Lower Duwamish Waterway Superfund Site
Terminal 117 Early Action Area

WORK PLAN FOR REVISED ENGINEERING EVALUATION/COST ANALYSIS FINAL

Prepared for:

The Port of Seattle
and
The City of Seattle

For submittal to:

US Environmental Protection Agency, Region 10
1200 Sixth Avenue
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Acronyms

Acronym	Definition
AOC	Administrative Order on Consent
ARAR	applicable or relevant and appropriate requirement
ASAOC	Administrative Settlement Agreement and Order on Consent
AST	aboveground storage tank
Basin Oil	Basin Oil Company, Inc.
BEHP	bis(2-ethylhexyl) phthalate
bgs	below ground surface
BHC	benzene hexachloride
BMP	best management practice
BTEX	benzene, toluene, ethylbenzene, and xylene
Boeing	The Boeing Company
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
CFR	Code of Federal Regulations
cfs	cubic feet per second
City	City of Seattle
COPC	chemical of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSL	cleanup screening level
CSM	conceptual site model
CUL	cleanup level
CSO	combined sewer overflow
DMMP	Dredged Material Management Program
DOF	Dalton, Olmsted & Fuglevand, Inc.
dw	dry weight
EAA	early action area
Ecology	Washington State Department of Ecology
EE/CA	engineering evaluation/cost analysis
EFH	essential fish habitat
EPA	US Environmental Protection Agency
ERA	ecological risk assessment
FEMA	Federal Emergency Management Agency
FS	feasibility study
HHRA	human health risk assessment
HPAH	high-molecular-weight polycyclic aromatic hydrocarbon
HpCDD	heptachlorodibenzo-*p*-dioxin

Acronym	Definition
HpCDF	heptachlorodibenzofuran
ID	identification
Integral	Integral Consulting, Inc.
KCCWD1	King County Commercial Waterway District No. 1
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
LNAPL	light non-aqueous-phase liquid
LPAH	low-molecular-weight polycyclic aromatic hydrocarbon
Marina	South Park Marina
MLLW	mean lower low water
MTCA	Model Toxics Control Act
NAPL	non-aqueous-phase liquid
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NTCRA	non-time-critical removal action
OC	organic carbon
OCDD	octachlorodibenzo-*p*-dioxin
OCDF	octachlorodibenzofuran
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
Port	Port of Seattle
PSDDA	Puget Sound Dredged Disposal Analysis
QAPP	quality assurance project plan
RAA	recontamination assessment area
RAO	removal action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RM	river mile
ROD	Record of Decision
ROW	right-of-way
SAIC	Science Applications International Corporation
SMS	Washington State Sediment Management Standards
SOW	scope of work
SPU	Seattle Public Utilities
SQS	sediment quality standards

Acronym	Definition
STM	sediment transport model
SVOC	semivolatile organic compound
T-117	Terminal 117
TBT	tributyltin
TCLP	toxicity characteristic leaching procedure
TCRA	time-critical removal action
TPH	total petroleum hydrocarbons
TPH-D	diesel-range total petroleum hydrocarbons
TPH-G	gasoline-range total petroleum hydrocarbons
TPH-O	lube oil-range total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
USACE	US Army Corps of Engineers
USFWS	US Fish and Wildlife Service
UST	underground storage tank
VOC	volatile organic compound
Windward	Windward Environmental LLC

1 Introduction

Terminal 117 (T-117) is a site within the Lower Duwamish Waterway (LDW) Superfund site that was selected for early action remediation in 2003 to address polychlorinated biphenyl (PCB) contamination in sediment. An engineering evaluation/cost analysis (EE/CA) for a non-time-critical removal action (NTCRA) for the sediment and adjacent bank area was submitted to the US Environmental Protection Agency (EPA) and approved in 2005 (Windward et al. 2005c). However, the discovery of PCB soil contamination in adjacent upland areas prompted EPA to implement a time-critical removal action (TCRA) and to expand the site boundary to include the Port of Seattle's (Port's) T-117 upland property and adjoining City of Seattle (City) streets, in addition to the bank and sediments. This work plan presents the approach for the development and preparation of a revised EE/CA to address the redefined T-117 Early Action Area (EAA) boundary.

The following sections present the purpose and objectives of the work plan, background information pertinent to the development of the revised T-117 EAA, the overall organization of the work plan, and the project team and responsibilities.

1.1 SCOPE OF WORK PLAN

This work plan presents the approach for a revised EE/CA for a NTCRA at the T-117 EAA of the LDW Superfund site. This NTCRA is being conducted by the Port and the City pursuant to an Administrative Settlement Agreement and Order on Consent (ASAOC) with EPA (Docket No.10-2006-0103).

In 2005, EPA approved an EE/CA (Windward et al. 2005c), and an action memorandum (EPA 2006a) was issued for the T-117 EAA sediment and adjacent bank. At that time, it was assumed that only minor revisions to the upland removal action boundary would be needed. However, the Port later discovered additional PCB contamination in the upland-117 upland property, the extent of which was broader than originally anticipated. This resulted in an increased scope for the NTCRA. In addition, the City discovered PCBs in the streets adjacent to the T-117 upland property. Thus, the T-117 EAA was expanded by EPA to include all three of these areas, hereafter referred to as the Sediment Study Area, the T-117 Upland Area, and the Adjacent Streets. The 2005 EE/CA for the T-117 EAA (Windward et al. 2005c) will be revised in accordance with this work plan. A more detailed discussion is presented in Section 1.2.

The scope of the NTCRA has also been expanded to include an assessment of the potential for recontamination of the T-117 EAA by the adjoining Basin Oil Company, Inc. (Basin Oil), property and South Park Marina (Marina) property, collectively referred to as the recontamination assessment areas (RAAs). Map 1-1 shows the T-117 EAA and the RAAs. The content of this work plan complies with that set forth in EPA's *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* (1993).

In addition, as requested by EPA, this work plan includes a comprehensive compilation of existing site data in an effort to streamline project reporting and expedite the EE/CA.

EPA also has requested that this work plan identify preliminary removal action alternatives that are compatible with the reasonably anticipated future land use at the site (2007a) (Appendix E). The list of preliminary removal action alternatives relies, in part, on those presented in the previous EE/CA as a starting point. These alternatives, along with possible additional alternatives, will be further developed and refined in the EE/CA.

This work plan also includes an evaluation of data gaps related to the T-117 EAA and potential T-117 EAA recontamination from the RAAs. A groundwater monitoring plan and quality assurance project plan (QAPP), are included as Appendices A and B, respectively, and address identified data gaps.

1.2 CERCLA PROJECT BACKGROUND

A portion of the T-117 EAA Upland Area was historically used for the manufacture of asphalt products, as well as other activities associated with former tenants. Asphalt manufacturing operations are suspected to have included the use of waste oils, which were believed to have contained PCBs, and these oils are believed to be a source of contaminants released to the surrounding site soils and sediment.[1] This section describes the project background as it relates to EPA's National Priorities List (NPL) of the adjacent LDW and the identification of the T-117 as an EAA within the LDW. Details on the site and regulatory history prior to the LDW Superfund designation are presented in Sections 2.1.2 and 2.2, respectively. A comprehensive and detailed timeline presenting project history and regulatory milestones will be provided in the EE/CA.

1.2.1 Lower Duwamish Waterway and Early Action Areas

The LDW, which includes the sediment portion of the T-117 EAA, was added to EPA's NPL defined under the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA], also known as Superfund) on September 13, 2001. The Phase 1 remedial investigation (RI) report for the LDW (Windward 2003a) presented a summary of available data for the waterway. One of the primary objectives of the Phase 1 RI was to identify areas within the LDW that might be candidates for early removal action because of their potential for higher levels of risk from contaminated sediment. The Port, the City, King County, and The Boeing Company (Boeing), working together as the Lower Duwamish Waterway Group (LDWG), prepared a technical memorandum (Windward 2003b) that recommended seven areas to EPA and

[1] Respondents do not admit, and retain the right to controvert in any subsequent proceedings other than proceedings to implement or enforce the Terminal 117 EAA Settlement Agreement and this work plan, statements of fact, including but not limited to those in this paragraph.

the Washington State Department of Ecology (Ecology) for early removal action. The Sediment Study Area of T-117 was one of the seven recommended EAAs. In 2003, EPA required that T-117 be investigated and cleaned up as a NTCRA, primarily because of high concentrations of PCBs and the potential for those PCBs to contaminate LDW sediment (EPA 2005b).

1.2.2 Initial Early Action Area investigations and 2005 EE/CA

In the time since T-117 was selected as an EAA, the Port and the City have conducted a series of environmental investigations to further characterize environmental conditions in the Sediment Study Area, determine a removal action boundary, and identify potential sources of contamination. The results of these efforts have included a summary of existing information and data gaps report (Windward et al. 2003), several data reports (Windward et al. 2005b, d, e), and an EE/CA (Windward et al. 2005c). These investigations (and the resulting reports) for the T-117 EAA were conducted under an existing Administrative Order on Consent (AOC) (EPA 2003) signed by all of the LDWG members, as well as by EPA and Ecology. Although all four members of LDWG are responsible for the LDW remedial investigation/feasibility study (RI/FS) , work at the T-117 EAA is conducted by only the Port and the City.

In 2005, an EE/CA was approved by EPA for the T-117 Sediment Study Area (Windward et al. 2005c). EPA issued a NTCRA memorandum on July 22, 2005 (EPA 2005a), for the a bank and sediment removal action. As part of this action additional sampling was requested by EPA to further characterize PCB contamination in the northern portion of the bank, which would then be used to adjust the final upland portion of the removal action boundary during the design and implementation of the remedial action. The additional bank characterization sampling resulted in the discovery of higher-than-expected PCB concentrations in the bank at the northern part of the T-117 EAA. This led EPA to require further sampling to delineate the extent of PCBs in the upland soil. An Administrative Settlement Agreement and Order on Consent (ASAOC) (CERCLA 10-2006-0072) (EPA 2005c) was issued to the Port on October 17, 2005, for the T-117 upland investigation. On December 22, 2005, an ASAOC (EPA 2005b) was issued with a scope of work (SOW) to the Port and the City jointly for the NTCRA design and removal activities. In January 2006, the Port conducted additional site characterization activities and found high concentrations of PCBs in soil (Windward and DOF 2006), which prompted a TCRA.

1.2.3 2006 Time Critical Removal Action

At the direction of EPA, the Port implemented the TCRA for T-117 Upland Area to remove upland source material that could potentially recontaminate the sediment and effect the success of the planned NTCRA for Sediment Study Area. Specific details of the 2006 TCRA are discussed in Section 2.2.2.

A TCRA memorandum (EPA 2006a) to address risks posed by the upland soil contamination was issued by EPA on June 15, 2006. EPA concluded that the scope of the TCRA would be limited to those areas of T-117 with the highest documented concentrations of PCBs in soils, as well as a limited area near the bank with exposed contaminated soils (i.e., an unpaved area), and that the rest of the upland contamination would be more efficiently addressed by revising the NTCRA. The SOW (EPA 2006b) was issued to the Port on August 11, 2006, for implementation of the TCRA to address the most contaminated areas of the T-117 upland property. The Port completed the TCRA in November 2006 (RETEC 2007b). The SOW also included requirements for post-TCRA site maintenance program, which is currently ongoing(RETEC 2007a).

1.2.4 Expanded T-117 EAA and the revised EE/CA

This EE/CA work plan is being prepared in accordance with SOW Amendment 1 (EPA 2007b), which replaces in its entirety the SOW appended to the NTCRA ASAOC issued on December 22, 2005. The T-117 EAA was previously confined to the sediment and adjacent bank (Sediment Study Area) adjacent to T-117 Upland Area but, as previously noted, is now expanded to include T-117 Upland Area, and the Adjacent Streets.

SOW Amendment 1 states that the revised EE/CA will include the information presented in the previous EE/CA (Windward et al. 2005c) and will also include new information that has been generated since the 2005 EE/CA or is currently being developed in conjunction with T-117 data gaps assessment and ongoing or planned investigation activities within the RAAs. Such information includes, but may not be limited to:

- Data collected by the Port in support of its investigation in the Sediment Study Area (see Section 2.3.1)
- Data collected by the Port in support of its investigation and removal action activities within the T-117 Upland Area (see Section 2.3.2)
- Pertinent information from the river-wide LDW RI/FS
- Data collected by the City in support of its investigation and interim action activities within the Adjacent Streets (see Section 2.3.3)
- Data collected as part of the T-117 data gaps assessment, including groundwater monitoring activities set forth in the SOW (see Section 2.3.4)
- Data collected by Ecology and EPA in conjunction with past and ongoing investigation and cleanup actions at Basin Oil (see Section 2.3.6)
- Data collected by Ecology as part of its investigation of the Marina (see Section 2.3.6)

The revised EE/CA will develop and analyze removal action alternatives for the expanded T-117 EAA in conjunction with previously analyzed sediment removal alternatives, taking into consideration all new information from the above-noted sources. Following the completion of the revised EE/CA, EPA will issue an amended action memorandum for the T-117 EAA NTCRA, which will replace the NTCRA memorandum issued on July 22, 2005.

The revised EE/CA will focus on for addressing the overall goal of the T-117 EAA NTCRA: to significantly reduce the exposure of ecological and human receptors to sediment and soil contamination and thereby reduce or eliminate adverse effects on biological resources in the removal area. The NTCRA will reduce potential risks to human health by removing or isolating bioaccumulative and toxic chemicals that are present in sediments and soils at the T-117 EAA (EPA 2005c).

1.3 WORK PLAN ORGANIZATION

In accordance with the SOW amendment (EPA 2007b), which is an appendix of the ASAOC (EPA 2005c), these remaining sections of this work plan are organized as follows:

- **Section 2, Site Background and Features –** Presents historical operations, previous investigation and removal actions, current site conditions, land use, geology, and hydrogeology. Summarizes existing data and sediment, soil, and groundwater.
- **Section 3, Streamlined Risk Assessment Approach, COPC Identification, and Conceptual Site Model –** Develops a preliminary list of chemicals of potential concern (COPCs) based on existing data for chemicals detected in the Sediment Study Area, T-117 Upland Area, and Adjacent Streets and exceeded screening criteria (Washington State Sediment Management Standards [SMS] and the Model Toxics Control Act [MTCA]). This section also presents the preliminary conceptual site model (CSM) and discusses the streamlined risk assessment approach.
- **Section 4, Identification of Removal Action Goals and Objectives, Regulatory Requirements, and Guidance –** Includes a preliminary list of published guidance, resource management plans, laws, regulations, and codes applicable to the proposed NTCRA. Also provides a discussion of the approach for refining the applicable or relevant and appropriate requirements (ARARs) evaluation in the EE/CA.
- **Section 5, Approach to the Selection of Removal Action Alternatives –** Identifies preliminary removal action technologies and describes how they will be assessed to develop and select final candidate removal action alternatives in the EE/CA.

- **Section 6, Preliminary Removal Action Alternatives –** Presents preliminary alternatives for further evaluation in the EE/CA.
- **Section 7, Data Gaps Assessment –**Identifies data gaps for the EAA areas (Sediment Study Area, T-117 Upland Area, and the Adjacent Streets) and those pertaining to the RAAs. Provides the basis for additional data collection and field activities.
- **Section 8, Preliminary Approach for Recontamination Assessment –** Describes how the preliminary recontamination assessments of Basin Oil and the Marina presented in this work plan for the purpose of the data gaps analysis, including the identified data needs related to those assessments, will be refined in the EE/CA.
- **Section 9, EE/CA Scope and Schedule –** Includes a list of tasks to be performed to complete the EE/CA and presents the EE/CA schedule with key milestones.
- **Section 10, References –** Includes references for published documents and other sources cited in this work plan.

The following appendices support the text:

- Appendix A. Groundwater Monitoring Program
- Appendix B. Quality Assurance Project Plan
- Appendix C. Health and Safety Plan
- Appendix D. Data Management Rules
- Appendix E. Reasonably Anticipated Future Land Use Letter
- Appendix F. Data Tables

All appendices are provided in electronic format on the CD located on the inside back cover.

1.4 PROJECT TEAM AND RESPONSIBILITIES

The project team for the revised T-117 EE/CA is described below and presented on the organization chart (Figure 1-1).

Regulatory and Agency Management

- Piper Peterson Lee from EPA will serve as the remedial project manager with responsibility for overseeing the implementation of the ASAOC and associated SOWs. All submissions required by ASAOC and SOW Amendment 1 will be delivered to the EPA remedial project manager.
- Kym Takasaki of the US Army Corps of Engineers (USACE) will serve as EPA's technical advisor and provide technical assistance to EPA, including reviewing documents and attending meetings

City and Port Management

- Roy Kuroiwa is the co-project manager on behalf of the Port, and is the designated Project Coordinator for the NTCRA. As such, he will coordinate all activities with the EPA remedial project manager and is responsible for the administration of all actions required by the ASAOC.
- Tom Meyer will serve as the City's program manager and primary point of contact, and will work with Mr. Kuroiwa as the co-project manager on behalf of the City. The Port and City are working together in response to the ASAOC under the terms of a Memorandum of Agreement between the two parties. The Port and City managers are the primary contacts representing their respective organizations.
- Kathy Bahnick of the Port and Harris Martin of the City will provide programmatic guidance as the policy advisors for their respective organizations.
- Doug Hotchkiss will serve as the sediment advisor on behalf of the Port, providing guidance and expertise with respect to the aquatic/sediment portions of the project.

Technical Team

- Warren Hansen, PE, of Windward Environmental LLC (Windward) will serve as the technical project manager, with responsibility for overall project coordination and planning to ensure the timely and successful completion of the project. Mr. Hansen will also be responsible for overseeing the consultant team and reviewing all reports and work products.
- Windward has been retained by the Port and is responsible for the aquatic/sediment portion of the EE/CA. Joanna Florer of Windward is the Sediment Study Area lead.
- Dalton, Olmsted & Fuglevand, Inc. (DOF), is a subconsultant to Windward, providing engineering support for the alternatives development and remediation design related to the Sediment Study Area. Paul Fuglevand, PE, of DOF is the sediment remediation engineer.
- ENSR (formerly RETEC) has been retained by the Port and is responsible for the T-117 Upland Area. ENSR also will lead the implementation of the groundwater monitoring program. Grant Hainsworth, PE, of ENSR is the T-117 Upland Area lead.
- Integral Consulting, Inc. (Integral), has been retained by the City and is responsible for the Adjacent Streets. Reid Carscadden, PE, of Integral is the Adjacent Streets lead.

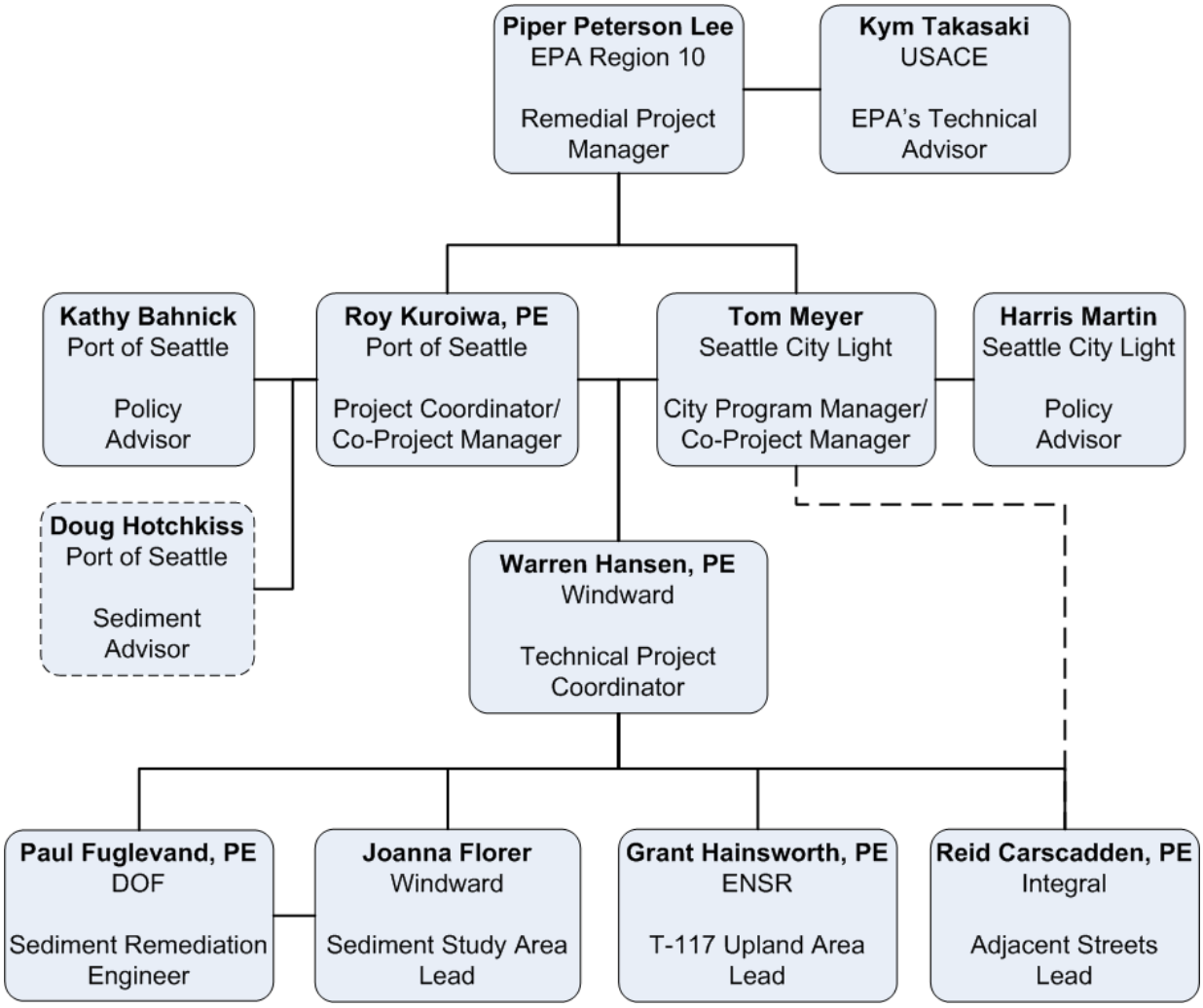


Figure 1-1. T-117 EE/CA project organization chart

2 Site Background and Features

The purpose of this section is to summarize readily available environmental, physical, and ecological information relevant to the T-117 EAA. A large amount of site information and investigation data have been generated in previous investigations and the 2005 EE/CA. The section includes a description of the historical activities, regulatory history and current site features. The current site uses and activities occurring in the vicinity are also described. There is also extensive discussion on the LDW and the geology of this area. Finally, the nature and extent of contamination in the T-117 EAA is summarized.

2.1 SITE DESCRIPTION AND HISTORY

2.1.1 Location

The T-117 EAA is located on the west bank of the LDW, along a narrow shallow reach, approximately between River Mile (RM) 3.5 and RM 3.7, as measured from the southern tip of Harbor Island (Map 1-1). The LDW flows north and empties into Elliott Bay. The site is approximately 6 miles due south of the Seattle downtown core area and is across the Duwamish River from Boeing's Plant 2. The T-117 EAA is located within a narrow strip of unincorporated King County that lies between the LDW to the east and the South Park neighborhood of Seattle to the west. The Port's T-117 property, which encompasses the T-117 Upland Area, is located at 8700 Dallas Avenue S and is just south of the 16th Avenue S bridge (also known as the South Park Bridge) (Map1-1). The T-117 EAA is characterized by gently sloping intertidal mudflat habitat, a steep vegetated riprap bank, and a relatively flat adjacent upland area. The T-117 EAA encompasses approximately 6.4 acres and consists of the three defined areas: the Sediment Study Area within the LDW, the T-117 Upland Area (Port-owned T-117 property), and the Adjacent Streets (City rights-of-way [ROWs]). Each area of the T-117 EAA is described in further detail in the subsections that follow.

The T-117 EAA is also adjacent to the Marina and Basin Oil properties, which are being evaluated as potential sources of recontamination to the T-117 EAA. These areas are also shown on Map 1-1 and are described in detail in Section 2.3.6.

2.1.1.1 Sediment Study Area

This area is the aquatic portion of the T-117 EAA, located within the LDW and consisting primarily of an intertidal zone with some subtidal zone. This area extends from the top of the shoreline bank (+14 ft mean lower low water [MLLW]) to 60 to 80 ft into the LDW at an elevation between 0 and -5 ft MLLW, encompassing approximately 1.4 acres (Map 1-1). This area is bordered by the LDW to the north, east, and south and by the T-117 Upland Area to the west.

2.1.1.2 T-117 Upland Area

The T-117 Upland Area is west of the Sediment Study Area and consists of the Port's T-117 upland property. This property, which includes the former Malarkey Asphalt Plant area, is located at 8700 Dallas Avenue S. In the 1963, the Port acquired a 50- to 60-ft (15- to 18-m)-wide section of land adjacent to the shoreline as successor in interest to the King County Commercial Waterway District No. 1 (KCCWD1) (Map 2-1). In 1999, the Port acquired the inland parcels that made up the former Malarkey property between the shoreline KCCWD1 parcel and Dallas Avenue S. These properties were consolidated to form the present-day T-117, which encompasses approximately 3.3 acres. This area is relatively flat with an elevation that ranges from approximately +14 ft MLLW at the top of the bank to approximately +21 ft MLLW along the western property boundary at Dallas Avenue S. This area is bordered by the Marina to the north, Boeing South Park to the south, Dallas Avenue S to the west, and the Sediment Study Area to the east.

2.1.1.3 Adjacent Streets

The Adjacent Streets encompasses approximately 1.75 acres and is composed of the street ROW area along sections of 16th and 17th Avenue S, Dallas Avenue S, and S Donovan Street. The northern part of the Adjacent Streets, along Dallas Avenue S, is relatively flat with an elevation of approximately +21 ft MLLW but rises gradually to a localized high point, approximately +30 ft MLLW, at the intersection of S Donovan Street and Dallas Avenue S.

The Adjacent Streets area is bordered by the T-117 Upland Area, the Marina, and residential properties to the south and west; the Adjacent Streets area also surrounds, but does not include, the former Basin Oil property. Until 2007, a former chocolate confectionery company, Seattle Chocolate Company, occupied a large building at 8620 16th Avenue S, north of Donovan Street, between 16th and 17th Avenues S. Previous occupants of this parcel included the Allied Bolt Company during the 1980s and 1990s; Fasteners, Inc., also reportedly occupied this property in 1999 (Windward et al. 2003).

2.1.2 Historical activities

2.1.2.1 T-117 operations

The Duwamish Manufacturing Company reportedly began asphalt roofing materials manufacturing operations at T-117 around 1937 and continued until 1978 at a location that generally corresponds with the present-day west half of T-117 Upland Area (URS 1994). The business and property was sold in 1978, after which it became known as the Malarkey Asphalt Company and continued roofing asphalt materials manufacturing operations until 1993. During the oil embargo in the 1970s, used oils, some of which may have contained PCBs, were used as fuel for the asphalt manufacturing process (Windward et al. 2003).

Features formerly associated with the asphalt materials plant but no longer present at the site included underground and aboveground storage tanks (USTs and ASTs) and associated piping, reaction tanks, sumps, a diesel fuel dispenser, a hot oil heater and associated shed, transfer pumps and pipes, warehouses at the east side of the plant area, a drum storage shed, and a partially buried railroad tank car.

A former ponding area was located just inland of the top of the shoreline bank and was reportedly used for some period of time during site operations for retaining non-contact cooling water (Hart Crowser 1992; URS 1994). This area was later determined to be merely a depression in the unpaved area of the site where stormwater collected and was also used by vehicles driving through the property. Periodic overflow from the pond to the LDW was noted during extended rainy periods (EMCON 1996). The former ponding area was located on property owned by the Port (EMCON 1996) and was subsequently excavated as part of a contaminated soil TCRA in 1999 and backfilled (Onsite 2000a) (see Section 2.2.2).

From 1989 to as late as 1995, Basin Oil leased a 10,000-gal. horizontal tank from the Malarkey Asphalt Company for storing and processing used oil (EPA 1995). After the asphalt plant closed in the late 1990s, portions of the property were occupied by Evergreen West Wholesale (a lumber wholesaler) for untreated lumber storage and loading (Windward et al. 2003). For a brief period of time, Basin Oil also used a portion of the interior of the south building on the T-117 property for storage and oil filter processing (Windward et al. 2003). Basin Oil occupied the south building from approximately 2003 until late 2004 through a lease with the Port.

In 1999, the Port acquired the asphalt plant parcels and related buildings located between the shoreline parcel (already owned by the Port as successor in interest to KCCWD1) and Dallas Avenue S. The port consolidated these parcels to form the present-day T-117 Upland Area. During the Port's ownership of the property, Port Construction Services used the outdoor area near the small office/carport for the storage of miscellaneous materials. International Inspection, a provider of non-destructive testing services, formerly leased the north building and the small office/carport. Second Use Building Materials, Inc., a recycling business that obtains reusable building materials from demolition projects for resale to the public, leased the south building for inventory storage. The site has been vacant since February 2007. No additional tenants are currently planned for the property.

2.1.2.2 Adjacent Streets

Aerial photographs show that the current street configuration in the South Park area was present as early as 1936. Available records indicate that S Cloverdale Street, between 14th Avenue S and 16th Avenue S, was paved or resurfaced with asphalt in 1947 (Allwine 2005). Other streets in the area (Dallas Avenue S, S Donovan Street, 16th Avenue S, and 17th Avenue S) remained unpaved until the mid-1970s or later, which extends into the period when used oils were used at T-117. Unpaved streets were oiled periodically to reduce dust.

Historical businesses within the neighborhood surrounding the Adjacent Streets included Basin Oil, the Marina, Seattle Chocolate Company, Allied Bolt Company, and Fasteners, Inc. The last three businesses occupied the same property at various times, with Seattle Chocolate Company being the most recent. Based on a preliminary review of available information, chemicals potentially associated with operations at the Allied Bolt Company and Fasteners, Inc., included volatile organic compounds (VOCs) and metals. These businesses were classified as small-quantity generators, and no violations were noted in association with their operations (Windward et al. 2003). It is not currently known whether chemicals of potential concern were associated with Seattle Chocolate Company; a thorough site history assessment will be conducted for this property during the EE/CA.

Further information pertaining to operations at the RAAs (Basin Oil and Marina properties) is presented in Sections 2.3.6.1 and 2.3.6.2, respectively.

2.1.3 Current site features

2.1.3.1 Upland structures and infrastructure

The only aboveground structures that remain on the T-117 Upland Area from the time when the asphalt plant was operational are the north and south buildings, the small office/carport inside the north gate, and the truck scale at the west side of the property. The remainder of the T-117 Upland Area is covered with asphalt or concrete pavement. Additional asphalt plant structures that remain at T-117 beneath the ground surface include the three closed-in-place USTs; the decommissioned large-diameter industrial water supply well; concrete foundations associated with the former warehouse structures, reaction tanks, cooling water sump, tank pads, and underground utility corridor; and a shallow, concrete-lined ditch that has subsequently been cleaned out and backfilled with concrete-densified fill (Windward and Onsite 2004). Some small-diameter remnant buried piping associated with the former plant may also be present in the vicinity, although most of this was removed during plant demolition and the subsequent cleanout of the concrete-lined utility corridor. The property is fenced, and gates are locked to control public access. The buildings on T-117 are supplied with potable water via the City public water supply system. The north building and the office/carport building discharge grey water and sewage to the onsite septic system.

Seattle City Light's Dallas Avenue Crossing power line, which was temporarily removed in 2005, passed through the existing easement across the T-117 Sediment Study Area and T-117 Upland Area. The lines are visible on Map 1-1 and traverse the T-117 Upland Area, in the vicinity of the Dallas Avenue S and 17th Avenue S intersection, and extend east across T-117 and the LDW to a location near the southwest corner of the Boeing Plant 2 property. The power line is scheduled for reconstruction following completion of the NTCRA.

The Adjacent Streets are paved, with gravel surfacing in some shoulder areas (along Dallas Avenue S, and 16th Avenue S). Sidewalks, with grass buffer strips and occasional trees, exist on sections of Dallas Avenue S, 16th Avenue S, and 17th Avenue S. There are overhead power lines and underground utilities (e.g., gas, water, telephone, combined sanitary sewer) throughout the area. Currently, no storm sewer serves the area to the east of 16th Avenue S. Temporary storm sewer and pavement improvements were completed within portions of the Adjacent Streets as part of the City's interim cleanup actions (discussed in Section 2.2.2.3).

