Five-Year Review Report

Third Five-Year Review Report
for
Commencement Bay Nearshore/Tideflats
Superfund Site
Tacoma, Washington

December 23, 2009

PREPARED BY:
United States Environmental Protection Agency
Region 10

Approved by:

12/23/09

Lori Cohen, Acting Director
Office of Environmental Cleanup
U.S. EPA Region 10

Date

[This page intentionally left blank]

Table of Contents

Acronyms and Abbreviations viii
Executive Summary xi
Five-Year Review Summary Form xvii
1 INTRODUCTION 1
2 SITE CHRONOLOGY 3
3 BACKGROUND 4
3.1 Site Location and Description 4
3.2 Land and Resource Use 5
3.3 History of Contamination 6
3.4 Initial Response 8
3.4.1 Commencement Bay Nearshore/Tideflats Sediments 8
3.4.2 Asarco Area 8
3.4.3 Tacoma Tar Pits 9
3.5 Basis for Taking Action 10
3.5.1 Commencement Bay Nearshore/Tideflats Sediments 10
3.5.2 Asarco Area 11
3.5.3 Tacoma Tar Pits 12
4 REMEDIAL ACTIONS AND FIVE-YEAR REVIEW PROCESS FOR CB/NT SEDIMENTS OPERABLE UNIT 01 ("Problem Area Waterways") 14
4.1 Remedy Selection 14
4.1.1 Cleanup Objectives 14
4.1.2 Selected Remedy 15
4.1.3 Source Control Strategy 16
4.1.4 Explanation of Significant Differences 17
4.1.5 Sitewide Biological Assessment 18
4.1.6 Sitewide 404(b)(1) Analysis 19
4.1.7 Dredged Material and Disposal Sites 19
4.1.8 CERCLA Removal Actions 20
4.1.9 Partial Deletion of the Site 21
4.2 Hylebos Waterway 21
4.2.1 Background 22
4.2.2 Site Chronology 22
4.2.3 Remedial Actions 24
4.2.4 Progress since the Last Five-Year Review 31
4.2.5 Five-Year Review Process 34
4.2.6 Technical Assessment 36
4.2.7 Issues 41
4.2.8 Recommendations and Follow-up Actions 42
4.2.9 Protectiveness Statement 42
4.3 Sitcum Waterway 42
4.3.1 Background 42
4.3.2 Site Chronology 43
4.3.3 Remedial Actions 44
4.3.4 Progress since the Last Five-Year Review 47

Table of Contents (continued)

4.3.5 Five-Year Review Process 49
4.3.6 Technical Assessment 53
4.3.7 Issues 54
4.3.8 Recommendations and Follow-up Actions 54
4.3.9 Protectiveness Statement 54
4.4 St. Paul Waterway 54
4.4.1 Background 54
4.4.2 Site Chronology 55
4.4.3 Remedial Actions 55
4.4.4 Progress since the Last Five-Year Review 58
4.4.5 Five-Year Review Process 59
4.4.6 Technical Assessment 61
4.4.7 Issues 62
4.4.8 Recommendations and Follow-up Actions 62
4.4.9 Protectiveness Statement 63
4.5 Middle Waterway 63
4.5.1 Background 64
4.5.2 Site Chronology 65
4.5.3 Remedial Actions 66
4.5.4 Progress since the Last Five-Year Review 79
4.5.5 Five-Year Review Process 81
4.5.6 Technical Assessment 83
4.5.7 Issues 86
4.5.8 Recommendations and Follow-up Actions 87
4.5.9 Protectiveness Statement 88
4.6 Olympic View Resource Area 89
4.6.1 Background 89
4.6.2 Site Chronology 89
4.6.3 Remedial Actions 90
4.6.4 Progress since the Last Five-Year Review 93
4.6.5 Five-Year Review Process 93
4.6.6 Technical Assessment 95
4.6.7 Issues 96
4.6.8 Recommendations and Follow-up Actions 96
4.6.9 Protectiveness Statement 97
4.7 Thea Foss and Wheeler-Osgood Waterways 97
4.7.1 Background 97
4.7.2 Site Chronology 98
4.7.3 Remedial Actions 99
4.7.4 Progress since the Last Five-Year Review 122
4.7.5 Five-Year Review Process 124
4.7.6 Technical Assessment 126
4.7.7 Issues 129
4.7.8 Recommendations and Follow-up Actions 130

Table of Contents (continued)

4.7.9 Protectiveness Statement 130
4.8 CB/NT Sediments OU-wide Issue 131
4.8.1 CB/NT Sediments OU 01, OU-wide Issue and Recommendation 131
4.8.2 Issues 134
4.8.3 Recommendations and Follow-up Actions 134
4.8.4 Protectiveness Statement 135
5 REMEDIAL ACTIONS AND FIVE-YEAR REVIEW PROCESS FOR CB/NT ASARCO OPERABLE UNITS 20, 22, AND 19 136
5.1 Background 138
5.2 Site Chronology 138
5.2.1 History of Enforcement Actions 140
5.3 Remedial Actions 141
5.3.1 Remedy Selection 141
5.3.2 Remedy Implementation 144
5.3.3 Post-Construction Monitoring/Operation and Maintenance 145
5.4 Progress since the Last Five-Year Review 145
5.5 Five-Year Review Process 152
5.5.1 Technical Assessment 153
5.5.2 Issues 158
5.5.3 Recommendations and Follow-up Actions 159
5.5.4 Protectiveness Statement 160
6 REMEDIAL ACTIONS AND FIVE-YEAR REVIEW PROCESS FOR CB/NT TACOMA TAR PITS OPERABLE UNIT 03 162
6.1 Background 163
6.1.1 Site Location 163
6.1.2 Hydrogeology 163
6.2 Site Chronology 164
6.3 Remedial Actions 166
6.3.1 Remedy Selection 166
A ROD was issued for the Tacoma Tar Pits site in December 1987 (EPA 1987). The selected remedy consisted of the following components: 166
6.3.2 Explanation of Significant Differences 168
6.3.3 Remedy Implementation 168
6.3.4 Post-Construction Monitoring/Operation and Maintenance 170
6.3.5 Remedy and O&M Costs 171
6.4 Progress Since the Last Five-Year Review 171
6.4.1 Previous Protectiveness Statement 171
6.4.2 Status of Recommendations 171
6.4.3 O&M Program Actions 173
6.4.4 Other Actions 174
6.5 Five-Year Review Process 176
6.5.1 Deadline for Five-Year Review 176
6.5.2 Components of Review 176
6.5.3 Community Notification and Involvement 176

Table of Contents (continued)

6.5.4 Document Collection and Review 177
6.5.5 Identification of Institutional Controls 177
6.5.6 Site Inspection 178
6.5.7 Interviews 178
6.5.8 Data Review and Evaluation 179
6.6 Technical Assessment 185
6.6.1 Soil and Surface Water 185
6.6.2 Groundwater 186
6.6.3 Institutional Controls 187
6.6.4 Technical Assessment Summary 189
6.7 Issues 191
6.8 Recommendations and Follow-up Actions 192
6.9 Protectiveness Statement 194
7 SUMMARY OF ISSUES 195
8 SUMMARY OF RECOMMENDATIONS AND FOLLOW-UP ACTIONS 197
9 SUMMARY OF PROTECTIVENESS STATEMENTS 202
9.1 CB/NT Sediments, Hylebos Waterway 202
9.2 CB/NT Sediments, Sitcum Waterway 202
9.3 CB/NT Sediments, St. Paul Waterway 202
9.4 CB/NT Sediments, Middle Waterway 202
9.5 CB/NT Sediments, Olympic View Resource Area 202
9.6 CB/NT Sediments, Thea Foss and Wheeler-Osgood Waterways 202
9.7 CB/NT Sediments, OU-wide 203
9.8 CB/NT Asarco 203
9.8.1 Asarco Smelter 203
9.8.2 Ruston/North Tacoma Study Area 203
9.8.3 Asarco Sediments 203
9.9 CB/NT Tacoma Tar Pits 203
10 NEXT REVIEW 205

Table of Contents (continued)

Tables (located within body of text)

Table 1. Sediments dredged from the Mouth of the Hylebos Waterway 28
Table 2. Hylebos Waterway Issues of the 2009 Five-Year Review 42
Table 3. Hylebos Waterway Recommended Follow-Up Actions 42
Table 4. Sitcum Waterway Issues of the 2009 Five-Year Review 54
Table 5. Sitcum Waterway Recommended Follow-Up Actions 54
Table 6. St. Paul Waterway Issues of the 2009 Five-Year Review 62
Table 7. St. Paul Waterway Recommended Follow-Up Actions 63
Table 8. Chemistry Monitoring Data Summary for Areas A and B 75
Table 9. Chemistry Monitoring Data Summary for Area C 78
Table 10. Middle Waterway Issues of the 2009 Five-Year Review 87
Table 11. Middle Waterway Recommended Follow-Up Actions 87
Table 12. Olympic View Resource Area Issues of the 2009 Five-Year Review 96
Table 13. Olympic View Resource Area Recommended Follow-Up Actions 97
Table 14. Thea Foss and Wheeler-Osgood Waterways Issues of the 2009 Five-Year Review. 130
Table 15. Thea Foss and Wheeler-Osgood Waterways Recommended Follow-Up Actions 130
Table 16. CB/NT Sediments OU, OU-wide Issue of the 2009 Five-Year Review 134
Table 17. CB/NT Sediments OU, OU-wide Recommended Follow-Up Action 134
Table 18. Asarco Issues of the 2009 Five-Year Review 158
Table 19. Asarco Recommended Follow-Up Actions 159
Table 20. Tacoma Tar Pits Issues of the 2009 Five-Year Review 191
Table 21. Tacoma Tar Pits Recommended Follow-Up Actions 192
Table 22. Summary of Issues for the 2009 Five-Year Review 195
Table 23. Summary of Recommended Follow-Up Actions 197

Five-Year Review Summary Forms

Hylebos Waterway 21
Sitcum Waterway 42
St. Paul Waterway 54
Middle Waterway 63
Olympic View Resource Area 89
Thea Foss and Wheeler-Osgood Waterways 97
CB/NT Sediments OU, OU-wide Issue 131
Asarco Operable Units 20, 22, and 19 136
Tacoma Tar Pits Operable Unit 03 162

Table of Contents (continued)

Figures (located after text)

Figure 1-1 Conceptual Site Model
Figure 4-1 Commencement Bay Nearshore/Tideflats Vicinity Map
Figure 4-2 Head of Hylebos Waterway
Figure 4-3 Mouth of the Hylebos Waterway Segments 3 and 4
Figure 4-4 Mouth of the Hylebos Waterway Segment 5
Figure 4-5 Sitcum Waterway
Figure 4-6 Clear Creek Habitat Area
Figure 4-7 St. Paul Waterway
Figure 4-8 Head of Middle Waterway Vicinity Map
Figure 4-9 Head of Middle Waterway
Figure 4-10 Mouth of Middle Waterway
Figure 4-11 Olympic View Resource Area Vicinity Map
Figure 4-12 Olympic View Resource Area, Site Areas and Survey Monitoring Transects
Figure 4-13 Main and Head Thea Foss Waterway
Figure 5-1 Asarco Site Location Map
Figure 5-2 Ruston/North Tacoma Study Area
Figure 6-1 Tacoma Tar Pits Site Vicinity Map
Figure 6-2 Tacoma Tar Pits Site Features
Figure 6-3 Site Boundary and Areas Where Institutional Controls Apply
Figure 6-4 Tacoma Tar Pits Benzene Plume, January 2009
Figure 6-5 Benzene Concentrations in Eastern Branch
Figure 6-6 Tacoma Tar Pits Tax Parcels and Numbers

Table of Contents (continued)

Attachments (located after text)

OU 1 Attachments
OU 1 Attachment 1 - List of Documents Reviewed
OU 1 Attachment 2 - ARARs Review Summary
OU 1 Attachment 3 - Toxicity Review Summary
OU 1 Attachment 4 - Five-Year Review Interview Record
OU 1 Attachment 5 - Advertisement for Notice of Five-Year Review
OU 1 Attachment 6 - Site Photos
OU 1 Attachment 7- Arkema Cap Approval Letter
OU 1 Attachment 8 - Occidental 2005 Amendment to the 1997 AOC
OU 1 Attachment 9 - Tribal Framework Evaluation

OU 20, 22, and 19 Attachments

OU 20, 22 and 19 Attachment 1 - List of Documents Reviewed
OU 20, 22 and 19 Attachment 2 - Site Photos

OU 3 Attachments
OU 3 Attachment 1 - List of Documents Reviewed
OU 3 Attachment 2 - Draft Groundwater Quality Update Using MAROS
OU 3 Attachment 3 - Community-Provided Information Technical Memorandum
OU 3 Attachment 4 - Draft Institutional Controls Report
OU 3 Attachment 5 - Site Inspection Team Roster, Checklist, and Photographs
OU 3 Attachment 6 - Inspection & Maintenance Review Technical Memorandum
OU 3 Attachment 7 - Screening Evaluation of Soils at the Northwest Detention Center
OU 3 Attachment 8 - ARARs Review Summary

Acronyms and Abbreviations

AET	Apparent Effects Threshold
AKART	All Known, Available, and Reasonable Treatment
AOC	Administrative Order on Consent
APP	Associated Petroleum Products
ARAR	Applicable or Relevant and Appropriate Requirement
BEHP	bis(2-ethylhexyl)phthalate
BMP	best management practice
BNRR	Burlington Northern Railroad
BNSF	Burlington Northern/Santa Fe
BORDC	Bill of Rights Defense Committee
CB/NT	Commencement Bay Nearshore/Tideflats
CD	Consent Decree
CDF	confined disposal facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFAWQC	chronic freshwater ambient water quality criteria
CFR	Code of Federal Regulations
CHB	Citizens for a Healthy Bay
COC	contaminant of concern
cPAH	carcinogenic polyaromatic hydrocarbon
CSC	Correctional Services Corporation
DEHP	di(2-ethylhexyl)phthalate
DMMP	Dredged Material Management Program
DNR	Washington State Department of Natural Resources
DOF	Dalton, Olmsted & Fuglevand, Inc.
DOH	Washington State Department of Health
E&E	Ecology and Environment
Ecology	Washington State Department of Ecology
ENR	enhanced natural recovery
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESD	Explanation of Significant Differences
FS	feasibility study
FYR	Five-Year Review
gpm	gallons per minute
HCC	Hylebos Cleanup Committee
HDPE	high-density polyethylene
HPAH	high molecular weight polynuclear aromatic hydrocarbons
IA	Interagency Agreement
IC	Institutional Control
ICE	Immigration and Customs Enforcement
JS&S	Joseph Simon & Sons
LMRP	Long-term Monitoring and Reporting Plan
LPAH	low molecular weight polynuclear aromatic hydrocarbon

Acronyms and Abbreviations (continued)

LRI	Land Recovery, Inc.
LTMP	Long-Term Monitoring Plan
LWD	large woody debris
MAROS	Monitoring and Remediation Optimization Software
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
MINI	Marine Industries Northwest, Inc.
MLLW	mean lower low water
MOU	Memorandum of Understanding
MTCA	Model Toxics Control Act
MWAC	Middle Waterway Action Committee
MWQC	marine water quality criteria
NCDF	nearshore confined disposal facility
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NWDC	Northwest Detention Center
O&M	Operation and Maintenance
OMMP	Operations, Maintenance, and Monitoring Plan
OCF	onsite containment facility
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
OVRA	Olympic View Resource Area
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyls
PCE	perchloroethylene
PDT	Project Delivery Team
POTW	Publicly-Owned Treatment Works
ppm	parts per million
ppt	parts per trillion
PRG	Preliminary Remediation Goal
PRP	Potentially Responsible Party
PSE	Puget Sound Energy
PSWQA	Puget Sound Water Quality Authority
PVC	polyvinyl chloride
RA	Remedial Action
RAOs	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RD	Remedial Design
RI/FS	remedial investigation/feasibility study
RNA	regulated navigation area
ROD	Record of Decision

Acronyms and Abbreviations (continued)

RPM	Remedial Project Manager
RSE	Remedial Systems Evaluation
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SMS	Sediment Management Standards
SMU	Sediment Management Unit
SPI	Sediment Profile Imaging
SQO	Sediment Quality Objective
SR	State Route (i.e., State Highway)
SRAL	Sediment Remedial Action Level
SVOC	semivolatile organic compounds
TBC	To Be Considered
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxicity Equivalent Quotient
TPCHD	Tacoma-Pierce County Health Department
TPH	total petroleum hydrocarbon
UAO	Unilateral Administrative Order
UECA	Uniform Environmental Covenants Act
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USEPA	U. S. Environmental Protection Agency (also EPA)
USFWS	U. S. Fish and Wildlife Service
VCP	Voluntary Cleanup Program (Washington State Department of Ecology)
VOC	volatile organic compound
WAC	Washington Administrative Code
WNG	Washington Natural Gas
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter

Executive Summary

This document presents the Five-Year Review for the Commencement Bay Nearshore/Tideflats Superfund site (CB/NT site) in Tacoma, Washington. This National Priorities List (NPL) site is divided into six Operable Units (OUs):

OU 01 Commencement Bay Nearshore/Tideflats Sediments.

OU 02 Asarco Tacoma Smelter Facility (currently renamed OU 20).

OU 03 Tacoma Tar Pits.

OU 04 Asarco Off-Property (referred to as Ruston/North Tacoma Study Area, currently renamed OU 22).

OU 05 Commencement Bay Nearshore/Tideflats Sources (associated with OU 01).

