology performed a site hazard assessment in 2015 and assigned the Site an overall hazard ranking of 2, where 1 represents the highest relative risk and 5 the lowest.

In 2016, Ecology issued three determinations establishing the PLPs for the Site (Ecology, 2019a):

- SPM was determined to be a PLP based on being the owner and operator of the existing facility where a release has occurred.
- The Port was determined to be a PLP based on the CWD being an owner of a facility (i.e., the Historical A&B Barrel Parcel) at the time of a release associated with A&B Barrel Co. operations.
- The City was determined to be a PLP based on being the current owner and operator of the ROW (a MTCA "facility") adjacent to SPM where hazardous substances were released. The City was also an arranger who owned or possessed hazardous substances and who, by contract, agreement, or otherwise, arranged for disposal or treatment of hazardous substances.

On April 3, 2019, the three PLPs entered into Agreed Order DE 16185 with Ecology to complete an RI for the Site.

3 Environmental Setting

This section provides a summary of the SPM Property's physical characteristics, including topography, adjacent surface water features, geology, and hydrogeology.

3.1 Upland Topography, Surface Drainage, and Shoreline Modifications

The upland portion of the SPM Property is relatively flat and varies in elevation between 14 and 20 feet (NAVD88)[2]. Generally, the SPM Property grades gently from Dallas Avenue South towards the LDW. South Thistle Street, on the western edge of the SPM Property, grades downward from an approximate elevation of 20 feet at the southwest corner of the SPM Property to an elevation of 14 feet at the northwest corner. The South Thistle Street ROW drains to stormwater catch basins and conveyance piping which flows north to an outfall into the LDW (OF-2215; Figure 2.4). The residential area to the west of the SPM Property is generally flat at an approximate elevation of 20 feet. The ROWs along Dallas Avenue South were redeveloped by the City to drain to bioswales and the 17th Avenue South Storm Drain Outfall (Figure 2.4).

The shoreline along the eastern boundary of the SPM Property consists of ecology blocks and riprap. The top of the ecology block retaining wall varies between elevations of 11 and 14 feet. The riprap and bank soils on the waterward side of the ecology blocks are typically submerged, as the LDW fluctuates in elevation between an MHHW of 9.00 feet and a mean lower-low water (MLLW) of -2.35 feet. The upland portion of the SPM Property, and the subject of this RI Work Plan, is defined as the portion of SPM Property above the MHHW and the riprap and bank soils on the waterward side of the ecology blocks (and below MHHW) are part of the LDW Superfund Site. However, seeps discovered during the T-117 Upland Property remediation are likely related to the waste pit on the Historical A&B Barrel Parcel (Appendix A.5). Data resulting from these seeps will be included in the RI report and evaluated during site characterization.

Shoreline modifications along the SPM parcels, generally, involved the dredging and removal of material from the bank (Figure 2.1). Based on aerial photographs, modifications appear to have been conducted around 1952, 1959, 1961, and 1981 (Appendix A). Three documented dredging events have occurred in-water along the SPM Property, and at least one of these events included shoreline modification (TIG Environmental, 2020):

- In 1957, General Construction Company (GCC) was authorized to dredge approximately 8,400 cubic yards (cy). The area to be dredged was part of a CWD lease area that had been leased to the owner of South Park Boat Haven. There is no documentation that permitted dredging was completed.
- In 1981, SPM contracted GCC to dredge and dispose of material along the shoreline, which was permitted by the USACE. Records indicate that approximately 26,742 cy of material were dredged and disposed; the permitted disposal location is the Four Mile Rock Deep Water Disposal Site, but no final

[2] All elevations in this RI Work Plan are relative to North American Vertical Datum of 1988 (NAVD88).

disposal records were identified to confirm. In addition to dredging, this project entailed excavation of near-shore upland soils to extend the bank approximately 15 feet farther west.

- In 1992, SPM contracted AH Power Co. and Industrial Pond Services to dredge the marina basin. The purpose of the dredging project was to restore moorage depth. The dredge materials were authorized to be disposed at the PSDDA Open-Water Disposal Site in Elliott Bay. A total of 5,688 cy of material were dredged.

In 2014, during the T-117 EEA Phase 1 cleanup, the southeast corner of the SPM Property was modified by removal of sediment and bank soil and installation of a sheet pile wall (refer to Section 3.2.3).

3.2 Geology and Hydrogeology

The general description of the regional geology and hydrogeology for the LDW basin is primarily adapted from Booth and Herman (1998). Site-specific geology, hydrostratigraphy, and groundwater conditions are adapted from environmental characterizations performed both on the SPM Property and the south-adjacent T-117 Upland Property.

3.2.1 Regional Geology

The Duwamish valley was formed between 10,000 and 15,000 years ago during the latest glaciation as glaciers carved their way southwards. As the ice sheets retreated, the Duwamish arm of the Puget Sound extended as far south as Auburn until approximately 5,700 years ago. Concurrently, the Osceola Mudflow traversed from Mount Rainier along the White River valley. The sediments spread along the Duwamish arm of the Puget Sound, including submarine deposits as far north as Kent. The White River subsequently eroded and redeposited these mudflow sediments farther downstream in the Green River and Duwamish valleys into the Puget Sound over thousands of years (Booth and Herman, 1998).

Based on the geologic record, the Seattle Fault, oriented east-west and extending beneath the mouth of the LDW, ruptured about 1,100 years ago and resulted in an approximately 20-foot uplift on the south (LDW-upstream) side of the fault. This uplifting would have resulted in a marked decrease of depth in the LDW, potentially raising the riverbed and floodplain of the LDW above the sea level at that time. The Duwamish River subsequently eroded and formed the channel that is mapped as the “historical” river channel prior to subsequent anthropogenic interference (Booth and Herman, 1998).

As nonnative settlers moved to the area in the 1850s, the LDW shorelines were cleared and wetlands were drained for agricultural and industrial purposes. Historically, the Duwamish River’s major tributaries included the Green, Black, and White Rivers. By the 1900s, flooding had arisen as a large concern for the LDW, and a combination of levees, dams, and channelization of the river was used for flood control. In the Great Flood of 1906, the White River became diverted by natural log/debris jams from the Green River into the Puyallup River. Continued diversion in the Duwamish watershed for both flood control and irrigation resulted in an approximately 70 percent reduction of flow in the LDW throughout the 1900s. The Black River, one of the LDW’s major tributaries, was fed by Lake

Washington and the Cedar River. In 1916, Lake Washington was connected to Lake Union, the Cedar River was rerouted to Lake Washington, and the subsequent reduction in the lake elevation resulted in the elimination of the Black River (Windward, 2010a).

Dredging of the LDW to facilitate navigation began in the early 1900s, including the dredging of the historical tide flats where the mouth of the Duwamish meets Puget Sound. Dredged material from the tide flats and LDW was used to create Harbor Island and in channelization efforts along the LDW. Booth and Herman (1988) note that nature of the fill material sourced from the LDW and used in the channelization effort is heterogenous and often difficult to distinguish from native alluvium. The heterogenous nature of fill soil can create complex hydrogeologic interactions, including the development of preferential flow paths.

3.2.2 Site Geology

The geologic logs available for review for the SPM Property are from borings performed in the Pond area by SAIC (2008a) and TIG Environmental (2019) (Appendix B). The current understanding of subsurface geologic conditions on the SPM Property is depicted in cross section on Figure 3.1, aligned west-east near the southern end of the SPM Property and transecting the location of the Pond area and LDW shoreline. Within the existing depth of exploration, soils at the SPM Property are generally divided into four distinct units, outlined here from top to bottom (SAIC, 2008a):

- **Base Course**. A layer of base course is present beneath the paved portions of the SPM Property. The base course primarily comprises gravel/crushed rock with varying amounts of sand and silt and has been documented at thicknesses up to 1 foot.
- **Fill**. Anthropogenic fill material, likely a result of the dredging of the LDW and/or regrading of nearby hills, underlies the base course. The fill material generally consists of fine- to medium-grained, very loose to loose sand and has been documented at thicknesses up to 10.5 feet.
- **Silt with Organics.** A layer of silt and sandy silt, commonly bedded with organic material, underlies the anthropogenic fill material. Generally, the density of the silt was noted as very soft to soft with occasional lens of medium stiff to stiff silt. Troost et al. (2005) mapped the SPM Property as a historic meander/oxbow of the Duwamish River and identified this unit as a younger alluvium that can locally contain soft peat lenses and woody debris, which is consistent with the organic material described in boring logs. This unit has been documented at thicknesses up to 9 feet at the SPM Property.
- **Alluvial Sand.** A layer of loose, fine- to medium-grained sand underlies the silt unit and has been documented at thicknesses of at least 9.5 feet.
- **Pond Fill.** In addition to the units described above, fill material in the waste pond associated with Pond area was described as silty sand and gravelly silt with anthropogenic debris. SAIC noted that the Pond area fill material was easily recognizable in the field and had a moderately strong chemical odor during drilling (SAIC, 2008a).

3.2.3 Site Hydrostratigraphy and Groundwater Conditions

The only geologic logs available for review were from on-SPM Property borings performed by SAIC (2008a). These borings were advanced during September 2007 and may be representative of the seasonal low in groundwater elevations. The majority of the borings encountered no saturation in the fill but encountered moist to wet soil at the interface between the fill material and silt layer. The alluvial sand beneath the silt layer was saturated.

SAIC (2008a) performed a short-term tidal study at three monitoring wells (MW-1, MW-2, MW-3) screened across the Silt and Alluvial Sand units and positioned on the east end of the SPM Property and at various distances from the LDW shoreline. The tidal study was performed during a 6-hour falling-tide cycle between higher-high tide and low tide. The results indicate that groundwater levels near the LDW shoreline fluctuate directly with the LDW tides as expected, and show relatively short tidal lag times (SAIC, 2008a). During tidal studies conducted at the T-117 Upland Property immediately east of the SPM Property, nearshore groundwater level fluctuations have been documented between 3 and 8 feet in response to LDW tides (Windward, 2010a). T-117 Upland Property tidal studies documented the expected groundwater gradient reversal along the shoreline during high tide, during which LDW surface water temporarily flows into the aquifer and mixes with groundwater within the groundwater "transitional zone." Tidal influence on groundwater elevations was noted as negligible approximately 230 feet from the shoreline on the T-117 Upland Property (Windward, 2010a).

At both the SPM Property and T-117 Upland Property, the tidally averaged net groundwater flow has been documented to discharge to the LDW (SAIC, 2008a; Windward, 2010a). SAIC (2008a) did not observe seeps on the SPM Property, but observed some seepage zones on the T-117 Upland Property just south of the SPM Property. Windward (2010a) documented seeps south of the marina boat ramp on the SPM Property. As noted above and discussed below in Section 5.2.3, AECOM (2014a) documented seeps at the southeast marina corner during T-117 Upland Property remedial actions. The memorandum documenting the observation and sampling of these seeps is presented in Appendix A.5.

During the T-117 EAA Phase 1 sediment and upland removal action, a steel sheet pile wall was installed along the SPM Property's southeast corner to provide geotechnical bank stability support during soil and sediment excavation on the T-117 Upland Property and SPM Property (Appendix A). The sheet pile wall was constructed in an "L" shape extending approximately 18 feet laterally on both the eastern and southern sides of the SPM Property's southeast corner and to a depth of 22 feet below grade (to elevation -5 to -6 feet NAVD88). During the March 2014 EAA remedial action, groundwater seepage was observed discharging at low tide from the exposed Silt Unit[3] along the east and south sides of the sheet pile wall. The sheet pile wall contains weep holes to prevent static buildup behind the wall but may locally disrupt the shallow groundwater flow regime in the vicinity of the former Pond area. Section 5.2.3 provides details regarding 2014 sampling and analysis of sediment, surface water, and groundwater seeps along the SPM Property's southeast corner during that remedial action.

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[3] Elevations in the range of 4.5 to 5.5 feet NAVD88.

4 RI Screening Levels

All previous and new chemical concentration data used in the RI will be compared against screening levels to identify chemicals of potential concern (COPCs) for the Site. The RI soil and groundwater screening levels to be applied address the environmental transport and exposure pathways applicable at the Site for the protection of LDW receiving sediment and surface water, as defined in Ecology's 2019 *Lower Duwamish Waterway Preliminary Cleanup Level* [PCUL] *Workbook and Supplemental Information* (Ecology, 2019b). Screening levels for media not regulated under MTCA (e.g., stormwater and catch basin solids) are also developed to assess potential contaminant transport to the LDW via stormwater and thus the need for stormwater source control measures in accordance with the LDW Source Control Strategy (Ecology, 2016). For the purposes of this RI Work Plan, including an initial screening of available chemical data (see Section 6), these are preliminary screening levels that have not been adjusted to practical quantitation limits (PQLs)or background. For some analytes, the LDW PCULs are below background concentrations and/or laboratory PQLs. For analytes with applicable PCULs below PQLs, Site cleanup levels will ultimately be adjusted to the PQL in the FS and CAP in accordance with MTCA. Because the RI is conducted to further delineate contamination and facilitate evaluation of cleanup actions in the FS, data screening conducted during the RI will consider PQL limitations when determining Site COPCs and investigation approaches, and identify potential future adjustments to Site cleanup levels for planning purposes.

Appendix C provides the details regarding derivation of the preliminary RI screening levels for the media to be sampled in Phase 1 of the RI. The screening levels provided in Appendix C do not necessarily represent cleanup levels for the Site. Many of the screening levels are calculated values, employing conservative assumptions regarding contaminant transport between media. Although Ecology has not issued a formal decision pertaining to non-potability of groundwater in the LDW, based on other sites adjacent to the LDW, groundwater is presumed to be non-potable and thus the use of drinking water standards in the RI screening levels is not appropriate. Appendix C provides further justification for the basis that groundwater at the Site is non-potable in accordance with MTCA. Additional information may be collected during the RI to support selection of COCs and cleanup levels for the Site in the RI, in accordance with MTCA (e.g., WAC-173-340-350(9)). This may include, but not be limited to, using measured data to demonstrate empirically that cross-media transport will not cause a screening level exceedance (e.g., WAC 173-340-747(9)) or incorporation of background information.

5 Previous Remedial Investigations and Source Control Actions on SPM Property

This section summarizes previous environmental investigations and independent cleanup actions conducted on the SPM Property. Key excerpts from selected previous environmental investigation reports are included in Appendix A to provide context to this summary. Boring logs from historical subsurface investigations are presented in Appendix B.

5.1 Previous Environmental Investigations

At least 10 separate environmental investigations have been completed at the SPM Property, beginning in 2002 and ending with sampling completed in 2017. Figure 5.1 depicts sample locations from the prior investigations. The investigations were conducted by a variety of entities over the years, and as such the findings are documented in various reports. Table 5.1 provides a chronological summary of the documents containing data collected on the SPM Property that are referenced below. The following presents a summary of the previous investigation references and includes a summary of key features of each investigation. Some of the data collected during these previous environmental investigations was off-property and out of the scope of this RI Work Plan, and as such are briefly introduced in the summaries below but are not evaluated further.

A summary of historical data usability and RI screening level exceedances for data collected on the SPM Property are presented in Section 6. The evaluation of analytical data collected during these previous investigations is presented in Appendix D in addition to tabulations of analytical data from the SPM Property collected during the prior investigations and source control activities.

Analytical results are summarized in Appendix D Tables D.1 through D.4.

5.1.1 SPM Investigations – Former A&B Barrel Area

The following references document investigations conducted in the vicinity of the former A&B Barrel Co. area of the SPM Property.

SAIC, 2008a, South Park Marina Seattle, Washington, Additional Site Characterization Activities Data Report Final, Prepared for Washington State Department of Ecology, June 30, 2008.

- Site walk and underground utilities location occurred on September 25, 2007.
- Installation of 16 soil borings (SB-1 through SB-16) and three monitoring wells (MW-1 through MW-3 installed in SB-1 through SB-3) occurred on September 26, 27, and 28 and October 1, 2007. Boring depths ranged from 2.5 to 20 feet below ground surface (bgs). Twenty-one (21) soil samples were submitted for chemical analysis from depths ranging from 1 to 15.5 ft bgs. Soil samples were analyzed for semivolatile organic compounds (SVOCs), PCB Aroclors, Resource Conservation and Recovery Act (RCRA) 8 metals, organochloride pesticides, hydrocarbon identification (HCID), VOCs (select samples only) and gasoline- and diesel-range

total petroleum hydrocarbons (TPH)[4] when HCID identified detections. Analytical results are summarized in Appendix D Tables D.1 through D.4.

- Well surveying and short-term tidal study occurred on October 1, 2007.
- Riverbank transect soil and sediment sampling occurred on October 8 and 9, 2007, and March 12, 2008. A total of four soil samples and two in-water sediment collected along two transects perpendicular to the shoreline, east of the southeast corner of the SPM Property, as depicted in the SAIC map included as Appendix A.6. All soil and sediment samples were collected from 0 to 4 inches bgs. Each transect included one soil sample from above the retaining wall (top of bank), one soil sample from just below the base of the wall, and one sediment sample a few inches below the water surface at low tide[5]. Riverbank transect soils and sediment were analyzed for the same constituents as soil boring samples, with the exception of VOC analysis which was not conducted on riverbank transect soils. Analytical results are summarized in Appendix D Table D.11.
- Groundwater sampling occurred on October 8 and 9, 2007, and March 12, 2008. Groundwater was collected from the three monitoring wells (MW-1 through MW-3) after a significant low tide. The October 2007 groundwater samples were analyzed for SVOCs, VOCs, PCBs, RCRA 8 metals (total and dissolved), chlorinated pesticides, and HCID[6]. Analytical results are summarized in Appendix D Tables D.5 and D.6. Based on the October 2007 results, the March 2008 analyte list was reduced to VOCs, chlorinated pesticides, and RCRA 8 metals (total only).
- Seep investigation occurred in 2007 and 2008. The banks of the LDW were inspected for seeps along the SPM Property shoreline but none were observed. Therefore, no seep samples were collected for characterization.

SAIC, 2008b, Final Technical Memorandum Subject: Transmittal of Low-Level Mercury Results, July 2008 Groundwater Sampling Round, South Park Marina Site, Seattle, Washington, Prepared for Mark Edens Washington State Department of Ecology, December 31, 2008.

- Resampling of groundwater from monitoring wells MW-1 through MW-3 in the vicinity of the A&B Barrel area of the SPM Property for low-level mercury analysis was performed in July 2008. Analytical results are summarized in Appendix D Tables D.5 and D.6.
- Groundwater monitoring wells were subsequently decommissioned after the last sampling event (SAIC, 2009a).

Farallon Consulting, LLC, 2011, Analytical Data for Project 289-001, Prepared by OnSite Environmental Inc. August 2011.

[4] Using silica gel cleanup

[5] SAIC concluded that, due to limited presence of soil on the banks, it likely did not represent eroded bank soil, but rather LDW sediment settled from upstream.

[6] No detections in the HCID analysis so gasoline- and diesel-range TPH were not analyzed.

- Soil and groundwater investigation conducted on July 27, 2011. Farallon did not prepare a report documenting the investigation; only the laboratory results were compiled.
- Six soil borings (SB-17 through SB-22) were advanced in the vicinity of the Pond area, and eight soil samples collected from depths ranging from 1 to 18 feet bgs were analyzed for gasoline-and diesel-range TPH, VOCs, SVOCs, PCB Aroclors, organochlorine pesticides, and total metals.
- Two grab groundwater samples were collected from temporary well screens inside soil borings SB-21 and SB-22 and analyzed for gasoline-and diesel-range TPH, VOCs, SVOCs, PCB Aroclors, organochlorine pesticides, and total metals.

5.1.2 SPM Investigations – Stormwater NPDES

The following references document investigations conducted of the stormwater and washwater-related systems.

Ecology, 2005, Stormwater Compliance Inspection Report, July 2005.

- A surprise stormwater inspection was conducted by Ecology on June 7, 2005.
- The inspection noted that the NPDES permit and Discharge Monitoring Reports were available for review by Ecology.
- The inspection noted the following deficiencies:
  - No tarping was found with upland boatyard activities.
  - There were visible spills under the crane.
  - Paints and solvents needed to be stored in a covered, bermed, and impervious area.
  - There was concern over the proximity of a stormwater catch basin (CB-07) to the boat wash pad and associated pump vault (also referred to as a sump; Sections 2.3.2.2.3, 5.3.1, and 5.3.2) and concern regarding the condition of the asphalt surrounding the catch basin.

Leidos, 2015, NPDES Inspection Sampling Support 2014/2015, Prepared for Washington State Department of Ecology, June 2015.

- Inspection of select stormwater conveyance structures occurred on October 8, 2014, at catch basins 2, 4, 5, and 9, manhole 5, and a feature referred to as an oil/water separator[7].
- Stormwater and solids samples were collected from the StormwateRx™ pump vault (mis-identified as an oil/water separator by Leidos; SWRX-PRE in Appendix D tables), and a solids sample was collected from catch basin CB-09. The stormwater

[7] TIG Environmental's 2018 and 2019 stormwater investigations did not verify the location of manhole 5. It is also presumed that the oil/water separator identified by Leidos (2015) was in fact the StormwateRx™ pump vault as there are no oil/water separators on the SPM Property.

sample was analyzed for metals, mercury, PCB congeners, SVOCs, dioxin/furans, alkalinity, pH, specific conductance, anions, total organic carbon (TOC), dissolved organic carbon (DOC), total suspended solids (TSS), turbidity, and oil and grease. Solids samples were analyzed for the same analytes as the stormwater sample, plus PCB Aroclors, TPH as diesel, motor oil, and gasoline, grain size, and VOCs. The analytical results are summarized in Appendix D Tables D.7 through D.10.

TIG Environmental, 2018a, Stormwater and Boat Wash Water Systems Evaluation South Park Marina, Prepared for South Park Marina Limited Partnership, February 2018.

- Investigation into potential sources of chemicals in stormwater discharging to the LDW and resulting in non-compliance with SPM's NPDES Boatyard General Permit.
- TIG Environmental reported 69 percent of the SPM Property's stormwater runoff is untreated and contains detectable concentrations of metals and PCBs.
- The StormwateRx™ treatment system currently receives 22 percent[8] of the SPM Property's stormwater. This stormwater is treated for metals. Reportedly, some PCBs and other chemicals are removed with moderate success.
- Currently, untreated stormwater can overflow the pump vault and bypass the treatment system to discharge directly to the LDW if the pump fails or the capacity of the vault is exceeded.
- Some co-mingling of boat washwater with stormwater may occur prior to getting pumped to the StormwateRx™ treatment system.
- Two catch basin samples (CB-02 and CB-06), one roof drain water sample (SRC-01), three boat washwater treatment samples (pre-, mid-, and post-treatment), and three stormwater treatment water samples (pre-, mid-, and post-treatment) were collected and analyzed for metals, including mercury, total PCB congeners, SVOCs, phenol, alkalinity, hardness, pH, conductivity, TOC, total dissolved solids (TDS), TSS, and turbidity. Laboratory data collected was validated by an independent data validator using EPA stage 2B validation. The validated results for these samples are summarized in Appendix D Tables D.7 through D.10.

TIG Environmental, 2019, Results of Drainage Pathway Investigation, January 16, 2019.

- Previous drainage investigations included ground-penetrating radar survey in February 2016, developing a topographic survey in March 2017, and camera surveys within stormwater and sewer pipes in September 2017.
- A stormwater drainage investigation was conducted in 2018 to address pathway data gaps resulting from the previous historical drainage investigation in order to identify discharge points. The data gaps included locating the South Park Marina outfall discharge point; trace the network of piping connected to catch basin CB-01; trace downgradient piping pathway from catch basins CB-02 and CB-05; trace the

[8] Area based on TIG Environmental's drainage pathway investigation (2019).

connection between CB-05 and CB-06; trace subsurface piping from roof drains on Rick's Master Marine shop; and identify the discharge path for roof drains from the Tire Factory and the woodworking shop.

- Five roof drain water samples (SRC-01 through SRC-05) were collected on October 25, 2018, for copper and zinc analysis. Results were compared to the NPDES benchmarks. The analytical results are summarized in Appendix D Table D.7.
- Dye tracer studies were conducted in February, November, and December 2018 to trace the drainage pathways for catch basins CB-01, CB-02, CB-05, and CB-06 and roof drains attached to Rick's Master Marine shop, Tire Factory, and the woodworking shop.

Some components of the drainage system, such as precise pipe connections and discharge points, remain unknown, but findings from these investigations helped refine the stormwater drainage pathway understanding as depicted on Figures 2.4 and 2.5 of this RI Work Plan. Details of the findings of the investigation and the follow-up activities are detailed in TIG Environmental's memorandum (TIG Environmental, 2019).

5.1.3 SPM Investigations – Site Wide

The following references documents and summarize investigations conducted across the entire SPM Property.

The Intelligence Group (TIG), Various field reports documenting site investigations (TIG, 2016a through 2016g and 2017).

- Between September 20, 2016, and February 23, 2017, TIG conducted eight site visits to investigate various conditions at the SPM Property. The intent of the site visits was to:
  - Inventory chemicals and hazardous material use on the SPM Property by all operators
  - Inspect pole-mounted transformers
  - Inspect compressors
  - Observe and inspect the boat washwater and the StormwateRx™ treatment systems
  - Investigate drainage pathways and the potential for septic tanks through ground penetrating radar investigations.

None of these site visits included subsurface investigations or sample collection but provided the basis for the investigations conducted by The Intelligence Group in 2016 and TIG Environmental in 2017, 2018, and 2019.

The Intelligence Group, 2016h, Data Report, 2016 Soil, Sediment and Catch Basin Sampling and Analysis, Lower Duwamish Superfund Site, September 20, 2016.

- Collected 30 surface soil samples in February 2016 across the SPM Property. Surface soil samples were collected to 1.5 feet bgs. Samples were analyzed for PCB Aroclors and PCB congeners.
- Collected nine catch basin solids samples from CB-01 through CB-09. Visible sheen was observed on standing water in all catch basins, except CB-01. Samples were analyzed for PCB Aroclors and PCB congeners.
- Laboratory data collected were validated by an independent data validator using EPA stage 2B validation. The validated results for these samples are summarized in Appendix D.
- Sediment samples collected as part of this investigation are discussed below in Section 5.1.5.

TIG Environmental, 2018b, South Park Marina (Facility/Site ID 44653368) Supplemental PCB Investigation Memorandum, September 11, 2018.

- Collected 23 surface and subsurface soil samples in 2017. Surface soil samples were collected from across the SPM Property and in areas near samples that previously exhibited high PCB concentrations, while subsurface soil samples focused on the former A&B Barrel area. Surface soil samples were collected to 1.5 feet bgs and subsurface samples were collected from a maximum depth of 10 feet bgs.
- Samples were analyzed for PCB Aroclors and a subset of samples were analyzed for PCB congeners. Laboratory data collected were validated by an independent data validator using EPA stage 2B validation.
- Four surface concrete and wood chip samples collected from below compressors were also submitted for PCB Aroclors and congener analysis. Although these media are not evaluated further in this RI Work Plan, building materials such as these may be investigated further during the RI if warranted to identify additional potential sources of PCBs.
- Laboratory data collected in 2017 were validated by an independent data validator using EPA stage 2B validation. The validated results for these soil samples are summarized in Appendix D Table D.2.
- PCB Aroclor profiles and congener fingerprints were developed and evaluated for source identification.

5.1.4 T-117-Related Soil Sampling on SPM Property

This section presents a summary of environmental investigations and historical data collected on the SPM Property during the T-117 EAA investigations and remedial action of the T-117 North Bank Area and Dredge Unit 3 (DU3). The T-117 EAA investigations and remedial actions on the SPM Property were focused at the southeast corner of the property adjacent to T-117 Upland Property. Data collected that are off the SPM Property (including data collected outside the parcel boundaries and below the MHHW line) are not included for evaluation as part of the RI Work Plan.

Windward Environmental LLC (Windward) 2006, T-117 Upland Area Soil Investigation Field Sampling and Data Report, Submitted to US Environmental Protection Agency, July 7, 2006.

- Three surface soil samples (A-10, A-11, and A-12) were collected in 2002 from the southeast corner of the Historical A&B Barrel Parcel in the vicinity of the Pond area. All samples were collected from 0 to 1.5 feet bgs and were analyzed for PCBs and TPH. The analytical results are summarized in Appendix D Tables D.1 and D.2.

5.1.5 Sediment Investigations Near the Marina

The following documents reference sediment investigations conducted in the LDW along the SPM shoreline between the MHHW line and the navigation channel, and between River Mile 3.4 and 3.5. The in-water area considered for this evaluation is generally defined by extending the SPM northern and southern property boundaries and projecting them out into the LDW up to the western boundary of the navigation channel. Analytical results are summarized in Appendix D Table D.11. Historical sampling locations are shown on Figure 5.1. A summary of sediment analytical data is provided in Appendix D, Table D.11.

Windward et al., 2010a, Revised Engineering Evaluation/Cost Analysis, June 3, 2010.

- Collected 10 surface and subsurface in-water sediment samples (73-G, 74-G, 84-G, 85-G, 98-G, 99-G, 100-G, 101-G, 102-G, and Comp1-SC) in 2004 and 2008 in front of the SPM property as part of the T-117 EAA engineering evaluation/cost analysis investigation. All samples were collected between 0 and 10 cm depth, with the exception of Comp1-SC which represents sediment collected between 0 and 122 cm. The primary focus of the sediment investigation was PCB Aroclor analysis; however, some samples were also analyzed for dioxin/furans, SVOCs, organochlorine pesticides, metals, tributyltin, ammonia as nitrogen, total volatile solids, total solids, total organic carbon, and grain size.

The Intelligence Group, 2016h, Data Report, 2016 Soil, Sediment and Catch Basin Sampling and Analysis, Lower Duwamish Superfund Site, September 20, 2016.

- From February 24 to February 26, 2016, 48 sediment samples were collected from 16 locations (SC-01 through SC-16) between the MHHW line along the SPM shoreline and the navigation channel. A sediment core from the upper 6 feet of sediments was removed from each sample location and the core divided into three segments: 0 to 0.1 meter (surface), 0.1 to 1 meter (middle), and 1 to 2 meter (bottom). The core from each segment was then homogenized for chemical analysis. Each of the 16 sample locations had a sample submitted for laboratory analysis representing each of the 3 depth segments (surface, middle, and bottom).
- Sediment samples were analyzed for PCB Aroclors and PCB congeners. Laboratory data were validated by an independent data validator using EPA stage 2B validation. The validated results for these samples are summarized in Appendix D.
- *AECOM Environment, 2016, Removal Action Construction Report Terminal 117 Sediment and Upland Cleanup, March 31, 2016.*Two surface (0 to 10 cm) sediment

samples (PERIM-5 PRE and PERIM-5 POST) were collected from the perimeter of the T-117 EAA Dredge Unit 3, in-water between two of the floating SPM boat docks. One sample was collected before dredging and one collected after the dredging and in-water backfilling was completed.

- Sediment samples were analyzed for T-117 EAA sediment COCs including dioxin/furans, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), SVOCs, metals, PCBs, and TOC.
- Laboratory data were validated by an independent data validator using EPA stage 2B validation for all analytes, with the exception of dioxin/furans where a stage 4 validation was conducted. No data were rejected and validated results for these samples are summarized in Appendix D.

5.1.6 T-117 EAA Relevant Data

Soil, sediment, seep, and groundwater data collected during investigations and remedial actions conducted on the adjacent T-117 EAA are potentially relevant to understanding contamination at SPM. Given the breadth of existing data, relevant tables and figures excerpted from previous reports have been compiled in Appendix A.7 for the purposes of this RI Work Plan. Relevant data from the T-117 EAA representative of current conditions will be included on nature and extent maps presented in the SPM RI Report, as appropriate.

5.2 Previous Cleanup Actions on SPM Property

Cleanups relating to past fuel spills, two UST removals, and T-117 EAA remediation have been conducted at the SPM Property. The following provides a summary describing these previous cleanup actions.

5.2.1 Spills and Leaks

Over the course of marina operations, spills and leaks of fuels and oil have occurred periodically. Spills and leaks of notable quantities are reportedly addressed by marina staff and reported to the appropriate regulating agency. Records of spills dating back to 1996 are maintained on Worksheet 6 in the marina's Stormwater Pollution Prevention Plan (SWPPP; South Park Marina, 2020). Likewise, the U.S. Coast Guard's National Response Center maintains records of incidents that occurred between 1990 to the present (TIG Environmental, 2020). Details of documented or reported spills will be included in the RI.

5.2.2 Underground Storage Tank Removals

One UST with an unknown installation date was registered and recorded with Ecology's UST Program as "removed" at some date prior to 1996. The size and content of this UST (UST ID 853) is unknown (SAIC, 2007a and Ecology, 2015). Anecdotal evidence provided by the SPM Property owner/operator and TIG Environmental (2020) indicates that this UST had two historical placements near the shoreline (Figure 2.1), both of which served marina fueling operations at separate points during marina operation. Reportedly, the 1,000-gallon UST operated along the shoreline of the Historical A&B Barrel Parcel from approximately 1970 to 1980 was removed in approximately 1981 to allow for SPM's excavation and dredging that modified the shoreline (TIG Environmental, 2020). This UST was then reinstalled at the downstream end of the South Parcel (Figure 2.1). The UST operated in this second location until approximately 1991, when it was decommissioned and removed (Burlington Environmental, 1991). As part of the UST removal, Burlington Environmental collected soil samples for benzene, toluene, ethylbenzene, and xylene, but there were no detectable concentrations of these chemicals in soil above the laboratory reporting limit.

King County tax assessor records document two 550-gallon USTs associated with the former gasoline service station that was located at the northwest corner of the Central Parcel (Figure 2.1). Tax assessor records do not specify the location or contents of the tanks. In 2014, a general contractor for King County's South Park Bridge replacement construction activities discovered and removed two USTs at the northwest corner of the Central Parcel, west of the Tire Factory (TIG Environmental, 2020). It is unknown if these were the two tanks noted in the King County tax assessor records related to operation of the former gasoline service station. King County's contractor collected soil samples after UST removal for chemical analysis. Laboratory results indicated concentrations of tetrachloroethene (PCE) and trichloroethene (TCE) in soil collected from the bottom of the UST excavation. The detections of chlorinated solvents were, at the time, attributed to potential releases from the Regency II Cleaners, formerly located south across Dallas Avenue from the Tire Factory.

5.2.3 T-117 EAA Phase 1 Cleanup – Marina Corner

A small portion of the T-117 EAA Phase 1 North Bank soil excavation and sediment DU3 areas occurred on the southeast corner of the SPM Property. These areas are referred to as the T-117 EAA "Marina Corner" (AECOM Environment, 2016). The Marina Corner Removal Area included shallow sediment removal from interstitial openings in existing riprap using a vactor truck from an area of approximately 33 feet by 35 feet (AECOM Environment, 2016). Final bank transect samples collected in this area were collected below MHHW and thus represent in-water sediment outside of the Site.

Prior to start of bank and sediment removal, a sheet pile wall was constructed in an "L" shape extending approximately 18 feet laterally on both the eastern and southern sides of the SPM Property's southeast corner and to a depth of 22 feet below grade (to elevation -5 to -6 feet NAVD88; see drawing presented in Appendix A.4). Near the start of DU3 dredging, on February 1, 2014, sheen was noted on the LDW water surface near the Marina Corner, although observation of a specific source was obscured by presence of geotextile fabric used to prevent soil erosion (AECOM, 2014a; included as Appendix A.5). During the subsequent February 2014 dredging in DU 3, the SPM Property bank immediately east of the new sheet pile wall sloughed (slope failed) from the top of bank down to below the low tide water line (slough location shown on Figure 1 in Appendix A.5).

Subsequently, during low-tide conditions on March 6, 2014, groundwater seepage was observed discharging from the exposed Silt Unit (elevations approximately 4 to 5 feet NAVD88) along the eastern sloughed bank and along the south side of the sheet pile wall (see figure presented in Appendix A.5). A sample of the seep water was collected on March 6, 2014 and submitted for analysis of TPH using the hydrocarbon identification (HCID) method. A six-point composite bank sediment sample was also collected from the intertidal eastern riverbank on the SPM Property for analysis of TPH-HCID and PCB Aroclors. The memorandum documenting this work is presented in Appendix A.5 and includes photographs, data summary tables, and a sample location figure.

On March 17, 2014, AECOM resampled the same exposed intertidal bank sediment for analysis of gasoline-, diesel-, and oil-range TPH, PCB Aroclors, chlorinated pesticides/herbicides, metals, and VOCs. That same day, AECOM also sampled groundwater seepage emanating south of the sheet pile wall on the T-117 Upland Property at elevation approximately 2.5 feet NAVD88 (see sample location depicted on Figure 1 in Appendix A.5). The seep sample was analyzed for gasoline-, diesel-, and oil-range TPH, PCB Aroclors, chlorinated pesticides/herbicides, metals, and VOCs (see Table 3 in Appendix A.5).

Based on the observed sheens discharging from residual materials east and south of the sheet pile wall, the Phase 1 removal action design was modified to install a high-permeability, approximately 1/4-inch-thick, granular activated carbon (GAC) geocomposite layer along the east and south sides of the sheet pile wall (Figure 2.2). The GAC layer was placed over imported gravel borrow backfill and extended vertically between elevations approximately 0 and 8 feet NAVD88. The GAC layer was covered with additional gravel borrow and then rip rap armoring up to mean high water. Above mean high water, an ecology block wall was constructed outside the sheet pile, with crushed rock backfill between the sheet pile wall and ecology block wall (AECOM, 2014b). As-builts for the sheet pile wall, excavation and dredging elevations[9], and GAC geocomposite mat are provided in Appendix A.4. In March 2015, the Port and SPM drafted a legal agreement that acknowledges the sheet pile will remain in place permanently, restricts surcharge/loading of the embankment around the wall, and designates SPM as responsible to maintain and repair the wall, as discussed above in Section 2.3.3.

5.3 Previous and Ongoing Source Control Actions at SPM

Previous source control actions implemented at the SPM Property have included installing the boat washwater treatment system, the StormwateRx™ system, and implementation of boat yard best management practices. This section provides a brief summary of these previous source control actions.

5.3.1 Boat Washwater Treatment System

The boat washwater treatment system was installed in approximately 1993 (King County, 1993) to manage metals associated with bottom paint and metals removed from the bottom of the boats during pressure-washing in an effort to meet NPDES requirements. This treatment system was not installed to treat all contaminants present on the SPM Property. Schematics of the treatment system from 1993 and present day are provided in Appendix A.3. Details on the exact treatment process are summarized in TIG Environmental's "Draft Water Treatment Systems Evaluation Report" (TIG Environmental, 2018a).

In summary, the boat washwater treatment system involves washing boats on a designated wash pad where washwater is collected in a vault, where it is then pumped to two baffled settling tanks (the schematic is included in Appendix A.3). Inside these settling tanks, a flocculant is added to aid in settlement of suspended solids. Washwater is then pumped to a holding tank before getting pumped through filters and then returning back to the

9 Relative to mean lower low water (MLLW) vertical datum.

washwater system. Settled solids and washwater are eventually disposed off-site in accordance with waste disposal regulations.

This is effectively a closed-loop system, with two exceptions:

1) Prior to November 23, 2016, there was a small drain line from the second baffled settling tank that allowed some water to flow to an unnamed outfall to the LDW (see schematic in Appendix A.3). This drain line was decommissioned on November 23, 2016, so it is no longer a potential source to the LDW.

2) Catch basin CB-08 is also located within the boat washing pad. This catch basin is connected to CB-09, which feeds into the StormwateRx™ system and then discharges to the LDW via Outfall UOF-1 (Figure 2.4). During boat washing activities, operators cover catch basin CB-08 with a plywood cover to direct washwater to the closed-loop vault and prevent washwater from infiltrating into CB-08. The plywood cover is removed after the wash pad is drained and washing is complete. If the board does not form a complete seal of CB-08, some washwater could reach the StormwateRx™ system prior to discharge at Outfall UOF-1.

Although there is no regular testing program for the boat washwater treatment system, samples of the washwater were collected in 2017 at three distinct points in the treatment system: pre-treatment (from the washwater in the vault), mid-treatment (from the holding tank after settlement), and post-treatment (after the final filtration)[10]. Sludge samples are routinely collected for waste profiling. Analytical data collected from the boat washwater treatment system are summarized in Appendix D Tables D.7 through D.10 and evaluated in Section 6 of this RI Work Plan.

5.3.2 StormwateRx™ Treatment System

The StormwateRx™ Aquip™ 50SBE stormwater treatment system was installed in 2009 (Leidos, 2015) and treats an estimated 22 percent of the property’s stormwater (TIG Environmental, 2018). The system collects stormwater from catch basin CB-09 in a vault[11] from where it is pumped to the StormwateRx™ steel tank. The stormwater then flows through pre-treatment and into a system of layered inert and adsorptive filtration media, designed to remove suspended solids and heavy metals in order to meet the SPM Property’s Boatyard NPDES Permit benchmarks, prior to its discharge to the LDW via Outfall UOF-1 (TIG Environmental, 2018a). The pre-treatment media is replaced approximately every 6 to 12 months, while the treatment media is replaced as needed when stormwater sampling shows decreased treatment efficiency. The last replacement of treatment media occurred in June 2019. A schematic of the treatment system is provided in Appendix A.3, and additional details on the exact treatment process are summarized in the “Stormwater and Boat Wash Water Systems Evaluation” report (TIG Environmental, 2018).

When stormwater exceeds the treatment system capacity or if a pump fails, stormwater bypasses the treatment system and discharges untreated directly into the LDW via an

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[10] Analytical data from the post-treatment location, which is included in this Work Plan, is used by South Park Marina for waste disposal profiling. The water is vactored from this storage container by Clean Harbors and transported for off-site disposal.
[11] Misidentified as an oil/water separator in Leidos (2015).