2.1.3.2 Offshore debris and structures

Waste materials that appear to be from former T-117 upland operations are present in the outboard riprap of the shoreline berm, on the vegetated berm crest, and in the drainage ditch at the south side of T-117 Upland Area. These materials include hardened asphalt and asphalt roofing materials. Weathered chunks of asphalt can also be found on the intertidal mudflat offshore of the berm.

An aerial photograph from 1946 (Windward et al. 2003) shows a row of pilings in the intertidal area that likely make up the deteriorating bulkhead that can be observed today at the base of the riprap, offshore of the north half of T-117 EAA. Also, a row of treated pilings and log boom used to divert floating debris away from the Marina is located in the intertidal area near the boundary with the Marina.

2.1.3.3 Drainage and outfalls

Two storm drain outfalls discharge directly to the Sediment Study Area of the T-117 EAA. Two storm drain outfalls to the north of the T-117 EAA discharge to the Marina; the southernmost outfall is owned by the Marina, and the northernmost outfall is for a public storm drain. Two storm drain outfalls located to the south of the T-117 EAA are owned by Boeing (Map 2-1). All other stormwater in the vicinity of the T-117 EAA discharges to the City's combined storm/sanitary sewer. No combined sewer overflow (CSO) outfalls are located in the vicinity of the T-117 EAA.

Two outfalls that drain catch basins located at T-117 Upland Area have been verified along the shoreline of the T-117 EAA (Phoinix 2007). Stormwater discharging through these outfalls primarily originates in the asphalt-paved T-117 Upland Area and is collected in catch basins before being discharged to the LDW. Stormwater runoff from the northern part of T-117 Upland Area flows to a catch basin that discharges to the LDW through a 6-in. outfall located within the shoreline riprap. All of the catch basins on T-117 include sumps for retaining settled solids and are equipped with inverted outlets to retain floating oil.

A vegetated drainage ditch on the southern boundary between Boeing South Park and T-117 Upland Area collects roof drainage from the warehouse on the south end of the T-117 Upland property Area and runoff from the small section of the adjacent slope at the north side of the Boeing South Park facility.

Prior to 2005, surface runoff from Basin Oil and the adjacent City streets flowed onto the T-117 Upland Area and into the catch basins at the south side of the T-117 Upland Area (SAIC 2007a). In 2005, the City installed a temporary stormwater collection system as part its interim cleanup project. Currently, as a temporary measure, stormwater runoff from the Adjacent Streets is collected, pumped to five holding tanks, and discharged at a controlled rate to the combined sewer system at 17th Avenue S and S Donovan Street. The City has received permission from the Port to discharge runoff to the T-117 southern drainage system as an emergency overflow during the rainy season. Over the past 2 years, nine emergency discharge events have occurred. All catch basins in the T-117 Upland Area and Adjacent Streets have been cleaned within the past 2 years.

The Marina operates a closed-loop boat pressure wash system near the southeast end of the T-117 Upland Area. The wash system is located in the vicinity of a catch basin that flows to an oil/water separator. This southern-most catch basin on the Marina property discharges through a general stormwater National Pollutant Discharge Elimination System (NPDES)-permitted shoreline outfall fitted with an oil/water separator. The Marina has been sampling and analyzing this discharge for oil and grease, total recoverable copper, and total suspended solids as required under its NPDES permit. Other catch basins on the Marina property discharge to the City's combined sanitary/stormwater sewer or to one of the outfalls that discharge to the LDW. According to the Marina, the offices and catch basins are connected to the City's combined sewer system, although no records were available from the City for verification (SAIC 2007c). Stormwater runoff from the additional Marina property located at the southeast corner of 16th Avenue S and Dallas Avenue S, which is used for additional dry boat storage, most likely enters the City catch basins located on 16th Avenue S, which convey stormwater to the City's combined sewerage system. Some drainage from this location may also flow onto Dallas Avenue S and into the LDW via the T-117 catch basins.

There are also two privately owned outfalls to the south of T-117 at Boeing South Park. The northernmost outfall reportedly discharged non-contact cooling water from Boeing South Park under an NPDES permit; but in 1993, this practice was discontinued, and the cooling water was re-routed to the sanitary system (Boeing 1993). Currently, both outfalls likely only discharge stormwater; however, stormwater drainage patterns associated with Boeing South Park have not been identified.

2.1.4 Current land use, zoning, ownership, and activities

This section describes the current land use, zoning, ownership, and activities for the T-117 EAA. Future land use may change depending on the remedial alternative selected in the EE/CA. These potential changes will be discussed and evaluated in the EE/CA.

2.1.4.1 Land-use, zoning, and ownership

The T-117 EAA and vicinity are zoned as mixed-use for residential, commercial, and industrial activities (Map 2-2). Current land use in the area is primarily manufacturing, commercial, or residential. Properties located on the east side of Dallas Avenue S are located in unincorporated King County (Map 2-2) and include:

- The Marina, which is primarily used for boat storage and maintenance, as well as the moorage of live-aboard and recreational vessels. The upland portion of the Marina is currently owned and operated by South Park Marina Ltd. Partners. The portion of the Marina west of the Duwamish Commercial Waterway District boundary (Map 2-2) is owned by the Port.
- T-117 Upland Area, which is currently owned by the Port and was formerly used for manufacturing and industrial activities.
- A portion of the Boeing South Park facility, which is currently owned by Boeing and is primarily used as a training center.

Properties within and surrounding the remaining portion of the T-117 EAA, to the west of Dallas Avenue S, include:

- The location of the former (operations ceased in 2004) Basin Oil plant (a used oil and antifreeze processing facility) at 8661 Dallas Avenue S, which is currently owned by Basin Oil Company.
- Commercial and residential parcels (located along Dallas Avenue S, 16th Avenue S, and 17th Avenue S), including six occupied residences.
- The location of the former (operations ceased in 2007) Seattle Chocolate Company (chocolate confectionery company), also formerly occupied by Allied Bolt Company (metal fabrication), and Fasteners, Inc. (metal fabrication), at 8620 16th Avenue S. The property is currently vacant but owned by Weatherly Holdings LLC.

Basin Oil formerly used the property at 8617 17th Avenue S for excess drum storage until this parcel was purchased by the Marina for boat storage in August 2007. The parcel located at 8603 Dallas Avenue S is also owned by the Marina and used for additional boat storage.

The Basin Oil parcels and the Boeing South Park parcels within the City limits are zoned as manufacturing/industrial; the parcels between 16th Avenue S and 17th Avenue S are zoned as industrial buffer. Parcels west of 16th Avenue S and north of S Donovan Street are zoned as residential/commercial and include approximately 20 houses and one 12-unit apartment complex (Map 2-2).

2.1.4.2 Commercial and residential activities

Both residential and commercial activities occur near the T-117 EAA. As previously described, there are several residences as well as various commercial and

manufacturing facilities in the T-117 EAA vicinity. Most of the public activities in the T-117 EAA occur in the Adjacent Streets because the T-117 Upland Area and Sediment Study Area have restricted access (the T-117 Upland Area is currently surrounded by a secure fence and a gate). Walking, jogging, biking, or driving are the likely activities in which residents participate in the area. Workers may also access the area to service utilities, which may require digging in the Adjacent Streets, as well as on the T-117 Upland Area.

The T-117 Sediment Study Area is accessible by boat; however, recreational boating occurs on a limited basis (as described in Section 2.1.4.3). The Muckleshoot Tribe currently conducts commercial netfishing operations on the LDW, which may occur within the sediment portion of T-117.

2.1.4.3 Recreational activities

The LDW is not a major recreational resource compared to other water bodies in and around the City (King County 1999b), but anecdotal evidence from community members suggests that recreational use of the LDW has been increasing. Few data that quantify the frequency with which people use the river for recreational purposes have been identified. King County's human health risk assessment (HHRA) (1999b) discussed the human use of both the Duwamish River and Elliott Bay but presented quantitative data only for fishing. The King County study assumed that few, if any, people engage in water activities such as swimming, scuba diving, and windsurfing within the LDW. There are several public access points where people may enter the LDW for recreational purposes, and recreational boating and kayaking in the LDW have been observed by Windward staff (2005). The Marina and a public boat launch north of the Marina are the closest recreation boating access points to the T-117 EAA. There is no known use of T-117 as a boat put-in or haul-out location. Such use is unlikely because the T-117 shoreline is steep and overgrown and the T-117 Upland Area is secured by a fence. However, the T-117 shoreline and intertidal mudflat is accessible from the LDW by boat. In the King County survey of fishing and seafood consumption practices (1999b), none of the LDW sites identified as locations where recreational fishing occurred were near the T-117 EAA. However, recreational fishing may occur from the Marina or from boats in the vicinity of the T-117 EAA.

2.1.5 Physical environment

This section describes the physical features associated with both the aquatic and upland portions of the T-117 EAA. Sections 2.1.5.1 and 2.1.5.2 discuss the aquatic portion of the site; Section 2.1.5.3 focuses on the upland environment.

2.1.5.1 Currents, circulation, and estuarine features

No studies of river currents and circulation characteristics specific to the Sediment Study Area have been conducted. However, the results of a site-wide hydrodynamic model developed as part of the LDW RI (Windward 2007) can be generally applied to T-117 insofar as the model provides information regarding the currents of the LDW as

a whole, including currents adjacent to the T-117 EAA. Water currents and circulation within the LDW are driven by tidal actions and river flow; the relative influence of each is highly dependent on seasonal river discharge volumes. Fresh water moving downstream overlies the tidally influenced salt water that enters the system. The Duwamish River is tidally influenced to the head of the estuary at RM 12.0 (Kerwin and Nelson 2000), with the degree of tidal influence varying depending on stream flow and tidal stage.

Tidal action significantly influences currents and water elevation in the LDW. The average tidal range is -0.91 to 12.81 ft MLLW.[2] Typical of tidally influenced estuaries, the LDW has a relatively sharp interface, or wedge, between the freshwater outflow at the surface and saltwater inflow at depth. Tidal effects and the volume of river flow also control the movement of the saltwater wedge. The toe of the saltwater wedge is generally located between Slip 4 (approximately 0.8 RM south of T-117) and Turning Basin 3 (approximately 1 RM north of T-117) (Santos and Stoner 1972). Salinity measurements by Santos and Stoner (1972) at RM 3.2, just downstream from T-117, indicated that at this location, the estuary had freshwater at all points in the vertical profile only when there was a combination of very low tide and high rates of river flow. Dye studies indicated that downward vertical mixing over the length of the saltwater wedge was almost nonexistent (Schock et al. 1998). The circulation of water within the LDW was determined to be a combination of a net upstream movement of water within the bottom-layer saltwater wedge and a net downstream movement of freshwater in the layer that overrides the wedge.

The Green River is the main source of water for the LDW. Average downstream flow for the Duwamish River measured at the Tukwila gaging station was 1,533 cubic feet per second (cfs) during 2003-2004, ranging from 327 cfs in August to 3,290 cfs in June (Clemens 2007). Flow at the Auburn gaging station ranged from 152 to 11,600 cfs (the record high) between 1962 and 2004 (Clemens 2007). Between 2000 and 2006, the annual average flow rate measured at the Auburn gaging station was 1,190 cfs, ranging between 850.6 cfs and 1,413 cfs (USGS 2007). Flow rates are greatest in the winter because of seasonal precipitation and lowest throughout the late summer dry season.

Stream flow to the LDW is also influenced by water diversions, particularly by the City of Tacoma's Headworks Dam, which diverts at least 113 cfs daily for municipal use. The Howard Hanson Dam (located upstream of the City of Tacoma's Headworks Dam) also influences flows in the river. Information on the estimated influence of the Howard Hanson Dam on flow rates (Kerwin and Nelson 2000) indicates flow rates in the Duwamish River have been reduced by 33 to 60%, depending on the season. The White, Black, and Cedar Rivers have also been diverted from the Green/Duwamish

[2] Information based on National Oceanic and Atmospheric Administration (NOAA) Center for Operational Oceanographic Products and Services National Tidal Datum from 1993 to 2003.

River system resulting in an contributing flow reduction by approximately 70% to the Green/Duwamish River system, ensuing in a significant reduction in total discharge.

LDW Stream flow is also influenced by inflows from surface water sources such as storm drains, CSOs, tributary creeks, and nonpoint inputs, although these sources are expected to be less than 1% of the total discharge, even during peak flow events (Windward 2007). Two main tributary creeks drain into the LDW: Puget Creek at approximately RM 0.7 (downstream of the T-117 EAA) and Hamm Creek at approximately RM 4.2 (upstream of the T-117 EAA).

Several organizations have measured current velocities within the LDW as part of environmental investigations. The most extensive measurements within the LDW have been conducted by King County. Current velocity meters were placed at two locations in the LDW (RM 1.1 and RM 3.5) for a 3-month period and recorded currents at 15-minute intervals along a vertical profile (King County 1999a). During this study, measured current velocities within the LDW rarely exceeded 40 cm/s (1.3 ft/s). Another study of current velocities involved the deployment of two current velocity meters at RM 1.1 for two 4-week periods (King County 2005). One meter was placed near the center of the navigation channel; the other was placed on a shallower channel side slope. Reported mean net current speeds for meters placed in the center of the channel ranged from 2.5 cm/s (0.082 ft/s) (at 25% channel depth) to 18 cm/s (0.59 ft/s) (at 10% channel depth). Mean net current speeds for meters placed at the channel side slope locations ranged from 1.3 cm/s (0.043 ft/s) (at 25% depth) to 8.9 cm/s (0.29 ft/s) (at 10% depth). Currents were predominately oriented along the channel, and velocities were generally slower along the side slopes.

2.1.5.2 Sediment transport

No studies on sediment transport specific to the Sediment Study Area have been conducted. However, LDW-wide investigations have been conducted that provide some insight into hydrodynamic and sediment transport conditions at T-117. Sediment transport within the LDW, including the T-117 EAA, is influenced by many variables, including hydrodynamic forces attributable to currents and circulation driven by tidal actions and river flow, the saltwater wedge, sediment loading from upstream and upland sources, channel morphology, and resuspension processes (i.e., propeller scour, bioturbation, bed shear stress, and dredging). As part of the LDW RI, sediment transport data were collected throughout the LDW (Windward and QEA 2005) to enable a better understanding of the LDW sediment transport process and the development of a draft LDW-wide sediment transport model (STM) (QEA 2007). The results of these investigations and analyses can also be used to assess evaluate sediment transport conditions in specific areas of the LDW, such as the T-117 EAA.

The draft LDW-wide STM included simulations of high-flow events (i.e., events with return periods of 2, 10, and 100 years) that occur over time scales of several days and long-term simulations (i.e., 30 years) that focused on sediment deposition patterns on annual time scales. A separate simple model was used to evaluate ship-induced

mixing of surface sediment (QEA 2007). For the T-117 EAA, up to 2 cm of net erosion is estimated to occur during high-flow events in the southern and central portion of the site. In the central portion of the site, up to 6 cm of net erosion is estimated to occur during the 100-yr high-flow event. During the 2-and 10-yr high-flow events, no more than 2 cm of net erosion was estimated to occur in the central portion of the site. In the northern portion of the site, no net erosion is predicted, even during the 100-yr high-flow event.

The draft LDW STM indicated that the T-117 EAA Sediment Study Area was net depositional over annual time scales. Along most of the T-117 EAA, the predicted net sedimentation rate for a 30-yr period ranged from 0 to 0.5 cm/yr, except along the northern portion of the EAA at the Marina interface, where the net sedimentation rate was estimated at > 3 cm/yr. While these results from the LDW-wide modeling effort provide potential insight to broader trends in the vicinity of the T-117 EAA, the spatial heterogeneity of the model predictions within and adjacent to the T117 EAA indicates the area is in a transitional location with regard to both erosion and sedimentation rates.

The investigations of ship traffic presented in the draft LDW RI (Windward 2007) did not indicate that there was significant ship traffic adjacent to the T-117 EAA. In other areas where such ship traffic does occur more frequently, there is no evidence in the bathymetric record of large depressions in areas with frequent ship traffic. The lack of such evidence validates the assumption that the upper sediment layer is continually reworked and deposited very close to its original location and suggests that ship activity is not a major cause of sediment transport in the LDW or the T-117 EAA. (Windward 2007)

2.1.5.3 Geology

Geology of the Duwamish Basin

The Greater Duwamish Valley was formed by the carving action of glaciers that last advanced into this area from British Columbia approximately 15,000 years ago. When the ice sheets began to retreat approximately 5,700 years ago, the waters of Puget Sound extended up the Duwamish Valley as far south as Auburn, about 32 km (19 mi) upstream of the present mouth of the LDW at Elliott Bay. Around that same time, the Osceola Mudflow descended from Mount Rainier, depositing a massive layer of sediment into the then marine waters near present-day Auburn and Kent. The mudflow diverted the historical course of the White River, at that time a tributary of the Puyallup River, to the Green River (Booth and Herman 1998).

The alluvial fill within the Duwamish Valley deepened over time from the deposition of upstream fluvial sediments of the White, Green, and Black Rivers, advancing the mouth of the Duwamish River farther to the north. The fill included beds of fine silts and sands deposited as riverine and floodplain deposits, with coarser sands and gravels deposited near the water's edge. These sediments eventually buried the post-glacial form of the valley so that only a few outcroppings of bedrock remain exposed

at the ground surface. As the river flooded and migrated back and forth across the floodplain, these sediments were redeposited by the river and continually intermixed with additional riverine and floodplain deposits (Booth and Herman 1998).

In the late 1800s and early 1900s, extensive modifications were made to the river, including the filling of tide flats and floodplains to straighten the river channel, resulting in the abandonment of almost 6 km (3.7 mi) of the original meandering river bed (Map 2-3). Several current side slips in the LDW are remnants of these old river meanders. The channel was dredged for navigational purposes, and the excavated material was frequently used to fill the old channel areas and the lowlands to bring them above flood levels. The portion of the LDW at the T-117 EAA was a new alignment, dredged and excavated as part of the "straightening" of the river. A former filled meander (oxbow) intercepts the shoreline in the vicinity of the north portion of T-117. Because the dredge fill materials were similar to the native deposits, they are difficult to distinguish from the native silts and sands. Subsequent filling of the lowlands for continued development resulted in a surficial layer of fill over most of the lower Duwamish Valley. Although the sediment types encountered in the LDW are variable (either from changing regional or local hydrodynamics or anthropogenic disturbances), basic sedimentary patterns of interbedded silts and sands are present in the LDW (Booth and Herman 1998).

The three principal geologic assemblages within the Greater Duwamish Valley that establish the regional hydrogeologic system, from oldest to youngest, are:

- Bedrock
- Glacial and non-glacial sedimentary units (glacially overridden and dense units that make up the plateaus to the east and west of the Duwamish Valley)
- Undifferentiated quaternary alluvial deposits (principal aquifer and groundwater pathway for the Duwamish basin)

Bedrock

Bedrock in the Greater Duwamish Valley provides the lower boundary of the aquifer system and limits groundwater flow in the basin. At the north end of the Duwamish Valley, the elevation of the bedrock unit ranges from roughly 60 m (200 ft) to over 500 m (1,640 ft) below ground surface (bgs). Exposed bedrock in the eastern and southern areas of the Duwamish Valley is predominantly marine and continental sedimentary rocks intermixed with isolated areas of igneous rock deposited during the Tertiary period. Sedimentary rock units within the Greater Duwamish Valley are not an important source of groundwater because the predominantly cemented, fine-grained nature of the material precludes rapid groundwater movement. However, igneous rock layers are extensive in the area and can store and move water much more readily (Booth and Herman 1998).

Glacial and Non-Glacial Sedimentary Deposits

The glacial and non-glacial sedimentary units within the Duwamish basin are complex sequences of interbedded and unconsolidated deposits. In areas where bedrock occurs at significant depth below the river valley, these glacial sedimentary deposits serve as the lower boundary of the alluvial deposits in the Greater Duwamish Valley. The upland plateau areas to the east and west of the valley are formed predominantly of these glacially deposited sedimentary units (Booth and Herman 1998).

Little information on the glacially overridden sedimentary units within the LDW study area is available. These overridden deposits are mainly fine-grained materials; their maximum depth is unknown (Booth and Herman 1998). Although these deposits provide a geologic boundary to the overlying alluvial deposits, they also provide a potential hydraulic pathway for the flow of upland groundwater to the Duwamish Valley alluvial sediments.

Thick sequences or silt beds (transitional beds) could potentially limit the upland inflow of groundwater where these deposits occur. The presence of saline water in the deeper alluvial sediments outside of current tidal influence areas suggests that there is little influx of fresh water into the original marine delta deposits. The lack of fresh groundwater in these deep alluvial sediments may indicate that the inflow of upland groundwater in this layer is limited (Booth and Herman 1998).

Duwamish Valley Alluvial Deposits

The near-surface alluvial deposits in the Duwamish River valley extend to a depth of roughly 60 m (200 ft) bgs within a trough bounded between the bedrock unit and the very dense upland glacial and non-glacial sedimentary deposits. The geologic history of this valley suggests that the alluvial deposit sequences include estuarine deposits, typically fine sands and silts (often including shell fragments), which progress upward into more complex, interbedded river-dominated sequences of sand, silt, and gravel. These layers of alluvial deposits delineated the areas of advancing river delta sedimentation that increase in thickness from south to north (Booth and Herman 1998).

Geology of the T-117 EAA Vicinity

A summary of geotechnical information for the west shore of the Duwamish River in the vicinity of the T-117 EAA indicates that shallow soils typically consist of fill material that ranges from 3 to 8 ft in thickness. This fill consists of sand with varying amounts of silt mixed with anthropogenic materials (e.g., bricks, rubble, and wood). The alluvium underlying the fill extends to a depth of approximately 95 ft (29 m) bgs and consists of discontinuous silt units with interbedded sands, silty sands, and some gravel. Thin peat deposits have also been encountered. A fine-grained lower unit that contains shell fragments has been observed in borings beneath the lower silt, and dense sand and gravel were reportedly observed at depths below 95 ft (29 m) bgs (Wilbur Consulting 2003).

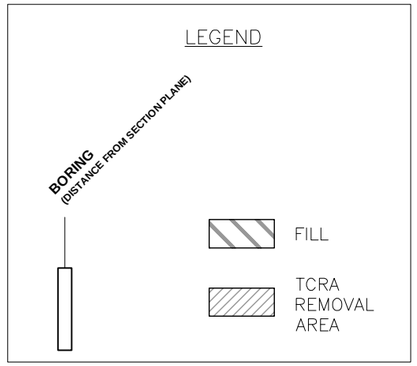
Geology of the T-117 Upland Area

According to the results of previous site characterization activities at T-117 Upland Area (Parametrix 1991; RETEC 2007b; SECOR 1997; Windward and DOF 2006), subsurface soil at the T-117 EAA consists of fine to medium sand, sand/silt mixtures, and silt. Previous work indicated that a silt layer was encountered between 5 and 15 ft (1.5 and 5 m) bgs, and sand and gravel were encountered below 15 ft bgs (Parametrix 1991). Fill reportedly was encountered from ground surface to approximately 3 ft (1 m) bgs; however, other observations (RETEC 2007b; Windward and DOF 2006) indicate that the recent fill material may be as thick as 4 to 5 ft or greater in the near-shore upland area (just inland of the shoreline berm). A general cross section of the T-117 EAA geology is shown on Figure 2-1.

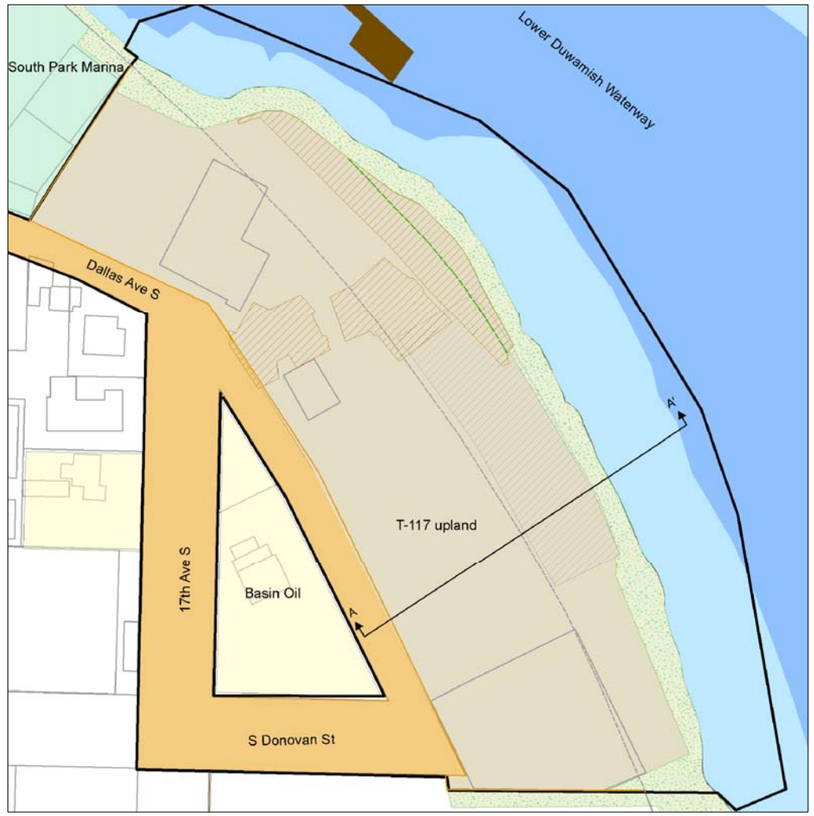
The removal area in the T-117 Upland Area that was excavated for the 1999 TCRA (Onsite 2000a) was backfilled with fill and quarry spalls (i.e., large angular rocks) to depths ranging from approximately 2 to 6 ft. This backfill was overlain with an asphalt pavement system (i.e., gravel subgrade and bituminous pavement) that was approximately 1 ft thick. The removal area of the T-117 Upland Area that was excavated for the 2006 TCRA (RETEC 2007b) was backfilled with crushed rock to depths ranging from approximately 2 to 6 ft (0.6 to 2 m) and covered with asphalt pavement.

Site characterization work conducted by the City in the Adjacent Streets determined that the soil gradation is generally fill material (asphalt and gravel with fines) in the top 1 to 2 ft underlain by silts, sandy silts, and a characteristic native sand deposit observed throughout most of the site (Integral 2006). The depth to the native sand unit varied approximately as follows:

- 4 to 6 ft at Dallas Avenue S, between 14th Avenue S and 17th Avenue S
- 1 to 2 ft at Dallas Avenue S, between 17th Avenue S and S Donovan Street
- 9 to 10 ft at S Donovan Street, between 17th Avenue S and Dallas Avenue S



Note:
MLLW = Mean Lower Low Water



15 0 30
SCALE IN FEET

PORT OF SEATTLE TERMINAL 117			CROSS SECTION
DATE: 03/12/08	DRWN: EM/SEA		FIGURE 2-1

2.1.5.4 Hydrogeology

The shallow unconfined aquifer in the Duwamish River valley is generally located within the native alluvium unit. At T-117, shallow groundwater extends upward into the overlying sand and silt fill, and water table fluctuations are influenced by river level fluctuations in the LDW. Groundwater is recharged from the upland areas to the west (Wilbur Consulting 2003), and net groundwater flow is toward the LDW (as shown on Map 2-1).

Recent groundwater level data collected in 2006 (Windward unpublished) indicate that groundwater near the T-117 EAA occurs between approximately 3.5 and 12.6 ft bgs. The groundwater beneath the T-117 Upland Area is hydraulically connected to the LDW and is tidally influenced. Tidal influence has been observed in all monitoring wells on the T-117 Upland Area and was confirmed by tidal study piezometric measurements made in 1998, 2003, and 2006 (SECOR 1998; Windward et al. 2005b; Windward unpublished). During these tidal studies, the water levels in the LDW varied by up to approximately 13 ft, from extreme high to extreme low tide, and water levels in the T-117 wells typically varied by 4.5 to 8 ft during the same study periods. The magnitude of the water level variation decreased inland. Groundwater elevations varied between 3.5 and 13 ft MLLW during the study. The exact limit of this influence is not known but likely extends throughout much of the upland portion of the T-117 EAA. An earlier investigator reported that the tidally influenced area adjacent to the waterway is generally within 300 to 500 ft of the shoreline (Booth and Herman 1998).

Hydraulic conductivities for typical silty sand units such as the fill soil range from 10^{-1} to 10^{-5} cm/s. Silt units, such as the upper portion of the native alluvium that is immediately below the fill unit, typically have hydraulic conductivities ranging from 10^{-3} to 10^{-7} cm/s (Freeze and Cherry 1979).

Groundwater seeps have been observed at the base of the shoreline riprap (at the mudline) near the central portion of T-117 EAA and south of the Marina boat ramp during low tides. The two seeps appear to be well established, as demonstrated by the channels that have been cut into the tide flats between the seep locations and the main river channel. Two or three minor seeps have also been observed along the T-117 EAA shoreline, but the flow is intermittent and not as pronounced.

2.1.6 Sensitive ecosystems and habitat

Sensitive ecosystems and habitat in the T-117 EAA are limited to the aquatic portion of the site. The upland portion of the EAA is developed and doesn't contain enough substantial habitat to support wildlife, as described in a terrestrial ecological evaluation conducted for the Adjacent Streets (Integral 2006).

Estuarine intertidal and near-shore subtidal ecosystems in the LDW provide important habitat for juvenile salmonid growth, physiological transition, and predator avoidance

during their outmigration. The estuarine environment also provides refuge for various marine fish during larval stages and supports an array of preferred prey for all salmonid life stages. The intertidal zone in the LDW is generally located between -4 ft and +14 ft MLLW, and the near-shore subtidal zone is just slightly deeper than the intertidal zone.

Within the intertidal areas, mudflats serve many ecosystem functions, including providing food and habitat for benthic invertebrates, fish, shorebirds, and aquatic mammals. A diverse assemblage of invertebrate species, including larvae, clams, worms, and crustaceans, can be found in these habitats, which typically consist of unconsolidated silts and clays and sand flats of unconsolidated sandy sediments (Simenstad et al. 1991). Mudflats containing gravel may support high densities of bivalve populations. The intertidal mudflat of the T-117 EAA extends approximately 15 to 65 ft (4.6 to 20 m) from the immediate shoreline, around +5 ft MLLW, to a depth of approximately -4 ft MLLW. The T-117 intertidal mudflat includes more than 43,000 ft^2 (4,000 m^2) of gently sloping, fine-grained sediment. This area is potential habitat for primary and secondary production benthic organisms for the juvenile salmonid food web.

2.2 PREVIOUS ENVIRONMENTAL INVESTIGATIONS AND REMOVAL ACTIONS

This section provides an overview of historical environmental investigations and removal action activities pertinent to the T-117 EAA.

2.2.1 Previous environmental investigations

Numerous environmental investigations have been conducted in the T-117 EAA and surrounding vicinity, as summarized in Table 2-1.