OU 06 Asarco Sediments (referred to as Asarco Sediments/Groundwater, currently renamed OU 19).

For the CB/NT site, there are three separate project areas that are being managed as distinct sites. These project areas include the Commencement Bay Nearshore/Tideflats Sediments and Sources (OU 01 and OU 05); the Asarco Smelter Facility and surrounding impacted areas (OU 20, OU 22, and OU 19); and the Tacoma Tar Pits (OU 03). The CB/NT Sediments OU (OU 01) includes eight contaminated sediment Problem Areas, within six marine waterways. These Problem Areas consist of the Head and Mouth of Hylebos Waterway, Sitcum Waterway, St. Paul Waterway, Middle Waterway, Head and Mouth of Thea Foss Waterway, and Wheeler-Osgood Waterway. The CB/NT Sediments OU also includes two non-time-critical removal actions known as the Olympic View Resource Area and the Occidental Site. The CB/NT Sediments and Sources OUs are under one Record of Decision (ROD). The CB/NT Asarco OUs (OU 20, OU 22, and OU 19) are addressed by three RODs, and the Tacoma Tar Pits OU (OU 03) is addressed by one ROD. This Five-Year Review addresses all OUs, except for CB/NT Sources.

Cleanup of the OUs addressed in this Five-Year Review has been conducted by Responsible Parties, under oversight by the U.S. Environmental Protection Agency (EPA). For CB/NT Sources (OU 05), the Washington Department of Ecology (Ecology) is lead agency for CB/NT source control actions. The strategic relationship and importance of coordination between EPA and Ecology regarding sediment cleanup and source control actions is described in Section 5.2 of the CB/NT ROD (OU 01 and OU 05). Since Ecology has the lead in addressing upland contaminant source areas, this Five-Year Review contains limited information about CB/NT Sources (OU 05).

The purpose of a Five-Year Review is to determine whether the remedy at a site is protective of human health and the environment. In addition, Five-Year Review reports identify issues or deficiencies found during the review, if any, and recommendations to address them.

Brief site descriptions are summarized below.

Commencement Bay Nearshore/Tideflats Sediments (OU 01)

The CB/NT Sediments OU 01 is located in Tacoma, Washington at the southern end of the main basin of Puget Sound (Figure 4-1). The site encompasses an active commercial seaport and includes 10-12 square miles of shallow water, shoreline, and adjacent land, most of which is highly developed and industrialized. The marine and estuarine portions of the site also support important recreational and tribal fisheries. The site is located in a tribal Usual and Accustomed fishing area.

Contaminants in the CB/NT area originate from both upland and in-water sources as depicted in the Conceptual Site Model (see Figure 1-1). Early industrial surveys conducted by the Tacoma-Pierce County Health Department (TPCHD) and the Port of Tacoma indicated that there are more than 281 active industrial facilities in the CB/NT area. With industrialization, the release of hazardous substances and waste materials into the environment resulted in alterations to the chemical quality of waters and sediments in many areas of the bay. Contaminants found in the nearshore area include arsenic, lead, zinc, cadmium, copper, mercury, and various organic compounds such as polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs), and phthalates.

The cleanup goal for the Commencement Bay problem areas is reduction of contaminant concentrations in sediments to levels that will support a healthy marine environment and will protect the health of people eating seafood from the bay. The ROD designated biological test requirements and associated sediment chemical concentrations referred to as Sediment Quality Objectives (SQOs) in order to achieve this goal. SQOs for all problem chemicals were set based on an evaluation of the ecological and human health risks posed by these chemicals. The SQO for PCBs was based on the human health risk assessment. SQOs for all other chemicals were based on the ecological risk assessment, because the ecologically-based cleanup levels were determined to be also protective of human health.

The ROD selected a cleanup remedy that identified eight problem areas for sediment cleanup and allowed flexibility to utilize any one, or a combination of, five key elements in any particular area. As described in the Declaration and Section 10.2 of the ROD, these elements are: 1) site use restrictions to reduce potential human health exposure to site contamination, particularly ingestion of contaminated seafood, 2) source control to prevent recontamination of sediments and meet Applicable or Relevant and Appropriate Requirements (ARARs), 3) natural recovery for marginally contaminated sediments that are predicted to achieve acceptable sediment quality within a reasonable timeframe, 4) sediment remedial action to address sediments containing contamination that is expected to persist for unacceptable periods of time, using in-place capping, dredging/confined aquatic disposal, dredging/nearshore disposal, and dredging/upland disposal, and 5) source and sediment monitoring to characterize the effectiveness of source controls and identify if additional actions are necessary, to ensure that all necessary remedial actions have been undertaken in each problem area, and to evaluate the effectiveness of the components of the remedy (including disposal sites and habitat mitigation/restoration areas), in achieving the sediment quality objectives and in relation to habitat function.

For each CB/NT Problem Area, and the two removal actions, the summary of issues and recommendations is provided in the Five-Year Review Summary Form, and a brief summary of protectiveness statements is provided below.

For the Hylebos Waterway, the remedy is expected to be protective of human health and the environment upon completion. Most remedial action construction has been accomplished, and the additional actions needed for the remedy throughout the waterway to be protective described in the ROD and this report, are progressing towards completion.

For the Sitcum Waterway, the remedy has been successfully completed, all required long-term monitoring efforts have been completed, the remedy remains protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled.

For the St. Paul Waterway, the remedial actions have been successfully completed, all required long-term monitoring efforts have been completed, and the remedy remains protective of human health and the environment.

For the Middle Waterway, all remedial actions have been completed, the remedy is currently protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled. In order for the remedy to be protective in the long-term, the Sediment Quality Objectives need to be met according to the timeframes established in the Middle Waterway Explanation of Significant Differences (ESDs), or any exceedances need to be shown to be biologically insignificant in all enhanced natural recovery (ENR) and natural recovery areas, and ICs must be fully implemented.

For the Olympic View Resource Area, the remedy is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled.

For the Thea Foss and Wheeler-Osgood Waterways, the remedy currently protects human health and the environment because the sediment remedial action significantly reduced sediment concentrations and most of the required institutional controls are in place to protect the integrity of the sediment cap. However, in order for the remedy to be protective in the long-term, additional source control activities need to be identified and implemented to reduce the extent of recontamination in the waterway and the USCG institutional control needs to be completed to help protect the long-term integrity of the sediment cap.

Taken as a whole, the remedies for the Sediments OU are expected to be protective when completed. In the interim, until site remedial objectives are met, site use restrictions (i.e., fish and shellfish consumption advisories) shall remain in effect to limit human exposure to contaminated seafood. The absence of fish tissue contaminant data does not mean that the remedy is not protective (see p. 4-14, OSWER No. 9355.7-03B-P). Recent fish tissue data for bioaccumulative chemicals have not been collected in Commencement Bay, so it is not known whether contaminant levels in fish tissues have been reduced since the remedies have been implemented, particularly for PCBs (which have a human-health based Sediment Quality Objective). Future fish tissue sampling results will be used along with other lines of evidence to ensure that the remedies are protective in the long-term.

Commencement Bay Nearshore/Tideflats Asarco (OUs 20, 22 and 19)

The Asarco portions of the CB/NT site are located in the town of Ruston at the southern end of the main basin of Puget Sound (Figure 4-1). The Smelter Facility is located along the Commencement Bay shoreline within the municipal boundaries of Ruston and Tacoma, Washington. The upland portion of the Smelter Facility is approximately 100 acres in size, and encompasses a 67-acre former smelter and a 23-acre slag Breakwater Peninsula.

The smelter specialized in processing ores with high arsenic concentrations and recovered arsenic trioxide and metallic arsenic as byproducts. Operation of the Asarco smelter for over 95 years resulted in contamination, primarily arsenic and lead, of the smelter site, off-shore sediments and the surrounding residential area.

For the Asarco Smelter and Groundwater, remedial actions are expected to be protective of human health and the environment when the remedy is completed. In the interim, exposure pathways that could result in unacceptable risks are being prevented because the site is fenced and access to the site is controlled by cell phone operated gates, monitoring during the day, and police patrols in the evenings. Dust control and other dust suppression activities (temporary capping, spraying tackifiers) are used to ensure that site contaminants remain on site.

For the Asarco Ruston/North Tacoma Study Area, remedial actions are expected to be protective of human health and the environment when the remedy is completed. In the interim, exposure pathways on the unremediated properties are only controlled through the compliance with the education program (hand washing, wetting soil, etc).

For the Asarco Sediments, remedial actions are expected to be protective of human health and the environment when the remedy is completed. For the area of sediments offshore of the Smelter where capping has been done, the remedy is already protective of human health and the environment. For the remaining sediments offshore of the Smelter and the Yacht Basin, implementation of the remedy is expected to occur in the next two to three years using money obtained from the Asarco bankruptcy settlement.

Commencement Bay Nearshore/Tideflats Tacoma Tar Pits (OU 03)

The Tacoma Tar Pits OU is located in Tacoma, Washington, within the Tacoma Tideflats industrial area near Commencement Bay. It is situated on a peninsula of land located between the Puyallup River and the Thea Foss Waterway, approximately three-quarters of a mile north of Interstate 5 (Figure 6-1). The total area of the site encompasses approximately 52 acres, and several active facilities are currently within the site boundaries including Simon Metals (a metals recycling business), the Northwest Detention Center (NWDC; an immigration detention facility), and a capped engineered waste pile and groundwater treatment plant constructed as part of the remedial action for the site.

Results of site investigations conducted in the 1980s indicated that soil, surface water and groundwater across most of the site were contaminated with organic and inorganic contaminants from former on site coal gasification plant operations and the recycling of automobiles and

electrical transformers. The primary contaminants included metals, PAHs, PCBs, and various volatile organic compounds (VOCs) including benzene.

The remedy selected in the 1987 ROD called for excavation and stabilization of contaminated soils into an engineered waste pile covered by a low permeability cap, and surface water controls to 1) manage storm water runoff from the waste pile and metal recycling operations, and 2) limit infiltration of surface water into the subsurface. The selected Superfund remedy also called for continued groundwater monitoring across the entire site to discern whether the remedial action implemented for soils and surface water caused contaminants in groundwater to drop below the ROD cleanup criteria. If it did not do so in a timely manner, the ROD anticipated the need for a groundwater remedy to be implemented.

The soil and surface water components of the selected Superfund remedy were completed in 1995, and soil and surface water cleanup criteria have been achieved. In 1998, due to continued exceedances of the groundwater cleanup criteria, EPA directed the PRP to design and install a groundwater extraction and treatment system to treat on site groundwater, with a focus on benzene contamination, and prevent it from migrating off site and potentially impacting the Puyallup River. The groundwater extraction and treatment system became fully operational in September 2002.

Over the past year there has been a lot of community concern over recent construction activities at the NWDC facility. This facility, first constructed in late 2003, is located on the former Hygrade meat packing plant property along the northwestern boundary of the site. Investigations conducted in the 1980s on this portion of the site showed groundwater contamination but little to no soil contamination. Except for a small section at the southeast corner, the vast majority of this property did not require excavation, capping or surface water controls under the Superfund remedy. Prior to the facility being built, three areas of petroleum-contaminated soils were cleaned up under the Washington State's Voluntary Cleanup Program. Expansion of the NWDC facility was initiated in late 2008 and completed in spring of 2009.

Fortunately, based on a review of site documents and construction plans, as well as observations and interviews conducted during recent expansion activities, community concerns regarding impacts on the Superfund remedy and the potential risks to detainees and on site workers from contact with contaminated soil and groundwater were not substantiated. The initial construction and subsequent expansion of the NWDC facility did not impact the Superfund remedy. It did, however, add a potential new exposure pathway for detainees and workers within the detention facility buildings via vapor intrusion from subsurface contamination. As such, a screening evaluation was conducted by an EPA risk assessor during this Five-Year Review using soil sampling data taken from expansion excavations. Results of this screening evaluation found that unacceptable risks to detainees and on site workers from exposure to estimated indoor air concentrations from vapor intrusion is not likely.

The results of this third Five-Year Review indicate that the Tacoma Tar Pits remedy is functioning as intended and is currently protective of human health and the environment because 1) sources of contamination (e.g., waste materials and contaminated soils) have been excavated, disposed of off site or treated and contained on site, 2) low permeability caps and surface water controls have been placed across critical areas of the site, 3) institutional controls are in place,

and 4) contaminated groundwater is not used as a drinking water source and does not appear to be discharging to the Puyallup River.

In order for the remedy to remain protective over the long-term, the follow-up actions recommended in this report need to be performed which include 1) continuing maintenance of the cap, cover and ancillary surface water drainage features, 2) continuing operation and optimization of the groundwater extraction, treatment and monitoring systems to reduce the size and concentration of the benzene plume, and 3) optimizing property owner compliance with institutional control requirements.

Environmental Indicators/Site Status Indicators: In addition to the Five-Year Review protectiveness determinations, EPA has also developed other environmental and site status indicators to measure and report progress and conditions of Superfund sites. These include two Sitewide Environmental Indicators (Human Health Exposure Under Control and Groundwater Migration Under Control) and the Cross-Program Revitalization Measures, which are evaluated by Project Area and Sitewide. Based on the findings of this Five-Year Review, EPA has made updated determinations for those indicators as follows:

Human Exposure Environmental Indicator: The status of the Superfund Human Exposure Environmental Indicator for the Site remains "Not Under Control." Despite considerable remedial action within this Site, which covers approximately 12 square miles, residential yard cleanups around the former Asarco smelter complex and some sediment remedial actions are not yet complete. In addition, while fish consumption advisories issued by the local health department which limit human exposure remain in effect, they are not enforceable and there is anecdotal evidence that some people do not follow the consumption advice provided in the advisories.

Groundwater Migration Environmental Indicator: The status of the Groundwater Migration Environmental Indicator for the Site remains "Not Under Control" because contaminated groundwater continues to discharge through bottom sediments into surface water in some areas.

Cross-Program Revitalization Measure: The Site has not yet been determined to be "protective for people under current conditions" because of the need to complete ongoing remedial actions and to put additional institutional controls in place as described in this report.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Commencement Bay, Near Shore/Tide Flats (CB/NT)		
EPA ID *(from WasteLAN)*: WAD980726368		
Region: 10	**State:** WA	**City/County:** Tacoma, Pierce County
SITE STATUS		
NPL status: ☒ Final ☐ Deleted ☐ Other (specify)		
Remediation status (choose all that apply): ☒ Under Construction ☒ Operating ☒ Complete		
Multiple OUs?* ☒ YES ☐ NO	**Construction completion date:** 9/30/2015	
Has site been put into reuse? ☒ YES ☐ NO		
REVIEW STATUS		
Lead agency: ☒ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____		
Author name: Nancy Harney, Karen Keeley, Tamara Langton, Kira Lynch, Kevin Rochlin, Jonathan Williams		
Author title: Remedial Project Manager	**Author affiliation:** USEPA Region 10	
Review period:** December 29, 2004 to December 29, 2009		
Date(s) of site inspection: Ongoing at each waterway and/or each Operable Unit		
Type of review: ☒ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion		
Review number: ☐ 1 (first) ☐ 2 (second) ☒ 3 (third) ☐ Other (specify) _____		
Triggering action: ☐ Actual RA On site Construction at OU #____ ☐ Actual RA Start at OU#____ ☐ Construction Completion ☒ Previous Five-Year Review Report ☐ Other (specify) Preliminary Closeout		
Triggering action date *(from WasteLAN)*: December 29, 2004		
Due date *(five years after triggering action date)*: December 29, 2009		

* ["OU" refers to operable unit.]
**[Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, continued

Commencement Bay Nearshore/Tideflats (CB/NT) Site

CB/NT Sediments, Operable Unit 01, OU-wide

Issues:

Recent fish tissue data for bioaccumulative chemicals have not been collected in Commencement Bay. Thus, it is not known whether contaminant levels in fish tissues have been reduced since the remedies have been implemented, particularly for PCBs (which have a human-health based Sediment Quality Objective), and whether fish advisories should be continued, modified, or removed.

Recommendations and Follow-up Actions:

Develop and implement a sampling plan for collection and analysis of bay-wide fish tissue data for bioaccumulative chemicals (particularly for PCBs, which have a human-health based Sediment Quality Objective). Provide results to appropriate state and local agencies to evaluate protectiveness of health-based fish consumption advisories for Commencement Bay.

Protectiveness Statement(s):

Taken as a whole, the remedies for the Sediments OU are expected to be protective when completed. In the interim, until site remedial objectives are met, site use restrictions (i.e., fish and shellfish consumption advisories) shall remain in effect to limit human exposure to contaminated seafood. The absence of fish tissue contaminant data does not mean that the remedy is not protective (see p. 4-14, OSWER No. 9355.7-03B-P). Future fish tissue sampling results will be used along with other lines of evidence to ensure that the remedies are protective in the long-term.

CB/NT Sediments, Hylebos Waterway

Issues:

Arkema Site source control is needed to meet RA performance standards.

Recommendations and Follow-up Actions:

Perform RI/FS and RD/RA for the Arkema Site to investigate and address contamination upland and beneath the waterway.

Protectiveness Statement(s):

The remedy is expected to be protective of human health and the environment upon completion. Most remedial action construction has been accomplished, and the additional actions needed for the remedy throughout the waterway to be protective described in the ROD and this report, are progressing toward completion.

