Lower Duwamish Waterway Superfund Site
Terminal 117 Early Action Area

REVISED ENGINEERING EVALUATION/COST ANALYSIS
EXECUTIVE SUMMARY

Prepared for:

The Port of Seattle
and
The City of Seattle

For submittal to:

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Executive Summary

ES.1 INTRODUCTION

This document presents an overview of the results of an engineering evaluation/cost analysis (EE/CA) performed to identify and select a removal action for the Terminal 117 (T-117) Early Action Area (EAA), which is located within the Lower Duwamish Waterway (LDW) Superfund site. The T-117 EAA is a 15.2-acre site located in Seattle's South Park neighborhood on the west bank of the LDW between River Miles 3.5 and 3.7. The T-117 EAA is one of seven sites identified by the US Environmental Protection Agency (EPA) in 2003 as being highly contaminated by polychlorinated biphenyls (PCBs).

The EE/CA describes the non-time critical removal action (NTCRA), referred to as the "removal action," being conducted at the T-117 EAA and has been prepared in accordance with the Superfund regulation and the requirements set forth in EPA guidance (EPA 1993). The EE/CA uses site background information and a comprehensive compilation of site sampling data to identify contaminants of concern (COCs) in soil, sediment, and groundwater that pose potential human health and ecological risks. The EE/CA also establishes the boundaries for removal areas and develops and proposes two removal action alternatives (as well as a No Action alternative, which is included for comparison purposes). The EE/CA also presents the rationale for the recommended removal action alternative. The final removal action to be implemented at the T-117 EAA will be determined by EPA based on the proposed alternative in the final EE/CA and in consideration of public comment. EPA will document its decision in an Action Memorandum.

The T-117 EAA removal action is being performed by the Port of Seattle (Port) and the City of Seattle (City) under the oversight of EPA. The proposed removal action includes the cleanup of contaminated soil, sediment, and groundwater at the T-117 EAA through the removal or combined removal and capping of contaminated soil and sediment and completion of a permanent stormwater system.

The T-117 EAA consists of three areas (Figure ES-1), referred to as study areas:

- **T-117 Sediment Study Area –** the aquatic portion of the site within the LDW
- **T-117 Upland Study Area –** an upland area that was the site of historical industrial activities
- **Adjacent Streets and Residential Yards Study Area –** the streets and residential yards adjacent to the T-117 Upland Study Area that were investigated for contamination resulting from historical industrial activities at T-117. This area is east of 14th Avenue S and bounded by Dallas Avenue S and S Donovan Street.

Figure ES-1. Site map

The EE/CA also presents an assessment of the potential for the recontamination of the T-117 EAA once the removal action has been completed. This recontamination assessment also includes an analysis of known contaminants from historical industrial activities at two neighboring properties, Basin Oil and the South Park Marina, collectively referred to as the recontamination assessment areas (RAAs) (Figure ES-1). The assessment also qualitatively considers other offsite contaminant sources (e.g., airborne contaminants originating from non-specific areas beyond the T-117 EAA) and the transport of contaminants in groundwater within the T-117 EAA. This assessment was necessary to evaluate the long-term permanence of the removal action; however, additional stormwater and groundwater data are needed and will be collected during the T-117 EAA removal action design.

ES.2 SITE BACKGROUND AND DATA

The T-117 EAA was selected for early action in 2003 as part of the LDW Superfund project. The T-117 EAA was specifically selected to reduce PCB contamination in sediment. Much of the PCB contamination at the site is associated with historical

industrial activities that involved asphalt manufacturing in the T-117 Upland Study Area. Asphalt manufacturing operations included the use of recycled oils, some of which contained PCBs and were released to the surrounding environment. Asphalt manufacturing activities ceased in the early 1990s; and the former asphalt plant, tanks, and some contaminated soil were removed in 1996 and 1997. The Port acquired the former asphalt plant property in 2000. Currently, the T-117 Upland Study Area is fenced, secured, and vacant.

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, identify the removal action boundary, and investigate potential sources of contamination. These investigations primarily focused on PCB contamination and led to several interim cleanup actions that have been conducted throughout portions of the T-117 EAA.

Between 1999 and 2006, the Port conducted several removal actions that focused on the removal of asphalt plant residues and PCB-contaminated soil that remained within the T-117 Upland Study Area. In 1999, a soil removal action was conducted within the T-117 Upland Study Area to remove PCB-contaminated soil from the eastern portion of the T-117 Upland Study Area. In 2003, several old drums and other large debris were removed from the offshore intertidal area. In 2004, former asphalt plant underground pipes, contaminated soil, and debris were removed. In 2006, an additional removal action was conducted to remove newly discovered PCB-impacted soil that had the highest concentrations of PCBs within the T-117 Upland Study Area.

In 2004 and 2005, the City implemented a series of independent cleanup actions to address PCBs discovered in soil in the adjacent streets and residential yards near the T-117 EAA (City of Seattle 2005). The City removed soil that had PCB concentrations that exceeded 1 mg/kg from two residential yards on 17th Avenue S and unpaved street shoulders along Dallas Avenue S and portions of 16th Avenue S and placed a temporary asphalt cap or gravel over areas with residual contamination within the street areas on 17th Avenue S and to the east. In 2007, these street areas were included as part of the T-117 EAA and referred to as the Adjacent Streets.