Table 2-1. Summary of previous investigations at Terminal-117 Early Action Area

ACTIVITY	DATE	SUMMARY	SOURCE
In-Water – Sediment			
Malarkey Asphalt Company site inspection	1994	One surface sediment sample was collected at the toe of the bank and analyzed for metals, pesticides, PCB Aroclors, SVOCs, and VOCs.	URS (1994)
Duwamish Waterway Phase 1 site characterization	1997	Site-wide LDW surface and subsurface sediment samples were analyzed for metals, PCB Aroclors, and SVOCs.	Exponent (1998)
Duwamish Waterway sediment characterization study	1997	Site-wide LDW surface and subsurface sediment samples were analyzed for total PCBs, selected PCB congeners, and total polychlorinated terphenyls.	NOAA (1998)
EPA site inspection: Lower Duwamish River	1998	Site-wide LDW surface and subsurface sediment samples were analyzed for metals, pesticides, PCB Aroclors and selected congeners, dioxins and furans, TBT, SVOCs, and VOCs.	Weston (1999)
T-117 EAA investigation	December 2003	An initial sediment investigation was conducted to determine the nature and extent of contamination in the T-117 EAA. Surface and subsurface sediments were analyzed for PCBs. Select locations were also analyzed for SMS analytes and TBT.	Windward et al. (2005b)
	March 2004	To better define the extent of contamination, additional subsurface and surface sediment samples were collected from the northern portion of T-117. All of these samples were analyzed for PCBs and compared to SMS. Large asphalt deposits and other major debris located in the shoreline bank were identified, described, and mapped.	
	June 2004	Surface sediment samples collected outside the offshore northern portion of the preliminary sediment boundary for the 2005 EE/CA were analyzed for PCBs, and archived samples collected in December 2003 that were either outside of the boundary or below the vertical extent of PCB contamination were analyzed for additional chemicals.	
	September 2004	Surface and subsurface samples were collected in the northern portion of the site that extends into the proposed Marina dredge area. This sampling event was conducted to satisfy both the EPA T-117 EAA boundary definition and the PSDDA sediment characterization requirements for the Marina.	Windward (2005a)
Upland – Soil and Groundwater			
Metro inspection – sampling of roadway ponded area and shoreline seep	1984	Water and sediment samples were collected from the LDW, roadway ponded area, catch basin 5 outfall, and an apparent groundwater seep at the shoreline. PCBs, PAHs, and metals were detected in one or more of the water and sediment samples. No PCBs were detected in the seep sample. Ponded area was reportedly used for non-contact cooling water, although this was later discounted by subsequent investigators.	URS (1994)

ACTIVITY	DATE	SUMMARY	SOURCE
Ecology sediment sampling and inspections	1985 and 1986	Sediment samples were collected from an onsite drainage ditch. Results showed elevated concentrations of lead (1,666 mg/kg), arsenic (2,027 mg/kg), and zinc (5,416 mg/kg).	URS (1994)
EPA TSCA inspection	1989	Samples were collected from a waste oil tank and another tank that contained usable light oils. No PCBs were detected. However, total halogenated hydrocarbons (as total chlorine) were reportedly detected at levels up to 1,160 mg/kg in the sampled product. No materials were noted at the facility to qualify for PCB regulation.	URS (1994)
Ecology site hazard assessment	May 1991	Work included review of Ecology and Malarkey Asphalt files, installation of three monitoring wells (MW-01, MW-02, and MW-03), soil sampling and analysis of borehole samples, groundwater sampling, sampling of product in USTs and ASTs. Metals, PCBs, pesticides, and VOCs were found in soil. Results of TCLP analyses on soil were below dangerous waste criteria. Metals, PCBs, pesticides, and SVOCs were detected in groundwater. A 1/8-in. (0.3-cm) layer of floating product was reported in MW-03.	Parametrix (1991)
UST decommissioning and site assessment	1992	Four USTs containing diesel and waste oil were decommissioned, including a partially buried railroad tank car. Three USTs were closed in place by filling with concrete slurry. The railroad tank car was removed. Soil samples were taken from the tanks and tested for TPH.	Hart Crowser (1992)
Malarkey Asphalt Company site inspection	1994	Onsite and offsite soil, sediment, groundwater, and surface water were sampled. PCBs and PAHs were detected in soil at the former ponded/waste areas. Three monitoring wells and a groundwater seep were also sampled. PCBs were detected in all wells, and PAHs were detected in MW-03. PCBs were not detected in the seep sample.	URS (1994)
Asbestos abatement survey	June 1995	Tanks requiring abatement work were identified.	EMCON (1996)
Asbestos abatement on Tanks 5 and 7	August 1995	Asbestos abatement work was performed on two tanks.	EMCON (1996)
Soil and water sampling	September 1995	Seven surface soil samples were collected from locations near the ponded area, former railroad tank car, and storm drain ditches. One water sample was collected from inside a sump. Samples were analyzed for PCBs and PAHs.	EMCON (1996)
Asbestos survey	March 1996	An asbestos-containing material survey was conducted. Twelve suspect materials were found to contain detectable amounts of asbestos.	EMCON (1996)
Removal actions, Malarkey dismantling	1996 to 1997	Tank and equipment decommissioning, decontamination, and removal were performed, as were hot spot removals (soil from ditch areas, utility corridor) and the removal of product from a large-diameter well.	SECOR (1998)
Focused site characterization	July 1997	Soil was sampled for PCBs, PAHs, TPH, and metals. Groundwater was sampled for PCBs, TPH, and TSS. Floating product was sampled in August 1996. Exploratory borings were made.	SECOR (1998)

ACTIVITY	DATE	SUMMARY	SOURCE
Utility corridor soil sampling	October 1999	Three borehole locations were sampled along a utility alignment that extended from the former tank area to the south building. PCB concentrations ranged from 0.77 to 15 mg/kg.	Windward and Onsite (2004)
PCB soil removal and containment – roadway area (1999 TCRA)	October 1999 to February 2000	Actions included the removal and treatment of impounded stormwater, the excavation and disposal of over 2,000 tons of PCB-contaminated soil with concentrations ranging up to 500 mg/kg, backfilling, installation of a pavement cap, and storm drain improvements. Also included was the abandonment of large-diameter well and replacement of three monitoring wells. PCB cleanup objective in soil was 25 mg/kg.	Onsite (2000a)
Underground diesel storage tank removal	January 2000	A 375-gal. (1,420-L) non-leaking diesel tank was removed. Two soil samples from excavation indicated elevated TPH diesel levels (462 and 2,780 mg/kg). Other sample concentrations were not -detected.	Onsite (2000b)
Groundwater sampling at T-117 wells	May 2003	Groundwater was sampled from three wells in the vicinity of T-117. TPH-D [0.70 mg/L], TPH-O [1.4 mg/L], and six PAH compounds at concentrations ranging from 0.013 to 1.6 µg/L) were detected in MW-03. PCBs were not detected in any of the wells.	Onsite (2003)
T-117 EAA investigation	December 2003	Soil samples were collected from the top of the shoreline, the southern drainage ditch, and the adjacent Dallas Avenue S roadway area. Water samples were collected from seeps and groundwater monitoring wells, and sediment samples were collected in catch basins. PCBs were detected in most soil samples. No chemicals were detected in the monitoring well samples. Copper, zinc, and BEHP were detected in seep samples. Concentrations of BEHP, BBP, PCP, PCBs, silver, and zinc in catch basin samples were greater than the SQS or CSL.	Windward et al. (2005b)
	March 2004	To better define the extent of contamination, shallow soil borings were collected from the northern upland bank. All these samples were analyzed for PCBs and compared to SMS to assess the risk from potential erosion. Soil sampling was also conducted to estimate concentrations of PCBs in the roadway along the entrance area of the T-117 property and determine if these materials were the likely source of elevated PCBs in and around catch basin 5. Roadway soil samples and catch basin samples were analyzed for PCBs. Large asphalt deposits and other major debris located in the south ditch were identified, described, and mapped.	
Upland street dust and road ROW sampling	July to December 2004	PCB concentrations exceeding the MTCA soil cleanup level for unrestricted use (1 mg/kg PCBs) were detected in a number of street dust, catch basin, and roadway samples.	Integral (2006)
T-117 South building planter soil sampling	November 2004	Four shallow soil grab samples were obtained from the concrete-enclosed soil-filled planter areas at the north side of the south building at T-117. PCB concentrations in the four soil samples ranged from 0.03 to 0.22 mg/kg. Soil in the west planter was subsequently covered over with a layer of clean gravel. Soil in the east planter was covered with asphalt pavement.	Onsite (2004)
T-117 upland soil sampling	June 2005	Soil borings and direct push probes were used to collect soil samples. All soil and groundwater samples were analyzed for PCBs. Five soil samples from beneath the pavement along the shoreline edge of the site contained the highest PCB concentrations, which ranged from 530 to 1,400 mg/kg.	Windward et al. (2005d)

ACTIVITY	DATE	SUMMARY	SOURCE
Additional upland soil sampling	August 2005	Supplemental upland soil sampling was conducted using 26 moderate-depth soil borings (0 to 9 ft); samples were analyzed for total PCBs. Three soil samples (SB-26, SB-51, and SB-28) along the northern shoreline contained PCB concentrations similar to those of the previous upland sampling effort in the same area. Two soil samples located in the paved driveway area inboard of the bank extending north of the 1999 PCB removal area had two of the highest PCB concentrations (1,200 and 730 mg/kg for soil samples SB-30 and SB-50, respectively). These data identified a new area of elevated PCB contamination on the T-117 site not previously observed in the June 2005 soil sample results.	Windward et al. (2005e)
Shallow soil sampling in Adjacent Streets ROW areas	September 2004 to October 2005	Shallow soil samples were collected within the city street ROW areas. Based on this work, SPU determined that PCBs were the primary COPCs within this subarea, although other chemicals were also detected in isolated locations.	Integral (2006)
Yard soil sampling	2005	In June 2005, SPU collected confirmatory soil samples at the base of the excavation following the removal of PCB-contaminated soil from the residential lots adjacent to the impacted ROW.	Hart Crowser (2005)
Subsurface sampling in Adjacent Streets	February 2006	Twenty-five direct push borings were advanced up to a depth of 20 ft bgs to delineate the extent of PCB contamination and to screen for other contaminants of potential concern (TPH, PAHs, BTEX, and metals) within the Adjacent Streets. Results of the investigation were used to delineate the preliminary boundary for the Adjacent Streets.	Integral (2006)
T-117 upland investigation	January 2006	Soils borings were collected throughout the upland property. PCBs were detected in several samples. Groundwater was also collected from several monitoring wells; PCBs were detected in unfiltered samples. The results of this investigation led to an interim soil removal action for PCB-contaminated soil.	Windward and DOF (2006)
T-117 TCRA activities (2006 TCRA)	October to November 2006	Confirmation samples were collected in the TCRA excavation areas upon completion of the soil removal activities. Baseline samples were also collected in the roadway along Dallas Avenue S before and after the TCRA.	RETEC (2007b)

AST – aboveground storage tank
BBP – benzyl butyl phthalate
BEHP – bis(2-ethylhexyl) phthalate
BTEX – benzene, toluene, ethylbenzene, and xylene
bgs – below ground surface
COPC – chemical of potential concern
CSL – cleanup screening level
DOF – Dalton, Olmsted & Fuglevand
EAA – early action area
LDW – Lower Duwamish Waterway
MTCA – Model Toxics Control Act
NOAA – National Oceanic and Atmospheric Administration
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PCP – pentachlorophenol
PSDDA – Puget Sound Dredged Disposal Analysis
ROW – right-of-way
Marina – South Park Marina
SMS – Washington State Sediment Management Standards
SPU – Seattle Public Utilities
SQS – sediment quality standard
SVOC – semivolatile organic compound
T-117 – Terminal 117
TBT – tributyltin
TCLP – toxicity characteristic leaching procedure
TCRA – time-critical removal action
TPH – total petroleum hydrocarbons
TSCA – Toxic Substances Control Act
TSS – total suspended solids
UST – underground storage tank
VOC – volatile organic compound

2.2.2 Previous removal actions

Prior to the Port's acquisition of the T-117 upland parcel in 1999, the Malarkey asphalt plant was closed, and a number of storage tanks were removed or abandoned (i.e., closed in place) as required by EPA in a 1996 AOC for Removal Action at Malarkey. In 1996 and 1997, Malarkey performed tank and equipment decommissioning and decontamination and removed soil from ditch areas and the utility corridor (i.e., hot spot removals). Product also was removed from a large-diameter well prior to Port ownership (SECOR 1998).

All of the tanks were decommissioned and removed from the property prior to the Port's acquisition in 1999. The three USTs, which contained diesel and waste oil, were filled with concrete slurry and closed in place; a partially buried railroad car, which was used to hold waste oil, was excavated and removed. Sixteen ASTs were also removed from the site. Soil samples were taken from the tanks and tested for total petroleum hydrocarbons (TPH) (Hart Crowser 1992). The former locations of these tanks are shown on Map 2-4.

Since the Port's acquisition of the former asphalt plant, several actions have been performed focusing on the removal of asphalt plant residues and PCB-contaminated soil from within the T-117 Upland Area and Adjacent Streets. A TCRA for upland soils was conducted within the T-117 Upland Area by the Port in 1999 pursuant to an EPA AOC (No. 10-2000-0222) (EPA 2000). In 2003, several old drums and other large debris were removed from the offshore intertidal area. In 2004, a below-grade utility corridor was cleaned out. In 2006, under the terms of a separate ASAOC, the Port carried out an additional TCRA to remove additional impacted soil with the highest concentrations of PCBs within the T-117 Upland Area.

In 2004 and 2005, the City, in coordination with EPA and Ecology, implemented a series of voluntary cleanup actions to address PCBs discovered in soil in the Adjacent Street and three neighboring residential properties near the T-117 EAA. The City removed soil that had PCB concentrations exceeding 1 mg/kg from the residential yards and unpaved street shoulders and placed an interim asphalt cap over residual contamination within the street ROW areas. The current preliminary removal action boundary for the Adjacent Streets has been established to address remaining contamination in this area.

The above removal actions conducted in the T-117 EAA are described in greater detail in the following subsections. The locations of previous removal actions are shown on Map 2-4.

2.2.2.1 1999 TCRA

PCBs were initially detected in surface and subsurface soil in the upland shoreline parcel (former ponding area) during several investigations in the 1990s. A TCRA (Map 2-4) was conducted in 1999 (Onsite 2000a) to remove PCB-contaminated soil from

an area within the shoreline parcel that contained elevated concentrations of PCBs based on previous sampling efforts (SECOR 1998, 1997). The TCRA was performed in accordance with the EPA AOC (No. 10-2000-0222) (EPA 2000) and associated SOW. Tasks included:

- Mobilization and site preparation (including installation of drainage controls and the establishment of controlled work areas)
- Removal, storage, testing, and treatment of water from the ponding area prior to soil removal
- Containment, testing, and removal (for offsite treatment) of approximately 50,000 gallons of water during excavation
- Removal from the work area and disposal of several drums that contained asphalt
- Excavation and disposal of 2,061 tons of contaminated soil with PCB concentrations that ranged up to 500 mg/kg
- Removal of shallow soil from exposed areas around the former asphalt plant structures
- Backfilling
- Installation of an asphalt pavement cap
- Improvement of storm drains (e.g., new catch basins in excavated area)
- Abandonment of the large-diameter industrial water supply well
- Replacement of three monitoring wells removed during the soil excavation

The project's target cleanup level (CUL) for PCBs in soil was 25 mg/kg. Remaining soil at the T-117 Upland Area was capped with asphalt pavement. A 375-gal. (1,420-L) non-leaking diesel tank was also discovered during the project and removed (Onsite 2000a). Two soil samples from the tank excavation had elevated concentrations of diesel-range TPH (TPH-D) (462 and 2,780 mg/kg). Other samples did not contain detectable concentrations of TPH.

2.2.2.2 2004 utility corridor cleanout

The Port removed contaminated and structurally unsuitable fill materials, debris, and waste from approximately 150 ft of a 2-ft-wide, 2.5-ft-deep, below-grade utility corridor) in the T-117 upland area (Map 2-4). The work was conducted to prevent further settling of the pavement surface along the concrete-lined corridor and to stem extrusions of an undesirable sticky black asphalt material that was caused by heavy vehicles (high surface loading) during warm weather and appeared at several locations along the alignment. Soft asphalt was observed extruding up through the pavement in the truck parking area and there was concern that this material could be tracked and spread by vehicles.

The Port removed the residual asphalt, contaminated soil, debris, and abandoned asphalt plant-era pipes and backfilled the corridor with concrete-densified fill. The overlying surface was repaved with asphalt to restore the pavement surface. Soil removed from the south portion of the concrete-lined corridor was found to contain elevated concentrations of diesel-range TPH-D and lube oil-range TPH (TPH-O), as well as large amounts of roofing asphalt. Concentrations of PCBs in excavated soils did not exceed 10 mg/kg, and the soil was not designated as a dangerous waste as a result of polycyclic aromatic hydrocarbon (PAH) or metals concentrations. Approximately 26 tons of TPH-contaminated soil were excavated and disposed of offsite. Asphalt, pipe and metal debris, and oil were also removed (Windward and Onsite 2004).

2.2.2.3 2006 TCRA

The Port conducted a TCRA (Map 2-4) to remove hazardous substances from the T-117 Upland Area from September to November 2006. EPA determined that a TCRA was required because of the high concentrations of PCBs in soil on the T-117 Upland Area. The objectives of the TCRA were to prevent or reduce the potential for human exposure to contaminants and to prevent or reduce the potential for contaminants to migrate into the LDW.

The TCRA was performed in accordance with the Superfund ASAOC (No. 10-2006-0072) SOW (RETEC 2006a), and EPA approved the TCRA work plan (RETEC 2006c). The TCRA included the excavation of PCB-contaminated soil, offsite disposal of PCB-contaminated soil at approved landfills, offsite disposal of construction debris (e.g., asphalt), backfilling of excavations with clean soil, environmental controls, monitoring to ensure there were no releases of PCB-contaminated soil to the adjacent neighborhood and to the LDW, and site restoration (e.g., new asphalt cap, street sweeping). TCRA activities were closely coordinated with EPA and the neighborhood, with regular meetings being held throughout the duration of the project.

Three areas with elevated PCB concentrations were excavated (up to 9,200 mg/kg): one area along the riverbank and two areas west of the riverbank (Map 2-4). Excavation along the riverbank consisted of the removal of the upper 2 ft of surficial soils, including the existing asphalt and pavement. Excavation depths in the remaining two areas varied from 2.5 to 7 ft bgs based on the depth needed to achieve the PCB removal action level of 25 mg/kg (RETEC 2007b). All material removed from the property was disposed of, treated, or recycled at approved facilities. The following quantities were removed:

- 3,030 tons of Toxic Substances Control Act (TSCA) soil (concentrations > 50 mg/kg total PCB)
- 78 tons of Subtitle D soil (concentrations < 50 mg/kg total PCB)
- 533 tons of Subtitle D asphalt and concrete debris
- 91,472 gal. of onsite runoff/decontamination water

- 2.7 tons of metal debris
- 1.2 tons of cleared and grubbed vegetative debris

Clean backfill was placed in all of the excavation areas after the analytical results for each excavation area had been reviewed. A non-woven geotextile was installed on top of the excavation subgrade as an identifying marker layer. Asphalt pavement (i.e., an interim cap) was installed after the backfill had been placed and compacted (RETEC 2007b).

2.2.2.4 Interim removal action in roadway areas

The City completed a series of interim remedial actions between December 2004 and October 2005 to reduce potential human exposure to PCB-impacted soil in the streets, ROWs, and yards in the vicinity of T-117 EAA (Map 2-4). The interim actions are described in a site characterization data report prepared by Integral (Integral 2006) and briefly summarized below.

- Soil with PCB concentrations that exceeded 1 mg/kg was removed from residential yards at 8601 and 8609 17th Avenue S, the boatyard at 8603 Dallas Avenue S, and from along the west side of 16th Avenue S (Hart Crowser 2005). (Note: the removal of PCB-impacted soil in the residential yards was performed as a final cleanup, not an "interim" remedial measure.)
- A small section of the road shoulder on the north side of the 8500 block of Dallas Avenue S was paved.
- Shallow excavations (i.e., between 6 and 12 in.) and the placement of clean gravel were completed in the unpaved road shoulders along selected portions of Dallas Avenue S, between 14th Avenue S and 17th Avenue S; on 16th Avenue S, between Dallas Avenue S and S Cloverdale Street; and in a boat storage area located within the public ROW on Dallas Avenue S, between 14th Avenue S and 16th Avenue S.
- The City street ROWs surrounding the Basin Oil property bounded by Dallas Avenue S, 17th Avenue S, and S Donovan Street were graded and paved with interim asphalt paving.
- Contaminated sediments were removed from an existing catch basin, and a catch basin that was no longer used near 8609 17th Avenue S was removed.
- The following streets were pressure washed, and the existing catch basins serving those streets were cleaned: S Cloverdale Street, between 14th Avenue S and 16th Avenue S; S Donovan Street, between 16th Avenue S and 17th Avenue S; and in front of the building located at 8620 16th Avenue S.
- A temporary stormwater collection and treatment system was installed to capture runoff from the ROW interim action area. This work included the installation of catch basins, two small pump stations, five 18,000-gal. storage

tanks, and a temporary treatment system (i.e., settling and sand and granular activated-carbon filters). All runoff from the area is now released at a controlled rate to the City's combined sewer system at 17th Avenue S and S Donovan Street. The temporary treatment system was installed during the interim remedial action to treat construction runoff and continued operation following cleanup. The system was closed in April 2005, when repeated sampling confirmed that PCBs were not detected in the incoming runoff. The City obtained discharge authorization from the King County Industrial Waste Program for this discharge. As part of the authorization, Seattle Public Utilities (SPU) tests the quality of water discharged to the combined sewer every month. PCBs have not been detected in the runoff (at a detection limit of 0.1 µg/L) since the interim remedial action was completed.

2.3 SUMMARY OF EXISTING ENVIRONMENTAL DATA

This section summarizes the chemistry data associated with the investigations discussed in Section 2.2.1 for each area of the T-117 EAA, (i.e., the Sediment Study Area, T-117 Upland Area, and the Adjacent Streets) and the two RAAs (i.e., Basin Oil and the Marina). Map 2-5 presents an overview of the sampling locations at all three areas of the T-117 EAA. A complete list of all available data is provided in Appendix F. Data summarized in this section are presented with screening criteria for comparative purposes only and to facilitate review and are not intended as removal action CULs. The screening criteria include:

- MTCA Method A – PCBs, PAHs, TPH, and lead in soil
- MTCA Method B – other soil chemicals
- SMS Criteria – sediment chemicals

Groundwater quality will be further evaluated and screened in the EE/CA once a more comprehensive dataset is available. Additional groundwater data from recently installed and existing wells is being collected in accordance with the T-117 EAA SOW and associated groundwater monitoring plan (Appendix A).

The existing data for the T-117 EAA and RAAs are presented in the following sections:

- Section 2.3.1 – Sediment Study Area
- Section 2.3.2 – T-117 Upland Area
- Section 2.3.3 – Adjacent Streets
- Section 2.3.4 – Groundwater and Seeps
- Section 2.3.5 – Summary of existing environmental conditions in the T-117 EAA (summarizes Sections 2.3.1 through 2.3.4)
- Section 2.3.6 – Recontamination Assessment Areas

2.3.1 Sediment Study Area

Extensive sediment sampling in the T-117 EAA was conducted from 1998 to 2005. Chemicals analyzed include PCBs, PAHs, other semivolatile organic compounds (SVOCs), pesticides, dioxin, VOCs, and metals, including tributyltin (TBT). Appendix F includes a complete list of available data for each chemical analyzed in the Sediment Study Area compared to SMS criteria. Table 2-2 presents a summary of the chemicals detected in the Sediment Study Area and SMS criteria.

Table 2-2. Summary of detected chemicals in sediment and SMS criteria

Chemical	Unit	Detection Frequency	Detected Concentration		SMS Criteria	
			Minimum	Maximum	SQS	CSL
PCBs						
Total PCBs (calc'd)	mg/kg OC	144/182	0.78 J	2,600	12	65
PAHs						
2-Methylnaphthalene	mg/kg OC	6/34	0.41	74	38	64
Acenaphthene	mg/kg OC	10/34	0.33 J	210	16	57
Acenaphthylene	mg/kg OC	4/34	0.43	2.5	66	66
Anthracene	mg/kg OC	20/34	0.90	230	220	1,200
Benzo(a)anthracene	mg/kg OC	30/34	1.7	440	110	270
Benzo(a)pyrene	mg/kg OC	30/34	2.0 J	420	99	210
Benzo(g,h,i)perylene	mg/kg OC	28/34	0.90	63	31	78
Total benzofluoranthenes (calc'd)	mg/kg OC	30/34	6.2 J	890	230	450
Chrysene	mg/kg OC	30/34	3.2	410	110	460
Dibenzo(a,h)anthracene	mg/kg OC	20/34	0.32 J	34	12	33
Dibenzofuran	mg/kg OC	7/34	0.34	220	15	58
Fluoranthene	mg/kg OC	32/34	1.5	1,300	160	1,200
Fluorene	mg/kg OC	11/34	0.40 J	290	23	79
Indeno(1,2,3-cd)pyrene	mg/kg OC	28/34	0.83	100	34	88
Naphthalene	mg/kg OC	6/34	0.26	68	99	170
Phenanthrene	mg/kg OC	29/34	2.6	1,500	100	480
Pyrene	mg/kg OC	32/34	1.4	840	1,000	1,400
Total HPAH (calc'd)	mg/kg OC	32/34	2.9	4,500	960	5,300
Total LPAH (calc'd)	mg/kg OC	29/34	2.6	2,300	370	780
Phthalates						
Bis(2-ethylhexyl) phthalate	mg/kg OC	29/34	1.7	66	47	78
Butyl benzyl phthalate	mg/kg OC	12/33	0.63 J	5.1	4.9	64
Diethyl phthalate	mg/kg OC	2/34	0.46 J	1.3	61	110
Dimethyl phthalate	mg/kg OC	4/34	0.47 J	1.3	53	53
Di-n-butyl phthalate	mg/kg OC	4/34	0.77	30	220	1,700
Di-n-octyl phthalate	mg/kg OC	2/34	1.3 J	2.2	58	4,500
Other SVOCs						
2,4-Dinitrophenol	mg/kg dw	1/23	0.30	0.30	nc	nc

Chemical	Unit	Detection Frequency	Detected Concentration		SMS Criteria	
			Minimum	Maximum	SQS	CSL
4-Methylphenol	mg/kg dw	8/34	0.028 J	0.15	0.67	0.67
Benzoic acid	mg/kg dw	2/34	0.30	0.30	0.65	0.65
Benzyl alcohol	mg/kg dw	1/34	0.072	0.072	0.057	0.073
Carbazole	mg/kg dw	9/23	0.020	2.1	nc	nc
Hexachlorobenzene	mg/kg OC	4/33	0.040 J	0.75	0.38	2.3
Pentachlorophenol	mg/kg dw	3/30	0.093 J	0.30 J	0.36	0.69
Phenol	mg/kg dw	7/34	0.072	2.1	0.42	1.2
Pesticides						
alpha-BHC	mg/kg dw	1/5	0.00081 JN	0.00081 JN	nc	nc
beta-BHC	mg/kg dw	1/5	0.0025 JN	0.0025 JN	nc	nc
DDTs (total calc'd)	mg/kg dw	4/6	0.0020	0.020 JN	nc	nc
Endrin ketone	mg/kg dw	1/5	0.11 JN	0.11 JN	nc	nc
Heptachlor	mg/kg dw	1/6	0.00089 JN	0.00089 JN	nc	nc
Mirex	mg/kg dw	1/2	0.0010 JN	0.0010 JN	nc	nc
Dioxin/furan						
1,2,3,4,6,7,8-HpCDD	mg/kg dw	1/1	0.000059	0.000059	nc	nc
1,2,3,4,6,7,8-HpCDF	mg/kg dw	1/1	0.0000099 J	0.0000099 J	nc	nc
OCDD	mg/kg dw	1/1	0.00068 J	0.00068 J	nc	nc
OCDF	mg/kg dw	1/1	0.000026	0.000026	nc	nc
Organometals						
Dibutyltin as ion	mg/kg dw	5/6	0.0016 J	0.015	nc	nc
Monobutyltin as ion	mg/kg dw	3/6	0.0012 J	0.0060 J	nc	nc
Tributyltin as ion	mg/kg dw	6/7	0.0027	0.023	nc	nc
Metals						
Aluminum	mg/kg dw	5/5	15,300	26,600	nc	nc
Antimony	mg/kg dw	3/8	0.79 J	6 J	nc	nc
Arsenic	mg/kg dw	19/32	7 J	22	57	93
Barium	mg/kg dw	5/5	41	91	nc	nc
Beryllium	mg/kg dw	5/5	0.28	0.49	nc	nc
Cadmium	mg/kg dw	13/32	0.160	0.74	5.1	6.7
Chromium	mg/kg dw	32/32	14.7	34	260	270
Cobalt	mg/kg dw	7/7	7	11	nc	nc
Copper	mg/kg dw	32/32	22.9	54.9	390	390
Iron	mg/kg dw	5/5	24,000	32,300 J	nc	nc
Lead	mg/kg dw	32/32	5.00	53	450	530
Magnesium	mg/kg dw	5/5	5,520	9,440	nc	nc
Manganese	mg/kg dw	5/5	276	411	nc	nc
Mercury	mg/kg dw	25/32	0.036	0.380	0.41	0.59
Molybdenum	mg/kg dw	2/2	0.902 J	0.994 J	nc	nc
Nickel	mg/kg dw	12/12	11.4	25	nc	nc

Chemical	Unit	Detection Frequency	Detected Concentration		SMS Criteria	
			Minimum	Maximum	SQS	CSL
Potassium	mg/kg dw	5/5	2,480	3,400	nc	nc
Selenium	mg/kg dw	5/7	0.6 J	17.5 J	nc	nc
Silver	mg/kg dw	8/32	0.08 J	0.54	6.1	6.1
Thallium	mg/kg dw	7/7	0.04	0.111	nc	nc
Tin	mg/kg dw	3/5	5 J	6	nc	nc
Vanadium	mg/kg dw	7/7	55	81	nc	nc
Zinc	mg/kg dw	32/32	41.1	143 J	410	960

BHC – benzene hexachloride
CSL – cleanup screening level
dw – dry weight
HPAH – high-molecular-weight polycyclic aromatic hydrocarbon
HpCDD – heptachlorodibenzo-*p*-dioxin
HpCDF – heptachlorodibenzofuran
J – estimated concentration
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
nc – no criteria
OC – organic carbon
OCDD – octachlorodibenzo-*p*-dioxin
OCDF – octachlorodibenzofuran
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
SMS – Washington State Sediment Management Standards
SQS – sediment quality standard
SVOC – semivolatile organic compound

PCBs

PCB concentrations for surface grab samples are presented on Map 2-6, and concentrations for subsurface samples are presented on Map 2-7. PCB concentrations on both maps are compared with SMS. Both the surface and subsurface sediment sampling data indicate a spatial trend of PCB concentrations decreasing from the bank out towards the navigation channel. Sediment samples with PCB concentrations above the cleanup screening level (CSL) were collected from within 100 horizontal ft of the shoreline bank and were typically confined to the upper 1 to 2 ft of sediment in the near-shore cores. PCB concentrations were also generally higher, and the frequency of CSL exceedances was greater, at similar depths in the northern portion of the T-117 EAA (as opposed to the southern portion).

PAHs

PAH sampling locations are shown on Map 2-8. PAH concentrations, summarized in Table 2-2, show that several individual PAHs have maximum concentrations that exceed either the sediment quality standard (SQS) or CSL criteria. PAH concentrations exceeded SMS criteria in less than 10% of the samples analyzed. These samples were collected from the toe of the shoreline bank and were co-located with samples that had PCB exceedances.

The detailed results (Appendix F) show that PAHs were detected in 3 of 34 samples (see Map 2-8) at concentrations exceeding SMS criteria. Two of these samples were from surface sediment sampling locations (25-G and 37-G) and one was from a subsurface sampling location (25-SC). The surface sediment sample from 25-G exceeded the SQS for three PAHs, and the sample from 37-G had 13 individual PAH SQS exceedances,

10 of which also exceeded the CSL. Total high-molecular-weight PAHs (HPAHs) also exceeded the SQS in 37-G, and total low-molecular-weight PAHs (LPAHs) in this sample exceeded both the SQS and CSL. The one subsurface sampling location, 25-SC, had a PAH (acenaphthene) concentration that exceeded the SQS in the 2-to-4-ft depth interval.

Other SVOCs and VOCs

Thirty-three surface and subsurface sediment samples were analyzed for other SVOCs. SVOCs that exceeded SMS were relatively few as compared with the PCB exceedances and were in discrete locations, as shown on Map 2-8. The following SVOCs exceeded SMS criteria: bis(2-ethylhexyl) phthalate and butyl benzyl phthalate (at DR206); hexachlorobenzene (at R19); phenol; (at C10-1, C10-2, and DR 207); and benzyl alcohol (at 08-G). VOCs were not detected in any sediment sample analyzed.

Metals

Thirty-one sediment samples were analyzed for metals. No metals concentrations exceeded SMS criteria. Map 2-8 shows the locations of all samples analyzed for the full suite of SMS chemicals, which includes metals.