Other Comments:

Pier 23 is within the CB/NT site and the U.S. Army is conducting the sediment cleanup under Washington Department of Ecology (Ecology) review. EPA has not reviewed all of the information developed by the U.S. Army and Remedial Action has not yet begun. Thus, EPA is unable at this time to assess the protectiveness of the response actions being undertaken by the U.S. Army at Pier 23. EPA will assess the level of cleanup achieved by the U.S. Army to determine the protectiveness of Pier 23 response actions.

Five-Year Review Summary Form, continued

CB/NT Sediments, Sitcum Waterway

Issues: None.

Recommendations and Follow-up Actions: None.

Protectiveness Statement(s): The remedy at the Sitcum Waterway Problem Area is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled.

Other Comments: None.

CB/NT Sediments, St. Paul Waterway

Issues: None.

Recommendations and Follow-up Actions: None.

Protectiveness Statement(s): The remedial actions at the St. Paul Waterway Problem Area of the CB/NT Site have been successfully completed, all required long-term monitoring efforts have been completed, and the remedy remains protective of human health and the environment.

Other Comments: None.

CB/NT Sediments, Middle Waterway

Issues:

1. Possible recontamination of surface sediments due to erosion and large burrowing organisms bringing the underlying, native sediments to the surface in Area C. Drainage from the Mylet property down-cutting, such that the underlying tideflat and wood debris are exposed in Area C.

2. Ineffectiveness of grade stake survey due to stakes missing during survey monitoring in Area C.

3. SQO exceedances for mercury in Areas A and B in NR areas where SQOs are expected to be met within a ten year timeframe.

4. SQO exceedance of bis(2-ethylhexyl)phthalate, with elevated (but below SQO) concentrations of mercury and PAH found in Area C sediments near the Mylet roof drain.

5. Beached logs have been a problem primarily for the recovering pickleweed and other vegetation at the upper tidal levels at the head of the waterway due to smothering or sediment gouging.

6. Institutional controls have not been fully implemented.

7. Year 5 monitoring results from summer of 2009 have not been included in this review and need to be evaluated to further assess status of sediments in the waterway.

Recommendations and Follow-up Actions:

1. Include chemical monitoring of burrows within drainage channels or other erosion features in future monitoring events. Evaluate options to prevent further erosion.

2. Replace with periodic topographic surveys to map the long-term effects of the outfall on the tideflat and remedy performance.

3. Continue monitoring and evaluate Year 5 data to evaluate potential causes of SQO exceedances in Areas A and B.

Five-Year Review Summary Form, continued

4. Include chemical monitoring of burrows within drainage channels or other erosion features in future monitoring events. Evaluate options to prevent further erosion.

5. Develop a Memorandum of Understanding with Simpson. Also evaluate the possibility of installing a breakwater to replace the protective function if the former piling field.

6. Conduct an IC study; follow up with the USCG about status of final RNA; verify that easements have been executed and recorded with Pierce County.

7. Evaluate Year 5 data; discuss options and potential need for additional remedial action.

Protectiveness Statement(s):

The remedial action in Middle Waterway has been completed, the remedy is currently protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled. In order for the remedy to remain protective in the long-term, the Sediment Quality Objectives need to be met according to the timeframes established in the Middle Waterway ESDs, or any exceedances need to be shown to be biologically insignificant in all enhanced natural recovery (ENR) and natural recovery areas, and ICs must be fully implemented.

Other Comments: None.

CB/NT Sediments, Olympic View Resource Area

Issues: None.

Recommendations and Follow-up Actions: None.

Protectiveness Statement(s):

The remedy at the Olympic View Resource Area is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled.

Other Comments: None.

CB/NT Sediments, Thea Foss and Wheeler-Osgood Waterways

Issues:

Source control does not appear adequate to prevent recontamination.

Recommendations and Follow-up Actions:

Continue to monitor and evaluate sources of phthalates and PAHs to sediments.

Protectiveness Statement(s): The remedy at the Thea Foss and Wheeler-Osgood Waterways currently protects human health and the environment because the sediment remedial action significantly reduced sediment concentrations and most of the required institutional controls are in place to protect the integrity of the sediment cap. However, in order for the remedy to be protective in the long-term, additional source control activities need to be identified and implemented to reduce the extent of recontamination in the waterway and the USCG institutional control needs to be completed to help protect the long-term integrity of the sediment cap.

Other Comments: None.

Five-Year Review Summary Form, continued

CB/NT Asarco, Operable Units 20, 22, and 19

Issues:

Asarco Smelter

None.

Ruston/North Tacoma Study Area

1. Based on phone calls received by EPA and Ecology, there is a subset of the people in the study area who do not know anything about the site, the fact that yards in the study area may be contaminated, the yard cleanup program, and the required institutional controls.

2. The site development may bring new people as well as different land uses to the area. This could result in differing exposures than those currently accounted for in the ROD.

3. There may be recontamination of the yards that have been remediated in the Study Area.

4. Potential for properties outside the Study area to be contaminated is being addressed by Ecology.

5. Ecology has requested that EPA review the remedy to ensure that it is still protective.

Asarco Sediments

1. The habitat basin is functioning as designed even though part of the breakwater collapsed in the 2001 Nisqually earthquake. Because the "shelf" holding the breakwater is no longer there, replacement would require a significant reduction in size of the habitat basin.

Recommendations and Follow-up Actions:

Asarco Smelter

None.

Ruston/North Tacoma Study Area

1. Review the institutional controls/education component for the Ruston/North Tacoma Study Area and determine what changes are needed to ensure that people are aware of the controls and that they are carried forward.

2. Review ongoing site and area development and ensure that changes in the area do not impact remedy protectiveness.

3. Resample a subset of properties to ensure that recontamination has not occurred.

4. EPA will document the fact that Ecology will have the lead for properties outside the study area.

5. EPA has agreed to conduct a more in depth review of the remedy for the site to ensure its protectiveness. This review will be completed by July 27, 2010. The review will use the criteria in the "Comprehensive Five-Year Review Guidance (OSWER No. 9355.7-03B-P, June 2001 and also consider strategies that Ecology has developed for addressing arsenic and lead throughout the State and within the Tacoma Smelter Plume.

Asarco Sediments

1. EPA will need to determine whether the habitat basin should be repaired or left as it is.

Five-Year Review Summary Form, continued

Protectiveness Statement(s):

Asarco Smelter

Remedial actions at the Asarco Smelter are expected to be protective of human health and the environment when the remedy is completed. In the interim, exposure pathways that could result in unacceptable risks are being prevented because the site is fenced and access to the site is controlled by cell phone operated gates, monitoring during the day, and police patrols in the evenings. Dust control and other dust suppression activities (temporary capping, spraying tackifiers) are used to ensure that site contaminants remain on site.

Ruston/North Tacoma Study Area

Remedial actions for the Ruston/North Tacoma Study Area are expected to be protective of human health and the environment when the remedy is completed. In the interim, exposure pathways on the unremediated properties are only controlled through the compliance with the education program (hand washing, wetting soil, etc).

Asarco Sediments

Remedial actions for the Asarco Sediments are expected to be protective of human health and the environment when the remedy is completed. For the area of sediments offshore of the Smelter where capping has been done, the remedy is already protective of human health and the environment. For the remaining sediments offshore of the Smelter and the Yacht Basin, implementation of the remedy is expected to occur in the next two to three years using money obtained from the Asarco bankruptcy settlement.

Other Comments: None.

CB/NT Tacoma Tar Pits, Operable Unit 03

Issues:

1. A small pavement failure was observed in the asphalt road leading to the top of the capped engineered waste pile, as shown in Operable Unit 3 (OU 3) Attachment 5, photo 8. This feature represents a potential pathway for surface water erosion of the cap. (NOTE: this is a separate pavement failure than the one noted in – and repaired after – the 2003 Five-Year Review).

2. Hydraulic conductivity testing of asphalt pavement covers has not been performed in accordance with the Inspection and Maintenance Manual. This was recommended in the 2003 Five-Year Review report.

3. The TTP-3M (East Branch) Area benzene plume within the site boundary has not appreciably diminished in size or concentration over the past several years. In addition, although this plume appears to be contained especially when looking at non-detect benzene concentrations in downgradient monitoring well DOF-19, Figure 6-5 shows a sewer line trench in hydraulic connection with the benzene plume which may convey the plume away from DOF-19.

4. The TTP-18M (North Branch) Area benzene plume appears to be contained or captured as seen through decreasing benzene concentrations; however, the concentrations are well above the ROD groundwater cleanup performance criterion for benzene (53 µg/L) and are also outside the site boundary.

5. The ROD groundwater remedy and RAOs focused on treatment and containment of the contaminated plume, but do not appear to have considered groundwater restoration.

6. Property owner compliance with site institutional control requirements is not optimal.

Five-Year Review Summary Form, continued

Recommendations and Follow-up Actions:

1. Repair the pavement hole.

2. Implement asphalt pavement permeability testing or develop and conduct an alternative way of systematically assessing asphalt pavement conditions and permeability and revise the Inspection and Maintenance Manual accordingly.

3. Optimize the TTP-3M (East Branch) Area system and conduct a capture zone analysis in order to reach the ROD groundwater cleanup criterion for benzene and reduce the size of the plume. A determination is also needed on the fate and transport of the benzene plume and its hydraulic relationship to the sewer line trench along the southern boundary of the site.

4. Optimize the TTP-18M (North Branch) Area system and conduct a capture zone analysis in order to reach the ROD groundwater cleanup criterion for benzene and reduce the size of the plume. An additional monitoring well may also be needed just beyond the stagnation point of Extraction Well A to help determine effectiveness.

5. Evaluate whether groundwater restoration at this site is feasible and necessary to 1) comply with ARARs, CERCLA, and EPA's CERCLA groundwater policies, and 2) ensure long-term protectiveness.

6. Request site property owners to comply with all Consent Decree conveyance of site/institutional control requirements. Voluntary compliance with the state of Washington's Uniform Environmental Covenants Act (UECA) should also be requested to ensure the long-term effectiveness of site institutional controls.

Protectiveness Statement(s): The results of this Five-Year Review indicate that the Tacoma Tar Pits remedy is functioning as intended and is currently protective of human health and the environment because 1) sources of contamination (e.g., waste materials and contaminated soils) have been excavated, disposed of off site or treated and contained on site, 2) low permeability caps and surface water controls have been placed across critical areas of the site, 3) institutional controls are in place, and 4) contaminated groundwater is not used as a drinking water source and does not appear to be discharging to the Puyallup River. In order for the remedy to remain protective over the long-term, the follow-up actions recommended in this report need to be performed which include 1) continuing maintenance of the cap, cover and ancillary surface water drainage features, 2) continuing operation and optimization of the groundwater extraction, treatment and monitoring systems to reduce the size and concentration of the benzene plume, and 3) optimizing property owner compliance with institutional control requirements.

Other Comments: None.

[This page intentionally left blank]

COMMENCEMENT BAY NEARSHORE/TIDEFLATS SUPERFUND SITE TACOMA, WASHINGTON

1 INTRODUCTION

The Commencement Bay Nearshore/Tideflats Superfund site (CB/NT site) is located in Tacoma, Washington at the southern end of the main basin of Puget Sound. This National Priorities List (NPL) site is divided into six Operable Units (OUs):

OU 01 Commencement Bay Nearshore/Tideflats Sediments.

OU 02 Asarco Tacoma Smelter Facility (currently renamed OU 20).

OU 03 Tacoma Tar Pits.

OU 04 Asarco Off-Property (referred to as Ruston/North Tacoma Study Area, currently renamed OU 22).

OU 05 Commencement Bay Nearshore/Tideflats Sources.

OU 06 Asarco Sediments (currently renamed Asarco Sediments/Groundwater OU 19).

For the CB/NT site, there are three separate project areas that are being managed as distinct sites. These project areas include the Commencement Bay Nearshore/Tideflats Sediments and Sources (OU 01 and OU 05); the Asarco Smelter Facility and surrounding impacted areas (OU 20, OU 22, and OU 19); and the Tacoma Tar Pits (OU 03).

The CB/NT Sediments OU (OU 01) includes eight contaminated sediment Problem Areas, within six marine waterways. These Problem Areas consist of the Head and Mouth of Hylebos Waterway, Sitcum Waterway, St. Paul Waterway, Middle Waterway, Head and Mouth of Thea Foss (formerly City) Waterway, and Wheeler-Osgood Waterway. The CB/NT Sediments OU also includes two non-time-critical removal actions known as the Olympic View Resource Area and the Occidental Site.

The CB/NT Sediments and Sources OUs are under one Record of Decision (ROD). The CB/NT Asarco OUs (OU 20, OU 22, and OU 19) are addressed by three RODs, and the Tacoma Tar Pits OU (OU 03) is addressed by one ROD. This Five-Year Review (FYR) addresses all OUs, except for CB/NT Sources.

Cleanup of the OUs addressed in this FYR has been conducted by Responsible Parties, under oversight by the U.S. Environmental Protection Agency (EPA). For CB/NT Sources (OU 05), the Washington Department of Ecology (Ecology) is lead agency for CB/NT source control actions. The strategic relationship and importance of coordination between EPA and Ecology regarding sediment cleanup and source control actions is described in Section 5.2 of the CB/NT

ROD (OU 01 and OU 05). Since Ecology has the lead in addressing upland contaminant source areas, this FYR contains limited information about CB/NT Sources (OU 05).

The purpose of a FYR is to determine whether the remedy at a site is protective of human health and the environment. In addition, FYR reports identify issues or deficiencies found during the review, if any, and recommendations to address them.

The Agency is preparing this FYR pursuant to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121(c) states:

> "If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."

The agency interpreted this requirement further in the NCP, at 40 Code of Federal Regulations (CFR) §300.430(f)(4)(ii), which states:

> "If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."

The EPA Region 10 has conducted this Five-Year Review of the remedial actions implemented at the CB/NT Site. This review was conducted from January 2009 through November 2009. This report documents the results of the review. For this Five-Year Review, the U.S. Army Corps of Engineers (USACE) provided support to EPA under an Interagency Agreement. Also, for some portions of the site Responsible Parties conducted analyses in support of the five-year review, which are described in unique sections below.

The first CB/NT Sediments and Asarco FYR was conducted in December 1999, and the second FYR was conducted in December 2004. The 2004 review is the trigger for conducting this third FYR. The first Tacoma Tar Pits FYR was conducted in September 1998, and the second FYR was conducted in September 2003. In 2004, EPA determined that the third FYR for the Tacoma Tar Pits should be included in the third FYR for the CB/NT Site, since the Tacoma Tar Pits is an OU within the CB/NT Site. This is a statutory FYR.

2 SITE CHRONOLOGY

A brief chronology of site events is listed below. For detailed information, see subsequent Sections 4, 5, and 6 for information on each project area.

1979	Commencement Bay Site Discovery.
1981	Commencement Bay placed on national interim list: deepwater, nearshore, tideflats/industrial, South Tacoma Channel (upland site).
1983	CB/NT designated on NPL; CB South Tacoma Channel designated as a separate site; CB deepwater eliminated from list.
1983	CB/NT EPA and Ecology agreement. Ecology designated as lead agency for RI/FS.
1985	CB/NT Sediments OU remedial investigation completed.
1987	Asarco RI/FS began.
1987	Tacoma Tar Pits ROD.
1988	CB/NT feasibility study completed for Sediments OU.
1989	CB/NT ROD for Sediments OU/Source Control OU.
1989	Asarco RI completed.
1991 - 1995	Tacoma Tar Pits, ESDs.
1993 - 2004	CB/NT Sediments OU, ESDs (see Section 4.1.4).
1993	Asarco Ruston/North Tacoma Study Area ROD.
1995	Asarco Smelter ROD.
1998	First Five-Year Review for Tacoma Tar Pits (separate from CB/NT Sediments and Asarco).
1999	First Five-Year Review for CB/NT Site.
2000	Asarco Sediments ROD.
2003	Second Five-Year Review for Tacoma Tar Pits (separate from CB/NT Sediments and Asarco).
2004	Second Five-Year Review for CB/NT Site.

3 BACKGROUND

3.1 Site Location and Description

The CB/NT Superfund site is located in the City of Tacoma (City) and Town of Ruston (Ruston), Washington, near the southern end of the Puget Sound lowland (Figure 4-1). The site encompasses an active commercial seaport and includes 10-12 square miles of shallow water, shoreline, and adjacent land, most of which is highly developed and industrialized. The subtidal and intertidal areas of the site support important recreational and tribal fisheries. The site is located within a tribal Usual and Accustomed fishing area.

The upland boundaries of the site are defined according to the contours of localized drainage basins that flow into the marine waters. The marine boundary of the site is limited to the shoreline, intertidal areas, bottom sediments, and water of depths less than 60 feet below mean lower low water (MLLW). The nearshore portion of the site is defined as the area along the Ruston shoreline from the mouth of the Thea Foss Waterway to Pt. Defiance. The tideflats portion of the site includes the Hylebos, Blair, Sitcum, St. Paul, Middle, Wheeler-Osgood, and Thea Foss Waterways; the Puyallup River upstream to the Interstate-5 bridge; and the adjacent land areas.

The Asarco Area Site (the Site) consists of the former Asarco copper and lead smelter facility ("Smelter Facility" or "facility") and the surrounding area (described below). The Smelter Facility is located along the Commencement Bay shoreline within the municipal boundaries of Ruston and Tacoma, Washington. The upland portion of the Smelter Facility is approximately 100 acres in size, and encompasses a 67-acre former smelter and a 23-acre slag Breakwater Peninsula. Approximately 30 acres of offshore intertidal and subtidal lands are also under Asarco ownership. Additional offshore areas are owned by the State of Washington and are managed by the Washington State Department of Natural Resources (DNR). The Asarco site includes an estimated population of approximately 5000 people, and about 1,820 housing units. Contamination at the site is the result of airborne emissions from smelting operations and consists primarily of arsenic and lead in surface soils. Smelter slag has also been used by residents and businesses for fill material.