Outfall OF-2214, adjacent to Outfall UOF-1 (Figure 2.4; TIG Environmental, 2018a). There are two places where the system can be bypassed: at the vault downstream from catch basin CB-09, and on the downstream end of the treatment tank.

The SPM Property's Boatyard General Permit dictates stormwater monitoring requirements. Samples were collected in 2014, 2016, and 2017 at three distinct points in the treatment system: pre-treatment (from the vault downstream from CB-09), mid-treatment (from inside the filtration chamber inside the treatment tank), and post-treatment (from the underdrain downstream from the treatment tank). Analytical data collected from the StormwateRx™ treatment system are evaluated in Section 6 of this RI Work Plan. In accordance with the SPM's SWPPP (2020), NPDES monitoring samples are now collected seasonally per the boatyard permit as further described in Section 5.3.3.

5.3.3 Boatyard Best Management Practices

Ecology's Boatyard General Permit stipulates a number of Best Management Practices (BMPs) for meeting Washington State water quality standards. Tenants of the marina are provided a copy of Puget Soundkeeper Alliance's *Best Management Practices (BMPs) for Boaters and Marinas* pamphlet, which is based on BMPs set forth by Ecology and EPA. According to SPM's SWPPP (2020) the mandatory BMPs implemented at the facility are posted on signs around the facility.

In general, the BMPs include the following topics:

- Vacuum sander use
- In-water vessel maintenance and repair
- Upland vessel maintenance and repair
- Solids management
- Paint and solvent use
- Oils and bilge water management
- Sacrificial anode (Zincs) management
- Chemical management
- Wash pad decontamination
- Sewage and gray water discharges
- Good housekeeping BMPs
- Preventative maintenance activities
- Structural source control BMPs
- Treatment BMPs (e.g., StormwateRx™ treatment system)

The May 2020 SWPPP provides further detail on all of these BMPs. The SWPPP also specifies stormwater sample collection once per month in January, April, May, October, and November and submittal of discharge monitoring reports to Ecology. SPM samples Outfall UOF-1 (monitoring point R001) as the stormwater monitoring location for the facility (Figure 2.4). The SWPPP provides specifics on the required analytes, sampling procedures, and inspections for compliance with the NPDES Boatyard General Permit.

SPM reported that catch basins solids were last removed in 2019 and as of September 15, 2020, approximately 0.5-inches of solids have accumulated on top of the filter fabric inside catch basin CB-02. Limited access to catch basins CB-05 and CB-06 precluded inspection of sediment accumulation at the time of the September 2020 inspection.

6 Existing Environmental Data

Analytical data from the prior environmental investigations at the SPM Property have been consolidated in a comprehensive environmental database that will be submitted to Ecology's Environmental Information Management (EIM) with this RI Work Plan. These data serve as the basis for the current understanding of the nature and extent for identifying data gaps to be addressed in the RI. The existing historical data includes soil, groundwater, stormwater, washwater, and catch basin solids data collected at the Site during investigations performed between 2002 and 2017 (prior explorations shown on Figure 5.1).

For the purposes of this RI Work Plan, data collected outside of the SPM Property boundary (e.g., sediment data collected within the LDW or data collected off-property as part of the T-117 EAA) are not included in this section of the report. Off-property soil and groundwater data collected as part of the T-117 EAA and sediment /riverbank soil, and seep data collected in-water between the MHHW line along the SPM shoreline and the navigational channel may be important during future conceptual site model development, and data from adjoining properties may be included in future nature and extent maps presented in the RI Report, if relevant to Site characterization. For example, seep data were collected downgradient of the former A&B Barrel Pond area to evaluate source control near the waste pond (Appendix A.5). These data will be used in the RI report to evaluate the groundwater-to-surface water/sediment pathway on the Historical A&B Barrel Parcel. Excerpts of historical reports containing potentially pertinent T-117 EAA data are provided in Appendix A.7 of this RI Work Plan. A summary of sediment analytical data are provided in Appendix D, Table D.11 and sediment sample locations are depicted on Figure 5.1.

The purpose of screening and evaluating existing environmental data are to identify chemical occurrences based on existing data, to identify areas of the Site that have been previously investigated, and to identify data gaps to be addressed in the RI. To aid in this evaluation, statistical summary tables of the existing data were prepared to provide an at-a-glance summary and streamline the data review process; the data are presented in Tables 6.1 through 6.4. Appendix D presents a tabulation of the full historical data set for reference. Data were compared to the RI screening levels identified in Section 4 and presented in Appendix C Tables C.1 through C.5. Each of the statistical summary Tables 6.1 through 6.4 provides the minimum, maximum, and average detected concentrations for each analyte and the number and frequency of screening level exceedances for the existing Site data set. For some analytes, the PCULs are below background concentrations and/or laboratory PQLs. For these analytes, Site cleanup levels will be ultimately adjusted to the PQL in the FS and CAP in accordance with MTCA. Because the RI is conducted to further delineate contamination and facilitate evaluation of cleanup actions in the FS, data screening conducted during the RI will consider PQL limitations when determining Site COPCs and investigation approaches, and identify potential future adjustments to Site cleanup levels for planning purposes.

The following sections assess the usability of historical data and present a preliminary assessment of the chemical occurrences on the SPM Property based on existing data exceedances of RI screening levels. A detailed account of the existing historical data evaluation process and evaluation results is presented in Appendix D, along with the full historical data set.

6.1 Data Usability

This section describes the usability of historical data for this RI Work Plan as a data gaps screening tool and for preliminary assessment of the chemical occurrences. The existing SPM database contains a breadth of data dating back to 2002, as described in the previous section. Review of this historical data identified the following issues that could affect data usability in the RI:

- Outdated soil sampling procedures (e.g., packing jars for volatiles)
- Elevated reporting limits
- Omissions of key information in laboratory reports (e.g., reporting limits, method detection limits, and dilution information)
- Sample quality (e.g., turbid grab groundwater samples collected from temporary borings, collection of groundwater samples using bailers or high flow pumps)

Since the first soil samples were collected at the SPM Property, sampling techniques for VOC analysis in soil have changed, principally to reduce potential for volatilization prior to analysis. Similarly, analytical methods for many of the parameters analyzed have improved, increasing laboratory quantitation precision and decreasing reporting limits. Prior analytical methods led to elevated reporting limits that may result in a bias toward non-detects. Laboratory reporting practices have also improved from the previous standard practices that omitted reporting limits, method detection limits, and dilution information. The quality of the samples may also affect data usability in the RI such that detections of parameters in turbid grab groundwater samples or samples collected using non-industry-standard methods may be deemed invalid or unusable. While grab groundwater sample results are considered helpful as a screening tool, they are likely not representative of groundwater conditions.

Despite some deficiencies identified with historical data, the bulk of the historical data were collected, analyzed, and reviewed in accordance with sampling and analysis plans. Data collected by SAIC in 2007 and 2008 were collected, analyzed, and reviewed pursuant to their "Sampling and Analysis Plan for Site reconnaissance Investigation" (SAIC, 2007c). Data collected by TIG Environmental were likewise collected, analyzed, and reviewed pursuant to their sampling and analysis and quality assurance project plans. During Phase 1 of the RI, PCB congener data collected by TIG will undergo stage 4 data validation.

Based on review of the data and associated documentation, including data validation reports, all historical data collected by SAIC and TIG Environmental are presumed to be of good, usable quality because of the sample collection and handling procedures, laboratory quality assurance and quality control (QA/QC), and data validation procedures in place. Data from samples collected by Farallon in 2011 are unvalidated and were provided in a summary table without a report detailing sample collection methodology and laboratory analytical reports. Those data are included in this preliminary evaluation, but the usability of those undocumented and unvalidated data will be re-evaluated in the RI.

The RI will emphasize the data collected in accordance with this RI Work Plan as the most representative of current conditions and will supplement the historical data deemed usable.

The RI will present further data usability determinations. For the purposes of this RI Work Plan, the tables in this section and those presented in Appendix D present all existing historical data deemed “reportable” in the database. Data identified in the database as not reportable included multiple results from diluted samples, those flagged through data validation as not reportable, NWTPH-HCID results, laboratory-calculated total PCBs results (these were recalculated internally), and results where a non-detect was reported but no reporting limit was provided. Historical groundwater data were considered in developing the conceptual site model, but the most current groundwater data will be used in the RI to represent current conditions.

Future environmental data will be collected pursuant to the Sampling and Analysis Plan (SAP)/Quality Assurance Protect Plan (QAPP) presented in Appendix E.

6.2 Chemical Occurrences Based on Existing Data

This section presents a synthesis of the existing usable data presented in tables in Appendix D by identifying, evaluating, and mapping the distribution of selected chemicals exceeding RI screening levels for each medium. The purpose of this section is to summarize the current contaminant data on the Site and identify additional data needs. This section focuses mainly on the former A&B Barrel area because the majority of prior investigations were located here, while sampling in other areas of the Site was generally limited to PCBs. Appendix D presents a thorough review of the existing data screening process and results and includes a tabulation of all existing Site analytical data in Tables D.1 through D.10. This information is summarized in the statistical tables presented as Tables 6.1 through 6.5.

The following parameters, organized into classes of contaminant, exceeded RI screening levels in one or more Site media:

- Metals – arsenic, barium, cadmium, total chromium, copper, lead, mercury, silver, and zinc
- TPH – gasoline-, diesel- and oil-range
- VOCs – benzene, toluene, ethylbenzene, 1,2-dichlorobenzene, tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride
- Non-PAH SVOCs – benzoic acid, benzyl alcohol, benzyl butyl phthalate, bis(2-ethylhexyl)phthalate (BEHP), dibenzofuran, dimethyl phthalate, di-n-butyl phthalate, 2,4-dinitrophenol, pentachlorophenol and phenol
- PAHs – 2-methylnaphthalene, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, pyrene, and cPAHs total toxic equivalent concentration (TEQ)
- PCBs – measured as total PCB Aroclors, total PCB congeners, and total dioxin-like PCBs TEQ
- Pesticides/herbicides – 4,4’-DDD, 4,4’DDE, 4,4’DDT, aldrin, dieldrin, heptachlor, and cis- and trans-chlordane

- Dioxin/furans – Total dioxin/furans (TEQ)

To aid in the evaluation of data gaps for the RI, representative contaminants were identified for each medium. These "representative contaminants" are not contaminants of concern, indicator hazardous substances, or intended to indicate the types of contaminants Site-wide, but rather to they are used in this RI Work Plan to represent the types and distributions of contaminants in particular areas of the Site where sampling has occurred, and data are available. Contaminants of concern and/or indicator hazardous substances will be identified and discussed in the forthcoming RI Report.

The representative contaminants presented in this RI Work Plan were selected based on parameters or classes of parameters exhibiting the greatest magnitude or frequency of screening level exceedances in Tables 6.1 through 6.5 for vadose soil, saturated soil, groundwater, stormwater, and catch basin solids, respectively. Figures 6.1 through 6.8 present location and relative concentrations of representative contaminants for each medium. Data are discussed by media and chemical class below.

6.2.1 Soil

The existing data set for soil is the most comprehensive both in number of samples collected and in spatial distribution. Soil samples[12] collected inside the Pond area were analyzed for a comprehensive list of analytes. Soil samples collected outside of the Pond area were primarily surface soil samples analyzed for PCBs but not analyzed for any other parameters, which represents a data gap for the RI. Figures 6.1 through 6.5 present select representative contaminants in soil from the existing data set including: copper, oil-range TPH, PCE, TCE, vinyl chloride, 4,4-DDT, aldrin, dieldrin, trans-chlordane, and total PCBs.

6.2.1.1 Metals

Copper was selected as a representative metals contaminant in soil because it was one of the metals with exceedances in both groundwater and stormwater. As depicted on Figure 6.1, the extent of vadose zone copper exceedances is limited to the former Pond area based on existing sampling; however, there were limited vadose zone soil samples collected throughout the Site for metals. Likewise, the extent of saturated zone copper exceedances is also limited to the former Pond area and immediately downgradient; the maximum depth that copper was detected above RI screening levels was 11 feet bgs at SB-02 located near the shoreline. Within the former Pond area, the extent of impact is unknown. The remaining nine saturated soil samples collected outside of the former Pond area had detected concentrations of copper less than RI screening levels.

6.2.1.2 TPH

Oil-range TPH was selected as a representative TPH contaminant on the Historical A&B Barrel Parcel, as it had the highest number of detections and exceedances in soil. Figure 6.2 depicts the current understanding of oil-range TPH in vadose and saturated soil. All of the soil samples analyzed for oil-range TPH were collected on the Historical A&B Barrel Parcel. Concentrations exceeding RI screening levels in both the vadose and saturated zones were mainly located in the Pond area. In general, soil samples further away from the

[12] For this RI Work Plan soil has been differentiated as vadose and saturated zones, based on the depth at which the sample was collected in relation to observed groundwater at the time of drilling. Ecology has not decided if this differentiation will be allowed in the RI or what depth would be used to differentiate.

former Pond area did not have detectable concentrations of oil-range TPH above the laboratory reporting limit. These data indicate that on the Historical A&B Barrel Parcel, TPH-impacted soil is largely limited to the former Pond area. The vertical extent of TPH-impacted soil remains undefined, as the saturated samples collected within and adjacent to the former Pond area (to a maximum depth of 10 feet bgs) had concentrations of oil-range TPH exceeding RI screening levels.

6.2.1.3 VOCs

The historical VOC data set for soil samples is limited, with only seven soil samples analyzed for VOCs (as depicted on Figure 6.3), which were all collected near the Pond area. PCE, and its degradation products TCE and vinyl chloride, are selected as representative VOC contaminants for Figure 6.3 because PCE in soil had the highest number of detections and exceedances. The limited data set provides a narrow view into conditions at the former Pond area. None of the sample locations analyzed for VOCs in the former Pond area had both vadose and saturated soil samples collected, so a complete vertical profile of conditions does not exist. However, based on samples collected near each other, it appears that soil in and around the former Pond area is impacted by VOCs at concentrations above RI screening levels in both the vadose and saturated zones. The vertical extent of VOC impact has not been bounded, as these saturated zone samples indicated exceedances to the bottom of boring SB-14, up to 10 feet bgs. Only one sample, SB-22, was non-detect for the representative VOCs.

6.2.1.4 Pesticides

Aldrin, dieldrin, 4,4-DDT, and trans-chlordane are selected as representative pesticide contaminants in soil (Figure 6.4) due to the number of detections and the magnitude of RI screening level exceedances by these compounds. Fourteen (14) soil samples analyzed for pesticides were located in the Historical A&B Barrel Parcel, as depicted on Figure 6.4. Concentrations were highest in samples collected in and around the former Pond area. Pesticide concentrations exceeding RI screening levels extend to at least 16 feet bgs, (SB-03 and SB-10). The maximum depth of pesticide impacts has not been identified. Only two samples, SB-02 and SB-14, had both vadose and saturated zone samples, so a complete vertical profile of pesticide impacted soil remains unknown.

6.2.1.5 Total PCBs

The most comprehensive historical soil data set is the PCB Aroclor analysis, with 51 samples collected throughout the Site. Thirty-six (36) of the 51 samples were analyzed for PCB congeners. Total PCB distribution in soil at the SPM Property is presented on Figure 6.5. This figure illustrates that the highest concentrations of total PCBs are located in and around the former Pond area, and that concentrations decrease with distance north and west from the former Pond area. In addition, several samples (SS-21, SS-25, SS-32, SS-33, and SS-38) collected on the SPM Property along Dallas Avenue South had detections of total PCBs at concentrations exceeding RI screening levels. Elsewhere, total PCB concentrations in surface soils are less than 1 mg/kg[13] but still above the RI screening levels. Additionally, there are several additional soil samples with no PCB detects scattered throughout the SPM Property, and there is no clear pattern to their nature. However, because the soil screening levels for total PCBs are so low (0.000043 ppm), the laboratory reporting limits are above

[13] The RvAL for total PCBs in upland soil in the T-117 EAA Phase 2 cleanup was 1 mg/kg (see Section 2.4.2).

the screening level. The RI will evaluate modifying screening levels for Site contaminants with laboratory reporting limits above RI screening levels.

The depth of PCB-impacted soil extends to at least 16 feet bgs, as evidenced by the Total PCB Aroclor exceedances at SB-03 and SB-10 locations in the former Pond area. These samples were not analyzed for total PCB congeners. The deepest soil sample analyzed for total PCB congeners was B-02 collected from 6.5 to 7 feet bgs.

The Aroclors detected in vadose and saturated soil in the former Pond area were 1242, 1254, and 1260. In surface soil outside of the former Pond area, only Aroclors 1254 and 1260 were detected. Total PCB congeners exceeded the RI screening level in all 36 samples where they were analyzed.

6.2.1.6 RI Recommendation Based on Existing Soil Data

Further evaluation of potential site contaminants in soil across the SPM Property is recommended in order to determine the nature and extent of contamination as well as to address source control concerns. This section does not provide an exhaustive list of data needs for soil, which includes a broader characterization of potential sources and pathways, but rather identifies specific gaps in the understanding of the nature and extent of contamination based on existing data. Based on the existing data, this includes further evaluation of:

- Metals and TPH in vadose zone soil samples Site-wide and saturated soil samples within the former Pond area.
- VOCs and pesticides in soil Site-wide, and the vertical extent of VOCs within the former Pond area.
- The vertical extent of total PCBs in the former Pond area, and total PCBs for the remainder of the SPM Property deeper than 1.5 feet bgs.
- SVOCs including PAHs in soil Site-wide.

6.2.2 Groundwater

The data set for groundwater is limited[14], both in number of samples (eight) collected and spatial distribution. Three groundwater monitoring wells (MW-1 through MW-3) previously located along the shoreline, generally downgradient of the former A&B Barrel area, were sampled on two occasions (October 2007 and March 2008). Two grab groundwater samples in the former A&B Barrel area were collected for analysis from two open boreholes, SB-21 and SB-22, at the time of drilling in July 2011. Although grab groundwater samples from open boreholes are not ideal for characterizing groundwater conditions and often create a high bias for hydrophobic contaminants due to disturbance of the formation and high turbidity, the data can be useful until additional data in that area can be collected.

[14] In addition to the groundwater data collected on the SPM Property discussed in this section, seep samples were collected near the southeast corner of the SPM Property during the T-117 EAA remedial action. That data is discussed in Section 5.2.3 and is presented in Appendix A.5.

Figure 6.6 illustrates the current distribution of data for representative contaminants in groundwater: copper, PCE, TCE, vinyl chloride, 4,4-DDT, aldrin, dieldrin, trans-chlordane, and total PCBs. These contaminants were selected based on the relative magnitude of screening level exceedances and to provide representative analytes of each contaminant suite. The following is a discussion of these representative site contaminants in groundwater.

6.2.2.1 Metals

Copper in the total and dissolved fractions was analyzed in groundwater samples collected from shoreline wells MW-1 through MW-3. Total copper was detected at concentrations exceeding the RI screening level in all samples during at least one of the monitoring events. Dissolved copper was detected above the RI screening level in samples collected from MW-2 and MW-3. The highest concentration of total copper was in the sample collected from MW-3, while the highest dissolved copper was observed in the MW-2 sample, both of which are located downgradient of the former Pond area. The grab groundwater samples were not analyzed for copper.

6.2.2.2 VOCs

PCE, TCE, and/or vinyl chloride were detected in samples collected from MW-2 and MW-3, but at concentrations below RI screening levels. These VOCs were not detected above laboratory reporting limits in the MW-1 sample. The grab groundwater samples from SB-21 and SB-22 were non-detect for PCE and were not analyzed for any of the other VOC contaminants of interest (refer to Table D.5 in Appendix D).

6.2.2.3 Pesticides

One or more pesticides were detected at concentrations above RI screening levels in all groundwater samples adjacent to and downgradient from the former Pond area. Samples collected from MW-1, which was located furthest from the former Pond area, did not have concentrations of pesticides above laboratory reporting limits.

6.2.2.4 Total PCBs

Total PCBs were detected at concentrations above RI screening levels in groundwater samples collected from SB-21 and SB-22. The only Aroclor detected in these samples was 1254. However, as described above, samples collected from open boreholes tend to be highly turbid and detections are typically biased high. PCBs sorb strongly to soil particles and colloids, so the detected concentrations of total PCBs in a turbid sample would not accurately represent groundwater conditions. Groundwater samples collected from MW-1, MW-2, and MW-3 did not detect any PCBs above the laboratory reporting limits. However, at the time the groundwater samples from MW-1 through MW-3 were analyzed, the reporting limits used by the laboratories were higher than reporting limits achievable now by laboratories and well above screening levels.

6.2.2.5 RI Recommendation Based on Existing Groundwater Data

Further evaluation of potential site contaminants in groundwater across the SPM Property is recommended in order to determine the nature and extent of contamination as well as to address source control concerns. This section does not provide an exhaustive list of data needs for groundwater, which includes a broader characterization of potential sources and pathways, but rather identifies specific gaps in the understanding of the nature and extent of contamination based on existing data. Based on the existing data, this includes:

- The extent of metals (total and dissolved fractions), VOCs, and PCBs in groundwater at the Site (including downgradient of the former dry cleaners)
- The extent of pesticides in groundwater within the Pond area

6.2.3 Stormwater

Tables D.7 and D.8 in Appendix D present the existing stormwater sample data collected from catch basins and roof drains, and the StormwateRx™ system (pre-, mid-, and post-treatment), respectively. The treatment system samples were included because they provide insight into the nature of chemicals present in stormwater currently generated in the eastern portion of the Site, prior to treatment.

Representative Site contaminants selected for visually demonstrating potential contaminants in stormwater are shown on Figure 6.7 and include copper, zinc, non-PAH SVOCs, and total PCBs. The stormwater data set is limited in the number of sampling events (in general, only one).

6.2.3.1 Metals

Total copper and zinc were selected as representative site groundwater contaminants because they exceeded RI screening levels in nearly every sample collected, they are the primary constituents regulated under the Boatyard General Permit, and they are COCs for the LDW. The location with the highest copper concentrations was the mid-treatment sample from the StormwateRx™ system. The location with the second-highest zinc concentration was the roof drain stormwater sample collected from SRC-02 on the Tire Factory building, indicative of galvanized roofing materials in the building. Figure 6.7 demonstrates that at every stormwater sample location where copper and zinc was analyzed, the concentrations exceeded screening levels.

Arsenic also exceeded the screening level in one catch basin (CB-02) sample and the influent (pre-treatment) samples to boat wash and StormwateRx™ samples. Because the arsenic screening level is below its PQL, any detection is an exceedance. Cadmium, lead, and nickel were below respective screening levels in the catch basin stormwater samples.

6.2.3.2 SVOCs including PAHs

Benzyl butyl phthalate and BEHP were the only two non-PAH SVOCs in which concentrations exceeded RI screening levels in stormwater samples. BEHP, a compound whose concentrations also exceeded the screening level in saturated zone soil samples, exceeded the screening level (that is below the PQL) in CB-02, CB-06, and the pre- and mid-treatment samples collected at the StormwateRx™ system. The maximum concentration (59 ug/L) was observed in a sample collected from CB-02, which captures drainage from the Tire Factory area. Benzyl butyl phthalate and BEHP were not detected in post-treatment samples collected from the StormwateRx™ treatment systems.

Although not displayed on Figure 6.7, cPAHs were detected above screening levels in samples collected from CB-06, the boat washwater pre-, mid-, and post-treatment samples, and in the pre- and mid-treatment samples from the StormwateRx™ system. The June 2017 post-treatment sample from the StormwateRx™ system contained no detectable cPAHs. Concentrations in the June 2017 boat washwater system treatment sample exceeded cPAH screening levels, but water from this closed-loop treatment system does not discharge directly to the LDW.

6.2.3.3 Total PCBs

Total PCB congeners were detected in all six catch basin samples and StormwateRx™ treatment system samples collected in 2017 (0.00032 to 0.057 µg/L).

6.2.3.4 RI Recommendation Based on Existing Stormwater Data

Stormwater is not an environmental medium regulated under MTCA. However, further evaluation of potential site contaminants in stormwater across the SPM Property and post-treatment system samples is recommended for source control purposes.

6.2.4 Boat Washwater

Tables D.7 and D.8 in Appendix D present the existing boat washwater system (pre-, mid-, and post-treatment) sample data. As described in Section 5.3, treatment and containment systems for boat washwater have been implemented as source control measures. Water from this closed-loop treatment system does not discharge directly to the LDW when it operates as intended, and data from boat washwater samples are not considered representative of Site stormwater. If a release from the closed-loop system were to occur, it would most likely enter the storm drain system that is connected to the StormwaterRx system and undergo treatment prior to discharge to the LDW. Boat washwater has been compared to stormwater RI screening levels as part of a conservative initial source control evaluation to provide insight into the nature of chemicals present in boat washwater currently generated that have the potential to discharge to the LDW via outfalls and to evaluate this process as a potential source if control measures were not in place. Of note, the data evaluation indicates that the boat washwater system is effective at reducing contaminant concentrations in washwater effluent in compliance with the general boatyard permit, but not below screening levels in post-treatment samples. Chemicals selected for visually displaying potential contaminants in boat washwater are the same as stormwater (Figure 6.7).

6.2.4.1 Metals

The highest concentration of copper (18,000 ug/L) and zinc (15,000 ug/L) were detected in the boat washwater samples and exceeded the screening levels by orders of magnitude. Lead and nickel also exceeded RI screening levels in all boat washwater samples collected. The treatment systems for the boat washwater appears effective at reducing metals concentrations as designed.

6.2.4.2 SVOCs including PAHs

No non-PAH SVOCs were detected in boat washwater samples above screening levels. Although not displayed on Figure 6.7, cPAHs were detected above screening levels in the 2017 samples collected from the boat washwater pre-, mid-, and post-treatment samples.

6.2.4.3 Total PCBs

Total PCB Aroclors were not detected above the laboratory reporting limit in any samples, but total PCB congeners were detected at concentrations exceeding the screening level in all boat washwater treatment system samples collected in 2017.

6.2.4.4 RI Recommendation Based on Existing Boat Washwater Data

No further characterization of boat washwater is recommended in the RI; rather, the stormwater-to-LDW pathway will be evaluated by directly sampling Site stormwater as described in Section 9.

6.2.5 Catch Basin Solids

Tables D.9 and D.10 in Appendix D summarize the solids data for samples collected from catch basins and the stormwater vault upstream of the StormwateRx™ system. This dataset is limited by the number of sampling events and the number of analytes evaluated. Figure 6.8 presents key chemicals of interest for catch basin solids. Chemicals selected for visually demonstrating potential contaminants in catch basin solids are the same as stormwater and include copper, zinc, non-PAH SVOCs, and total PCBs.

Although not selected as a chemical for visually demonstrating potential contamination, total dioxin/furan TEQ exceeded the RI screening level in the one sample (CB-09) that was analyzed for dioxin/furans.

6.2.5.1 Metals

Only two catch basin solids samples, CB-09 and the stormwater vault prior to the StormwateRx™ system, were analyzed for metals. In both of these samples, copper and zinc concentrations exceeded the screening levels. Concentrations of other metals that exceeded screening levels in both samples included arsenic, cadmium, and total chromium. Concentrations of lead and mercury exceeded screening levels in only the stormwater vault sample. Because of the limited data set, meaningful conclusions on the results cannot be made.

6.2.5.2 SVOCs including PAHs

Similar to the metals above, only samples collected from CB-09 and the stormwater vault were analyzed for SVOCs. In general, the stormwater vault solids concentrations had more exceedances and higher concentrations of non-PAH SVOCs and PAHs than the CB-09 sample. Because of the limited data set, meaningful conclusions on the results cannot be made.

6.2.5.3 Total PCBs

The most comprehensive data set for catch basin solids at the Site is for total PCBs. As depicted on Figure 6.8, total PCBs exceeded screening levels in three of the 10 locations sampled. Exceedances were observed at CB-06, CB-09, and the stormwater vault prior to the StormwateRx™ treatment system. Catch basins CB-02 and CB-05 are not connected to one another but discharge to the SPM Outfall. Catch basins CB-07, CB-08, CB-09, and the stormwater vault are all connected in-line with each other (with CB-07 furthest upstream) and discharge to Outfall UOF-1 (after being treated by the StormwateRx™ system) and/or OF-2214 (during periods of overflow). Concentrations of total PCBs generally increased as sample collection moved progressively downstream from CB-07 to CB-09 to the StormwateRx™ pre-treatment vault.

6.2.5.4 RI Recommendation Based on Existing Catch Basin Solids Data

Stormwater solids are not an environmental medium regulated under MTCA. Rather, they are of primary interest for tracing sources of contaminants discharging via stormwater to the LDW as an element of source control. Further evaluation of potential site contaminants in catch basin solids across the SPM Property is recommended for contaminants identified in stormwater for source control purposes.

7 Preliminary Conceptual Site Model

The Preliminary Conceptual Site Model (preliminary CSM), based solely on the existing information presented in prior sections, describes potential on-Property and off-Property sources of contaminants (historical and current), initial chemicals of interest, potential contaminant migration pathways, and potential receptors and pathways by which they may be exposed to SPM Property-derived contaminants. This preliminary CSM does not make determinations of complete/incomplete exposure pathways; rather, that determination will be made in the RI after additional data are collected.

7.1 Potential Sources of Contamination

This subsection describes historical operations on and near the Site in addition to current operations and ownerships that are potential and/or confirmed sources of contamination.

7.1.1 South Parcel

As discussed in Sections 2.2.1 and 2.3.1.1, the South Parcel was historically used for potential boat manufacturing in at least the 1950s and has been used for activities associated with boat maintenance for at least the past 70 years. Potential and/or confirmed contaminant sources associated with historical (Figure 2.1) and current (Figure 2.2) operations on or near the Site include:

- Stormwater running onto the Site from Dallas Avenue South
- The historical presence of a single 1,000-gallon UST that was located proximal to the existing dock access (1981-1991)
- Historical boat manufacturing as shown on the 1950/1951 Sanborn map (Appendix A.1)
- Historical discharge of treated boat washwater via the infiltration sump inside the Harbormaster shop and discharge to the LDW
- Do-it-yourself boat maintenance, including sanding and refinishing
- Infiltration of stormwater into pervious areas

7.1.2 Historical A&B Barrel Parcel

As discussed in Sections 2.2.2 and 2.3.1.2, the Historical A&B Barrel Parcel was used for barrel reconditioning and cleaning for approximately 10 years ending in 1960 and has been used for marina activities for at least the past 40 years. Potential contaminant sources associated with historical (Figure 2.1) and current (Figure 2.2) operations on or near the Site include:

- The historical presence of a single 1,000-gallon UST located adjacent to the southeast corner of the Historical A&B Barrel Parcel (1970-1981)
- The historical operations of the A&B Barrel Co., particularly in the Pond area
- The historical fire associated with the A&B Barrel Co.

- Historical outdoor vessel pressure washing, wherein untreated washwater was discharged to ground surfaces and to the LDW
- Historical boat bottom cleaning
- Do-it-yourself boat maintenance, including sanding and refinishing
- Documented leaks of oil from the crane to pervious ground surfaces (Ecology, 2005)
- Potential discharge of untreated stormwater and solids to the LDW from the SPM Outfall, Outfall UOF-1, and Outfall OF-2214 during high-flow stormwater events[15]
- Infiltration of stormwater into pervious areas

Current product and chemical use on the South Parcel was documented during a chemical inventory update in 2016 (the detail for which is found in Table 1 of Appendix A.8). The following is a summary of current product and chemical use:

- Boat Wash Water Treatment – cleaners, coating, and solvents for the treatment system, new and spent motor oil

7.1.3 Central Parcel

As discussed in Sections 2.2.3 and 2.3.1.3, the Central Parcel has historically been used as a gasoline service station, as a radiator repair shop, for automotive maintenance and repair, as a mobile home park, and for boat storage for over 90 years, beginning prior to the 1930s. Potential contaminant sources associated with historical (Figure 2.1) and current (Figure 2.2) operations on or near the Site include:

- The historical operation of a gasoline service station, including two 550-gallon USTs and a hydraulic hoist
- The historical operation of a radiator repair shop
- The historical and current operation of an automotive service station with in-ground hydraulic hoists and a used-oil AST
- Do-it-yourself boat maintenance, including sanding and refinishing
- Stormwater running onto the Site from Dallas Avenue South
- The historical residences and mobile homes and associated potential for septic systems

Current product and chemical use on the Central Parcel was documented during a chemical inventory update in 2016 (the detail for which is found in Table 1 of Appendix A.8). The following is a summary of current product and chemical use:

- South Park Tire Factory – automotive engine oil, waste oil, antifreeze, and small quantities of automotive-related chemicals.

[15] Discharge of untreated stormwater and solids was documented in a report to Ecology in March and April 2016.

- SPM Main Shop – small volumes of petroleum-based lubricants, adhesives, degreasers, and paints, waste oil, and antifreeze.
- Woodworking Shop – paints and enamels
- SPM Administrative office – miscellaneous household cleaners, solvents, and pesticides for weed and pest management. According to SPM management, only household pesticides (e.g., Raid®) are used on an as needed basis and only in de minimis quantities. There is no formal weed or pest control program.

7.1.4 North Parcel

As discussed in Sections 2.2.4 and 2.3.1.4, the North Parcel was historically used for residences prior to redevelopment in 1987. Potential sources of contamination associated with historical (Figure 2.1) and current (Figure 2.2) operations include the current use as a marine engine maintenance and repair shop for over 30 years and historical residences and associated potential for heating-oil USTs and septic systems.

Current product and chemical use on the Central Parcel was documented during a chemical inventory update in 2016 (the detail for which is found in Table 1 of Appendix A.8). The following is a summary of current product and chemical use:

- Rick's Master Marine – engine gear oil, antifreeze, waste oil, waste mixed solvents, miscellaneous boat maintenance and cleaning products.

7.1.5 Neighboring Properties

As discussed in Section 2.4, there are three additional potential sources of contamination associated with neighboring properties:

- South – The Port's T-117 Upland Property (part of the T-117 EAA) and associated PCB contamination (historical)[16]
- West – Dallas Avenue South/adjacent streets and yards (part of the T-117 EAA) and associated PCB contamination (historical)
- Northwest – The two historical dry cleaning operations and associated potential chlorinated solvent contamination located upgradient to the south across Dallas Avenue South at 8500 14th Avenue South (historical)

7.2 Potential Site Contaminants

To support the preliminary CSM, potential Site contaminants were identified by: reviewing the existing analytical data compared to RI screening levels; reviewing potential Site contaminants identified in the AO, including potential contaminants from historical Site uses; and reviewing SPM's chemical inventory (presented in Appendix A.8). Tables of all available SPM Property analytical data are presented in Appendix D (Tables D.1 through

[16] A removal action pursuant to an Administrative Agreement and Order on Consent with EPA was completed at both the Port's T-117 Upland Property and the adjacent side streets and yards (collectively referred to as the T-117 EAA), the findings of which are document in *T-117 Sediment and Upland Cleanup Removal Action Construction Report* (AECOM, 2016).

D.10), and summary statistics are presented in Tables 6.1 through 6.5. Potential contaminants from historical and current Site operations are summarized as follows:

Land Use / Operation	Potential Contaminants	Reference
A&B Barrel	Drum residuals including paints, organochlorine pesticides, fuels and oils; sodium hydroxide; and dioxin/furans (potential combustion byproduct from fire)	1
Boat Manufacturing	Solvents, paints (potentially containing metals [particularly copper, zinc, and TBT] and PCBs), glues and other adhesives, lacquers, tars, sealants, epoxy wastes, and other miscellaneous chemical wastes	2
Boat Maintenance	Diesel, metals (particularly copper, zinc, and TBT), wood preservative and treatment chemicals, paints, waxes, varnishes, and motor oils and wastes	2, 3
Dry Cleaner	Solvents, spotting chemicals	2, 4
Service Stations	Gasoline, antifreeze, transmission fluid, solvents and degreasers, brake fluid, motor oils, waste oils, hydraulic fluids (potentially including PCB-containing fluids)	2, 5
USTs	Gasoline and diesel (including heating oil and potential fuel additives)	2, 5
Mobile Home Parks	Septic waste, household hazardous wastes (e.g., cleaning solutions, paints, etc.)	2
Radiator Repair Shop	Metals (particularly copper, lead, and zinc), antifreeze, paints and paint wastes, solvents and degreasers,	2, 6

References:

1 – Existing analytical data and Agreed Order
2 - Oregon Department of Environmental Quality (DEQ), 2001
3 – Eklund and Eklund, 2014
4 – EPA, 2011
5 – EPA, 2020
6 – ODEQ, 2007

Based on the available analytical data (Section 6), the chemical inventory, current site uses described above, historical operations, and historical contaminants identified in the Agreed Order, the following classes of chemicals have been identified as potential contaminants at the Site to be evaluated during the RI:

- Metals
- TPHs (gasoline-, diesel-, and oil-range)
- VOCs
- PAHs
- Non-PAH SVOCs

- Organochlorine Pesticides & Herbicides
- PCBs
- Dioxins & Furans
- Tributyltin

Analyses for each media are discussed in Section 9.1 and presented on Tables 9.1 and 9.2. Individual chemicals for each chemical class listed above are presented in Tables E.4 and E.5 of the SAP/QAPP.

7.3 Potential Contaminant Migration Pathways

The potential contaminant migration pathways applicable to the SPM Property are as follows:

- Leaching of contaminants from soil to groundwater
- Migration of dissolved-phase contaminants in groundwater and discharge to sediment and then surface water of the LDW
- Transport of dissolved-phase contaminants in stormwater discharging to LDW surface water via pipes or overland flow, including groundwater infiltration into stormwater pipes and discharge to LDW surface waters
- Transport of soil/solids contaminants suspended in stormwater discharging to LDW surface sediment via pipes or overland flow
- Erosion of soil contaminants in contaminated shoreline bank soils to LDW sediment and transport of soil contaminants via surface or overland flow
- Vapor-phase transport of volatile contaminants from vadose zone soil or shallow groundwater to soil gas and then to indoor air inside existing structures

A number of physical, chemical, and biological processes affect transport and fate of organic and inorganic contaminants at the Site. Of particular importance, tidal fluctuations induce twice-daily reversals in nearshore groundwater flow directions. This increases groundwater flow path length and hydrodynamic dispersion, and circulates oxygenated river water into the subsurface, creating a physically and chemically dynamic nearshore groundwater environment termed the transitional zone.

7.4 Potential Receptors and Potential Exposure Pathways

The potential receptors and all potential exposure pathways for contaminants in Site environmental media are described below and displayed schematically on Figure 7.1.

7.4.1 Potential Receptors

Based on the current and likely future uses of the SPM Property (described in Section 2.3), potential receptors of Site contaminants are as follows:

- Humans, including recreational users, commercial workers, and residents on the SPM Property (direct)

- Terrestrial ecological receptors (plants, soil biota, wildlife) on the SPM Property (direct)
- Benthic organisms in LDW sediment (indirect)
- Marine aquatic organisms in LDW surface water and humans who may consume them (indirect)

7.4.2 Potential Exposure Pathways by Media

The pathways by which the potential receptors may be exposed to Site contaminants are listed below by environmental media.

7.4.2.1 Soil

- Human direct contact[17] with contaminants in soil
- Terrestrial ecological receptor direct contact with contaminants in soil

7.4.2.2 Indoor Air

- Human inhalation of vapor-phase contaminants in indoor air

7.4.2.3 LDW Sediment

The following are exposure pathways and receptors for LDW sediment identified in the LDW ROD (EPA, 2014) that could be affected by Site contaminants:

- Benthic organisms (e.g., invertebrates), fish and shellfish exposed to Site contaminants in LDW sediment
- Higher-trophic-level ecological receptors (e.g., river otters, seals, birds) consuming the benthic organisms, fish and shellfish, and incidentally ng ingesting sediment
- Human consumption of fish and shellfish exposed to Site contaminants in LDW sediment
- Human incidental ingestion and dermal contact with Site contaminants in LDW sediment

7.4.2.4 LDW Surface Water

The following are exposure pathways and receptors for LDW surface water identified in the LDW ROD (EPA, 2014) that could be affected by Site contaminants, warranting further investigation:

- Benthic organisms, fish and shellfish exposed to Site contaminants in LDW surface water
- Higher-trophic-level ecological receptors ingesting Site contaminants in LDW surface water and in fish and shellfish exposed to Site contaminants in LDW surface water
- Human consumption of fish and shellfish exposed to Site contaminants in LDW surface water

[17] Incidental ingestion of soil.

8 Investigation Rationale

As described in Section 1.1 and Ecology guidance, the RI is intended to collect, develop, and evaluate sufficient information regarding a site to select a cleanup action under WAC 173-340-360 through 173-340-390. Additionally, this RI is intended to support Ecology's Source Control Strategy for the LDW. The goals of the Source Control Strategy are to address existing, ongoing sources of contaminants to the LDW and to minimize the risk of recontaminating sediments above the RALs in the short-term and cleanup levels in the long-term for the LDW (Ecology, 2016). Specific objectives of the RI are to:

- Obtain data of sufficient quality and quantity to describe the physical setting and physical properties of soil, groundwater, stormwater, and catch basin solids.
- Determine the nature and extent of contamination in soil and groundwater.
- Evaluate potential pathways of hazardous substances from the Site to the LDW.
- Determine the appropriateness of an Interim Action to address potential ongoing sources.
- Characterize the fate and transport of identified contaminants, including how contaminants migrate between media and possibly between properties.
- Use the information collected to assess potential risk to human health and the environment through complete exposure pathways under the current and potential future land use(s).
- Determine COCs and unacceptable risks that will be carried forward into a future FS.
- Report the methods and findings of the RI to Ecology and project stakeholders, including the local community.