2.3.2 T-117 Upland Area

Soil conditions at the T-117 Upland Area have been determined through the evaluation of an extensive collection of soil samples from borings advanced from 1990 to 2006. Chemicals analyzed included PCBs, TPH, PAHs, other SVOCs (including phthalates, and phenols), pesticides, and metals. As a result of the 1999 and 2006 TCRAs, the contaminated soil from which those samples were collected has been removed All available soil data (including data for samples collected from soil that is remaining or has been excavated) for the T-117 Upland Area are provided in Appendix F. Table 2-3 presents a summary of the chemicals detected in the T-117 Upland Area for samples that represent current site conditions.

Table 2-3. Summary of detected chemicals in the T-117 Upland Area soil

Chemical	Detection Frequency	Detected Concentration (mg/kg dw)		Screening Criteria (mg/kg dw)[a]
		Minimum	Maximum	
PCBs				
Aroclor 1254	13/478	0.018 J	2.1	nc
Aroclor 1260	369/478	0.0082	4,200	nc
Total PCBs (calc'd)	401/514	0.0082	4,200	1.0
TPH				
TPH-D	181/248	5.2	21,000	2,000
TPH-O	213/271	11	25,400 J	2,000
Total TPH (calc'd)	230/276	11	55,100 J	nc
TPH – unknown heavy fuel oil	14/27	40.2 J	55,100 J	nc

Chemical	Detection Frequency	Detected Concentration (mg/kg dw)		Screening Criteria (mg/kg dw)[a]
		Minimum	Maximum	
PAHs				
1-Methylnaphthalene	23/210	0.039 J	10	1,600
2-Methylnaphthalene	21/241	0.048 J	14	1,600
Acenaphthene	26/268	0.025	55	4,800
Acenaphthylene	5/241	0.040	1.2	nc
Anthracene	35/241	0.021	160	24,000
Benzo(a)anthracene[b]	76/268	0.0111 J	180	0.137
Benzo(a)pyrene[b]	75/268	0.0126 J	130	0.137
Benzo(b)fluoranthene[b]	64/268	0.014 J	110	0.137
Benzo(g,h,i)perylene[b]	43/241	0.023	22	nc
Benzo(k)fluoranthene[b]	65/268	0.0115 J	94	0.137
Total benzofluoranthenes (calc'd)[b]	67/268	0.0115 J	200	nc
Chrysene[b]	94/268	0.026	150	0.137
Dibenzo(a,h)anthracene[b]	13/268	0.029 J	8.0	0.137
Dibenzofuran	14/241	0.034 J	46	160
Fluoranthene	89/268	0.0207 J	480	3200
Fluorene	26/241	0.023	76	3200
Indeno(1,2,3-cd)pyrene[b]	36/241	0.024	32	0.137
Naphthalene	17/241	0.020	13	1,600
Phenanthrene	70/256	0.022	420	nc
Pyrene[b]	91/268	0.0158 J	260	2,400
Total HPAH (calc'd)	107/268	0.024	1,470	nc
Total LPAH (calc'd)	72/268	0.022	720	nc
Carcinogenic PAHs (calc'd)	97/268	0.01 J	180	0.1
Total PAH (calc'd)	109/268	0.0269 J	2,190	nc
Phthalates				
Bis(2-ethylhexyl) phthalate	7/23	0.048 J	0.59 J	71.4
Butyl benzyl phthalate	3/23	0.26	0.48 J	16,000
Dimethyl phthalate	3/23	0.095	0.12	80,000
Other SVOCs				
Benzoic acid	3/3	1.3	4.5 J	320,000
Benzyl alcohol	3/3	0.19	1.0	24,000
Metals				
Aluminum	3/3	13,700	15,700	nc
Arsenic	64/119	5	160 J	0.667
Barium	3/3	55	75	16,000
Cadmium	12/54	0.3	2.2	80
Chromium[c]	128/128	5.32	43	240/120,000
Copper	54/54	9.7	106 J	2960
Lead	112/128	2	219	250

Chemical	Detection Frequency	Detected Concentration (mg/kg dw)		Screening Criteria (mg/kg dw)[a]
		Minimum	Maximum	
Mercury	3/3	0.20	0.30	24
Nickel	3/3	10	16	1,600
Silver	1/4	2.3	2.3	400
Zinc	128/128	17.5	530	24,000

Note: Summary table does not include samples that have been excavated from the TCRAs.

[a] Screening criteria are MTCA Method A for PCBs, cPAH, TPH, and lead and MTCA Method B for all other soil chemicals.

[b] These chemicals are cPAHs.

[c] Chromium values are presented as chromium IV/chromium III.

cPAH – carcinogenic polycyclic aromatic hydrocarbon

dw – dry weight

HPAH – high-molecular-weight polycyclic aromatic hydrocarbon

J – estimated concentration

LPAH – low-molecular-weight polycyclic aromatic hydrocarbon

nc – no criteria

PAH – polycyclic aromatic hydrocarbon

PCB – polychlorinated biphenyl

TPH – total petroleum hydrocarbons

TPH-D – diesel-range total petroleum hydrocarbons

TPH-O – lube oil-range total petroleum hydrocarbons

PCBs

A total of 573 samples from 207 locations have been analyzed from the T-117 Upland Area. During the two TCRAs, the soil associated with 59 sampling locations was excavated, leaving 514 samples that are representative of current site conditions. PCB concentrations associated with both remaining and excavated soil in the T-117 Upland Area are presented on Maps 2-9a and 2-9b. PCB concentrations are also presented by subarea to facilitate data presentation because of the large number of sampling locations. Subareas were delineated during the 2006 T-117 upland investigation (Windward and DOF 2006) and are shown on Map 2-10. Maps 2-11 through 2-15 present the PCB sample concentrations associated with the remaining and excavated T-117 Upland Area soil by subarea (A through F). The excavated data is presented to illustrate chemical distribution and to facilitate the assessment of data gaps.

PCBs (predominantly Aroclor 1260) are generally found within the uppermost 2 ft of surface soils, and concentrations tend to decrease with depth (Maps 2-9a and 2-9b). Exceptions to this trend have been found at the following locations:

- Beneath the 1999 TCRA removal area (Subarea C, Map 2-13) and the 2006 TCRA removal area (Subarea B, Map 2-12), where the highest PCB concentrations were located at 2 to 8 ft bgs and then decreased with depth

- Near Catch Basin 5 (Subarea E, Map 2-15), where elevated PCB concentrations ranged from 0 to 6.5 ft in depth

The highest PCB concentrations (i.e., greater than 1,000 mg/kg) were detected in the upper 2 ft at location T-117-D-11 and between 2 and 5 ft bgs at location T-117-E-1. Below 7 ft, PCBs were detected above 50 mg/kg only at locations PS-7 (110 mg/kg) and T-117-6 (94 mg/kg).

The 2006 TCRA included the excavation of three areas in Subarea B (Map 2-12) that contained the highest concentrations of PCBs in the T-117 Upland Area, including the highest PCB concentration (9,200 mg/kg) at location T-117-B-8.

TPH

A total of 345 samples have been analyzed for TPH from 136 locations. Of this total, 70 sampling locations were associated with the soil was excavated during the 1999 and 2006 TCRAs. The site-wide total TPH chemical concentrations associated with samples that were collected from the remaining and excavated soil in the T-117 Upland Area are presented on Maps 2-16a and 2-16b. Maps 2-17 through 2-21 present total TPH chemical concentrations associated with samples that were collected from the remaining and excavated soil in the T-117 Upland Area by subareas (A through F).

The highest concentrations of TPH (i.e., greater than 10,000 mg/kg) were detected in the former roadway ponding area (Subarea C, Map 2-19) and in the vicinity of Catch Basin 5 (Subarea E, Map 2-21), where elevated TPH concentrations were detected as deep as 6.5 ft. Most of the shallow soil (0 to 2 ft bgs) that had elevated concentrations of TPH was removed as part of the 1999 and 2006 TCRAs (Maps 2-18 and 2-19).

PAH

A total of 303 samples from 81 locations have been analyzed, and soil associated with 35 of these sampling locations was excavated during the 1999 and 2006 TCRAs. Only individual carcinogenic PAH (cPAH) concentrations and total cPAH concentrations exceeded the screening criteria. A summary of the T-117 Upland Area soil cPAH concentrations associated with soil that has since been excavated are presented on Maps 2-22 and 2-23. cPAHs tend to be co-located with elevated concentrations of PCBs and TPH. The highest cPAH concentrations were detected at T-117-D-6 (22.67 mg/kg), T-117-B-4 (23.82 mg/kg), E-1 (27.89 mg/kg) and T-117-C-4 (176.3 mg/kg). Three of these samples were collected from between 2 and 5 ft bgs.

Other SVOCs and VOCs

A total of 303 samples have been analyzed from 81 locations, and soil associated with 35 sampling locations was excavated during the 1999 and 2006 TCRA. Based on a previous screening evaluation (RETEC 2006c), these chemicals had maximum concentrations below relevant screening criteria (MTCA Method A). SVOC concentrations (including PAHs) for samples collected within the T-117 Upland Area are presented in Appendix F.

Metals

Metals have been detected in the T-117 Upland Area, but only arsenic exceeded the screening criteria. The highest arsenic concentrations were detected at locations T-117-C-8 (55 mg/kg), T-117-D-6 (40 mg/kg, and T-117-D-10 (160 mg/kg), as shown on Map 2-24. All of the samples were collected from within the upper 4 ft. Concentrations of PCBs and TPH were also elevated at these sampling locations.

2.3.3 Adjacent Streets

Several investigations were conducted within the Adjacent Streets and neighboring residential properties to support the City's site characterization and interim remedial actions between 2004 and 2006 (Integral 2006). The investigations focused on total PCB concentrations in soil. Samples were also collected from representative locations and analyzed for TPH; SVOCs (including PAHs); benzene, toluene, ethylbenzene, and xylene (BTEX); and metals to screen for other potential chemicals within the Adjacent Streets.

In addition, the Port collected surface soil samples from unpaved portions of the roadway and shoulder areas along Dallas Avenue S in conjunction with the 2006 TCRA in the T-117 Upland Area (RETEC 2006b). These samples were used to monitor for potential releases of PCBs during the offsite transport of contaminated soils for offsite disposal.

The results of the above-referenced investigations are compiled and tabulated in Appendix F. Appendix F also identifies samples that were removed during the City's interim removal actions; this data is presented to illustrate the spatial distribution of contaminants and to facilitate the assessment of data gaps. A summary of all chemicals detected in the Adjacent Streets, excluding data for soils that have been removed, is presented in Table 2-4. The sections that follow provide a brief overview of key findings from the Adjacent Street investigations.

Table 2-4. Summary of detected chemicals in the Adjacent Street soils

Chemical	Detection Frequency	Detected Concentration (mg/kg dw)		Screening Criteria (mg/kg)[a]
		Minimum	Maximum	
PCBs				
Total PCBs (calc'd)[b]	234 / 294	0.012 J	480	1
TPH				
TPH-D	32 / 41	5.3	4,600	2,000
TPH-O	40 / 41	11	9,500	2,000
Total TPH (calc'd)	36 / 37	11	14,100	nc
PAHs				
1-Methylnaphthalene	1 / 4	1.4	1.4	1,600
2-Methylnaphthalene	1 / 5	1.5	1.5	1,600
Acenaphthene	2 / 5	0.081	2.2	4,800

Chemical	Detection Frequency	Detected Concentration (mg/kg dw)		Screening Criteria (mg/kg)[a]
		Minimum	Maximum	
Acenaphthylene	1 / 5	0.095	0.095	nc
Anthracene	2 / 5	0.22	4.5	24,000
Benzo(a)anthracene	2 / 5	0.73	3.5	0.137
Benzo(a)pyrene	2 / 5	0.64	3.1	0.137
Benzo(b)fluoranthene	3 / 5	0.029	1.8	0.137
Benzo(g,h,i)perylene	2 / 5	0.26	2	nc
Benzo(k)fluoranthene	3 / 5	0.03	2.2	0.137
Total benzofluoranthenes (calc'd)	3 / 5	0.06	4.0	nc
Chrysene	3 / 5	0.035	3.7	0.137
Dibenzo(a,h)anthracene	2 / 5	0.075	0.49	0.137
Dibenzofuran	1 / 5	0.69	0.69	160
Fluoranthene	3 / 5	0.034	10	3200
Fluorene	2 / 5	0.095	2.7	3200
Indeno(1,2,3-cd)pyrene	2 / 5	0.2	1.5	0.137
Naphthalene	1 / 5	0.79	0.79	1,600
Phenanthrene	3 / 5	0.029	17	nc
Pyrene	3 / 5	0.059	12	2,400
Total HPAH (calc'd)	3 / 5	0.19	40	nc
Total LPAH (calc'd)	3 / 5	0.029	27	nc
Carcinogenic PAHs	3 / 5	0.022	4.2	0.1
Total PAH (calc'd)	3 / 5	0.22	70	nc
Phthalates				
Bis(2-ethylhexyl) phthalate	1 / 1	0.79	0.79	71.4
VOCs				
Toluene	2 / 2	2.1	11	8,000
Metals				
Antimony	3 / 4	6	6	32
Arsenic	4 / 12	1.1	19.2	0.667
Beryllium	3 / 4	0.1	0.2	16,000
Cadmium	1 / 4	0.8	0.8	80
Chromium	4 / 4	11.8	23.9	240/120,000[c]
Copper	12 / 12	11.2	146	2960
Lead	12 / 12	1	141	250
Mercury	8 / 12	0.06	0.42	24
Nickel	4 / 4	5	23	1,600
Zinc	12 / 12	15.7	808 J	24,000

Note: Summary table does not include samples that have been excavated from removal actions.

[a] Screening criteria are MTCA Method A for PCBs, cPAH and TPH and lead and MTCA Method B for all other soil chemicals.

[b] Aroclor 1260 was most frequently detected (see Appendix F all PCB Aroclor data).

[c] Chromium concentrations are presented as chromium IV/chromium III.

HPAH – high-molecular-weight polycyclic aromatic hydrocarbon

J – estimated concentration

LPAH – low-molecular-weight polycyclic aromatic hydrocarbon

nc –no criteria

PAH – polycyclic aromatic hydrocarbon

PCB – polychlorinated biphenyl

TPH – total petroleum hydrocarbon

TPH-D – diesel-range total petroleum hydrocarbons

TPH-O – lube oil-range total petroleum hydrocarbons

PCBs

A total of 354 soil, street dust, and catch basin samples were collected and analyzed for PCBs within the Adjacent Streets and residential lots; the soil associated with 58 of these samples was removed in conjunction with the City's interim actions. PCB concentrations associated both the remaining and excavated Adjacent Street soil are presented on Maps 2-25 and 2-26.

The PCB results for samples collected in the Adjacent Streets (Map 2-25) are summarized as follows:

- The areas within the Adjacent Streets with PCB concentrations greater than 1 mg/kg are located on Dallas Avenue S, between 16th and 17th Avenues S, the north portion of 17th Avenue S, and other isolated areas on Dallas Avenue S and S Donovan Street. PCBs were also detected at concentrations greater than 1 mg/kg in street dust along Cloverdale and in street dust samples collected along Dallas Avenue S in conjunction with the 2006 TCRA at T-117.
- PCB concentrations greater than 1 mg/kg were generally limited to the upper 12 in. of soil, with isolated areas extending as deep as 24 in. and one sample at 48 in. deep (P66).
- PCB concentrations greater than 10 mg/kg are generally limited to surface samples (0 to 6 in. bgs) in the immediate vicinity of the T-117 Upland Area, with the following exceptions:
  - Eight exceedances at 12 in. (at locations TP6, TP8, TP9, TP12, TP13, TP19, TP26, and TP41)
  - Four exceedances at 24 in. (at locations TP9, TP19, P81, and P86)
- PCB concentrations greater than 50 mg/kg are limited to surface samples (i.e., 0 to 6 in. bgs), except at two locations (P81 and P86), each of which represents a 12-to-24-in. sampling interval. These borings are located near the intersections of Dallas Avenue S and 17th Avenue S and Dallas Avenue S and S Donovan Street.
- To support its delineation of PCB-impacted areas within the broader South Park neighborhood, the City also collected and analyzed street dust and catch basin samples at six locations to the west of 14th Avenue S. PCB concentrations for

these samples were all less than 1 mg/kg. These concentrations are not shown on Map 2-25 but are presented in Appendix F.

The concentrations for samples collected in the residential lots (Map 2-26) are summarized as follows:

- Sampling performed during the City's cleanup of the residential lots located near the intersection of Dallas Avenue S and 17th Avenue S (across from the entrance to the T-117 Upland Area) indicated that elevated PCB concentrations (> 1 mg/kg) extended to depths that were similar to those in the adjacent streets, with the following exception. During the City's cleanup of the residential lots, an isolated area with elevated PCB concentrations extending to a depth of 8 ft bgs was identified along the northern boundary of the property at 8601 17th Avenue S, immediately adjacent to the street. All impacted soil detected within the residential lots was excavated and disposed of at an offsite landfill (Hart Crowser 2005). All yard data presented in tables and maps are based on analytical laboratory analyses.
- Aroclor 1260 was the only PCB Aroclor detected for all samples analyzed from the adjacent streets and residential lots, with the following exception. Aroclor 1254 was detected in a street dust sample collected on Dallas Avenue S (SD19,A1254= 0.043 mg/kg), and two locations within the Marina boat storage yard located on the south side of Dallas Avenue S (SD53, A1254 = 2.4 mg/kg; and YS37, A1254 = 0.18 mg/kg).

TPH

A total of 48 soil, street dust, and catch basin samples were collected for analysis of TPH within the Adjacent Streets. The soil associated with seven of these samples was later removed in conjunction with the City's interim actions. TPH concentrations associated with samples collected from both the remaining and excavated soil in the Adjacent Streets are presented on Map 2-27. TPH-D exceeded the screening criteria (2,000 mg/kg) at two locations, a catch basin located at the corner of Dallas Avenue S and S Donovan Street (SD3) and a five-point surface composite soil sample from the ROW area at the east end of S Donovan Street (SD4) that was previously used by Basin Oil to store equipment. TPH-O exceeded the screening criteria of 2,000 mg/kg in nine samples, including two catch basins (SD3 and SD8), five street dust samples (SD2, SD4, SD7, SD19, and SD21), and one push probe location (P81). As noted above, the City collected and analyzed additional street dust and catch basin samples from the broader South Park neighborhood to support delineation of PCB-impacted areas. TPH analyses of these samples showed that of the four samples collected to the west of 14th Avenue S (SD27, SD28, SD29, and SD30), none exceeded the screening criteria for TPH-D (2,000 mg/kg). TPH-O exceeded the screening criteria of 2,000 mg/kg at one location, a catch basin located at the southwest corner of S Donovan Street and 12th Avenue S (SD30). The data for these six sampling locations are not shown on Map 2-27 but are presented in Appendix F.

PAHs

A total of six soil and street dust samples were collected for analysis of PAHs within the Adjacent Streets; one sample was collected from soil that was subsequently removed in conjunction with the City's interim actions. Total cPAH concentrations associated with both the remaining and excavated Adjacent Street soil are presented on Map 2-28. At two locations (P60 and P81), total cPAH concentrations exceeded the screening criteria of 0.1 mg/kg. At P60, located on Dallas Avenue S (west of 16th Avenue S), total cPAHs were detected in the 4-to-6-ft depth interval and appeared to be associated with a thin soil horizon between 5 and 5.5 ft bgs, where a slight petroleum odor was detected during sampling. At P81, located near the east end of S Donovan Street, total cPAHs were detected in the 2-to-4-ft depth interval and again were associated with a slight petroleum odor detected during sampling. These individual cPAHs, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene, were also detected at concentrations exceeding screening criteria at these sample locations and intervals.

Other SVOCs and VOCs

Two samples were collected from locations within the Adjacent Streets (P72 and P78) for BTEX analyses. The only chemical detected was toluene, which did not exceed the screening criteria.

Metals

A total of 13 soil and street dust samples were collected for analysis of metals within the Adjacent Streets. The soil from which one of these samples was collected was removed in conjunction with the City's interim actions. Arsenic was the only metal with concentrations that exceeded the screening criteria at four sampling locations (P60-6, P72-4, P78-4, and P81-2). Arsenic concentrations associated with both the remaining and excavated Adjacent Street soil are presented on Map 2-29. With the exception of the concentration at P81-2 (19.2 mg/kg), the arsenic concentrations in the Adjacent Streets are generally consistent with regional background concentrations.

2.3.4 Groundwater and seeps

Groundwater data has been collected at T-117 since 1991. Historical (pre-2003) groundwater conditions are detailed in the data gaps report (Windward et al. 2003). Table 2-5 presents a summary of the chemicals detected in groundwater from sampling events conducted between 2003 and 2006. Locations of groundwater monitoring wells are shown on Map 2-1. All the groundwater data from sampling events conducted between 2003 and 2006 are presented in Appendix F.

Table 2-5. Summary of groundwater samples collected between 2003 and 2007 with at least one detected chemical

Chemical	Detected Concentration by Location ID, Sample Date, and Sample Type										
	MW-02	MW-02	MW-03	MW-04		MW-05	MW-05	MW-05	MW-06	MW-07	MW-08
	6/22/05	8/10/06	5/8/03	8/11/06		6/20/05	1/26/06	8/10/06	8/11/06	8/11/06	8/10/06
	N	N	N	N	FD	N	N	N	N	N	N
PCBs (µg/L)											
Aroclor 1260	0.04 U	0.01 J	0.053 U	0.01 UJ	0.01 UJ	0.04 J	0.32	0.029 J	0.02 J	0.01 UJ	0.021 J
Total PCBs	0.16 U	0.01 J	0.053 U	0.01 UJ	0.01 UJ	0.04 J	0.32	0.029 J	0.02 J	0.01 UJ	0.021 J
PAHs (µg/L)											
1-Methylnaphthalene	na	na	0.15	na	na	na	na	na	na	na	na
Acenaphthene	0.2 U	1 U	0.39	1 U	1 U	na	na	1 U	1 U	1 U	1 U
Benzo(a)anthracene	0.2 U	1 U	0.016	1 U	1 U	na	na	1 U	1 U	1 U	1 U
Total benzofluoranthenes	0.2 U	1 U	0.013	1 U	1 U	na	na	1 U	1 U	1 U	1 U
Chrysene	0.2 U	1 U	0.1	1 U	1 U	na	na	1 U	1 U	1 U	1 U
Fluorene	0.2 U	1 U	1.6	1 U	1 U	na	na	1 U	1 U	1 U	1 U
Total HPAH	0.2 UJ	1 U	0.1	1 U	1 U	na	na	1 U	1 U	1 U	1 U
Total LPAH	0.2 U	1 U	2	1 U	1 U	na	na	1 U	1 U	1 U	1 U
Total PAH	0.2 UJ	1 U	2.1	1 U	1 U	na	na	1 U	1 U	1 U	1 U
TPH (µg/L)											
TPH-D	500	940	700	250 U	250 U	na	na	250 U	250 U	250 U	250 U
TPH-G	na	na	100 U	na	na	na	na	na	na	na	na
TPH-O	na	na	1400	na	na	na	na	na	na	na	na
Total TPH (calc'd)	500	940	2100	500 U	500 U	na	na	500 U	500 U	500 U	500 U
Other SVOCs (µg/L)											
Phenol	na	5.8	na	1 U	1 U	na	na	1 U	1 U	1 U	1 U
VOCs (µg/L)											
Total xylenes	na	na	1.3	na	na	na	na	na	na	na	na
m,p-Xylene	na	na	1.3	na	na	na	na	na	na	na	na
Metals (µg/L)											
Arsenic (dissolved)	na	82	na	0.66	0.66	na	na	1.29	0.62	0.72	0.86

Chemical	Detected Concentration by Location ID, Sample Date, and Sample Type										
	MW-02	MW-02	MW-03	MW-04		MW-05	MW-05	MW-05	MW-06	MW-07	MW-08
	6/22/05	8/10/06	5/8/03	8/11/06		6/20/05	1/26/06	8/10/06	8/11/06	8/11/06	8/10/06
	N	N	N	N	FD	N	N	N	N	N	N
Arsenic (total)	na	90.3	na	0.65	0.65	na	na	1.4	0.65	0.68 U	0.89
Cadmium (dissolved)	na	0.011 U	na	0.518	0.55	na	na	0.289	0.064	0.019 U	0.174
Cadmium (total)	na	0.123	na	0.482	0.453	na	na	0.375	0.115	0.086	0.189
Chromium (dissolved)	na	3.04	na	1.23	1.07	na	na	1.7	0.52	0.26 U	1.72
Chromium (total)	na	3.93	na	1.28	1.29	na	na	3.07	1.93	0.34 U	2.46
Lead (total)	na	0.027	na	0.036 U	0.033 U	na	na	0.034 U	0.19	0.043 J	0.09

Note: Only chemicals that were detected in at least one sample are presented.

FD – field duplicate
HPAH – high-molecular-weight polycyclic aromatic hydrocarbon
ID – identification
J – estimated concentration
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
N – normal sample (not a duplicate)
na – not analyzed
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
SVOC – semivolatile organic compound
TPH – total petroleum hydrocarbons
TPH-D – diesel-range total petroleum hydrocarbons
TPH-G – gasoline-range total petroleum hydrocarbons
TPH-O – lube oil-range total petroleum hydrocarbons
U – not detected at the reporting limit shown
VOC – volatile organic compound

In 2004, wells MW-02, MW-04, MW-05 and MW-06 were sampled. No chemicals were detected during the 2004 sampling event, during which groundwater was analyzed for PCBs, SVOCs, and VOCs. Samples collected in 2005 were analyzed only for PCBs and TPH. The only chemicals detected during the 2005 sampling event were Aroclor 1260 (an estimated concentration of 0.04 µg/L in MW-5) and TPH-D (0.5 mg/L in MW-2). In January 2006, only one well, MW-5, was sampled to confirm the 2005 result. Aroclor 1260 was detected again in 2006 in MW-5 at a concentration of 0.32 µg/L.

During the most recent sampling event in August 2006, monitoring wells MW-4 through MW-8 were sampled and analyzed for PCB, TPH, PAHs, other SVOCs, and metals. PCBs were detected in monitoring wells MW-5 (estimated concentration of 0.029 µg/L), MW6 (estimated concentration of 0.020 µg/L), and MW-8 (estimated concentration of 0.021 µg/L). No TPH or SVOCs were detected. Arsenic, cadmium, chromium, lead, and mercury were detected in several wells.

During the 2004 and 2005 tidal studies, an oil-water interface probe was used to determine the presence or absence of light non-aqueous-phase liquid (LNAPL) in the groundwater monitoring wells. In 2004, no LNAPL was detected in any of the wells. During the 2005 tidal study, trace amounts of LNAPL (essentially a sheen [i.e., < 0.01 ft thick]),were detected in MW-2 and MW-7 (Windward et al. 2005d). The presence of sheen in MW-2 during high water levels is consistent with the presence of TPH concentrations in the soil. The sheen in MW-7 was noted at 1 of the 10 gauging events during the 2005 tidal study. This observation is not consistent with the non-detect TPH groundwater chemistry in MW-7 and the absence of TPH concentrations in the soil.

In 1991, prior to the decommissioning of the onsite asphalt plant, trace amounts of LNAPL (essentially a sheen [i.e., < 0.01 ft thick]), were observed in MW-3 (Parametrix 1991). MW-3 was decommissioned and replaced in 1999 during the TCRA. No LNAPL has been observed in the new MW-3.

Three seeps were identified and sampled by Windward in 2003 (Windward et al. 2005d). The seep water samples were analyzed for total PCBs, SVOCs, PAHs, other SVOCs, and total metals. As presented in Table 2-6, the only definitive detected chemicals were bis(2-ethylhexyl) phthalate (BEHP), copper, chromium, and zinc. Total PCBs were detected in one seep sample (SW3); however, it is possible that the PCBs were associated with contaminated fine particles present in the seep sample instead of the water. This seep was subsequently re-sampled, and the sample was centrifuged prior to analysis to remove any fine particles, resulting in a non-detected concentration for PCBs. It is unknown whether the PCBs were attached to fine particles traveling with the seep water or if contaminated particles became entrained in the sample during collection.

Table 2-6. Chemicals detected in seep water samples

LOCATION ID	SAMPLE ID	CHEMICAL	CONCENTRATION (µg/L)
T-117-SW-1	T-117-SW1	copper (total)	3
		zinc (total)	7 J
T-117-SW-2	T-117-SW2	bis(2-ethylhexyl) phthalate	2.7 J
		chromium (total)	6
		copper (total)	2
	T-117-SW4[a]	bis(2-ethylhexyl) phthalate	15 J
		chromium (total)	6
		copper (total)	3
T-117-SW-3	T-117-SW3	total PCBs (non-centrifuged)[b]	0.94 J
		total PCBs (centrifuged)[b, c]	0.033 U
		chromium (total)	7
		copper (total)	4

[a] Field duplicate sample.

[b] Based on detection of Aroclor 1260.

[c] Non-detected result presented for T-117-SW-3 centrifuged sample.

ID – identification

J – estimated concentration

PCB – polychlorinated biphenyl

T-117 – Terminal 117

2.3.5 Summary of existing environmental conditions in the T-117 EAA

As presented in the previous sections, PCBs are the prevalent chemical in soil and sediment within the T-117 EAA. The data indicate that the current environmental conditions at the T-117 EAA are likely the result of historical site use and operations. Somewhat lower concentrations of PCBs have also been detected in the Adjacent Streets and are likely present, in part, because of the historical track-out of fuel- and waste-oil from the terminal/former asphalt plant area.

Sediment

PCBs are present in the sediment immediately adjacent to the T-117 Upland Area, with the highest concentrations detected near the shoreline bank and decreasing towards the navigation channel. Sediment samples with PCB concentrations above the CSL were found within 100 ft of the top of the bank. PCB concentrations also typically decreased with depth, with only two exceptions in which PCBs were detected above the SMS criteria at depths greater than 4 ft (T-117-16-SC and T-117-34-SC; see Map 2-7). This suggests a historical upland source for these chemicals, which were subsequently conveyed to the river via stormwater runoff and direct erosion of PCB-contaminated soil in the upland bank. SMS exceedances of other chemicals are co-located with PCB exceedances.

Soil

PCBs and TPH (as diesel, motor oil, and heavy fuel oil) are the most prevalent compounds detected at the T-117 Upland Area. Elevated soil PCB concentrations were found in the general vicinity of the former asphalt plant facilities in the central and shoreline parcel (former driveway) areas of the site (Subareas B through E, Maps 2-12 to 2-15). PCBs are most prevalent within the uppermost 2 ft of surface soils, but in isolated areas extend as deep as 8 feet. TPH soil concentrations were highest in the former roadway ponding area (Subarea C, Map 2-19) and near Catch Basin 5 (Subarea E, Map 2-21). In these areas, measured TPH impacts extended to 6.5 ft bgs. Elevated concentrations of cPAHs were co-located with elevated concentrations of PCBs and TPH. Arsenic concentrations above screening criteria were co-located with elevated concentrations of PCBs.

PCBs are also the primary chemicals within the Adjacent Streets. PCB concentrations greater than 1 mg/kg were generally limited to the upper foot. of soil, with isolated areas extending as deep as 2 ft and up to 4 ft in one location. TPH-D exceeded the screening criteria (2,000 mg/kg) at eight locations. However, concentrations at two of these locations have been addressed by the City's interim actions and the remaining exceedances are either co-located with PCBs or will be removed as part of the NTCRA. Detections of elevated PAH and metals that exceeded screening criteria in the Adjacent Streets were limited; these exceedances were also generally co-located with PCBs and will be addressed as part of the NTCRA.

Groundwater

PCBs have been sporadically detected in groundwater monitoring wells at the T-117 EAA at low concentrations. Groundwater in these wells is typically turbid, indicating the likelihood that low concentrations of PCBs present in the fine silts surrounding the well screens may be leaching in to the wells during well purging. This process is difficult to control and is the likely cause of the low concentrations of detectable PCBs described in Section 2.3.2.

Trace amounts of LNAPL (i.e., a sheen < 0.01 ft thick) have been observed in two of the existing monitoring wells (MW-2 and MW-7) on one occasion during the 2005 tidal study.

Although the existing groundwater data for the T-117 EAA provide an initial picture of groundwater quality at the site, additional monitoring required by EPA will include a broader suite of chemicals and seasonal (quarterly) monitoring.