The Tacoma Tar Pits is an uplands component of the overall CB/NT Superfund site, situated within a peninsula of land between the Puyallup River and the Thea Foss Waterway, approximately three-quarters of a mile north of Interstate 5. The total area of the site encompasses approximately 52 acres.

Within the CB/NT site, the land, water, and shoreline within the site boundary are owned by various parties, including the state of Washington, the Port of Tacoma, the City of Tacoma, the Town of Ruston, Pierce County, the Puyallup Tribe of Indians, and numerous private entities. Much of the publicly-owned land is leased to private enterprises. Within the site boundaries, land use is primarily industrial and commercial. Ruston is primarily residential. Subtidal and intertidal portions of the site support important recreational and tribal fisheries as described below.

3.2 Land and Resource Use

The Port of Tacoma operates many cargo handling and storage facilities along the Sitcum Waterway and owns and leases properties to large and small industrial, manufacturing, marina, and commercial tenants in the Hylebos and Thea Foss Waterways. Major private landowners include lumber, chemical, and petroleum companies. A majority of the property along the Hylebos Waterway is owned by private companies, and there are several privately-owned parcels along the Blair Waterway. The Thea Foss and Wheeler-Osgood Waterways have a mixture of privately-owned businesses with a large tract along the west side of the Thea Foss Waterway purchased by the City to facilitate a large urban renewal project. Other privately owned parcels are found predominantly at the landward end of the port and industrial area.

A large portion of the tideland and offshore areas of the CB/NT site is either owned or managed by the State of Washington through DNR, or is designated as state-owned harbor areas. Most of the bottom sediments in the Thea Foss and Middle Waterways are state land, and some sediments at St. Paul Waterway are state land. The Port of Tacoma owns tidelands and bottom sediments in several areas including Hylebos Waterway, the Head of Blair Waterway, and Sitcum Waterway. Bottom sediment in the St. Paul and Wheeler-Osgood Waterways are privately owned. Private ownership of the shorelines and intertidal areas in many portions of the site generally corresponds with ownership of the adjacent upland property parcels.

Contaminants in the CB/NT area originate from both upland and in-water sources as depicted in the schematic Conceptual Site Model (Figure 1-1). Early industrial surveys conducted by the Tacoma-Pierce County Health Department (TPCHD) and the Port of Tacoma indicated that there were more than 281 active industrial facilities in the CB/NT area. At that time, approximately 34 of these facilities were National Pollutant Discharge Elimination System (NPDES)-permitted dischargers. Other sources to the CB/NT site include numerous storm drains, contaminated groundwater seeps, open channels, atmospheric deposition, direct dumping or filling, and industrial spills. TPCHD identified several hundred diffuse sources that empty into Commencement Bay.

Fresh groundwater is found within about 10 feet of the land surface over much of the site. Although protected as a potential source of drinking water, shallow groundwater at the site is not currently used for drinking water purposes and it is unlikely that drinking-water wells will be installed in the foreseeable future because of the industrial nature of the area and the availability of municipal water. Shallow groundwater quality is principally a concern because of discharge into surface water sediments.

Abundant high-quality deep groundwater from glacially-derived sediments has historically been tapped by water supply production wells. That usage has declined in recent years as facilities which used industrial water supply wells have ceased operations. Most of the deeper aquifers naturally discharge into Commencement Bay at depth. Over much of the site, these deeper aquifers are protected from contamination by fine-grained low permeability confining beds.

Commencement Bay, including the CB/NT site, supports important fishery resources. Salmonid species including steelhead and bull trout occupy the bay for part of their life cycle. Extensive inshore marine fish resources include English sole, rock sole, flathead sole, c-o sole, sand sole,

starry flounder, and speckled sand dab. Rock sole, c-o sole, and several species of rockfish are most abundant along the outer shoreline. Although the TPCHD has warned against regularly consuming fish, shellfish, and crabs caught within the study area, recreational harvesting of many of these species occurs, primarily within the Thea Foss Waterway and along the Ruston-Pt. Defiance Shoreline. Signs are posted around the waterway in 5 languages warning the public not to eat the fish and shellfish. Puget Sound Chinook salmon and bull trout are Endangered Species Act (ESA) listed species. The CB/NT site is located in a tribal Usual and Accustomed fishing area.

The Asarco smelter began operations in 1890 as a lead smelter. Asarco purchased the smelter in 1905 and converted it to a copper smelter in 1912. The smelter specialized in processing ores with high arsenic concentrations and recovered arsenic trioxide and metallic arsenic as byproducts. Operation of the Asarco smelter for over 95 years resulted in contamination, primarily arsenic and lead, of the smelter site, off-shore sediments and the surrounding residential area. In recovering copper from ores and concentrates, the smelting process produced slag, a hard, glassy material containing elevated concentrations of arsenic, lead, and other metals. Copper smelting operations ceased in 1985, and the arsenic production plant was closed in 1986.

Much of the smelter facility was constructed on slag fill. The slag fill was used to modify and extend the pre-existing shoreline by approximately 500 feet into Commencement Bay. The slag beneath the Breakwater Peninsula is up to 125 feet thick. The Asarco site includes an estimated population of approximately 5,000 people, and about 1,820 housing units.

The Tacoma Tar Pits site and surrounding area is located within the city limits of Tacoma, in the industrialized tide flats where the Puyallup River discharges to Commencement Bay on Puget Sound. The site and adjacent properties are zoned as "PMI – Port Maritime Industrial." The site is currently occupied by the following businesses: 1) Simon Metals, a metals recycling business, 2) the Northwest Detention Center (NWDC), an immigration detention facility owned and operated by The GEO Group, Inc., under contract with the U.S. Immigration and Customs Enforcement (a component of Homeland Security), located on the former Hygrade meat packing plant property, 3) Tri-Pak, a transloading facility, formerly KML Corporation, 4) Burlington Northern/Santa Fe (BNSF) and Union Pacific Railroad (UPRR) rail lines, 5) a Puget Sound Energy (PSE) natural gas regulation station, and 6) an Associated Petroleum Products (APP) cardlock fueling station. In addition to the aforementioned businesses, prominent remedy-related site features include 1) the stabilized waste pile – a 30- to 40-foot high capped engineered waste pile with a footprint of approximately eight acres located in the center of the site, 2) various ditches and culverts that drain into surface water detention basins Nos. 1 and 2, each about one acre in size, and 3) the groundwater treatment plant. As with the CB/NT Sediments OU, shallow groundwater in the vicinity of the Tar Pits site is not used for drinking water purposes and it is unlikely that drinking-water wells will be installed in the future because of the industrial nature of the area and the availability of municipal water.

3.3 History of Contamination

At the time of urban and industrial development in the late 1800s, the south end of Commencement Bay was composed largely of tideflats formed by the Puyallup River delta. Dredge and fill activities have significantly altered the estuarine nature of the bay since the

1920s. Many intertidal areas were filled. This was commonly accomplished with dredged sediment removed from distributary channels as they were deepened and widened into marine waterways. Numerous industrial and commercial operations located in the filled areas surrounding the constructed marine waterways. These included shipbuilding, chemical manufacturing, ore smelting, oil refining, food preserving, and transportation facilities.

With industrialization, the release of hazardous substances and waste materials into the environment resulted in alterations to the chemical quality of waters and sediments in many areas of the bay. Contaminants found in the area include arsenic, lead, zinc, cadmium, copper, mercury, and various organic compounds such as polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs), and phthalates.

For the Asarco-related portions of the site, contamination of the smelter property resulted from spills and dumped material from smelter operations. Contaminants primarily include copper, lead and arsenic. In addition, much of the smelter property and the peninsula are constructed entirely of slag from the smelting process. Ruston and North Tacoma were contaminated from airborne emissions from smelting operations. Contaminants are primarily arsenic and lead in soils. Offshore sediments were contaminated by contaminated runoff from the smelter site, contaminated groundwater discharges, and slag spills. Contaminants primarily include copper, arsenic and lead.

For the Tacoma Tar Pits portion of the site, imported or dredged fills were placed in the vicinity of the site around the turn of the last century to provide foundation support for structures associated with a meat packing plant, a bulk fuel storage facility, and railroad tracks. In 1924, a manufactured coal gasification plant began operating on the eastern portion of the site. It operated on the site through 1956 and the facility was demolished in 1966. Waste materials remaining on site from coal gasification operations included coal ash, coal tar liquor, and coal tar solids and semisolids. This waste material was either buried on site at shallow depths or disposed of in on site ponds.

Starting in 1967, a portion of the Tacoma Tar Pits site was used for metal recycling operations by Joseph Simon & Sons (JS&S, now Simon Metals). As part of construction and operation of the metals recycling facility, a variety of new fills were emplaced, including metal debris, soil, and shredded car interiors referred to as “auto fluff.” During the early operational history of the recycling facility, metals predominantly from automobiles and electrical transformers were recycled. Recycling of transformers led to the release of oils containing polychlorinated biphenyls (PCBs). The auto fluff used as fill also contained PCBs as well as heavy metals. The metal recycling operations on site are still currently active; however, auto fluff and other materials containing PCBs are no longer being handled at the facility. In the late 1990s, an approximately 3,000 gallon diesel fuel spill occurred on the APP cardlock property at the far southeastern end of the Tacoma Tar Pits site. This spill and subsequent diesel spills on this property are being addressed by the property owner and Ecology apart from the OU 03 remedy.

3.4 Initial Response

3.4.1 Commencement Bay Nearshore/Tideflats Sediments

Commencement Bay was placed on a national interim list of 115 highest priority hazardous waste sites on October 23, 1981. Initially, the Commencement Bay site was divided into four areas: deepwater, nearshore, tideflats/industrial, and South Tacoma Channel (an upland site). The NPL promulgated on September 8, 1983 designated the Commencement Bay Nearshore/Tideflats area and the Commencement Bay South Tacoma Channel as separate NPL sites. The deepwater portion of the bay was eliminated from the list at that time because water quality studies indicated there was minimal contamination in the area.

Under an April 1983 agreement between EPA and Ecology, Ecology was designated as the lead agency for a remedial investigation/feasibility study (RI/FS) on the nature and extent of sediment contamination in the CB/NT site. The Commencement Bay Nearshore/Tideflats Remedial Investigation (RI) (August 1985) generally characterized the nature and extent of contamination at the site. The Commencement Bay Nearshore/Tideflats Feasibility Study (FS) (December 1988) described feasible alternatives for sediment remedial action at the site. The FS included an integrated action plan to coordinate ongoing source control efforts and sediment remedial alternatives and a sediment quality goals document to develop Sediment Quality Objectives. Contaminated sediments associated with the Asarco Tacoma Smelter were initially included in the CB/NT RI/FS, but were later separated from the CB/NT Sediments OU (see below).

3.4.2 Asarco Area

In the 1980s, EPA identified the Asarco Smelter, Ruston/North Tacoma Study Area, and Off-shore Sediments as Operable Units (initially identified as OU 02, 04 and 06, respectively) in the Commencement Bay Nearshore/Tideflats interim and final NPL listing. EPA is the lead regulatory agency for each of the Asarco-related operable units, and Ecology has supported EPA CERCLA efforts within them. Asarco is the only identified responsible party for these operable units.

Originally, Asarco sediments were going to be included in the CB/NT Record of Decision (ROD). However, Asarco further characterized the contaminated sediments along the Ruston-Pt. Defiance shoreline during a site-specific remedial investigation for the Asarco Tacoma Smelter. Findings of this study were presented during public comment on the CB/NT FS and proposed plan. As a result of Asarco's study, EPA separated the Asarco sediments from the CB/NT sediments, creating a new operable unit (OU 06).

In the late 1980s, 11 publicly available sites were identified, which consisted primarily of school yards, parks and vacant lots. These sites were known as the Expedited Response Action (ERA) sites. Asarco removed contaminated soil, and placed clean soil if necessary, at these locations.

In 1987, pursuant to an Administrative Order on Consent (AOC), Asarco began an RI/FS for the Asarco Smelter facility. As part of the Smelter facility RI/FS, site stabilization was addressed, and the ore flues to the Asarco Stack were demolished in 1987. In January 1993, the Asarco

Stack, which was 562 feet tall, was imploded and temporarily buried onsite. The Smelter RI/FS was completed in 1993.

EPA began a fund-lead RI/FS for the off-property area, referred to as the Ruston/North Tacoma Study Area in 1989. The RI/FS was completed in 1993.

As describe above, the Asarco Off-shore Sediments were initially investigated under the CB/NT RI/FS, and sediments were subsequently separated from the CB/NT sediments into a new operable unit. Also, initially, groundwater was to be included in the Asarco Smelter facility ROD. However, while preparing the ROD, EPA determined that it did not have enough information on the impacts of groundwater to the off-shore sediments. It was, therefore, determined to omit groundwater from that ROD and include it in the additional off-shore sediment studies. The RI/FS for the Asarco sediments and groundwater OU was completed in 2000.

Three RODs were issued addressing contamination at the Asarco-related portions of the CB/NT site. The RODs divided the Asarco-related portions of the site into the following operable units: The Smelter Facility OU 20 (formerly OU 2) consists of the Smelter Property and the slag peninsula. The Ruston/North Tacoma Study Area Operable Unit 22 (formerly OU 4) consists of contaminated properties in an approximate 1 square mile area surrounding the smelter. Asarco Sediments/Groundwater Operable Unit 19 (formerly OU 6) encompasses sediments offshore of the smelter and the Yacht Basin formed by the slag peninsula. See Section 3 for more detailed information.

3.4.3 Tacoma Tar Pits

Analysis of air photography of the site in 1981 by EPA as part of the overall evaluation of the CB/NT area indicated the presence of ponds at the Tacoma Tar Pits site that potentially contained waste materials from the former coal gasification plant. Ecology also conducted a site inspection in 1981 and noted oil runoff into one of the on site ponds. An EPA Field Investigation Team also conducted a perimeter inspection of the site that same year. Based on the findings by EPA and Ecology, a Potential Hazardous Waste Preliminary Assessment concluded that the site represented a potential hazard to the environment through contamination of surface water.

At the request of EPA, three of the property owners (Burlington Northern Railroad [BNRR], Joseph Simons & Sons, and Hygrade Food Products) conducted a preliminary investigation. A draft report was issued in May 1983 which indicated that tar (a by-product of the coal gasification process), PCBs, and lead were present on the site.

An EPA contractor mobilized to the site in 1984 to begin a government-lead RI. However, subsequent to initiation of the RI field work, EPA and the Potentially Responsible Parties (PRPs) reached agreement allowing the PRPs to continue and complete the RI/FS. Four companies joined in commissioning the PRP-lead RI/FS: Washington Natural Gas (WNG; the former coal gasification plant PRP), Joseph Simon & Sons, Hygrade Food Products, and BNRR. A contractor for the PRPs began the RI in late-1984. The RI was completed in 1987 (Applied

Geotechnology 1987), followed by an FS and Risk Assessment (Envirospehere Company 1987a and 1987b).

3.5 Basis for Taking Action

3.5.1 Commencement Bay Nearshore/Tideflats Sediments

The primary objective of the remedial investigation for the CB/NT Sediments (OU 01) was to define the nature and extent of sediment contamination. That investigation involved the compilation and evaluation of existing data and an extensive field sampling effort to collect additional data. At the conclusion of the remedial investigation, the database contained over 25,000 records, each consisting of 15-150 separate variables. There were descriptions of over 50 surveys, 500 sampling stations, and 2,000 samples of water, solids, and biota. Over 400 components of the Commencement Bay drainage system had been identified. Included were data on sediment and water column chemistry, bioassays, benthic invertebrates, fish pathology, and bioaccumulation. The distribution of sediment contaminants is described in detail in the remedial investigation report.

There was considerable variation in the types and concentrations of chemical contaminants in CB/NT sediments. Investigations of the nearshore waters of Commencement Bay have demonstrated the existence of sediment contamination by toxic pollutants, accumulation of some of these substances by biota, and possible pollution-associated abnormalities in indigenous biota. The highest concentrations of certain metals (i.e., arsenic, copper, lead and mercury) have been found in sediments in the waterways along the southwest shore, and near the Asarco smelter. Sediment contamination by persistent organic compounds (e.g., PCBs) was detected in the heavily industrialized waterways (e.g., Hylebos Waterway). The ecological risk assessment identified adverse biological effects, primarily toxic effects to the benthic infaunal community. The baseline human health risk assessment conducted for the site concluded that the most significant human health risks are associated with elevated concentrations of PCBs in the tissue of resident seafood.

The purpose of the CB/NT FS was to develop and evaluate the most appropriate remedial strategies for correcting the human health and environmental impacts associated with contaminated sediments in the CB/NT problem areas. The FS described cleanup objectives for the site and presented a range of alternatives that offered viable means of achieving those objectives.

Source control was described as the most challenging and critical first step in the overall response strategy for the CB/NT site. Ecology's Commencement Bay Urban Bay Action Team was established in response to that challenge. To more effectively manage source control as a key element in the selected remedy, Operable Unit 05 (Source Control) was established in the spring of 1989. Public comment received on the CB/NT FS indicated a very broad-based consensus that enhanced source control measures were important to overall project success.