In 2008, two archived LDW source control samples from two locations near T-117 were evaluated for dioxins and furans, and concentrations were above the Washington State Department of Ecology's (Ecology's) Model Toxics Control Act (MTCA) Method B cleanup level (CUL). EPA ordered an additional analysis for PCBs and dioxins and furans in streets, rights-of-way, and residential yards in 2008, and both contaminants were discovered in these areas. EPA requested that additional PCB and dioxin and furan investigations be conducted in all three T-117 EAA study areas. These investigations were conducted in 2008 and 2009 (Ecology 2009; Integral 2009; Windward and Integral 2009). The 2008 investigation resulted in detections of dioxins and furans and PCBs in sediment, upland soil, streets, parking strips, and residential

yards. These results led to EPA's request for additional sampling of yards and street shoulders in 2009 in order to refine the removal area boundary and determine the concentrations of PCBs and dioxin and furans in the yards. This additional soil sampling effort resulted in the detection of PCBs and dioxins and furans at concentrations above the MTCA Method B CUL in portions of the Adjacent Streets and in some residential yards. As a result of the 2008-2009 investigations, EPA directed that the Adjacent Streets portion of the T-117 EAA be expanded to include the area bounded by Dallas Avenue S to the north and east, 14th Avenue S to west, and S Donovan Street to the south (EPA 2009). The T-117 EAA boundary and samples used for decision-making from the T-117 Sediment, T-117 Upland, and Adjacent Streets and Yards Study Areas are shown on Figure ES-2.

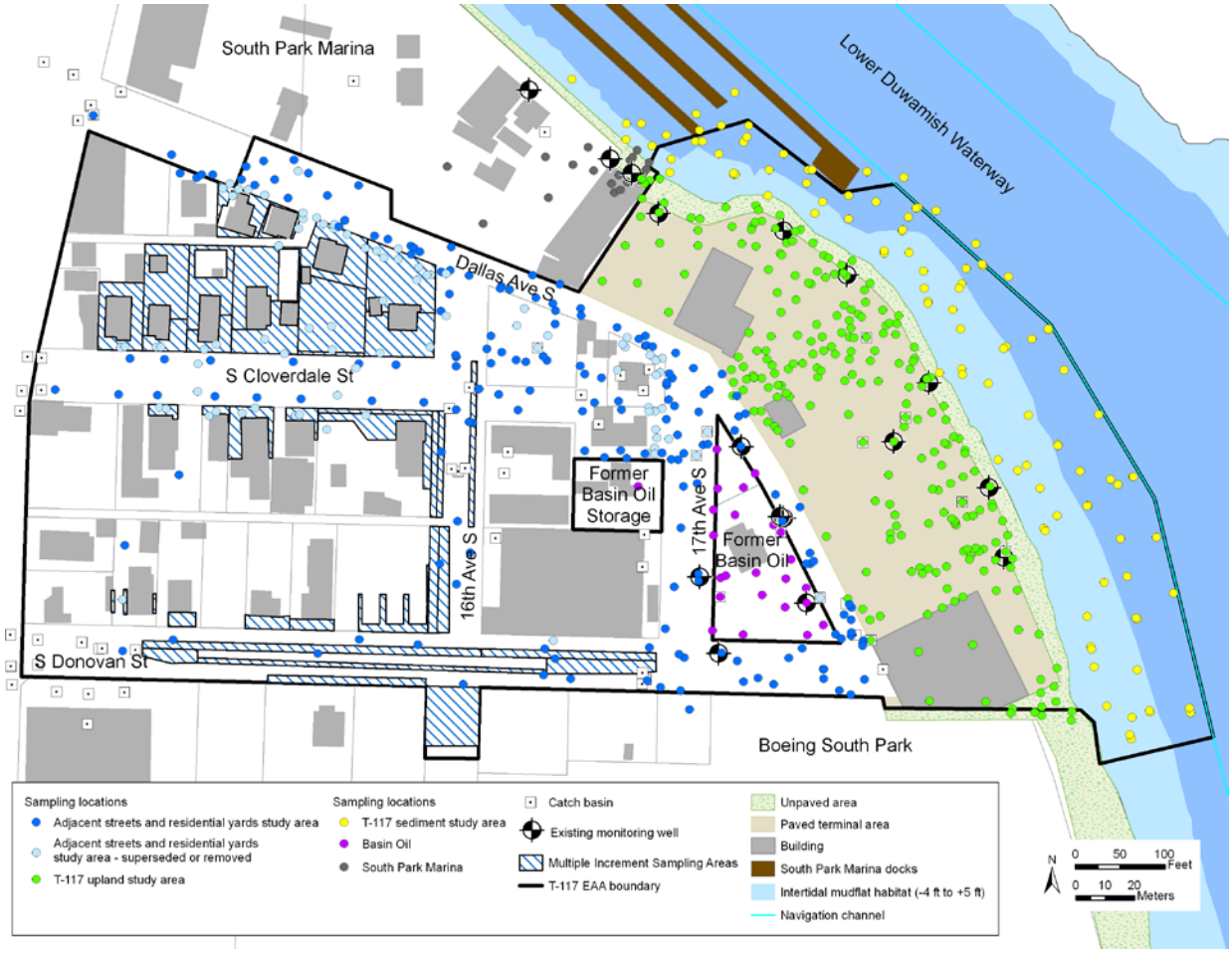

Figure ES-2. Sampling locations in T-117 EAA and vicinity

In total, 37 field investigations were conducted between 2003 and 2009 to characterize the nature and extent of PCBs and other contaminants in the T-117 EAA and vicinity. During these investigations, approximately 1,200 soil samples, over 100 groundwater

samples, and nearly 200 sediment samples were collected and principally analyzed for PCBs as well as other contaminants in select samples. The field investigations were iterative events; each additional field effort was based on the results of the preceding effort. Figure ES-2 presents the sampling locations in the T-117 EAA and vicinity.