Seep monitoring data collected to date indicate that seep discharges to the LDW do not appear to be a source of potential recontamination to the sediment because the chemicals detected in the seep samples do not exceed the SMS in sediment, with the exception of BEHP. This potential source will be further evaluated in the EE/CA.

2.3.6 Recontamination assessment areas

This section briefly describes the RAAs and summarizes available data for all media in each of the RAAs - Basin Oil and the South Park Marina. The complete dataset for the RAAs is presented in Appendix F.

2.3.6.1 Basin Oil Parcels

Site Description and History

Basin Oil's primary operations occurred in the triangular-shaped property (8661 Dallas Avenue S) bounded by Dallas Avenue S to the east, Donovan Street S to the south, and 17th Avenue S to the west (Map 1-1). Basin Oil operated at the site between 1987 and 2004 (Ecology 2005). Three additional business entities are documented as having operated on the property at one time or another during the Basin Oil tenure: Frontwater, Inc.; Basin Tank and Environmental Services, Inc.; and Northwest Antifreeze Service, Inc. Basin Oil also leased property on the T-117 Upland property, or former Malarkey site, located across the street to the east, where they stored materials in drums and in a tank. Basin Oil also stored drums and trucks at 8617 17th Avenue S, a residential property, located across the street to the west.

Basin Oil was a collector, transporter, and marketer of used oil. According to Basin Oil's spill prevention, control, and countermeasure plan (Basin Oil 1995), materials handled routinely at the facility included lubricating oil, Bunker C heating oil, diesel fuel, crude oil, jet fuel, and gasoline. Based on Ecology inspection reports (Ecology 2000; Hohmann 1992), Frontwater and Basin Tank and Environmental Services handled similar materials. Northwest Antifreeze Service handled new and used antifreeze.

According to a site assessment conducted in 1996 (Creative Environmental Technologies 1996), the property was first developed and used for residential purposes in the 1930s and was converted to an oil recycling facility in the late 1980s. At the time of the 1996 site assessment, the northern portion of the property was paved, and the southern portion was not. Standing water and tanks without containment were both observed on the southern portion (Creative Environmental Technologies 1996).

Currently, Basin Oil property is undergoing demolition and remediation, including the excavation of contaminated surface soils and backfilling, which began in 2004 (Ecology 2005). Neither confirmation sampling data nor data on the backfill used for the excavations are available, although it is anticipated that additional data will be available in the future. An application form for Ecology's Voluntary Cleanup Program (ENSR 2006) indicates that Basin Oil is intended to be used for boat storage. It is not clear if this application applies to both of the Basin Oil parcels. (A review of Ecology's files for Basin Oil will be conducted as part of the EE/CA to clarify this uncertainty and to obtain any additional available information that may be pertinent to the recontamination assessment for the T-117 EAA.)

Basin Oil was visited by regulators on at least 12 occasions between December 1992 and December 2004 in the course of site inspections or in response to incident reports or

neighborhood complaints. Concerns and incidents included, but were not limited to, the items listed below (Ecology 1992a, b, 1993, 1994b, a, 2003; Hohmann 1992).

- Improper designation and labeling of wastes, including the potential handling of hazardous wastes
- Errors, omissions, and discrepancies in waste manifests, including an allegation of forgery
- Inappropriate waste storage containers
- Insufficient secondary containment
- A spill of 500 to 600 gal. of used fuel oil that occurred during Basin Oil operations on the Malarkey site in October 1993
- Inadequacies in the spill prevention, control, and countermeasure plan; the stormwater pollution prevent plan; and in emergency planning procedures

A more detailed discussion of selected compliance inspections and site visits is available in the T-117 summary of existing information and data gaps analysis report (Windward et al. 2003).

Used oils are generally known to contain PAHs. Recycled and waste oils have been known to occasionally contain low concentrations of PCBs, although this has not been reported specifically at Basin Oil. In addition, the likelihood of such contamination has lessened as the use of oil that contains PCBs have become regulated since the late 1970s, prior to known Basin Oil operations, under TSCA and the Resource Conservation and Recovery Act (RCRA) (Windward et al. 2003). Used antifreeze can contain metals such as lead and cadmium.

The limited amount of data available for soils, groundwater, and liquids and sludges in tanks and drums at Basin Oil and soil at the 8617 17th Avenue S property are discussed below. Known sampling locations are shown on Map 2-30. Because of on-going remediation activities at Basin Oil, the oil/water separator and area drain samples and most of the soil samples are not necessarily representative of current site conditions, with the possible exception of the sample collected at 8617 17th Avenue S. Some of the soils previously sampled may have been removed during the Basin Oil cleanup, but there are no post-cleanup samples available to confirm this. Questions remain regarding how well historical samples represented site conditions at the time, and there are no data that represent current site conditions. Many of the historical samples were analyzed for only a few of the chemicals of potential interest.

Soil

A surface soil sample and two subsurface samples were collected on the Basin Oil property outside the fence line in the MW-01 boring in July 1991 (Parametrix 1991). Two surface soil samples were collected and composited during the 1996 site assessment (Creative Environmental Technologies 1996). Two samples were collected from an

oil/water separator and an area drain (CB41 and CB42, respectively) during a joint City/ Ecology site visit in July 2004 (Ecology 2005).

EPA collected a surface soil sample and samples of liquid and/or sludge from two tanks and four drums during a site visit in May 2007 (Rodin 2007a). Basin Oil reported concentrations for a soil sample it collected at the 8617 17th Avenue S property in May 2007. Although few chemicals exceeded applicable screening criteria, the elevated concentrations for TPH and lead in the oil/water separator and area drain samples raise concerns about potential historical leakage from these structures. Detected chemicals in soil collected from Basin Oil are summarized in Table 2-7.

PCBs and Pesticides

Aroclor 1260 was detected in each of the soil samples in which it was analyzed at concentrations ranging from 0.0012 to 1.1 mg/kg. The latter result (composite sample COMP-2), which was collected from the north half of the Basin Oil property in 1996, exceeded the screening criteria of 1 mg/kg. Aroclor 1248 was detected at 1.5 mg/kg in one of three soil samples analyzed. Total PCBs were detected at concentrations of 0.14 to 0.35 mg/kg in the area drain and oil water/separator, respectively. DDT, DDD, DDE, and gamma chlordane were detected in two soil samples analyzed for pesticides, with DDE exceeding screening criteria.

TPH

TPH was detected at concentrations ranging from 67 to 87 mg/kg in the two soil samples analyzed. TPH-D was detected from 3,900 to 72,000 mg/kg, and TPH-O was detected from 17,000 and 77,000 mg/kg in the area drain samples and oil water/separator, respectively. All of the TPH-D and TPH-O concentrations were well above the screening criteria of 2,000 mg/kg. None of the other petroleum concentrations exceeded the screening criteria.

PAHs

Chrysene was the only PAH detected exceeding the screening criteria. Chrysene was detected in one of four soil samples analyzed but not in the oil water/separator or area drain samples. No other cPAHs were detected. Six non-cPAHs were detected in soil samples, and seven were detected in the oil water/separator and area drain samples; all below applicable screening criteria.

Other SVOCs and VOCs

The BEHP concentration of 84 mg/kg in the oil/water separator exceeded the screening criteria of 71.4 mg/kg. Other detections of phthalate, phenol, toluene, xylene, and solvents in soil samples were all at concentrations below the respective screening criteria. The oil water/separator and area drain were not analyzed for SVOCs or VOCs.

Table 2-7. Summary of chemicals detected in soil and catch basin samples at Basin Oil

Chemical	Detected Concentration by Sample ID, Date, Sample Type, and Depth									Screening Criteria (mg/kg)[f]
	MW-1 Jul 91[a]			Comp 1 Dec 96[b]	Comp 2 Dec 96[c]	CB41 Jul 04[c]	CB42 Jul 04[c]	EPA07052001DL May 07[d]	Drexler May 07[e]	
	Soil 1.5 ft bgs	Soil 3 ft bgs	Soil 7.5 ft bgs	Soil 1 ft bgs	Soil 1 ft bgs	Oil/Water Separator Solids	Area Drain Solids	Surface Soil	Surface Soil	
PCBs (mg/kg)										
Aroclor 1248	1.5	nd	na	nd	nd	na	na	0.040 UJ	na	nc
Aroclor 1260	0.0012	0.0024	na	0.11	1.1	na	na	0.25 J	0.020	nc
Total PCBs	0.0027	0.0024	na	0.11	1.1	0.35	0.14	0.25 J	0.020	1
Pesticides (mg/kg)										
DDT	0.063	1.7	na	na	na	na	na	na	na	2.94
DDD	0.0073 J	0.14	na	na	na	na	na	na	na	4.17
DDE	20 J	nd	na	na	na	na	na	na	na	2.9
gamma Chlordane	0.022 J	0.021 J	na	na	na	na	na	na	na	2.9
TPH (mg/kg)										
TPH-D	na	na	na	na	na	72,000	3,900	na	na	2,000
TPH-O	na	na	na	na	na	77,000	17,000	na	na	2,000
Total TPH	na	na	na	87	67	na	na	na	na	nc
PAHs (mg/kg)										
2-Methylnaphthalene[g]	nd	nd	nd	na	na	350	1.4 U	0.12 J	na	1600
Anthracene	nr	nr	nr	na	na	4.3 U	1.4 U	1.4 J	na	24,000
Benzo[a]anthracene[h]	nd	nd	nd	na	na	4.3 U	1.4 U	0.12 J	na	0.137
Chrysene[h]	nd	nd	nd	na	na	4.3 U	1.4 U	0.22 J	na	0.137
Fluoranthene	nd	0.098 J	nd	na	na	4.3 U	1.4 U	0.64 J	na	3,200
Fluorene	nr	nr	nr	na	na	14	1.4 U	1.4 J	na	3,200
Naphthalene	nd	nd	nd	na	na	170	1.4 U	0.78 UJ	na	1,600
Phenanthrene	nd	nd	nd	na	na	24	1.4 U	4.4 J	na	nc
Pyrene[h]	0.084 J	0.11 J	0.095 J	na	na	4.3 U	1.4 U	0.56 J	na	2,400

Chemical	Detected Concentration by Sample ID, Date, Sample Type, and Depth									Screening Criteria (mg/kg)[f]
	MW-1 Jul 91[a]			Comp 1 Dec 96[b]	Comp 2 Dec 96[c]	CB41 Jul 04[c]	CB42 Jul 04[c]	EPA07052001DL May 07[d]	Drexler May 07[e]	
	Soil 1.5 ft bgs	Soil 3 ft bgs	Soil 7.5 ft bgs	Soil 1 ft bgs	Soil 1 ft bgs	Oil/Water Separator Solids	Area Drain Solids	Surface Soil	Surface Soil	
Other SVOCs (mg/kg)										
3- and 4-Methylphenol	0.19 J	nd	nd	na	na	na	na	0.78 U	na	400
Bis(2-ethylhexyl) phthalate	nd	0.15 BJ	0.082 BJ	na	na	84	41	35 J	na	71.4
Butyl benzyl phthalate	nr	nr	nr	na	na	4.3 U	2.6	0.89 J	na	16,000
VOCs (mg/kg)										
Acetone	0.031	nr	nr	na	na	na	na	4.6	na	8000
Carbon disulfide	nr	nr	nr	na	na	na	na	0.010 J	na	8000
Methylene chloride	nd	nr	nr	na	na	na	na	0.077 J	na	133
2-Butanone	nr	nr	nr	na	na	na	na	0.35 J	na	48,000
4-Methyl-2-pentanone	nr	nr	nr	na	na	na	na	0.16 J	na	6,400
Toluene	nr	nr	nr	na	na	na	na	0.018 J	0.14	6,400
2-Hexanone	nr	nr	nr	na	na	na	na	0.062 J	na	nc
Ethylbenzene	nr	nr	nr	na	na	na	na	0.019 U	0.14	8000
Total xylenes	nr	nr	nr	na	na	na	na	na	1.16	16,000
m,p-Xylene	nr	nr	nr	na	na	na	na	0.002 J	na	16,000
Halogens (mg/kg)										
Total organic halogens	na	na	na	6	9	na	na	na	5 U	nc
Metals (mg/kg)										
Mercury	na	na	na	0.05 U	0.05 U	0.11	0.08 U	0.0733 J	na	24
Aluminum	17,500	20,000	11,000	na	na	na	na	22,000 J	na	nc
Arsenic	na	na	na	5 U	5 U	20 U	20 U	5.7	na	0.667
Barium	326	114	34	84.7	48.9	na	na	63.4 J	na	16,000
Beryllium	na	na	na	na	na	na	na	0.18 J	na	160
Cadmium	1 U	1 U	1 U	0.3	0.1	na	na	1.8	0.4	80
Calcium	na	na	na	na	na	na	na	12,400 J	na	nc
Chromium[i]	1,860	26	10	119	13.6	na	na	32.1 J	17	240/120,000

Chemical	Detected Concentration by Sample ID, Date, Sample Type, and Depth									Screening Criteria (mg/kg)[f]
	MW-1 Jul 91[a]			Comp 1 Dec 96[b]	Comp 2 Dec 96[c]	CB41 Jul 04[c]	CB42 Jul 04[c]	EPA07052001DL May 07[d]	Drexler May 07[e]	
	Soil 1.5 ft bgs	Soil 3 ft bgs	Soil 7.5 ft bgs	Soil 1 ft bgs	Soil 1 ft bgs	Oil/Water Separator Solids	Area Drain Solids	Surface Soil	Surface Soil	
Cobalt	na	na	na	na	na	na	na	15.3 J	na	nc
Copper	433	36	13	na	na	134	173	119 J	na	2960
Iron	na	na	na	na	na	na	na	38,700	na	nc
Lead	83	61	5 U	29	8	428	98	209	29	250
Magnesium	na	na	na	na	na	na	na	9,270 J	na	nc
Manganese	na	na	na	na	na	na	na	491	na	11,200
Nickel	218	20	3	na	na	na	na	43.3	na	1600
Potassium	na	na	na	na	na	na	na	701 J	na	nc
Silver	na	na	na	0.7 U	0.7 U	na	na	0.19 J	na	400
Sodium	na	na	na	na	na	na	na	2,620 J	na	nc
Vanadium	na	na	na	na	na	na	na	40.3	na	560
Zinc	296	110	17	na	na	711	830	221	na	24,000

[a] Parametrix (1991).

[b] Creative Environmental Technologies (1996). Some sample points may have been removed during site remediation.

[c] Integral (2006). These structures are no longer in service.

[d] Rodin (2007a). Soil may have been excavated since being sampled.

[e] Rodin (2007b). Sampling location not shown on Map 2-30.

[f] Screening criteria are MTCA Method A for PCBs, cPAH and TPH and lead and MTCA Method B for all other soil chemicals.

[g] Naphthalene criteria were used for comparison.

[h] These chemicals are cPAHs.

[i] Chromium screening criteria are provided for trivalent/hexavalent forms. Four of the seven detected concentrations exceed the screening criteria for trivalent chromium but not the screening criteria for hexavalent chromium.

bgs – below ground surface
ID – identification
J – estimated concentration
na – not analyzed or data not available
nc – no criteria
nd – not detected at unknown reporting limit
nr – not reported
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
SVOC – semivolatile organic compound
TPH – total petroleum hydrocarbon
TPH-D – diesel-range total petroleum hydrocarbons
TPH-O – lube oil-range total petroleum hydrocarbons
U – not detected at the reporting limit shown
VOC – volatile organic compound

Metals

Arsenic and chromium were the only two metals detected in soil that exceeded their respective screening criteria. Arsenic was detected in one of three soil samples analyzed, at a concentration of 5.7 mg/kg, which is greater than the screening criteria of 0.67 mg/kg. It was not detected in the oil water/separator and area drain samples. Chromium concentrations in one of the seven soil samples analyzed exceeded the screening criteria of 240 mg/kg for hexavalent chromium, but none exceeded the screening criteria of 120,000 mg/kg for trivalent chromium. The sample result from the oil/water separator (CB41), as shown on Map 2-30, exceeded the lead screening criteria of 250 mg/kg.

Groundwater

The only groundwater monitoring well at Basin Oil is MW-01, located on the southeast property boundary (Map 2-30). MW-01 has been sampled 7 times between 1991 and 2003 (Windward et al. 2003). Table 2-8 presents a summary of the chemicals detected in groundwater in MW-01 between 1991 and 2003.

Table 2-8. Groundwater sampling concentrations from Basin Oil (MW-01) for chemicals detected in at least one sample

Chemical	Detected Concentration						
	July 1991 (Installation)[a]	June 1994[b]	July 1997[b]	Oct 1997[b]	Jan 1998[b]	April 1998[b]	Sept 2003[b]
PCBs (µg/L)							
Aroclor 1260	1.8	1.2 J	0.1 U	0.1 U	0.2 U	0.2 U	0.049 U
Pesticides (µg/L)							
DDT	0.087 J	na	na	na	na	na	na
SVOCs (µg/L)							
Bis(2-ethylhexyl) phthalate	11	na	na	na	na	na	na
Diethyl phthalate	na	0.93 J	na	na	na	na	na
Metals (µg/L)							
Aluminum	0.231	na	na	na	na	na	na
Barium	0.00080	na	na	na	na	na	na
Chromium	0.00028	na	na	na	na	na	na
Copper	0.00042	na	na	na	na	na	na
Lead	0.00018	na	na	na	na	na	na
Nickel	0.00030	na	na	na	na	na	na
Zinc	0.00059	na	na	na	na	na	na

[a] Parametrix (1991).
[b] Windward (2003).
J – estimated concentration
na – not analyzed
PCB – polychlorinated biphenyl
SVOC – semivolatile organic compound
U – not detected at the reporting limit shown

PCBs (as Aroclor 1260) were detected in groundwater at MW-01 at 1.8 µg/L in 1991 and 1.2 µg/L in 1994. However, PCBs were not detected in subsequent samples collected from 1997 to 2003 (detection limits ranged from 0.05 to 0.2 µg/L). The trace detection of PCBs in a sample collected shortly after well installation (1991) may have been the result of entrained particulates and thus may not accurately reflect PCB concentrations in groundwater. TPH was not detected in the five groundwater samples analyzed (detection limits ranged from 0.26 to 250 µg/L). DDT was detected at an estimated concentration of 0.087 µg/L in the one groundwater sample analyzed for pesticides in July 1991 (Parametrix 1991). Two SVOCs were detected in groundwater samples. No PAHs were detected in the five groundwater samples analyzed. VOCs were not detected in groundwater samples from MW-01. Metals (not including arsenic) were only analyzed in groundwater from MW-01 in July 1991. A total of seven metals were detected in this groundwater sample as presented on Table 2-8.

Tank and Drum

The tank and drum data do not directly represent site environmental conditions but because they are indicative of past operations on the site, they provide an indication of chemicals that could be present in the site soils and groundwater. The concentrations of chemical analyses of the tank and drum samples are summarized in Table 2-9. Aroclor 1260 was detected in sludge from one drum but not in sludge or liquids from the other three drums or the two tanks. Petroleum was not analyzed in the tank or drum samples. Chrysene, seven non-carcinogenic PAHs, three phthalates, BTEX, one chlorinated solvent, and two non-chlorinated solvents were detected in tank or drum samples. Arsenic, chromium, copper, lead, nickel, zinc and 16 other metals were detected in tank and drum samples.

Table 2-9. Tank and drum sampling concentrations from Basin Oil

Chemical	Detected Concentration by Source and Sample Type						
	Tank 5 Liquid	Tank 11 Liquid	Drum E-0012 Liquid	Drum E-0012 Sludge	Drum E-0014 Sludge	Drum E-0019 Liquid	Drum E-0022 Sludge
Metals (mg/kg)[a]							
Aluminum	26.1 J	295	na	567	239	3U	11,500
Antimony	1.9 J	4.5 J	na	9	8.2 J	0.18U	0.14U
Arsenic	0.27 U	0.35 J	na	48.6	36.3	0.34U	2
Barium	8 J	72.3 J	na	114 J	31.7 J	0.58J	81.5J
Beryllium	0.038 U	0.041 U	na	0.07 U	0.1U	0.048U	0.34J
Cadmium	0.29 J	0.62 J	na	0.59 J	0.57 J	0.071U	3.9
Calcium	763 J	4350	na	2,040	4,220	60.4J	4,980
Chromium	1 J	4.2 J	na	144 J	108 J	2.6J	16.6J
Cobalt	0.072 J	0.18 J	na	23.5 J	26.2	0.064U	8.7
Copper	53.6	49.1	na	243	363	0.11J	20.6
Iron	130	727 J	na	455,000 J	98,600 J	15.5U	20,400 J
Lead	25.4	36.5	na	67.9	132	0.21U	13.9
Magnesium	125 J	263 J	na	618 J	1,300	0.55J	3740
Manganese	3	17.3	na	2,570	644	0.014UJ	364
Mercury	0.0137 UJ	0.0204 J	na	1.66	0.401 J	0.0137UJ	0.00571UJ
Nickel	0.93 J	2.9 J	na	102	133	0.077U	17.2
Potassium	275 J	275 J	na	165 J	284J	9.3U	1,720 J
Selenium	0.23 U	0.25 U	na	2.1	0.75J	0.29U	0.28J
Silver	0.095 J	0.034 J	na	1.6	0.081UJ	0.037UJ	0.15J
Sodium	483 J	483	na	602 J	3,490	11.4U	802J
Vanadium	0.47 U	4.2	na	7.7 J	4.7 J	0.53J	55.5
Zinc	336	1,820 J	na	378 J	219 J	1.2UJ	58.1J
PCBs (mg/kg)[a]							
Aroclor 1260	5.1 U	5.1 U	na	0.27 U	0.89	5.1 U	0.036 U
VOCs (mg/kg)[a]			na				
Acetone	700 U	1,300 U	na	na	na	650 U	0.13 J
Methylene chloride	140 U	250 U	na	na	na	130 U	0.086 J
Benzene	5,500	250 U	na	na	na	130 U	0.016 U
Toluene	28,000	1,600	na	na	na	130 U	0.014 J

Chemical	Detected Concentration by Source and Sample Type						
	Tank 5 Liquid	Tank 11 Liquid	Drum E-0012 Liquid	Drum E-0012 Sludge	Drum E-0014 Sludge	Drum E-0019 Liquid	Drum E-0022 Sludge
Tetrachloroethene	390	250 U	na	na	na	1300 U	0.016 U
Ethylbenzene	5,200	370	na	na	na	1300 U	0.016 U
m,p-Xylene	21,000	1,500	na	na	na	400	0.010 J
o-Xylene	7,800	570	na	na	na	650	0.016 U
SVOCs (mg/kg)[a]							
Phenol	50 U	130 U	50 U	2.2 J	13 U	250 U	0.69 U
2-Methylphenol	50 U	130 U	14 J	8.2	0.040 J	250 U	0.69 U
3- and 4-Methylphenol	50 U	130 U	50 U	3.1 J	9.6 J	250 U	0.69 U
Naphthalene	800	170	630 J	100 J	110 J	390 J	0.69 UJ
2-Methylnaphthalene	1,400	260	1,600	250 J	450	3,800 J	0.69 UJ
Acenaphthylene	50 U	130 U	50 U	4.2 U	**27 J**	250 U	0.69 UJ
Acenaphthene	39 J	130 U	1,900 J	16 J	13 U	390 J	0.69 UJ
Dibenzofuran	57	130 U	230 J	20 J	34 J	250 U	0.69 UJ
Fluorene	98	130 U	510 J	49 J	87 J	590 J	0.69 UJ
Phenanthrene	130 J	43 J	330 J	41 J	160 J	1,000 J	0.20 J
Anthracene	17 J	130 U	40 J	6.0 J	15 J	100 J	0.69 UJ
Carbazole	50 UJ	130 U	50 UJ	6.0 J	27 J	250 U	0.69 UJ
Di-n-butyl phthalate	13 J	130 U	50 UJ	4.2 UJ	13 UJ	250 U	0.69 UJ
Fluoranthene	50 UJ	130 U	50 UJ	1.5 J	6.6 J	250 U	0.69 UJ
Pyrene	21 J	130 U	44 J	3.8 J	8.4 J	250 U	0.69 U
Butyl benzyl phthalate	41 J	130 U	50 U	4.2 U	17 J	250 U	0.69 U
Bis(2-ethylhexyl) phthalate	50 U	140	38 J	3.4 J	26 J	250 U	8.1
Chrysene	90	130 U	50 U	4.2 U	13 UJ	250 U	0.17 J

Source: Rodin (2007a)

[a] Units were reported in mg/kg for metals and µg/kg for PCBs, VOCs, and SVOCs, which is atypical for liquid media.

J – estimated concentration	SVOC – semivolatile organic compound
na – not analyzed	U – not detected at the reporting limit shown
PCB – polychlorinated biphenyl	VOC – volatile organic compound
nr – not reported	

2.3.6.2 South Park Marina

Site Description and History

The Marina is located at 8604 Dallas Avenue S and is adjacent to the T-117 Upland property to the North. Since the early 1970s, the site has been used as a small boat marina and repair and maintenance facility. Activities at marinas elsewhere are known to result in copper, lead, TBT, PAH, and phthalate impacts. Best management practices (BMPs) are in place and Ecology has inspected the site. The Marina BMPs include the use of vacuum sanders, tarps to catch debris, routine sweeping of boat maintenance areas, and a closed-loop wash system. If Ecology's recommendations are implemented, the potential for sediment recontamination associated with current operations is believed to be low (SAIC 2007c).

In the early to mid-1950s, A&B Barrel reconditioned and repainted drums on southeastern portion of the Marina using sodium hydroxide as a cleaning agent. Liquid waste was discharged to an onsite pond that discharged to the LDW. The northern half of the Marina was also formerly a mobile home park. Other former operations at the Marina site included the North Star Trading Company, Evergreen Boat Transport, R.P. Boatbuilding, and Dekker Engineering.

Soil

In 2004 and 2006, the Port collected and analyzed seven soil samples for PCBs (including a duplicate sample) near the Marina and T-117 Upland property boundary. These sampling locations are shown on Map 2-11, and the PCB concentrations are presented in Table 2-10. PCBs were detected at relatively low concentrations in samples from all locations. At locations T-117 A11 and T-117 A12, Aroclor 1254 was detected in addition to Aroclor 1260 (Aroclor 1260 is the predominant Aroclor at the T-117 EAA). TPH was also analyzed and detected in one sample and the field duplicate sample from location T-117-A10 but at concentrations well below the screening criteria (2,000 mg/kg).

Table 2-10. Detected chemical concentrations in near the T-117 Upland property and Marina boundary

Map ID	Sample ID	Sample Depth (ft)	Concentration (mg/kg)				
			TPH-D	TPH-O	Aroclor 1254	Aroclor 1260	Total PCBs (calc'd)[a]
SB-13	T-117-SB13-01	0 – 1.5	na	na	0.29 U	5.0	5.0
SB-14	T-117-SB14-01	0 – 1.5	na	na	0.33 U	31	31
A10	T-117-A10-SB-01	0 – 1.5	94	100	0.33 U	0.088	0.088
	T-117-A10-SB-206[b]	0 – 1.5	66	72	0.33 U	0.075	0.075
A11	T-117-A11-SB-0.0-0.5	0 – 0.5	na	na	0.069	0.15 J	0.22 J
A12	T-117-A12-SB-0.0-0.5	0 – 0.5	na	na	2.1	1.1 J	3.2 J
	T-117-A12-SB-0.5-1.5	0.5 – 1.5	na	na	0.25	0.34	0.59

[a] Sum of detected Aroclors (Aroclors 1016,1221,1232,1242,and 1248 were not detected in any of these samples).

[b] Field duplicate of the preceding sample.

ID – identification

J – estimated concentration

PCB – polychlorinated biphenyl

TPH-D – diesel-range total petroleum hydrocarbons

TPH-O – lube oil-range total petroleum hydrocarbons

U – not detected at the reporting limit shown

Ecology recently conducted a reconnaissance-level environmental investigation of the area formerly occupied by A&B Barrel. According to the LDW South Park Marina site reconnaissance plan (SAIC 2007b), the following tasks were to be performed to address data gaps associated with potential historical uses:

- Installation of three monitoring wells with pre-packed screens
- Subsurface sampling of seven boreholes using a geoprobe drill rig and five boreholes using a hand auger
- Sediment sampling along two transects perpendicular to the shore

The investigation will also involve an examination of the accessible intertidal area during low tide for seeps. One of the monitoring wells was located downgradient of a pond that reportedly was used for liquid waste disposal in the 1950s (SAIC 2007b). The other two wells were installed in locations selected to characterize groundwater in other areas with a high potential for impacts. Groundwater samples were collected from these wells. Preliminary soil and groundwater analyses are pending and will reportedly include PCBs, TPH, SVOCs (including PAHs), VOCs and metals. The soil and groundwater data are currently being validated and will be presented and evaluated in the EE/CA.

3 Streamlined Risk Assessment Approach, COPC Identification, and Conceptual Site Model

This section describes the approach to be used in the EE/CA streamlined risk assessment, identifies preliminary COPCs, and develops a preliminary CSM. The streamlined risk assessment approach will identify and address exposure pathways by evaluating potential ecological and human health risks. The streamlined risk assessment and preliminary COPC identification processes are related to one another because they use a protective, risk-based approach, which compares contaminant concentrations to regulatory screening criteria that are considered protective of the environment. The CSM, which is presented in Section 3.3, is developed using the preliminary COPCs identified here and will be used to evaluate the exposure pathways and receptors determined in the EE/CA streamline risk assessment for the appropriate contaminated media and transport mechanisms.

3.1 STREAMLINED RISK ASSESSMENT APPROACH

As described in the EE/CA guidance (EPA 1993), a streamlined risk assessment is intermediate in scope between the limited risk assessment conducted for emergency removal actions and the conventional baseline assessment normally conducted for remedial actions. The purpose of a streamlined risk assessment is to justify a removal action and to identify current or potential exposure pathways that should be addressed.

A protective approach will be used in the streamlined risk assessment for the T-117 EAA, which will rely in part on the results of the ecological risk assessment (ERA) and HHRA that have been completed for the LDW (Windward 2007) and a terrestrial ecological evaluation that has been prepared for the Adjacent Streets (Integral 2006).

Consistent with EE/CA guidance, the streamlined risk assessment will identify the potential for risk if no removal action is taken. The assessment will focus on the human health and ecological risks associated with elevated PCB and other COPC concentrations at the T-117 EAA. The streamlined risk evaluation to be included in the EE/CA will focus on the media that the removal action is intended to address (EPA 1993), which are upland soil and the sediment adjacent to T-117. Risks associated with surface water and groundwater that may discharge to surface water will be evaluated based on results of the groundwater monitoring program described in Appendices A and B. Short- and long-term risks associated with specific removal action alternatives will be evaluated in the EE/CA as part of the "effectiveness" criteria discussed in Section 5.3. The EE/CA will also evaluate potential exposure pathways that could occur as a result of possible future site uses (see Section 4.2).

3.1.1 Preliminary exposure pathways

The risk assessment is designed to identify risk from potential exposure pathways if no action is taken within the T-117 EAA or RAAs. An exposure pathway is considered

complete if a chemical can travel from a source to a human or ecological receptor and is available to the receptor via one or more exposure routes (EPA 1997a, b). The preliminary risk characterization is described below for the aquatic (i.e., Sediment Study Area) and terrestrial (i.e., T-117 Upland Area and Adjacent Streets) portions of the EAA. The work plan is not considered the final assessment of all exposure pathways; this entire evaluation will be updated and revised as necessary in the EE/CA.

The principal human exposure pathways for sediment include direct contact via incidental ingestion or dermal contact and indirect contact from seafood ingestion. The most likely exposure routes for people in the terrestrial (i.e., soils from T-117 Upland Area and Adjacent Streets) portion of the site would be through direct contact via incidental ingestion, dermal contact, dust inhalation.

Ecological receptors include both aquatic and terrestrial species, such as benthic and soil-dwelling invertebrates, fish, birds, mammals and plants. The exposure pathways for benthic or soil-dwelling invertebrates are direct and include ingestion or direct contact with sediment or soil. Porewater and surface water are also additional exposure pathways to benthic organisms. Exposure pathways for fish, birds, and mammals are both direct and indirect. Direct exposure pathways include incidental ingestion and direct contact with sediment or soil. Indirect exposure is primarily through the ingestion of marine or terrestrial organisms. The exposure pathways for plants are direct by contact or root uptake.