As described in the preceding sections, previous investigations provided a preliminary or partial assessment of these objectives; however, additional data are needed to complete characterization for the entire Site in accordance with MTCA. This Section is organized as follows:

- Section 8.1 identifies general data gaps.
- Section 8.2 provides data quality objectives for collecting additional data.
- Section 8.3 describes the general approach and phasing for Site characterization activities.

A detailed description of data collection activities is provided in Section 9 and in the accompanying SAP/QAPP (Appendix E).

8.1 Identification of Data

This section discusses the general data needs to complete Site characterization. Data needed are described below in three general categories:

- Site physical characteristics, including geology and hydrogeology
- Nature and extent of contamination in Site environmental media
- Fate and transport of COCs, including the potential migration of contaminants to potential receptors such as the LDW

8.1.1 Site Physical Characteristics

Characterization of the physical properties of the soil is necessary to evaluate the contaminant migration pathways. Representative soil samples will be collected from lithologic units for physical characterization, which will include ASTM International (ASTM) visual soil logging, estimation of sand, silt, gravel, and organic carbon content.

The needs associated with the hydrogeology of the Site include data to define the spatial distribution of aquifer and aquitard units across the Site and understand groundwater flow and contaminant transport to and from the Site. The installation and sampling of groundwater monitoring wells is needed to provide these data. The information needed to satisfy these data needs will be obtained by sampling groundwater for chemical and geochemical parameters, logging geologic information, and measuring static and transient water levels, including potential tidal influence.

8.1.2 Nature and Extent of Contamination

A primary objective of the RI is to delineate the nature and distribution of contamination in the potentially affected media at the Site, which include soil and groundwater. To accomplish this objective, a phased investigation approach will be implemented: Phase 1 will focus on identifying and characterizing sources and their pathways to the LDW; and Phase 2 will characterize the site and define the nature and extent of contamination.

Historical investigations have focused on characterization of soil and groundwater for a large suite of contaminants within and downgradient of the Pond area; characterization of surface soil across the SPM Property for PCBs (Aroclors and congeners); and characterization of stormwater and catch basin solids discharging from the SPM Property to the LDW for metals, SVOCs including PAHs, and PCBs (Aroclors and congeners).

Although these historical investigations have provided some existing data (as presented in Section 6.3), additional data are required to compile a sufficient understanding of contaminant nature and extent and associated Site risks to complete the RI and source control evaluations. Chemical analysis of soil and groundwater samples will be collected to evaluate potential sources of contamination to the LDW, and define the lateral and vertical extent of contamination from the Site (i.e., the Site boundary). Based on existing information, the occurrence and extent of contaminants in the following areas require additional investigation during Phase 1 of the RI:

- Further delineation of contamination in the Pond area, including vertical extent, by investigating at the downgradient edge of the estimated pond edge. the purpose for targeting the edge of the pond is to avoid drilling through Pond contaminants and potential carry-down issues.
- Characterization of contamination in soil and groundwater in the former gasoline service station and current repair shop area

- Characterization of contamination in soil and groundwater in the historical boat manufacturing building
- Characterization of soil and in areas of the SPM Property adjacent to Dallas Avenue South and T117
- Characterization of soil and groundwater at representative locations within the boat maintenance area
- Characterization of contamination in groundwater downgradient of the former residential areas in the Central Parcel to assess potential sources (i.e., undocumented heating oil tanks)
- Characterization of contamination in groundwater downgradient of the former adjacent dry cleaner
- Characterization of contamination of any contamination found in the potential source areas (identified in Section 7.1)

After review and evaluation of Phase 1 data, a RI Work Plan addendum will be prepared describing work to achieve the RI objectives identified in Section 1.1. Phase 2 work may include additional borings, samples, and wells for Phase 2 to delineate the lateral and vertical extents of contamination identified during Phase 1, or to evaluate other areas of this Site identified as being potentially contaminated.

8.1.3 Contaminant Fate and Transport

Contaminants present in Site media may migrate from one location to another via the fluid flow processes of advection (including stormwater transport of suspended particles) or diffusion, transfer between media via partitioning mechanisms, and attenuation as the result of physical, chemical, or biological processes. Contaminants can also be transformed into different chemicals or destroyed by biological or chemical reactions.

The data needs associated with the evaluation of contaminant fate and transport include data identified in Section 8.1.1 and 8.1.2 to define the physical characteristics of soil, aquifers and aquitards, to evaluate natural attenuation and degradation of contaminants in soil and groundwater, and to evaluate groundwater chemical data to assess spatial and temporal trends.

Additional data will also need to be collected to inform the evaluation of contaminant transport within and between environmental media and to evaluate potential mechanisms for contaminant attenuation. Data needs include:

- Stormwater and catch basin solids chemical data, to evaluate stormwater as a transport mechanism between surface soil and LDW sediment.
- Soil and groundwater chemical data, along with physical characteristics, will be used to evaluate potential migration pathways to soil vapor and indoor air. Soil gas sampling may be employed to further evaluate the vapor intrusion pathway if warranted based on the results of the soil and groundwater evaluation.
- Groundwater geochemical data, potentially including but not limited to TSS, TDS, dissolved organic carbon (DOC), nitrate, nitrite, sulfate, sulfide, ferrous iron,

dissolved manganese, alkalinity, pH, dissolved oxygen, turbidity, and oxidation-reduction potential, to evaluate natural attenuation and biological and chemical degradation of contaminants. The need for these data will be assessed at the conclusion of the Phase 1 sampling program when contaminants of concern with respect to migration are identified and the need for fate/transport analysis known.

8.2 Data Quality Objectives

The data needs for the RI have been developed through a methodical planning process to ensure appropriate sampling, analyses, and data evaluations are conducted to meet the RI objectives. This process, called Data Quality Objectives (DQOs), is described in EPA's *Guidance on Systematic Planning Using the Data Quality Objective Process* (EPA, 2006). The seven-step DQO process is a tool to determine the type, quantity, and quality of data necessary for any subject analysis. The seven steps are:

1. State the problem
2. Identify the Goal of the Study
3. Identify Information Inputs
4. Define the Boundaries of the Study
5. Develop the Analytic Approach
6. Specify Performance or Acceptance Criteria
7. Develop the Plan for Obtaining the Data

DQOs are developed to address the data needs identified to complete the RI:

1. Nature and Extent of Contamination in Soil (Table 8.1)
2. Nature and Extent of Contamination in Groundwater (Table 8.2)
3. Site Physical Characteristics (Table 8.3)
4. Contaminant Fate and Transport: Soil/Groundwater to Sediment/ Surface Water Pathway (Table 8.4)
5. Contaminant Fate and Transport: Surface Soil/Stormwater to Sediments/Surface Water Pathway (Table 8.5)
6. Contaminant Fate and Transport: Soil/Groundwater to Indoor Air Pathway (Table 8.6)

These DQOs are summarized in Tables 8.1 through 8.6. The characterization approach to fulfill these DQOs is described in the following sections.

8.3 Phased Investigation Approach

To enable efficient and focused data collection, investigation activities will be performed in a phased approach that enables the data from the initial phase to inform the scope of data collection in the next phase. The investigations for this RI Work Plan will consist of two main phases of work:

- Phase 1 will focus on: (a) characterizing potential sources of contamination, as identified by the review of historical and prior investigation documents; (b) identifying COPCs; and (c) sampling selected media to evaluate potential contaminant migration pathways from the Site to the LDW.
- Using the historical data and Phase 1 characterization data, Phase 2 will (a) refine the identified nature and extent of contamination, (b) further evaluate potential transport and exposure pathways and risks, and (c) confirm COPCs/COCs.

The general scope of each phase is described below. The specific scope of Phase 1 is provided in Section 9, below. After completing Phase 1, the collected data will be evaluated to update the CSM and determine data needs for Phase 2. The updated CSM, including tables and figures summarizing the collected data, identification of Site COPCs, and a specific scope for Phase 2 will be provided in an RI Work Plan Addendum that will be submitted for Ecology review, discussion, and approval.

8.3.1 Phase 1 Data Collection

During Phase 1, potential contaminant source areas will be investigated based on locations of historical Site features. These areas include:

- The former A&B Barrel area
- The historical boat manufacturing building area
- The former gasoline service station and current repair shop area
- The former and current boat maintenance areas that cover a majority of the property
- Downgradient of the adjacent former dry cleaner
- Downgradient of the former residential areas

The existing investigations to date have focused on the former Pond area and characterizing PCBs in surface soil across the Property, with very little if any characterization of the other potential source areas. Phase 1 is intended to refine characterization in the Pond area (including assessing conditions west of the Pond area along the T117 property line) and beginning characterization of the remainder of the Property.

The potential source areas will be investigated using soil borings within the areas and monitoring wells within and/or downgradient of the areas. Soil and groundwater samples will be collected and analyzed for chemical suites based on historical operations in each area.

The other primary objective of this work is to evaluate the potential for contaminant migration to the LDW. In Phase 1, this work will include:

- Pre-investigation field work including wet-weather[18] site walk during a precipitation event, utility locating, and marking previously un-marked sanitary utilities. Further detail is provided in the SAP in Appendix E.
- Installation of monitoring wells and analysis of groundwater along the shoreline during the wet-weather season[19], as close as practical to the point of groundwater discharge to the LDW, to evaluate the soil/groundwater-to-surface water/sediment pathway
- Analysis of two stormwater events to monitor stormwater[20] discharging to the SPM Outfall[21] and Outfall UOF-1, as close as practical to the outfalls, to evaluate the stormwater-to-surface water/sediment pathway[22]
- Analysis of catch basin solids from CB-02, CB-06, and the StormwateRx pump vault (SWRX-Pre), to evaluate the catch basin solids-to-surface water/sediment pathway
- Analysis of surface soil in pervious areas within the major stormwater catchment areas, including areas of current or former boat maintenance activities, to evaluate potential contributions of surface soil to stormwater
- Analysis of erodible bank soils, if observed during the wet-weather RI site walk
- Confirm groundwater flow direction

All of the soil data collected will also be used to assess the direct contact exposure pathways for humans and terrestrial ecological receptors.

8.3.2 Phase 2 Data Collection

During Phase 2, the extent of contaminated soil and groundwater identified in Phase 1 will be refined using additional soil borings, monitoring wells, and/or surface soil samples as appropriate to complete the Site delineation and characterization. The type, number, and location of Phase 2 explorations will be identified in the RI Work Plan Addendum submitted to begin discussion with, and approval by, Ecology prior to initiating the Phase 2 data collection.

If stormwater data indicate a potential source of contaminants to the LDW via outfall discharges, Phase 2 would include additional characterization of this pathway to determine the potential source of contaminants and evaluate if source control is warranted for that pathway. Phase 2 work may include sampling of catch basin solids and/or stormwater from specific catch basins and/or sampling of exposed surface soils.

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[18] Wet weather season is presumed to be October through May, consistent with the boatyard permit.
[19] Phase 1 well installation will be conducted during wet weather season to evaluate the potential for saturated fill conditions that may be seasonal.
[20] Samples representing the combined suspended-solids and dissolved-phase contaminant concentrations.
[21] Based on available information, access to the SPM Outfall for sampling is impracticable. Stormwater samples will be collected from catch basins that have been determined to discharge to the SPM Outfall based on dye tracing (refer to Section 2.3.2.2.4).
[22] Sampling events for Phase 1 will be as soon as possible after Work Plan approval (estimated February 2021) and near the end of the wet season (approximately April 2021). The need for additional stormwater samples will be evaluated and discussed with Ecology after Phase 1.

If groundwater data along the shoreline indicates a potential source of contaminants to the LDW via the groundwater pathway, Phase 2 would include additional characterization of this pathway, such as sampling to characterize the source and extent of contamination along the shoreline (i.e., seeps). If groundwater wells installed in the fill during Phase 1 indicate the presence of contamination, then alluvium wells (i.e., wells installed in the alluvial aquifer below the fill) will be installed during Phase 2.

If either stormwater or groundwater data indicate a potential source of contaminants to the LDW, the RI Work Plan Addendum would evaluate available LDW sediment data as an additional line of evidence in determining if impacts to sediment potentially related to Site contamination are present.

Temporal variability in groundwater quality would be evaluated by conducting wet- and dry-season monitoring at wells to assess seasonal variability.

9 Proposed Remedial Investigation Tasks

This section presents the rationale and locations for RI data collection to address data gaps described in Section 8 pertaining to Site physical characteristics and contaminant nature, extent, and transport pathways.

9.1 Phase 1 Field Investigation

This section describes the Phase 1 field investigation activities to be completed within each of the four identified potential contaminant source areas (Section 9.1.1), and to assess potential contaminant migration pathways to the LDW (Section 9.1.2). Figure 9.1 depicts the proposed Phase 1 exploration locations. Some borings address both objectives and are referenced in Sections 9.1.1 and 9.1.2 below. Tables 9.1 and 9.2 identify the Phase 1 exploration locations, their objectives, and the proposed samples and chemical analyses for soil and for groundwater, respectively.

Section 9.1.3 provides details on the methods and protocols for conducting the Phase 1 investigation. Additional details regarding the techniques and quality assurance/quality control procedures to be employed for collecting reliable data are described in the Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP; Appendix E). Appendix F provides the Site-specific Health and Safety Plan that Aspect field personnel will follow during the Phase 1 data collection work. Appendix G presents the Archaeological Monitoring and Inadvertent Discovery Plan providing notification procedures to follow if potential cultural resources or human skeletal remains are discovered during subsurface investigations.

9.1.1 Investigation of Potential Source Areas

As identified in Section 7.1, the main potential source areas on the SPM Property include the former A&B Barrel area; the historical boat manufacturing building; the former service station and current auto repair shop; the former and current boat maintenance areas (including soil areas adjacent to Dallas Avenue South), and the property boundary between the SPM Property and T-117 Upland Property.

9.1.1.1 Former A&B Barrel Area

Five soil borings, four completed as monitoring wells, will be advanced to refine the current understanding of the lateral and vertical extent of soil and groundwater contamination in the Former A&B Barrel Area and the potential for migration from this area to the LDW. The following are the proposed A&B Barrel area explorations and their objective:

- SB-26, to be advanced near the former building, to determine if the area of soil contamination around the former Pond area extends laterally to the south beneath existing structures.
- MW-05, to be completed on the inferred downgradient edge of the Pond area, to delineate the vertical extent of contamination beneath the Pond area and determine groundwater quality within the Pond area. This boring will be the deepest exploration to be completed during Phase 1.

- MW-04 and MW-06, at both ends of the sheet pile wall (i.e., currently hydraulically downgradient of the Pond area), to evaluate chemical concentrations in soil in both the vadose and saturated zones and the direction of groundwater flow in the vicinity of the sheet pile wall. These will be completed as monitoring wells to also assess the groundwater-to-surface water and groundwater-to-sediment pathway (see Section 9.1.2). Certain access constraints, such as protecting the GAC mat outside the sheet pile wall, may dictate adjusting these locations at the time of drilling.
- MW-07, to be completed on the shoreline, to evaluate chemical concentrations in soil in both the vadose and saturated zones. This will be completed as a monitoring well to also assess the groundwater-to-surface water and groundwater-to-sediment pathway (see Section 9.1.2).

Soil sample screening, collection, and analysis or archive protocols are described in Section 9.1.3 and Appendix E. Targeted soil samples and analytes are listed in Table 9.1, the sample selection methodology presented in Table 9.2, and groundwater analytes are listed in Table 9.3.

9.1.1.2 Historical Boat Manufacturing Building Area

Three soil borings, one completed as a monitoring well, will be advanced to evaluate the nature and extent of contamination at the historical boat manufacturing building and evaluate the potential for migration to the LDW. Because access inside the building is constrained, borings will be advanced at the perimeter of the building[23]. The following are the proposed historical boat manufacturing building area explorations and their objective:

- SB-27 and SB-28, located on the west side and the east side of the building (shoreward of the Harbormaster shop), to evaluate chemical concentrations in soil in both the vadose and saturated zones.
- MW-08, located along the shoreline downgradient of the building, will be completed as a monitoring well. This will be completed as a monitoring well to also assess the groundwater-to-surface water and groundwater-to-sediment pathway (see Section 9.1.2).

Soil sample screening, collection, and analysis or archive protocols are described in Section 9.1.3 and Appendix E. Targeted soil samples and analytes are listed in Table 9.1, the sample selection methodology presented in Table 9.2, and groundwater analytes are listed in Table 9.3.

9.1.1.3 Former Gasoline Service Station/Former Radiator Repair/Current Auto Repair Shop Area

Six borings, two of which will be completed as monitoring wells, will be advanced to evaluate the potential presence of contamination at the historical gasoline station, historical radiator repair shop, and existing auto repair building[24], while simultaneously evaluating

[23] The historical manufacturing building is believed to be the same structure that currently exists; however, the northern boring will be located beneath the former footprint of this building, which was narrowed in the northerly direction when the shoreline was modified.
[24] Access for drilling inside the existing building is limited. Proposed borings are located as close as practicable to existing and historical operation areas.

the potential for migration of contamination from the off-site former dry cleaner. The following are the proposed explorations and their objectives:

- SB-29, located near the northeast side of the existing auto repair building, is positioned to evaluate the potential presence of contamination resulting from the existing auto repair building and evaluate surface soils related to general boat maintenance activities. The location will be approximately downgradient of the used oil AST observed in the shop during the November 21, 2019 site walk.
- SB-30, SB-31, and MW-13, located near the former gasoline station pump islands and likely UST locations along Dallas Avenue South and South Thistle. Well MW-13 is also positioned generally downgradient of the former dry cleaner on the south side of Dallas Avenue South and will be used to assess on-SPM Property migration of potential groundwater contamination from that facility.
- MW-12, located adjacent to and downgradient of the existing auto repair building. This well is also positioned generally downgradient of the former gasoline station and will be used to assess migration of contaminants from that area and the existing auto repair building.
- SB-34, located behind the former radiator repair shop, is positioned to evaluate the potential presence of contamination resulting from past business practices by the radiator repair shop operators. The location of this boring is near what was presumed to be the backdoor of the former radiator repair shop where darkened soil appears in aerial photographs.

Soil sample screening, collection, and analysis or archive protocols are described in Section 9.1.3 and Appendix E. Targeted soil samples and analytes are listed in Table 9.1, the sample selection methodology presented in Table 9.2, and groundwater analytes are listed in Table 9.3.

9.1.1.4 Former and Current Boat Maintenance Areas

As a potential source area, this refers to the potential presence of contamination in soil in the current unpaved boat maintenance yard areas in the Central and South parcel areas and historically unpaved boat maintenance area (i.e., areas that are paved now but historically were unpaved[25]), as well as potential stormwater runoff from Dallas Avenue South onto the SPM Property. Evaluating soil in these areas will help characterize the direct contact, leaching to groundwater, and potential transport of surface soils to stormwater pathways, followed by the stormwater-to-surface water and -sediment pathways. This potential source area is identified as the pervious and impervious surface areas on Figure 9.1 where boats are currently stored. The majority of the pervious surfaces on the SPM Property are located within the SPM Outfall catchment area, so the majority of the investigation for Phase 1 will be in this area. The following are the proposed explorations and their objectives:

- SB-32, located in a pervious area between CB-01 and CB-05 within an area of current boat storage and maintenance. This boring is intended to evaluate nature

[25] Prior to 1981, SPM property was entirely unpaved. In August 1981, portions of the property were paved, in particular the main roadways and a boat ramp. Based on aerial photograph interpretation, periodic paving of other areas was completed between 1981 and 1985 including additional roadways and parking areas.

and extent of soil impacted by current boat maintenance activities and is within an area where stormwater infiltration and sheetflow occur.

- SB-33, located near CB-05 and CB-06 within a pervious area of current boat storage and maintenance. This boring is intended to evaluate nature and extent of soil impacted by current boat maintenance activities and is within an area where stormwater infiltration and runoff to adjacent catch basins occurs.
- MW-14, located within a pervious area of current boat storage and maintenance close to Dallas Avenue South, within the SPM Outfall catchment but distant from any existing catch basins. This well is positioned to evaluate nature and extent of surface soil impacted by current boat maintenance activities and is within an area where stormwater infiltration likely occurs. This well will also provide opportunity to assess property-wide groundwater flow direction and groundwater quality near the center of the property.
- MW-15, located within an impervious, asphalt paved area of current boat storage and maintenance close to Dallas Avenue South, within the Unnamed Outfall No. 1 catchment area. This well is positioned to evaluate nature and extent of surface soil (below the current asphalt pavement) impacted by former boat maintenance activities. This well will also provide opportunity to assess property-wide groundwater flow direction and groundwater quality near the southwest side of the property.

Soil sample screening, collection, and analysis or archive protocols are described in Section 9.1.3 and Appendix E. Targeted soil samples and analytes are listed in Table 9.1; for this investigation area, all surface soil samples will be submitted for VOC analysis. Groundwater analytes are listed in Table 9.3.

9.1.1.5 T-117 Property Line

Two hand-auger shallow soil borings will be advanced on the SPM property near the property line with the T-117 Upland Property to refine the current understanding of the lateral extent of soil contamination between the A&B Barrel Area and the neighboring T-117 Property. Soil samples collected will focus on surface soil (within 3 feet of ground surface) to assist in characterizing the direct contact and potential transport to surface water and sediment via the stormwater pathway to the LDW. These explorations will be advanced using hand-auger sampling method because of physical obstacles such as overhead powerlines and buried utilities that preclude standard drilling methods. The following are the proposed T-117 Upland Property and SPM property line samples:

- HA-01, located near the southwest corner of the SPM property in a pervious area to determine if soil contamination from T-117 Upland Property extends laterally to the north onto the SPM property.
- HA-02, located at the center of the SPM property line with T-117 Upland Property, behind the former A & B Barrel building in a pervious area to determine if soil contamination from T-117 Upland Property extends laterally to the north onto the SPM property.

Soil sample screening, collection, and analysis or archive protocols are described in Section 9.1.3 and Appendix E. Targeted surface soil samples and analytes are listed in Table 9.1.

9.1.2 Investigation of Contaminant Migration Pathways to the LDW

To satisfy the data gaps related to evaluating the potential migration of contaminants to the LDW as a potential receptor, the Phase I field investigation will assess the condition of shoreline groundwater and surface soils that could present as erodible bank soils, as well as assess the condition of stormwater discharging to the LDW. These investigations are outlined below.

9.1.2.1 Shoreline Groundwater Monitoring

The shoreline groundwater monitoring investigation will evaluate the condition of groundwater along the shoreline to assess the potential for contaminant migration to the surface water and sediment in the LDW. Several of the wells identified above (MW-7 and MW-8) will be dual-purpose because they are located along the shoreline and will also provide information for the potential source area in which they are located. Phase 1 wells proposed for the shoreline to maximize spatial coverage of the entire SPM Property shoreline include the following:

- MW-06 and MW-07 (described above) located downgradient of the A&B Barrel area
- MW-08 (described above), located downgradient of the historical boat manufacturing building
- MW-09, located near the entrance to the current marina docks and in the approximate former UST areas
- MW-10, located downgradient from former and current boat maintenance areas
- MW-11, located downgradient from the existing Rick's Master Marine building, the current auto repair building, and the former gasoline station

Soil samples collected from MW-8 through MW-11 will focus on surface soil (within 1 foot of ground surface) to assist in characterizing the direct contact pathways. However, additional samples will be collected, preserved, and archived throughout the soil column. Soil sample screening, collection, and analysis or archive protocols are described in Section 9.1.3.1 and Appendix E. Groundwater sample collection and analysis protocols are described in Section 9.1.3.3 and Appendix E. Targeted surface soil samples and analytes are listed in Table 9.1, the sample selection methodology presented in Table 9.2, while groundwater samples and analytes are listed in Table 9.3.

During the groundwater sampling program, the shoreline will be inspected for seeps during a period of no precipitation and a daytime low tide if weather and tides allow. These observations will be collected for use in scoping potential Phase 2 activities.

9.1.2.2 Stormwater Monitoring

The stormwater sampling investigation will be initiated by a site walk during a heavy rain event to assess and map drainages and overland flow patterns and confirm the current understanding of stormwater catchment areas shown on Figure 2.4. Seeps will be noted if observed but are not an objective of the stormwater wet-weather site walk. During this site walk, drainage features of the adjoining streets will also be documented. Two stormwater sampling events will then be conducted targeting the SPM Outfall and Outfall UOF-1, the timing of which will be dependent upon when storm events occur. See Appendix E for sampling event criteria. Pending observed runoff conditions during the storm events, stormwater samples will be collected from catch basins CB-02, CB-06, and the pump vault upstream from the StormwateRx™ system that, based on prior sampling, are accessible locations as close as practicable upstream of the two targeted outfalls. In addition, if stormwater along the shoreline is observed flowing overland to the LDW, a sample of it will be collected. Stormwater collection and analysis protocols are described in Section 9.1.3 and Appendix E. Stormwater samples will be analyzed for the parameters listed in Table 9.3.

9.1.2.3 Catch Basin Solids Sampling

Three catch basin solids samples will be collected to assess erodible soils and characterize the transport of catch basin solids via stormwater pathway to surface water and sediment in the LDW. The following are the proposed catch basin samples:

- CB-02, located downstream from the South Park Tire Factory, within an impervious area used for boat storage and maintenance and which discharges to the LDW via the SPM Outfall.
- CB-06, located near the center of the property within an impervious area used for boat storage and maintenance and which discharges to the LDW via the SPM Outfall.
- SWRX-Pre, the stormwater vault immediately upstream of the StormwateRx™ treatment system. This vault is located in an impervious area on the south end of the property used for boat storage and maintenance and discharges through the treatment system to the LDW via the Unnamed Outfall No. 1 or the OF-2214 overflow outfall if the treatment system pump is disabled, fails, or the capacity of the vault is exceeded.

Catch basin solids collection and analysis protocols are described in Section 9.1.3 and Appendix E. Stormwater samples will be analyzed for the parameters listed in Table 9.1.

9.1.2.4 Erodible Bank Soils Sampling

Erodible bank soils are defined as those soils along riverbanks that could easily be eroded into the LDW by overland flow of stormwater and/or physical erosion and are not protected by engineering structures such as rip rap or Ecology blocks. To assess the potential for erodible soils reaching the LDW, this task will include a wet-weather survey of the shoreline to determine and document whether soil erosion is occurring along the shoreline above MHHW. If erodible soil is observed during this wet-weather survey, one or more representative samples will be collected and analyzed for the same parameters listed in Table 9.1. If erodible bank soils are not observed, representative surface soil samples from borings along the shoreline will be analyzed to determine potential for soil that is erodible under future site use as a source to the LDW.

9.1.2.5 Sanitary Sewer

A camera inspection of the two floor drains located at Rick's Master Marine shop and their discharge point will be performed during Phase 1, if feasible based on the system design. If determined infeasible, a dye tracer test may be performed during Phase 2 but only if a suitable monitoring location in the sanitary system downstream of the floor drains is available.

9.1.3 General Field Procedures

The following subsections provide a brief, general overview of the field procedures to be implemented during the Phase 1 field investigation. Detailed field sampling and analysis protocols are provided in the SAP/QAPP presented in Appendix E.

9.1.3.1 Soil Screening and Sampling

Direct-push drilling will be the preferred method for the subsurface borings. If direct-push drilling methods are unsuccessful due to hitting refusal in any areas, the drillers will step out the boring a minimum of three feet and attempt to reach the target depth. If refusal is met at a location three times, and in Aspect's judgement could be advanced using a hollow-stem auger (HSA) drill rig, then an HSA drill rig will be mobilized to complete drilling in difficult locations. If HSA drilling methods are utilized and refusal is still encountered, a minimum of two attempts will be made at each boring location. The direct-push and HSA investigation will be conducted as follows:

- Predrilling activities, including an initial site visit, field locating borings, utility locates, and surveying drilling locations with hand-held GPS units.
- Advance all borings to a depth of 20 feet, with the exception of boring MW-05, located adjacent to the edge of the former Pond area, which will be advanced to a depth of 30 feet to assess historical data gaps related to vertical delineation.
- Drilling for borings SB-26, MW-04, and MW-05, located immediately adjacent to the former A&B Barrel Pond (Figure 9.1), will be advanced using dual-tube or conductor casing methods to minimize the potential for carry-down of contaminants.
- Soil logging and field screening for evidence of contamination based on sheen, odor, staining, VOC presence as measured with a photoionization detector (PID), and/or indications of non-soil materials (e.g., anthropogenic material, organics, large gravel, etc.).
    - If direct-push technology is feasible, collect soil samples from continuous cores.
    - If, as a contingency, HSA technology is utilized, collect soil samples from split-spoon samplers from a sampling interval of approximately 2.5 feet.
- At least four soil samples will be collected from each boring (except hand auger locations HA-1 and HA-2 where only 1 sample will be collected) for potential chemical analysis. For each location, the planned sampling intervals of these four samples are based on the historical and current uses of each investigation area as described below. At least two samples from each boring will be analyzed by the laboratory. However, if any of the borings show indications of potential

contamination (i.e., greater than 40 ppm VOCs via PID, a heavy odor, a heavy sheen, or other visual indications), additional samples will be collected from the interval with the field screening observations. The sample selection methodology is presented in Table 9.2.

- Soil sample analysis will be performed according to Table 9.1. A select subset of samples will be analyzed for dioxins/furans and PCB congeners. The subset of samples for PCB congeners will be from the five locations noted in Table 9.1; at each location, one sample from the depth interval with the highest Aroclor results will be submitted for congener analysis. The samples selected for dioxin/furan analysis will be the three samples with the highest chlorinated phenols and/or PCB Aroclor concentrations.
- Borings not being completed as monitoring wells will be decommissioned using pressurized grout or bentonite chips[26] to prevent compromising confining layers.

Detailed field sampling and analysis protocols are provided in the SAP/QAPP presented in Appendix E.

If compounds are detected above MRLs and RI screening levels, then additional archived soil samples at depth will be submitted for laboratory analysis of those analytes. An archived sample may also be analyzed for other compound(s); if applying best professional judgement, there is a reasonable probability that those compound(s) could exceed the RI screening level in soil at the depth of the archived sample[27], However, no archived samples will be run outside of method holding times.

9.1.3.2 Monitoring Well Installation and Development

Monitoring wells will be constructed with 2-inch-diameter, 5-foot-long screens, and developed after installation. The wells will be screened to allow sampling of the shallowest water-bearing zone present as determined at the time of drilling. The limited available subsurface information from SAIC (2008a) indicates very limited saturation within the Fill Unit on top of the Silt Unit, but those explorations were completed in the peak dry season (refer to Section 3.2.3).

During drilling of the Phase 1 borings to be constructed as monitoring wells, care will be taken to accurately document the top and bottom depths of the Silt Unit so as to ensure that the well screens (including filter packs) do not interconnect the Fill Unit and underlying Alluvial Sand Units. A groundwater monitoring well will be installed in the Fill Unit if at least 2 feet saturation is observed in that unit at the time of drilling. If less than 2 feet of saturation or no saturation is observed, then a monitoring well will be installed in the

[26] Borings in the alluvial aquifer will be decommissioned by pressurized grout, while shallow borings in the fill will be decommissioned using hydrated bentonite chips.

[27] Best professional judgement will consider factors such as the depth of the archived sample relative to the detection, the potential source or release, and hydrostratigraphic conditions; the magnitude of the detection relative to the screening level; potential association of the detected chemical and other chemicals exceeding screening levels; and contaminant transport characteristics of the detected analyte.

Alluvial Sand Unit. Drilling and monitoring well installation for Phase 1 will be timed to be completed during the wet season.

Details on monitoring well installation and development are provided in the SAP/QAPP presented in Appendix E.

9.1.3.3 Groundwater Sampling

Monitoring wells will be sampled after sufficient development and stabilization has occurred. Prior to sampling, a down-hole Van Essen Instruments, CTD-Diver® data-logger capable of measuring pressure, temperature, and conductivity will be installed in monitoring wells MW-04, MW-07, MW-09, MW-11, MW-12, and MW-14 for a minimum of 72 hours to determine the effects of tidal influence on groundwater conductivity (surrogate for salinity) at the SPM Property. Monitoring wells will be sampled using a peristaltic pump and low-flow sampling techniques in accordance with the SAP (Appendix E). For monitoring well locations suspected of being tidally influenced, groundwater samples will be collected at low tides within a 3-hour window bracketing the lowest conductivity values and groundwater elevations (to account for any tidal lag) measured by the datalogger to minimize the influence of saltwater into the formation. Water levels and field parameters (temperature, pH, conductivity, turbidity, salinity, and dissolved oxygen) will be recorded at each well and tabulated for inclusion in the RI report.

Groundwater samples will be analyzed for parameters listed in Table 9.3. A select subset of groundwater samples will be analyzed for tributyl tin and PCB congeners. Groundwater samples will only be analyzed for tributyl tin if soil in that investigation area had detectable concentrations of tributyl tin. Groundwater sample selection for tributyl tin analysis will be selected after identifying groundwater flow direction and review of soil analytical results. Four sample locations will be selected for PCB congener analysis from wells representing a range of highest to lowest (including possible non-detected) PCB Aroclor concentrations, as identified in Table 9.3.

9.1.3.4 Stormwater Sampling

Based on current understanding of the accessible sampling locations, stormwater samples will be collected as water grab samples in accordance with the procedures detailed in the SAP (Appendix E). Stormwater samples will be analyzed for parameters listed in Table 9.3.

9.1.3.5 Catch Basin Solids Sampling

Aspect will confirm with SPM operations that the catch basins have not been cleaned within the previous 6 months. Catch basin solids samples will be collected from material accumulated in the sump and/or pipes at each catch basin with the procedures detailed in the SAP (Appendix E). Catch basin solids samples will analyzed for the chemical analyses summarized in Table 9.1.

9.2 Phase 2 Field Investigation

Upon review, validation, and evaluation of the data collected during Phase 1 of the RI field investigation, the data will be summarized and used as the basis for determining activities for the Phase 2 field investigation. Phase 1 results and the scope of work for Phase 2 will be presented in an RI Work Plan Addendum. Prior to drafting the RI Work Plan Addendum, a Key Project Meeting will be held between the PLPs and Ecology to begin the discussion on the Phase 1 results, update the Conceptual Site Model, and reach agreement on data gaps to be addressed by Phase 2 to be presented in the RI Work Plan Addendum.

The scope for locations for the Phase 2 investigation will delineate the extents of soil and groundwater contamination identified in Phase 1, and sample other media or locations at the Site, if warranted, to complete the Site characterization.

As part of the delineation conducted in Phase 2, if clear evidence of contamination (strong odors, sheens, or product) is observed at a boring that is intended to identify a boundary, a "step-out" boring will be advanced. To facilitate rapid follow up, potential step-out boring locations will be identified prior to conducting utility clearances for the field program.

At the conclusion of the Phase 2 implementation, another Key Project Meeting between Ecology and the PLPs will be held to discuss any remaining data gaps, the updated Conceptual Site Model, and the content and organization of the RI Work Plan Addendum.

9.3 RI Reporting

This section summarizes the data reporting requirements and elements that will be included in the RI Report in accordance with the guidance provided in WAC 173-340-350 and the AO.

During RI Work Plan implementation, all newly collected (and validated) sampling data generated will be submitted to Ecology's Environmental Information Management (EIM) database. Data will be submitted to the EIM database within 30 days of receipt of validated data results.

In accordance with the AO, data collected during Phase 1 will be used to prepare a Source Control Review Memorandum that summarizes the data as it applies to the potential pathways of hazardous substances from the Site to the LDW and discusses the need (if any) for interim action(s) to address these pathways, or if additional data are needed to further assess these pathways or potential interim action(s).

The RI Report will present the existing environmental data, including the data collected as described in this RI Work Plan and in the future RI Work Plan Addendum. The RI Report will also summarize the sources of contamination, the nature and extent of contamination, and present a refined CSM of exposure pathways. It will also include an evaluation of risks and receptors, and recommended suite of COCs. The data will be presented in both tabular and map form.

10 Schedule

The schedule for field work will depend on the approval date of this RI Work Plan and contractor availability. The following Table 10.1 presents a summary of the estimated dates for upcoming project milestones in accordance with the AO based on an estimated duration of field work and Ecology reviews. This schedule includes time for one round of archive sample analysis.

Table 10.1. Project Milestones and Estimated Dates

Milestone	Estimated Date
Final Work Plan Issued & Approval[28]	February 22, 2021
Phase 1 Field Work	February 23 to April 22, 2021
Agency Review Source Control Eval Memo	September 22, 2021
Final Source Control Eval Memo	November 5, 2021
Agency Review Draft Work Plan Addendum	December 9, 2021
Final Work Plan Addendum	January 24, 2022

Table 10.2 provides an estimated schedule and detail on the process workflow for Phase 1 field activities and preparation of the RI Work Plan Addendum. Phase 1 field work will begin within 30 days of RI Work Plan approval, in accordance with the AO. The schedule for Phase 2 field activities and preparation of the RI Report will be provided in the RI Work Plan Addendum.

[28] Final Work Plan approval date assumes 20 days for Ecology review of this draft Work Plan and 7 days for Ecology review and approval of the Final Work Plan.

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12 Report Limitations and Guidelines for Use

Work for this project was performed for the Port of Seattle, City of Seattle, and South Park Marina (collectively the Client), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

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Please refer to Appendix H titled "Report Limitations and Guidelines for Use" for additional information governing the use of this report.