The cleanup goal for the Commencement Bay Problem Areas is reduction of contaminant concentrations in sediments to levels that will support a healthy marine environment and will protect the health of people eating seafood from the Bay. The ROD designated biological test

requirements and associated sediment chemical concentrations referred to as Sediment Quality Objectives (SQOs) in order to achieve this goal (ROD; Table 5). SQOs for all problem chemicals were set based on an evaluation of the ecological and human health risks posed by these chemicals. The SQO for PCBs was based on the human health risk assessment (and was modified in EPA's subsequent ESD in 1997). SQOs for all other chemicals were based on the ecological risk assessment, because the ecologically-based cleanup levels were determined to be also protective of human health.

Since the CB/NT ROD (September 1989) for the Sediments and Source Control OUs was written prior to EPA's (1991[1], 1999[2]) guidance on preparation of Proposed Plans and RODs, the short narrative statements defining "remedial action objectives" that are provided in recent RODs are not present in the CB/NT ROD.

3.5.2 Asarco Area

For the Asarco Smelter OU, the ecological risk assessment found that based on exceedances of Federal and state water quality criteria in ground water and surface water and exceedances of state sediment quality criteria in off-shore sediments, sea life in the off-shore sediments have been adversely affected by releases from the Site.

The results of the human health risk assessment showed that the estimated cancer and non-cancer impacts from exposure to site contaminants in soil varied with the site areas and with the projected future land-use. The estimated lifetime cancer risk from ingesting soil in the arsenic kitchen area, assuming residential land use, was determined to be up to two chances in ten (2 in 10). Cancer risks in other site source areas, assuming residential land use, ranged from about 4 chances in 100 to 2 chances in a 1,000. These risks were lower primarily because contaminant levels are higher in the arsenic kitchen area than in the rest of the site.

For the Ruston/North Tacoma Study Area OU, the human health risk assessment found that for both arsenic and lead, the estimated exposures and risks in the Study Area exceed those levels that generally require remedial action at a Superfund site as defined by EPA in the NCP and program guidance. The ROD was signed on June 16, 1993. Action levels identified for soil removal of residential soil were 230 parts per million (ppm) for arsenic and 500 ppm for lead. The arsenic action level of 230 ppm was based on reducing the additional potential skin cancer risk to no more than 5 in 10,000, within EPA's acceptable risk range (5×10^{-4}) for cancer causing chemicals. The 500 ppm action level for lead was based upon a national goal of reducing levels in children's blood to no greater than 10 micrograms per deciliter, as well as EPA guidance that recommended establishing soil lead cleanup levels of 500 to 1,000 ppm.

Under Ecology's Model Toxics Control Act (MTCA) Method A, the soil cleanup levels for residential areas were 20 ppm for arsenic and 250 ppm for lead. MTCA requires that some form of action be taken to address contamination above these levels. In evaluating the available

---

1 EPA 1991. *Risk Assessment Guidance for Superfund*. Volume 1. *Human Health Evaluation Manual*. Part B, *Development of Preliminary Remediation Goals*, EPA 540-R-92-003. Washington, D.C., EPA. Office of Emergency and Remedial Response.

2 EPA 1999. *A Guide for Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*, EPA 540R-98-031. Washington, D.C., EPA, July 1999.

remedial actions to address contamination at this site, EPA considered the nature and extent of site contamination, the nature of human health risks, the exposure pathways, and the potential impacts and costs associated with physical remediation activities in the community. EPA concluded that the EPA action level of 230 ppm for soil arsenic represented the best balancing of factors for a level at which engineering actions (e.g., soil removal) for remediation should begin at this site. Institutional controls, mostly consisting of educational measures, were deemed by EPA to be suitable for protection of human health and the environment at those locations within the Study Area where soil arsenic concentrations were between the MTCA cleanup level of 20 ppm and 230 ppm. For lead, EPA set the soil lead cleanup level under MTCA at 500 ppm for this site. Ecology concurred on this ROD.

The March 1995 ROD for the Asarco smelter facility called for the use of the R/NT soils as part of the sub-base for the smelter site cap. The remedy also identified that slag driveways within the Study Area (as well as other areas where small, ingestible, pieces of slag were used) would be excavated and replaced with gravel. The community had an extensive role in the remedy selection process for the site.

For the Asarco Sediments OU, the ecological risk assessment identified adverse biological effects, primarily toxic effects to the benthic infaunal community in sediments. Approximately 11 percent of the stations (170,000 square yards or approximately 35 acres of sediments) were considered severely impacted. This determination meant that sediment chemical concentrations exceeded sediment standards and multiple adverse biological impacts (e.g., more than one biological test exhibited a significant effect) were observed. In addition, every station that had an adverse effect associated with the benthic community was included in this area considered severely impacted.

3.5.3 Tacoma Tar Pits

At the Tacoma Tar Pits, the results of site investigations conducted in the 1980s indicated that soil, surface water and groundwater across most of the site were contaminated with organic and inorganic contaminants from former on site coal gasification plant operations and the recycling of automobiles and electrical transformers. The primary contaminants included metals, PAHs, PCBs, and various volatile organic compounds (VOCs) including benzene. Results of investigations on the former Hygrade meat packing plant property (now the NWDC property), located northwest of the coal gasification plant and metals recycling facility, showed groundwater contamination but little to no soil contamination.

A Risk Assessment was performed that considered the risks to on site workers because the Tacoma Tar Pits site is located in a heavily industrialized area. Three organic constituents and one trace metal were selected as indicator chemicals representing the overall level of site contamination. These chemicals were: benzo(a)pyrene (a PAH), PCBs, benzene, and lead. Avian receptors were also considered because of an avian population that occasionally used the ponds at the site. Based on unacceptable risks to on site workers and avian receptors, and the potential discharge of contaminated groundwater to off site surface water bodies, maximum allowable concentrations for on site soils, surface water, and groundwater were calculated as part of the Risk Assessment.

A ROD was issued for the Tacoma Tar Pits site in December 1987 (EPA 1987). The maximum allowable concentrations determined in the Risk Assessment were used as the ROD cleanup criteria. The selected remedy called for excavation and stabilization of approximately 45,000 cubic yards of materials, including on site wastes and the most severely contaminated soils. The remedy also called for placement of the stabilized material in an engineered waste pile covered by a low permeability cap. Additionally, the remedy called for surface water controls to 1) manage storm water runoff from the waste pile and metal recycling operations, and 2) limit infiltration of surface water into the subsurface. Except for a small section at the southeast corner, the vast majority of the NWDC property did not require excavation, capping or surface water controls under the Superfund remedy.

The selected Superfund remedy also called for continued groundwater monitoring across the entire site, including the NWDC property, to discern whether the remedial action implemented for soils and surface water caused contaminants in groundwater to drop below the ROD cleanup criteria. If it did not do so in a timely manner, the ROD anticipated the need for a groundwater remedy to be implemented.

Subsequent to the 1987 ROD, EPA issued Explanation of Significant Differences (ESDs) in 1991 and 1995 (EPA 1991; EPA 1995) as a result of studies conducted during remedial design and field conditions encountered during initiation of the remedial action at the site. None of the ESD changes fundamentally changed the nature of the selected remedy described in the 1987 ROD. See Section 6.3.2 for further discussion of the ESD changes.

As mentioned above, the ROD anticipated the need for groundwater remediation if it was found that the initial remedy did not achieve ROD groundwater cleanup criteria at the site boundary in a timely manner. In 1998, due to continued exceedances of the groundwater cleanup criteria, EPA directed PSE, who had since merged with WNG, to design and install a groundwater extraction and treatment system to treat on site contaminated groundwater, with a focus on benzene contamination, and prevent it from migrating off site and potentially impacting the Puyallup River. The remedy is discussed further in Section 6.3.

4 REMEDIAL ACTIONS AND FIVE-YEAR REVIEW PROCESS FOR CB/NT SEDIMENTS OPERABLE UNIT 01 ("Problem Area Waterways")

4.1 Remedy Selection

EPA issued the Commencement Bay Nearshore/Tideflats ROD in September 1989. EPA selected a remedial action for eight of the nine sediment problem areas which were identified during the RI/FS. These problem areas are: 1) Mouth of Hylebos Waterway, 2) Head of Hylebos Waterway, 3) Sitcum Waterway, 4) St. Paul Waterway, 5) Middle Waterway, 6) Head of Thea Foss Waterway, 7) Mouth of Thea Foss Waterway, and 8) Wheeler-Osgood Waterway. The ninth problem area, sediments off-shore of the Asarco Tacoma Smelter (OU 6), was addressed in a separate ROD signed in July 2000.

4.1.1 Cleanup Objectives

The cleanup objective for the remedial action, as described in Section 10 of the 1989 ROD, states that "the selected remedy is to achieve acceptable sediment quality in a reasonable time frame." "Acceptable sediment quality" is defined as "the absence of acute or chronic adverse effects on biological resources or significant human health risks." The ROD designated biological test requirements and associated sediment chemical concentrations referred to as Sediment Quality Objectives (SQOs) to attain the cleanup objective for the CB/NT site. Sampling and test evaluation protocols for environmental effects, as well as the apparent effects threshold (AET) database, were to remain consistent with any adjustments adopted by the Puget Sound Estuary Program.

The Sediment Quality Objectives also applied to source control requirements. Monitoring of sources and sediments will be used to determine the effectiveness of source controls. Habitat function and enhancement of fisheries resources were also identified as part of the overall project cleanup objectives.

SQOs for all problem chemicals were set based on an evaluation of the ecological and human health risks posed by these chemicals. All chemical SQOs, except PCBs, were developed based on an ecological risk assessment, using AET generated from site data and data sets from various areas in Puget Sound. The AET data set was used in the CB/NT FS to establish sediment cleanup goals. A list of AET used to define the SQOs for the FS is provided in Table 5 of the ROD. These values represented the lowest AET for the three biological effects indicators (i.e., amphipod mortality, oyster larvae abnormality, and benthic infaunal abundances). These ecologically-based cleanup levels were determined to be also protective of human health.

The SQO for PCBs was based on the human health risk assessment. In 1997, EPA issued an Explanation of Significant Differences (ESD) to modify the PCB SQO for community health standards for the problem areas where PCBs are present (primarily Hylebos and Thea Foss Waterways). The 1997 ESD also modified the PCB Sediment Remedial Action Level. There have been no additional changes to the PCB SQOs or Sediment Remedial Action Levels to date.

A specific cleanup level/cleanup objective based on fish tissue data was not a requirement identified in the ROD, and has not been derived as a performance standard for any of the response actions in Commencement Bay based on ARARs in the ROD. However, Section 11.1 of the CB/NT ROD suggests that fish tissue contaminant levels are an important indicator of human health exposure. Accordingly, EPA plans to conduct fish-tissue sampling.

EPA and Ecology worked together to develop the SQOs as cleanup standards for contaminated sediments in Commencement Bay. After Ecology promulgated the Sediment Management Standards (SMS) in 1991, EPA and Ecology again worked together to compare the SMS to the CB/NT SQOs, to ensure that the SQOs for the CB/NT site were still protective of human health and the environment.

The SMS establishes an acceptable range of cleanup levels. Cleanup levels for a specific site using SMS are established as near as practicable to the no adverse effects level, taking into account net environmental effects, cost, and technical feasibility. EPA and Ecology agreed that, in general, the CB/NT SQOs are within the range of cleanup levels established by the SMS.

Water quality standards which apply to the site are listed as ARARs in Section 11.2 of the ROD. Within the biologically active zone of surface sediment, marine water quality criteria (MWQC) are of most concern, and have been identified as performance standards for response actions such as sediment cap design.

4.1.2 Selected Remedy

The ROD selected a cleanup remedy that identified eight problem areas for sediment cleanup and allowed flexibility to utilize any one, or a combination of, five key elements in any particular area which are:

Site use restrictions – Reduce potential human health exposure to site contamination, particularly ingestion of seafood. The ROD noted that site use restrictions would consist primarily of public warnings and educational programs to reduce potential exposure to site contamination. Site use restrictions are now commonly referred to as institutional controls.

Source control – Implement to prevent recontamination of sediments and meet ARARs.

Natural recovery – Included as an optional (and preferred) remediation strategy for marginally contaminated sediments that are predicted to achieve acceptable sediment quality, through naturally occurring processes such as burial and mixing with naturally accumulating clean sediments, within a reasonable time frame.

Sediment remedial action – Address sediments containing contamination that is expected to persist for unacceptable periods of time through confinement and treatment options. For areas that are not expected to recover within a 10-year time frame, the ROD specified that active remediation of problem sediments would be accomplished by utilizing a limited range of four confinement technologies. These technologies are in-place capping, dredging/confined aquatic disposal, dredging/nearshore disposal, and dredging/upland disposal.

Source and sediment monitoring – Refine cleanup volume estimates, characterize the effectiveness of source controls, and ensure that the remedy is effective. Long-term monitoring of the remediated areas, including disposal sites and habitat mitigation areas, is also a component of the remedy. Monitoring will be conducted to evaluate the effectiveness of the remedy in achieving SQOs and in achieving the habitat functions that are called for in the mitigation plans.

Based on the cleanup objectives and five key elements, the intent of the ROD was for further remedial design sampling and analysis to determine specific cleanup plans for each of the waterway problem areas.

4.1.3 Source Control Strategy

The objectives under source control were to control major sources of contamination to the waterways prior to implementation of active remediation in the waterways and to monitor source control effectiveness both prior to and after completion of sediment remedial action.

In May 1992, Ecology and EPA issued a Source Control Strategy which outlined how Ecology's Urban Bay Action Team would prioritize, organize and conduct source control activities. The Source Control Strategy also described the administrative process Ecology would use to report on and document the progress of source control. Basically, Ecology conducted a sitewide investigation of sources and sorted them according to their likely potential for having contributed problem chemicals to the waterways. Because the ROD identified eight problem areas with unique lists of problem chemicals, Ecology's source control efforts were also focused on sources of the specific problem chemicals in sediments. For instance, PCBs were a high priority problem chemical in the Hylebos Waterway, but were not problem chemicals in sediments of the Wheeler-Osgood Waterway.

Ecology's general step-wise process is outlined below. The primary deliverables to EPA were the Source Control Status Reports, commonly known as Milestone Reports. Milestones are described below:

Milestone 1: Following investigation and evaluation of all potential sources of problem chemicals to a problem area, all confirmed ongoing sources were identified as one of the following types: potential (List 1), probable (List 2), or ongoing (List 3).

Milestone 2: Required essential administrative actions to be in place for "major sources" of problem chemicals in each problem area. Administrative actions included orders, decrees and permits. "Essential administrative action" meant that the action was needed to ensure the major sources would be controlled so that sediment recontamination would not be expected to occur (i.e., source is controlled sufficiently for remedial action to begin). "Major sources" were defined by the CB/NT ROD as sources most directly aligned with current sediment impacts in a given problem area of a waterway; thus, "essential" varied from problem area to problem area.

Milestone 3: Required essential remedial actions for all major sources to be implemented. "Essential remedial actions" were largely physical or operational changes (construction,

improved Best Management Practices, removals, etc.) at major sources that represented elimination and/or reduction, to the extent practicable, of the contaminant sources most directly linked to existing sediment impacts. Ultimately, these actions eliminated or reduced to the extent practicable, sources of problem chemicals that could potentially recontaminate sediments. Final and complete remedial action on all "non-essential" aspects of each major source was not required for this Milestone.

Milestone 4: Required administrative actions (e.g., orders, permits) to be in place for all confirmed ongoing sources in the problem area. "Confirmed ongoing sources" were identified on List 3 of the Milestone 1 Report, and also included any new sources that were identified in subsequent investigations or source control work.

Milestone 5: Required remedial actions (e.g., construction, removal) for all sources in the problem area to be implemented. Remedial actions at some sites (sources) are still underway.

After the all of the Milestone Reports for a sediment problem area were issued, EPA then issued a Source Control Completion Report to document this final step of the source control process. Source control completion in a problem area indicated that Ecology and EPA believed, based on information provided to them, that source control measures were adequate for sediment remedial action to move forward in a problem area. This did not mean that all sources had been completely controlled, but that EPA and Ecology believed that sources were sufficiently controlled to prevent widespread recontamination of sediments. Source Control Completion Reports have been completed for all waterway problem areas.

The strategic relationship and importance of coordination between EPA and Ecology regarding sediment cleanup and source control actions is described in Section 5.2 of the CB/NT ROD (OU 01 and OU 05). Source control will be implemented by Ecology, as well as other local agencies, using combinations of site inspections, voluntary actions, technical assistance, cleanup actions, and legal actions. As stated in the ROD (Section 5.2), "*Comprehensive source control as defined by this Record of Decision is essential to ensure that the overall remediation is permanent. Consequently, source identification and control programs are ongoing and will continue beyond the completion of remedial actions.*" After sediment cleanups, Ecology maintains the lead for source control actions. As part of source control efforts, source and sediment monitoring will be required by Ecology to evaluate the effectiveness of source control measures. Ecology may also verify the success of source control action using available monitoring data.

4.1.4 Explanation of Significant Differences

After the 1989 ROD, EPA issued the following Explanation of Significant Differences (ESDs) that expand on and clarify the general cleanup approach set forth in the CB/NT ROD:

June 1993 ESD	Identified the remedial action for contaminated sediments in the Sitcum Waterway.
March 1997 ESD	Modified the sediment cleanup standard for PCBs for the CB/NT sediments.