3.1.2 Preliminary risk characterization

The purpose of this section is to provide a preliminary discussion of risk characterization-related issues and approaches that will be more fully examined in the EE/CA.

3.1.2.1 Aquatic

Ecological Risk

Site-wide ecological risks for the LDW were evaluated as part of the LDW ERA (Windward 2007). Many ecological receptors (e.g., fish, birds, mammals) are mobile and could be exposed to PCBs throughout the LDW. PCBs were identified as a risk driver, indicating a need in the LDW feasibility study (FS) for a remedial analysis for river otters but not for any other fish or wildlife species. The risk to fish is uncertain.

Risks to the benthic community are area-specific within the LDW, based primarily on a comparison of select chemical concentrations to state SMS criteria. This comparison was done for the LDW ERA but will also be presented in the EE/CA. The T-117 EAA was one of the identified LDW areas with the potential for greater risk to the benthic community. Under the provisions of the SMS, when no bioassay data are available (none were collected in the T-117 EAA during the LDW RI), surface sediments are categorized in one of three ways:

- Sediments with chemical concentrations equal to or less than SQS are designated as having no adverse effects on biological resources (WAC 173-204-301[1][a])
- Sediments with chemical concentrations above the SQS but below the CSL have potential for adverse effects on biological resources
- Sediments with chemical concentrations above the CSL have a greater potential for adverse effects on biological resources requiring evaluation of cleanup alternatives

Human Health Risk

Site-wide human health risks for the LDW were evaluated as part of the LDW HHRA (Windward 2007). The HHRA established that humans are exposed to chemicals found in LDW sediments, identified the relevant exposure pathways, and formed exposure scenarios based on the complete exposure pathways. The primary exposure scenarios identified for the LDW were direct contact with sediments during commercial netfishing, clam digging, and beach play and consumption of seafood harvested from the LDW. These scenarios, except for beach play, also apply to the T-117 EAA, although the exposure areas evaluated in the LDW HHRA for these scenarios were much larger than the T-117 EAA. The beach play exposure scenario evaluated in the LDW HHRA is not reasonably expected to occur at the T-117 EAA. The human access survey (Windward 2005) conducted as part of the LDW RI noted that shoreline access in this area was difficult, and no human use was identified in the Sediment Study Area. Other types of direct sediment exposure, such as adult trespasser, kayaker, or habitat restoration worker, could occur at the T-117 EAA. However, the clam digging and netfishing scenarios that will be evaluated are protective of the less frequent exposures associated with these other types of exposure.

Based on the results of the LDW HHRA, PCBs, arsenic, cPAHs, and dioxins/furans were identified as risk drivers. The LDW exposure areas on which this assessment was based included the entire LDW. Consequently, the risk estimates are not directly applicable to the much smaller T-117 EAA. However, for the purposes of the EE/CA preliminary risk characterization, chemical concentrations in T-117 sediments will be compared to appropriate risk-based concentrations.

3.1.2.2 Terrestrial

Ecological Risk

Ecological risks from contaminated soil in the Adjacent Streets were evaluated in a terrestrial ecological evaluation (Integral 2006). A similar evaluation has not been conducted for the T-117 Upland Area, but because of the close proximity of the areas and similar site features, the terrestrial ecological evaluation for Adjacent Streets should be considered applicable to the T-117 Upland Area. The terrestrial ecological evaluation was conducted in compliance with documentation forms provided by Ecology and focused on ecological issues related to the terrestrial environment. The

terrestrial ecological evaluation determined that substantial wildlife exposure is unlikely because a majority of the site is paved. Adjoining undeveloped land, which is the most likely area for wildlife exposure, does not exceed 1.5 acres. Wildlife exposure to contaminants has also been further minimized by the interim actions conducted on city streets. Consequently, no further terrestrial ecological evaluation is considered necessary for the EE/CA.

Human Health Risk

MTCA screening criteria are derived to be protective of human health based on direct contact with soil and leaching from the unsaturated zone to groundwater. The screening criteria of 1 mg/kg dw PCBs is protective for unrestricted land use. In addition, a concentration of 1 mg/kg is biased toward the more protective end of EPA's target range (0.1 mg/kg PCBs to 10 mg/kg) for excess cancer risk and non-cancer hazards at Superfund sites. PCB concentrations in T-117 upland soil will be compared to this screening criteria in the EE/CA.

3.1.2.3 Summary of the streamlined risk assessment

The streamlined risk assessment compares sediment concentrations to SMS criteria and soil concentrations to applicable screening criteria to enable an evaluation of the potential ecological and human health risks.

The chemicals in sediment in this area are at concentrations known to have potentially adverse effects on benthic organisms. Sediment with chemical concentrations above the CSL (primarily total PCBs) is located within the T-117 EAA preliminary sediment removal boundary, which if removed would significantly reduce the potential for adverse affects to benthic organisms. Furthermore, a removal action is supported by the HHRA, which established that the exposure of humans will be reduced indirectly by the removal of sediment that contains bioaccumulative chemicals found in seafood. The removal action will help to reduce the quantity of PCBs present in the LDW and reduce exposure.

Total PCB concentrations in the T-117 Upland Area soil exceed MTCA screening criteria, which were developed to be protective of human health. The removal action will directly reduce the exposure of humans by removing soil that has chemical concentrations above MTCA and render the T-117 Upland Area suitable for unrestricted land use.

3.2 CONTAMINANTS OF POTENTIAL CONCERN

This section identifies preliminary COPCs for the T-117 EAA based on the requirements of the SOW and consideration of the site's reasonably anticipated future land use, as defined by EPA (2007a; Appendix E).

The process for defining COPCs for the T-117 EAA, as set forth in the SOW (EPA 2007b), includes relevant chemicals that are:

- Found in T-117 EAA sediment and exceed the SMS SQS
- Found on the T-117 Upland Area
- Found on the Basin Oil or the Marina properties and pose a potential risk of recontamination to the T-117 EAA

Furthermore, requirements set forth by EPA for reasonably anticipated future land use (Appendix E) specify that the T-117 EAA upland (i.e., collectively the T-117 Upland Area and Adjacent Streets) meet unrestricted land use criteria in accordance with Ecology's MTCA.

In addition, EPA's risk assessment guidance for superfund (1991) will be used in the EE/CA to further screen the preliminary COPCs.

This work plan provides an initial screening process as outlined below.

- Section 3.2.1 compares chemicals that exceed SQS criteria to those chemicals also found on the T-117 Upland Area.
- Section 3.2.2 further examines chemicals that exceed Ecology's MTCA screening criteria in the T-117 EAA upland portion.
- Section 3.2.3 includes a preliminary identification of chemicals associated with the RAAs (Basin Oil and Marina).
- Section 3.2.4 includes the list of preliminary COPCs based on the aforementioned evaluation process.

In summary, the preliminary COPCs identified for the Sediment Study Area are PCBs (primarily Aroclor 1260), PAHs, benzyl alcohol, BEHP, and butyl benzyl phthalate. Preliminary COPCs identified for the T-117 Upland and Adjacent Street areas are PCBs (primarily Aroclor 1260), PAHs, TPH and arsenic. In the EE/CA, chemicals associated with the RAAs may be identified as COPCs depending on findings from the field investigations and cleanup actions that are ongoing in those areas.

The preliminary COPCs identified in this work plan are not considered final; the EE/CA will include a re-assessment of chemicals based on any newly available information and the results of the streamlined risk assessment. The COPCs and screening criteria may also be used during the EE/CA to further refine the NTCRA removal boundaries within the T-117 EAA.

3.2.1 Initial screening of preliminary COPCs exceeding SQS and detected in the T-117 Upland Area

As indicated in Section 3.2, COPCs are defined as chemicals that exceed the SQS criteria in T-117 EAA sediment and also found on the T-117 Upland Area. In Section 2.3, sediment sample concentrations are presented together with SQS criteria. Detected chemicals that exceed the SQS in sediment are: benzyl alcohol, BEHP, butyl benzyl phthalate, hexachlorobenzene, PAHs, PCBs, and phenol. Of these chemicals,

PCBs are the most prevalent in sediment and most often exceed the CSL. Phenol and hexachlorobenzene are the only two chemicals detected in the Sediment Study Area at concentrations that exceeded the SQS but not detected in the T-117 Upland Area, so they do not qualify as a COPC as defined in the SOW.

3.2.2 Initial screening of preliminary COPCs that exceed MTCA

In accordance with EPA's future land use letter (Appendix E), the T-117 EAA Upland Area soil chemical concentrations also need to meet unrestricted land criteria as set forth under MTCA. Section 2.3 presents the soil sample concentrations together with MTCA screening criteria. Detected chemicals that exceeded MTCA screening criteria in T-117 Upland Area soils were arsenic, PAHs, PCBs, and TPH. PCB and PAH concentrations that exceeded MTCA criteria were the most prevalent throughout the T-117 Upland Area. Locations where TPH (predominantly TPH-D and TPH-O) and arsenic concentrations exceeded MTCA screening criteria were relatively few in comparison to the number of locations with PCB exceedance. Arsenic will be further evaluated in the EE/CA in terms of its documented area-wide presence in soil and groundwater within the greater Duwamish region.

Based on the most recent results (RETEC 2006), which are considered to be representative of current site conditions, arsenic was the only chemical that was detected above MTCA Method B in groundwater (as discussed in Section 2.3). Additional groundwater data (from recently installed and existing wells) are being collected (see the groundwater monitoring plan in Appendix A). Groundwater will be further evaluated and screened in the EE/CA when a more comprehensive groundwater dataset is available.

3.2.3 Additional screening for the RAA contaminants

According to the SOW (EPA 2007b), COPCs also include those contaminants found on the Basin Oil or Marina properties that pose a potential risk of recontamination to the T-117 EAA. The recontamination criteria for the COPCs identified for the RAAs will be evaluated in the EE/CA. Existing analytical results for soil and groundwater at the Basin Oil and Marina properties is limited at this time, as discussed in the data gaps assessment (Section 7). However, the investigations of the RAAs are being conducted, and the results will be included and evaluated in the EE/CA.

South Park Marina

As presented in Section 2.3, two soil samples from the Marina near the T-117 upland property boundary were analyzed for PCBs (Map 2-11). Both samples had soil concentrations that exceeded MTCA screening criteria for PCBs (5.0 and 31 mg/kg dw). These limited results indicate that PCBs from the Marina may pose a potential risk of recontamination to the T-117 EAA, which will be further evaluated in the EE/CA.

Ecology evaluated existing data for the Marina and identified data gaps that, if not addressed, could lead to recontamination (SAIC 2007c) of the T-117 EAA. The data gaps identified by Ecology in the Science Applications International Corporation (SAIC) report included the need to evaluate the possible historical impacts from the former A&B Barrel Company, a drum refurbishing company, operations and a former pond reportedly used by the company for liquid waste disposal in the 1950s. To address this data gap, Ecology planned additional soil and groundwater sampling for PCBs, TPH, SVOCs (including PAHs), pesticides/herbicides, and metals at the Marina in the former location of the A&B Barrel Company, which is currently being conducted (SAIC 2007b). Pending the timing of the publication of these data, the results of these investigations will be included and evaluated in the EE/CA.

Basin Oil

TPH and PAHs are chemicals likely associated with historical operations at the facility (as discussed in Section 2.3.6.1). As presented in Section 2.3, a limited set of historical groundwater, soil, catch basin, and tank and drum samples are available for Basin Oil. However, ongoing remediation activities have removed most of the soil associated with these samples so they are no longer representative of current site conditions. There are no post-cleanup samples available at this time to evaluate current conditions at the site.

It is recommended that soil and possibly groundwater samples be collected within the Basin Oil site following completion of the independent cleanup activities currently being performed by the owner and overseen by Ecology. It is understood that a sampling program will be developed and implemented by the property owner, with Ecology oversight, in accordance with applicable MTCA requirements for confirmatory sampling, monitoring, and site closure (Fujita 2007). Pending the timing of the post-cleanup investigation, these results will be included and evaluated in the EE/CA.

Additional groundwater samples from recently installed wells downgradient of Basin Oil is being collected as part of this work plan (Appendix A). Groundwater will be further evaluated and screened in the EE/CA once the more comprehensive groundwater dataset is available.

3.2.4 Summary of preliminary COPCs

Table 3-1 presents preliminary COPCs based on the screening presented in Sections 3.2.1 and 3.2.2. The preliminary COPCs associated with the RAAs, as discussed in Section 3.2.3, cannot be determined at this time because investigations of the RAAs are currently underway.

Table 3-1. Preliminary COPCs

Chemical	Chemicals Detected in Sediment Exceeding SQS and Detected in Upland Soil	Chemicals Detected in Upland Soil	Chemicals Detected in Soil Exceeding MTCA Screening Criteria
Total PCBs	X	X	X
PAHs	X	X	X
Benzyl alcohol	X	X	
Bis(2-ethylhexyl) phthalate	X	X	
Butyl benzyl phthalate	X	X	
TPH[a]			X
Arsenic			X

[a] At T-117, TPH is predominately diesel- and oil-range hydrocarbons.

COPCs – chemicals of potential concern

MTCA – Model Toxics Control Act

PAH – polycyclic aromatic hydrocarbons

PCB – polychlorinated biphenyl

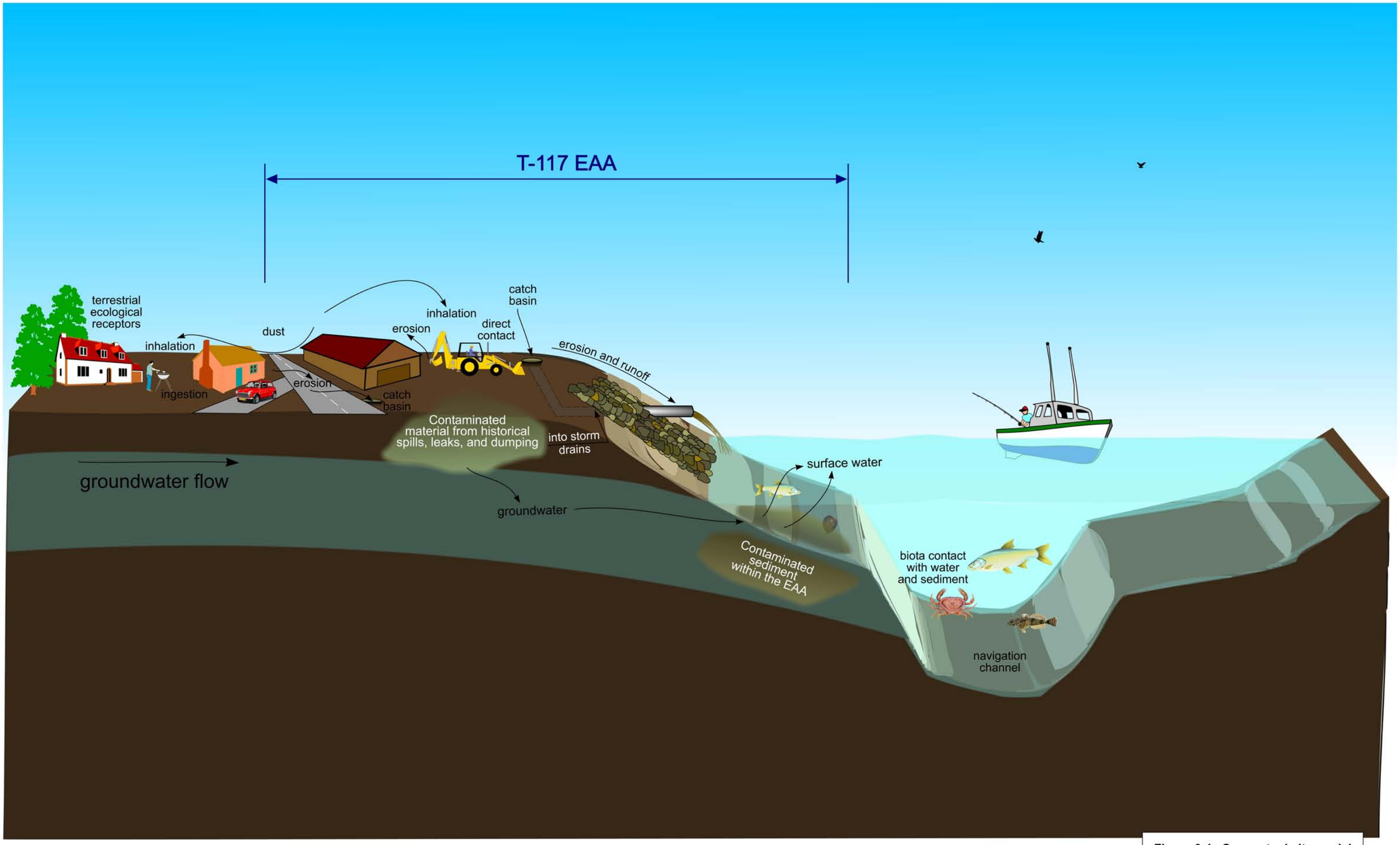
SQS – sediment quality standards of the SMS

TPH – total petroleum hydrocarbons

In summary, the following COPCs are considered preliminary and not necessarily the final and complete listing of COPCs that will be developed in the EE/CA. If additional chemicals are identified through ongoing investigations within the EAA and RAAs, they will be included in the EE/CA evaluation.

3.3 Conceptual Site Model

A CSM has been developed for the T-117 EAA (Figure 3-1) and includes current chemical sources (contaminated soil and groundwater), transport mechanisms, exposure routes, and potentially exposed receptors. Information regarding the presence of contaminants in the RAAs is currently limited but is being addressed through additional soil sampling and groundwater monitoring.



Note: features are generalized and not intended to be a literal representation of site conditions. Vertical scale is exaggerated.

Figure 3-1. Conceptual site model for the T-117 EAA

3.3.1 Chemical sources to the T-117 EAA and contaminated media

The original chemical sources to the T-117 EAA upland subarea are include process-related historical releases and spills from the former asphalt roofing materials manufacturing plant or releases at neighboring RAAs. Currently, chemical contamination is present within soil beneath the asphalt pavement and at locations beneath the adjacent streets and along the exposed shoreline bank areas. Trace amounts of LNAPL have also been observed on the groundwater in several of the monitoring wells at the T-117 Upland Area during certain tide levels. A sheen (< 0.01 ft thick) was reported in several studies in wells MW-2 (at high tide) and MW-7 (at low tide) (Windward et al. 2005d). However, the presence of non-aqueous-phase liquid (NAPL) at these wells appears to be transitory and dependent on tidal levels (suggesting a "residual saturation" condition in the soil rather than "mobile" NAPL in groundwater) and has not been observed in subsequent sampling. NAPL in contact with groundwater may contribute to dissolved-phase contamination in groundwater and to contamination of the soil within the depth interval in contact with the fluctuating water table.

The principal sources of contaminants in the adjacent LDW were historical upland process-related releases and spills that discharged directly to the waterway or were incorporated into upland/bank soil and subsequently transported into the waterway via runoff. This latter mode of transport may still be a concern for the T-117 EAA, particularly where bank soils are exposed, adjacent to the mudflat area. Groundwater migration is a potential pathway for chemicals to the river, as indicated by detections of PCBs in four shoreline wells (MW-02, MW-05, MW-06, and MW-08) during previous monitoring. Additional monitoring proposed as part of the EE/CA work plan (Appendices A and B) will be useful in continuing to evaluate groundwater as a potential transport mechanism.

Chemical sources also include those that may currently exist or were historically present within the RAAs. During Basin Oil operations, the company and affiliated firms received, stored, and processed used oil and antifreeze at the site (Creative Environmental Technologies 1996). Current available information suggests some of these products were released into the soil and may have come into contact with surface water runoff; it is unknown at this time what impact, if any, these releases have had on groundwater at the Basin Oil site. Potential contaminant migration pathways from the Basin Oil RAA include soil erosion and transport (via stormwater or as airborne particulates) and groundwater migration toward the river in the vicinity of the T-117 EAA.

Similar potential pathways exist for the Marina; contaminant transport pathways are primarily the erosion and transport of contaminated soil from the Marina onto the T-117 Upland area and cross-boundary groundwater migration toward the T-117 Upland area, depending on groundwater direction. The results of recent (and

recommended future) soil and groundwater investigation activities at the Basin Oil and Marina sites will be reviewed during the EE/CA to further assess potential chemical sources and migration pathways associated with these sites.

3.3.2 Transport mechanisms, exposure routes, and potential receptors

The following sections describe transport mechanisms, exposure routes, and potential receptors for chemicals present in the T-117 EAA. Unless otherwise noted, the discussion is presented in the context of the T-117 EAA in its entirety, rather than discrete subareas within the EAA.

Transport mechanisms for chemicals present in media include erosion of surface soil, stormwater infiltration, and leaching of contaminants from the soil column into groundwater and lateral migration of contaminated groundwater to adjacent LDW surface water and sediment. The erosion of surface soil, primarily along the exposed bank areas, and its resulting entrainment as fugitive dust in ambient air can result in inhalation exposures of construction workers and upland residents living in the vicinity of the T-117 EAA. Although believed to be a relatively minor transport mechanism, contaminated airborne particulates can also be deposited directly onto adjacent sediment and surface water. A more significant mode of transport for eroded soil is via stormwater runoff into the river, contaminating the mudflat or surface water. Lastly, contaminated groundwater beneath the site can convey dissolved-phase contaminants into the adjacent surface water and sediment through tidal exchange with the river and bank seepage.

Potential receptors associated with the T-117 EAA include part-time construction workers (e.g., utility workers), upland residents and employees (from adjacent homes and commercial properties), water recreators, fishers, shell fishers, and biota. The principal human exposure pathways were identified in Section 2.1.4 and were discussed in detail in Section 3.1. These pathways include direct contact with contaminated sediment or soil, ingestion of contaminated seafood, or incidental ingestion of contaminated sediment or soil.

Ecological receptors include both aquatic and terrestrial species, including benthic and soil-dwelling invertebrates, fish, birds, mammals, and plants. The exposure pathways for benthic or soil-dwelling invertebrates are direct and include ingestion or direct contact with contaminated sediment or soil. Porewater and surface water are also exposure pathways for benthic organisms. Exposure pathways for fish, birds, and mammals are both direct and indirect. Direct exposure pathways include incidental ingestion and direct contact with contaminated sediment or soil. Indirect exposure is primarily through the ingestion of marine or terrestrial organisms. The exposure pathways for plants are direct through contact or root uptake. Finally, aquatic biota may be exposed through direct contact with contaminated sediment and water to chemicals transported from the T-117 Upland Area to sediment.

3.3.3 Pathways of concern

3.3.3.1 Terminal 117 Early Action Area

In summary, principal contamination and exposure pathways of concern for the T-117 EAA include the following:

Contamination Migration Pathways

- **Erosion of exposed upland and bank soil to surface water and sediment via stormwater.** The bank at the T-117 area is currently heavily vegetated, which helps stabilize the soil and reduces erosion. Although erosion is limited, the potential for future erosion exists. Loose soil in the shoreline bank area can be entrained in stormwater runoff and conveyed to the river. Therefore, the direct erosion and transport of contaminated soil from the bank to the LDW is a potential pathway for contaminants to reach the river water and sediment.
- **Soil leaching to groundwater.** PCBs in soil are very immobile and tend to absorb strongly to organic matter in soil rather than dissolve into water. For low concentrations of PCBs in the aqueous phase, PCB transport is significantly retarded by the partitioning from water to soil (EPA 1990). However, PCBs and other hydrophobic chemicals may migrate in association with colloidal particles or as dissolved components in more mobile substances such as oil which have higher miscibility. PCBs and oil have been observed in soil in parts of T-117, so migration from soil to groundwater is a potential pathway.
- **Groundwater discharge to surface water and sediment.** The net discharge of shallow groundwater at T-117 is toward the LDW. Several active groundwater seeps are present at the base of the shoreline bank and flow out onto the intertidal mudflat. Because much of the shallow aquifer adjacent to the LDW is tidally influenced, some of this discharge is water that previously infiltrated into soils through the shoreline interface during the preceding high tide. Because previous groundwater monitoring has detected trace concentrations of COPCs, migration from groundwater to surface water is identified as a potential pathway.
- **Stormwater discharges to the LDW.** Stormwater discharges from the T-117 Upland were historically a means for dissolved contaminants and entrained contaminated solids to be conveyed to the LDW. However, since the 1990s, improvements to the T-117 Upland Area and Adjacent Streets and associated stormwater collection systems by the Port and City have significantly controlled this pathway. Run-on to the terminal area from the streets, and all runoff in the Adjacent Streets is collected and discharged to the city's storm sewer conveyances. The City plans to implement permanent drainage improvements after the completion of cleanup. Subsequent to the 2006 TCRA, the Port is required to inspect and maintain the terminal catch basins to control the accumulation and discharge of solids.

Exposure Pathways

- **Erosion of bank soil as fugitive dust in outdoor air.** The generation of fugitive dust is a potential concern in areas where there are exposed and contaminated surface soils. The majority of T-117 is paved. Areas of exposed soil on the upper bank have been covered with a geotextile fabric and layer of clean gravel to mitigate the potential for fugitive dust generation. There is the potential for exposure via inhalation by workers or nearby residents if fugitive dust is generated during construction activities.
- **Direct contact with soil.** Direct contact is a concern in areas where impacted soil is uncapped, such as in the bank, or where contaminated soil could become exposed during construction. Workers or residents in the T-117 EAA or vicinity could potentially come into direct contact with impacted soil. In the T-117 Upland Area and Adjacent Streets, Port and City workers as well as residents are currently protected from coming into direct contact with impacted soil because those portions of the T-117 EAA are paved. There is the potential for future direct contact if workers (e.g., utility workers) excavate into areas of contaminated soil beneath the pavement without proper controls.

3.3.3.2 Recontamination assessment areas

Basin Oil

Principal pathways of concern for chemical migration from the T-117 RAAs include the migration of potentially contaminated groundwater from the Basin Oil facility toward the Adjacent Streets and T-117 Upland Area. However, groundwater monitoring at the well located on the Basin Oil property and nearby wells located on theT-117 Upland Area that are in close proximity to soils with elevated concentrations of PCBs has not shown a consistent pattern of association between PCBs in soil and those in groundwater. These observations and the very low solubility of PCBs suggest that the presence of a groundwater transport pathway for PCBs from Basin Oil to the Adjacent Streets or T-117 upland is unlikely. However, in light of the operational history of Basin Oil, and the potential for TPH soil contamination there, the potential does appear to exist for off-site TPH migration in groundwater. Data are anticipated from the ongoing cleanup activities at Basin Oil that will likely provide more information.

For historical context, potential pathways related to historical operations and features at the Basin Oil site are summarized in the following paragraphs. Ecology (2005) described the control systems that were in place to prevent soil and groundwater contamination during Basin Oil operations. The tank storage areas on the northern and southern portions of the Basin Oil property were equipped with secondary containment systems; though, as noted earlier, there were concerns about the adequacy of these containment systems, and secondary containment was apparently

not always present on the southern portion. Water from the containment systems was collected and shipped offsite for disposal.

Runoff from the yard area outside containment on the north end of the Basin Oil property was routed to an oil/water separator and then discharged to Dallas Avenue S. During an inspection, Ecology (Stone 2000) noted concerns about the adequacy and maintenance of the separator. Runoff from the yard area outside containment on the south end of the property sheet flowed to the east and discharged to Dallas Avenue S. An oil/water separator at the southwest end of the property was plumbed to discharge onto 17th Avenue S may have been used to treat this water. The separated oil layer in the oil/water separators was skimmed off and processed as used oil.

The north half of the site was largely paved, but there were unpaved areas on the south half of the site. Activities conducted in the unpaved areas included storage and decommissioning of used USTs and ASTs and storage of vehicles, equipment, crushed oil filters, and bags of absorbents (Stone 2000).

During an Ecology site inspection, the property owner was questioned about a complaint by a former Basin Oil employee that oily wastes had been flushed down a toilet, and the property owner responded that this was a disgruntled, problem employee (Ecology 1993). This raises questions about the contents and integrity of the septic system, about which no other information is available in regulatory inspection reports.

Surface runoff from the Basin Oil site to the T-117 EAA is currently controlled as a result of recent temporary improvements to the surrounding streets. Future runoff from Basin Oil could be a transport mechanism of potential concern if site cleanup activities fail to adequately address surface contamination that may be present. In addition, potentially contaminated soil could be transported by vehicles exiting the property. However, the City plans to implement permanent drainage improvements to the adjacent streets post cleanup.

South Park Marina

Groundwater migration and soil erosion could be pathways for chemicals dissolved in groundwater and present in contaminated surface soil to migrate onto the T-117 upland area from the Marina. PCB concentrations detected in the soil samples in the vicinity of the southeast corner of the Marina are not sufficiently elevated to cause an exceedance of the MTCA Method A screening criteria for unrestricted residential land use should those soils erode and migrate to the T-117 EAA.

Three surface sediment samples (73-G, 74-G, 84-G) were collected along the area just offshore of the southern portion of the Marina property (see Map 2-5 and Section 2.3.6.2). All three samples had PCB concentrations that ranged well below the SQS for PCBs, indicating that PCBs from the Marina bank do not have a significant impact on the sediment below. Recent sampling activities conducted by SAIC included

groundwater monitoring, the results of which (when available) will likely help to characterize the groundwater to sediment pathway from the Marina to downgradient areas.

3.4 PRELIMINARY EAA BOUNDARY DEFINITION

3.4.1 Preliminary EAA boundary

The preliminary EAA boundary (Map 1-1) consists of an aquatic (sediment) portion upland (soil) portion. The preliminary T-117 EAA boundary encompasses the Sediment Study Area, the T-117 upland Area, and the Adjacent Streets. This EAA boundary is preliminary and subject to further review in the EE/CA. The details on how the preliminary EAA boundary was determined for each area of the EAA are provided below.

Sediment Study Area

The Sediment Study Area was originally determined in the summary of existing information and data gaps analysis report for the T-117 EAA (Windward et al. 2003). The original Sediment Study Area boundary was based on incorporating all of the sediment in the aquatic portion of the T-117 EAA in front of the T-117 Upland Area out to the navigation channel, except for the portion of the Marina that extends into the T-117 aquatic portion. In this EE/CA work plan, the northern and southern limits of the Sediment Study Area boundary have been expanded to include sample locations where concentrations of COPCs in the sediment may potentially be associated with the T-117 EAA.

T-117 Upland Area

The T-117 upland Area boundary is the T-117 upland property boundary. The soil removal boundary(s) within the property boundary will be identified through an evaluation of soil sampling results compared to screening criteria in the EE/CA.

Adjacent Streets

The Adjacent Streets boundary was determined by comparing soil concentrations of preliminary COPCs that exceeded MTCA screening criteria for unrestricted land use. The Adjacent Streets boundary was delineated based on an evaluation of over 300 soil, street dust, and catch basin samples collected throughout the streets ROW and neighborhood yards in the vicinity of the T-117 Upland Area.

3.4.2 Preliminary sediment removal boundary

A preliminary sediment removal boundary (shown by a dashed line on Map 1-1) is located within the Sediment Study Area boundary. The preliminary sediment removal boundary was originally defined in the previous EE/CA (Windward et al. 2005) by comparing the sediment chemical concentrations within the Sediment Study Area

with SMS criteria. The following were considered in determining the preliminary sediment removal boundary:

- Results of 182 samples within the sediment study area boundary
- Inclusion of surface sediment PCB concentrations above the CSL (65 mg/kg OC)], which have a greater potential for adverse effects on biological resources, thus requiring an evaluation of cleanup alternatives as defined by SMS
- Sediment outside of the preliminary removal boundary, to the navigation channel line and up to 300 ft north and south of the boundary, has an average PCB concentration of 8.4 mg/kg OC, which is below the SQS criteria for PCBs (12 mg/kg OC)
- An observed spatial trend, in which PCB concentrations are higher near the shoreline and gradually decrease with distance from the shoreline
- Inclusion of Marina sediments that do not meet Puget Sound Dredged Disposal Analysis (PSDDA) guidelines of the Dredged Material Management Program (DMMP) for the open-water disposal of PCBs

Sediment quality within the sediment study area boundary will be further evaluated in the EE/CA as described below.