TABLES

Table 2.1. SPM Property Information and Historical Uses

Project No. 190293, South Park Marina, Seattle, Washington

	South Parcel	Historical A&B Barrel Parcel	Central Parcel	North Parcel
Current Parcel No.	0001600001		2185600025	2185600070
Address	8544 Dallas Avenue South 8546 Dallas Avenue South 8604 Dallas Avenue South	N/A	8510 Dallas Avenue South 8522 Dallas Avenue South	8500 Dallas Avenue South
Historical Use	Residential, boat manufacturing, and marina purposes	Drum reconditioning facility, boat maintenance, boat washing, and boat manufacturing	Gasoline station, radiatior repair shop, residential, mobile home park, restaurant	Mobile home park, boat and marine supply retailer and boat repair facility

Table 5.1. Summary of SPM Property Historical Investigations

Project No. 190293, South Park Marina, Seattle, Washington

Year	Author	Title / Subject	Prepared For	Date	Reference
2006	Windward Environmental LLC	*"T-117 Upland Area Soil Investigation Field Sampling and Data Report"*	US Environmental Protection Agency	July 7, 2006	Windward Environmental LLC (Windward), 2006
2008	SAIC	*"South Park Marina Seattle, Washington, Additional Site Characterization Activities Data Report Final"*	Washington State Department of Ecology	June 2008	SAIC, 2008a
2008	SAIC	*"Final Technical Memorandum Subject: Transmittal of Low-Level Mercury Results, July 2008 Groundwater Sampling Round, South Park Marina Site, Seattle, Washington"*	Mark Edens Washington State Department of Ecology	December 31, 2008	SAIC, 2008b
2010	Windward Environmental LLC., Integral Consulting Inc., AECOM, Crete Consulting, Inc., and Dalton, Olmsted & Fuglevand, Inc.	"Revised Engineering Evaluation/Cost Analysis"	The Port of Seattle and The City of Seattle	June 3, 2010	Windward et al., 2010a
2011	OnSite Environmental Inc.	Analytical Data for Project 289-001	Farallon Consulting, LLC	August, 2011	Farallon Consulting, LLC, 2011
2014	AECOM Environment	"Terminal 117 - Upland and Sediment NTCRA, Sheen in Seeps Bordering Dredge Unit 3 Memorandum"	Port of Seattle	April 7, 2014	AECOM, 2014a
2015	Leidos	*"NPDES Inspection Sampling Support 2014/2015"*	Washington State Department of Ecology	June 2015	Leidos, 2015
2016	AECOM Environment	*"Removal Action Construction Report Terminal 117 Sediment and Upland Cleanup"*	US Environmental Protection Agency	March 31, 2016	AECOM, 2016
2016	The Intelligence Group	Field Report No. 1 - Transformer Inventory	South Park Marina	September 20, 2016	The Intelligence Group (TIG), 2016a
2016	The Intelligence Group	Field Report No. 2 - Chemical and Hazardous Material Inventory	South Park Marina	September 20-22, 2016	The Intelligence Group (TIG), 2016b
2016	The Intelligence Group	Field Report No. 3 - Water Treatment Systems Inspection and Initial Interview with Steven Brown Regarding System Operation	South Park Marina	September 21-22, 2016	The Intelligence Group (TIG), 2016c
2016	The Intelligence Group	Field Report No. 4 - Interview with Steven Brown Regarding Marina Operations and Inspection of a Room Not Previously Accessed	South Park Marina	October 18, 2016	The Intelligence Group (TIG), 2016d
2016	The Intelligence Group	Field Report No. 3 - Visual Inspection of Air Compressors, Air Compressor Lubricants, and Any Maintenance Information Available for On-Site Air Compressors	South Park Marina	October 18, 2016	The Intelligence Group (TIG), 2016e
2016	The Intelligence Group	Field Report No. 2 - Visual Inspection of Electrical Poles and Pole-Mount Transformers Located on the South Park Marina Property	South Park Marina	October 18, 2016	The Intelligence Group (TIG), 2016f
2016	The Intelligence Group	Field Report No. 1 - Water Treatment Systems Inspection and Interview with Steven Brown Regarding System Operation	South Park Marina	October 18, 2016	The Intelligence Group (TIG), 2016g
2016	The Intelligence Group	*"Data Report, 2016 Soil, Sediment and Catch Basin Sampling and Analysis, Lower Duwamish Superfund Site"*	South Park Marina and Karr Tuttle Campbell	September 20, 2016	The Intelligence Group (TIG), 2016h
2016	TIG Environmental	Field Report - Investigate Locations of Potential Septic Tanks and Investigate Drainage Pathways	South Park Marina	February 22-23, 2017	TIG Environmental, 2017
2018	TIG Environmental	*"Stormwater and Boat Wash Water Systems Evaluation South Park Marina"*	South Park Marina Limited Partnership	February 2018	TIG Environmental, 2018a
2018	TIG Environmental	*"South Park Marina (Facility/Site ID 44653368) Supplemental PCB Investigation Memorandum"*		September 11, 2018	TIG Environmental, 2018b
2019	TIG Environmental	*"Results of Drainage Pathway Investigation"*		January 16, 2019	TIG Environmental, 2019

Table 6.1. Summary Statistics of Soil Chemical Analytical Results - Vadose Zone
Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Units	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Maximum Detected Concentration	Minimum Detected Concentration	Average Detected Concentration	Minimum Reporting Limit	Maximum Reporting Limit	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of Non-Detects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Metals																			
Arsenic	mg/kg	5	5	9/28/2007	10/1/2007	5	100%	10/1/2007	9.4	1.5	5.4			7	2	40%	1.3		10/1/2007
Cadmium	mg/kg	5	5	9/28/2007	10/1/2007	5	100%	10/1/2007	31.4	0.087	14			0.3	4	80%	105		10/1/2007
Chromium	mg/kg	5	5	9/28/2007	10/1/2007	5	100%	10/1/2007	465	9	225			48	3	60%	10		10/1/2007
Copper	mg/kg	5	5	9/28/2007	10/1/2007	5	100%	10/1/2007	198	8.9	91.9			36	3	60%	5.5		10/1/2007
Lead	mg/kg	5	5	9/28/2007	10/1/2007	5	100%	10/1/2007	3180	4.53	1500			50	4	80%	64		10/1/2007
Mercury	mg/kg	5	5	9/28/2007	10/1/2007	5	100%	10/1/2007	29.5	0.011	11.8			0.07	4	80%	421		10/1/2007
Silver	mg/kg	5	5	9/28/2007	10/1/2007	5	100%	10/1/2007	0.299	0.052	0.167			0.323	0				
Zinc	mg/kg	5	5	9/28/2007	10/1/2007	5	100%	10/1/2007	1510	20.3	755			86	4	80%	18		10/1/2007
Total Petroleum Hydrocarbons																			
Gasoline Range Organics	mg/kg	4	4	9/28/2007	10/1/2007	0	0%					20	2000	30	0			3	10/1/2007
Diesel Range Organics	mg/kg	9	9	1/17/2006	7/28/2011	7	78%	7/27/2011	12000	94	4700	27	50	260	6	67%	46	0	7/27/2011
Motor Oil Range Organics	mg/kg	9	9	1/17/2006	7/28/2011	8	89%	7/28/2011	34000	81	13000	100	100	2000	6	67%	17	0	7/27/2011
Diesel and Oil Extended Range Organics	mg/kg	9	9	1/17/2006	7/28/2011	8	89%	7/28/2011	40300	94.5	17500	100	100	2000	6	67%	20	0	7/27/2011
Total TPHs	mg/kg	1	1	1/17/2006	1/17/2006	1	100%	1/17/2006	190	190	190								
Benzene, Toluene, Ethylbenzene, and Total Xylenes																			
Benzene	mg/kg	3	3	9/28/2007	10/1/2007	2	67%	10/1/2007	0.078	0.072	0.075	0.0041	0.0041	0.00875	2	67%	8.9	0	10/1/2007
Toluene	mg/kg	3	3	9/28/2007	10/1/2007	3	100%	10/1/2007	7.2	0.0017	3.8			0.917	2	67%	7.9		10/1/2007
Ethylbenzene	mg/kg	3	3	9/28/2007	10/1/2007	3	100%	10/1/2007	9.3	0.00023	4.5			0.259	2	67%	36		10/1/2007
Volatile Organic Compounds																			
1,1,1,2-Tetrachloroethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	38.5				0	
1,1,1-Trichloroethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	371				0	
1,1,2,2-Tetrachloroethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	0.00168				3	10/1/2007
1,1,2-Trichloroethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	0.00498				2	10/1/2007
1,1-Dichloroethane	mg/kg	3	3	9/28/2007	10/1/2007	1	33%	9/28/2007	0.00031	0.00031	0.00031	0.068	0.071	175	0			0	
1,1-Dichloroethene	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	25.1				0	
1,1-Dichloropropene	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071					0	
1,2,3-Trichlorobenzene	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.017	0.29	20				0	
1,2,3-Trichloropropane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	0.0333				2	10/1/2007
1,2,4-Trichlorobenzene	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.009	0.48	0.00138				5	10/1/2007
1,2,4-Trimethylbenzene	mg/kg	3	3	9/28/2007	10/1/2007	3	100%	10/1/2007	17	0.00023	9			800	0				
1,2-Dibromo-3-chloropropane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.017	0.29	1.25				0	
1,2-Dibromoethane (EDB)	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.017	0.29	0.5				0	
1,2-Dichlorobenzene	mg/kg	5	5	9/28/2007	10/1/2007	2	40%	10/1/2007	0.31	0.24	0.28	0.0041	0.48	0.036	2	40%	8.6	1	10/1/2007
1,2-Dichloroethane (EDC)	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	0.35				0	
1,2-Dichloropropane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	0.0157				2	10/1/2007
1,3,5-Trimethylbenzene	mg/kg	3	3	9/28/2007	10/1/2007	2	67%	10/1/2007	6.6	3.3	5	0.017	0.017	800	0			0	
1,3-Dichlorobenzene	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071					0	
1,3-Dichloropropane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071					0	
1,4-Dichlorobenzene	mg/kg	5	5	9/28/2007	10/1/2007	2	40%	10/1/2007	0.038	0.038	0.038	0.0041	0.48	0.11	0			1	10/1/2007
2,2-Dichloropropane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071					0	
2-Butanone	mg/kg	3	3	9/28/2007	10/1/2007	3	100%	10/1/2007	0.71	0.012	0.45			48000	0				
2-Chlorotoluene	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.017	0.29	1600				0	
2-Hexanone	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.017	2.9	400				0	
4-Chlorotoluene	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.017	0.29					0	
4-Methyl-2-pentanone	mg/kg	3	3	9/28/2007	10/1/2007	3	100%	10/1/2007	1.4	0.0028	0.69			6400	0				
Acetone	mg/kg	3	3	9/28/2007	10/1/2007	1	33%	9/28/2007	0.048	0.048	0.048	0.58	0.93	72000	0			0	
Bromobenzene	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.29	640				0	
Bromochloromethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071					0	
Bromodichloromethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	0.0145				2	10/1/2007
Bromoform	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	0.0785				0	
Bromomethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	1.2				0	
Carbon Disulfide	mg/kg	3	3	9/28/2007	10/1/2007	1	33%	9/28/2007	0.00012	0.00012	0.00012	0.068	0.071	8000	0			0	
Carbon Tetrachloride	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	0.00291				3	10/1/2007
Chlorobenzene	mg/kg	3	3	9/28/2007	10/1/2007	1	33%	10/1/2007	0.046	0.046	0.046	0.0041	0.071	1.72	0			0	
Chloroethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071					0	
Chloroform	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	0.806				0	
Chloromethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071					0	
cis-1,2-Dichloroethene (cDCE)	mg/kg	3	3	9/28/2007	10/1/2007	3	100%	10/1/2007	11	0.0078	6.6			160	0				
cis-1,3-Dichloropropene	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	0.0105				2	10/1/2007
Dibromochloromethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	0.0117				2	10/1/2007
Dibromomethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	800				0	
Dichlorodifluoromethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	16000				0	
Isopropylbenzene	mg/kg	3	3	9/28/2007	10/1/2007	2	67%	10/1/2007	1.7	0.56	1.1	0.017	0.017	8000	0			0	
m,p-Xylenes	mg/kg	3	3	9/28/2007	10/1/2007	3	100%	10/1/2007	44	0.0013	22			16000	0				
Methylene Chloride	mg/kg	3	3	9/28/2007	10/1/2007	1	33%	9/28/2007	0.034	0.034	0.034	0.00044	0.27	0.43	0			0	
n-Butylbenzene	mg/kg	3	3	9/28/2007	10/1/2007	2	67%	10/1/2007	2	0.96	1.5	0.017	0.017	4000	0			0	
n-Propylbenzene	mg/kg	3	3	9/28/2007	10/1/2007	2	67%	10/1/2007	1.8	0.67	1.2	0.017	0.017	8000	0			0	
o-Xylene	mg/kg	3	3	9/28/2007	10/1/2007	3	100%	10/1/2007	24	0.00049	13			16000	0				
p-Isopropyltoluene	mg/kg	3	3	9/28/2007	10/1/2007	2	67%	10/1/2007	2.6	1.2	1.9	0.017	0.017					0	
sec-Butylbenzene	mg/kg	3	3	9/28/2007	10/1/2007	2	67%	10/1/2007	1.2	0.54	0.87	0.017	0.017	8000	0			0	
Styrene	mg/kg	3	3	9/28/2007	10/1/2007	1	33%	9/28/2007	0.037	0.037	0.037	0.0041	0.068	300	0			0	
tert-Butylbenzene	mg/kg	3	3	9/28/2007	10/1/2007	2	67%	10/1/2007	0.087	0.042	0.065	0.017	0.017	8000	0			0	
Tetrachloroethene (PCE)	mg/kg	3	3	9/28/2007	10/1/2007	3	100%	10/1/2007	0.17	0.0015	0.11			0.029	2	67%	5.9		10/1/2007
trans-1,2-Dichloroethene	mg/kg	3	3	9/28/2007	10/1/2007	2	67%	10/1/2007	0.21	0.098	0.15	0.0041	0.0041	5.18	0			0	
trans-1,3-Dichloropropene	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	0.0105				2	10/1/2007
Trichloroethene (TCE)	mg/kg	3	3	9/28/2007	10/1/2007	3	100%	10/1/2007	0.17	0.0005	0.11			0.00441	2	67%	39		10/1/2007
Trichlorofluoromethane	mg/kg	3	3	9/28/2007	10/1/2007	0	0%					0.0041	0.071	24000				0	
Vinyl Chloride	mg/kg	3	3	9/28/2007	10/1/2007	3	100%	10/1/2007	0.87	0.0014	0.32			0.00104	3	100%	837		10/1/2007

Table 6.1. Summary Statistics of Soil Chemical Analytical Results - Vadose Zone

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Units	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Maximum Detected Concentration	Minimum Detected Concentration	Average Detected Concentration	Minimum Reporting Limit	Maximum Reporting Limit	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of Non-Detects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Semivolatile Organic Compounds																			
2,4-Dimethylphenol	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.045	4.6	0.029				5	10/1/2007
2-Methylphenol	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.009	0.92	0.063				4	10/1/2007
4-Methylphenol	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.009	0.92	0.67				1	10/1/2007
Benzoic acid	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.18	19	0.65				4	10/1/2007
Benzyl alcohol	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.018	1.9	0.057				4	10/1/2007
Benzyl butyl phthalate	mg/kg	5	5	9/28/2007	10/1/2007	1	20%	9/28/2007	2.2	2.2	2.2	0.009	0.92	0.00361	1	20%	609	4	10/1/2007
Bis(2-ethylhexyl) phthalate	mg/kg	5	5	9/28/2007	10/1/2007	1	20%	10/1/2007	7	7	7	0.09	4.8	0.102	1	20%	69	3	10/1/2007
Dibenzofuran	mg/kg	6	6	1/17/2006	10/1/2007	0	0%					0.009	0.92	0.54				1	10/1/2007
Diethyl phthalate	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.009	0.92	0.2				3	10/1/2007
Dimethyl phthalate	mg/kg	5	5	9/28/2007	10/1/2007	1	20%	9/28/2007	0.23	0.23	0.23	0.009	0.92	0.071	1	20%	3	3	10/1/2007
Di-n-butyl phthalate	mg/kg	5	5	9/28/2007	10/1/2007	1	20%	10/1/2007	1.1	1.1	1.1	0.018	0.96	0.283	1	20%	4	3	10/1/2007
Di-n-octyl phthalate	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.009	0.92	6.2				0	
Hexachlorobenzene	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.009	0.92	0.00000802				5	10/1/2007
Hexachlorobutadiene	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.009	0.48	0.0108				4	10/1/2007
N-Nitrosodiphenylamine	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.009	0.92	0.0206				4	10/1/2007
Pentachlorophenol	mg/kg	5	5	9/28/2007	10/1/2007	2	40%	9/28/2007	2.8	2.3	2.6	0.09	9.2	0.0000317	2	40%	88,328	3	10/1/2007
Phenol	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.03	2.8	0.42				3	10/1/2007
Polycyclic Aromatic Hydrocarbons																			
1-Methylnaphthalene	mg/kg	1	1	1/17/2006	1/17/2006	0	0%					0.066	0.066	29.4				0	
2-Methylnaphthalene	mg/kg	6	6	1/17/2006	10/1/2007	3	50%	10/1/2007	3	0.26	1.8	0.009	0.48	0.67	2	33%	4.5	0	10/1/2007
Acenaphthene	mg/kg	6	6	1/17/2006	10/1/2007	1	17%	9/28/2007	0.25	0.25	0.25	0.009	0.92	0.5	0			1	10/1/2007
Acenaphthylene	mg/kg	6	6	1/17/2006	10/1/2007	0	0%					0.009	0.92	1.3				0	
Anthracene	mg/kg	6	6	1/17/2006	10/1/2007	2	33%	9/28/2007	0.33	0.065	0.2	0.009	0.92	0.96	0			0	
Benz(a)anthracene	mg/kg	6	6	1/17/2006	10/1/2007	3	50%	10/1/2007	0.24	0.074	0.18	0.009	0.48	0.00114	3	50%	211	3	10/1/2007
Benzo(a)pyrene	mg/kg	6	6	1/17/2006	10/1/2007	0	0%					0.009	0.92	0.00031				6	10/1/2007
Benzo(b)fluoranthene	mg/kg	6	6	1/17/2006	10/1/2007	1	17%	9/28/2007	0.13	0.13	0.13	0.009	0.92	0.00394	1	17%	33	5	10/1/2007
Benzo(g,h,i)perylene	mg/kg	6	6	1/17/2006	10/1/2007	1	17%	9/28/2007	0.13	0.13	0.13	0.009	0.92	0.67	0			1	10/1/2007
Benzo(k)fluoranthene	mg/kg	6	6	1/17/2006	10/1/2007	0	0%					0.009	0.92	0.0394				5	10/1/2007
Chrysene	mg/kg	6	6	1/17/2006	10/1/2007	3	50%	10/1/2007	0.49	0.17	0.35	0.009	0.48	0.127	3	50%	3.9	1	10/1/2007
Dibenzo(a,h)anthracene	mg/kg	6	6	1/17/2006	10/1/2007	0	0%					0.009	0.92	0.000573				6	10/1/2007
Fluoranthene	mg/kg	6	6	1/17/2006	10/1/2007	3	50%	10/1/2007	0.5	0.12	0.36	0.009	0.48	1.7	0			0	
Fluorene	mg/kg	6	6	1/17/2006	10/1/2007	2	33%	10/1/2007	0.67	0.064	0.37	0.009	0.48	0.54	1	17%	1.2	0	10/1/2007
Indeno(1,2,3-cd)pyrene	mg/kg	6	6	1/17/2006	10/1/2007	1	17%	9/28/2007	0.1	0.1	0.1	0.009	0.92	0.0111	1	17%	9.0	4	10/1/2007
Naphthalene	mg/kg	6	6	1/17/2006	10/1/2007	3	50%	10/1/2007	2.5	0.36	1.8	0.009	0.48	0.0389	3	50%	64	2	10/1/2007
Phenanthrene	mg/kg	6	6	1/17/2006	10/1/2007	3	50%	10/1/2007	1.4	0.16	0.95	0.009	0.48	1.5	0			0	
Pyrene	mg/kg	6	6	1/17/2006	10/1/2007	3	50%	10/1/2007	0.82	0.17	0.6	0.009	0.48	2.6	0			0	
Total HPAHs	mg/kg	1	1	1/17/2006	1/17/2006	0	0%					0.066	0.066	12				0	
Total LPAHs	mg/kg	1	1	1/17/2006	1/17/2006	0	0%					0.066	0.066	5.2				0	
Total PAHs	mg/kg	1	1	1/17/2006	1/17/2006	0	0%					0.066	0.066					0	
Total cPAHs TEQ (ND multiplier Unknown)	mg/kg	1	1	1/17/2006	1/17/2006	0	0%					0.06	0.06	0.00031				1	1/17/2006
Polychlorinated Biphenyls																			
Aroclor 1016	mg/kg	51	57	1/17/2006	11/17/2017	0	0%					0.004	6.3					0	
Aroclor 1221	mg/kg	46	52	1/17/2006	11/17/2017	0	0%					0.004	6.3					0	
Aroclor 1232	mg/kg	46	52	1/17/2006	11/17/2017	0	0%					0.004	6.3					0	
Aroclor 1242	mg/kg	46	52	1/17/2006	11/17/2017	3	6%	11/17/2017	5.2	3.9	4.4	0.004	6.3					0	
Aroclor 1248	mg/kg	51	57	1/17/2006	11/17/2017	0	0%					0.004	6.3					0	
Aroclor 1254	mg/kg	51	57	1/17/2006	11/17/2017	20	35%	11/17/2017	36	0.069	10	0.004	5.4					0	
Aroclor 1260	mg/kg	51	57	1/17/2006	11/17/2017	44	77%	11/17/2017	54	0.0048	3.46	0.004	1.1					0	
Aroclor 1262	mg/kg	30	30	2/8/2016	2/11/2016	0	0%					0.004	0.08					0	
Aroclor 1268	mg/kg	30	30	2/8/2016	2/11/2016	0	0%					0.004	0.08					0	
Total PCB Aroclors	mg/kg	51	57	1/17/2006	11/17/2017	49	86%	11/17/2017	66	0.0048	7.62	0.004	0.08	0.0000433	49	86%	1,524,249	8	11/17/2017
Total PCB Congeners	mg/kg	36	36	2/8/2016	11/17/2017	36	100%	11/17/2017	107	0.00482	8.03			0.0000433	36	100%	2,471,132	0	11/17/2017
Total Dioxin-like PCBs	mg/kg	30	30	2/8/2016	2/11/2016	30	100%	2/11/2016	0.340518	0.00006187	0.01728567			0.0000000274	30	100%	12,427,664	0	2/11/2016
Pesticides/Herbicides																			
2,4'-DDD	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.00099	0.67					0	
2,4'-DDE	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.00099	0.59					0	
2,4'-DDT	mg/kg	5	5	9/28/2007	10/1/2007	5	100%	10/1/2007	3.6	0.00051	1.6								
4,4'-DDD	mg/kg	5	5	9/28/2007	10/1/2007	4	80%	10/1/2007	0.8	0.051	0.49	0.00099	0.00099	0.00000727	4	80%	110,041	1	10/1/2007
4,4'-DDE	mg/kg	5	5	9/28/2007	10/1/2007	1	20%	10/1/2007	0.37	0.37	0.37	0.00099	0.3	0.00000152	1	20%	243,421	4	10/1/2007
4,4'-DDT	mg/kg	5	5	9/28/2007	10/1/2007	4	80%	10/1/2007	4	0.00087	1.4	3.2	3.2	0.0000163	4	80%	245,399	1	10/1/2007
Aldrin	mg/kg	5	5	9/28/2007	10/1/2007	3	60%	10/1/2007	3.5	0.24	1.9	0.00099	0.019	4.01E-08	3	60%	87,281,796	2	10/1/2007
Dieldrin	mg/kg	5	5	9/28/2007	10/1/2007	1	20%	10/1/2007	0.92	0.92	0.92	0.00099	0.14	0.000000617	1	20%	1,491,086	4	10/1/2007
Heptachlor	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.00099	0.1	6.62E-08	0			5	10/1/2007
Lindane	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.00099	0.1	0.00389	0			4	10/1/2007
Total Chlordane	mg/kg	5	5	9/28/2007	10/1/2007	0	0%					0.0099	5.2	0.0000227	0			5	10/1/2007
Conventionals																			
Total Organic Carbon	%	3	3	1/17/2006	1/24/2006	3	100%	1/24/2006	1.25	0.721	0.972								
Total Organic Carbon (Calculated)	%	30	30	2/8/2016	2/11/2016	28	93%	2/11/2016	1.5	0.052	0.46								
Total Solids	%	8	9	1/17/2006	10/1/2007	9	100%	10/1/2007	94.8	82.2	87.51								

Notes:

[a] - Remedial Investigation Screening Level based on the most stringent Lower Duwamish Waterway Preliminary Cleanup Level for Soil in the Vadose Zone, excluding protection of drinking water (screening levels SL-1, SL-3, SL-4, SL-8, SL-9, SL-10). See Table C.2 in Appendix C.

For purposes of this initial screening, samples included in the statistical analysis are those from vadose soil samples collected from on the SPM Property (see Tables D.1 and D.2 in Appendix D).

Blank cells = not applicable   mg/kg - milligrams per kilogram

Many maximum and minimum reporting limits were not explicitly listed in the historical database. We have assumed the values given for non-detect results are the reporting limit where historical reporting limits were omitted. Therefore some of the maximum and minimum reporting limits are based on non-detect results only.

Diesel and Oil Extended Range Organics Calculation Note: Results were calculated as the sum of Diesel Range Organic and Motor Oil Range Organics, with non-detects summed at 1/2 the reporting limit. If all components were non-detect, the sum is reported as non-detect at the largest component's reporting limit.

Total PCBs (Sum of Aroclors) calculation note: Results are either reported as-given from historical database or calculated by Aspect using reported Aroclor values. For calculations by Aspect, non-detect results = 0. If all Aroclor results were non-detect, the total was reported as the largest RL of any single Aroclor, which appears to match the logic used in the historical database.

Total TPH, cPAHs TEQ, PCB Congeners, PAHs, HPAHs, and LPAHs calculation note: The reported results are from the historical database, and the calculation used in the historical database is unknown.

Total Organic Carbon calculation note: TOC was back calculated using the TOC-normalized historical data. The reporting limits are unknown, and the reported results assume all constituents were detected.

Table 6.2. Summary Statistics of Soil Chemical Analytical Results - Saturated Zone

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Units	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Maximum Detected Concentration	Minimum Detected Concentration	Average Detected Concentration	Minimum Reporting Limit	Maximum Reporting Limit	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of Non-Detects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Metals																			
Arsenic	mg/kg	14	15	9/27/2007	7/27/2011	13	87%	10/1/2007	8.7	1	2.7	12	13	7	1	7%	1.2	2	7/27/2011
Barium	mg/kg	2	2	7/27/2011	7/27/2011	2	100%	7/27/2011	35	31	33	3	3.2	8.26	2	100%	4.2		7/27/2011
Cadmium	mg/kg	14	15	9/27/2007	7/27/2011	14	93%	7/27/2011	4.97	0.021	0.472	0.59	0.65	0.3	2	13%	16.6	1	10/1/2007
Chromium	mg/kg	14	15	9/27/2007	7/27/2011	15	100%	7/27/2011	192	6.37	25.4	0.59	0.65	48	1	7%	4.0		10/1/2007
Copper	mg/kg	12	13	9/27/2007	10/1/2007	13	100%	10/1/2007	69.6	7.19	19.6			36	2	15%	1.9		10/1/2007
Lead	mg/kg	14	15	9/27/2007	7/27/2011	15	100%	7/27/2011	1030	1.29	79.8	5.9	6.5	50	1	7%	21		10/1/2007
Mercury	mg/kg	14	15	9/27/2007	7/27/2011	13	87%	10/1/2007	5.81	0.004	0.484	0.3	0.32	0.07	2	13%	83	2	7/27/2011
Selenium	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					12	13	0.3				2	7/27/2011
Silver	mg/kg	14	15	9/27/2007	7/27/2011	13	87%	10/1/2007	0.145	0.049	0.0825	0.59	0.65	0.0163	13	87%	8.9	2	7/27/2011
Zinc	mg/kg	12	13	9/27/2007	10/1/2007	13	100%	10/1/2007	515	14.8	60.9			85	1	8%	6.1		10/1/2007
Total Petroleum Hydrocarbons																			
Gasoline Range Organics	mg/kg	15	16	9/27/2007	7/27/2011	2	13%	10/1/2007	350	150	250	6	20	30	2	13%	11.7	0	10/1/2007
Diesel Range Organics	mg/kg	21	23	9/27/2007	7/28/2011	8	35%	7/27/2011	4100	3.7	1200	27	170	260	4	17%	15.8	0	7/27/2011
Motor Oil Range Organics	mg/kg	21	23	9/27/2007	7/28/2011	10	43%	7/28/2011	10000	21	3100	54	100	2000	4	17%	5.0	0	7/27/2011
Diesel and Oil Extended Range Organics	mg/kg	21	23	9/27/2007	7/28/2011	10	43%	7/28/2011	14100	24.7	4050	54	100	2000	4	17%	7.1	0	7/27/2011
Benzene, Toluene, Ethylbenzene, and Total Xylenes																			
Benzene	mg/kg	5	5	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.000558				5	7/27/2011
Toluene	mg/kg	5	5	10/1/2007	7/27/2011	2	40%	10/1/2007	0.0023	0.00089	0.0016	0.0057	0.38	0.0555	0			2	7/27/2011
Ethylbenzene	mg/kg	5	5	10/1/2007	7/27/2011	1	20%	10/1/2007	0.0078	0.0078	0.0078	0.0011	0.076	0.0152	0			2	7/27/2011
Volatile Organic Compounds																			
1,1,1,2-Tetrachloroethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	38.5				0	
1,1,1-Trichloroethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	21.1				0	
1,1,2,2-Tetrachloroethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0063	0.076	0.00011				4	7/27/2011
1,1,2-Trichloroethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.000326				4	7/27/2011
1,1-Dichloroethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	175				0	
1,1-Dichloroethene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	1.36				0	
1,1-Dichloropropene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076					0	
1,2,3-Trichlorobenzene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.025	0.076	20				0	
1,2,3-Trichloropropane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0063	0.076	0.0333				2	7/27/2011
1,2,4-Trichlorobenzene	mg/kg	14	15	9/27/2007	7/27/2011	0	0%					0.0098	0.076	0.000072				15	7/27/2011
1,2,4-Trimethylbenzene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.025	0.076	800				0	
1,2-Dibromo-3-chloropropane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.025	0.38	1.25				0	
1,2-Dibromoethane (EDB)	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.5				0	
1,2-Dichlorobenzene	mg/kg	14	15	9/27/2007	7/27/2011	1	7%	7/27/2011	0.11	0.11	0.11	0.0063	0.066	0.00307	1	7%	36	14	7/27/2011
1,2-Dichloroethane (EDC)	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.0237				1	7/27/2011
1,2-Dichloropropane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.00103				4	7/27/2011
1,3,5-Trimethylbenzene	mg/kg	4	4	10/1/2007	7/27/2011	1	25%	10/1/2007	0.058	0.058	0.058	0.025	0.076	800	0			0	
1,3-Dichlorobenzene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0063	0.076					0	
1,3-Dichloropropane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076					0	
1,4-Dichlorobenzene	mg/kg	14	15	9/27/2007	7/27/2011	0	0%					0.0063	0.076	0.00807				13	7/27/2011
2,2-Dichloropropane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076					0	
2-Butanone	mg/kg	4	4	10/1/2007	7/27/2011	2	50%	7/27/2011	0.017	0.0061	0.012	0.025	0.38	48000	0			0	
2-Chloroethyl Vinyl Ether	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.0057	0.38					0	
2-Chlorotoluene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.025	0.076	1600				0	
2-Hexanone	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0057	0.38	400				0	
4-Chlorotoluene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.025	0.076					0	
4-Methyl-2-pentanone	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0057	0.38	6400				0	
Acetone	mg/kg	4	4	10/1/2007	7/27/2011	2	50%	7/27/2011	0.11	0.044	0.077	0.014	0.38	72000	0			0	
Bromobenzene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0063	0.076	640				0	
Bromochloromethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076					0	
Bromodichloromethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.000957				4	7/27/2011
Bromoform	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.00495				3	7/27/2011
Bromomethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.0792				0	
Carbon Disulfide	mg/kg	4	4	10/1/2007	7/27/2011	2	50%	7/27/2011	0.0093	0.00067	0.005	0.0063	0.076	8000	0			0	
Carbon Tetrachloride	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.000154				4	7/27/2011
Chlorobenzene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.102				0	
Chloroethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0057	0.38					0	
Chloroform	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.0524				1	7/27/2011
Chloromethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0057	0.38					0	
cis-1,2-Dichloroethene (cDCE)	mg/kg	4	4	10/1/2007	7/27/2011	1	25%	10/1/2007	0.00054	0.00054	0.00054	0.0011	0.076	160	0			0	
cis-1,3-Dichloropropene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.000627				4	7/27/2011
Dibromochloromethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.000769				4	7/27/2011
Dibromomethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	800				0	
Dichlorodifluoromethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	16000				0	
Isopropylbenzene	mg/kg	4	4	10/1/2007	7/27/2011	1	25%	10/1/2007	0.01	0.01	0.01	0.0011	0.076	8000	0			0	
m,p-Xylenes	mg/kg	5	5	10/1/2007	7/27/2011	1	20%	10/1/2007	0.0046	0.0046	0.0046	0.0023	0.15	16000	0			0	
Methyl tert-butyl ether (MTBE)	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.0011	0.076	556				0	
Methylene Chloride	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.00097	0.76	0.0297				1	7/27/2011
Methyliodide	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.0057	0.38					0	
n-Butylbenzene	mg/kg	4	4	10/1/2007	7/27/2011	1	25%	7/27/2011	0.17	0.17	0.17	0.025	0.066	4000	0			0	
n-Propylbenzene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.025	0.076	8000				0	
o-Xylene	mg/kg	5	5	10/1/2007	7/27/2011	1	20%	10/1/2007	0.0013	0.0013	0.0013	0.0011	0.076	16000	0			0	
p-Isopropyltoluene	mg/kg	4	4	10/1/2007	7/27/2011	1	25%	10/1/2007	0.039	0.039	0.039	0.025	0.076					0	
sec-Butylbenzene	mg/kg	4	4	10/1/2007	7/27/2011	1	25%	7/27/2011	0.14	0.14	0.14	0.025	0.066	8000	0			0	
Styrene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	300				0	

Table 6.2. Summary Statistics of Soil Chemical Analytical Results - Saturated Zone

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Units	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Maximum Detected Concentration	Minimum Detected Concentration	Average Detected Concentration	Minimum Reporting Limit	Maximum Reporting Limit	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of Non-Detects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
tert-Butylbenzene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.025	0.076	8000				0	
Tetrachloroethene (PCE)	mg/kg	4	4	10/1/2007	7/27/2011	3	75%	7/27/2011	0.002	0.00073	0.0016	0.076	0.076	0.0016	2	50%	1.3	1	7/27/2011
trans-1,2-Dichloroethene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.325				0	
trans-1,3-Dichloropropene	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.000627				4	7/27/2011
Trichloroethene (TCE)	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	0.000266				4	7/27/2011
Trichlorofluoromethane	mg/kg	4	4	10/1/2007	7/27/2011	0	0%					0.0011	0.076	24000				0	
Vinyl Acetate	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.0057	0.38	80000				0	
Vinyl Chloride	mg/kg	4	4	10/1/2007	7/27/2011	1	25%	10/1/2007	0.0027	0.0027	0.0027	0.0011	0.076	0.0000549	1	25%	49	3	7/27/2011
Semivolatile Organic Compounds																			
1,2-Dinitrobenzene	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	8				0	
1,2-Diphenylhydrazine	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	1.07				0	
1,3-Dinitrobenzene	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	8				0	
1,4-Dinitrobenzene	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	8				0	
2,3,4,6-Tetrachlorophenol	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	485				0	
2,3,5,6-Tetrachlorophenol	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43					0	
2,3-Dichloroaniline	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43					0	
2,4,5-Trichlorophenol	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	1.13				0	
2,4,6-Trichlorophenol	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.000187				2	7/27/2011
2,4-Dichlorophenol	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.00434				2	7/27/2011
2,4-Dimethylphenol	mg/kg	14	15	9/27/2007	7/27/2011	0	0%					0.049	5	0.00314				15	7/27/2011
2,4-Dinitrophenol	mg/kg	2	2	7/27/2011	7/27/2011	1	50%	7/27/2011	2.3	2.3	2.3	2.2	2.2	0.0287	1	50%	80	1	7/27/2011
2,4-Dinitrotoluene	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.0000688				2	7/27/2011
2,6-Dinitrotoluene	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.106				2	7/27/2011
2-Chloronaphthalene	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	6400				0	
2-Chlorophenol	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.0115				2	7/27/2011
2-Methylphenol	mg/kg	14	15	9/27/2007	7/27/2011	0	0%					0.0098	1	0.0102				4	7/27/2011
2-Nitroaniline	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	800				0	
2-Nitrophenol	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43					0	
3 & 4 Methylphenol	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43					0	
3,3'-Dichlorobenzidine	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					4	4.3	0.00000334				2	7/27/2011
3-Nitroaniline	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43					0	
4,6-Dinitro-2-methylphenol	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					2	2.2					0	
4-Bromophenyl phenyl ether	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43					0	
4-Chloro-3-methylphenol	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43					0	
4-Chloroaniline	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.81				0	
4-Chlorophenyl phenyl ether	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43					0	
4-Methylphenol	mg/kg	12	13	9/27/2007	10/1/2007	1	8%	9/27/2007	0.0022	0.0022	0.0022	0.0098	1	0.67	0			2	10/1/2007
4-Nitroaniline	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43					0	
4-Nitrophenol	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	7				0	
Aniline	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	150				0	
Benzidine	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					4	4.3	0.00371				2	7/27/2011
Benzoic acid	mg/kg	12	13	9/27/2007	10/1/2007	1	8%	9/27/2007	0.19	0.19	0.19	0.2	20	0.169	1	8%	1.1	12	10/1/2007
Benzyl alcohol	mg/kg	14	15	9/27/2007	7/27/2011	2	13%	9/28/2007	0.0077	0.0041	0.0059	0.02	2	0.057	0			4	7/27/2011
Benzyl butyl phthalate	mg/kg	14	15	9/27/2007	7/27/2011	1	7%	9/28/2007	0.0052	0.0052	0.0052	0.0098	4.3	0.000182	1	7%	29	14	7/27/2011
Bis(2-chloroethoxy)methane	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43					0	
Bis(2-chloroethyl) ether	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.0000218				2	7/27/2011
bis(2-Chloroisopropyl)ether	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43					0	
Bis(2-ethylhexyl) adipate	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	711				0	
Bis(2-ethylhexyl) phthalate	mg/kg	14	15	9/27/2007	7/27/2011	3	20%	7/27/2011	2.8	0.74	1.8	0.0095	0.4	0.00512	3	20%	547	12	7/27/2011
Carbazole	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43					0	
Dibenzofuran	mg/kg	14	15	9/27/2007	7/27/2011	1	7%	10/1/2007	0.6	0.6	0.6	0.0098	0.99	0.54	1	7%	1.1	1	10/1/2007
Diethyl phthalate	mg/kg	14	15	9/27/2007	7/27/2011	0	0%					0.0019	2.2	0.0341				4	7/27/2011
Dimethyl phthalate	mg/kg	14	15	9/27/2007	7/27/2011	2	13%	9/28/2007	0.026	0.0067	0.016	0.0098	1	0.071	0			4	7/27/2011
Di-n-butyl phthalate	mg/kg	14	15	9/27/2007	7/27/2011	1	7%	10/1/2007	1.3	1.3	1.3	0.0095	4.3	0.0149	1	7%	87	10	7/27/2011
Di-n-octyl phthalate	mg/kg	14	15	9/27/2007	7/27/2011	0	0%					0.0098	1	0.326				4	7/27/2011
Hexachlorobenzene	mg/kg	14	15	9/27/2007	7/27/2011	0	0%					0.0098	1	0.000000401				15	7/27/2011
Hexachlorobutadiene	mg/kg	14	15	9/27/2007	7/27/2011	0	0%					0.0098	0.38	0.00054				15	7/27/2011
Hexachlorocyclopentadiene	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.2				2	7/27/2011
Hexachloroethane	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.0000413				2	7/27/2011
Isophorone	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.0367				2	7/27/2011
Nitrobenzene	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.0406				2	7/27/2011
N-Nitrosodimethylamine	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.0167				2	7/27/2011
N-Nitroso-di-n-propylamine	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.4	0.43	0.000018				2	7/27/2011
N-Nitrosodiphenylamine	mg/kg	14	15	9/27/2007	7/27/2011	0	0%					0.0098	1	0.00109				15	7/27/2011
Pentachlorophenol	mg/kg	14	15	9/27/2007	7/27/2011	3	20%	9/28/2007	0.079	0.028	0.049	0.098	10	0.00000176	3	20%	44,886	12	7/27/2011
Phenol	mg/kg	14	15	9/27/2007	7/27/2011	0	0%					0.014	3	0.115				4	7/27/2011
Pyridine	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					4	4.3	80				0	

Table 6.2. Summary Statistics of Soil Chemical Analytical Results - Saturated Zone
Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Units	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Maximum Detected Concentration	Minimum Detected Concentration	Average Detected Concentration	Minimum Reporting Limit	Maximum Reporting Limit	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of Non-Detects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Polycyclic Aromatic Hydrocarbons																			
1-Methylnaphthalene	mg/kg	2	2	7/27/2011	7/27/2011	1	50%	7/27/2011	0.13	0.13	0.13	0.016	0.016	29.4	0			0	
2-Methylnaphthalene	mg/kg	14	15	9/27/2007	7/27/2011	2	13%	10/1/2007	4.5	1.1	2.8	0.0098	0.016	0.67	2	13%	6.7	0	10/1/2007
Acenaphthene	mg/kg	14	15	9/27/2007	7/27/2011	2	13%	7/27/2011	0.51	0.21	0.36	0.0098	0.99	0.0277	2	13%	18	1	7/27/2011
Acenaphthylene	mg/kg	14	15	9/27/2007	7/27/2011	1	7%	7/27/2011	0.052	0.052	0.052	0.0098	1	1.3	0			0	
Anthracene	mg/kg	14	15	9/27/2007	7/27/2011	3	20%	7/27/2011	1.2	0.016	0.58	0.0098	0.99	0.0511	2	13%	23	1	7/27/2011
Benz(a)anthracene	mg/kg	14	15	9/27/2007	7/27/2011	5	33%	7/27/2011	0.12	0.0022	0.028	0.0098	1	0.0000573	5	33%	2,094	10	7/27/2011
Benzo(a)pyrene	mg/kg	14	15	9/27/2007	7/27/2011	5	33%	7/27/2011	0.17	0.0044	0.039	0.0098	1	0.0000155	5	33%	10,968	10	7/27/2011
Benzo(b)fluoranthene	mg/kg	14	15	9/27/2007	7/27/2011	5	33%	7/27/2011	0.081	0.0072	0.023	0.0098	1	0.000197	5	33%	411	10	7/27/2011
Benzo(g,h,i)perylene	mg/kg	14	15	9/27/2007	7/27/2011	5	33%	7/27/2011	0.035	0.0058	0.012	0.0098	1	0.67	0			2	10/1/2007
Benzo(j,k)fluoranthene	mg/kg	2	2	7/27/2011	7/27/2011	1	50%	7/27/2011	0.066	0.066	0.066	0.016	0.016					0	
Benzo(k)fluoranthene	mg/kg	12	13	9/27/2007	10/1/2007	3	23%	9/28/2007	0.0036	0.0019	0.0026	0.0098	1	0.00197	2	15%	1.8	10	10/1/2007
Chrysene	mg/kg	14	15	9/27/2007	7/27/2011	7	47%	7/27/2011	0.53	0.0063	0.11	0.0098	0.99	0.00637	6	40%	83	8	7/27/2011
Dibenzo(a,h)anthracene	mg/kg	14	15	9/27/2007	7/27/2011	2	13%	7/27/2011	0.017	0.0022	0.0096	0.0098	1	0.0000286	2	13%	594	13	7/27/2011
Fluoranthene	mg/kg	14	15	9/27/2007	7/27/2011	12	80%	7/27/2011	0.88	0.0021	0.14	0.0098	0.01	0.0899	3	20%	10	0	7/27/2011
Fluorene	mg/kg	14	15	9/27/2007	7/27/2011	3	20%	7/27/2011	1	0.39	0.61	0.0098	0.016	0.0294	3	20%	34	0	7/27/2011
Indeno(1,2,3-cd)pyrene	mg/kg	14	15	9/27/2007	7/27/2011	5	33%	7/27/2011	0.029	0.0057	0.011	0.0098	1	0.000555	5	33%	52	10	7/27/2011
Naphthalene	mg/kg	14	15	9/27/2007	7/27/2011	4	27%	7/27/2011	0.51	0.0037	0.25	0.0098	0.016	0.00207	4	27%	246	11	7/27/2011
Phenanthrene	mg/kg	14	15	9/27/2007	7/27/2011	12	80%	7/27/2011	2.4	0.0024	0.29	0.0099	0.016	1.5	1	7%	1.6	0	10/1/2007
Pyrene	mg/kg	14	15	9/27/2007	7/27/2011	12	80%	7/27/2011	0.99	0.0025	0.17	0.0098	0.01	0.137	3	20%	7.2	0	7/27/2011
Polychlorinated Biphenyls																			
Aroclor 1016	mg/kg	18	19	9/27/2007	11/17/2017	0	0%					0.0099	6.3					0	
Aroclor 1221	mg/kg	6	6	7/27/2011	11/17/2017	0	0%					0.064	6.3					0	
Aroclor 1232	mg/kg	6	6	7/27/2011	11/17/2017	0	0%					0.064	6.3					0	
Aroclor 1242	mg/kg	6	6	7/27/2011	11/17/2017	3	50%	11/17/2017	15	2.3	7	0.064	1.2					0	
Aroclor 1248	mg/kg	18	19	9/27/2007	11/17/2017	0	0%					0.0099	6.3					0	
Aroclor 1254	mg/kg	18	19	9/27/2007	11/17/2017	12	63%	11/17/2017	93	0.0059	11	0.0099	0.064					0	
Aroclor 1260	mg/kg	18	19	9/27/2007	11/17/2017	7	37%	11/17/2017	23	0.021	4.8	0.0099	1.2					0	
Total PCB Aroclors	mg/kg	18	19	9/27/2007	11/17/2017	13	68%	11/17/2017	131	0.0059	14.7	0.0099	0.064	0.00000217	13	68%	60,368,664	6	11/17/2017
Total PCB Congeners	mg/kg	1	1	11/17/2017	11/17/2017	1	100%	11/17/2017	99.1	99.1	99.1			0.00000217	1	100%	45,668,203	0	11/17/2017
Pesticides/Herbicides																			
2,4'-DDD	mg/kg	12	13	9/27/2007	10/1/2007	1	8%	9/28/2007	0.0023	0.0023	0.0023	0.00099	0.28					0	
2,4'-DDE	mg/kg	12	13	9/27/2007	10/1/2007	0	0%					0.00099	0.24					0	
2,4'-DDT	mg/kg	12	13	9/27/2007	10/1/2007	6	46%	10/1/2007	1.3	0.0011	0.37	0.00099	0.001					0	
4,4'-DDD	mg/kg	14	15	9/27/2007	7/27/2011	6	40%	10/1/2007	0.2	0.00022	0.055	0.00099	0.013	0.000000364	6	40%	549,451	9	7/27/2011
4,4'-DDE	mg/kg	14	15	9/27/2007	7/27/2011	8	53%	7/27/2011	0.39	0.00045	0.11	0.00099	0.18	0.0000000763	8	53%	5,111,402	7	7/27/2011
4,4'-DDT	mg/kg	14	15	9/27/2007	7/27/2011	7	47%	10/1/2007	1.5	0.0018	0.39	0.00099	0.013	0.000000814	7	47%	1,842,752	8	7/27/2011
Aldrin	mg/kg	14	15	9/27/2007	7/27/2011	6	40%	7/27/2011	9.4	0.002	2.3	0.00099	0.001	0.00000000201	6	40%	4,676,616,915	9	7/27/2011
Alpha-BHC	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.0059	0.0065	0.0000000982	0			2	7/27/2011
Beta-BHC	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.0059	0.0065	0.00000340	0			2	7/27/2011
cis-Chlordane	mg/kg	2	2	7/27/2011	7/27/2011	1	50%	7/27/2011	0.047	0.047	0.047	0.013	0.013	0.00000529	1	50%	8,885	1	7/27/2011
Delta-BHC	mg/kg	2	2	7/27/2011	7/27/2011	1	50%	7/27/2011	0.056	0.056	0.056	0.0059	0.0059	6	0			0	
Dieldrin	mg/kg	14	15	9/27/2007	7/27/2011	5	33%	7/27/2011	0.18	0.00058	0.058	0.00099	0.1	0.0000000309	5	33%	5,825,243	10	7/27/2011
Endosulfan I	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.0059	0.0065	0.0000202				2	7/27/2011
Endosulfan II	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.012	0.013	0.0000202				2	7/27/2011
Endosulfan Sulfate	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.012	0.013					0	
Endrin	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.012	0.013	0.0000222				2	7/27/2011
Endrin Aldehyde	mg/kg	2	2	7/27/2011	7/27/2011	2	100%	7/27/2011	0.16	0.036	0.098	0.012	0.013						
Endrin ketone	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.012	0.013					0	
Heptachlor	mg/kg	14	15	9/27/2007	7/27/2011	3	20%	7/27/2011	0.017	0.00056	0.0084	0.00099	0.1	0.00000000334	3	20%	5,089,820	12	7/27/2011
Heptachlor Epoxide	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.0059	0.0065	0.0000002				2	7/27/2011
Lindane	mg/kg	14	15	9/27/2007	7/27/2011	0	0%					0.00099	0.1	0.000205				15	7/27/2011
Methoxychlor	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.012	0.013	0.00161				2	7/27/2011
Total Chlordane	mg/kg	12	13	9/27/2007	10/1/2007	0	0%					0.0099	5	0.00000113				13	10/1/2007
Toxaphene	mg/kg	2	2	7/27/2011	7/27/2011	0	0%					0.059	0.065	0.00000307				2	7/27/2011
trans-Chlordane	mg/kg	2	2	7/27/2011	7/27/2011	1	50%	7/27/2011	0.18	0.18	0.18	0.013	0.013	0.00000529	1	50%	34,026	1	7/27/2011
Conventionals																			
Total Solids	%	12	13	9/27/2007	10/1/2007	13	100%	10/1/2007	87.5	60.5	78.9								

Notes:

[a] - Remedial Investigation Screening Level based on the most stringent Lower Duwamish Waterway Preliminary Cleanup Level for Soil in the Saturated Zone, excluding protection of drinking water (screening levels SL-1, SL-6, SL-7, SL-8, SL-9, SL-10). See Table C.2 in Appendix C.