ES.3 STREAMLINED RISK EVALUATION

A streamlined risk evaluation was performed to assess the need for a removal action. This evaluation was conducted in accordance with both Ecology (i.e., MTCA) and EPA (i.e., the Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]) risk evaluation frameworks. Soil, sediment, and groundwater data were evaluated to identify soil, sediment, and groundwater COCs that will be addressed by the removal action to eliminate or reduce the ecological and human health risks associated with these contaminants. The streamlined risk evaluation also demonstrated that upon completion of the removal action, COC concentrations will be at or below the ecological and human health risk levels established for the T-117 EAA. The streamlined risk evaluation first used a conceptual site model to identify complete exposure pathways, sources, potential transport mechanisms, and receptors (e.g., people, fish) within each of the three T-117 EAA study areas, as presented in Table ES-1.

Table ES-1. Summary of exposure pathways and receptors identified in the streamlined risk evaluation

Exposure Pathway by Receptor	Receptor Type	Sediment Study Area	Soil		Groundwater
			T-117 Upland Study Area	Adjacent Streets and Residential Yards Study Area	
Aquatic Organisms					
Ingestion, direct contact	benthic invertebrates	X			X
	mammals	X			
	Fish	X			X
	Birds	X			
People Who Use the LDW and Reside or Work in the Adjacent Streets and Residential Yards Study Area					
Ingestion, direct contact	kayakers	X			X
	fishermen	X			X
	clammers	X			X
	beachgoers	X			X
	residents			X	
	Workers	X	X	X	X

Exposure Pathway by Receptor	Receptor Type	Sediment Study Area	Soil		Groundwater
			T-117 Upland Study Area	Adjacent Streets and Residential Yards Study Area	
Inhalation	residents		X	X	
	Workers		X	X	
People, Fish, and Wildlife					
Seafood consumption	Fish	X			
	Birds	X			
	mammals	X			
	people	X			

LDW – Lower Duwamish Waterway
T-117 – Terminal 117

Risk-based screening levels for soil, sediment, and groundwater relative to the pathways (e.g., direct contact, seafood consumption, and inhalation) were then used to identify COCs. The COCs identified for sediment, soil, and groundwater are presented in Table ES-2.

Table ES-2. T-117 EAA contaminants of concern

Contaminant of Concern	Sediment Study Area	Soil		Groundwater
		T-117 Upland Study Area	Adjacent Streets and Residential Yards Study Area	
Arsenic	X	X		X
Silver		X		X
PAHs[a]	X			
Carcinogenic PAHs	X	X		X
TPH(diesel and oil range)		X		X
Bis(2-ethyhexyl) phthalate				X
Phenol	X			
Total PCBs	X	X	X	X
Dioxin and furans	X	X	X[b]	

[a] PAHs include individual PAH compounds, total LPAHs, and total HPAHs.

[b] Dioxins and furans were designated as COCs where co-located with PCBs above the PCB removal action level in the Adjacent Streets and Residential Yards Study Area

EAA – early action area
HPAH – high-molecular-weight polycyclic aromatic hydrocarbon
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
T-117 – Terminal 117
TPH – total petroleum hydrocarbons

ES.4 REMOVAL ACTION GOALS AND OBJECTIVES

The goal of the removal action is to reduce human health and ecological risks to acceptable levels in the T-117 EAA. In addition, the removal action will make the site available for a variety of potential future land uses, including unrestricted land uses, industrial and commercial activities, and non-industrial uses such as river and/or shoreline habitat, public access, and recreational facilities. The removal action is believed to be sufficient to prevent the recontamination of the T-117 Sediment Study Area from sources within the T-117 EAA and RAAs.

To accomplish this goal, the scope of the removal action includes the removal of soil and the removal or containment of sediment from within the T-117 EAA that will be sufficient to achieve concentrations at or below specific risk-based levels. These levels are referred to as removal action levels (RvALs). The T-117 EAA is located within the LDW, and sediment cleanup goals, including chemical-specific CULs, have not been determined for the LDW remediation because a cleanup decision has not been finalized. Therefore, EPA has specified that the T-117 removal action must use site-specific RvALs until the final LDW cleanup goals have been determined. These RvALs are based on federal and state cleanup and remediation levels and will be reviewed as the removal action progresses into the design phase. The RvALs are presented in Table ES-3.

Table ES-3. T-117 EAA sediment, soil, and groundwater removal action levels

	Removal Action Level				
		Soil			
Contaminant of Concern	Sediment	T-117 Upland Study Area	Adjacent Streets	Residential Yards	Groundwater
Arsenic	12 mg/kg	7.3 mg/kg	na	na	5 µg/L
Silver	na	2.0/400 mg/kg[a]	na	na	1.9 µg/L
PAHs	0.25 – 15 mg/kg[b]	na	na	na	na
Carcinogenic PAHs	0.09 mg/kg	0.14 mg/kg	na	na	0.15 µg/L
TPH (diesel and oil range)	na	200/2,000 mg/kg[a]	na	na	500 µg/L
Bis(2-ethylhexyl) phthalate	na	na	na	na	1.7 µg/L
Phenol	0.420 mg/kg	na	na	na	na
Total PCBs	12 mg/kg OC or 0.13[d] mg/kg dw	0.65/1.0 mg/kg[c]	1.0 mg/kg	1.0 mg/kg	0.01 µg/L
Dioxin/furan TEQ	13 ng/kg	11 ng/kg	11 ng/kg[e]	11 ng/kg[e]	na

[a] First RvAL is for the upper 0 to 6 ft of soil, and the second RvAL is for soil deeper than 6 ft as defined by MTCA (see Table 4-6 of the EE/CA for details).