3.4.3 Approach to finalizing the sediment removal boundary

The location of the preliminary sediment removal boundary will be re-examined during the EE/CA in conjunction with the final removal action objectives (RAOs) for the site as a means of defining the final NTCRA removal boundary for the entire T-117 EAA. The final NTCRA removal boundary will be decided when the EPA signs an action memorandum following approval of the EE/CA.

Specific factors to be considered in the EE/CA include:

- COPC concentrations in sediment that exceed SMS
- Preliminary RAOs as defined for the LDW RI/FS
- Implementation requirements of the selected removal technologies and alternatives evaluated in the EE/CA

4 Identification of Removal Action Goals and Objectives, Regulatory Requirements, and Guidance

4.1 REMOVAL ACTION SCOPE

The anticipated removal action will address contamination within the limits of the T-117 EAA. The scope will include removal of soil in the T-117 Upland Area and the Adjacent Streets and removal of sediment or a combination of removal and capping in the Sediment Study Area within the final removal boundaries. The removal action will also include site restoration elements such as backfilling, street paving, drainage, and final grading. The scope of the EE/CA also includes an assessment of recontamination potential from adjacent properties, as described in Section 8 of this work plan. If recontamination potential from Basin Oil or the Marina is identified, control of the sources by the respective property owners may be necessary prior to the commencement of the T-117 EAA NTCRA.

4.2 REMOVAL ACTION GOALS, OBJECTIVES AND SITE USE CONSIDERATIONS FOR THE T-117 EAA

The removal action goal for the T-117 EAA NTCRA specifies what is to be achieved by the removal action by addressing risks or by controlling or eliminating specific exposure pathways. The objectives are specific measures that meet the action goal and future site-specific CULs while meeting the statutory limits and ARARs to the extent practicable (EPA 1993). The T-117 EAA consists of both aquatic and upland portions; therefore, the removal action goals, objectives, and cleanup criteria are determined, to some degree, by the types of environments and contaminant conditions encountered in each portion of the T-117 EAA.

The goal of the removal action for the T-117 EAA upland portion was set forth by EPA in their assessment of reasonably anticipated future land use (Appendix E). The goal of the removal action for the T-117 sediments is to reduce exposure to ecological and human receptors and thereby reduce or eliminate adverse effects on biological resources in the T-117 EAA, as set forth in the ASAOC. EPA's assessment also directs the Port and City to develop removal alternatives that are consistent with these goals and thus provide a site that is suitable for a range of final site uses, not just those limited to industrial activities. EPA's assessment concludes that reasonably anticipated future land uses could include a variety of non-industrial uses, including river and/or shoreline habitat, public access, recreational amenities or commercial facilities, in addition to potential future uses retaining industrial activities. The Port is examining habitat restoration alternatives for portions of the T-117 EAA and will be evaluating those alternatives in the context of potential arrangements related to natural resource damage settlements or settlement credit banking. The EE/CA will be coordinated with that process to ensure that the EE/CA includes one or more alternatives that are compatible with habitat restoration.

The following RAOs are recommended by EPA for the T-117 EAA removal action as a means of meeting the stated goals:

- Reduce contaminant concentrations in surface sediment (biologically active zone, 0 to 10 cm) within the removal boundary to below the SQS for PCBs (12 mg/kg OC).
- Ensure that any remaining bank and upland soil contamination at the T-117 EAA will not be released into the waterway and result in unacceptable human and ecological exposures.
- Ensure that any contaminant concentrations in upland soils within the T-117 removal boundary are protective of human health and the environment for current and reasonably anticipated future land use.
- Ensure that NTCRA measures are effective for the long term (i.e., are not influenced by erosion) and are consistent with long-term cleanup objectives for the LDW.
- Reduce contaminant concentrations in T-117 upland Area and adjacent street soil to allow unrestricted site use.
- Prevent or reduce the potential for the migration of contaminants to the LDW at concentrations that may cause exceedances of SMS criteria for COPCs.
- Complete cleanup and site restoration in accordance with applicable federal, state, and local regulatory requirements and guidance.

4.3 RECONTAMINATION ASSESSMENT GOALS AND OBJECTIVES

The goals of the recontamination assessment are to:

- Increase the likelihood of the permanence of the NTCRA
- Minimize the potential for recontamination of soil, groundwater, and sediment that could result from the influx of COPCs from adjacent properties where they may be present because of historical or ongoing site operations or conditions

The recontamination assessment will evaluate potential offsite upland sources within the RAAs and the potential pathways for contaminants from those sources to be conveyed to the T-117 EAA. These goals will be reiterated in the EE/CA and will serve as criteria for evaluating the adequacy of the recontamination assessment outlined in Section 8.

4.4 PRELIMINARY REVIEW AND ANALYSIS OF REGULATORY REQUIREMENTS AND GUIDANCE

Potential regulatory requirements and guidance for removal activities within the LDW were identified in the Phase 1 RI (Windward 2003a). Most of these are relevant to the preliminary removal alternatives for sediments identified in this work plan and the

detailed evaluation of alternatives to be included in the EE/CA. A preliminary review and analysis of these requirements is provided below for selected regulations, including CERCLA, TSCA, MTCA, and SMS. The applicability of these regulations, as well as other regulatory requirements and guidance will be evaluated in further detail in consultation with EPA during the preparation of the EE/CA. The approach for further identifying and describing ARARs for the T-117 removal action alternatives is discussed in Section 4.3.

Table 4-1 presents a preliminary list of potential regulatory requirements that have been identified for the T-117 EAA. Details of some of the more comprehensive federal and state regulations (i.e., CERCLA, TSCA and MTCA) follow Table 4-1.

Table 4-1. Regulatory requirements that may be applicable or relevant and appropriate to the T-117 EAA

SOURCE	REQUIREMENT
Washington State Model Toxics Control Act (WAC 173-340-440)	These regulations are applicable for setting soil and groundwater cleanup levels and establishing institutional controls that may be required for certain cleanup actions.
Federal Water Pollution Control Act/ Clean Water Act (33 USC 1251-1376; 40 CFR 100-149)	Establishes the basic structure for regulating discharges of pollutants into the waters of the United States. Section 404 regulates the discharge of dredged material or fill into navigable waters. Section 401 requires water quality certification for such activities.
Washington State Water Quality Standards for Surface Waters (WAC 173-201A)	Standards for the protection of surface water quality have been established in Washington State. Acute marine criteria are anticipated to be applicable requirement for discharge to marine surface water during sediment dredging.
Washington State Sediment Management Standards (WAC 173-204)	Chemical concentration and biological effects standards are established for Puget Sound sediments and are applicable to both alternatives.
Construction in State Waters, Hydraulic Code Rules (RCW 75.20; WAC 220-110)	Hydraulic project approval and associated requirements for construction projects in state waters have been established for the protection of fish and shellfish.
Toxic Substances Control Act (TSCA) (40 CFR 761)	This regulation pertains to the upland remediation of PCB waste.
Federal Endangered Species Act of 1973 (16 USC 1531 et seq.; 50 CFR 200; 50 CFR 402)	This regulation is applicable to any actions performed at this site because this area is potential habitat for threatened and/or endangered species. A biological assessment will be conducted in conjunction with the removal design documents in consultation with NMFS and USFWS. The removal action will comply with the substantive requirements of the act by implementing BMPs for the protection of fish and shellfish, as recommended by NMFS and USFWS.
Essential Fish Habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act (50 CFR 600)	Identifies and protects important habitats of federally managed marine and anadromous fish species in consultation with NMFS regarding the potential effects of the action on EFH.
US Fish and Wildlife Coordination Act (16 USC 661-667(e))	Prohibits water pollution with any substance deleterious to fish, plant life, or bird life. USFWS and appropriate state agencies will be consulted to ascertain the means and measures necessary to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources.
Migratory Bird Treaty Act (16 USC 703-712)	Governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests.

SOURCE	REQUIREMENT
Rivers and Harbors Appropriations Act (33 USC 403; 33 CFR 322)	Section 10 of this act establishes permit requirements for activities that may obstruct or alter a navigable waterway. Activities that could impede navigation and commerce are prohibited. These substantive permit requirements are anticipated to be applicable to actions such as dredging, which may affect the navigable portions of the waterway.
Solid Waste Handling Standards (WAC 173-350)	Applicable to the disposal of non-hazardous waste generated during removal activities. These standards set minimum functional performance standards for the proper handling and disposal of solid waste, identify functions necessary to ensure effective solid waste handling programs at both the state and local level, and follow priorities for the management of solid waste as set by the legislature in RCW 70.95, Solid Waste Management – Reduction and Recycling.
Washington Dangerous Waste Regulations (WAC 173-303)	The state RCRA program regulations, which operate in lieu of the federal RCRA program in Washington, contain a series of rules that are applicable to the generation, handling, storage, and disposal of dangerous waste.
Native American Graves Protection and Repatriation Act (25 USC 3001 et seq; 43 CFR Part 10)	Excavation must cease if Native American burials or cultural items are inadvertently discovered.
American Indian Religious Freedom Act (42 USC 1996 et seq.)	Work must stop if sacred religious sites are discovered.
National Historic Preservation Act (16 USC 470(f); 36 CFR Parts 60, 63, and 800)	The removal action must be evaluated to avoid, minimize, or mitigate the impact on historic sites or structures, if discovered.
Archaeological Resources Protection Act (16 USC 470 et seq; 43 CFR Part 7)	Removal of archaeological resources is prohibited without a permit.
Shorelines Management (KCC Title 25)	Regulates all building, excavation, dredging, and filling within 200 ft of regulated shorelines. Any illegal fill placed after 1972 must be removed.
Critical Areas (KCC Title 21A.24)	State law (Growth Management Act) requires local governments to develop regulations to protect critical areas, but the content of these regulations is left to local government discretion, and these ordinances are not subject to state approval. These will be addressed as "To Be Considered" for CERCLA purposes.

BMP – best management practice

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act

CFR – Code of Federal Regulations

EFH – essential fish habitat

KCC – King County Code

NMFS – National Marine Fisheries Service

PCB – polychlorinated biphenyl

RCRA – Resource Conservation and Recovery Act

RCW – Revised Code of Washington

TSCA – Toxic Substances Control Act

USC – US Code

USFWS – US Fish and Wildlife Service

WAC – Washington Administrative Code

Additional potential ARARs and related requirements include:

- Washington Solid Waste Management Act (RCW 70.95)
- Washington State Shoreline Management Act (RCW 90.58)
- RCRA (40 CFR 260-268)
- NPDES Construction Stormwater General Permit (RCW 90.48; WAC 173-201A)

- Executive Order for Floodplain Management (Executive Order 11988; 40 CFR Part 6, App. A)
- Federal Emergency Management Agency (FEMA) National Flood Insurance Program Regulations (44CFR 60.3 (d)(3))

4.4.1 CERCLA requirements and guidance

The NTCRA for the T-117 EAA will be conducted under CERCLA, 42 U.S.C. §§ 9601 et seq. (as amended). CERCLA Section 121 (d) requires that a cleanup: 1) be protective and, 2) if any hazardous substance will remain on the site, attain a CUL that complies with any ARAR. The NTCRA will also follow the requirements of the following EPA documents:

- **Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA (OSWER Directive 9360.0-32) (EPA 1993) –** The guidance describes the essential components of the NTCRA process with particular emphasis placed on conducting the EE/CA. The document sets forth the format for the EE/CA and also provides general guidance on other activities that may be required as part of the NTCRA, such as enforcement, public involvement, and action memorandum preparation by EPA.
- **Reasonably Anticipated Future Land Use at T-117 Early Action Area, Lower Duwamish Waterway Superfund Site, Seattle, Washington (EPA 2007a) –** This letter was issued by EPA Region 10 to clarify the agency's expectations regarding reasonably anticipated future land use at the T-117 EAA as it relates to future removal action decision-making and to set forth the removal action goals and objectives (discussed in Section 4.2). The letter states that although current T-117 land use and zoning is industrial, EPA believes that it is no longer reasonable to conclude that T-117 land use will be restricted to industrial uses. EPA thus concluded that unrestricted land use CULs such as those defined under the relevant sections of MTCA and other ARARs must be considered in the development of removal alternatives.

4.4.2 Requirements and guidance under MTCA, TSCA, and SMS

In addition to CERCLA, the development of remedial action objectives and removal alternatives for the site requires consideration of regulatory requirements established for cleanup in the State of Washington as defined under MTCA (WAC 173- 340). Because PCBs are the primary COPCs at the site, federal regulatory requirements defined under TSCA (40 CFR 761) are applicable. The SMS (WAC 173-204) also govern the development of CULs for LDW sediment.

MTCA governs the investigation and cleanup of hazardous waste sites in the State of Washington. The law sets forth the cleanup process by establishing stringent cleanup standards and providing flexibility to allow cleanups to be addressed on a site-specific basis.

MTCA defines three methods for establishing screening criteria that are relevant for T-117 soil and groundwater:

- Method A provides tables of CULs that are protective of human health for common hazardous substances found in soil and groundwater at sites with few hazardous substances. CULs must be at least as stringent as concentrations established under applicable state or federal laws. Method A criteria have been developed for both unrestricted land use and industrial properties.
- Method B criteria are risk-based levels for unrestricted land use. This method is applicable to all hazardous waste sites.
- Method C criteria are less-stringent, risk-based criteria used primarily for industrial properties, as defined by Ecology [WAC 173-340-200 and 745(1)]. The T-117 EAA does not meet the MTCA definition of an industrial property, so CULs established based on Methods A and B for unrestricted land use are likely to apply.

TSCA (40 CFR 761) governs the manufacture, processing, distribution in commerce, use, disposal, storage, and marking of PCBs and PCB items. There are two mechanisms for establishing CULs for PCB remediation wastes: 1) self-implementing onsite cleanup and disposal and 2) risk-based disposal. The self-implementing rule specifies CULs differently for high occupancy areas, such as residences, and low occupancy areas, such as electrical substations. The soil CULs for PCBs at the T-117 EAA were established consistent with the TSCA CUL for high-occupancy areas.

The SMS include numeric chemical standards for contaminants in sediment. Contaminant concentrations need to be at or below the SQS, and this may be achieved by either sediment removal (e.g., excavation, dredging) or capping.

4.5 ARARs Approach

The removal action to be identified and recommended in the EE/CA and implemented under CERCLA authority and final RAOs for the site must comply with state and federal ARARs and local regulations to the extent practicable given the site conditions and scope of the removal action (40 CFR 300.415(i)). The final listing, discussion and detailed evaluation of ARARs pertinent to the T-117 removal action will be based on the preliminary listings presented in Section 4.4 and refined as the RAOs and scope of the removal action are refined in the EE/CA. The final ARARs will be applied in the selection of the preferred alternative.

5 Approach to the Selection of Removal Action Alternatives

5.1 IDENTIFICATION OF REMOVAL ACTION TECHNOLOGIES

Removal action alternatives in the T-117 EAA will address all areas (i.e., Sediment Study Area, T-117 Upland Area, and the Adjacent Streets) and will therefore include technologies necessary to address submerged and intertidal sediment, as well as upland soil. At this stage, it is appropriate to include a preliminary discussion of removal technologies (i.e., excavation and dredging) and sediment capping. This section also provides a listing of candidate waste disposal and treatment options to set the stage for the further development and evaluation of removal action alternatives in the EE/CA. This section concludes with a description of the work plan tasks that will be performed during the preparation of the EE/CA to:

- Further develop any additions to the preliminary alternatives identified in this work plan
- Perform the comparative analysis of removal alternatives
- Select one recommended removal action alternative

All alternatives will include preparation of the site for the selected removal action. Examples of these activities include aboveground structural demolition, asphalt removal, well abandonment, site security, soil/sediment staging areas, water management systems and other needed support facilities. A discussion of these adjunct technologies will be included in the final EE/CA.

Actions in the T-117 Upland Area will consist primarily of soil removal (i.e., excavation) for the purpose of subsequent treatment and/or disposal. Upland or "land-based" removal technologies are well known and proven and are discussed further in this section. Upland removal technologies can also be used as a means for excavating contaminated sediment using equipment positioned on the upland portion of the site and working during low tide. This can be an efficient approach when used in conjunction with procedures and safeguards to prevent excessive turbidity in the river during the removal work.

Over-water technologies for addressing intertidal and subtidal sediment include dredging and capping. Sediment caps can be applied offshore of the site through either placement from land (i.e., during low tides) or placement offshore using floating equipment.

5.1.1 Land-based technologies

The primary land-based removal technology under consideration for the T-117 EAA is excavation. Excavation has already been used as the principal means for removing upland soil in the T-117 Upland Area and Adjacent Streets and is also a viable method

for addressing near-shore sediment requiring cleanup. Equipment typically used to accomplish excavation includes backhoes, front-end loaders and dump trucks. Secondary (supporting) technologies include shoring (for deeper excavations and excavations close to structures), soil containers and staging areas, dust control systems, excavation dewatering and water storage and treatment equipment. Contaminated soil or sediment can be excavated, placed in properly lined trucks, and transported to selected treatment or disposal facilities. Truck wash and inspection systems would be required to control the potential for soil track-out during the excavation work. Excavation and the supporting technologies have been successfully applied during previous removal actions and are proven removal methods for this site.

5.1.2 Over-water technologies

Over-water technologies for addressing contaminated sediment at the T-117 EAA include dredging and capping. Both technologies have been applied elsewhere within the LDW and have been proven to be feasible methods for removing or containing contaminated sediment.

5.1.2.1 Sediment dredging

As mentioned previously, upland removal technologies may also be used as a means for removing contaminated sediment from the intertidal mudflat. This approach could be used to remove the most impacted sediment while working from the upland, without significant exposure of the water column to excessive turbidity because excavation would be conducted during low tides. With this approach, only the less-impacted subtidal sediment would need to be addressed by conventional over-water dredging methods.

For subtidal sediment, both mechanical and hydraulic dredging methods are candidate technologies. Mechanical dredging involves lowering a bucket or clamshell to the bottom, excavating the target material, and then lifting the bucket to the surface. The dredged material is placed onto a barge for transport to a placement or offloading site. Some dredges, known as environmental bucket dredges are equipped with specially designed buckets to minimize outflow of contaminated solids during the dredging process. This type of dredge will also be considered as the removal alternatives are more fully developed and evaluated in the EE/CA.

The hydraulic dredging process involves loosening the target material from the bed with some form of agitation equipment, mixing the loosened material with water to form a slurry, and then transporting the slurry to a placement or process site via either a pipeline (pipeline dredge) or via a storage hopper in the hull of the dredge (hopper dredge). Potential dredging methods and equipment will be further discussed and evaluated in the EE/CA.

5.1.2.2 Sediment capping

Sediment capping could be completed using either upland earthmoving equipment or conventional placement from offshore floating equipment. Capping of the shoreline bank and intertidal mudflat sediment could be completed with upland-based earthmoving equipment (e.g., excavators, front-end loaders, and dump trucks). Clean capping material could be imported to the site in dump trucks or on barges and then placed as engineered fill. The cap would be designed to resist disturbance and re-exposure of the capped materials.

Alternately, capping of subtidal sediment could be completed with floating equipment similar to that used for mechanical dredging. The dredge would use a bucket to collect capping material from a haul barge and place the material on the bed of the waterway. A typical cap design includes a subtidal cap consisting of three layers: a sandy material to provide primary physical and chemical containment of the impacted sediment, an armor layer to protect against erosion, and a surface layer of natural sand and gravel. Capping designs may also include an additional layer, such as a sorbent material (e.g., activated carbon), which can enhance cap performance (via chemical absorption). Potential cap designs and specific structural components will be further discussed and evaluated in the EE/CA and/or incorporated at the removal design stage, if needed and appropriate.

5.1.3 Material disposal and treatment

The EE/CA will also examine and recommend waste management technologies for excavated or dredged soil and sediment. For soil, the EE/CA will include an examination of established technologies, including:

- Soil or sediment washing and separation
- Physical separation methods
- Solidification
- Thermal technologies (incineration, high-temperature thermal desorption, and low-temperature thermal desorption)
- Offsite disposal (Subtitle C or D landfills)

Secondary supporting technologies including dewatering, wastewater treatment and transportation will also be considered.

The identification and development of disposal and treatment technologies for sediment in the EE/CA will also take into account the broader range of technologies identified by LDWG in the draft candidate technologies memorandum (RETEC 2005). These sources identify several disposal and treatment technologies that are considered potentially applicable, with particular emphasis on their applicability to remedial actions specific to for the LDW. The EE/CA will focus on demonstrated technologies

appropriate for the size, timeframe, and site-specific conditions of the T-117 EAA and the selected removal alternative.

Each technology will be evaluated in the EE/CA for its applicability to the T-117 removal action. The evaluation will include consideration of expected soil and sediment quantities associated with each removal alternative; physical characteristics; estimated contaminant concentrations and suitable staging/transfer areas for storing, treating, and loading excavated or dredged materials. Technologies will be evaluated and selected based on their estimated effectiveness, implementability, and cost, as well as any input received during the EE/CA public review process.

5.2 IDENTIFICATION AND ANALYSIS OF PRELIMINARY REMOVAL ACTION ALTERNATIVES

A final list of candidate technologies will be presented in the final EE/CA and used to review and supplement the removal action alternatives. This review process will ensure that:

- All viable alternatives are included and represented in the comparative analysis to be performed in the EE/CA
- All alternatives are sufficiently robust and inclusive of all removal activities, including water management requirements and excavated soil/sediment management options

The preliminary alternatives will be reviewed to ensure they provide as broad a range of removal actions as possible given the specific RAOs for the T-117 EAA mandated by EPA (EPA 2007a). They will also be re-examined in the EE/CA to ensure that they are revised based on any new information that is obtained relative to the data gaps assessment, appropriate for the nature and extent of contamination known to exist at the T-117 EAA and RAAs, and applicable to the T-117 removal action. Treatability studies are not anticipated to be part of the EE/CA process at this time and thus are not included in this work plan. Only the most qualified technologies for treatment and disposal of removed soil or sediment will be included in the final alternatives in the EE/CA. Presumptive remedies are not applicable to this type of site.

5.3 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

The evaluation criteria described in NTCRA guidance (EPA 1993) will be applied as a means of comparing the final removal action alternatives in the EE/CA. The three broad criteria and associated subcriteria listed in the EPA guidance are:

- **Effectiveness –** Protectiveness of public health and the community, workers, and the environment and compliance with ARARs (i.e., the ability to achieve removal objectives, including the level of treatment/containment expected, with no concerns regarding residual effects)

- **Implementability –** Technical feasibility, availability of equipment and personnel, and administrative feasibility
- **Cost –** Including capital, post-removal site control, and present-worth costs

The EE/CA will include a discussion of how the proposed removal action addresses each of these requirements.

5.4 SELECTION OF RECOMMENDED REMOVAL ACTION ALTERNATIVE

The recommended removal action alternative will be described in detail in the EE/CA and will include site diagrams and cross sections to show where specific removal and/or treatment technologies will be applied within each of the T-117 EAA areas (Sediment Study Area, T-117 Upland Area, and Adjacent Streets). The EE/CA will also describe potential environmental impacts during construction and BMPs that could be implemented during construction to minimize the potential for environmental impacts, particularly to the adjacent residential areas, roadways, and the river.

6 Preliminary Removal Action Alternatives

This section presents a preview of three preliminary NTCRA alternatives (Table 6-1). Table 6-1 is intended to serve only as a starting point and uses information developed during the previous T-117 EE/CA (Windward et al. 2005) and the FS for the adjacent city streets (Integral 2006). Examples of site-wide removal action alternatives include the comparative "no-action" baseline alternative and two "action" alternatives, which will include the range of final site uses discussed in Section 4.2. The two action alternatives consist of assembled removal action technologies designed to address contaminated soil and sediment volumes within each T-117 EAA portion and to meet the identified CULs at specified points of compliance. A more comprehensive and complete list of alternatives for the T-117 EAA will be assembled and evaluated in the EE/CA.

Table 6-1. Identification of preliminary site-wide removal action alternatives

Alternative	Extent of Action and Action Goals Based on Preliminary RAOs		
	Sediment Study Area	T-117 Upland Area	Adjacent Streets
1. No action.	No action.	No action.	No action.
2. Upland soil excavation; bank/sediment excavation and dredging combined with capping	Combined excavation and capping with limited dredging to meet SMS criteria in surface sediment. Finish allowing for a variety of possible future site uses.	Unrestricted site use conditions and associated cleanup level met based on MTCA as ARAR.[a] Finish allowing for variety of possible future site uses.	Unrestricted site use conditions and associated cleanup level met based on MTCA as ARAR.[a] Finish allowing for variety of possible future site uses.
3. Upland soil excavation; bank/sediment Excavation and dredging (no capping)	Excavation and dredging to remove surface sediment concentrations exceeding SMS criteria. Finish allowing for a variety potential future site uses.	Same as Alternative 2.	Same as Alternative 2.

[a] According to MTCA unrestricted site use conditions, "Restrictions on the use of the site or natural resources affected by releases of hazardous substances from the site are not required to ensure continued protection of human health and the environment" (WAC 173-340-200).The point of compliance is typically throughout the site to a depth of 15 ft (WAC 173-340-740(6)). MTCA CULs are specific to each contaminant and are derived using default or site-specific assumptions as set forth for soil under WAC 173-340-740 (i.e., the Method A default CUL for total PCBs in soil for unrestricted land use is 1.0 mg/kg).

ARAR – applicable or relevant and appropriate requirement

MTCA – Model Toxics Control Act

SMS – Washington State Sediment Management Standards

T-117 – Terminal 117

7 Data Gaps Assessment

The data gaps assessment is necessary to evaluate the adequacy of the existing data for the development and selection of the removal action alternative in the EE/CA and the assessment of recontamination pathways to the T-117 EAA. Therefore, this assessment considers existing data for sediment, soil, and groundwater within the T-117 EAA, as well as information available for the RAAs (Basin Oil and the Marina). Data gaps are identified through an analysis of existing data and an evaluation of the CSM. The results of the data gaps assessment provide a basis for the planning and collection of additional samples, as needed.

Section 3.3 presented the CSM for the T-117 EAA, including a description of sources and potential pathways of concern. Pathways and potential sources at T-117 have also been examined by Ecology as part of the source control action plan for the LDW (Ecology 2005). Ecology concluded that the principal ongoing pathway of contaminants to the T-117 EAA (then limited to the T-117 Upland Area) was from direct erosion of PCB-contaminated soil to LDW sediment. Historical uncontrolled stormwater discharges and releases were also identified as important transport mechanisms, although as described in Ecology's action plan, these were subsequently controlled through drainage improvements at the terminal and in the Adjacent Streets. Ecology also concluded that based on the results of samples collected from monitoring wells and seeps at the site, groundwater or shoreline seeps did not appear to be transport pathways for COPCs. However, subsequent (i.e., since the publication of the action plan) groundwater monitoring has detected trace concentrations of COPCs, and groundwater is now included as a potential pathway.

The following sections discuss data gaps and needs for soil, sediment or groundwater as applicable for each subarea within the T-117 EAA, as well as the two RAAs (Basin Oil and the Marina).

7.1 EARLY ACTION AREA

Extensive sampling has been conducted throughout the T-117 EAA to characterize the nature and extent and evaluate potential sources of contamination. Sufficient sediment and soil data have been collected to conduct the EE/CA. No additional data gaps have been identified for the Sediment Study Area, or the Adjacent Streets portions of the EAA. However, in the T-117 Upland Area, there may be insufficient data to define the depth of contamination in the soil relative to the RAOs. There is also a lack of data representing the soil underneath the north building. These data gaps do not need to be addressed to conduct the EE/CA but will be addressed during the design phase of the NTCRA or with post-excavation confirmational sampling.

Information on RAA soil and groundwater conditions is the only recontamination assessment data gap identified at this time and will be evaluated in the EE/CA once

additional data from these areas is available. There is no current comprehensive information about groundwater quality at the west side (i.e., upgradient of the T-117 Upland Area. The groundwater data gap is being addressed via the interim groundwater monitoring program described in this work plan and accompanying groundwater monitoring plan (Appendix A). Groundwater will continue to be evaluated as part of the NTCRA post-remediation monitoring to ensure that the groundwater pathway has been sufficiently addressed.

7.1.1 Sediment Study Area

No data gaps have been identified for the Sediment Study Area. The data gaps for the Sediment Study Area were previously examined in the data gaps report (Windward et al. 2003). These data gaps involved the nature and extent of contamination and information needed for engineering design and source control. Since 2003, several investigations have been conducted to determine the nature and extent of sediment contamination (as summarized in Sections 2.2 and 2.3). These investigations are considered sufficient to characterize the surface and subsurface sediment within the Sediment Study Area to determine a removal boundary.

7.1.1.1 Removal boundary evaluation

The preliminary sediment removal boundary that defines the T-117 EAA was developed using a weight-of-evidence approach, which was first set forth in the 2005 EE/CA (Windward et al. 2005c), including a comparison of chemical concentrations with SMS numerical criteria for SQS and CSLs (WAC 173-204). Although these criteria provide a basis for identifying the preliminary areal extent of sediments that may pose a risk to ecological receptors, they will continue to be examined in the EE/CA to ensure they are the appropriate criteria for identifying sediments that may pose unacceptable risks. The existing dataset is sufficient to support this ongoing evaluation. Sediments that are adjacent to but not contained within the preliminary boundary will continue to be evaluated for risks to both human health and other ecological receptors through the LDW RI/FS human health and ecological baseline risk assessment processes. Results of that ongoing assessment process will be monitored during the development of the EE/CA to help ensure that the objectives of the removal action remain consistent. If minor additional sediment sampling is required, it can be performed prior to the design of the removal action.

In addition to delineating the areal extent of contamination, previous investigations also include the engineering data necessary to determine the vertical extent of PCB-contaminated soil along the shoreline of T-117 and define the general physical characteristics of the shoreline soil to assess the structural conditions and constructability of various removal actions.

7.1.1.2 Recontamination evaluation

Evaluations have also been conducted to examine chemical pathways from the T-117 Upland Area to the river. Potential pathways for sediment contamination from upland sources identified for the T-117 EAA (Windward et al. 2003) included:

- Groundwater discharges, including shoreline seeps
- Stormwater drain sediment (catch basins and drainage ditch)
- Direct erosion of contaminated shoreline bank materials

The groundwater pathway to the Sediment Study Area has been evaluated. Groundwater from T-117 Upland Area monitoring wells and intertidal seeps have been sampled, and the results are presented in Section 2.3.4 of this work plan. Existing data indicate that groundwater contaminants are present at low concentrations. The potential for groundwater to be a transport pathway to sediment will be further evaluated once additional data are available. Groundwater will continue to be evaluated and monitored as a potential source of recontamination to sediment before and after the NTCRA. The details of the groundwater monitoring program are presented in Appendix A.

Storm drains as a potential pathway to the Sediment Study Area have been evaluated. Catch basin solids and soils accumulated around catch basin openings were sampled and analyzed for PCBs. All T-117 catch basins were cleaned prior to the 2006 TCRA, and the City is continuing to evaluate the quality of the material in the City stormwater conveyance system. Interim actions already conducted by the City in the ROW and the cleanup action from this NTCRA are expected to address the potential for recontamination from stormwater conveyances. Groundwater infiltration into buried storm drain pipes is not considered a pathway for the EAA. Storm drain lines in the T-117 Upland Area are all well above the water table, and the recently installed storm drains in the street ROW were constructed to prevent infiltration.

Contaminated solids in the stormwater drainage system are not likely to be a source of recontamination because they originated from historical sources and are routinely removed as part of the site maintenance requirements established since the implementation of the TCRA (RETEC 2007a). Although cleaning and interim actions have significantly reduced storm drain solids as a potential source of future sediment recontamination, this source will need to be re-examined through additional sampling of re-accumulated solids. Any solids remaining in the interconnecting drain and outfall lines will be removed during the removal action. No additional sampling of the storm drains will be necessary for the purpose of the NTCRA.

The erosion of materials in the shoreline bank and the drainage ditch along at the south side of the T-117 Upland Area is a potential mechanism for the transport of chemicals to the Sediment Study Area. This contaminant source and potential transport mechanisms (surface runoff/airborne particulates) must be addressed as part of the selected removal action alternative. Existing data for these areas are

sufficient to characterize this potential source of contaminants, identify the need for removal action, and specify those removal actions in the EE/CA.