For purposes of this initial screening, samples included in the statistical analysis are those from vadose soil samples collected from on the SPM Property (see Tables D.3 and D.4 in Appendix D).

Blank cells = not applicable

mg/kg - milligrams per kilogram

Many maximum and minimum reporting limits were not explicitly listed in the historical database. We have assumed the values given for non-detect results are the reporting limit where historical reporting limits were omitted. Therefore some of the maximum and minimum reporting limits are based on non-detect results only.

Diesel and Oil Extended Range Organics Calculation Note: Results were calculated as the sum of Diesel Range Organic and Motor Oil Range Organics, with non-detects summed at 1/2 the reporting limit. If all components were non-detect, the sum is reported as non-detect at the largest component's reporting limit.

Total PCBs (Sum of Aroclors) calculation note: Results are either reported as-given from historical database or calculated by Aspect using reported Aroclor values. For calculations by Aspect, non-detect results = 0. If all Aroclor results were non-detect, the total was reported as the largest RL of any single Aroclor, which appears to match the logic used in the historical database.

Total TPH, cPAHs TEQ, PCB Congeners, PAHs, HPAHs, and LPAHs calculation note: The reported results are from the historical database, and the calculation used in the historical database is unknown.

Total Organic Carbon calculation note: TOC was back calculated using the TOC-normalized historical data. The reporting limits are unknown, and the reported results assume all constituents were detected.

Table 6.3. Statistical Summary of Groundwater Chemical Analytical Results

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Fraction	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Minimum Reporting Limit	Maximum Reporting Limit	Units	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of Non-Detects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Metals																				
Arsenic	D	3	3	10/8/2007	10/9/2007	3	100%	10/9/2007	3.26	8.08	5.27			ug/L	8	1	33%	1.0		10/9/2007
Arsenic	T	5	8	10/8/2007	7/27/2011	6	75%	3/12/2008	1.56	8.07	3.66	3.3	3.3	ug/L	8	1	13%	1.0	0	10/9/2007
Barium	T	2	2	7/27/2011	7/27/2011	1	50%	7/27/2011	47	47	47	28	28	ug/L	200	0			0	
Cadmium	D	3	3	10/8/2007	10/9/2007	3	100%	10/9/2007	0.026	0.105	0.0543			ug/L	1.19	0				
Cadmium	T	5	8	10/8/2007	7/27/2011	6	75%	3/12/2008	0.013	0.091	0.033	4.4	4.4	ug/L	1.19	0			2	7/27/2011
Chromium	D	3	3	10/8/2007	10/9/2007	3	100%	10/9/2007	1.25	25.2	9.35			ug/L						
Chromium	T	5	8	10/8/2007	7/27/2011	6	75%	3/12/2008	1.52	40.4	17.7	11	11	ug/L					0	
Copper	D	3	3	10/8/2007	10/9/2007	3	100%	10/9/2007	2.77	6.27	4.72			ug/L	14	0				10/9/2007
Copper	T	3	6	10/8/2007	3/12/2008	6	100%	3/12/2008	2.83	9.83	6.67			ug/L	14	0				3/12/2008
Lead	D	3	3	10/8/2007	10/9/2007	3	100%	10/9/2007	0.021	0.057	0.044			ug/L	8.1	0				
Lead	T	5	8	10/8/2007	7/27/2011	6	75%	3/12/2008	0.046	0.519	0.191	1.1	1.1	ug/L	8.1	0			0	
Mercury	D	3	3	10/8/2007	10/9/2007	0	0%					0.2	0.2	ug/L	0.025	0			3	10/9/2007
Mercury	T	5	8	10/8/2007	7/27/2011	0	0%					0.2	0.5	ug/L	0.025	0			8	7/27/2011
Selenium	T	2	2	7/27/2011	7/27/2011	0	0%					5.6	5.6	ug/L	71	0			0	
Silver	D	3	3	10/8/2007	10/9/2007	0	0%					0.02	0.02	ug/L	1.9	0			0	
Silver	T	5	8	10/8/2007	7/27/2011	2	25%	10/9/2007	0.005	0.01	0.008	0.005	11	ug/L	1.9	0			2	7/27/2011
Zinc	D	3	3	10/8/2007	10/9/2007	3	100%	10/9/2007	2.1	5.2	3.8			ug/L	85	0				
Zinc	T	3	6	10/8/2007	3/12/2008	6	100%	3/12/2008	2.93	4.9	4.06			ug/L	85	0				
Total Petroleum Hydrocarbons																				
Gasoline Range Organics	N	5	5	10/8/2007	7/27/2011	0	0%					100	250	ug/L					0	
Diesel Range Organics	N	5	5	10/8/2007	7/27/2011	0	0%					270	630	ug/L					0	
Motor Oil Range Organics	N	5	5	10/8/2007	7/27/2011	0	0%					430	630	ug/L					0	
Diesel and Oil Extended Range Organics	N	5	5	10/8/2007	7/27/2011	0	0%					430	630	ug/L					0	
Benzene, Toluene, Ethylbenzene, and Total Xylenes																				
Benzene	N	5	8	10/8/2007	7/27/2011	0	0%					0.2	0.5	ug/L	1.6	0			0	
Toluene	N	5	8	10/8/2007	7/27/2011	2	25%	10/9/2007	0.11	0.12	0.12	0.5	1	ug/L	130	0			0	
Ethylbenzene	N	5	8	10/8/2007	7/27/2011	0	0%					0.2	0.5	ug/L	31	0			0	
Total Xylenes	N	5	8	10/8/2007	7/27/2011	0	0%					0.5	0.6	ug/L	332	0			0	
Volatile Organic Compounds																				
1,1,1,2-Tetrachloroethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	7.36	0			0	
1,1,1-Trichloroethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	5460	0			0	
1,1,2,2-Tetrachloroethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	0.3	0			6	3/12/2008
1,1,2-Trichloroethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	0.9	0			0	
1,1-Dichloroethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	11.1	0			0	
1,1-Dichloroethene	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	129	0			0	
1,1-Dichloropropene	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L					0	
1,2,3-Trichlorobenzene	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L					0	
1,2,3-Trichloropropane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L					0	
1,2,4-Trichlorobenzene	N	3	6	10/8/2007	3/12/2008	0	0%					0.21	2	ug/L	0.037	0			6	3/12/2008
1,2,4-Trimethylbenzene	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L	239	0			0	
1,2-Dibromo-3-chloropropane	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L					0	
1,2-Dibromoethane (EDB)	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L	0.271	0			6	3/12/2008
1,2-Dichlorobenzene	N	5	8	10/8/2007	7/27/2011	0	0%					0.2	0.5	ug/L	4.61	0			0	
1,2-Dichloroethane (EDC)	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	4.22	0			0	
1,2-Dichloropropane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	3.1	0			0	
1,3,5-Trimethylbenzene	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L					0	
1,3-Dichlorobenzene	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	2	0			0	
1,3-Dichloropropane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L					0	
1,4-Dichlorobenzene	N	3	6	10/8/2007	3/12/2008	0	0%					0.21	0.5	ug/L	4.93	0			0	
2,2-Dichloropropane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L					0	
2-Butanone	N	5	8	10/8/2007	7/27/2011	0	0%					5	20	ug/L	1750000	0			0	
2-Chlorotoluene	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L					0	
2-Hexanone	N	3	6	10/8/2007	3/12/2008	0	0%					20	20	ug/L					0	
4-Chlorotoluene	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L					0	
4-Methyl-2-pentanone	N	3	6	10/8/2007	3/12/2008	0	0%					20	20	ug/L	470000	0			0	
Acetone	N	3	6	10/8/2007	3/12/2008	0	0%					20	20	ug/L					0	
Bromobenzene	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L					0	
Bromochloromethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L					0	
Bromodichloromethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	1.82	0			0	
Bromoform	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	12	0			0	
Bromomethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	12.9	0			0	
Carbon Disulfide	N	5	8	10/8/2007	7/27/2011	0	0%					0.2	0.5	ug/L	399	0			0	
Carbon Tetrachloride	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	0.35	0			6	3/12/2008

Table 6.3. Statistical Summary of Groundwater Chemical Analytical Results
Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Fraction	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Minimum Reporting Limit	Maximum Reporting Limit	Units	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of Non-Detects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Chlorobenzene	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	200	0			0	
Chloroethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	18500	0			0	
Chloroform	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	1.19	0			0	
Chloromethane	N	3	6	10/8/2007	3/12/2008	4	67%	3/12/2008	0.36	0.9	0.64	0.5	0.5	ug/L	153	0			0	
cis-1,2-Dichloroethene (DCE)	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L					0	
cis-1,3-Dichloropropene	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	2	0			0	
Dibromochloromethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	2.2	0			0	
Dibromomethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L					0	
Dichlorodifluoromethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	5.65	0			0	
Isopropylbenzene	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L					0	
m,p-Xylenes	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L					0	
Methylene Chloride	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L	100	0			0	
n-Butylbenzene	N	5	8	10/8/2007	7/27/2011	0	0%					0.2	2	ug/L					0	
n-Propylbenzene	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L					0	
o-Xylene	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	432	0			0	
p-Isopropyltoluene	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L					0	
sec-Butylbenzene	N	5	8	10/8/2007	7/27/2011	0	0%					0.2	2	ug/L					0	
Styrene	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	8190	0			0	
tert-Butylbenzene	N	3	6	10/8/2007	3/12/2008	0	0%					2	2	ug/L					0	
Tetrachloroethene (PCE)	N	5	8	10/8/2007	7/27/2011	3	38%	3/12/2008	0.16	0.2	0.18	0.2	0.5	ug/L	2.9	0			0	
trans-1,2-Dichloroethene	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	1000	0			0	
trans-1,3-Dichloropropene	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	2	0			0	
Trichloroethene (TCE)	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	0.7	0			0	
Trichlorofluoromethane	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	120	0			0	
Vinyl Chloride	N	3	6	10/8/2007	3/12/2008	0	0%					0.5	0.5	ug/L	0.18	0			6	3/12/2008
Semivolatile Organic Compounds																				
2,4-Dimethylphenol	N	3	3	10/8/2007	10/9/2007	0	0%					4.1	4.1	ug/L	6.34	0			0	
2,4-Dinitrophenol	N	2	2	7/27/2011	7/27/2011	0	0%					5	5.2	ug/L	100	0			0	
2-Methylphenol	N	3	3	10/8/2007	10/9/2007	0	0%					0.51	0.51	ug/L	27	0			0	
4-Methylphenol	N	3	3	10/8/2007	10/9/2007	0	0%					0.51	0.51	ug/L					0	
Benzoic acid	N	3	3	10/8/2007	10/9/2007	0	0%					5.1	5.1	ug/L	589	0			0	
Benzyl alcohol	N	3	3	10/8/2007	10/9/2007	0	0%					5.1	5.1	ug/L					0	
Benzyl butyl phthalate	N	3	3	10/8/2007	10/9/2007	0	0%					0.21	0.21	ug/L	0.013	0			3	10/9/2007
Bis(2-ethylhexyl) phthalate	N	5	5	10/8/2007	7/27/2011	0	0%					1	1.1	ug/L	0.046	0			5	7/27/2011
Dibenzofuran	N	3	3	10/8/2007	10/9/2007	0	0%					0.21	0.21	ug/L					0	
Diethyl phthalate	N	3	3	10/8/2007	10/9/2007	3	100%	10/9/2007	0.036	0.059	0.047			ug/L	92.6	0				
Dimethyl phthalate	N	3	3	10/8/2007	10/9/2007	0	0%					0.21	0.21	ug/L	600	0			0	
Di-n-butyl phthalate	N	3	3	10/8/2007	10/9/2007	3	100%	10/9/2007	0.065	0.08	0.075			ug/L	8	0				
Di-n-octyl phthalate	N	3	3	10/8/2007	10/9/2007	0	0%					0.21	0.21	ug/L	0.00392	0			3	10/9/2007
Hexachlorobenzene	N	3	3	10/8/2007	10/9/2007	0	0%					0.21	0.21	ug/L	0.000005	0			3	10/9/2007
Hexachlorobutadiene	N	3	6	10/8/2007	3/12/2008	0	0%					0.21	2	ug/L	0.01	0			6	3/12/2008
N-Nitrosodiphenylamine	N	3	3	10/8/2007	10/9/2007	0	0%					0.21	0.21	ug/L	0.69	0			0	
Pentachlorophenol	N	3	3	10/8/2007	10/9/2007	0	0%					1.1	1.1	ug/L	0.002	0			3	10/9/2007
Phenol	N	3	3	10/8/2007	10/9/2007	0	0%					0.51	0.51	ug/L	365	0			0	
Polycyclic Aromatic Hydrocarbons																				
1-Methylnaphthalene	N	2	2	7/27/2011	7/27/2011	0	0%					0.1	0.1	ug/L					0	
2-Methylnaphthalene	N	3	3	10/8/2007	10/9/2007	0	0%					0.21	0.21	ug/L					0	
Acenaphthene	N	5	5	10/8/2007	7/27/2011	0	0%					0.1	0.21	ug/L	5.34	0			0	
Acenaphthylene	N	5	5	10/8/2007	7/27/2011	0	0%					0.1	0.21	ug/L					0	
Anthracene	N	5	5	10/8/2007	7/27/2011	0	0%					0.1	0.21	ug/L	2.15	0			0	
Benz(a)anthracene	N	5	5	10/8/2007	7/27/2011	0	0%					0.01	0.21	ug/L	0.00016	0			5	7/27/2011
Benzo(a)pyrene	N	5	5	10/8/2007	7/27/2011	0	0%					0.01	0.21	ug/L	0.000016	0			5	7/27/2011
Benzo(b)fluoranthene	N	5	5	10/8/2007	7/27/2011	0	0%					0.01	0.21	ug/L	0.00016	0			5	7/27/2011
Benzo(g,h,i)perylene	N	5	5	10/8/2007	7/27/2011	0	0%					0.01	0.21	ug/L					0	
Benzo(j,k)fluoranthene	N	2	2	7/27/2011	7/27/2011	0	0%					0.01	0.01	ug/L					0	
Benzo(k)fluoranthene	N	3	3	10/8/2007	10/9/2007	0	0%					0.21	0.21	ug/L	0.0016	0			3	10/9/2007
Chrysene	N	5	5	10/8/2007	7/27/2011	0	0%					0.01	0.21	ug/L	0.016	0			3	10/9/2007
Dibenzo(a,h)anthracene	N	5	5	10/8/2007	7/27/2011	0	0%					0.01	0.21	ug/L	0.000016	0			5	7/27/2011
Fluoranthene	N	5	5	10/8/2007	7/27/2011	0	0%					0.1	0.21	ug/L	1.82	0			0	
Fluorene	N	5	5	10/8/2007	7/27/2011	0	0%					0.1	0.21	ug/L	3.67	0			0	
Indeno(1,2,3-cd)pyrene	N	5	5	10/8/2007	7/27/2011	0	0%					0.01	0.21	ug/L	0.00016	0			5	7/27/2011
Naphthalene	N	5	8	10/8/2007	7/27/2011	0	0%					0.1	2	ug/L	1.4	0			3	3/12/2008
Phenanthrene	N	5	5	10/8/2007	7/27/2011	0	0%					0.1	0.21	ug/L					0	
Pyrene	N	5	5	10/8/2007	7/27/2011	0	0%					0.1	0.21	ug/L	2.01	0			0	

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Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Fraction	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Minimum Reporting Limit	Maximum Reporting Limit	Units	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of Non-Detects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Polychlorinated Biphenyls																				
Aroclor 1016	N	5	5	10/8/2007	7/27/2011	0	0%					0.05	0.21	ug/L					0	
Aroclor 1221	N	2	2	7/27/2011	7/27/2011	0	0%					0.05	0.053	ug/L					0	
Aroclor 1232	N	2	2	7/27/2011	7/27/2011	0	0%					0.05	0.053	ug/L					0	
Aroclor 1242	N	2	2	7/27/2011	7/27/2011	0	0%					0.05	0.053	ug/L					0	
Aroclor 1248	N	5	5	10/8/2007	7/27/2011	0	0%					0.05	0.21	ug/L					0	
Aroclor 1254	N	5	5	10/8/2007	7/27/2011	2	40%	7/27/2011	0.059	0.1	0.08	0.2	0.21	ug/L					0	
Aroclor 1260	N	5	5	10/8/2007	7/27/2011	0	0%					0.05	0.21	ug/L					0	
Total PCBs Aroclors	N	5	5	10/8/2007	7/27/2011	2	40%	7/27/2011	0.059	0.1	0.08	0.2	0.21	ug/L	0.000007	2	40%	14285.7	3	7/27/2011
Pesticides/Herbicides																				
2,4'-DDD	N	3	6	10/8/2007	3/12/2008	0	0%					0.00049	0.011	ug/L					0	
2,4'-DDE	N	3	6	10/8/2007	3/12/2008	0	0%					0.00049	0.011	ug/L					0	
2,4'-DDT	N	3	6	10/8/2007	3/12/2008	1	17%	10/8/2007	0.001	0.001	0.001	0.00049	0.011	ug/L					0	
4,4'-DDD	N	4	8	10/8/2007	7/27/2011	0	0%					0.00049	0.011	ug/L	0.0000079	0			8	7/27/2011
4,4'-DDE	N	4	8	10/8/2007	7/27/2011	0	0%					0.00049	0.011	ug/L	0.00000088	0			8	7/27/2011
4,4'-DDT	N	4	8	10/8/2007	7/27/2011	3	38%	3/12/2008	0.00082	0.0022	0.0015	0.0005	0.011	ug/L	0.0000012	3	38%	1,833	5	7/27/2011
Aldrin	N	4	8	10/8/2007	7/27/2011	3	38%	7/27/2011	0.0012	0.01	0.0041	0.00049	0.011	ug/L	0.000000041	3	38%	243,902	5	7/27/2011
Alpha-BHC	N	1	2	7/27/2011	7/27/2011	0	0%					0.005	0.0052	ug/L	0.000048	0			2	7/27/2011
Beta-BHC	N	1	2	7/27/2011	7/27/2011	0	0%					0.005	0.0052	ug/L	0.0014	0			2	7/27/2011
Chlordane	N	3	6	10/8/2007	3/12/2008	0	0%					0.0097	0.21	ug/L	0.000022	0			6	3/12/2008
cis-Chlordane	N	4	5	3/12/2008	7/27/2011	0	0%					0.00049	0.0052	ug/L	0.000103	0			5	7/27/2011
Delta-BHC	N	1	2	7/27/2011	7/27/2011	0	0%					0.005	0.0052	ug/L					0	
Dieldrin	N	4	8	10/8/2007	7/27/2011	4	50%	3/12/2008	0.00071	0.041	0.016	0.0005	0.082	ug/L	0.0000012	4	50%	34,167	4	7/27/2011
Endosulfan I	N	1	2	7/27/2011	7/27/2011	0	0%					0.005	0.0052	ug/L	0.0087	0			0	
Endosulfan II	N	1	2	7/27/2011	7/27/2011	0	0%					0.005	0.0052	ug/L	0.0087	0			0	
Endosulfan Sulfate	N	1	2	7/27/2011	7/27/2011	0	0%					0.005	0.0052	ug/L	10	0			0	
Endrin	N	1	2	7/27/2011	7/27/2011	0	0%					0.005	0.0052	ug/L	0.002	0			2	7/27/2011
Endrin Aldehyde	N	1	2	7/27/2011	7/27/2011	0	0%					0.005	0.0052	ug/L	0.035	0			0	
Endrin ketone	N	1	2	7/27/2011	7/27/2011	0	0%					0.02	0.021	ug/L					0	
Heptachlor	N	4	8	10/8/2007	7/27/2011	0	0%					0.00049	0.011	ug/L	0.00000034	0			8	7/27/2011
Heptachlor Epoxide	N	1	2	7/27/2011	7/27/2011	0	0%					0.005	0.0052	ug/L	0.0000024	0			2	7/27/2011
Lindane	N	4	8	10/8/2007	7/27/2011	0	0%					0.00049	0.011	ug/L	0.126	0			0	
Methoxychlor	N	1	2	7/27/2011	7/27/2011	0	0%					0.01	0.01	ug/L	0.02	0			0	
Toxaphene	N	1	2	7/27/2011	7/27/2011	0	0%					0.05	0.052	ug/L	0.000032	0			2	7/27/2011
trans-Chlordane	N	4	5	3/12/2008	7/27/2011	1	20%	7/27/2011	0.015	0.015	0.015	0.00049	0.005	ug/L	0.000103	1	20%	146	4	7/27/2011

Notes:

[a] - Remedial Investigation Screening Level based on the most stringent Lower Duwamish Waterway Preliminary Cleanup Level for Protection of Nonpotable Water (screening levels GW-2, GW-3, GW-4, and GW-5). See Table C.1 in Appendix C.

For purposes of this initial screening, samples included in the statistical analysis are those from groundwater monitoring wells and grab samples from open boreholes with temporary screens (see Tables D.5 and D.6 in Appendix D).

Blank cells = not applicable D - Dissolved T- Total N - not applicable ug/L - micrograms per liter

Many maximum and minimum reporting limits were not explicitly listed in the historical database. We have assumed the values given for non-detect results are the reporting limit where historical reporting limits were omitted. Therefore some of the maximum and minimum reporting limits are based on non-detect results only.

Diesel and Oil Extended Range Organics Calculation Note: Results were calculated as the sum of Diesel Range Organic and Motor Oil Range Organics, with non-detects summed at 1/2 the reporting limit. If all components were non-detect, the sum is reported as non-detect at the largest component's reporting limit.

Total PCBs (Sum of Aroclors) calculation note: Results are either reported as-given from historical database or calculated by Aspect using reported Aroclor values. For calculations by Aspect, non-detect results = 0. If all Aroclor results were non-detect, the total was reported as the largest RL of any single Aroclor, which appears to match the logic used in the historical database.

Total TPH, cPAHs TEQ, PCB Congeners, PAHs, HPAHs, and LPAHs calculation note: The reported results are from the historical database, and the calculation used in the historical database is unknown.

Total Organic Carbon calculation note: TOC was back calculated using the TOC-normalized historical data. The reporting limits are unknown, and the reported results assume all constituents were detected.

Table 6.4. Statistical Summary of Stormwater Chemical Analytical Results
Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Maximum Detected Concentration	Minimum Detected Concentration	Average Detected Concentration	Units	Minimum Reporting Limit	Maximum Reporting Limit	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of Non-Detects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Metals																			
Antimony	3	3	6/8/2017	6/8/2017	0	0%					ug/L	0.0056	0.0056	90	0			0	
Arsenic	3	3	6/8/2017	6/8/2017	1	33%	6/8/2017	3.9	3.9	3.9	ug/L	0.0033	0.0033	0.14	1	33%	28	2	6/8/2017
Beryllium	3	3	6/8/2017	6/8/2017	0	0%					ug/L	0.011	0.011	75.6	0			0	
Cadmium	3	3	6/8/2017	6/8/2017	0	0%					ug/L	0.0044	0.0044	7.9	0			0	
Chromium	3	3	6/8/2017	6/8/2017	1	33%	6/8/2017	11	11	11	ug/L	0.011	0.011						
Copper	7	8	6/8/2017	10/25/2018	7	88%	10/25/2018	130	12	66	ug/L	0.011	0.011	50	4	50%	3	1	10/25/2018
Lead	3	3	6/8/2017	6/8/2017	3	100%	6/8/2017	5.9	2.9	4.8	ug/L			8.1	0				
Mercury	3	3	6/8/2017	6/8/2017	0	0%					ug/L	0.0005	0.0005	0.025	0			3	6/8/2017
Nickel	3	3	6/8/2017	6/8/2017	0	0%					ug/L	0.022	0.022	8.2	0			3	6/8/2017
Selenium	3	3	6/8/2017	6/8/2017	0	0%					ug/L	0.0056	0.0056	71	0			0	
Silver	3	3	6/8/2017	6/8/2017	0	0%					ug/L	0.011	0.011	1.9	0			3	6/8/2017
Thallium	3	3	6/8/2017	6/8/2017	0	0%					ug/L	0.0056	0.0056	0.0619	0			3	6/8/2017
Zinc	7	8	6/8/2017	10/25/2018	8	100%	10/25/2018	8700	92	2259	ug/L			85	8	100%	102	0	10/25/2018
Volatile Organic Compounds																			
1,2,4-Trichlorobenzene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.037	0			2	6/8/2017
1,2-Dichlorobenzene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	800	0			0	
1,3-Dichlorobenzene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	2	0			0	
1,4-Dichlorobenzene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	59.8	0			0	
Semivolatile Organic Compounds																			
1,2-Dinitrobenzene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
1,2-Diphenylhydrazine	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.02	0			2	6/8/2017
1,3-Dinitrobenzene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
1,4-Dinitrobenzene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
2,3,4,6-Tetrachlorophenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
2,3,5,6-Tetrachlorophenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
2,3-Dichloroaniline	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
2,4,5-Trichlorophenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	600	0			0	
2,4,6-Trichlorophenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.28	0			2	6/8/2017
2,4-Dichlorophenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	10	0			0	
2,4-Dimethylphenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	97	0			0	
2,4-Dinitrophenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	4.7	4.8	100	0			0	
2,4-Dinitrotoluene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.18	0			2	6/8/2017
2,6-Dinitrotoluene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
2-Chloronaphthalene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	100	0			0	
2-Chlorophenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	17	0			0	
2-Methylphenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
2-Nitroaniline	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
2-Nitrophenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
3 & 4 Methylphenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
3,3'-Dichlorobenzidine	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.0033	0			2	6/8/2017
3-Nitroaniline	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
4,6-Dinitro-2-methylphenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	4.7	4.8	7	0			0	
4-Bromophenyl phenyl ether	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
4-Chloro-3-methylphenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	36	0			0	
4-Chloroaniline	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
4-Chlorophenyl phenyl ether	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
4-Nitroaniline	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
4-Nitrophenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	4.7	4.8						
Aniline	2	2	6/8/2017	6/8/2017	0	0%					ug/L	4.7	4.8						
Benzidine	2	2	6/8/2017	6/8/2017	0	0%					ug/L	4.7	4.8	0.000023	0			2	6/8/2017
Benzyl alcohol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
Benzyl butyl phthalate	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.013	0			2	6/8/2017
Bis(2-chloroethoxy)methane	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
Bis(2-chloroethyl) ether	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.06	0			2	6/8/2017
bis(2-Chloroisopropyl)ether	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
Bis(2-ethylhexyl) adipate	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
Bis(2-ethylhexyl) phthalate	2	2	6/8/2017	6/8/2017	2	100%	6/8/2017	59	1.9	30	ug/L			0.046	2	100%	1283	0	6/8/2017
Carbazole	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
Dibenzofuran	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
Diethyl phthalate	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	200	0			0	
Dimethyl phthalate	2	2	6/8/2017	6/8/2017	1	50%	6/8/2017	17	17	17	ug/L	0.96	0.96	600	0			0	
Di-n-butyl phthalate	2	2	6/8/2017	6/8/2017	1	50%	6/8/2017	1.9	1.9	1.9	ug/L	0.94	0.94	8	0			0	
Di-n-octyl phthalate	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
Hexachlorobenzene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.000005	0			2	6/8/2017
Hexachlorobutadiene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.01	0			2	6/8/2017
Hexachlorocyclopentadiene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	1	0			0	

Table 6.4. Statistical Summary of Stormwater Chemical Analytical Results

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Maximum Detected Concentration	Minimum Detected Concentration	Average Detected Concentration	Units	Minimum Reporting Limit	Maximum Reporting Limit	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of Non-Detects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Hexachloroethane	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.02	0			2	6/8/2017
Isophorone	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	110	0			0	
Nitrobenzene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	100	0			0	
N-Nitrosodimethylamine	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.34	0			2	6/8/2017
N-Nitroso-di-n-propylamine	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.058	0			2	6/8/2017
N-Nitrosodiphenylamine	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	0.69	0			2	6/8/2017
Pentachlorophenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	4.7	4.8	0.002	0			2	6/8/2017
Phenol	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96	70000	0			0	
Pyridine	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.94	0.96						
Polycyclic Aromatic Hydrocarbons																			
1-Methylnaphthalene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.094	0.096						
2-Methylnaphthalene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.094	0.096						
Acenaphthene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.094	0.096	30	0			0	
Acenaphthylene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.094	0.096						
Anthracene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.094	0.096	100	0			0	
Benz(a)anthracene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.0094	0.0096	0.00016	0			2	6/8/2017
Benzo(a)pyrene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.0094	0.0096	0.000016	0			2	6/8/2017
Benzo(b)fluoranthene	2	2	6/8/2017	6/8/2017	1	50%	6/8/2017	0.015	0.015	0.015	ug/L	0.0096	0.0096	0.00016	1	50%	94	1	6/8/2017
Benzo(g,h,i)perylene	2	2	6/8/2017	6/8/2017	1	50%	6/8/2017	0.014	0.014	0.014	ug/L	0.0096	0.0096						
Benzo(j,k)fluoranthene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.0094	0.0096						
Chrysene	2	2	6/8/2017	6/8/2017	1	50%	6/8/2017	0.032	0.032	0.032	ug/L	0.0096	0.0096	0.016	1	50%	2.0	0	6/8/2017
Dibenzo(a,h)anthracene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.0094	0.0096	0.000016	0			2	6/8/2017
Fluoranthene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.094	0.096	6	0			0	
Fluorene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.094	0.096	10	0			0	
Indeno(1,2,3-cd)pyrene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.0094	0.0096	0.00016	0			2	6/8/2017
Naphthalene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.094	0.096	1.4	0			0	
Phenanthrene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.094	0.096						
Pyrene	2	2	6/8/2017	6/8/2017	0	0%					ug/L	0.094	0.096	8	0			0	
Polychlorinated Biphenyls																			
Aroclor 1016	4	6	6/8/2017	9/19/2017	0	0%					ug/L	0.000047	0.000048						
Aroclor 1221	4	6	6/8/2017	9/19/2017	0	0%					ug/L	0.000047	0.000048						
Aroclor 1232	4	6	6/8/2017	9/19/2017	0	0%					ug/L	0.000047	0.000048						
Aroclor 1242	4	6	6/8/2017	9/19/2017	0	0%					ug/L	0.000047	0.000048						
Aroclor 1248	4	6	6/8/2017	9/19/2017	0	0%					ug/L	0.000047	0.000048						
Aroclor 1254	4	6	6/8/2017	9/19/2017	0	0%					ug/L	0.000047	0.000048						
Aroclor 1260	4	6	6/8/2017	9/19/2017	0	0%					ug/L	0.000047	0.000048						
Total PCB Aroclors	4	6	6/8/2017	9/19/2017	0	0%					ug/L	0.000047	0.000048	0.000007	0			6	9/19/2017
Total PCB Congeners	4	6	9/19/2017	9/19/2017	6	100%	9/19/2017	0.0574	0.0038	0.020165	ug/L	0.00000485	0.0000253	0.000007	6	100%	8200.0	0	9/19/2017
Conventionals																			
Alkalinity, Total	2	2	6/8/2017	6/8/2017	2	100%	6/8/2017	11	9	10	mg/L								
Hardness	2	2	6/8/2017	6/8/2017	2	100%	6/8/2017	12	9.1	11	mg/L								
Total Dissolved Solids	2	2	6/8/2017	6/8/2017	2	100%	6/8/2017	60	52	56	mg/L								
Total Organic Carbon	2	2	6/8/2017	6/8/2017	2	100%	6/8/2017	16000	15000	16000	ug/L								
Total Suspended Solids	2	2	6/8/2017	6/8/2017	2	100%	6/8/2017	18	8	13	mg/L								

Notes:

[a] - Remedial Investigation Screening Level based on the most stringent state or federal marine water quality or sediment standards with the addition of SPM boatyard permit benchmarks. See Table C.4 in Appendix C.

For purposes of this initial screening, samples included in the statistical analysis are those from catch basins and roof drains (see Table D.7 and D.8 in Appendix D).

Blank cells = not applicable   mg/L -milligrams per liter   ug/L - micrograms per liter

Diesel and Oil Extended Range Organics Calculation Note: Results were calculated as the sum of Diesel Range Organic and Motor Oil Range Organics, with non-detects summed at 1/2 the reporting limit. If all components were non-detect, the sum is reported as non-detect at the largest component's reporting limit.

Total PCBs (Sum of Aroclors) calculation note: Results are either reported as-given from historical database or calculated by Aspect using reported Aroclor values. For calculations by Aspect, non-detect results = 0. If all Aroclor results were non-detect, the total was reported as the largest RL of any single Aroclor, which appears to match the logic used in the historical database.

Total TPH, cPAHs TEQ, PCB Congeners, PAHs, HPAHs, and LPAHs calculation note: The reported results are from the historical database, and the calculation used in the historical database is unknown.

Total Organic Carbon calculation note: TOC was back calculated using the TOC-normalized historical data. The reporting limits are unknown, and the reported results assume all constituents were detected.