[b] PAHs include individual PAH compounds, total LPAHs, and total HPAHs and are presented as the range of RvALs for these compounds.

[c] First RvAL is for the upper 0 to 2 ft of soil, and the second RvAL is for soil deeper than 2 ft as defined by MTCA (see Table 4-6 of the EE/CA for details).

[d] If the SQS of 12 mg/kg OC cannot used because the TOC in a sediment sample is outside the range of acceptability for TOC normalization (0.5 to 4.0%), then the lowest apparent effects threshold (upon which the

SQS is based) in dry-weight units of 0.13 mg/kg can be applied as a surrogate value. This dry-weight value of 0.13 mg/kg was used for the purposes of risk estimation.

[e] Where co-located with PCBs above the PCB RvAL.

dw – dry weight
EE/CA – engineering evaluation/cost analysis
HPAH – high-molecular-weight polycyclic aromatic hydrocarbon
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
na – not applicable
OC – organic carbon
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
TOC – total organic carbon
TPH – total petroleum hydrocarbons
RvAL – removal action level

Sediment RvALs for the T-117 Sediment Study Area are based on Washington State Sediment Management Standards (SMS) and EPA risk-based goals developed for the LDW remedial project. EPA has also specified that RvALs for soil in the Upland Study Area and the Adjacent Streets and Residential Yards Study Area must be developed based on the methodology set forth under MTCA for calculating soil cleanup levels and defining appropriate points of compliance. RvALs are thus based on the objective of protecting human health and the environment for exposure pathways present throughout the T-117 EAA in sediment and soil. This overall objective has been divided into removal action objectives (RAOs), which are:

Sediment

- **Human health – seafood consumption**. Reduce human health risks associated with the consumption of resident LDW fish and shellfish by reducing sediment and surface water concentrations of COCs to protective levels.
- **Human health – direct contact**. Reduce human health risks associated with exposure to COCs through direct contact with sediments and incidental sediment ingestion by reducing sediment concentrations of COCs to protective levels.
- **Ecological health – benthic**. Reduce toxicity to benthic invertebrates by reducing sediment concentrations of COCs to comply with the SMS.
- **Ecological health – seafood consumption**. Reduce risks to crabs, fish, birds and mammals from exposure to COCs by reducing sediment and surface water concentrations of COCs to protective levels.

Soil

- **Sediment protection.** Reduce PCB concentrations in upland soils to ensure protection of sediments.

The removal action will meet these RAOs, with the exception of the RAO for human seafood consumption. Protective levels of some COCs, particularly PCBs, are well below background concentrations, so it will not be possible to completely eliminate any unacceptable risk from this pathway.

Removal areas include all locations where soil and sediment COC concentrations exceeded RvALs; however, in the Adjacent Streets and Residential Yards Study Area,

dioxins and furans are COCs in soil only where PCBs exceeded the PCB RvAL as directed by EPA. The removal areas are shown on Figure ES-3. The removal areas include most of the T-117 Sediment Study Area, nearly all of the T-117 Upland Study Area and portions of the Adjacent Streets and Residential Yards Study Area. A few areas need additional sampling during remedial design and may or may not be designated as removal areas. These areas are also identified on Figure ES-3.

Figure ES-3. T-117 EAA removal areas

RvALs were also developed for groundwater at the T-117 EAA to determine the groundwater concentrations needed in order to prevent the recontamination of sediment or unacceptable levels of groundwater contaminants to the LDW. It was determined that through the removal of contaminated soil, concentrations of COCs in groundwater at the point of discharge to surface water and sediment are expected to be reduced to below the RvALs. Therefore, specific groundwater treatment measures, other than the removal of soil, are not included as part of the removal action.

ES.5 RECONTAMINATION ASSESSMENT

The EE/CA also includes an assessment of the potential for the recontamination of the EAA after it has been cleaned up, identifies strategies to control potential sources of recontamination, and provides recommendations for post-removal action monitoring. The source control strategy for the T-117 EAA is governed by that outlined for the LDW (Ecology 2004). One goal of the strategy is to control sources so that the potential for contaminants in sediment to exceed the LDW cleanup goals and the SMS (Washington Administrative Code [WAC] 173-204) is minimized.

Potential source areas and transport mechanisms within or near the T-117 EAA are shown on Figure ES-4. These areas include upland portions of the T-117 EAA, Basin Oil, South Park Marina, the LDW, and offsite regional urban and industrial sources. Potential transport mechanisms include the erosion of onsite surface or subsurface soil, stormwater and groundwater movement from upland areas, sediment movement within the LDW, and atmospheric deposition from regional sources.