August 2000 ESD	Identified the specific cleanup plans for contaminated sediments in the Thea Foss, Wheeler-Osgood, and Hylebos Waterways; included Endangered Species Act (ESA) as an Applicable or Relevant and Appropriate Requirement (ARAR); selected the acceptable in-water and upland disposal options for dredged sediments from nearshore areas; provided remedial design performance criteria for capping, dredging, confined disposal, natural recovery and ENR, and mitigation activities, and, institutional controls related to contaminated sediments contained onsite.
February 2002 ESD	Identified the specific remedy for contaminated sediments in Areas A and B in the Middle Waterway
March 2003 ESD	Identified the specific remedy for contaminated sediments in Area C in the Middle Waterway
September 2004 ESD	Identified more specifically the cleanup remedy for contaminated sediments in the Thea Foss and Wheeler-Osgood Waterways. Identified a temporary storage area for dredged sediments, identified two new sources of capping material for the cleanup of the Thea Foss and Wheeler-Osgood Waterways, and identified and clarified several cleanup issues that were defined after completion of the remedial design for the Thea Foss and Wheeler-Osgood Waterways.

4.1.5 Sitewide Biological Assessment

In 1999, both Chinook salmon and bull trout were listed as threatened species within the Puget Sound waters. All of Puget Sound has been designated as critical habitat for Chinook salmon and bull trout. EPA concluded that the performance of the remedial actions together with all of the mitigative measures that have been required would be unlikely to jeopardize the continued existence of any federally listed or threatened or endangered species or result in the destruction or adverse impacts to critical habitat. Mitigation measures were followed using Section 404 of the Clean Water Act. In 2008, Steelhead Puget Sound Distinct Population Segment (*Oncorhynchus mykiss*) was added as a threatened species to the Washington endangered species list.

Chinook salmon are known to be present in the Puyallup River and rely, to some extent, on the nearshore and tideflat habitats in Commencement Bay. Analysis of existing habitat conditions and project effects on Chinook will apply to other listed species that may occur in Commencement Bay.

The remedial response actions described in the ROD are considered agency actions under ESA and are therefore required to substantively comply with the ESA. Although divided into six separate problem areas, and now two removal actions, EPA's proposed action is remediation of the entire CB/NT site as identified in the ROD. Therefore, EPA has maintained a Commencement Bay-wide perspective in formulating and evaluating remedial action plans and requirements for mitigation to ensure that ecological gains result from the cleanup actions. While specific actions within each individual waterway may vary due to site-specific conditions,

the combined effect of each remediation is expected to contribute to measurable improvement to aquatic habit functions in Commencement Bay.

Following the overall sitewide Biological Assessment, site-specific Biological Assessments for each waterway evaluated the impacts of the remedies on the listed species. These projects received Biological Opinions from the National Oceanic and Atmospheric Administration (NOAA) and/or the U.S. Fish and Wildlife Service (USFWS). Biological Assessments for Sitcum and St. Paul waterways were not conducted since these cleanups were completed before the ESA listing.

To comply with some the provisions of ESA, all in-water remediation work was restricted to established "fish windows" or in-water construction seasons. These can vary, but are generally between July 16 and February 14. In addition to restricting in-water construction, "conservation measures" were identified by the ESA agencies for the sediment remediation work.

4.1.6 Sitewide 404(b)(1) Analysis

The 2000 ESD selected disposal sites for the remaining cleanup actions in Hylebos, Thea Foss, Wheeler-Osgood, and Middle Waterways. Because the ESD selected two in-water disposal sites, EPA was required to conduct a sitewide evaluation of impacts associated with the filling of aquatic habitat. A Bay-wide 404 analysis was conducted to meet the substantive requirements of Section 404 of the Clean Water Act (CWA). The ESD also added a new ARAR, the Endangered Species Act as a result of the 1999 listing of Chinook salmon and bull trout as threatened, ESA-protected species (see above). Prior to the issuance of the 2000 ESD, EPA had prepared a project-specific Section 404(b)(1) Evaluation for the Sitcum Waterway Remediation Project for evaluating potential discharges of the dredged and fill material.

EPA identified a comprehensive, bay-wide approach to mitigation that would fulfill EPA's responsibility in meeting the substantive requirements of these two ARARs. Specifically, nine performance criteria were identified in the ESD, CWA 404(b)(1) evaluation, and biological assessment documents, which required remedial design elements, remedial action implementation and compensatory mitigation plans to contribute toward the conservation and recovery of ESA-listed species. Mitigation plans, due to unavoidable losses of aquatic habitat, were approved for the two in-water disposal sites selected in the 2000 ESD. A description of the approved mitigation projects developed in fulfillment of these performance criteria are described in each of the waterway sections below.

4.1.7 Dredged Material and Disposal Sites

There are several disposal sites selected in the 1989 ROD and the 1993, 2000, and 2002 ESDs for the disposal of contaminated sediments dredged from the various problem areas. The ROD included the options of using upland, nearshore and confined aquatic disposal locations.

At Sitcum Waterway, the 1993 ESD selected the Milwaukee Waterway as its disposal location for a nearshore confined disposal facility (NCDF), and created a habitat area in front of the containment berm as part of its mitigation activities.

The 2000 ESD identified upland disposal in a regional landfill, in-water disposal at the Puget Sound Dredged Disposal Analysis site located in Commencement Bay [now referred to as the Dredged Material Management Program (DMMP) site], and disposal at two nearshore confined disposal facilities (CDFs) (Blair Slip 1, St. Paul Nearshore Fill). Dredged sediments from the Hylebos and Middle Waterways, as per the 2002 ESD, were placed in the Blair Slip 1 Nearshore Confined Disposal Facility (NCDF) which is approximately 10 acres and had a disposal capacity of 650,000 cy. Dredged sediments from the Thea Foss and Wheeler-Osgood Waterways were placed at the head of the St. Paul Waterway in a confined disposal facility that is 14 acres and contains approximately 525,000 cy of contaminated sediments. Some sediments from the Hylebos and Thea Foss Waterways were also disposed in the DMMP site and in upland facilities either in central Washington or in south Pierce County, Washington.

These three in-water disposal sites – the Milwaukee NCDF, Blair Slip 1 NCDF, and the St. Paul CDF will be continually monitored for any potential releases into the environment.

4.1.8 CERCLA Removal Actions

Olympic View Resource Area

A non-time-critical removal action was conducted in 2001 to address contaminated marine sediments at the Olympic View Resource Area (OVRA). The OVRA was not identified as a problem area in the CB/NT ROD, but it is located within the boundaries of the CB/NT Site. In 1997, the OVRA site was identified as one of five City restoration projects addressed in the City's Natural Resource Trustee Consent Decree (CD) to settle the City's liability for natural resource damages at the CB/NT site. As part of studies at OVRA, dioxin sediment contamination was found, and it was determined to be an imminent and substantial threat to human health and the environment. Section 4.6 describes the cleanup action taken in this area.

Occidental Chemical

Two non-time critical removal actions were performed by Occidental Chemical Corporation at its former chlor-alkali plant facility along the Hylebos Waterway. 1) The Area 5106 Removal Action included dredging, treatment and disposal of approximately 36,000 cubic yards (cy) of sediment contaminated mostly with chlorinated organic solvents and degradation products from October 2002 through February 2003. The work was completed as designed, contaminated sediment was found to extend deeper than anticipated, and additional response actions were conducted to partly characterize remaining contamination. 2) The Embankment Area Removal Action led to the 2003 draft design of a permeable cap to cover the intertidal and subtidal embankment to the toe of the slope. Information obtained from the Area 5106 Removal Action identified cap design limitations and concerns about upland source control measures. Remaining work from each of these two Removal Actions have since been melded into an overall Occidental Site Removal Action to address remaining soil, ground water, and sediment contamination. More detailed information about the Occidental Site can be found in Section 4.2, the Hylebos Waterway portion of this FYR.

4.1.9 Partial Deletion of the Site

EPA's partial deletion pertains only to portions of OU 01 (CB/NT Sediments) and OU 05 (CB/NT Sources). Specifically, it pertains to the sediments contained in and upland properties draining only to the St. Paul Waterway or Blair Waterway, and to four properties which were transferred to the Puyallup Tribe of Indians under the Puyallup Land Settlement Act of 1989 ("Puyallup Land Settlement Properties"). The four Puyallup Land Settlement Properties are: the Taylor Way Property, the East-West Road Property, the Blair Waterway Property and the portion of the Blair Backup Property that drains only to the Blair Waterway. These areas were deleted in 1996.

A partial deletion of a site from the NPL does not affect or impede EPA's ability to conduct CERCLA response activities at areas not deleted and remaining on the NPL. In addition, deletion of a portion of a site from the NPL does not affect the liability of responsible parties or impede agency efforts to recover costs associated with response efforts. It does not impact the ability of Natural Resource Trustees to assess or recover for damages to natural resources at deleted portions of the site.

Further, removal of a site from the NPL does not affect or impede the continuance of long-term monitoring, operation and maintenance (O&M), or institutional controls at deleted portions of the site. Removal of portions of the site from the NPL does not preclude Ecology from subsequently conducting investigations or requiring response actions, including source control, under state law at the deleted portions of the site or areas remaining on the NPL.

4.2 Hylebos Waterway

Five-Year Review Summary Form - Hylebos Waterway

Issues:

Arkema Site source control is needed to meet RA performance standards.

Recommendations and Follow-up Actions:

Perform RI/FS and RD/RA for the Arkema Site to investigate and address contamination upland and beneath the waterway.

Protectiveness Statement(s):

The remedy is expected to be protective of human health and the environment upon completion. Most remedial action construction has been accomplished, and the additional actions needed for the remedy throughout the waterway to be protective described in the ROD and this report, are progressing toward completion.

Other Comments:

Pier 23 is within the CB/NT site and the U.S. Army is conducting the sediment cleanup under Washington Department of Ecology review. EPA has not reviewed all of the information developed by the U.S. Army and Remedial Action has not yet begun. Thus, EPA is unable at this time to assess the protectiveness of the response actions being undertaken by the U.S. Army at Pier 23. EPA will assess the level of cleanup achieved by the U.S. Army to determine the protectiveness of Pier 23 response actions.

4.2.1 Background

The Hylebos Waterway is the northeastern most waterway in the Commencement Bay tideflats area. The three-mile long waterway has been the site of several industries, such as manufacturing of chlorine and chlorinated chemicals, shipbuilding and repair, scrap metal recycling, lumber milling and log export, since the early 1900s. Sampling during the 1984 Remedial Investigation (RI) showed several contaminants of concern in Hylebos Waterway sediments, including arsenic, volatile organic compounds (VOCs), PAHs, hexachlorobenzene, hexachlorobutadiene, and PCBs. The 1989 ROD identified two contaminated sediment problem areas at the Mouth and Head of Hylebos Waterway that require Superfund cleanups.

EPA and a group of Hylebos Waterway PRPs known as the Hylebos Cleanup Committee (HCC), which consisted of Asarco, Inc., Elf Atochem North America, Inc., General Metals of Tacoma, Inc., Kaiser Aluminum and Chemical Corporation, Occidental Chemical Corporation, and the Port of Tacoma, signed an AOC for pre-design studies in 1993. Under the AOC, the HCC collected more than 500 physical, chemical, and biological samples in two sampling rounds to characterize the nature and extent of sediment contamination. The HCC developed a cleanup plan to address contaminated sediments, assessed the potential for recontamination from upland facility operations, and inventoried and evaluated potential disposal sites for dredged contaminated sediments. In 1999, the HCC completed the Pre-Remedial Design Evaluation Report, which formed the basis for EPA's selected cleanup plan for the Hylebos Waterway (August 2000 ESD).

4.2.2 Site Chronology

Some key dates for Hylebos Waterway actions are as follows. (Sediment remedial action seasons occur from July through February of each year when in-water construction is allowed.) Section 4.2.3 provides a description of the actions.

1997	AOC for investigations and performance of non-time critical removal actions at the Occidental Embankment Area and Area 5106.
1999	Hylebos Waterway Pre-Remedial Design Evaluation Report complete.
June 2000	Hylebos Waterway source control actions considered complete enough for contaminated sediment RD/RA to begin. Based upon information provided to Ecology, it appeared that upland sources were sufficiently controlled to prevent widespread recontamination of sediments. (This did not mean that all sources had been entirely controlled.).
Aug 2000	ESD set cleanup plan and disposal site selection.
Mar 2002	Three Unilateral Administrative Orders (UAOs) issued to four parties: 1. General Metals of Tacoma and Atofina (now Arkema) for Segments 1 & 2 (Head of Hylebos) sediments RD/RA. 2. Port of Tacoma and Occidental Chemical for Segments 3, 4, & 5 (Mouth of Hylebos) sediments RD/RA. 3. Occidental Chemical for Area 5106 Removal Action.

Aug 2002 - Mar 2003	Occidental Chemical Area 5106 hydraulic dredging, onsite sediment treatment, and emplacement in Blair Slip 1 NCDF. Additional response actions were required under the UAO to characterize remaining sediment contamination.
July 2003 - Feb 2004	Intertidal excavation at the Head of Hylebos completed, Mouth of Hylebos RA dredging partly accomplished, Blair Slip 1 NCDF constructed and partly filled with dredge material from the Mouth of Hylebos and Middle Waterways.
July 2004 - Feb 2005	Mouth of Hylebos RA dredging largely accomplished. Blair Slip 1 NCDF contaminated sediment fill placement completed. Head of Hylebos RA dredging partly completed. Clean sand cover placed on fresh dredge cuts where contamination was exposed when season ended.
Sept 2004	Head of Hylebos (General Metals and Arkema) UAO converted into a CD.
Nov 2004	Ecology-EPA Occidental embankment subtidal investigation report completed.
Jan 2005	Mouth of Hylebos (Port of Tacoma and Occidental Chemical) UAO converted to CD. The Occidental Site was defined and administratively separated.
Feb 2005	1997 Occidental Site AOC and associated Statement of Work (SOW) amended. The SOW tasks include further remedial investigations, alternatives analysis, remedial design up to the 90 percent level, and provision for interim response actions at Occidental Site. Both EPA and Ecology signed the amendment in order to combine RCRA and CERCLA response actions to address contaminated soil, groundwater, and sediment at the Occidental Site. Remaining work under the Embankment Area and Area 5106 non-time critical CERCLA removal actions was merged into the amended AOC and SOW.
June 2005	Occidental Site investigations specified in the SOW began. Head of Hylebos characterization of remaining sediment contamination completed in anticipation of 2005-06 dredging season.
July 2005 - Feb 2006	Head of Hylebos RA dredging largely completed. Arkema dock creosoted piling removal completed, Arkema embankment sediment cap design finalized and cap constructed.
July 2007 - Feb 2008	Mouth of Hylebos Piers 24 and 25 clean sand cap constructed. Head of Hylebos scrap steel removal initiated.
July 2008 - Feb 2009	Head of Hylebos scrap steel removal completed. General Metals cap assessment and repair.

4.2.3 Remedial Actions

Remedy Selection

Remedy selection for the CB/NT Sediments OU is described in Section 4.1.

Remedy Implementation (Sources)

Ecology identified 10 major sources to Hylebos Waterway sediment contamination:

- Occidental Chemical Corporation (former chlor-alkali plant).
- Elf Atochem 3009 Taylor Way (inactive log sort yard).
- Elf Atochem 2901 Taylor Way (former manufacturer of arsenic-based and chlorine-based chemicals).
- Kaiser Aluminum and Chemical Company (aluminum plant).
- General Metals of Tacoma (metal scrap yard).
- Wasser Winters (inactive log sort yard).
- Louisiana Pacific (operating log sort yard).
- Tacoma Boat (former large shipyard).
- B&L Landfill (drains to Hylebos Creek.
- Blair Backup Property (inactive log sort yard).

Essential source control actions were considered sufficiently complete for sediment RA to begin at all of these facilities as documented in Ecology's milestone reports for the Mouth and Head of Hylebos Waterway. Nineteen additional ongoing sources of contamination to Hylebos sediments were also identified and addressed through enforcement actions and/or voluntary cleanups under Washington state regulatory authorities (e.g., orders, decrees, permits). Ecology's Milestone 4 report (November 4, 1999) and Milestone 5 report (June 14, 2000) documents the completion of essential, site-specific, source control actions for Hylebos Waterway. Since then, additional source control concerns have been identified at two of these 10 major source areas.

Arkema Site

EPA and Ecology are concerned about arsenic-contaminated groundwater and high pH plumes at the former Elf Atochem 2901 Taylor Way property, later acquired by Arkema Chemical, at the Head of Hylebos waterway. Source control actions have included installation of a sheetpile wall, operation of a contaminated groundwater pump-and-treat system, and partial in-situ chemical stabilization of dissolved arsenic. Even so, a significant amount of source material and contaminated groundwater remain. Arsenic contaminated groundwater is known to be adjacent to the waterway, and is likely discharging into it.

In 2006, it appeared that Arkema would negotiate an Agreed Order with Ecology to address soil and ground water contamination under MTCA. (The existing legal agreement predated MTCA

and also had an arsenic cleanup level of 1000 µg/L. In comparison, the Marine Water Quality Criteria is 36 µg/L, and the Maximum Contaminant Level for ground water is 10 µg/L. In 2007,

Arkema sold their property to the Port of Tacoma, which assumed financial responsibility for remaining cleanup actions onshore and beneath the waterway.

Recent investigations conducted by the Port of Tacoma have identified a plume of arsenic contaminated ground water along the waterway. The plume apparently discharges subtidally into the waterway since the pump and treat system is no longer in operation to exert some degree of hydraulic control. And previous investigations have identified arsenic-contaminated soil/sediment within and adjacent to the waterway which may serve as an ongoing source of contamination.