Table 6.5. Statistical Summary of Catch Basin Solids Chemical Analytical Results
Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Minimum Reporting Limit	Maximum Reporting Limit	Units	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of NonDetects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Metals																			
Antimony	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	20	20	20			mg/kg						
Arsenic	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	22	22	22			mg/kg	93	0				
Beryllium	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	0.23	0.23	0.23			mg/kg						
Cadmium	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	6.5	6.5	6.5			mg/kg	6.7	0				
Chromium	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	160	160	160			mg/kg	270	0				
Copper	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	1800	1800	1800			mg/kg	390	1	100%	5	0	10/8/2015
Lead	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	430	430	430			mg/kg	530	0				
Mercury	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	0.19	0.19	0.19			mg/kg	0.59	0				
Nickel	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	180	180	180			mg/kg						
Selenium	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	1.2	1.2	1.2			mg/kg						
Silver	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	2.1	2.1	2.1			mg/kg	6.1	0				
Thallium	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	0.3	0.3	0.3			mg/kg						
Zinc	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	5600	5600	5600			mg/kg	960	1	100%	6	0	10/8/2015
Total Petroleum Hydrocarbons																			
Gasoline Range Organics	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	480	480	480			mg/kg						
Diesel Range Organics	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	5300	5300	5300			mg/kg						
Motor Oil Range Organics	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	14000	14000	14000			mg/kg						
Diesel and Oil Extended Range Organics	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	19300	19300	19300			mg/kg						
Benzene, Toluene, Ethylbenzene, and Total Xylenes																			
Benzene	1	1	10/8/2015	10/8/2015	0	0%					89	89	ug/kg						
Toluene	1	1	10/8/2015	10/8/2015	2	200%	10/8/2015	380	380	380			ug/kg						
Ethylbenzene	1	1	10/8/2015	10/8/2015	2	200%	10/8/2015	240	240	240			ug/kg						
Total Xylenes	1	1	10/8/2015	10/8/2015	2	200%	10/8/2015	660	660	660			ug/kg						
Volatile Organic Compounds																			
1,1,1,2-Tetrachloroethane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
1,1,1-Trichloroethane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
1,1,2,2-Tetrachloroethane	1	1	10/8/2015	10/8/2015	0	0%					56	66	ug/kg						
1,1,2-Trichloroethane	1	1	10/8/2015	10/8/2015	0	0%					67	80	ug/kg						
1,1,2-Trichlorotrifluoroethane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
1,1-Dichloroethane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
1,1-Dichloroethene	1	1	10/8/2015	10/8/2015	0	0%					110	130	ug/kg						
1,1-Dichloropropene	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
1,2,3-Trichlorobenzene	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
1,2,3-Trichloropropane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
1,2,4-Trichlorobenzene	1	1	10/8/2015	10/8/2015	0	0%					140	10000	ug/kg	51				1	10/8/2015
1,2,4-Trimethylbenzene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	3300	4600	4000			ug/kg						
1,2-Dibromo-3-chloropropane	1	1	10/8/2015	10/8/2015	0	0%					1100	1300	ug/kg						
1,2-Dibromoethane (EDB)	1	1	10/8/2015	10/8/2015	0	0%					89	110	ug/kg						
1,2-Dichlorobenzene	1	1	10/8/2015	10/8/2015	0	0%					160	10000	ug/kg	50				1	10/8/2015
1,2-Dichloroethane (EDC)	1	1	10/8/2015	10/8/2015	0	0%					89	110	ug/kg						
1,2-Dichloropropane	1	1	10/8/2015	10/8/2015	0	0%					67	80	ug/kg						
1,3,5-Trimethylbenzene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	610	2000	1300			ug/kg						
1,3-Dichlorobenzene	1	1	10/8/2015	10/8/2015	0	0%					140	10000	ug/kg						
1,3-Dichloropropane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
1,4-Dichloro-2-Butene	1	1	10/8/2015	10/8/2015	0	0%					1100	1300	ug/kg						
1,4-Dichlorobenzene	1	1	10/8/2015	10/8/2015	0	0%					140	10000	ug/kg	110				1	10/8/2015
2,2-Dichloropropane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
2-Butanone	1	1	10/8/2015	10/8/2015	0	0%					2200	2700	ug/kg						
2-Chloroethyl Vinyl Ether	1	1	10/8/2015	10/8/2015	0	0%					1100	1300	ug/kg						
2-Chlorotoluene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2014	67	67	67	220	220	ug/kg						
2-Hexanone	1	1	10/8/2015	10/8/2015	0	0%					1100	1300	ug/kg						
4-Chlorotoluene	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
4-Methyl-2-pentanone	1	1	10/8/2015	10/8/2015	1	100%	10/8/2014	900	900	900	1100	1100	ug/kg						
Acetone	1	1	10/8/2015	10/8/2015	0	0%					2200	2700	ug/kg						
Acrolein	1	1	10/8/2015	10/8/2015	0	0%					6700	8000	ug/kg						
Acrylonitrile	1	1	10/8/2015	10/8/2015	0	0%					1100	1300	ug/kg						
Bromobenzene	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
Bromochloromethane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
Bromodichloromethane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
Bromoform	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
Bromomethane	1	1	10/8/2015	10/8/2015	0	0%					780	930	ug/kg						
Carbon Disulfide	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
Carbon Tetrachloride	1	1	10/8/2015	10/8/2015	0	0%					110	130	ug/kg						
Chlorobenzene	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
Chloroethane	1	1	10/8/2015	10/8/2015	0	0%					2200	2700	ug/kg						
Chloroform	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
Chloromethane	1	1	10/8/2015	10/8/2015	0	0%					560	660	ug/kg						
cis-1,2-Dichloroethene (cDCE)	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
cis-1,3-Dichloropropene	1	1	10/8/2015	10/8/2015	0	0%					89	110	ug/kg						
Dibromochloromethane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						

Analyte	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Minimum Reporting Limit	Maximum Reporting Limit	Units	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of NonDetects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Dibromomethane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
Dichlorodifluoromethane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
Isopropylbenzene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	50	830	440			ug/kg						
m,p-Xylenes	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	430	5200	2800			ug/kg						
Methyl tert-butyl ether (MTBE)	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
Methylene Chloride	1	1	10/8/2015	10/8/2015	0	0%					140	170	ug/kg						
Methyliodide	1	1	10/8/2015	10/8/2015	0	0%					1100	1300	ug/kg						
n-Butylbenzene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	1200	1800	1500			ug/kg						
n-Propylbenzene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	180	1100	640			ug/kg						
o-Xylene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	230	2300	1300			ug/kg						
p-Isopropyltoluene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	290	400	350			ug/kg						
sec-Butylbenzene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	160	370	270			ug/kg						
Styrene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	220	9300	4800			ug/kg						
tert-Butylbenzene	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
Tetrachloroethene (PCE)	1	1	10/8/2015	10/8/2015	0	0%					110	110	ug/kg						
trans-1,2-Dichloroethene	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
trans-1,3-Dichloropropene	1	1	10/8/2015	10/8/2015	0	0%					89	110	ug/kg						
Trichloroethene (TCE)	1	1	10/8/2015	10/8/2015	0	0%					89	89	ug/kg						
Trichlorofluoromethane	1	1	10/8/2015	10/8/2015	0	0%					220	270	ug/kg						
Vinyl Acetate	1	1	10/8/2015	10/8/2015	0	0%					1100	1300	ug/kg						
Vinyl Chloride	1	1	10/8/2015	10/8/2015	0	0%					89	110	ug/kg						
Semivolatile Organic Compounds																			
2,4,5-Trichlorophenol	1	1	10/8/2015	10/8/2015	0	0%													
2,4,6-Trichlorophenol	1	1	10/8/2015	10/8/2015	0	0%													
2,4-Dichlorophenol	1	1	10/8/2015	10/8/2015	0	0%													
2,4-Dimethylphenol	1	1	10/8/2015	10/8/2015	0	0%								29				1	10/8/2015
2,4-Dinitrophenol	1	1	10/8/2015	10/8/2015	0	0%													
2,4-Dinitrotoluene	1	1	10/8/2015	10/8/2015	0	0%													
2,6-Dinitrotoluene	1	1	10/8/2015	10/8/2015	0	0%													
2-Chloronaphthalene	1	1	10/8/2015	10/8/2015	0	0%													
2-Chlorophenol	1	1	10/8/2015	10/8/2015	0	0%													
2-Methylphenol	1	1	10/8/2015	10/8/2015	0	0%								63				1	10/8/2015
2-Nitroaniline	1	1	10/8/2015	10/8/2015	0	0%													
2-Nitrophenol	1	1	10/8/2015	10/8/2015	0	0%													
3,3'-Dichlorobenzidine	1	1	10/8/2015	10/8/2015	0	0%													
3-Nitroaniline	1	1	10/8/2015	10/8/2015	0	0%													
4,6-Dinitro-2-methylphenol	1	1	10/8/2015	10/8/2015	0	0%													
4-Bromophenyl phenyl ether	1	1	10/8/2015	10/8/2015	0	0%													
4-Chloro-3-methylphenol	1	1	10/8/2015	10/8/2015	0	0%													
4-Chloroaniline	1	1	10/8/2015	10/8/2015	0	0%													
4-Chlorophenyl phenyl ether	1	1	10/8/2015	10/8/2015	0	0%													
4-Methylphenol	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	330	330	330			ug/kg	670	0				
4-Nitroaniline	1	1	10/8/2015	10/8/2015	0	0%													
4-Nitrophenol	1	1	10/8/2015	10/8/2015	0	0%													
Benzoic acid	1	1	10/8/2015	10/8/2015	0	0%								650				1	10/8/2015
Benzyl alcohol	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	3600	3600	3600			ug/kg	73	1	100%	49	0	10/8/2015
Benzyl butyl phthalate	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	1800	1800	1800			ug/kg	900	1	100%	2	0	10/8/2015
Bis(2-chloroethoxy)methane	1	1	10/8/2015	10/8/2015	0	0%													
Bis(2-chloroethyl) ether	1	1	10/8/2015	10/8/2015	0	0%													
Bis(2-ethylhexyl) phthalate	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	37000	37000	37000			ug/kg	1900	1	100%	19	0	10/8/2015
Carbazole	1	1	10/8/2015	10/8/2015	0	0%													
Dibenzofuran	1	1	10/8/2015	10/8/2015	0	0%								540					
Diethyl phthalate	1	1	10/8/2015	10/8/2015	0	0%								1200					
Dimethyl phthalate	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	3900	3900	3900			ug/kg	160	1	100%	24	0	10/8/2015
Di-n-butyl phthalate	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	3700	3700	3700			ug/kg	1400	1	100%	3	0	10/8/2015
Di-n-octyl phthalate	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	1200	1200	1200			ug/kg	6200	0				
Hexachlorobenzene	1	1	10/8/2015	10/8/2015	0	0%								70				1	10/8/2015
Hexachlorobutadiene	1	1	10/8/2015	10/8/2015	0	0%								120				1	10/8/2015
Hexachlorocyclopentadiene	1	1	10/8/2015	10/8/2015	0	0%													
Hexachloroethane	1	1	10/8/2015	10/8/2015	0	0%													
Isophorone	1	1	10/8/2015	10/8/2015	0	0%													
Nitrobenzene	1	1	10/8/2015	10/8/2015	0	0%													
N-Nitrosodimethylamine	1	1	10/8/2015	10/8/2015	0	0%													
N-Nitroso-di-n-propylamine	1	1	10/8/2015	10/8/2015	0	0%													
N-Nitrosodiphenylamine	1	1	10/8/2015	10/8/2015	0	0%								40				1	10/8/2015
Pentachlorophenol	1	1	10/8/2015	10/8/2015	0	0%								690				1	10/8/2015
Phenol	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	370	370	370			ug/kg	1200	0				

Table 6.5. Statistical Summary of Catch Basin Solids Chemical Analytical Results

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Minimum Reporting Limit	Maximum Reporting Limit	Units	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of NonDetects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Polycyclic Aromatic Hydrocarbons																			
1-Methylnaphthalene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	3100	3100	3100			ug/kg						
2-Methylnaphthalene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	4600	4600	4600			ug/kg	670	1	100%	6.9	0	10/8/2015
Acenaphthene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	170	170	170			ug/kg	500	0				
Acenaphthylene	1	1	10/8/2015	10/8/2015	0	0%					88	88	ug/kg	1300	0				
Anthracene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	190	190	190			ug/kg	960					
Benz(a)anthracene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	270	270	270			ug/kg	1600	0				
Benzo(a)pyrene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	370	370	370			ug/kg	1600	0				
Benzo(g,h,i)perylene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	360	360	360			ug/kg	720	0				
Chrysene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	960	960	960			ug/kg	2800	0				
Dibenzo(a,h)anthracene	1	1	10/8/2015	10/8/2015	0	0%					180	180	ug/kg	230					
Fluoranthene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	1600	1600	1600			ug/kg	2500	0				
Fluorene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	510	510	510			ug/kg	540	0				
Indeno(1,2,3-cd)pyrene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	250	250	250			ug/kg	690	0				
Naphthalene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	2200	2200	2200			ug/kg	2100	1	100%	1.05	0	10/8/2015
Phenanthrene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	880	880	880			ug/kg	1500	0				
Pyrene	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	2200	2200	2200			ug/kg	3300	0				
Total Benzofluoranthenes	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	1000	1000	1000			ug/kg	3600	0				
Total HPAHs	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	7000	7000	7000			ug/kg	17000	0				
Total LPAHs	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	4000	4000	4000			ug/kg	5200	0				
Total cPAHs TEQ (ND = 0)	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	530	530	530			ug/kg						
Total cPAHs TEQ (ND = 1/2 RDL)	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	540	540	540			ug/kg						
Total cPAHs TEQ (ND=1)	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	550	550	550			ug/kg						
Polychlorinated Biphenyls																			
Aroclor 1016	9	10	10/8/2015	2/11/2016	0	0%					0.022	20	mg/kg						
Aroclor 1221	9	10	10/8/2015	2/11/2016	0	0%					0.024	20	mg/kg						
Aroclor 1232	9	10	10/8/2015	2/11/2016	0	0%					0.024	20	mg/kg						
Aroclor 1242	9	10	10/8/2015	2/11/2016	0	0%					0.022	20	mg/kg						
Aroclor 1248	9	10	10/8/2015	2/11/2016	0	0%					0.022	20	mg/kg						
Aroclor 1254	9	10	10/8/2015	2/11/2016	3	30%	2/11/2016	0.34	1.5	0.73	0.022	20	mg/kg						
Aroclor 1260	9	10	10/8/2015	2/11/2016	4	40%	2/11/2016	0.43	0.57	0.51	0.08	20	mg/kg						
Aroclor 1262	9	9	2/9/2016	2/11/2016	0	0%					0.04	20	mg/kg						
Aroclor 1268	9	9	2/9/2016	2/11/2016	0	0%					0.04	20	mg/kg						
Total PCB Aroclors	9	10	10/8/2015	2/11/2016	6	60%	2/11/2016	0.34	1.5	0.7	0.8	20	mg/kg	1	1	10%	2	3	2/11/2016
Aroclor 1016 (OC normalized)	9	9	2/9/2016	2/11/2016	0	0%					0.49	342	mg/kg-OC						
Aroclor 1221 (OC normalized)	9	9	2/9/2016	2/11/2016	0	0%					0.49	342	mg/kg-OC						
Aroclor 1232 (OC normalized)	9	9	2/9/2016	2/11/2016	0	0%					0.49	342	mg/kg-OC						
Aroclor 1242 (OC normalized)	9	9	2/9/2016	2/11/2016	0	0%					0.49	342	mg/kg-OC						
Aroclor 1248 (OC normalized)	9	9	2/9/2016	2/11/2016	0	0%					0.49	342	mg/kg-OC						
Aroclor 1254 (OC normalized)	9	9	2/9/2016	2/11/2016	3	33%	2/11/2016	2.94	25.6	10.6	0.49	342	mg/kg-OC						
Aroclor 1260 (OC normalized)	9	9	2/9/2016	2/11/2016	3	33%	2/11/2016	3.61	11.7	7.57	0.73	342	mg/kg-OC						
Aroclor 1262 (OC normalized)	9	9	2/9/2016	2/11/2016	0	0%					0.49	342	mg/kg-OC						
Aroclor 1268 (OC normalized)	9	9	2/9/2016	2/11/2016	0	0%					0.49	342	mg/kg-OC						
Total PCB Aroclors (OC normalized)	9	9	2/9/2016	2/11/2016	5	56%	2/11/2016	3.09	25.6	10.9	6.61	342	mg/kg-OC						
Total PCB Congeners	9	10	10/8/2015	2/11/2016	10	100%	2/11/2016	0.0507	1.19	0.438			mg/kg	1	1	10%	1.19	0	2/9/2016
Total PCB TEQ (ND = 0)[b]	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	0.000017	0.000017	0.000017			mg/kg	0.0000002	1	100%	85	0	10/8/2015
Total PCB TEQ (ND = 1 RDL)[b]	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	0.00017	0.00017	0.00017			mg/kg	0.0000002	1	100%	850	0	10/8/2015
Total PCB TEQ (ND = 1/2 RDL)[b]	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	0.0000852	0.0000852	0.0000852			mg/kg	0.0000002	1	100%	426	0	10/8/2015
Total Dioxin-like PCBs	9	9	2/9/2016	2/11/2016	9	100%	2/11/2016	0.00291216	0.1245205	0.03303673			mg/kg	0.0000002	9	100%	622603	0	2/11/2016

Table 6.5. Statistical Summary of Catch Basin Solids Chemical Analytical Results

Project No. 190293, South Park Marina, Seattle, Washington

Analyte	Number of Sampled Locations	Number of Samples (excluding Field Dups)	First Sample Date	Most Recent Available Sample Date	Number of Samples with Detected Concentration	Frequency of Detection	Last Sample Date with Detected Concentration	Minimum Detected Concentration	Maximum Detected Concentration	Average Detected Concentration	Minimum Reporting Limit	Maximum Reporting Limit	Units	RI Screening Level[a]	Number of Exceedances of RI Screening Level	Frequency of Exceedance	Ratio of Maximum Exceedance to RI Screening Level	Number of NonDetects with Reporting Limit Above RI Screening Level	Date of Last RI Screening Level Exceedance
Dioxins/Furans																			
Total Dioxin/Furan TEQ (ND = 0)	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	59	59	59			ng/kg	2	1	100%	29.5	0	10/8/2015
Total Dioxin/Furan TEQ (ND = 1/2 RDL)	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	59	59	59			ng/kg	2	1	100%	29.5	0	10/8/2015
Total Dioxin/Furan TEQ (ND = 1x RDL)	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	59	59	59			ng/kg	2	1	100%	29.5	0	10/8/2015
2,3,7,8-TCDD	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	2.03	2.03	2.03			ng/kg						
1,2,3,7,8-PeCDD	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	11.7	11.7	11.7			ng/kg						
1,2,3,4,7,8-HxCDD	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	20.9	20.9	20.9			ng/kg						
1,2,3,6,7,8-HxCDD	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	51.8	51.8	51.8			ng/kg						
1,2,3,7,8,9-HxCDD	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	37.4	37.4	37.4			ng/kg						
1,2,3,4,6,7,8-HpCDD	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	1650	1650	1650			ng/kg						
OCDD	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	19800	19800	19800			ng/kg						
Total TCDD	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	31.4	31.4	31.4			ng/kg						
Total PeCDD	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	86.1	86.1	86.1			ng/kg						
Total HxCDD	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	479	479	479			ng/kg						
Total HpCDD	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	3620	3620	3620			ng/kg						
2,3,7,8-TCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	7.9	7.9	7.9			ng/kg						
1,2,3,7,8-PeCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	4.66	4.66	4.66			ng/kg						
2,3,4,7,8-PeCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	10.5	10.5	10.5			ng/kg						
1,2,3,4,7,8-HxCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	14.8	14.8	14.8			ng/kg						
1,2,3,6,7,8-HxCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	13.8	13.8	13.8			ng/kg						
1,2,3,7,8,9-HxCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	1.18	1.18	1.18			ng/kg						
2,3,4,6,7,8-HxCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	18.5	18.5	18.5			ng/kg						
1,2,3,4,6,7,8-HpCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	256	256	256			ng/kg						
1,2,3,4,7,8,9-HpCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	15.7	15.7	15.7			ng/kg						
OCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	876	876	876			ng/kg						
Total TCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	127	127	127			ng/kg						
Total PeCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	230	230	230			ng/kg						
Total HxCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	360	360	360			ng/kg						
Total HpCDF	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	718	718	718			ng/kg						
Alkyl Halides																			
1-Chloropropane	1	1	10/8/2015	10/8/2015	0	0%					1100	1100	ug/kg						
Conventionals																			
Total Organic Carbon	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	11	11	11			%						
Total Organic Carbon (Calculated)	9	9	2/9/2016	2/11/2016	9	100%	2/11/2016	4.1	12	8.3			%						
Total Solids	1	1	10/8/2015	10/8/2015	1	100%	10/8/2015	44.7	44.7	44.7			%						

Notes:

[a] - Remedial Investigation Screening Level based on the most stringent from either the SMS Upper Tier 2LAET for marine benthic and the Lower Tier natural background. See Table C.5 in Appendix C.

[b] - Total PCB TEQ values are shown as reported in the historical analytical database. Total values for the complete dataset will be calculated and reported in the RI.

For purposes of this initial screening, samples included in the statistical analysis are those from catch basins only (see Tables D.9 and D.10 in Appendix D).

Blank cells = not applicable milligrams per kilogram ug/kg - micrograms per kilogram ng/kg - nanograms per kilogram OC - organic carbon

Many maximum and minimum reporting limits were not explicitly listed in the historical database. We have assumed the values given for non-detect results are the reporting limit where historical reporting limits were omitted. Therefore some of the maximum and minimum reporting limits are based on non-detect results only.

Diesel and Oil Extended Range Organics Calculation Note: Results were calculated as the sum of Diesel Range Organic and Motor Oil Range Organics, with non-detects summed at 1/2 the reporting limit. If all components were non-detect, the sum is reported as non-detect at the largest component's reporting limit.

Total PCBs (Sum of Aroclors) calculation note: Results are either reported as-given from historical database or calculated by Aspect using reported Aroclor values. For calculations by Aspect, non-detect results = 0. If all Aroclor results were non-detect, the total was reported as the largest RL of any single Aroclor, which appears to match the logic used in the historical database.

Total TPH, cPAHs TEQ, PCB Congeners, PAHs, HPAHs, and LPAHs calculation note: The reported results are from the historical database, and the calculation used in the historical database is unknown.

Total Organic Carbon calculation note: TOC was back calculated using the TOC-normalized historical data. The reporting limits are unknown, and the reported results assume all constituents were detected.

Table 8.1. Data Quality Objectives
Nature and Extent of Contamination in Soil

Project No. 190293, South Park Marina, Seattle, Washington FINAL

Step	Description
State the Problem	Additional information is necessary determine Site COIs and the lateral and vertical extent of contamination in soil.
Identify the Goal of the Study	The goals are to: • Identify contaminants in soil exceeding RI screening levels that address all applicable exposure pathways. • Determine the nature and extent of contaminant concentrations in soil exceeding screening levels in the Study Area.
Identify Information Inputs	Information inputs include: • Historical information, including aerial photographs and maps (see Section 2.2). • Infrastructure and utilities, including utility location and geophysical surveys (see Section 2.3). • Preliminary conceptual site model (CSM) (see Section 7). • Site geology and hydrogeology, including fill characteristics. (see Section 3). • RI screening levels (see Section 4). • Concentrations of COIs in soil.
Define the Boundaries of the RI Study	Spatial boundaries: The horizontal extent of the Agreed Order Study Area is defined by the T-117 property boundary on the east, Dallas Avenue on the south, South Thistle Street on the west, and the Ordinary High Water Mark of the Lower Duwamish Waterway on the north. The vertical extent of the Study Area will be based on bounding contamination (as determined by comparison of analytical data to RI screening levels) during the course of the study. Data from adjacent sites (including T-117 and Dallas Avenue Early Action Areas and the Lower Duwamish Waterway) of sufficient quality will be used to inform conditions that may affect contaminant conditions within the Study Area boundaries. Based on data collected and evaluated during the study, the boundaries of the Study Area will be adjusted, as needed, to encompass the extent of where contamination from the Site has come to be located in soil. Temporal boundaries: Data of sufficient quality (see Section 3.6.2) from previous investigations (beginning in 2008) to those collected as part of this RI will be used. Constraints on data collection: The field work and evaluation of data will be phased in order to allow for refinement to the scopes of work for subsequent RI activities (adaptive management). Other constraints may include limitations due to sampling methods, drilling refusal, encountering subsurface structures (such as piping or foundations), or accessibility for sampling equipment.
Develop the Analytic Approach	Nature and extent of contamination: Analyte concentrations from soil samples will be used to determine the extent of contamination. Sample-specific concentrations will be compared to RI screening levels. Data will be evaluated and displayed using figures and tables, and the findings will be used to update the CSM.

Step	Description
Specify Performance or Acceptance Criteria	Ensure, through data review and validation, that the analytical data for collected samples are within acceptable quality limits as defined by applicable data quality protocols (see the Appendix E QAPP). Ensure that sampling and analytical representativeness allow for adequate delineation of contaminant nature and extent and identification of areas and media requiring remediation.
Develop the Plan for Obtaining Data	The detailed plan for obtaining data is presented in this work plan and accompanying SAP/QAPP (Appendix E). A stepwise approach is proposed to determine the extent of contamination in soil: <u>Phase I</u> • Investigate potential contaminant source areas via soil borings at locations of historical Site features. Collect soil samples of potentially contaminated materials to evaluate the types and concentrations of contaminants associated with each area. Collect samples of soil beneath potentially contaminated materials to evaluate vertical extent of contaminants. Analyze samples for COIs of each area based on historical operations and existing data. After Phase 1 data is completed, the collected data will be used to update the CSM and identify Phase 2 data needs in a RI Work Plan Addendum. <u>Phase 2</u> • Investigate the extent of contaminated soil in each area. Collect soil samples via soil borings and surface soil samples stepping out laterally to define limits of contamination above RI screening levels. Analyze samples for COIs identified in Phase 1 for each area.

Table 8.2. Data Quality Objectives
Nature and Extent of Contamination in Groundwater

Step	Description
State the Problem	Additional information is necessary determine Site COIs and the lateral and vertical extent of contamination in groundwater.
Identify the Goal of the Study	The goals are to: • Identify contaminants in groundwater exceeding RI screening levels that address all applicable exposure pathways. • Determine the nature and extent of contaminant concentrations in groundwater exceeding screening levels in the Study Area. • Determine seasonal variability in contaminant concentrations in groundwater. • Determine the potential for recontamination of the Site from groundwater flowing from adjacent sites.
Identify Information Inputs	Information inputs include: • Historical information, including aerial photographs and maps (see Section 2.2). • Infrastructure and utilities, including utility location and geophysical surveys (see Section 2.3). • Preliminary conceptual site model (CSM) (see Section 7). • Site hydrogeology, including groundwater occurrence and flow characteristics. (see Section 3). • RI screening levels (see Section 4). • Concentrations of COIs in groundwater.
Define the Boundaries of the RI Study	Spatial boundaries: The horizontal extent of the Agreed Order Study Area is defined by the T-117 property boundary on the east, Dallas Avenue on the south, South Thistle Street on the west, and the Ordinary High Water Mark of the Lower Duwamish Waterway on the north. The vertical extent of the Study Area will be based on bounding contamination (as determined by comparison of analytical data to RI screening levels) during the course of the study. Data from adjacent sites (including T-117 and Dallas Avenue Early Action Areas and the Lower Duwamish Waterway) of sufficient quality will be used to inform conditions that may affect contaminant conditions within the Study Area boundaries. Based on data collected and evaluated during the study, the boundaries of the Study Area will be adjusted, as needed, to encompass the extent of where contamination from the Site has come to be located in groundwater. Temporal boundaries: Data of sufficient quality (see Section 3.6.2) from previous investigations (beginning in 2008) to those collected as part of this RI will be used. Constraints on data collection: The field work and evaluation of data will be phased in order to allow for refinement to the scopes of work for subsequent RI activities (adaptive management). Other constraints may include limitations due to sampling methods, drilling refusal, encountering subsurface structures (such as piping or foundations), or accessibility for sampling equipment.

Step	Description
Develop the Analytic Approach	Nature and extent of contamination: Analyte concentrations from groundwater samples will be used to determine the extent of contamination. Sample-specific concentrations will be compared to RI screening levels. Data will be evaluated and displayed using figures and tables, and the findings will be used to update the CSM.
Specify Performance or Acceptance Criteria	Ensure, through data review and validation, that the analytical data for collected samples are within acceptable quality limits as defined by applicable data quality protocols (see the Appendix E QAPP). Ensure that sampling and analytical representativeness allow for adequate delineation of contaminant nature and extent and identification of areas and media requiring remediation.
Develop the Plan for Obtaining Data	The detailed plan for obtaining data is presented in this work plan and accompanying SAP/QAPP (Appendix E). A stepwise approach is proposed to determine the extent of contamination in groundwater: <u>Phase I</u> • Investigate potential contaminant migration impacts to groundwater via monitoring wells downgradient of potential contaminant source areas, including potential off-Site sources of groundwater contamination to the Study Area. Analyze groundwater samples for COIs of each area based on historical operations and existing data. After Phase 1 data is completed, the collected data will be used to update the CSM and identify Phase 2 data needs in a RI Work Plan Addendum. <u>Phase 2</u> • Characterize groundwater quality in each area via monitoring well(s) near the location of highest soil contamination. • Install monitoring wells outside the area of soil contamination to determine the extent of groundwater contamination above RI screening levels. • Conduct wet- and dry-season monitoring of contaminants in groundwater at monitoring wells for 1 year to assess seasonal variability.

Table 8.3. Data Quality Objectives
Site Physical Characteristics

Project No. 190293, South Park Marina, Seattle, Washington FINAL

Step	Description
State the Problem	Additional information is necessary to characterize Site physical characteristics that influence contaminant fate and transport.
Identify the Goal of the Study	The goals are to: • Determine vertical distribution, grain size characteristics, and water-bearing properties of geologic units. • Determine if there is a perched water-bearing zone in the Fill above the Silt aquitard. • Understand seasonal groundwater flow characteristics.
Identify Information Inputs	Information inputs include: • Preliminary conceptual site model (CSM) • Logging of Site soil lithology from subsurface explorations • Physical soil characteristics, including gradation, density/penetration tests, and moisture content • Water levels at Site wells throughout seasonal cycles • Salinity data at Site monitoring wells as an indicator of LDW surface water intrusion
Define the Boundaries of the Study	The Study Area is defined in Table 8.1. The horizontal and vertical boundaries of the Study Area will be adjusted, as needed, to encompass the extent of where contamination from the Site has come to be located in soil and groundwater.
Develop the Analytic Approach	Identify distinct lithologic and aquifer units through soil logging and water level measurements.
Specify Performance or Acceptance Criteria	Physical data will be collected and analyzed using standard test measurements and procedures. Geologic and hydrogeologic characterization will be performed under the supervision of a licensed hydrogeologist.
Develop the Plan for Obtaining Data	The detailed plan for obtaining data is presented in this work plan and accompanying SAP/QAPP (Appendix E). All subsurface explorations at the Site will be logged for lithology and water levels.

Table 8.4. Data Quality Objectives
Contaminant Fate and Transport: Soil/Groundwater to Sediment/Surface Water Pathway

Project No. 190293, South Park Marina, Seattle, Washington FINAL

Step	Description
State the Problem	Additional information is necessary to characterize the potential for contamination in Site soil and groundwater to migrate to LDW sediment or surface water.
Identify the Goal of the Study	The goals are to: • Evaluate contaminant transport partitioning between soil and groundwater and migrating through groundwater to reach the LDW. • Evaluate potential mechanisms for contaminant attenuation along this migration pathway.
Identify Information Inputs	Information inputs include: • Areas of structures and impervious surfaces • Location and depth of subsurface utilities and subsurface infrastructure • Logging of Site soil lithology from subsurface explorations • Groundwater characteristics, including water-bearing zones and flow direction • Total organic carbon in soil • Chemical concentrations of contaminants in soil and groundwater • Conventional geochemical parameters that influence and serve as indicators of contaminant attenuation by physical, chemical, or biological means
Define the Boundaries of the Study	The Study Area is defined in Table 8.1. The boundaries of the Study Area will be adjusted, as needed, to encompass the extent of where contamination from the Site has come to be located in soil and groundwater.
Develop the Analytic Approach	Assess subsurface geology, utilities, and structures to evaluate potential preferential groundwater migration pathways. Collect and analyze representative samples of each geologic unit for total organic carbon for evaluations of leaching (sorption). Evaluate geochemical parameters, in conjunction with contaminant data, to assess potential for natural attenuation of contaminants. Compare chemical concentrations in soil and groundwater to screening levels based on migration to surface water and sediment. Evaluate collocated soil and groundwater chemical concentrations as a means to determine leaching potential. Assess existing data for LDW sediment adjacent to Study Area as an empirical assessment of the groundwater-to-sediment pathway.
Specify Performance or Acceptance Criteria	Ensure through data review and validation that the analytical data for collected samples are within acceptable quality limits as defined by applicable data quality protocols.
Develop the Plan for Obtaining Data	The detailed plan for obtaining data is presented in this work plan and accompanying SAP/QAPP (Appendix E). Lithologic characterization and collection of samples for total organic carbon analysis will be performed during soil investigations. Geochemical monitoring will be included in groundwater monitoring program.

Table 8.5. Data Quality Objectives
Contaminant Fate and Transport: Surface Soil/Stormwater to Sediment/Surface Water Pathway

Project No. 190293, South Park Marina, Seattle, Washington FINAL

Step	Description
State the Problem	Additional information is necessary to characterize the potential for contamination to migrate via Site stormwater to sediment or surface water.
Identify the Goal of the Study	The goals are to: • Evaluate contaminant transport migrating through stormwater to the LDW. • Evaluate potential sources of contamination to stormwater.
Identify Information Inputs	Information inputs include: • Areas of exposed surface soils and impervious surfaces • Location, depth, and continuity of stormwater infrastructure including catch basins/yard drains, pipes, treatment system, and outfalls • Site topography and drainage patterns • Chemical concentrations of contaminants in unfiltered samples of stormwater representing combined suspended-solids and dissolved-phase concentrations • Chemical concentrations in catch basin solids and surface soils, if contamination is identified in stormwater
Define the Boundaries of the Study	The Study Area is defined in Table 8.1.
Develop the Analytic Approach	Assess drainage patterns during rain events to confirm preliminary CSM. Collect and analyze representative samples of stormwater as close as practical to outfalls. Compare chemical concentrations in stormwater to screening levels based on migration to surface water and sediment. If chemical concentrations exceed screening levels: • Collect and analyze representative samples of catch basin solids and exposed surface soils within drainage area. • Assess existing data for LDW sediment adjacent to Study Area as an empirical assessment of the stormwater-to-sediment pathway.
Specify Performance or Acceptance Criteria	Ensure through data review and validation that the analytical data for collected samples are within acceptable quality limits as defined by applicable data quality protocols.
Develop the Plan for Obtaining Data	The detailed plan for obtaining data is presented in this work plan and accompanying SAP/QAPP (Appendix E). Two quarterly events for stormwater sampling are proposed. A preliminary evaluation of the data and proposed catch basin solids/surface soil sampling, if appropriate, would be presented in the RI Work Plan Addendum for Phase 2.

Step	Description
State the Problem	Additional information is necessary to characterize the potential for contamination to migrate via soil vapor to indoor air.
Identify the Goal of the Study	The goals are to: • Evaluate potential for VOCs in soil gas to migrate into indoor air at concentrations above applicable air cleanup levels.
Identify Information Inputs	Information inputs include: • Location, construction details, and occupancy of enclosed, heated structures on the SPM Property • Chemical concentrations of contaminants in shallow groundwater • Chemical concentrations in vadose-zone soil above the water table
Define the Boundaries of the Study	The Study Area is defined in Table 8.1.
Develop the Analytic Approach	Collect soil and groundwater data for VOCs and conduct a Tier I Screening in accordance with Ecology guidance (Ecology, 2018). If a Tier 1 screening indicates a potential VI concern: • Conduct soil gas and/or indoor air sampling (Tier 2 assessment) in accordance with Ecology guidance (Ecology, 2018).
Specify Performance or Acceptance Criteria	Ensure through data review and validation that the analytical data for collected samples are within acceptable quality limits as defined by applicable data quality protocols.
Develop the Plan for Obtaining Data	The detailed plan for obtaining data is presented in this work plan and accompanying SAP/QAPP (Appendix E). Soil and groundwater data are proposed to be collected under other DQOs to characterize contaminant nature and extent. If a Tier 2 assessment is warranted, a sampling plan, including sampling and analytical procedures, will be provided in the RI Work Plan Addendum.

Table 9.1. Phase 1 Field Investigation Soil and Catch Basin Solids Sampling Matrix

Project No. 190293, South Park Marina, Seattle, Washington

Investigation Area	Soil Exploration	Planned Exploration Depth (ft bgs)(1)	Northing/ Easting(2)		Objective	Analyses: Metals	Tributyl Tin	TPH	VOCs	SVOCs	Low-Level PAHs (SIM)	Organochlorine Pesticides	PCBs: Aroclors	PCBs: Congeners(3)	Dioxins / Furans(4)	TOC(5)
Former A&B Barrel Area	SB-26	0 - 20	1275076	195747	Lateral extent of former pond.	x		x	x	x	x	x	x		One location	x
	MW-04	0 - 20	1275107	195753	Sheet pile wall area groundwater-to-surface water sediment pathway.	x		x	x	x	x	x	x			x
	MW-05	0 - 30	1275098	195771	Vertical extent of former pond contamination.	x	x	x	x	x	x	x	x	x		x
	MW-06	0 - 20	1275096	195794	Sheet pile wall area groundwater-to-surface water sediment pathway.	x		x	x	x	x	x	x			x
	MW-07	0 - 20	1275056	195829	Migration from pond area and groundwater-to-surface water sediment pathway.	x		x	x	x	x	x	x			x
Historical Boat Manufacturing Area	SB-27	0 - 20	1274993	195869	Nature and extent of contamination from historical boat manufacturing.	x	x	x	x	x	x		x			x
	SB-28	0 - 20	1274935	195890	Nature and extent of contamination from historical boat manufacturing.	x	x	x	x	x	x		x			x
	MW-08	0 - 20	1274975	195899	Migration from historical boat manufacturing area and groundwater-to-surface water sediment pathway.	x	x	x	x	x	x	x	x	x		x
Former Service Station / Former Radiator Repair / Current Repair Shop Area	SB-29	0 - 20	1274644	195986	Nature and extent of contamination from current repair shop.	x	x	x	x	x	x	x	x			x
	SB-30	0 - 20	1274564	195873	Nature and extent of contamination from historical gasoline station.	x		x	x		x		x			x
	SB-31	0 - 20	1274518	195900	Nature and extent of contamination from historical gasoline station.	x		x	x		x		x			x
	MW-12	0 - 20	1274618	196046	Assess potential migration from former gasoline station and current repair shop area.	x		x	x		x		x			x
	MW-13	0 - 20	1274530	195878	Nature and extent of contamination from historical gasoline station and potential on-Property migration from dry cleaner.	x		x	x		x		x	x		x
	SB-34	0 - 20	1274626	195917	Assess potential migration from former radiator repair shop.	x		x	x		x		x			x
Shoreline	MW-09	0 - 1	1274873	195986	Assess surface soil to characterize erodible soil and direct contact pathways.	x	x	x	x	x	x	x	x			x
	MW-10	0 - 1	1274725	196126	Assess surface soil to characterize erodible soil and direct contact pathways.	x	x	x	x	x	x		x	x		x
	MW-11	0 - 1	1274632	196212	Assess surface soil to characterize erodible soil and direct contact pathways.	x	x	x	x	x	x		x			x
Former / Current Boat Maintenance Area	MW-14	0 - 20	1274745	195834	Assess surface soil to characterize direct contact and transport to stormwater-to-surface water sediment pathways. Nature and extent of contamination from historical and current boat maintenance activities.	x	x	x	x	x	x		x		One location	x
	MW-15	0 - 20	1274878	195776	Assess surface soil to characterize direct contact and transport to stormwater-to-surface water sediment pathways. Nature and extent of contamination from historical and current boat maintenance activities.	x	x	x	x	x	x	x	x			x
	SB-32	0 - 20	1274721	196055	Assess surface soil to characterize direct contact and transport to stormwater-to-surface water sediment pathways. Nature and extent of contamination from historical and current boat maintenance activities.	x	x	x	x	x	x		x	x		x
	SB-33	0 -20	1274769	195939	Assess surface soil to characterize direct contact and transport to stormwater-to-surface water sediment pathways. Nature and extent of contamination from historical and current boat maintenance activities.	x	x	x	x	x	x		x			x
T-117 Property Line	HA-01	0 - 3	1275051	195669	Assess surface soil to characterize direct contact and transport to stormwater-to-surface water sediment pathways. Nature and extent of contamination from neighboring T-117 Site.	x	x	x	x	x	x	x	x			x
	HA-02	0 - 3	1275079	195715	Assess surface soil to characterize direct contact and transport to stormwater-to-surface water sediment pathways. Nature and extent of contamination from neighboring T-117 Site.	x	x	x	x	x	x	x	x			x
Catch Basin Solids	CB-02	N/A	1274675	196004	Assess erodible soil to characterize transport to stormwater-to-surface water sediment pathways.	x	x	x	x	x	x	x	x		One location	x
	CB-06	N/A	1274787	195957	Assess erodible soil to characterize transport to stormwater-to-surface water sediment pathways.	x	x	x	x	x	x	x	x			x
	SWRX-Pre	N/A	1275080	195804	Assess erodible soil to characterize transport to stormwater-to-surface water sediment pathways.	x	x	x	x	x	x	x	x			x
Erodible Bank Soils(6)	TBD	0 - 1	TBD		Assess erodible soil to characterize transport to stormwater-to-surface water sediment pathways.	x	x	x	x	x	x	x	x			x

Notes:

(1) - Targeted depths for sample collection, analysis, and archival can be found in Table 9.2.

(2) - These are approximate locations for planning purposes. Actual investigation locations will be documented using a hand-held GPS unit during field work. Coordinates provided in NAD83 State Plan Washington North, feet.

(3) - At each location, only one soil sample from the depth with the highest Aroclor results will be submitted for congener analysis. If not detected, samples for analysis will be selected from locations based on Site history including historical PCB data.

(4) - At each of these investigation areas, one soil sample from the location and depth with the highest chlorinated PCB concentrations will be submitted for dioxin/furan analysis. If not detected, samples for analysis will be selected from locations based on Site history including historical PCB and D/F data.

(5) - TOC analysis will be conducted for one sample of unsaturated soil and one sample of saturated soil from each location to be determined in the field.

(6) - Potential erodible bank soils will be evaluated. If present, a sample will be collected for the analysis shown.

Metals - As, Cd, Cu, Cr, Pb, Hg, Ni, Zn

TPH - total petroleum hydrocarbons, including gasoline-, diesel-, and oil-ranges

VOCs - volatile organic compounds

SVOCs - semivolatile organic compounds

PAHs - polycyclic aromatic hydrocarbons

PCBs - polychlorinated biphenyls

TOC - total organic carbon

TSS - total suspended solids

See Appendix E for additional details on sampling protocol, procedures, and analytical methods.

Table 9.2. Phase 1 Field Investigation Targeted Depth Intervals for Laboratory Analysis

Project No. 190293, South Park Marina, Seattle, Washington

	Investigation Area	Former A&B Barrel Area	Historical Boat Manufacturing	Former Service Station / Former Radiator Repair / Current Repair Shop	Shoreline	Former / Current Boat Maintenance	T-117 Property Line	Contingent Analyses
Targeted Sample Number	**Soil Exploration**	SB-26, MW-04, MW-05, MW-06, & MW-07	SB-27, SB-28, & MW-08	SB-29, SB-30, SB-31, SB-34, MW-12, & MW-13	MW-09, MW-10, & MW-11	SB-32, SB-33, MW-14, & MW-15	HA-01 & HA-02	Borings with Indications of Contamination
1 (analysis)		0- to 1-foot depth bgs	0- to 1-foot depth bgs	0- to 1-foot depth bgs	0- to 1-foot depth bgs	0- to 1-foot depth bgs	0- to 1-foot depth bgs	Zone of highest indications
2 (analysis)		1-foot zone straddling water table	1-foot zone straddling water table	3- to 5-foot depth bgs	1-foot zone straddling water table	3- to 5-foot depth bgs	2- to 3-foot depth bgs	No indications of contamination below sample #1
3 (archival)		3- to 5-foot depth bgs	3- to 5-foot depth bgs	1-foot zone straddling water table	3- to 5-foot depth bgs	1-foot zone straddling water table	1- to 2-foot depth bgs	> 1 foot below sample #2
4 (archival)		Bottom of Boring	Bottom of boring	Bottom of boring	Bottom of boring	Bottom of boring	N/A	Bottom of boring

Notes:

Sampling depth indicates the targeted range from which soil samples will be submitted for laboratory analysis. Additional samples will be collected and archived from the length of each boring in accordance with the procedures identified in Appendix E, Section E.2.1.3.3 and identified above. Archived samples may be released for laboratory analysis if laboratory analysis of other samples at that exploration detect compounds exceeding screening levels. If field screening indications of contamination are present at the bottom of any boring, the boring will be extended until no evidence of contamination is observed (to a maximum of 30 feet bgs).