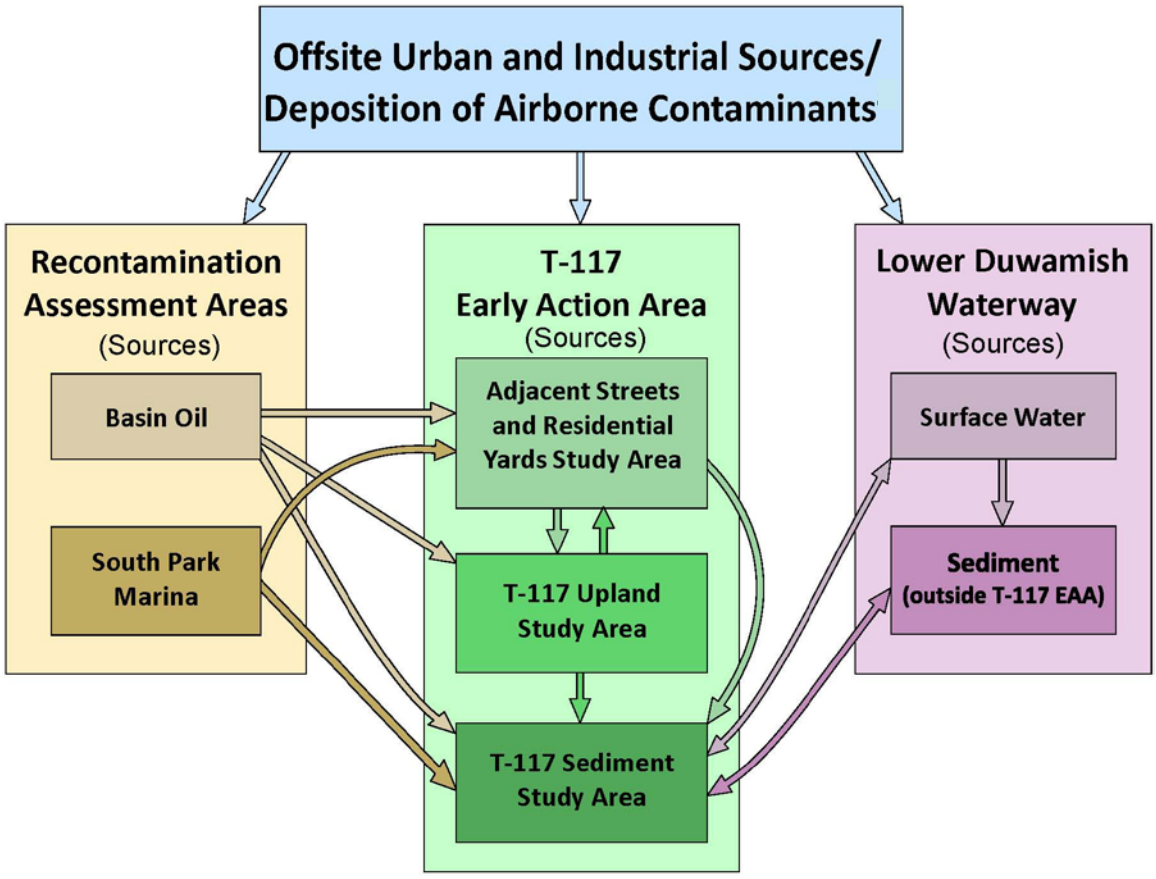

Figure ES-4. T-117 EAA potential recontamination sources and routes

The recontamination assessment concluded that potential recontamination of the T-117 Sediment Study Area after the planned removal action is not likely to occur because the primary source of contaminated soil and sediment within the T-117 EAA will be removed. The groundwater quality is expected to improve after the removal of the contaminated soil. In addition, potential contaminant transport from Basin Oil, South Park Marina, offsite urban sources, and the LDW (e.g., upstream sediment transport) is not expected to result in the recontamination of the T-117 Sediment Study Area at concentrations that exceed the sediment RvALs. Nevertheless, post-removal action monitoring of stormwater solids, groundwater, and sediment will be performed to ensure the long-term effectiveness of the removal action and support the objective of protecting ecological receptors and human health.

ES.6 REMOVAL ACTION TECHNOLOGIES

The EE/CA considers a range of removal action technologies, including soil excavation, sediment dredging, sediment capping, treatment, and disposal. The evaluation and selection process emphasized technologies that have been proven and are readily implementable at full scale (rather than research or pilot scale). Additional key selection criteria included the appropriateness of the technology for the size and site-specific conditions of the T-117 EAA, availability for implementation, and feasibility of implementation within the anticipated removal action timeframe. Removal, containment (capping), and disposal were selected as technologies appropriate for the removal action, as summarized in Table ES-4.

Table ES-4. Removal action technologies selected for the T-117 EAA

Category	Technology/ Method	Applicable Media	Rationale
Removal	land-based excavation	upland soil, nearshore sediment	Technology is appropriate and readily available for the scale and site-specific conditions at the T-117 EAA.
	over-water mechanical dredging	sediment	Technology is proven and available within the project area. Special bucket designs and operating procedures can be used for mechanical dredging to limit the release of solids.
Containment	in-water capping	sediment	Technology is appropriate for the T-117 Sediment Study Area but will likely require restrictive environmental covenants and monitoring to demonstrate effectiveness.
Disposal	hazardous and non-hazardous landfill disposal	soil or sediment	Method is available and typically used for managing contaminated material.

EAA – early action area
T-117 – Terminal 117

ES.7 REMOVAL ACTION ALTERNATIVES

The EE/CA identified two viable removal action alternatives. Both of these alternatives have the ability to meet the defined remedial action objectives using the selected technologies. A No Action alternative was also included in the analysis as a basis for the comparison of the two viable alternatives. The alternatives are:

- **No Action alternative –** This alternative does not remove or provide containment of any contaminated sediment or soil and does not meet the RAOs. It would also require the prolonged use of ongoing institutional controls, monitoring, and inspection, as well as the maintenance of erosion and stormwater controls. The No Action alternative is not considered acceptable for the T-117 EAA.
- **Alternative 1: Upland soil removal and sediment removal combined with sediment capping –** Alternative 1 involves the removal of soil from the T-117 Upland Study Area and adjacent shoreline bank as well as the Adjacent Streets and Residential Yards Study Area to meet the soil RAOs. The soil RvALs for COCs would be met to the appropriate point of compliance below completed grade per MTCA requirements for unrestricted land use. The Upland Study Area would be backfilled to an elevation of +14 ft mean lower low water (MLLW), and the Adjacent Streets and Residential Yards would be backfilled to near original grades. Alternative 1 includes the removal of contaminated sediment within the intertidal portion of the sediment removal area, as well as dredging within the Marina to re-establish navigation depths. The excavated nearshore areas would then be backfilled with clean material to re-establish site grades. The remainder of the sediment located farther offshore in the subtidal portion of the sediment removal area would be isolated beneath a sediment cap**.**
- **Alternative 2: Upland soil removal and sediment excavation/dredging –** Alternative 2 is the same as Alternative 1 with regard to excavation and backfilling within the T-117 Upland Study Area and adjacent shoreline bank, as well as the Adjacent Streets and Residential Yards Study Area. Alternative 2 only differs from Alternative 1 relative to the nature of the removal action in the T-117 Sediment Study Area. Alternative 2 would involve the dredging of all contaminated sediment within the sediment removal area, including dredging within the Marina to re-establish navigation depths. The dredged areas, except the Marina, would be backfilled with clean material to re-establish site grades.

Figure ES-5 graphically presents the principal difference between Alternatives 1 and 2, which is the removal action within the sediment removal area. The removal action for the Upland and Adjacent Streets and Residential Yards Study Areas is the same under both alternatives.

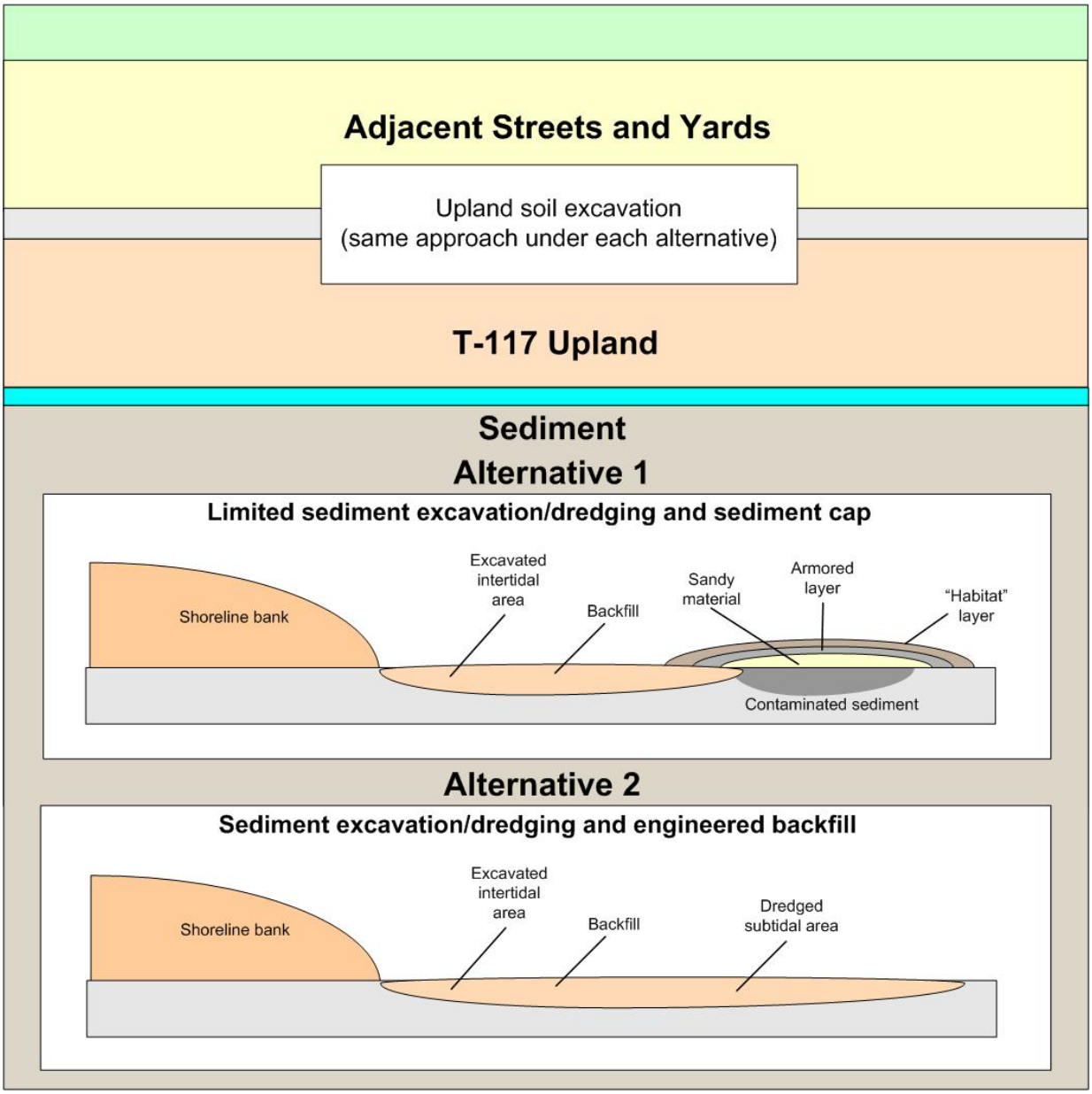

Figure ES-5. Comparison of Alternatives 1 and 2

The final redevelopment of the site is a separate action that will be conducted after the removal action has been completed. Under both Alternatives 1 and 2, it has been assumed that the T-117 Upland Study Area will be backfilled to an intermediate grade of approximately +14 ft MLLW in order to complete the removal action. This completion scenario has been assumed as the selected option for the purpose of developing costs and comparing alternatives.