7.1.2 T-117 Upland Area

For the T-117 Upland Area, there are potential data gaps regarding the overall depth of soil contamination and a lack of data representing the soil underneath the north building, which are described in detail below.

As discussed in Section 2.3.2, the upland soils have been well characterized. PCB samples have been collected at 510 locations; this number is sufficient to approximate areas and depths of contamination. Post-excavation confirmation sampling will be conducted to address any areas of uncertainty. The sampling density averages one sampling location for every 280 ft^2 (smaller than a 20-by-20-ft grid). The sampling density in the least-sampled section of the site, Subarea D, is one sampling location per 1,600 ft^2. (Two new monitoring wells will be installed in Subarea D.) An important RAO for the T-117 EAA preliminary removal action is the cleanup of soil to meet the State's criteria for unrestricted site use as defined under MTCA, typically in the range of 1 mg/kg for PCBs. For the purpose of the data gap assessment, sampling locations that were defined by a 1-mg/kg PCB concentration depth limit were identified. An analysis of the existing dataset reveals that for 76 sampling locations, there are no analytical results that define the depth at which the PCB concentration is $\leq$ 1 mg/kg. This is not unexpected inasmuch as this was not an objective of the previous sampling activities. Table 7-1 lists these samples and provides their locations with respect to other sampling locations. Of the 76 sampling locations without a defined 1-mg/kg PCB depth limit, 69 locations are within 41 ft of other locations where a 1-mg/kg PCB depth limit has been established. Another seven locations were within 30 ft of locations where a < 1-mg/kg PCB concentration was detected at the same depth.

Only three sampling locations (T-117 D11, T-117 E1, and T-117 E3 are not within 36 ft of another sampling location where a ≤ 1 mg/kg PCB concentration was found at a similar or deeper interval (Maps 9a and 9b). In sample T-117-D11, there was a high PCB concentration (4,200 mg/kg) in the upper 2.5 ft bgs, although the PCB concentrations at 2.5 to 11.5 ft bgs were less than 5 mg/kg. At 12.5 to 14 ft bgs, the concentration jumped to 28 mg/kg (average of the original and duplicate sample). This is an unusual pattern given that PCBs are generally insoluble in water and tend to migrate vertically in the soil column with concentrations attenuating at depth. A somewhat similar pattern was noted in T-117-E1, where the highest PCB concentration (1,100 mg/kg PCB) was detected at 3.5 to 5 ft bgs. PCB concentrations were less than 1 mg/kg PCB from 6.5 to 12.5 ft bgs and then increased to 4.1 mg/kg PCB in the 12.5-to- 14-ft-bgs interval. In spite of these anomalies, the dataset for subsurface soil contamination is sufficient to support the development and selection of a removal action alternative for the T-117 Upland Area.

Table 7-1. T-117 upland soil data gaps analysis

Sub-area	Location	Sample ID	Depth (ft bgs)		PCB Concentration (mg/kg dw)	Nearest Sampling Location(s) with < 1 mg/kg PCB	Distance from Nearest Sampling Location(s) with < 1 mg/kg PCB	Is the Depth of Nearest Sampling Location with < 1 mg/kg PCB Greater Than the Sample Depth?
			Top	Bottom				
A	IS-BA-S1	IS-BA-S1	0	2	750	SB-17	7 ft	yes
A	SB-11	T-117-SB11-01	0	1.5	70	SB-17	32 ft	yes
A	SB-12	T-117-SB12-01	0	1.5	37	SB-16	9 ft	yes
A	SB-13	T-117-SB13-01	0	1.5	5	T-117-A1, SB-15	20 ft (T-117 A1), 26 ft (SB-15)	yes
A	SB-14	T-117-SB14-01	0	1.5	31	SB-15	28 ft	yes
A	SB-19	T-117-SB19-01	0	1.5	5.7	SB-20, SB-29	21 ft (SB-20), 19 ft (SB-29)	yes
A	PS-1	T-117-PS-1A-02	2	4	20	SB-15	12 ft	yes
A	PS-2	T-117-PS-2A-03	4	6	2	SB-16	10 ft	yes
A	IS-B3-S1	IS-B3-S1	0	2	49	SB-20	4 ft	yes
A	IS-B3-B1	IS-B3-B1	2	2	260	PS-3	7 ft	yes
A	IS-B3-B1	IS-B3-B41[a]	2	2	250	SB-20	4 ft	yes
A	PS-3	T-117-PS-3-04	7.5	9	2.7	SB-20, SB-17	9 ft (SB-20), 18 ft (SB-17)	yes
B	CS-B1-NS3	CS-B1-NS3	0	7	1.4	PES-3	10 ft	yes
B	CS-B2-S2	CS-B2-S2	0	2.5	420	T-117-B4	9 ft	yes
B	CS-B2-S3	CS-B2-S3	0	2.5	20	SB-35	17 ft	yes
B	CS-B2-S4	CS-B2-S4	0	2.5	14	SB-38	10 ft	yes
B	CS-B2-S5	CS-B2-S5	0	2.5	160	T-117-B5	6 ft	yes
B	CS-B2-S5	CS-B2-S51[a]	0	2.5	130	T-117-B5	6 ft	yes
B	IS-B1-NS2	IS-B1-NS2	0	2	5.8	PES-1	12 ft	yes
B	IS-B2-S2B	IS-B2-S2B	0	7	5.7	T-117-B4	24 ft	yes
B	IS-B3-S2	IS-B3-S2	0	2	3	SB-21	3 ft	yes
B	IS-B3-S3	IS-B3-S3	0	2	200	SB-23	4 ft	yes

Sub-area	Location	Sample ID	Depth (ft bgs)		PCB Concentration (mg/kg dw)	Nearest Sampling Location(s) with < 1 mg/kg PCB	Distance from Nearest Sampling Location(s) with < 1 mg/kg PCB	Is the Depth of Nearest Sampling Location with < 1 mg/kg PCB Greater Than the Sample Depth?
			Top	Bottom				
B	IS-B3-S4	IS-B3-S4	0	2	5.7	SB-25	16 ft	yes
B	IS-B3-S5	IS-B3-S5	0	2	11	PS-8	20 ft	yes
B	IS-BA-S2	IS-BA-S2	0	2	830	SB-18	3 ft	yes
B	IS-BA-S3	IS-BA-S3	0	2	210	SB-24	23 ft	yes
B	IS-BA-S4	IS-BA-S4	0	2	230	SB-1	9 ft	yes
B	IS-BA-S5	IS-BA-S5	0	2	300	SB-2	9 ft	yes
B	IS-BA-S6	IS-BA-S6	0	2	15	SB-2	32 ft	yes
B	SB-10	T-117-SB10-01	0	1.5	100	SB-41	16 ft	yes
B	SB-31	T-117-SB31-01	0	1.5	5.4	SB-32, SB-33	23 ft (SB-32), 28 ft (SB-33)	yes
B	SB-8	T-117-SB8-01	0	1.5	15	SB-24	26 ft	yes
B	SB-8	T-117-SB15-01[a]	0	1.5	11	SB-24	26 ft	yes
B	SB-9	T-117-SB9-01	0	1.5	100	SB-18, PS-4	21 ft (SB-18), 22 ft (PS-4)	yes
B	CS-B1-CS1	CS-B1-CS1	2	7	2.1	IS-B1-NS1	19 ft	no, but similar
B	CS-B1-CS2	CS-B1-CS2	2	7	3.8	SB-37	14 ft	yes
B	IS-B3-B2	IS-B3-B2	2	2	58	PS-4	7 ft	yes
B	IS-B3-B3	IS-B3-B3	2	2	140	PS-6	11 ft	yes
B	IS-B3-B4	IS-B3-B4	2	2	13	T-117 B2	20 ft	yes
B	IS-BA-B1	IS-BA-B1	2	2	71	SB-17	5 ft	yes
B	CS-B2-B1	CS-B2-B1	2.5	2.5	760	T-117-B4	17 ft	yes
B	CS-B2-B2	CS-B2-B2	2.5	2.5	77	SB-40	9 ft	yes
B	T-117 B6	T-117-B6-SB-03	5	6.5	3.6	SB-37	27 ft	yes
B	IS-B2-B1B	IS-B2-B1B	7	7	2.9	T-117-B4	26 ft	yes
B	PS-7	T-117-PS-7-04	7.5	9	110	SB-26, SB-1	7 ft (SB-26), 15 ft (SB-1)	yes
B	PS-5	T-117-PS-5-04	7.5	9	14	PS-6	24 ft	no, but similar

Sub-area	Location	Sample ID	Depth (ft bgs)		PCB Concentration (mg/kg dw)	Nearest Sampling Location(s) with < 1 mg/kg PCB	Distance from Nearest Sampling Location(s) with < 1 mg/kg PCB	Is the Depth of Nearest Sampling Location with < 1 mg/kg PCB Greater Than the Sample Depth?
			Top	Bottom				
B	SB-22	T-117-SB22-04	7.5	9	2.4	PS-6	28 ft	no, but similar
B	SB-34	T-117-SB34-04	7.5	9	2.8	SB-35	26 ft	no, but similar
B	SB-39	T-117-SB39-04	7.5	9	3.1	SB-38, SB-35	23 ft (SB-38), 29 ft (SB-35)	no, but similar
B	SB-50	T117-SB50-02	2.5	4	13	SB-40	8 ft	yes
B	CS-B1-B1	CS-B1-B1	7	7	1.5	SB-37	33 ft	yes
B	PES-4	PES-4-10-11.5	10	11.5	1.6J	T117 B7	27 ft	yes
B	IS-B1-WS	IS-B1-WS	0	7	7.9	IS-B1-NS-1	27 ft	no, but similar
B	CS-B1-B2	CS-B1-B2	2	2	7.4	SB-37	25 ft	yes
B	CS-B1-B2	CS-B1-B42[a]	2	2	6.2	SB-37	25 ft	yes
C	IS-B3-B5	IS-B3-B5	2	2	25	SB-3	36 ft	yes
C	IS-BA-S7	IS-BA-S7	0	2	17	SB-3	4 ft	yes
C	PES-2	PES-2-10-11.5	10	11.5	6.4	T117 B7	41 ft	yes
C	CS-B2-S1	CS-B2-S1	0	2.5	5.5	T-117-B4	30 ft	yes
C	IS-B3-S6	IS-B3-S6	0	2	17	T-117-C2	28 ft	yes
C	MW-03	MW03-4.5	4	4.5	1.8	T-117-D2	30 ft	yes
C	IS-BA-B3	IS-BA-B3	2	2	2.3	SB-3	27 ft	yes
C	DS	DS-S-EAST	3	3	32	SB-3	10 ft	yes
C	DS	DS-S-WEST	3	3	32	SB-3	10 ft	yes
C	SB-B3	SB-B3-3.5	3.5	3.5	6.8	T-117-C4	10 ft	yes
C	DS	DS-B	4	4	14	SB-3	10 ft	yes
C	SB-E1	SB-E1-3.5	3.5	3.5	1.66	SB-E2	15 ft	no, but similar
D	T-117 D11	T-117-D11-SB-07	15	16.5	2.6	none within 36 ft	none within 36 ft	no
D	IS-B2-S6	IS-B2-S6	0	2.5	11	T-117-B4	30 ft	yes
D	SB-UA	SB-UA-4.5	4.5	4.5	17.6	SB-UB, T-117-D6	12 ft (SB-UB), 8 ft (T-117 D6)	yes

Sub-area	Location	Sample ID	Depth (ft bgs)		PCB Concentration (mg/kg dw)	Nearest Sampling Location(s) with < 1 mg/kg PCB	Distance from Nearest Sampling Location(s) with < 1 mg/kg PCB	Is the Depth of Nearest Sampling Location with < 1 mg/kg PCB Greater Than the Sample Depth?
			Top	Bottom				
D	SB-UC	SB-UC-4.5	4.5	4.5	2.14	SB-UB, T-117-D6	12 ft (SB-UB), 16 ft (T-117-D6)	yes
E	T-117 E3	T-117-E3-SB-03	5	6.5	2.2	none within 36 ft	none within 36 ft	no
E	T-117 E1	T-117-E1-SB-12.5-14.0	12.5	14	4.1	none within 36 ft	none within 36 ft	no
E	DS-1	T-117-DS1	0	0.5	2.2	PD-3, PD-2	8 ft (PD-3), 20 ft (PD-2)	yes
E	DS-1	T-117-DS1-D[a]	0	0.5	2.2	PD-3, PD-2	8 ft (PD-3), 20 ft (PD-2)	yes
E	DS-2	T-117-DS2	0	0.5	4.6	PD-6	8 ft	yes
E	PD-4	T-117-PD-4-03	2	3	21	T-117-F5, PD-1	15 ft (T-117-F5 and PD-1)	yes
E	PD-5	T-117-PD-5-03	2	3	18 J	PD-6, T-117-F5	10 ft (PD-6), 30 ft (T-117-F5)	yes
E	SB-A1	SB-A1-2	2	2	33.7	T-117 C8, T-117-C5	9 ft (T-117-C8), 10 ft (T-117-C5)	yes
E	SB-A2	SB-A2-3.5	4.8	4.8	2.9	SG-A2, T-117-C5	5 ft (SG-A2), 7 ft (T-117-C5)	yes
F	T-117 F4	T-117-F4-SB-03	5	6.5	26	T-117-F2	21 ft	yes

[a] Duplicate of preceding sample.

bgs – below ground surface

dw – dry weight

ID – identification

PCB – polychlorinated biphenyl

Additional limited pre-design sampling to address these few data gaps could eventually be required in order to refine the volumetric estimate and identify specific locations of contaminated soil that would require removal. Addressing these gaps is not viewed as a prerequisite to completing the EE/CA.

Both T-117-E3 and T-117-D11 are deep borings (14 and 16.5 ft bgs, respectively). It is not anticipated that PCB concentrations greater than 1 mg/kg exist beneath the above depths. Assuming a point of compliance based on MTCA unrestricted site use as ARAR, the maximum required depth of excavation would be 15 ft bgs. Therefore, increasing the amount of data regarding the depth at which the PCB concentration is at or below 1 mg/kg will not significantly change the exaction volume.

PCB concentrations at sampling location T-117-E3 consistently decrease with depth from 130 mg/kg at 0.5 to 2.5 ft bgs to 2.2 mg/kg at 5 to 6.5 ft bgs. Based on the boring log, the native alluvium layer was not reached at 6.5 ft bgs. The fill material ranges from 3 to 8 ft in thickness. It is anticipated that the PCB contamination does not extend into native material because it is finer than the fill layer and the PCB concentrations are already fairly low at 6.5 ft.

Another potential data gap is the north building. Based on aerial photographs, the north building was constructed between 1960 and 1969 (Windward et al 2003). The use of this area prior to 1960 is unknown. However, there are four samples within 10 ft of the building (IS-B1-NS1, IS-B1-NS2, SB-30. T-117 A9) that indicate that if contamination is present under the building, it is limited to the upper 2 ft. These sampling locations are located near the building on the north, east, and west sides. Only in the upper 2 ft at sampling locations IS-B1-NS-2 and T-117-A9 are the PCB concentrations above 1 mg/kg.

Two new monitoring wells will be installed as part of the groundwater monitoring program (Appendix A). Soil samples will be collected and analyzed from these borings at multiple depths to provide additional information in the vicinity of the T-117 EAA Upland Area (in the vicinity of Dallas Avenue S). Additional sampling may be conducted for design purposes at a later date if determined necessary.

7.1.2.2 Groundwater

Several rounds of groundwater sampling have been conducted, as discussed in Section 2.3.4 These data will be supplemented by the collection of quarterly groundwater monitoring data as specified in the groundwater monitoring plan and QAPP (Appendices A and B, respectively). The first round of sampling is anticipated to begin in March 2008. Groundwater samples will be collected and analyzed for a wide range of chemicals, including PCBs, PAHs (including SVOCs), TPH (oil and gasoline), BTEX, VOCs, and total and dissolved-phase priority pollutant metals.

Two new monitoring wells at the upgradient (i.e., west) side of the T-117 EAA and three replacement wells (for wells removed during the recent TCRA) at the shoreline

will be installed for this groundwater monitoring program (Appendix A). This network of wells (described in Appendix B) provides coverage of the shoreline, the interior, and the presumed upgradient boundary of the EAA (within the Dallas Avenue S ROW, including the area downgradient of Basin Oil).

In addition, a tidal study will be conducted to determine the appropriate groundwater sampling time and the hydraulic gradient for the monitoring wells that make up the enhanced monitoring network. Completion of the groundwater sampling and tidal study described above will address gaps in the groundwater data and provide the information required to complete the EE/CA.

7.1.3 Adjacent Streets

No additional data gaps have been identified for the Adjacent Streets. Sources of contamination associated with the Adjacent Streets include known soil contaminants and possibly groundwater beneath the area. According to the CSM, pathways would include erosion of surface soil as dust or contaminated particulates in surface runoff and groundwater migration. The adequacy of data needed to evaluate these sources and pathways is discussed in the following sections.

7.1.3.1 Soil

To date, extensive sampling has been conducted to characterize the nature and extent of soil contamination within the Adjacent Streets, which is sufficient to delineate the areas and depths of contamination. Post-excavation confirmational sampling will be conducted, as necessary, to address any areas of uncertainty. As summarized in Section 2.3.3 and presented on Maps 2-25 and 2-26, PCB contamination in the City street ROWs is largely confined to the surficial soils in the immediate vicinity of the T-117 Upland Area. The extent of PCB contamination is also well documented by the existing data, showing that detected concentrations decrease with increasing distance from the T-117 upland property. The pattern of contamination is also consistent with the predominant access route to and from the T-117 upland property (Dallas Avenue S), which remained unpaved until the mid-1970s or later. The other COPCs in the Adjacent Streets appear to be generally associated with PCB-impacted soil and thus will be addressed in conjunction with the PCB-contaminated soil as part of the NTCRA. In light of these findings, no further investigation of soil conditions within the Adjacent Streets is proposed.

7.1.3.2 Groundwater

Groundwater elevations within the Adjacent Streets are approximately 12 ft bgs, which is substantially deeper than the soils that have elevated concentrations of COPCs. Furthermore, given the very low solubility of PCBs, the presence of a groundwater contaminant transport pathway for this chemical from the Adjacent Streets is unlikely. Nevertheless, this hypothesis will be confirmed through the installation of groundwater wells along Dallas Avenue S pursuant to the requirements of the T-117 SOW, the methods set forth in the groundwater monitoring plan and

QAPP (Appendices A and B), and confirmational groundwater sampling and monitoring recommended for the Basin Oil RAA (see Section 7.3.1).

7.2 RECONTAMINATION ASSESSMENT AREAS

The Marina and the Basin Oil properties that border the T-117 EAA may be potential recontamination sources to the T-117 EAA because of the known presence of chemicals in soil, documented historical material handling practices, and/or historical site uses, such as those by the former A&B Barrel facility at the south side of the Marina, adjacent to the T-117 property. Existing environmental data for these two RAAs are summarized and presented in Section 2.3.6 and are evaluated in this section to determine if there are data gaps associated with these areas.

As discussed in the presentation of the CSM, there is a potential for chemicals that may be present at the Basin Oil and the Marina RAAs to migrate onto the T-117 EAA. The pathways are erosion of surface soil as dust or contaminated particulates in surface runoff, and groundwater migration. The adequacy of data needed to evaluate these sources and pathways is discussed below.

7.2.1 Basin Oil parcels

Based on information presented in Section 2.3.6.1, the following data gaps have been identified for the primary Basin Oil parcel located at 8661 Dallas Avenue S:

- Lack of subsurface soil data to document whether historical operations or remediation activities have impacted soil or groundwater
- Lack of confirmational samples to document that ongoing remediation activities (conducted by the property owner) have successfully removed surface and subsurface soil contamination, if present
- Lack of information on the source and quality of backfill materials used for excavations
- Lack of groundwater sampling data to document whether historical operations and ongoing remediation activities have impacted groundwater
- Lack of subsurface soil data in the vicinity of the septic system to document whether soil or groundwater was impacted

Data gaps for the Basin Oil parcel at 8617 17th Avenue S include:

- Insufficient sampling of surface soils
- Lack of information on the source and quality of backfill used for excavations (It is understood that backfill used in the excavated area on this property is composed of concrete rubble from the walls of the containment area located in the main yard on the Basin Oil property.)

- Lack of subsurface soil data to document whether historical operations or remediation activities have impacted soil or groundwater

The one surface soil sample available for 8617 17th Avenue S was collected by the owner of Basin Oil and is not considered an independent verification of site conditions.

7.2.2 South Park Marina

The potential pathways for T-117 recontamination from the Marina are discussed in Section 3.2.2 and include soil erosion and groundwater migration to the sediment and/or uplands. The existing dataset includes three surface sediment samples and six soil borings located on or near the Marina. In addition, there is one monitoring well within 50 ft of the T-117/ Marina boundary. Based on these data, soil erosion appears to be the only potential pathway for recontamination; however, the impacts at the Marina have not been fully characterized.

Additional data to be used in the recontamination assessment are pending. On behalf of Ecology, SAIC has recently conducted an investigation designed to address a lack of information regarding the potential contaminants associated with the former A&B Barrel facility in the southern portion of the Marina. This investigation (detailed in Section 2.3.6.2) includes an analysis of multiple groundwater, sediment, and soil samples at various depths for a variety of analytes. The investigation is focused on the area with the highest likelihood of contamination that is adjacent to the T-117 property. Once this additional information is available, a conclusive determination regarding the potential recontamination pathways will be presented in the EE/CA.

7.2.3 Recommendations for additional data collection for the RAAs

Additional data collection to address data gaps associated with the RAAs will focus on uncharacterized potential soil and groundwater migration pathways for contaminants that could be originating from these adjacent sites.

7.2.3.1 Basin Oil parcels

Two new groundwater monitoring wells will be installed at two locations within the Dallas Avenue S ROW, between the former Basin Oil site and the T-117 Upland Area. The new wells will be used to characterize groundwater conditions immediately down-gradient of the Basin Oil site. The wells will be installed and sampled in accordance with the T-117 EAA SOW and the groundwater monitoring plan and QAPP (Appendices A and B). Borehole samples will also be obtained during the installation of the wells and analyzed at a minimum for PCBs**.** After the installation and development of the wells, groundwater samples will be obtained and analyzed for PCBs, SVOCs (including PAHs), TPH (oil and gasoline), BTEX, VOCs, and total and dissolved-phase priority pollutant metals as part of the year of quarterly ground water monitoring to be conducted at all T-117 EAA monitoring wells (Appendices A and B).

The objectives for groundwater monitoring are set forth in the groundwater monitoring plan and QAPP (Appendices A and B). The objective for Basin Oil is to determine if groundwater migrating onto the T-117 EAA upland portion contain contaminants at concentrations that have the potential to recontaminate the T-117 EAA upland portion. If the objectives have not been met after 1 year, then additional monitoring may need to be developed (in cooperation with EPA) and implemented.

Based on the data gaps identified in Section 7.2.1, it is also recommended that surface and subsurface soils, and possibly groundwater, be collected within the Basin Oil site following completion of cleanup activities currently being performed by the owner and overseen by Ecology. It is understood that a sampling program will be developed and implemented by the property owner, with Ecology oversight, in accordance with applicable MTCA requirements for confirmational sampling, monitoring, and site closure (Fujita 2007). For current planning purposes, it is assumed that the results of the referenced Basin Oil sampling program will satisfy the data needs for the T-117 EAA recontamination assessment. To that end, the sampling program should include, but not be limited to, the following elements (applicable to each of the Basin Oil parcels).

- **Soils –** Completion of representative borings and sampling of fill material (including new backfill, if present) and native soils at 1-to-2-ft intervals down to the groundwater table. At least one of the soil borings on the primary Basin Oil parcel should be located in the vicinity of the septic tank or drain field (or historical location, if no longer present).
- **Groundwater –** Installation of new groundwater monitoring well(s) within the Basin Oil parcels, as deemed necessary based on soil sampling results and as directed by Ecology.
- **Catch basins, if present –** Collection of sediment sample from any remaining catch basins located on the property.

All soil, catch basin, and groundwater samples obtained to characterize the Basin Oil RAA should be analyzed for PCBs, TPH, PAHs, and metals. At least one soil sample at each property and at least one groundwater sample from each well should also be analyzed for all COPCs.

The owner of Basin Oil has stated plans to retain the services of an environmental professional to conduct confirmational sampling upon completion of his independent cleanup activities (Smith 2007). I It is recommended that EPA coordinate with Ecology during the development of the Basin Oil site sampling plan to ensure that the needs of both the Basin Oil cleanup and T-117 NTCRA projects are met. The timing for such investigations will also need to be assessed relative to the T-117 EE/CA schedule.

Information obtained from the Basin Oil investigation activities recommended above will be used in conjunction with results of the T-117 EAA groundwater monitoring program to assess the potential risk of recontamination to the T-117 EAA. In the event

that such risks are identified, the Port and City will coordinate with EPA to identify the appropriate course of action to ensure the success of the T-117 NTCRA.

7.2.3.2 South Park Marina

A summary of existing data and data gaps associated with historical and current operations at the Marina were identified for Ecology by SAIC (2007c). This report summarized property ownership and site use (historical and current), identified potential contaminant sources, and identified data gaps and areas for further investigation. The SAIC report indicated that there is little data and information on past site uses associated with the Marina. However, the most likely potential sources of recontamination to the T-117 EAA were identified as being in the southern portion of the site. Even though there are uncertainties associated with the northern portion of the Marina, it is not likely that this area is a potential source of recontamination to T-117. No industrial operations were identified in the northern or central portion of the Marina. Five surface sediment samples collected offshore of the central and northern portion of the marina did not have any detected concentrations exceeding the SQS. At two of these locations 1,2,4-trichlorobenzene and hexachlorobenzene non-detect concentrations (i.e., laboratory reporting limits) exceeded the SQS.

Data gaps identified in the SAIC report associated with historical uses included determining the extent of impacts in soil and groundwater near the former operations area of the A&B Barrel Company, which was located in the southern portion of the Marina and the potential pathways for chemical transport. Data gaps identified with current site use include additional information and data collection associated with the catch basins and oil/water separator, verification of the stormwater compliance, and information on the septic system reportedly located in the southern portion of the site.

Current site investigations address the former A&B Barrel Company area and potential contaminants in the river bank sediment, groundwater and seeps (as discussed in Section 2.3.6.2 (SAIC 2007b)). The collected data will be used to evaluate recontamination potential from the Marina in the EE/CA. Additional data gap sampling may be required based on an analysis of these data. Ecology is the lead agency for this work and is responsible for addressing questions associated with the current operations.

8 Preliminary Approach for Recontamination Assessment

As discussed in the previous section, the Marina and the Basin Oil properties that border the T-117 EAA are considered to be potential recontamination sources to the EAA because of the known presence of soil contaminants, documented historical material handling practices, and/or historical site uses. Existing environmental data for these two RAAs are summarized and presented in Section 2.3.6; an assessment of the data gaps is presented in Section 7. Additional soil and groundwater collection needs have been identified and may be modified as the results of Ecology's site work at the Marina become available.

The recontamination assessment, to be performed during the EE/CA, will be based on the characterization of the potential sources at the RAAs and their associated pathways. The criteria for assessing the need for source control relative to the RAAs are defined by the following questions.

- Are there source materials present on the RAAs, and do they contain COPCs above relevant screening criteria?
- Are there potential pathways for contaminant migration from the RAAs to the EAA, and, if so, are they adequately characterized?
- Do measured or estimated concentrations of chemicals associated with transport mechanisms/pathways (e.g., groundwater or airborne dust, soil erosion) exceed contaminant screening criteria specific to those pathways?
- If sources or pathways contain contaminants that exceed acceptable criteria, are they reliably controlled and/or will they be addressed through other removal or remedial actions by other parties.

If these criteria are not met, then there is a potential for recontamination that must be addressed in cooperation with EPA and Ecology. Once data gaps for the RAAs have been addressed, concentrations of identified COPCs in soil will be compared in the EE/CA to soil CULs established for the T-117 EAA and based on the RAOs described in this work plan. In cases where concentrations exceed the CULs, the potential pathways will be evaluated to ensure removal actions take into account the need to address or control potential pathways for soil contaminants that could migrate to the T-117 EAA. Similarly, if COPCs are detected in groundwater, they will be evaluated to:

- Determine if groundwater migrating onto the T-117 upland contains chemicals at concentrations that have the potential to recontaminate the T-117 upland soil or groundwater or LDW sediment
- Determine if groundwater at the T-117 upland contains contaminants at concentrations that exceed Washington State Water Quality Standards or that

have the potential to cause unacceptable human or ecological exposure after the implementation of the NTCRA

If a recontamination potential from Basin Oil or the Marina is identified, control of the sources by the respective property owners may be necessary prior to the commencement of the T-117 EAA removal action.

9 EE/CA Scope and Schedule

According to SOW Amendment 1 (EPA 2007b), the EE/CA SOW includes:

- EE/CA Work Plan – Prepare and submit a draft and final EE/CA work plan. An interim groundwater monitoring plan, QAPP, and health and safety plan for data collection activities required to support the EE/CA have been prepared and are submitted as appendices to this work plan (Appendices B and C, respectively). This requirement will be fulfilled through the preparation and submittal of the final document and appendices upon EPA's approval.
- Data Gaps Analysis – Assess the sufficiency of the existing data to confirm or refute recontamination pathways to the Sediment Study Area, T-117 Upland Area or the Adjacent Streets The results of the data gaps analysis and a plan for additional data collection (if determined to be required after completion of the data gaps analysis) will be included in this work plan. This requirement will be fulfilled through the preparation and submittal of the final work plan and appendices.
- Work Plan Implementation – Implement collection of data per work plan if required.
- EE/CA – Prepare and submit an EE/CA that includes a recommended removal action alternative for each area of the T-117 EAA. Accordingly, one EE/CA will be submitted with three unique yet integrated chapters that will address the Sediment Study Area, the T-11 Upland Area, the Adjacent Streets. The EE/CA will include a front section that integrates and coordinates these parts. The EE/CA will also present a T-117 EAA recontamination assessment of the adjoining Basin Oil and the Marina properties.
- Groundwater Monitoring – Implement the approved groundwater monitoring plan.

Table 9-1 presents the planned milestone dates for completing the T-117 EE/CA. Approximately 12 weeks have been included to provide time to implement the additional data collection activities described in Section 8 for the purpose of implementing the groundwater monitoring program and QAPP (Appendices A and B, respectively) and to have the additional information generated by the monitoring program and QAPP (Appendix B) available in a timely manner for inclusion in the EE/CA. The draft EE/CA will be submitted to EPA within 120 days after EPA

approval of final work plan or receipt of additional data (whichever comes later). The draft final EE/CA for public comment is scheduled to be produced within 30 days after receipt of EPA comments on the draft EE/CA. The final EE/CA will be submitted to EPA within 30 days after receipt of public comments and the responsiveness summary from EPA.

Table 9-1. T-117 EE/CA milestones and schedule

MILESTONE	DATE OR TIMEFRAME
EE/CA Work Plan	
First draft	December 31, 2007
EPA review and comment	30 days from draft submittal
Revise draft	30 days from receipt of comments from EPA
Final	April 1, 2008
Groundwater Implementation and Field Work	Upon approval of the groundwater monitoring plan, QAPP, and HSP (Appendices A, B, and C) – February 11,2008
EE/CA Report	
First draft	120 days after EPA approval of final work plan or receipt of additional data (whichever comes later)
EPA review and comment	30 days from draft submittal
Revise draft and submit draft final for public comment	30 days from receipt of comments from EPA
Public comment period	30 days from draft final submittal
Revise draft final and submit final EE/CA	30 days from receipt of public comments and responsiveness summary from EPA

EE/CA – engineering evaluation/cost analysis

EPA – US Environmental Protection Agency

HSP – health and safety plan

QAPP – quality assurance project plan

T-117 – Terminal 117

Adherence to this schedule is dependent upon the timely receipt of all investigation results and data for the Marina that are currently being generated by Ecology and their contractor. Data from the anticipated sampling implemented by the Basin Oil property owner with Ecology oversight may also affect this schedule.

Based on the currently identified data gaps and the scope of the field program to address those gaps and install replacement groundwater wells, it is expected that the current field schedule can be met. The project team and EPA will work diligently during the preparation of the EE/CA to streamline task elements and internal/agency reviews where possible to help assure that sufficient time is available for meaningful public-review and input.

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