Table 9.3. Phase 1 Field Investigation Groundwater and Stormwater Sampling Matrix

Project No. 190293, South Park Marina, Seattle, Washington

Investigation Area	Location(1)	Northing/ Easting(2)		Objective	Analyses										
												PCBs			
					Metals(3)	Tributyl Tin(4)	TPH	VOCs	SVOCs	Low-Level PAHs	Organochlorine Pesticides	Aroclors	Congeners(5)	TOC	TSS
Former A&B Barrel Area	MW-04	1275107	195753	Sheet pile wall area groundwater-to-surface water sediment	x	x	x	x	x	x	x	x		x	x
	MW-05	1275098	195771	Leaching of former pond contamination to groundwater.	x	x	x	x	x	x	x	x		x	x
	MW-06	1275096	195794	Sheet pile wall area groundwater-to-surface water sediment pathway.	x	x	x	x	x	x	x	x		x	x
	MW-07	1275056	195829	Migration from pond area and groundwater-to-surface water sediment pathway.	x	x	x	x	x	x	x	x		x	x
Shoreline (Including Historical Boat Manufacturing Well)	MW-08	1274975	195899	Migration from historical boat manufacturing area and groundwater-to-surface water sediment pathway.	x	x	x	x	x	x	x	x		x	x
	MW-09	1274873	195986	Assess the groundwater-to-surface water sediment pathway.	x	x	x	x	x	x		x		x	x
	MW-10	1274725	196126	Assess the groundwater-to-surface water sediment pathway.	x	x	x	x	x	x		x	Four locations	x	x
	MW-11	1274632	196212	Assess the groundwater-to-surface water sediment pathway.	x	x	x	x	x	x		x		x	x
Former Service Station / Former Radiator Repair / Current Repair Shop	MW-12	1274618	196046	Assess potential migration from former gasoline station and current repair shop area.	x		x	x		x		x		x	x
	MW-13	1274530	195878	Nature and extent of contamination from historical gasoline station and potential on-Property migration from dry cleaner.	x		x	x		x		x		x	x
Groundwater Flow Direction / Boat Maitenance	MW-14	1274745	195834	Assess property-wide groundwater flow direction and groundwater quality in center of property	x	x	x	x	x	x		x		x	x
	MW-15	1274878	195776	Assess property-wide groundwater flow direction and groundwater quality in center of property	x	x	x	x	x	x	x	x		x	x
Stormwater	CB-02	1274675	196004	Evaluate the stormwater-to-surface water sediment pathway.	x	x	x		x	x		x		x	x
	CB-06	1274787	195957	Evaluate the stormwater-to-surface water sediment pathway.	x	x	x		x	x		x	One location	x	x
	SWRX-Pre	1275080	195804	Evaluate the stormwater-to-surface water sediment pathway.	x	x	x		x	x		x		x	x

Notes:

(1) - MW locations represent groundwater samples; CB and SWRX locations represent stormwater samples.
(2) - These are approximate locations for planning purposes. Actual well locations will be surveyed by a licensed surveyor upon completion. Coordinates provided in NAD83 State Plan Washington North, feet.
(3) - Metals include both total and dissolved concentrations.
(4) - Tributyl Tin (TBT) will only be analyzed from locations where it was detected in soil and/or from locations downgradient of soil detections.
(5) - Locations for PCB congener analysis will be selected based on Aroclor results.
Metals - As, Cd, Cu, Cr, Pb, Hg, Ni, Zn
TPH - total petroleum hydrocarbons, including gasoline-, diesel-, and oil-ranges
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
PAHs - polycyclic aromatic hydrocarbons
PCBs - polychlorinated biphenyls
TOC - total organic carbon
TSS - total suspended solids
SWRX-Pre - Vault located downstream from CB-09, from which water is pumped into the StormwateRx system for treatment.
See Appendix E for additional details on analytical methods and sampling procedures.

Table 10.2. Phase I Field Investigation RI Work Plan Addendum Schedule

Project No. 190293, South Park Marina, Seattle, Washington

Task	Estimated Task Duration (Calendar Days)	Time to Completion (Days from RI Work Plan Approval)	Estimated Completion Date (see Note 3)
RI Work Plan Approval Date			February 22, 2021
Phase 1 Investigation, Source Control Evaluation, and Work Plan Addendum			
Field Work (See Note 1)	59	59	April 22, 2021
Laboratory Analysis	60	119	June 21, 2021
Data Validation	31	150	July 22, 2021
Ecology Meeting	31	150	July 22, 2021
EIM Submittal of Phase 1 Data (see Note 2)	30	180	August 21, 2021
Draft Work Plan Addendum	64	291	December 10, 2021
Ecology comments on Draft Work Plan Addendum	15	306	December 25, 2021
Final Work Plan Addendum	32	338	January 26, 2022
Source Control Evaluation Memorandum			
Draft Memorandum	92	211	September 21, 2021
Ecology comments on Draft Memorandum	15	226	October 6, 2021
Final Memorandum	30	256	November 5, 2021

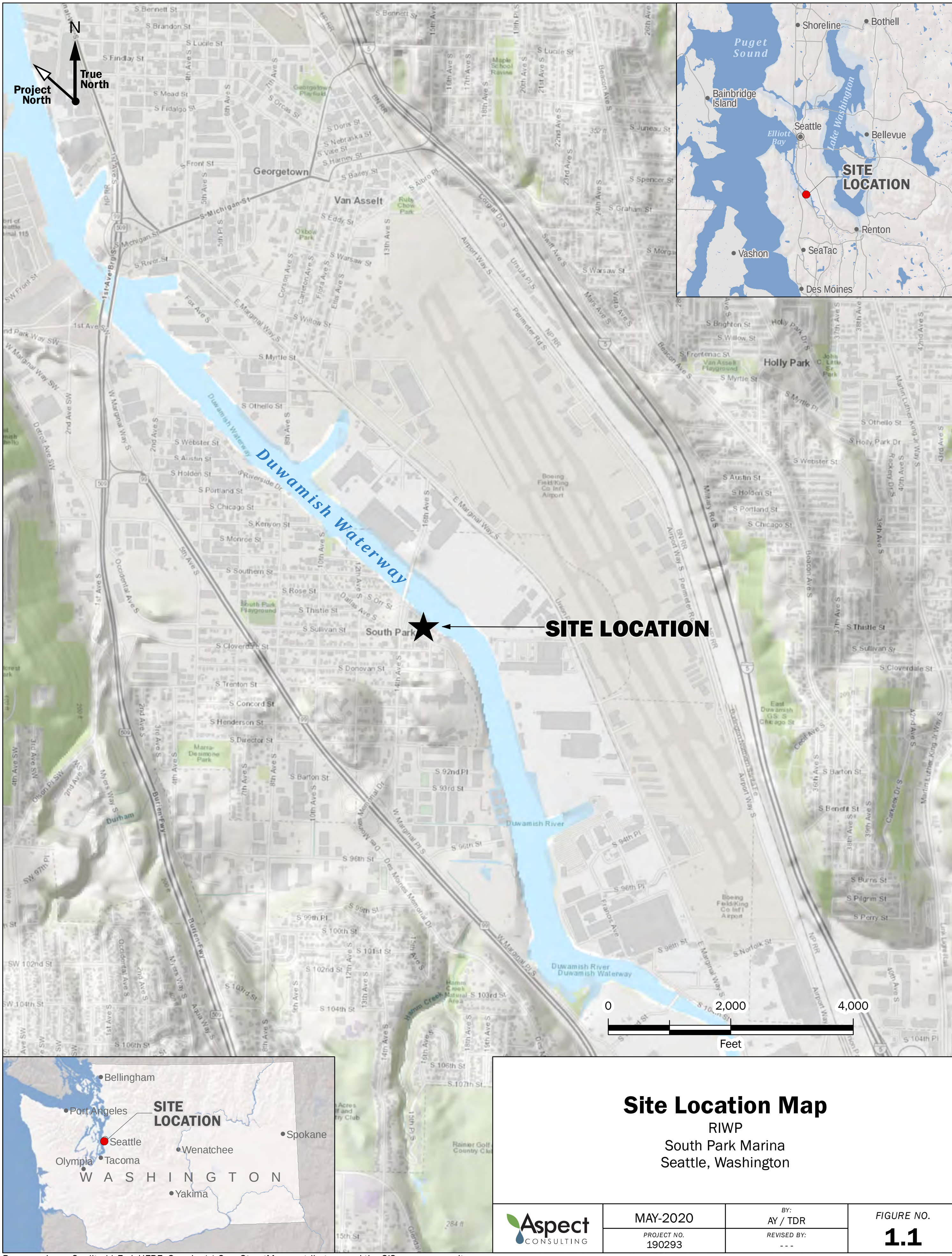
Notes

Note 1: Estimated schedule excluding stormwater sampling. Stormwater sampling schedule will be weather-dependent.

Note 2: In accordance with the Agreed Order, data will be submitted to Ecology's Environmental Information Management (EIM) database within 30 days of receiving validated data.

Note 3: Completion dates on a holiday or weekend will be adjusted to the next regular business day.

FIGURES



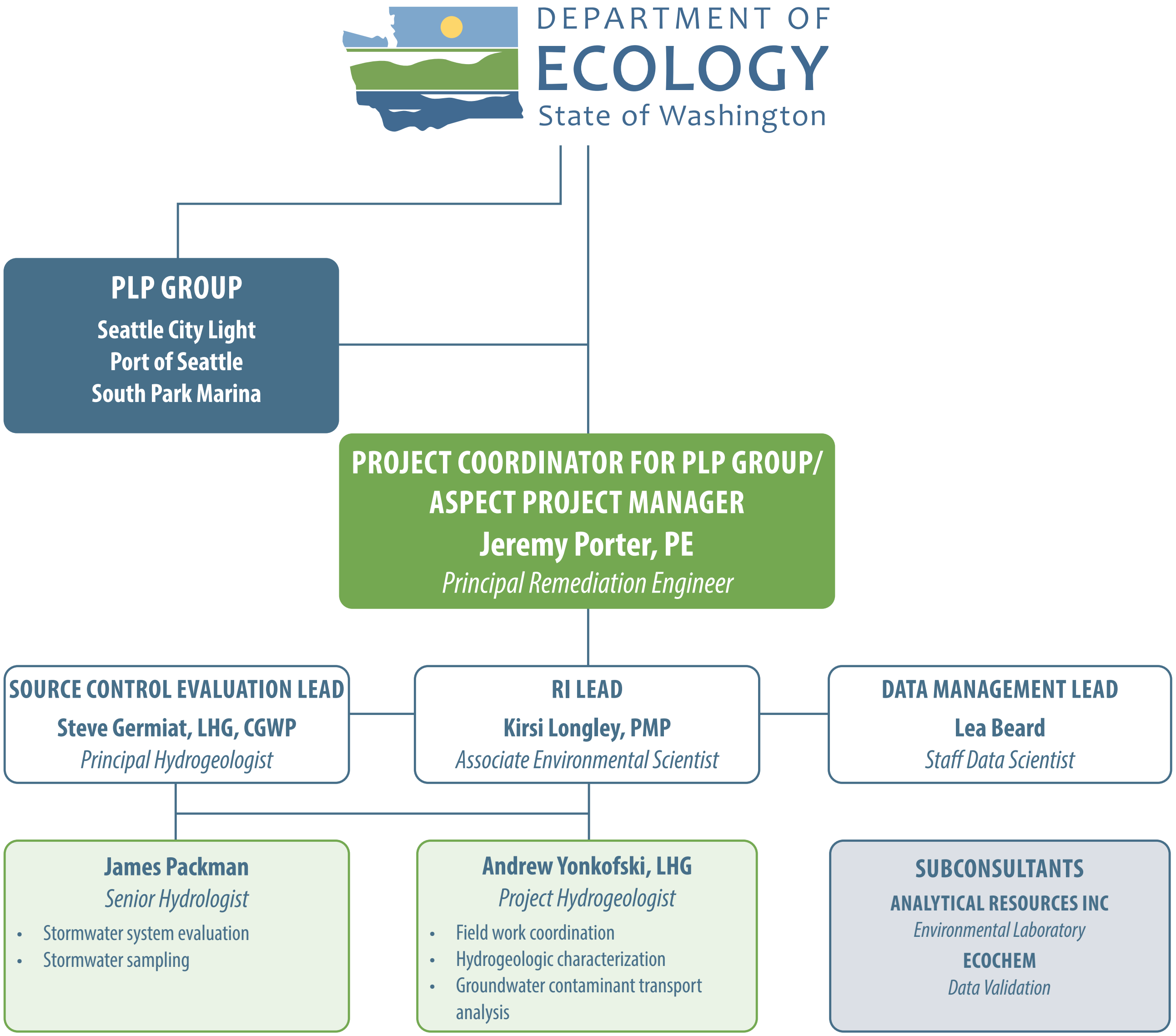
GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\RIWP\1.1 Site Location Map.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 2020-05-08 || User: trullen || Print Date: 2020-05-08

Site Location Map

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING	MAY-2020	BY: AY / TDR	FIGURE NO. 1.1
	PROJECT NO. 190293	REVISED BY: - - -	

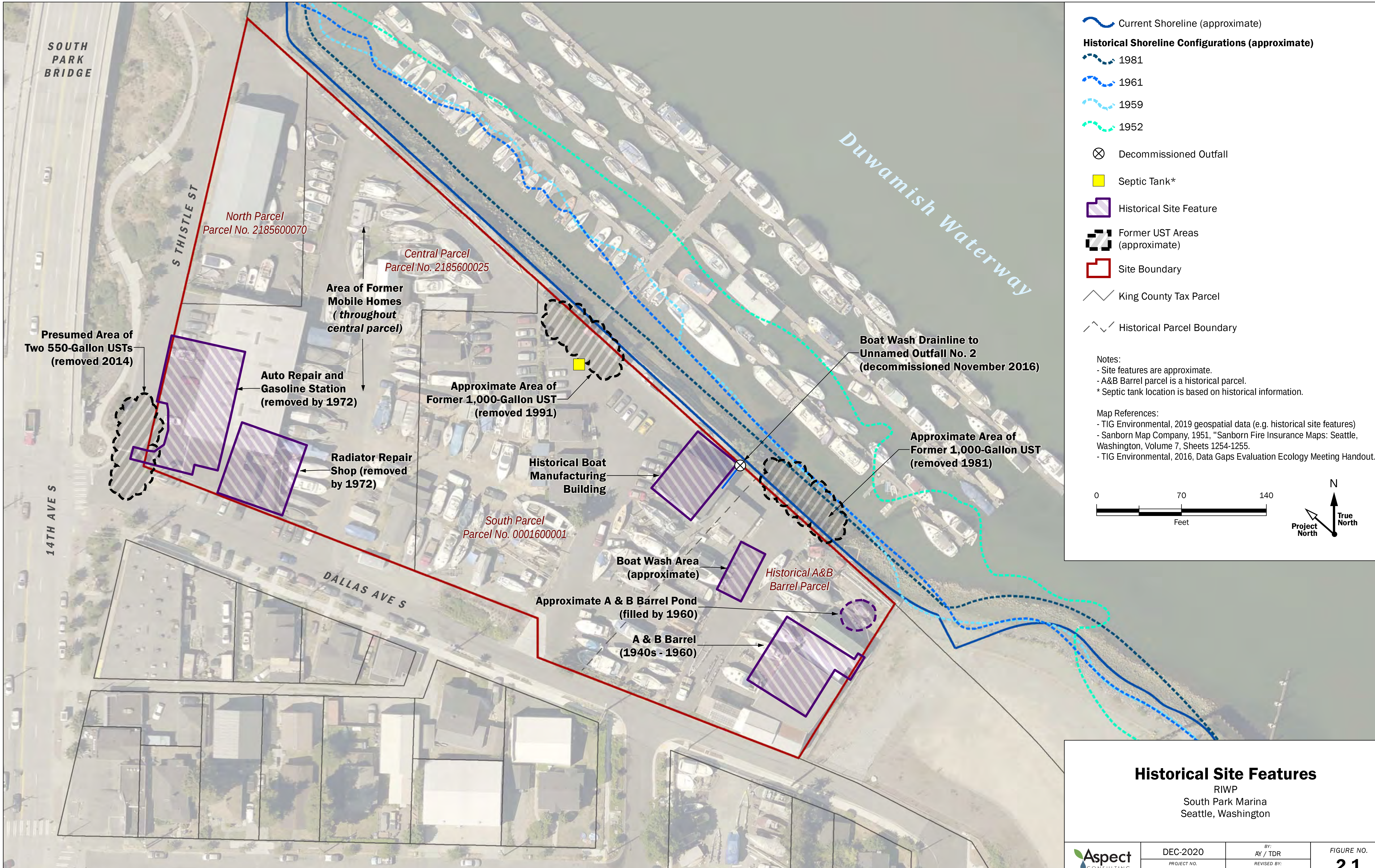
Basemap Layer Credits || Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community



Project Organizational Chart

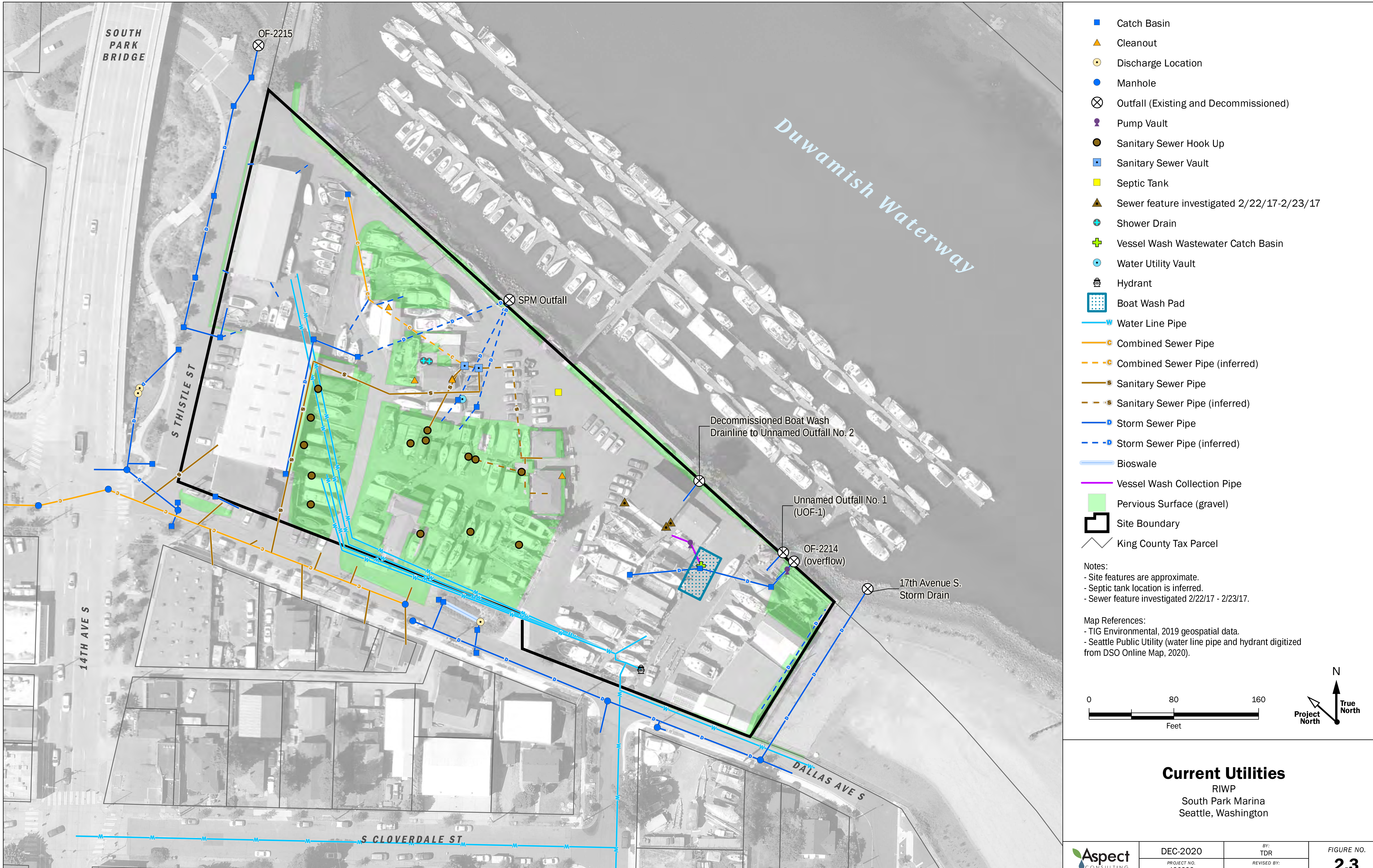
RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING	APR-2020 / PROJECT NO. 190293	BY: AY / TDR / REV BY: - - -	FIGURE NO. 1.2



Basemap Layer Credits || Pictometry, King County


Existing Outfall
Site Boundary
Washwater and Stormwater Treatment Areas
King County Tax Parcel
Approximately Extent of GAC Geocomposite Mat
Historical Parcel Boundary
Pervious Surface (gravel)
Sheet Pile Wall
Notes:
- Site features are approximate.
- A&B Barrel parcel is a historical parcel.
N
True North
Project North
0
70
140
Feet
Boat Ramp
SOUTH PARK BRIDGE
South Park Marina Dock
Duwamish Waterway
Rick's Master Marine Shop
S THISTLE ST
North Residential Structure
North Parcel
Parcel No. 2185600070
Unnamed Shed
Restrooms/Showers/ Laundry
Central Parcel
Parcel No. 2185600025
South Park Tire Factory Shop
South Park Marina Office
Shed
South Parcel
Parcel No. 0001600001
East Residential Structure
West Residential Structure
South Park Marina Main Shop
South Park Marina Main Shop Compressor Room
Container
Historical A&B Barrel Parcel
Harbormaster Shop
Washwater Treatment CONEX Box
Boat Wash Area (approximate)
35-Ton Crane
StormwateRx CONEX Box
Storage Shed
Woodworking Shop
Lumber Storage Building
14TH AVE S
DALLAS AVE S
2185000895
2185001045
7883608688
7883608691
7883608693
7883608696
7883607550
7883607567
7883607566
7883607565
7883608711
7883608714
7883608709
7883608706
7883608704
7883608701
7883608698
7883608699
7884100550
7884100490
7884100455
0001600044
Current Property Features
RIWP
South Park Marina
Seattle, Washington
Aspect CONSULTING
DEC-2020
PROJECT NO.
190293
BY:
AY / TDR
REVISED BY:
- - -
FIGURE NO.
2.2
Basemap Layer Credits || Pictometry, King County



Current Utilities

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING

DEC-2020

PROJECT NO. 190293

BY: TDR

REVISED BY: - - -

FIGURE NO. 2.3

Pervious Surface (gravel)
Site Boundary
King County Tax Parcel

Stormwater Infrustucture

- Catch Basin
- Overflow
- Manhole
- Metal Roof Drain
- Non Metal Roof Drain
- Outfall (Existing and Decommissioned)
- Pump Station
- Pump Vault
- Vessel Wash Wastewater Catch Basin
- Yard Drain
- Combined Sewer Pipe
- Combined Sewer Pipe (inferred)
- Sanitary Sewer Pipe
- Storm Sewer Pipe
- Storm Sewer Pipe (inferred)
- Bioswale
- Vessel Wash Collection Pipe

Stormwater Catchment Areas and Discharge Areas

- City of Seattle Combined Sewer System
- Infiltrates Through Gravel Surface
- OF-2214 (South Park Marina SD)
- OF-2215
- Offsite Directly to River
- South Park Marina Outfall
- 17th Avenue S Storm Drain
- Boat Wash Pad

Note:

- Site features are approximate.

0 80 160
Feet

N
Project North
True North

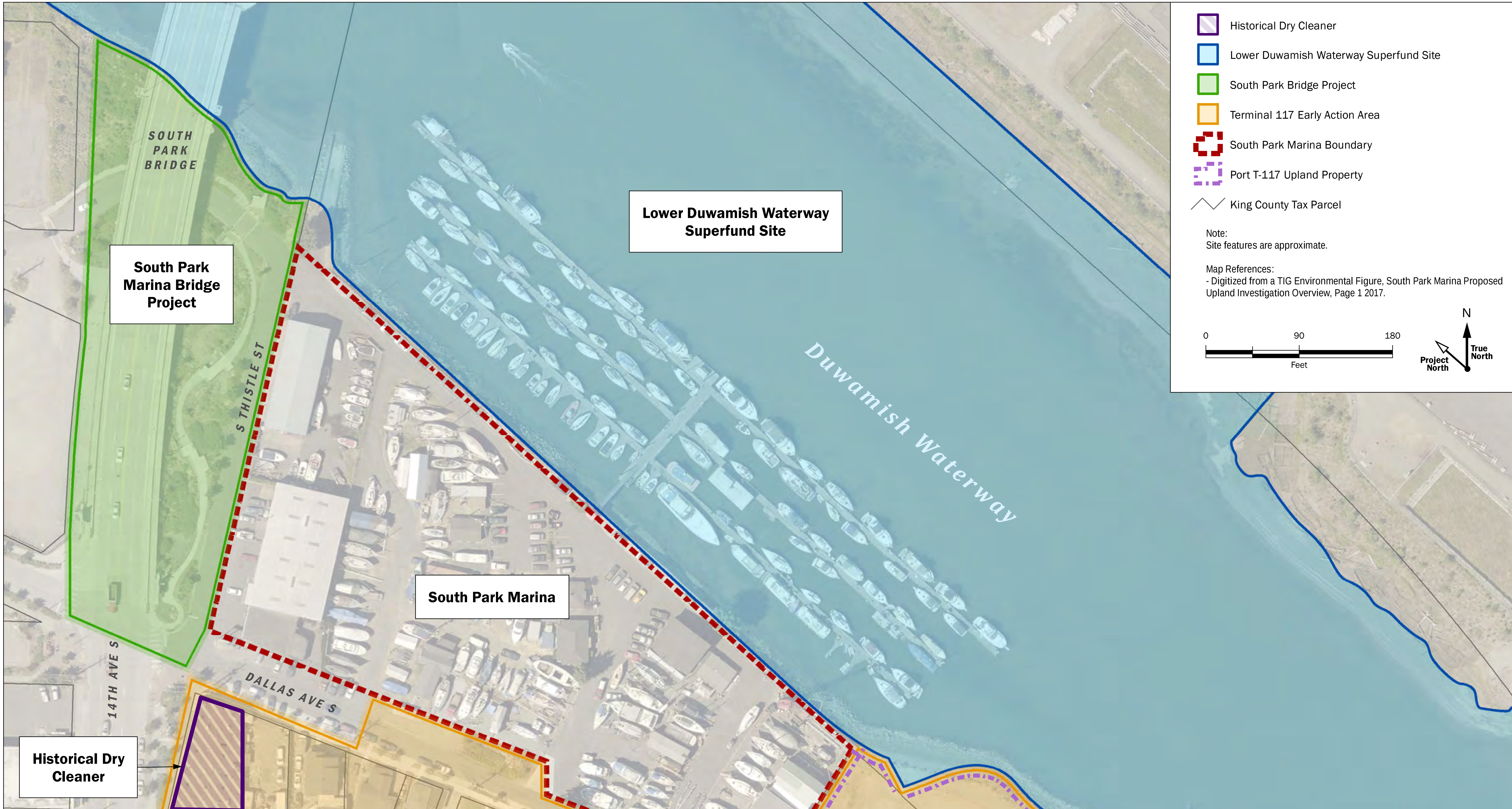
Stormwater Catchment Areas and Infrastructure

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING

OCT-2020	BY: TDR	FIGURE NO.
PROJECT NO. 190293	REVISED BY: - - -	2.4

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\RIWP\2.4 Stormwater Catchment Areas and Infrastructure.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 2020-10-27 || User: trullen || Print Date: 2020-10-27



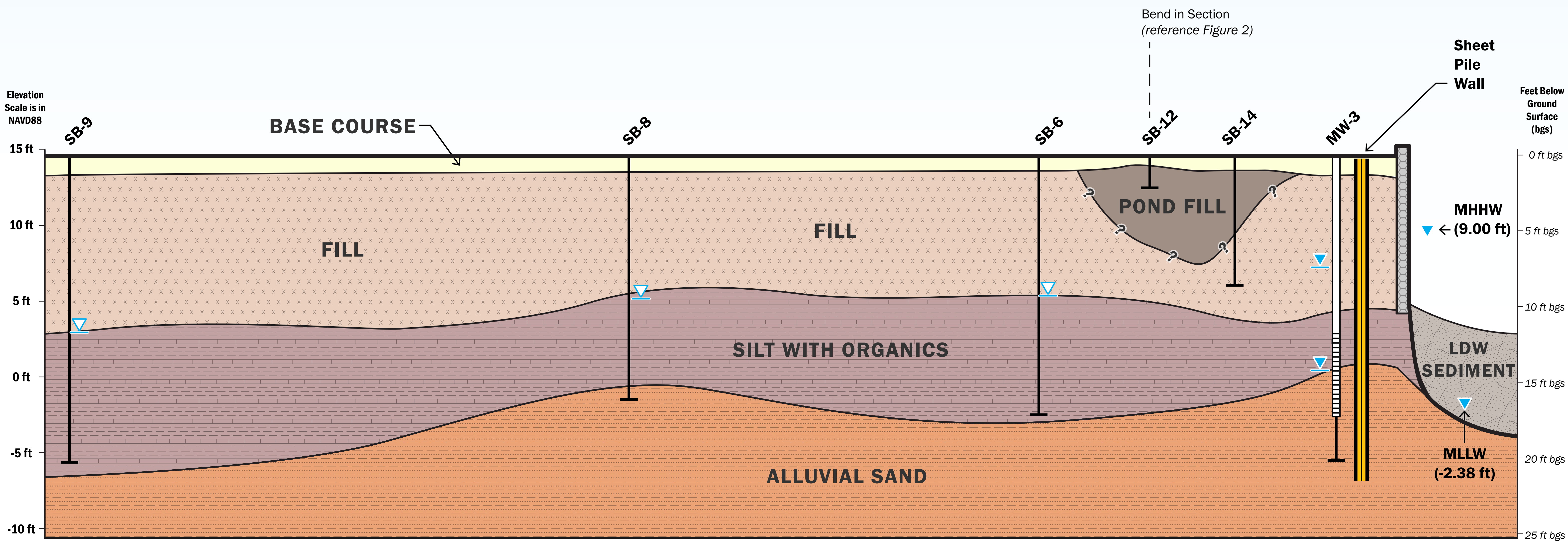
Surrounding Sites

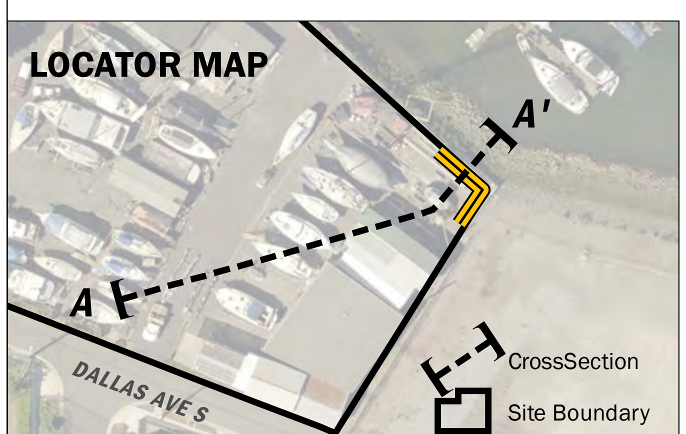
RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING	NOV-2020 PROJECT NO. 190293	BY: AY / TDR REVISED BY: - - -	FIGURE NO. **2.5**

Basemap Layer Credits || Pictometry, King County

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\RIWP\2.5 Surrounding Sites.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 2020-11-30 || User: trullen || Print Date: 2020-11-30





MW-3 ← *Monitoring Well Name*

← *Blank PVC Casing*

← *Well Screen*

← *Approximate Depth*

SB-9 ← *Soil Boring Name*

← *Groundwater at Time of Drilling*

← *Range of Water Table Elevations Measured Oct. 2007 (SAIC, 2008a)*

← *Boring Depth*

Sheet Pile Wall

Ecology Block Retaining Wall

Notes: *- Cross section location line shown on Figure 2.*
- Features are approximate.
- Grade elevations are approximate.

Vertical Exaggeration = 2.5X

0 10 20 ft

SCALE IS APPROXIMATE

Subsurface Cross Section A-A'

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING

DEC-2019

PROJECT NO. 190293

BY: AY / TDR

REV BY: - - -

FIGURE NO. **3.1**

Historical Sampling Locations

RIWP
South Park Marina
Seattle, Washington

Aspect Consulting	OCT-2020	BY: AY / TDR	FIGURE NO.
	PROJECT NO. 190293	REVISED BY: - - -	5.1

Zone	Screening Level (mg/Kg)
Vadose	***36***
Saturated	***36***

- Copper detected at a concentration greater than the SLs.
- Copper detected at a concentration less than the SLs.
- Copper not detected.
- Copper not sampled.
- Soil Boring
- Site Boundary
- Historical Site Feature
- King County Tax Parcel

Vadose Zone
SB-12 *Boring Name*
Saturated Zone

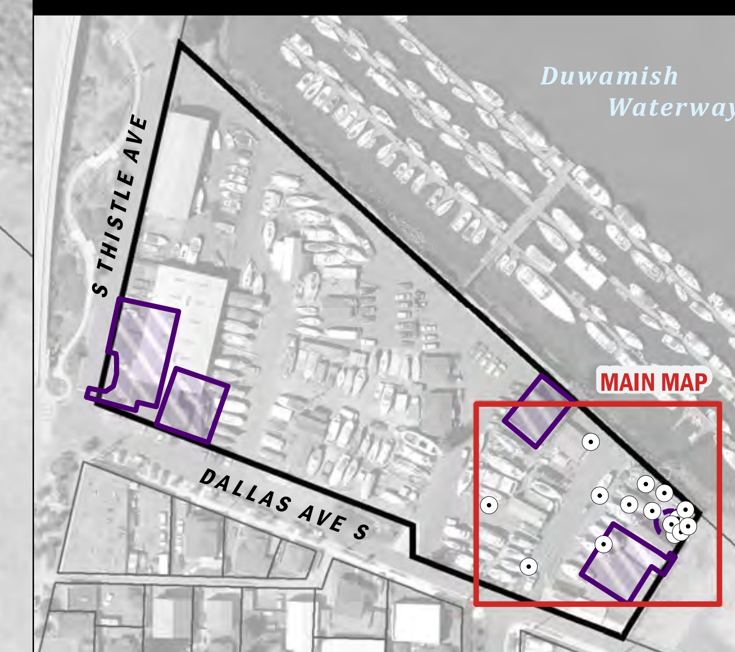
Notes:

- Copper selected as an indicator compound for RCRA-8 metals.
- mg/Kg = milligram per kilogram
- LDW = Lower Duwamish Waterway
- PCUL = Preliminary Cleanup Level
- SL = Screening Level
- Site features are approximate.
- Vadose samples compared against LDW PCULs SL-1, SL-3, SL-4, SL-8, SL-9, and SL-10).
- Saturated samples compared against LDW PCULs SL-1 and SL-6 through SL-10).

0 20 40
Feet

N
Project North
True North

LOCATOR MAP



Historical Concentrations of Copper in Soil

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING | NOV-2020 | BY: AY / TDR | FIGURE NO. **6.1**
PROJECT NO. 190293 | REVISED BY: - - -

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\RIWP\6.1 Copper in Soil.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 2020-11-30 || User: trullen || Print Date: 2020-11-30

Zone	Screening Level (mg/Kg)
Vadose	***2,000***
Saturated	***2,000***

- Oil-range TPH detected at a concentration greater than the respective SLs.
- Oil-range TPH detected at a concentration less than the respective SLs.
- Oil-range TPH not detected.
- Oil-range TPH not sampled.
- Soil Boring
- Site Boundary
- Historical Site Feature
- King County Tax Parcel

Vadose Zone
SB-12 ← *Boring Name*
Saturated Zone

Notes:

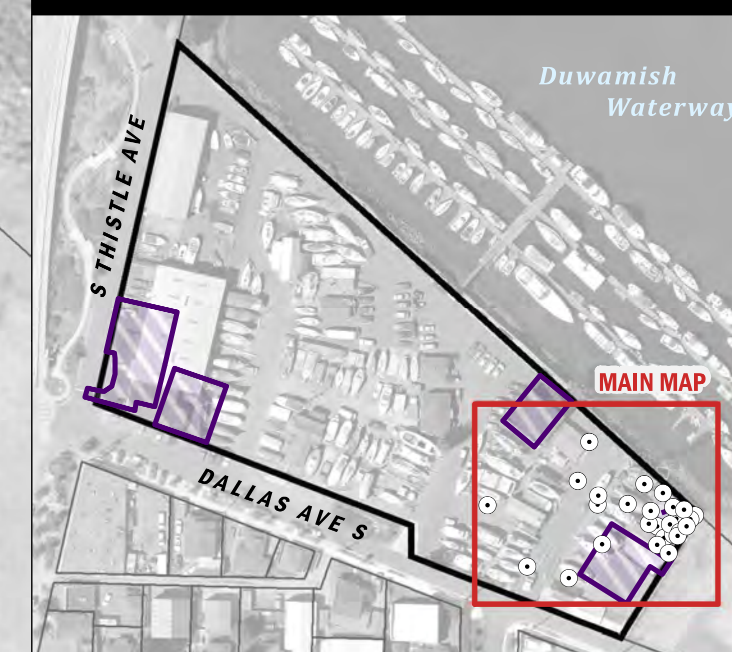
- Oil-range TPH selected as an indicator compound for all TPHs.
- TPH = Total Petroleum Hydrocarbons
- mg/Kg = milligram per kilogram
- LDW = Lower Duwamish Waterway
- PCUL = Preliminary Cleanup Level
- SL = Screening Level
- Site features are approximate.

- Vadose samples compared against LDW PCULs SL-1, SL-3, SL-4, SL-8, SL-9, and SL-10). Saturated samples compared against LDW PCULs SL-1 and SL-6 through SL-10).