At this juncture, the Port of Tacoma, Ecology, and EPA agree that additional investigations are needed to characterize the nature/extent of soil and ground water contamination, the flow of contaminated groundwater into Hylebos Waterway sediments, and to develop remedial alternatives.

Occidental Site

A second source of remaining contamination is the Occidental Chemical Corporation former production facility and surrounding areas within and adjacent to the Mouth of Hylebos Waterway. EPA actions at the Occidental site, discussed below, are jointly regulated with Ecology's RCRA program to address remaining soil, ground water, sediment and surface water contamination.

Informal coordination efforts between the agencies became increasingly focused after the Area 5106 Removal Action in 2003 and, consequently, the 2005 amendment to the 1997 Occidental Site AOC included Ecology as a signatory. The associated 2005 Statement of Work was developed for the performing party to delineate the nature/extent of contamination in both upland and waterway areas, characterize contaminated ground water flow into Hylebos Waterway, identify remedial alternatives to address soil, ground water, sediment, and surface water contamination, and complete a remedial design through the 90 percent level of an EPA-Ecology selected remedy.

Principal contaminants at the site are 1) VOCs from chlorinated solvent production waste, 2) high pH (8.5 - 13+) from caustic soda production, 3) metals from industrial debris disposal, and 4) PCBs (including congeners) and dioxins/furans. The contaminant transport pathway of most concern is ground water flow from source areas located both upland and beneath the waterway to sediment and surface water.

Remedial Action (Sediments)

EPA signed an ESD that finalized the cleanup plan for the Mouth and Head Hylebos Waterway problem areas in August 2000. These two problem areas were further divided into five segments in the design phase. The cleanup plan for the Hylebos Waterway included dredging of an estimated 940,000 cubic yards of contaminated sediments, capping 11 acres, and monitoring 20 acres of marginally contaminated sediments as natural recovery areas. Consistent with the

August 2000 ESD, all five of the CB/NT ROD key elements were incorporated into the design of the Hylebos Waterway Remedial Action. Response actions have also occurred pursuant to the Occidental Site non-time critical removal actions, and the remaining work folded into an amended AOC and associated SOW.

The design and implementation of the Hylebos Waterway sediments cleanup plan was implemented in three sections as follows:

- Head of Hylebos Segments 1 and 2.
- Mouth of Hylebos Segments 3 and 4.
- Mouth of Hylebos Segment 5.

General Metals of Tacoma (now Schnitzer Steel) and Arkema (whose environmental liabilities were recently acquired by the Port of Tacoma via property sale) are implementing the cleanups at the Head of Hylebos (Segments 1 and 2). The Port of Tacoma and Occidental Chemical are implementing cleanups in the Mouth of Hylebos (Segments 3, 4 & 5). Remaining contamination within the Occidental Site is being addressed by the Occidental Chemical Corporation.

In the Hylebos Waterway, essential source control actions were determined to be complete in June 2000, allowing EPA to initiate sediment remedial action. Based upon information provided to Ecology and EPA, upland sources were considered sufficiently controlled to prevent recontamination of sediments. This did not mean that all sources of contamination to soil, ground water, and sediment had been completely controlled.

Segments 1 and 2 (Head of Hylebos)

Intertidal cleanup actions were completed at the Head of Hylebos (Segments 1 and 2) in 2003. In order to avoid capping and long-term monitoring, four areas covering 1.5 acres were excavated to remove 7,400 cy of sediment exceeding the SQOs and then backfilled with clean sand and gravel. The General Metals graving slip, J&G property, Arkema intertidal shoreline and Dunlap Log Haul out area were excavated in the dry using upland excavation equipment.

The 2004 remedial action dredging started July 16, 2004, and continued through the end of the in-water construction season on February 14, 2005. At the completion of the 2004-2005 dredging season, several shallow core samples were collected to further characterize remaining sediment contamination and refine plans for the 2005-06 remedial action work. This data confirmed the need to dredge areas already planned, and also served to identify the relative amount of asbestos in contaminated sediment yet to be dredged.

Remedial action construction began again in July 2005 and continued through February 2006. During that time, the remaining dredge prisms were removed, the Arkema subtidal cap design finalized, and the cap constructed. During review of the final design, it became clear that the cap would not function as intended until arsenic contaminated ground water was addressed. EPA elected to allow installation of a standard cap (rather than requiring an amended cap) with an expectation that the performing parties would work with Ecology's MTCA program to control

the source of arsenic. The letter documenting this decision is found in OU 1 Attachment 7. As outlined in the previous section, the source of arsenic has not been controlled.

Unanticipated remedial action was initiated during the in-water construction season of 2007-08 to remove scrap steel, originating from a capsized barge, from the recently dredged sediment surface along the Schnitzer Steel dock. This effort continued during the 2008-09 construction season, and included use of an electromagnet to retrieve debris not previously removed.

This scrap steel debris removal occurred partly atop the sediment cap (installed in 1999) beneath the dock, which precipitated an inspection clause of the Post-Removal Site Control Plan. In response to that inspection, toe berm repairs were completed in February 2009, and sediment quality sampling occurred afterword. Results from the sediment quality sampling identified some areas above the SQO for zinc. Sediment cap PCB levels are below the SQO but well above background concentrations when the clean sand cap was installed about 10 years ago. In response to the zinc SQO exceedances, Schnitzer Steel has proposed to initiate a focused reconnaissance and sediment sampling effort to identify continuing sources of contamination to the sediments.

Segments 3, 4, and 5 (Mouth of Hylebos)

At the Mouth of Hylebos, intertidal cleanup actions were implemented at Sound Refining, Murray Pacific, and the Taylor Way properties. Excavation, bulkhead removal, regrading and backfilling were completed at the Murray Pacific and Sound Refinery properties. Dredging and excavation of about 60,000 cy at the Taylor Way property was completed in December 2004.

In 2003, dredging was completed for Segment 5 of the Mouth of Hylebos. At the completion of the 2004-2005 dredging season, dredging within Segments 3-4 was completed. Confirmation sampling along the Taylor Way property embankment, within Sediment Management Unit 421B, identified PAH contamination which is currently attributed to dredging through creosoted piles rather than first removing them.

To date, an estimated 628,000 cy of sediment has been dredged from the Mouth of Hylebos and approximately 400,000 cy has been dredged from the Head of Hylebos. Mouth of Hylebos dredge material was disposed of in the Blair Slip 1 NCDF and the DMMP open-water disposal site in Commencement Bay.

In 2006, the Port of Tacoma decided to cap contaminated sediment beneath Pier 24 and 25 as had been planned rather than remove the pier(s) and underlying sediment. EPA approved the final cap design, with several conditions, in July 2007. Cap construction began in September 2007 and continued through mid-February 2008 when the in-water construction season ended. The approved design called for removal of several fused metallic debris piles and some contaminant hot-spots prior to overall capping. Part of the intertidal area beneath Pier 25 was covered with shotcrete rather than sand in an effort to more effectively isolate underlying contamination.

At the Occidental Site (which extends north along Pier 25 about 750 feet beyond the Pioneer facility property line) remedial action will be initiated following additional investigations and remedy selection. See the Occidental Site removal actions section below.

Remedial Action dredging did not occur within the 11th Street Bridge Right-of-Way (ROW), and sampling data within the ROW and nearby is sparse. This was brought into focus recently when the City of Tacoma alerted EPA of its plans to rebuild the bridge. The in-water construction portion of the bridge rehabilitation is scheduled to be completed between August 2009 and February 2010. The work requires removal of pilings within the ROW and installation of new approaches on either side of the span.

Limited sediment sample collection during geotechnical borings in 2006 identified a general area of high PAH sediment contamination in the subsurface. The City collected and analyzed subsurface sediment samples in 2009 to approximately bound that area both laterally and vertically prior to construction, and obtained pre-construction surface sediment samples within the ROW and adjacent areas to compare with post-construction samples. Based upon the sampling results, the City estimates that perhaps about 1,000 cubic yards of potentially contaminated sediment will be removed from encased shafts during cement piling installation.

Disposal of Dredged Material

The selected disposal sites for dredged material from the cleanup of the Hylebos Waterway were an upland regional landfill for dredge material from the Head of Hylebos, and a nearshore NCDF at Blair Slip 1 for dredge spoils from the Mouth of Hylebos. The DMMP open water disposal site in Commencement Bay was also used for less contaminated sediments from the Mouth of Hylebos.

The following table shows the origin and approximate amount of sediments dredged from the Mouth of the Hylebos Waterway (Segments 3, 4 & 5) as well as the disposal location:

Table 1. Sediments dredged from the Mouth of the Hylebos Waterway

Blair Slip 1 Nearshore Confined Disposal Facility	
Segment 3-4	197,000 cy
Segment 5	260,000 cy
Treated Area 5106 Sediment	36,000 cy
DMMP (For Less Contaminated Sediment)	
Segment 5	135,000 cy
Estimated Total of Dredged Sediment from Mouth of Hylebos	**628,000 cy**

At the Head of Hylebos, dredged material was transported by rail for disposal at the Roosevelt Regional RCRA Subtitle D Landfill in semi-arid central Washington. The wet sediment was used as daily landfill cover.

Construction activities to fill and cap the Blair Slip 1 NCDF began in July 2002 and continued through February 15, 2005. As part of the final construction, stone pilings were placed in the containment berm to provide additional structural stability and protection against seismic

activity, and to ensure that the NCDF surface would be suitable for subsequent development as a container cargo facility. Both the NCDF and overlying container cargo facility are complete.

Habitat Mitigation

Two mitigation projects, Clear Creek Phase 2 and Blair Slip 5, were approved by EPA to offset impacts from filling Blair Slip 1, which converted 14 acres of primarily subtidal aquatic habitat to uplands. The Clear Creek project restored two-acres of habitat along the Puyallup River to provide habitat for juvenile salmonids. This Phase 2 project expands the mitigation site previously developed by the Port of Tacoma as part of the Sitcum Waterway project. The second mitigation project, Blair Slip 5, located adjacent to the Blair Slip 1 NCDF, is intended to convert 7 acres of subtidal habitat to protected, intertidal habitat more conducive to migrating juvenile salmonids. The two-acre Clear Creek restoration was completed in early 2004 and significantly improves the lower reach of Clear Creek for salmon migration and habitat for upland species.

Institutional Controls

Institutional controls for the Hylebos Waterway remedial actions include sitewide fish use advisories maintained by the TPCHD in designated areas.

Site use restrictions are often needed for areas where contaminants remain in place (i.e., caps and NCDF). The following remedial action elements are subject to institutional controls:

- General Metals of Tacoma (MTCA covenant filed with title).
- Arkema SE Shoreline (formerly Elf Atochem 2901 Taylor Way) - notice to successor in title and MTCA covenant required by consent decree.
- Blair Slip 1 NCDF where contaminated sediments are to remain in a containment structure for some time.

Institutional controls might also be needed to augment OMMPs in one or more of the following areas:

- Piers 24 and 25 (remedial action construction completed 2008).
- Occidental Site (after RD/RA accomplished).
- Arkema Site (After RD/RA accomplished).

Institutional control plans or other means to regulate subsurface exploration and/or excavation necessary to protect response actions might also be developed for other areas of the waterway and adjacent uplands. If so, this could be accomplished as part of the upcoming remedial action construction completion documentation approval.

Occidental Site Removal Actions

The Area 5106 Removal Action was completed as designed in February 2003, under authority of a UAO. Approximately 36,000 cubic yards (cy) of sediment contaminated with chlorinated

organic chemicals associated with perchloroethylene (PCE) production waste were hydraulically dredged, piped to a temporary onsite treatment facility, treated to reduce VOC mass, and disposed in the Blair Slip 1 aquatic CDF. The 1989 ROD did not include treatment as part of the selected remedy due to the nature of the sediments found throughout the site; however, treatment prior to disposal was needed for Area 5106 sediments because of high VOC and semivolatile organic compounds (SVOC) concentrations.

Post-dredge sediment sampling indicated severe, and potentially deep, VOC and SVOC contamination of underlying native sediment. EPA required additional response actions in March 2003 to characterize the extent of remaining sediment contamination within and around Area 5106 and work began in August 2003. This initial and subsequent sampling identified additional principal threat source material and suggested that it was contiguous with upland soil and ground water contamination.

The Embankment Area Removal Action, performed under authority of the 1997 AOC, led to the draft design of a permeable cap to cover the intertidal and subtidal embankment to the toe of the slope at about -40 feet MLLW. In July 2003, before the design was finalized, additional information about contaminated sediment beneath portions of the subtidal slope, VOC contaminated ground water discharges, and discharges of groundwater with high pH to the waterway led Occidental, EPA's CERCLA program, and the Washington Department of Ecology's RCRA program to conclude that the permeable cap remedy would fail if implemented.. Occidental then proposed a new type of embankment cap, for hydraulic containment of contaminated groundwater, to EPA and Ecology in October 2003. With the concurrence of EPA and Ecology, Occidental subsequently began efforts to assess the feasibility of an impermeable embankment cap and under drain groundwater containment system. This effort led the parties to conclude that more information about the nature/extent of (soil/sediment and ground water) contamination and ground water flow to Hylebos Waterway was needed.

In March 2004, EPA and Ecology agreed that additional remedial investigation~~s~~, an FS, and RD/RA were needed to address the remaining contaminated soil, ground water, and sediment at the site in an integrated manner. During the summer of 2004, EPA and Ecology collected ground water samples from subtidal sediments along the Occidental embankment, and analyzed them for contaminants of concern. The report which documents the investigation was published November 2004. Recommendations from that report were then used by Occidental to later develop a subtidal investigation work plan.

In February 2005, the 1997 AOC with Occidental was amended to address remaining field investigations, site characterization, high pH neutralization pilot testing, remedy selection and remedial design up to the 90 percent level. This amended AOC between EPA, Ecology, and Occidental Chemical Corporation includes remaining work under the CERCLA Embankment Area and Area 5106 removal actions and RCRA corrective action. The tasks needed to accomplish this are included in the 2005 Statement of Work referenced in the amended AOC.

Post-Construction Monitoring/Operation and Maintenance

Long-term monitoring and maintenance is required for all of the remedial action components to assess the overall effectiveness of the remedy and ongoing source control actions. Much of the

Hylebos Waterway RA has occurred within the past five years, and some quite recently. Draft OMMPs for both the Mouth and Head of Hylebos have been prepared and are under review by EPA.

For the Hylebos Waterway, O&M monitoring will be required for the following key remedy elements:

- Dredged areas – To evaluate sediment quality trends and determine if recontamination is occurring.
- Intertidal and subtidal caps – To confirm that buried contaminants remain physically and chemically isolated, and recontamination from the surface water column is not occurring.
- Blair Slip 1 NCDF – ground water monitoring to confirm that contaminants remain within the disposal facility.
- Mitigation sites (Blair Slip 5 and Clear Creek Phase 2) – to confirm that the desired habitat function(s) are being achieved.

One monitoring plan, for the General Metals cap installed in 1999, has been implemented, both for physical integrity monitoring and sediment quality. Data collected from years 0-10 by lead line and diver surveys indicated that cap thickness remained within design limits. In 2001, General Metals conducted minor repair to the cap after a docked ship damaged several pier pilings located within the cap footprint. No significant damage was done to the cap. However, new pilings were put in and additional cap material was placed in around the new pilings. In 2007-08, remedial action to remove scrap steel along the cap toe berm apparently caused minor damage which was repaired in early 2009.

The General Metals cap Post-Removal Site Control Plan calls for sediment quality sampling if an increase in thickness suggests that significant new sedimentation has occurred. Sediment quality sampling was performed in early 2009, some samples exceeded the SQO for zinc, and several samples had elevated PCB levels though still below the SQO. In response, further sampling is planned in an effort to determine the source(s) of contamination.

4.2.4 Progress since the Last Five-Year Review

See Section 4.2.3 for detailed information about the Head of Hylebos, Mouth of Hylebos, and Occidental Site.

Previous Protectiveness Statement

The protectiveness statement in the last Five-Year Review (2004) stated:

> "Remedial actions at Hylebos Waterway are under construction. The remedy is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled."

Since 2004, the following actions have been substantially completed and are considered largely protective from the standpoint of achieving SQOs for surface sediments:

- Intertidal cleanup at the Head of Hylebos.
- General Metals intertidal cap (with caveat of recent Zn exceedances).
- Dredging in Segment 5 (Mouth of Hylebos) except at the Occidental Site.
- Intertidal and subtidal cap beneath and between Piers 24 and 25.
- Segment 3/4 Dredging (Mouth of Hylebos).
- Segment 1 and 2 Dredging (Head of Hylebos).
- Clear Creek Phase 2 Mitigation Project.
- Slip 5 Mitigation Project.
- Blair Slip 1 CDF construction.

Status of Recommendations

A summary of the recommendations made in the previous five-year review (2004) and an evaluation of their progress are presented below.

- **Hylebos/Occidental – a) Complete the characterization of the Occidental site, b) select and implement the remedy.**

  The Occidental Site characterization is nearing completion. A remedy (or set of remedial actions) to address remaining soil, ground water, and sediment contamination has not yet been selected. The current Occidental Site task schedule suggests that remedy selection by EPA and Ecology will occur in 2010-11. Remedy design and implementation will depend upon remedy selection and there are currently a number of options under preliminary consideration. A summary of Occidental Site cleanup progress and challenges since the last FYR follows.