However, other completion options are possible, including: 1) restoring the T-117 Upland Area to the existing elevation of approximately +20 ft MLLW, or 2) limiting backfilling to transition directly to create habitat or implement other aquatic-oriented

site improvements. The latter option would be the preferred option, but the precise coordination required between the removal and redevelopment projects cannot be planned at this time. The Port will work with the community to determine the final redevelopment design of the T-117 Upland Study Area and will facilitate a smooth transition between the removal and redevelopment projects.

ES.8 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Both Alternatives 1 and 2 achieve the site-specific remedial action objectives described in Section ES.4, comply with all applicable or relevant and appropriate requirements (ARARs), and provide long-term effectiveness through the removal of the majority of the contaminated soil and sediment at the site. In addition, both alternatives are feasible, and the technologies required for their implementation are readily available. The notable differences between the two alternatives are that Alternative 1 is slightly less expensive, requires the removal of less sediment, and relies on the integrity of the sediment cap to provide long-term effectiveness. Table ES-5 provides a brief comparison of the two removal action alternatives.

Table ES-5. Summary of comparative analysis of Alternatives 1 and 2

Component	Alternative 1	Alternative 2
Protection of human health and the ecological receptors	Achieves protection of ecological receptors and reduces risk to human health.	Same as that for Alternative 1.
Achievement of RAOs	At the completion of the removal action, the EAA will remain part of the larger LDW Superfund site and will have the benefit of the remedial action to further reduce risks to human health and ecological receptors.[a]	Same as that for Alternative 1.
Compliance with ARARs	Complies with ARARs to the extent practicable.	Same as that for Alternative 1.
Effectiveness		
Long-term effectiveness and permanence	Achieves long-term effectiveness and permanence through dredging and the placement of a sediment cap that will require long-term monitoring and maintenance.[b]	Achieves long-term effectiveness and permanence through dredging.
Short-term effectiveness	Achieves short-term effectiveness and involves less dredging than does Alternative 2. The potential period of short-term impacts to water quality would be of slightly shorter duration than that for Alternative 2.	Achieves short-term effectiveness but involves more dredging than does Alternative 1. The potential period of short-term impacts to water quality would be of slightly longer duration than that for Alternative 1.
Implementability		
Upland removal	Alternative is readily implementable.	Alternative is readily implementable.
Sediment removal	Alternative is readily implementable.	Alternative is readily implementable.

Component	Alternative 1	Alternative 2
Volumes (cubic yards)		
Soil removed	47,000	47,000
Sediment removed	6,500	14,000
Sediment engineered cap material required	8,000	not applicable
Sediment engineered backfill material required	not applicable	10,000
Cost	$31,700,000	$33,200,000

[a] These actions are anticipated to consist of: 1) LDW-wide source control of lateral loading to reduce cap recontamination, 2) monitored natural recovery of expected sedimentation from the upper Green River system into the LDW system, and 3) institutional controls.

[b] Maintains long-term effectiveness and permanence to the extent that items 1 through 3 in footnote a are implemented.

ARAR – applicable or relevant and appropriate requirements

RAO – remedial action objective

ES.9 RECOMMENDATION

Alternative 2 is the recommended alternative for the T-117 removal action. The key advantage of Alternative 2 is that it provides for maximum long-term effectiveness and permanence. Although Alternative 2 would cost more to implement because of the added quantity of dredged material, this additional cost will be offset, in part, by the fact that there will be no post-removal action cap monitoring and performance review costs, which would be required under Alternative 1. Alternative 2 also has the potential for slightly greater short-term impacts associated with sediment disturbance resulting from additional dredging, compared with those associated with less dredging and the placement of a cap, but these can be mitigated through the use of proper dredging project design and controls. Alternative 2 also allows for maximum design flexibility, which may be needed to accommodate final site uses that will be selected in cooperation with the South Park community. Final site contours can be designed without the need to accommodate permanent intertidal cap structures.

ES.10 PRE-DESIGN AND POST-REMOVAL ACTIVITIES

Supplementary information needs for the removal action design will be addressed before the removal action is implemented. These needs relate to the items listed below and are described in further detail in the Section 9.4 of the EE/CA.

- Adjacent Streets and Residential Yards Study Area soil and groundwater data
- RAA groundwater, catch basin, and stormwater data
- T-117 Upland Study Area groundwater and geotechnical data
- Pre-removal confirmation sampling
- Site preparation and constraints

- Coordination of final grade for restoration grading plan
- Development of community protective measures

Post-removal activities will include monitoring and maintenance to ensure that the RAOs are being met and that there is compliance with ARARs. A long-term operation, monitoring, and maintenance plan will be prepared in accordance with appropriate guidance documents during the design phase of the removal action and will address the final site configuration, potential site uses, and additional redevelopment details. The post-removal action plan will be prepared in association with EPA and Ecology and stakeholder review and input. The plan will address the principal study areas; groundwater monitoring; and the operation, monitoring and maintenance requirements for storm drainage systems that serve the upland portions of the EAA. The post-removal monitoring plan will be designed to evaluate the effectiveness of source control measures put in place.

ES.11 SCHEDULE

The EE/CA will be used to assist EPA in the selection of the final removal action alternative and preparation of an Action Memorandum. The removal action design will begin once EPA issues the Action Memorandum. Figure ES-6 presents a timeline for these key milestones as well as the anticipated duration of removal action activities.