0 20 40
Feet

N
Project North
True North

LOCATOR MAP

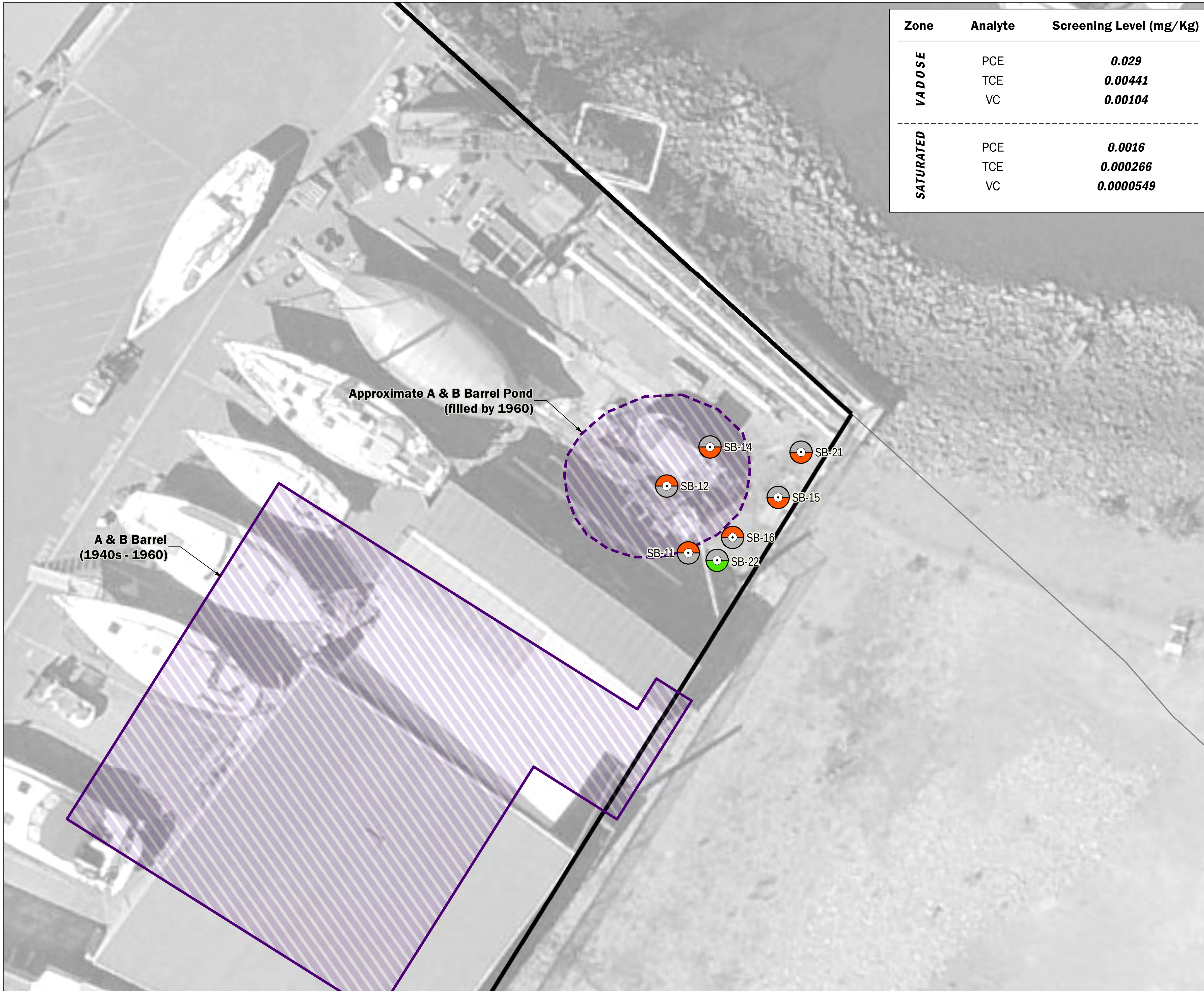


Historical Concentrations of Oil-Range Total Petroleum Hydrocarbons in Soil

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING	NOV-2020	BY: AY / TDR	FIGURE NO.
	PROJECT NO. 190293	REVISED BY: - - -	**6.2**

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\RIWP\6.2 Total Petroleum Hydrocarbons in Soils.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 2020-11-30 || User: trulien || Print Date: 2020-11-30



Zone	Analyte	Screening Level (mg/Kg)
VADOSE	PCE	***0.029***
	TCE	***0.00441***
	VC	***0.00104***
SATURATED	PCE	***0.0016***
	TCE	***0.000266***
	VC	***0.0000549***

- One or more chlorinated solvent detected at a concentration greater than the respective SLs.
- One or more chlorinated solvent detected at a concentration less than the respective SLs.
- Chlorinated solvents not detected.
- Chlorinated solvents not sampled.
- Soil Boring
- Site Boundary
- Historical Site Feature
- King County Tax Parcel

Vadose Zone
SB-12 ← *Boring Name*
Saturated Zone

Notes:

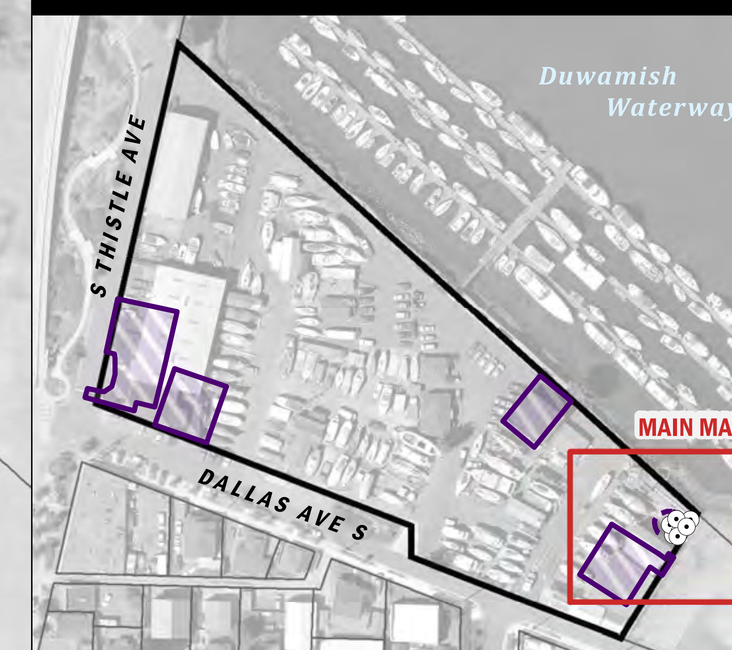
- PCE, TCE, and VC selected as indicator compounds for chlorinated solvents.
- TCE = Trichloroethene
- PCE = Tetrachloroethene
- VC = Vinyl Chloride
- mg/Kg = milligram per kilogram
- LDW = Lower Duwamish Waterway
- PCUL = Preliminary Cleanup Level
- SL = Screening Level
- Site features are approximate.

- Vadose samples compared against LDW PCULs SL-1, SL-3, SL-4, SL-8, SL-9, and SL-10). Saturated samples compared against LDW PCULs SL-1 and SL-6 through SL-10).

0 15 30
Feet

N
Project North
True North

LOCATOR MAP



Historical Concentrations of Chlorinated Solvents in Soil

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING

NOV-2020	BY: AY / TDR	FIGURE NO.
PROJECT NO. 190293	REVISED BY: - - -	6.3

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\RIWP\6.3 Chlorinated Solvents in Soil.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 2020-11-30 || User: trulien || Print Date: 2020-11-30

Zone	Analyte	Screening Level (mg/Kg)
VADOSE	4,4'-DDT	*0.0000163*
	Aldrin	*0.0000000401*
	Dieldrin	*0.000000617*
	Trans-chlordane	*0.0000227*
SATURATED	4,4'-DDT	*0.000000814*
	Aldrin	*0.00000000201*
	Dieldrin	*0.0000000309*
	Trans-chlordane	*0.00000529*

One or more pesticides detected at a concentration greater than the respective SLs.
One or more pesticides detected at a concentration less than the respective SLs.
Pesticides not detected.
Pesticides not sampled.
Soil Boring
Site Boundary
Historical Site Feature
King County Tax Parcel

Vadose Zone
SB-12 ← Boring Name
Saturated Zone

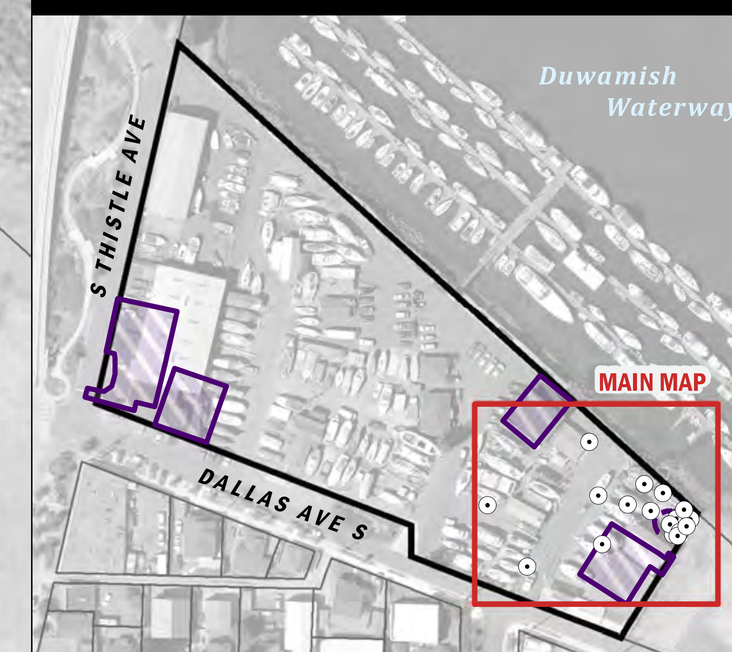
Notes:

- 4,4'-DDT, Aldrin, Dieldrin, and trans-chlordane selected as indicator compounds for pesticides.
- mg/Kg = milligram per kilogram
- LDW = Lower Duwamish Waterway
- PCUL = Preliminary Cleanup Level
- SL = Screening Level
- Site features are approximate.
- Vadose samples compared against LDW PCULs SL-1, SL-3, SL-4, SL-8, SL-9, and SL-10). Saturated samples compared against LDW PCULs SL-1 and SL-6 through SL-10).

0 20 40
Feet

N
True North
Project North

LOCATOR MAP

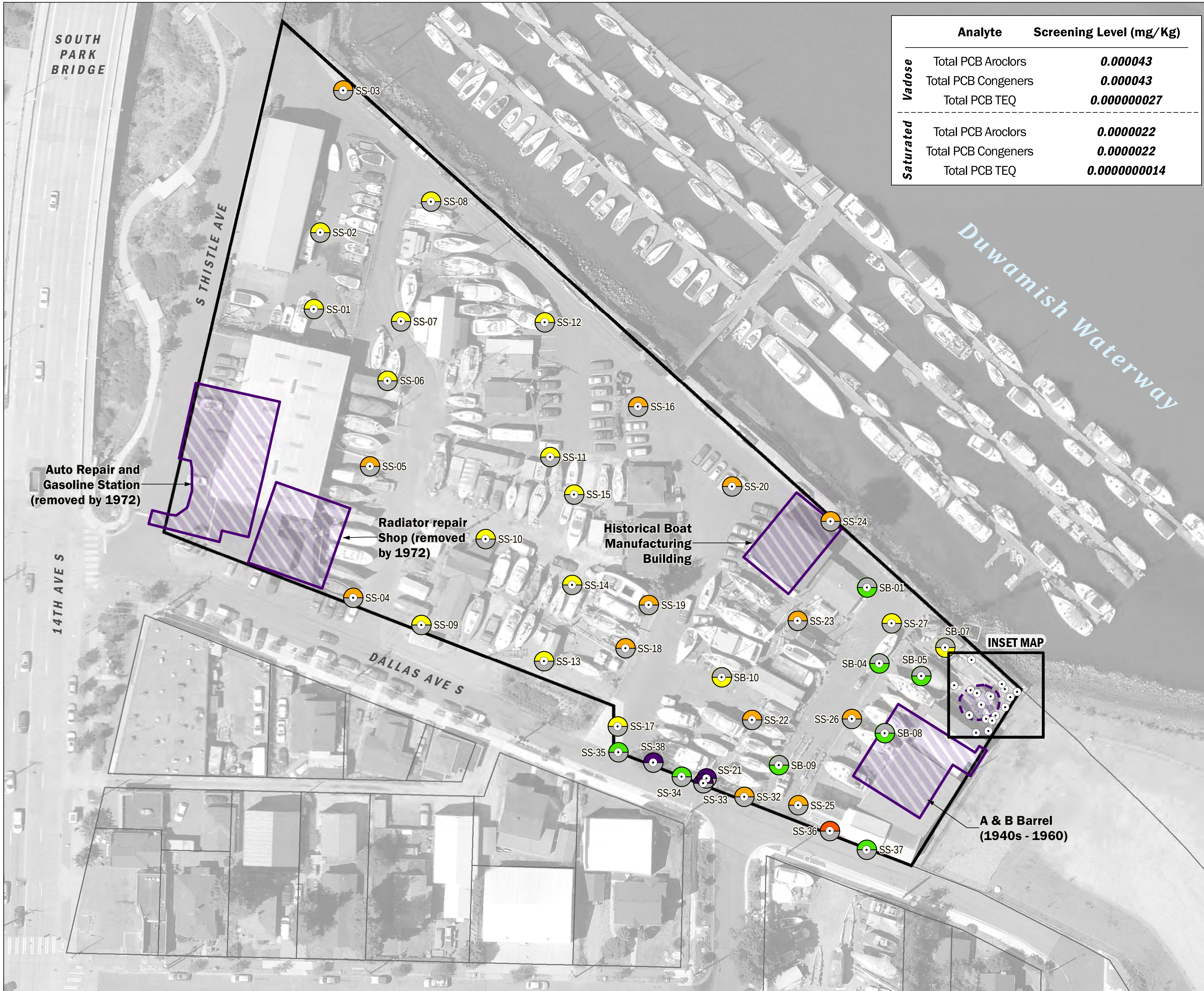


Historical Concentrations of Select Pesticides in Soil

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING | NOV-2020 | BY: AY / TDR | FIGURE NO. 6.4
PROJECT NO. 190293 | REVISED BY: - - -

	Analyte	Screening Level (mg/Kg)
Vadose	Total PCB Aroclors	0.000043
	Total PCB Congeners	0.000043
	Total PCB TEQ	0.000000027
Saturated	Total PCB Aroclors	0.0000022
	Total PCB Congeners	0.0000022
	Total PCB TEQ	0.0000000014



Total PCBs detected at a concentration greater than the respective SLs and > 10 mg/kg.
Total PCBs detected at a concentration greater than the respective SLs and between 1 and 10 mg/kg.
Total PCBs detected at a concentration greater than the respective SLs and between 0.1 and 1 mg/kg.
Total PCBs detected at a concentration greater than the respective SLs and less than 0.1 mg/kg.
Total PCBs not detected.
Total PCBs not sampled.
Soil Boring
Site Boundary
Historical Site Feature
King County Tax Parcel

Vadose Zone
SB-12 ← Boring Name
Saturated Zone

Notes:

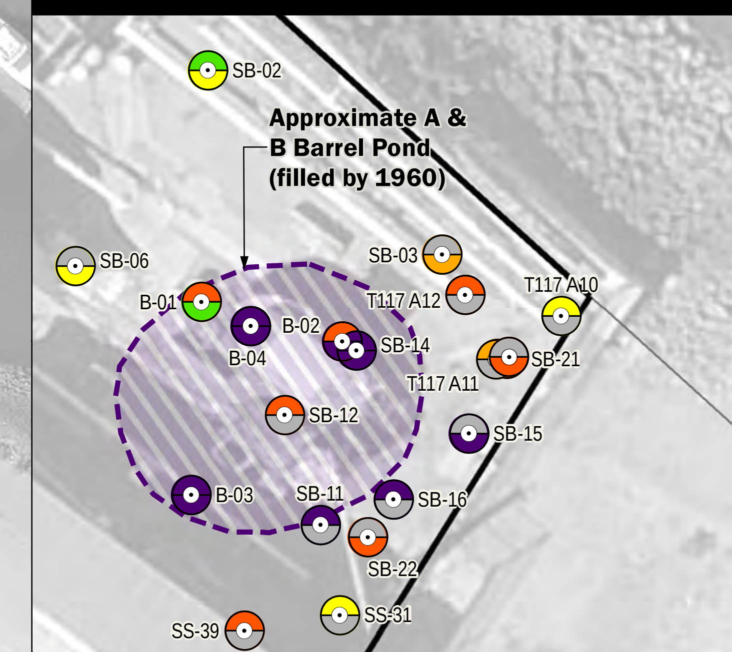
- Total PCBs = Total polychlorinated biphenyls
- mg/Kg = milligram per kilogram
- LDW = Lower Duwamish Waterway
- PCUL = Preliminary Cleanup Level
- SL = Screening Level
- Site features are approximate.

- Vadose samples compared against LDW PCULs SL-1, SL-3, SL-4, SL-8, SL-9, and SL-10). Saturated samples compared against LDW PCULs SL-1 and SL-6 through SL-10).

0 70 140 Feet

N True North
Project North

INSET MAP



Historical Concentrations of Total PCBs in Soil

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING

NOV-2020	BY: AY / TDR	FIGURE NO. 6.5
PROJECT NO. 190293	REVISED BY: - - -	

	Analyte	Screening Level (ug/L)
	PCBs	***0.000007***
	Copper	***3.1***
PESTICIDES	4,4'-DDT	***0.0000012***
	Aldrin	***0.000000041***
	Dieldrin	***0.0000012***
	Trans-chlordane	***0.0000012***
CHLORINATED SOLVENTS	PCE	***0.16***
	TCE	***0.5***
	VC	***0.5***

- Analyte detected at a concentration greater than the respective SLs.
- Analyte detected at a concentration less than the respective SLs.
- Analyte not detected.
- Analyte not sampled.
- Monitoring Well
- Soil Boring
- Site Boundary
- Historical Site Feature
- King County Tax Parcel

Total PCB Aroclors
Pesticides
SB-21 ← *Exploration Name*
Chlorinated Solvents
Copper

Notes:

- 4,4'-DDT, Aldrin, Dieldrin, and trans-chlordane selected as indicator compounds for pesticides.
- PCE, TCE, and VC selected as indicator compounds for chlorinated solvents.
- TCE = Trichloroethene
- PCE = Tetrachloroethene
- VC = Vinyl Chloride

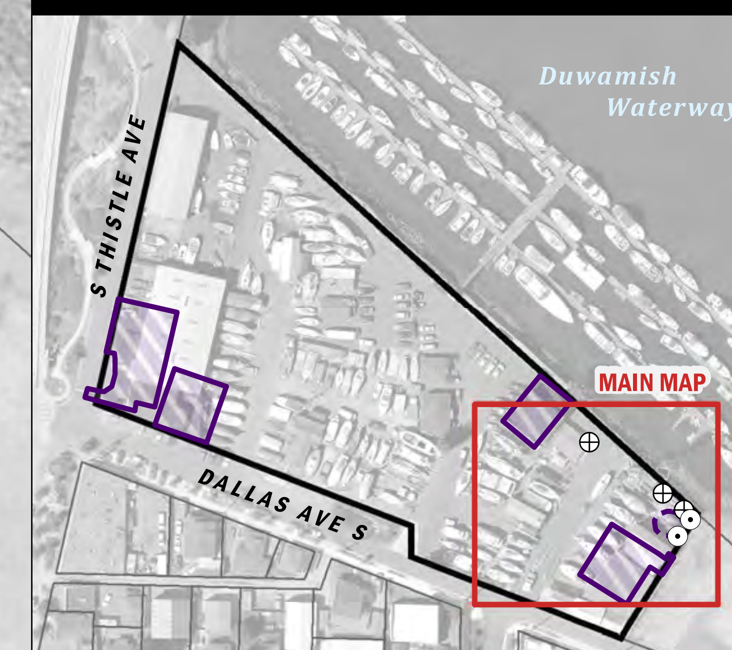
- PCUL = Prelim in ary Clean up Level
- Site features are approximate.
- ug/L = Microgram per liter

*** Grab groundwater sample.**

0 20 40
Feet

N
Project North
True North

LOCATOR MAP

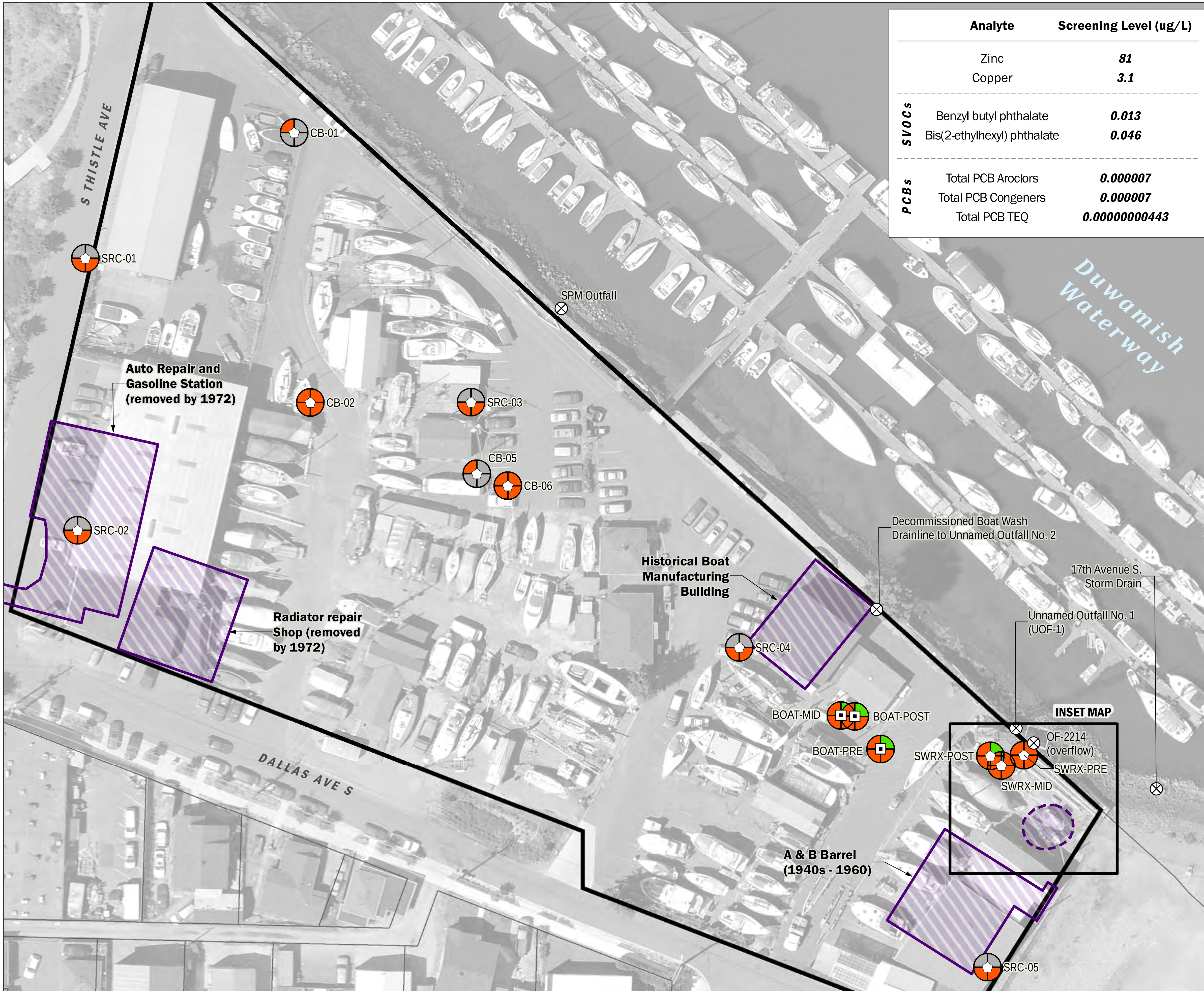


Historical Concentrations of Select Analytes in Groundwater

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING	NOV-2020	BY: AY / TDR	FIGURE NO.
	PROJECT NO. 190293	REVISED BY: - - -	**6.6**

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\RIWP\6.6 Select Analytes in Groundwater.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 2020-11-30 || User: trullen || Print Date: 2020-11-30



Analyte	Screening Level (ug/L)
Zinc	*81*
Copper	*3.1*
SVOCs	
Benzyl butyl phthalate	*0.013*
Bis(2-ethylhexyl) phthalate	*0.046*
PCBs	
Total PCB Aroclors	*0.000007*
Total PCB Congeners	*0.000007*
Total PCB TEQ	*0.00000000443*

Analyte detected at a concentration greater than the respective SLs.
Analyte detected at a concentration less than the respective SLs.
Analyte not detected.
Analyte not sampled.
Stormwater
Boat Wash Water
Outfall (Existing and Decommissioned)
Site Boundary
Historical Site Feature
King County Tax Parcel

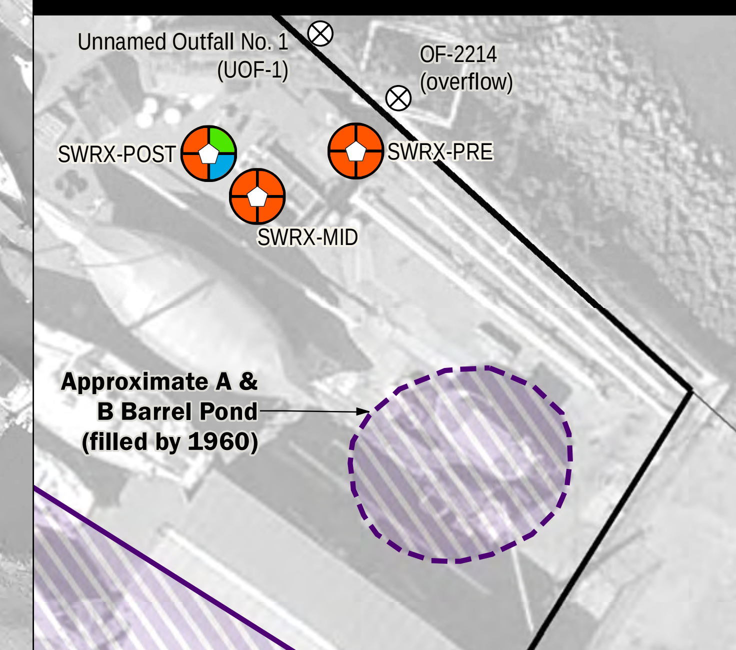
Total PCB Aroclors
SVOCs
CB-06 ← *Exploration Name*
Zinc
Copper

Notes:
- Stormwater compared to most stringent state or federal marine water quality or sediment standards with the addition of SPM boatyard permit benchmarks.
- SVOCs = non-PAH Semivolatile organic compounds
- Total PCBs = Total polychlorinated biphenyls.
- ug/L = Microgram per liter
- LDW = Lower Duwamish Waterway
- PCUL = Preliminary Cleanup Level
- SL = Screening Level
- Site features are approximate.

0 55 110
Feet

N
Project North
True North

INSET MAP

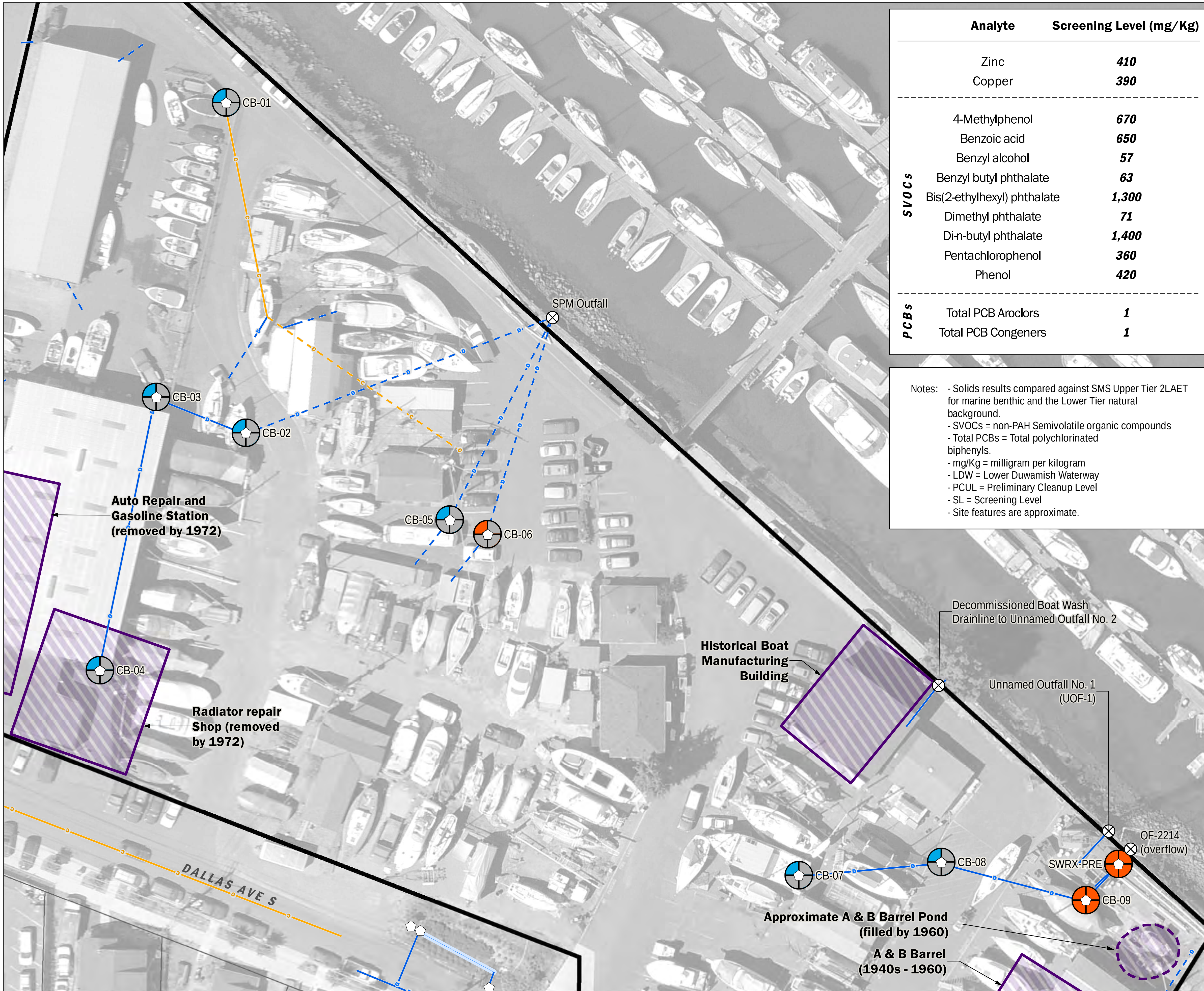


Historical Concentrations of Select Analytes in Stormwater and Boat Wash Water

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING	NOV-2020	BY: AY / TDR	FIGURE NO.
	PROJECT NO. 190293	REVISED BY: - - -	6.7

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\RIWP\6.7 Select Analytes in Stormwater.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 2020-11-30 || User: trulien || Print Date: 2020-11-30



	Analyte	Screening Level (mg/Kg)
	Zinc	410
	Copper	390
SVOCs	4-Methylphenol	670
	Benzoic acid	650
	Benzyl alcohol	57
	Benzyl butyl phthalate	63
	Bis(2-ethylhexyl) phthalate	1,300
	Dimethyl phthalate	71
	Di-n-butyl phthalate	1,400
	Pentachlorophenol	360
	Phenol	420
PCBs	Total PCB Aroclors	1
	Total PCB Congeners	1

Notes:
- Solids results compared against SMS Upper Tier 2LAET for marine benthic and the Lower Tier natural background.
- SVOCs = non-PAH Semivolatile organic compounds
- Total PCBs = Total polychlorinated biphenyls.
- mg/Kg = milligram per kilogram
- LDW = Lower Duwamish Waterway
- PCUL = Preliminary Cleanup Level
- SL = Screening Level
- Site features are approximate.

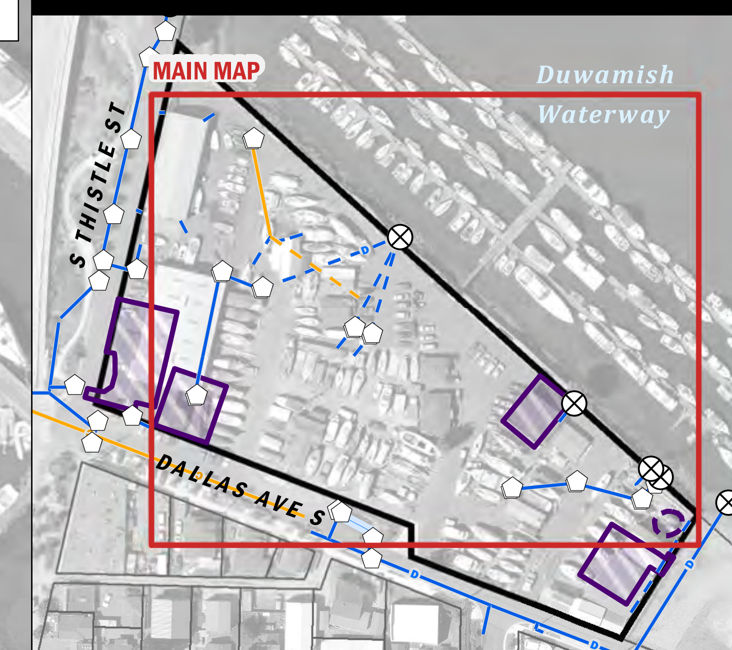
Analyte detected at a concentration greater than the respective SLs.
Analyte detected at a concentration less than the respective SLs.
Analyte not detected.
Analyte not sampled.
Catch Basin
Outfall (Existing and Decommissioned)
Combined Sewer Pipe
Combined Sewer Pipe (inferred)
Storm Sewer Pipe
Storm Sewer Pipe (inferred)
Bioswale
Site Boundary
Historical Site Feature
King County Tax Parcel

Total PCB Aroclors
SVOCs
CB-09 ← Exploration Name
Zinc
Copper

0 45 90
Feet

N
True North
Project North

LOCATOR MAP

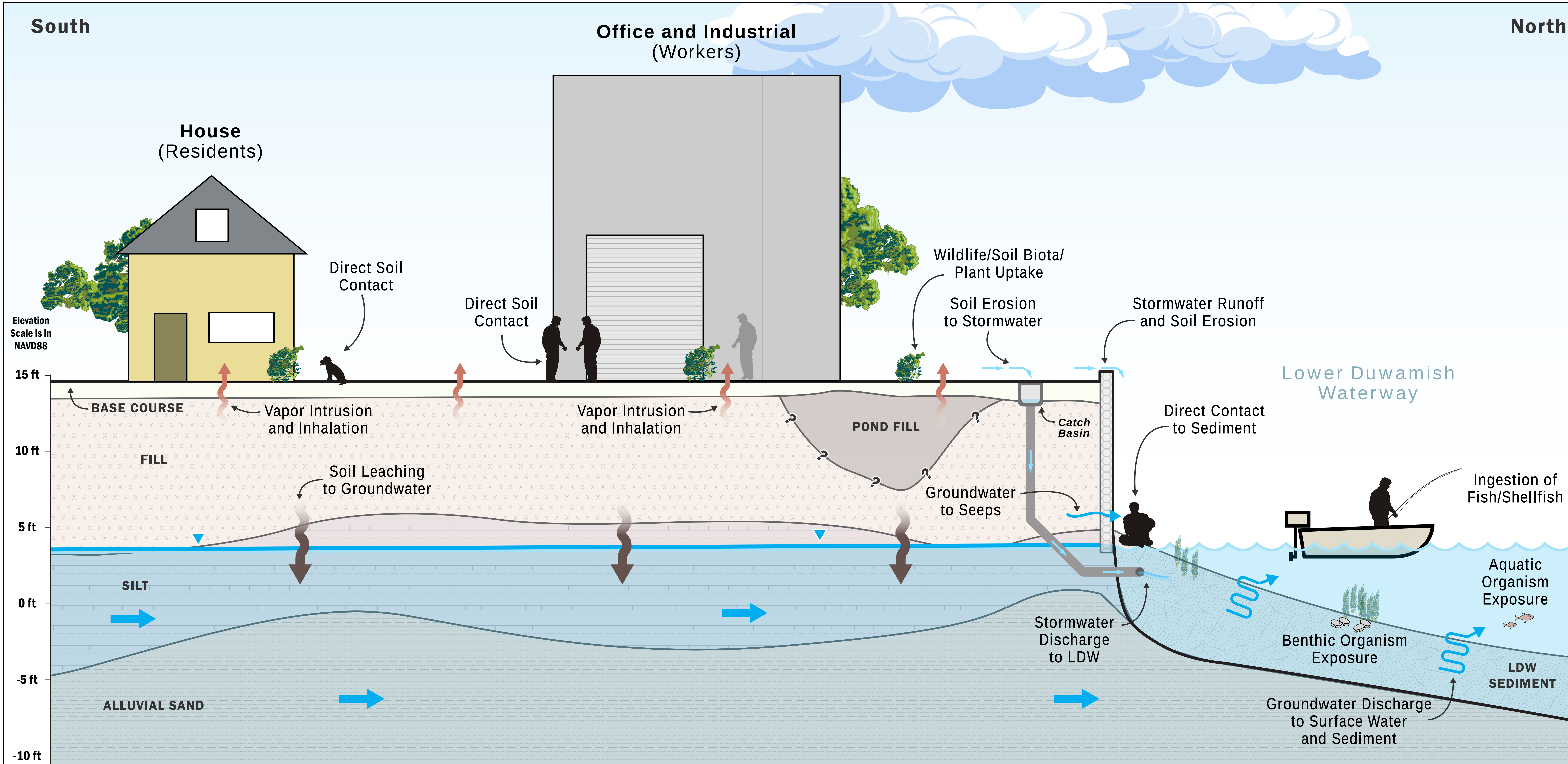


Historical Concentrations of Select Analytes in Catch Basin and Stormwater Pre-Treatment Solids

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING | NOV-2020 | BY: AY / TDR | FIGURE NO. 6.8
PROJECT NO. 190293 | REVISED BY: - - -

GIS Path: T:\projects_8\SeattleCityLight\SouthParkMarina_190293\Delivered\RIWP\6.8 Select Analytes in Catch Basin Solids.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 2020-11-30 || User: trullen || Print Date: 2020-11-30



Vapor Intrusion

Groundwater Flow

Stormwater Pipe and Outfall

Soil Leaching
to Groundwater

Nearshore Groundwater
Mixing and Discharge

Vertical Exaggeration = 2.5X

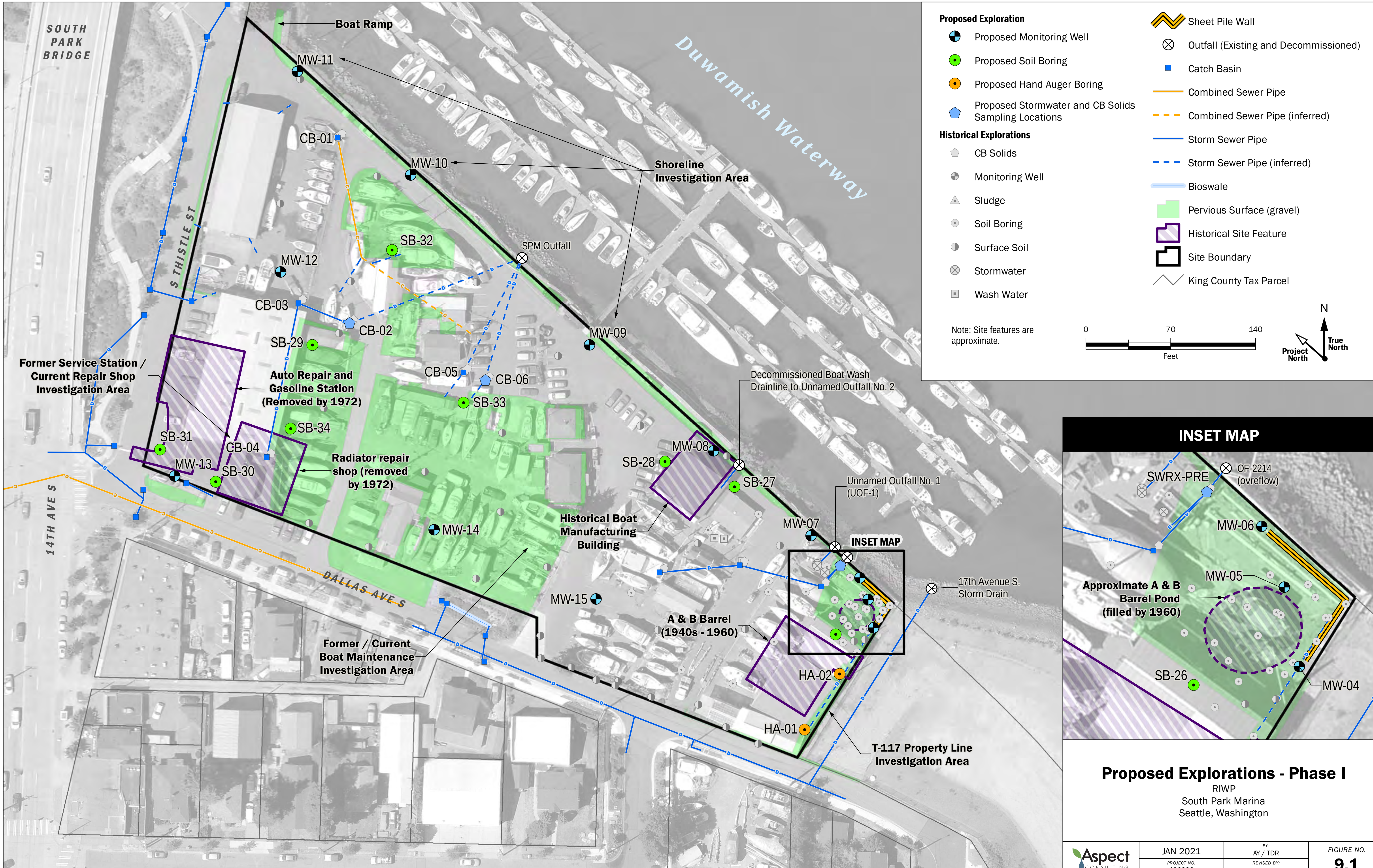
0 10 20 ft

SCALE IS APPROXIMATE

Preliminary Conceptual Site Model for Migration and Exposure Pathways

RIWP
South Park Marina
Seattle, Washington

Aspect CONSULTING	DEC-2019	BY: AY / TDR	FIGURE NO.
	PROJECT NO. 190293	REV BY: - - -	7.1



SOUTH PARK BRIDGE
Boat Ramp
MW-11
Duwamish Waterway
CB-01
MW-10
Shoreline Investigation Area
S THISTLE ST
SB-32
MW-12
SPM Outfall
CB-03
CB-02
MW-09
SB-29
Former Service Station / Current Repair Shop Investigation Area
Auto Repair and Gasoline Station (Removed by 1972)
CB-05
CB-06
SB-33
SB-34
SB-31
CB-04
MW-13
SB-30
Radiator repair shop (removed by 1972)
Decommissioned Boat Wash Drainline to Unnamed Outfall No. 2
MW-08
SB-28
SB-27
Unnamed Outfall No. 1 (UOF-1)
14TH AVE S
MW-14
Historical Boat Manufacturing Building
MW-07
INSET MAP
DALLAS AVE S
MW-15
17th Avenue S. Storm Drain
A & B Barrel (1940s - 1960)
Former / Current Boat Maintenance Investigation Area
HA-02
HA-01
T-117 Property Line Investigation Area
Proposed Exploration
Proposed Monitoring Well
Proposed Soil Boring
Proposed Hand Auger Boring
Proposed Stormwater and CB Solids Sampling Locations
Historical Explorations
CB Solids
Monitoring Well
Sludge
Soil Boring
Surface Soil
Stormwater
Wash Water
Sheet Pile Wall
Outfall (Existing and Decommissioned)
Catch Basin
Combined Sewer Pipe
Combined Sewer Pipe (inferred)
Storm Sewer Pipe
Storm Sewer Pipe (inferred)
Bioswale
Pervious Surface (gravel)
Historical Site Feature
Site Boundary
King County Tax Parcel
Note: Site features are approximate.
0
70
140
Feet
N
Project North
True North
INSET MAP
SWRX-PRE
OF-2214 (overflow)
MW-06
MW-05
Approximate A & B Barrel Pond (filled by 1960)
SB-26
MW-04
Proposed Explorations - Phase I
RIWP
South Park Marina
Seattle, Washington
Aspect CONSULTING
JAN-2021
PROJECT NO.
190293
BY:
AY / TDR
REVISED BY:
- - -
FIGURE NO.
9.1