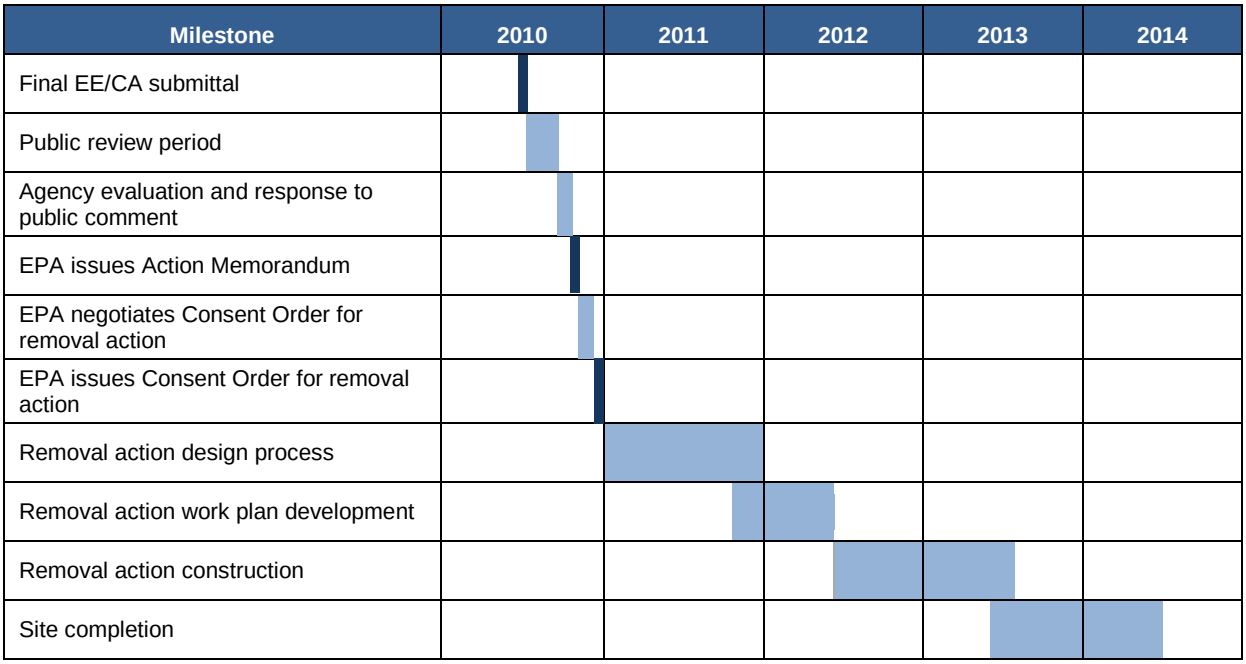

Figure ES-6. T-117 NTCRA schedule

Upon completion of the removal action, a significant early action site within the LDW Superfund site will be addressed, reducing contamination in the LDW and providing the potential for a broad range of potential future site uses at T-117.

ES.12 REFERENCES

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Glossary

Terminology	Definition
Action Memorandum	An EPA document that provides a concise, written record of the decision to select the appropriate removal action alternative
applicable or relevant and appropriate requirement (ARAR)	The requirement that any legally applicable or relevant and appropriate remediation requirement, standard, criteria, or limitation promulgated under federal or state environmental law be consistent with CERCLA
cleanup level (CUL)	The concentration of a hazardous substance that does not threaten human health or the environment
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	A 1980 federal law that created a trust fund to investigate and clean up abandoned or uncontrolled hazardous waste sites; also referred to as the Superfund act
conceptual site model	A schematic diagram that identifies the relationships between sources of environmental contamination in the environment, potential exposure pathways (e.g., ingestion or contact with skin), and potential receptors (e.g., fish or people who might come into contact with contaminated media), and lists the potential exposure pathways (e.g., dermal contact with contaminated soil)
contaminant of concern (COC)	Chemical that has been evaluated and determined to be likely to cause risk to human health and the environment
early action area (EAA)	A site along the Lower Duwamish Waterway that has been selected for remediation prior to the establishment of site-wide Lower Duwamish Waterway remediation goals
engineering evaluation/cost analysis (EE/CA)	A preliminary remediation design process to evaluate engineering options and analyze costs
mean lower low water (MLLW)	The average of the lower of the two daily low tides; typically used as an elevation reference
Model Toxics Control Act (MTCA)	A 1988 Washington State law designed to clean up hazardous waste sites
non-time-critical removal action (NTCRA)	A removal action at a site that does not pose imminent and substantial threat to public health or the environment
point of compliance	The depth at which the RvALs are met
polycyclic aromatic hydrocarbons (PAHs)	A group of chemicals present in fuels, oils, and creosote; some PAHs are known to cause cancer (i.e., are carcinogenic)
polychlorinated biphenyls (PCBs)	A group of toxic chemicals that is persistent in the environment despite the fact that the use of PCBs in the US was banned in 1979
recontamination assessment areas (RAAs)	Nearby contaminated areas that have been identified for investigation as potential sources of recontamination once the site has been cleaned up; Basin Oil and the South Park Marina were identified as RAAs for T-117
removal action objective (RAO)	The goal of the cleanup action
removal action level (RvAL)	The cleanup level that must be met at the T-117 EAA
total petroleum hydrocarbons (TPH)	A measured portion of oil that is contained in motor oil and fuels that are derived from the refining of crude oil
US Environmental Protection Agency (EPA)	The federal agency responsible for protecting the environment
Washington State Department of Ecology (Ecology)	The Washington State agency responsible for protecting the environment
Washington State Sediment Management Standards (SMS)	Washington State sediment quality criteria developed by Ecology