  As pointed out in the previous FYR, two Hylebos Waterway non-time critical removal actions at the Occidental Site revealed that sediment and ground water contamination were more severe than realized, and appeared contiguous with upland contamination being addressed under a RCRA Corrective Action permit. This led EPA to require additional response actions under the Area 5106 UAO in 2003, followed by a more collaborative working relationship with Ecology's RCRA program. In 2005, EPA, Ecology and Occidental Chemical reached agreement on an amended Administrative Order on Consent (AOC) and associated Statement of Work (SOW) for RI/FS through RD tasks under joint EPA-Ecology oversight. A copy of the 2005 amendment to the 1997 AOC is found in OU 1 Attachment 8.

  The principal tasks in the 2005 SOW include investigations to delineate the nature/extent of contamination onshore and beneath the waterway, characterize movement of contaminated groundwater from upland areas to the waterway sediments, conduct pilot tests to identify how to neutralize high (8.5 to 13+) pH groundwater where necessary, evaluate remedial alternatives, and implement remedial design up to the 90 percent level. Completion of the

remedial design and implementation of remedial action will require either a CD or UAO. Also, either a ROD amendment or ESD may be required.

Remedial investigations to determine nature/extent of contamination and characterize contaminated groundwater flow from upland areas to the waterway began in June 2005. These investigations have included:

- Initial and step-out drilling (total of 94 boreholes) beneath the waterway to delineate the three-dimensional extent of VOCs (mostly PCE and/or its degradation products) within sediment and ground water, and the 3D extent of elevated pH. Ground water samples were also analyzed for dissolved metals but the results did not govern step-out boring decisions.
- Upland sampling from 42 borings to generally delineate soil (both unsaturated and saturated) and ground water contamination within VOC source areas.
- Focused dioxin/furan and PCB congener investigations to determine presence/absence and identify the nature/extent where found.
- Installation of transducers beneath the waterway to measure pressure (surrogate for hydraulic head) changes at different depths with respect to tidal stage over two 72-hour intervals.
- Temporary placement of seepage meters at several locations to measure groundwater flux into Hylebos Waterway with respect to tidal stage.
- Measurement of groundwater density (directly and through established relationship between density and electrical conductivity) across the site since density-driven flow appears to be an important consideration.

The results from these investigations are being used to produce a site characterization report, and develop three-dimensional groundwater flow and contaminant transport models. Data acquired from recent (2005 to date) and previous site investigations have been entered into a database managed by Occidental's consultant (CRA), and entered into visualization software purchased by CRA and shared with the agencies.

Also during this time, pilot tests were conducted to evaluate the practical efficacy of using ferric sulfate for in-situ neutralization of high (9 to 14) pH groundwater. The field-scale pilot studies have served to identify several drawbacks with in-situ neutralization using iron sulfate, and led to development of additional laboratory and bench-scale testing to see if other reagents and/or ex-situ pH neutralization can be used.

SOW tasks anticipated to be completed within the next few years include completion of high pH pilot testing, evaluating remedial alternatives for soil, ground water, and sediment remediation, leading to selection of a remedy or set of remedial actions.

- **Sitewide – Implementation of OMMPs for Hylebos, Middle and Thea Foss and Wheeler-Osgood Waterways to ensure effectiveness of remedial actions and mitigation activities.**

  Sediment remedial action and associated mitigation has been mostly accomplished within Hylebos Waterway with the exception of the Occidental Site. Overall OMMPs for the Head of Hylebos and Mouth of Hylebos have been drafted but not revised and finalized.

  The EPA approved OMMP for the clean sediment cap beneath the Schnitzer Steel (formerly General Metals) dock was incorporated by reference into the Head of Hylebos Consent Decree of 2004. The terms of that OMMP include regular cap thickness monitoring, additional monitoring if there is reason to suspect that the physical integrity of the cap might have been compromised, and sediment quality (chemistry) monitoring in areas of significant new sedimentation.

- **Sitewide – Implementation of Institutional Controls for all waterways and review status of institutional controls already in place.**

  Legally enforceable Institutional Controls have not yet been developed and implemented. Additional information regarding institutional controls is discussed in the Data Review and Evaluation section below.

- **Sitewide – Review the results of monitoring at the mitigation sites and based on that data describe the contribution of those sites towards the recovery of ESA species.**

  Hylebos-approved mitigation sites have been partly evaluated, and further evaluation is needed. Also, mitigation for the Mouth of Hylebos SMA 421B RA dredging (instead of capping and enhanced habitat as originally planned) has not been completed.

- **Sitewide – Develop a work plan to conduct fish tissue sampling for CB/NT after sediment Remedial Actions are complete. Provide results to Washington State Department of Health (DOH) to determine if they should continue with fish advisories after the sediment cleanup RAOs have been achieved.**

  See Section 4.8 of this Five-Year Review for a discussion on fish tissue sampling for the CB/NT Site.

4.2.5 Five-Year Review Process

Administrative Components

The Hylebos Waterway Superfund Site FYR team was lead by Jonathan Williams, EPA Remedial Project Manager (RPM). Emile Pitre, with the USACE Seattle District, assisted with the review as representative of the support agency.

By February 2009, the review team had been formed, and had established the review schedule and its major components including:

- Document Collection and Review.
- Data Assessment/Analysis.
- Site Inspection.
- Interviews and Community Notification and Involvement.
- FYR Report Development and Review.

The FYR has a statutory completion date of December 29, 2009.

Community Involvement

EPA's Community Relations staff sent a postcard to stakeholders and neighbors on the CB/NT project mailing list (approximately 1,440 addressees) in February to notify them of the five-year review process. After checking in with several members of the community, EPA determined that some of them had not yet received the information. EPA then mailed a second postcard on March 19, 2009 to the project mailing list to ensure that people had an opportunity to provide information to EPA. In addition, a display advertisement ran on page B3 of the Tacoma News Tribune Newspaper on February 6, 2009.

A telephone interview was completed with Leslie Ann Rose, Senior Policy analyst with Citizens for a Healthy Bay.

Document Review

A review of reports pertinent to this Five-Year Review was conducted by the review team. The types of documents reviewed included decision documents; risk assessment documents; annual data reports; technical memoranda; and other supporting materials. OU 1 Attachment 1 is a complete list of documents reviewed during this FYR.

Data Review and Evaluation

Remedial activities are discussed in the previous Sections 4.2.3 and 4.2.4. In order to protect the remedy and prevent spreading of subsurface sediment contamination within waterways, EPA has, to a great extent, depended upon coordination with the U.S. Army Corps of Engineers which issues permits under the Clean Water Act for in-water construction projects. The Seattle District Office has a Standard Operating Procedure (SOP) for coordinating with EPA prior to issuing permits within the CB/NT site. This allows EPA to work through the Corps to include permit conditions needed to prevent the spread of contamination and/or protect remedial actions already accomplished. The Corps Seattle District Regulatory Branch has also developed standard permit language for CERCLA sites which is applied even if EPA does not identify any particular concerns or the need for particular permit conditions.

Generally, this working relationship has been effective. An exception has been the 2009 reconstruction of the Hylebos Waterway 11th Street Bridge. The Corps reviewed the City of

Tacoma permit application, did not contact EPA, and elected to consider the removal and replacement of bridge abutments within contaminated sediment as routine maintenance, and not construction, because the ultimate in-water footprint would be the same after the bridge was rebuilt. The nature and timing of this Corps Seattle District Regulatory Branch decision was unexpected. In response, the City's Special Projects group responsible for the bridge construction continued to coordinate pre-construction right-of-way characterization and surface sediment background sampling with EPA but without a binding legal relationship.

Operation, maintenance, and monitoring plans (OMMPs) are being developed for dredged, capped, and natural recovery areas within Hylebos Waterway. As the OMMPs are developed, EPA will evaluate whether some type of institutional controls are needed to supplement the OMMP provisions.

Interviews

Interviews were performed by telephone. Parties were identified for the interviews based on the following criteria:

- Parties adjacent to the site or effected by site related contaminants.
- Public entities/utilities affected by operation of the remedy.
- Interested and concerned citizens or citizen groups.

Parties identified for interviews included:

- Leslie Ann Rose with Citizens for a Healthy Bay (CHB).

The following recommendations and suggestions were made:

- Establish a system to alert EPA when there is a planned disturbance of sediments or soils within operable units. The sites can be entered into the City of Tacoma land-use database to notify EPA when a person applies for a land-use permit within the operable units.
- To assign one EPA RPM for all operable units post-remediation.

4.2.6 Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?
Answer: Yes.

However, not all remedial actions are complete. A definitive assessment will require all aspects of the remedy to be completed, and long-term monitoring data trend analysis.

The ROD speaks to source control and sediment remediation in order to reach sediment cleanup objectives, which are then expected to provide a benthic habitat protective of human health and the environment. Source control efforts are continuing with a particular focus on the Arkema and Occidental Sites. Most surface sediment within the waterway has been remediated to SQOs.

To protect the remedy, EPA has, to a great extent, depended upon coordination with the U.S. Army Corps of Engineers, which issues permits under the Clean Water Act for in-water construction projects. OMMPs, which might include ICs, are being developed for long-term remedy protection and evaluation purposes. Sitewide ICs to provide current protectiveness in the form of fish advisories have been put in place.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?
Answer: Yes.

Changes in Standards and To Be Considered. Applicable or relevant and appropriate requirements (ARARs) cited in the ROD were reviewed to evaluate changes in the ARARs since the last five-year review. A summary table is presented in OU 1 Attachment 2. There have been few changes in regulatory standards since the last five-year review: Puget Sound steelhead was listed as threatened on May 11, 2007.

Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics. The ROD described current and anticipated future land uses and identified likely exposure pathways. Given the size and complexity of the site, the ROD also identified the need for additional data to be collected in the remedial design phase (see "Problem Definition" Section 2.4) and the ROD stressed the natural relationship and consequent need for coordination between the contaminated sediment and sources operable units (see especially Section 5.2). As additional data have been collected over the years, within waterways and upland source areas, the relative importance of different contaminant transport pathways across the site have been better defined. Consequently, the importance of the soil to ground water to surface water sediments contaminant transport pathway has been highlighted in some areas. For example, within the Hylebos Waterway, the Arkema and Occidental Sites have been identified as having significant remaining source areas and contaminated groundwater flow to the adjacent waterway sediments.

Although the majority of the apparent effect threshold (AET) values have remained unchanged since the date of the original ROD, a recent set of unpromulgated AET values appear pertinent to the five-year review process. These values were prepared in 1998 by the DMMP based on biological tests of polychaetes (*Neanthes* sp.), and bivalves. Approximately 45 percent of the AET values listed in OU 1 Attachment 3 would be lowered by these unofficial standards. If made official, these changes would presumably affect the assessment of the cleanup values established in the original ROD. Because the 1998 values are not promulgated the AET standards for the Puget Sound remain unchanged and will not affect the cleanup remedies in places at the Commencement Bay and Near Shore/Tidal Flats site. The assessment of changes made to AET values may be partially incomplete as the most recent AET values are in mg/kg organic carbon, while the AET values in the ROD are in mg/kg dry weight. In addition, only the SQO for PCBs was based on human health risk assessment (ecologically-based cleanup levels for all other toxins were deemed protective of human health).

Finally, it should also be noted that since the ROD, the DMMP has listed both Chlordane and dioxins/furans as bioaccumulative chemicals. Neither chemical was evaluated for human health risks in the RI/FS.

Since the 1989 CB/NT ROD, new information has become available on Tribal seafood consumption rates and exposure durations for Tribal populations. This new information has been considered for the Sediments OU, as detailed below.

In August 2007, EPA Region 10 issued a "Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-Based Decision Making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia" (hereinafter referred to as the Framework). The Framework was designed to assist EPA Region 10 with managing hazardous waste cleanup sites with Tribal seafood consumption exposures and concerns.

The primary focus of the Framework is on the performance of risk assessments and their input into risk-based cleanup decisions. In part, the Framework concluded:

> "Based on EPA's knowledge of sediment cleanup sites in Puget Sound, the Framework may have limited application for those CERCLA and RCRA sites where the remedy has already been selected…As part of the five-year review process, Tribes can provide new information to be considered or request that the lead federal agency evaluate particular aspects of a remedy relative to Tribal interests…Such requests would be evaluated on a site-specific basis consistent with EPA's five-year review guidance...In determining whether a recalculation of site risks or any other detailed analysis is needed as part of the five-year review, EPA would review the basis of the selection of the remedial action and cleanup levels and other relevant information to determine whether further analysis of such updated information is appropriate, and focus our analysis on matters that would help assess the protectiveness of the selected remedy."

In Commencement Bay, the CB/NT ROD identified PCBs as the key contaminant of concern for human health due to seafood consumption. The SQO for PCBs is based on the human health risk assessment, and a high-end tribal fishing scenario was used as the reasonable maximum exposure scenario.

PCBs were identified as a contaminant of concern in the Hylebos Waterway. PCBs were not identified as a contaminant of concern in other waterways. EPA's 1997 Explanation of Significant Differences for the CB/NT site provides a brief summary of PCB contamination in the Sediments OU:

> "PCBs, along with a number of other chemicals, were identified as problem chemicals in the Mouth and Head of Hylebos Waterway problem areas. PCBs are also present in the Thea Foss Waterway problem areas, however, current information indicates that cleanup of other chemicals such as polynuclear aromatic hydrocarbons (PAHs) and metals will also encompass PCB-contaminated areas. PCBs are not widely distributed in elevated concentrations in other CB/NT problem areas."

Within the CB/NT Sediments OU, the majority of PCB-contaminated sediments have been addressed by dredging or capping, and long-term monitoring results in the waterways, including in natural recovery areas, do not show significant PCB recontamination.

In consideration of the Framework, as part of this Five-Year Review, EPA identified and evaluated the effects of recent information on seafood consumption rates and exposure durations for Tribal populations as changes in assumptions that were used at the time of remedy selection that could potentially call into question the protectiveness of the remedy where human health exposure to, and risk from, consumption of seafood contaminated with PCBs above levels of concern. EPA compared the new information to the information used at the time of remedy selection/modification in the 1997 ESD.

If the estimated risk has increased, EPA's Five-Year Review Guidance recommends determining whether the new estimated risk is acceptable and the remedy remains protective. In most cases, this determination is to be based on whether the risk is within or below the generally acceptable risk range of 10^{-4} to 10^{-6} for carcinogenic risk and the hazard index is below 1 for non-carcinogenic effects. If the estimated risk is not protective, the review should identify what actions need to be taken to achieve an acceptable level of risk.

As described in this Five-Year Review, the actual post-cleanup concentration of PCBs in sediments is much lower than the PCB SQO in many areas[3]. Fewer PCBs in the environment would lower the potential for PCB bioaccumulation in seafood, and reduce risks to humans consuming seafood.

In areas of the Sediments OU where PCBs remain present in sediments, PCBs are a potential human health contaminant of concern. Therefore, for this Five-Year Review, EPA identified the consumption rates and exposure duration in the Framework as new information that could impact

---

3 In the Hylebos Waterway, the majority of PCB-contaminated sediment has been removed by remedial action dredging. Approximately one million cubic yards of contaminated sediment have been removed from the Hylebos Waterway. Much of the sediment contamination within Hylebos Waterway (including most of the PCBs) appears to have occurred from historic discharges within the water column. The remedial actions in this waterway were designed to physically remove most contaminated sediment to a clean sediment surface. In some areas, expensive shoreline infrastructure (e.g., shipping docks) along steep subtidal slopes led to capping of contaminated sediment instead. Remaining PCB contamination will be addressed, and should be viewed within the overall context of the majority of the PCB mass having been removed from the waterway. In other waterways, although PCBs were not identified as a contaminant of concern, any potential PCBs in sediments would have been addressed as part of the overall remedy for the problem area waterway.

In the Sitcum Waterway, contaminated sediments were dredged to native materials, so any PCBs would have been dredged as part of the remedy.

In the St. Paul Waterway Problem Area problem area, all contaminated sediments were capped with clean material, which would have also addressed any PCB contamination.

In the Olympic View Resource Area, all contaminated sediments were either dredged or capped.

In the Middle Waterway, approximately two-thirds of the problem area was either dredged or capped, which would have addressed any potential PCB contamination. In this waterway, the remedy also included some natural recovery areas, and post-cleanup sediment sampling in these natural recovery areas monitor for contaminants of concern (i.e., PAHs in Area C; mercury in Areas A and B).

In the Thea Foss/Wheeler-Osgood Waterways, the remedy for contaminated sediments included dredging, capping, enhanced natural recovery, and natural recovery. For these waterways, the most recent post-cleanup sediment monitoring (Year 2, 2008) results for the capped and natural recovery areas report undetected concentrations of PCBs, except for two stations with concentrations that are slightly above the SQO.

the estimated risk associated with residual PCBs which could call into question the long-term protectiveness of the remedy.

Consistent with the Framework, EPA completed an evaluation of this issue (see OU 1 Attachment 9). A brief summary of the evaluation, and EPA's conclusions, follows:

- The primary Tribe that could be affected by Commencement Bay contamination is the Puyallup Tribe. The CB/NT Sediments OU is within the Puyallup Tribe's Usual and Accustomed seafood harvesting areas.

- The Puyallup Tribe was notified of EPA's intent to perform the third Five-Year Review in February and March 2009.

- The Puyallup Tribe did not provide any new information for EPA consideration. However, EPA determined that for those PCB-contaminated sediments where exposure to sediment contamination was of potential concern, and the sediments had not been dredged or capped, there could be residual PCBs that could pose an unacceptable risk to human health. In those areas it is appropriate to evaluate the exposure information in the Framework, identify any significant changes to estimates of human health risks, and evaluate whether the changes call into question the protectiveness of the remedy.

- The Framework identifies the Tulalip Tribes' seafood consumption data set as appropriate for assessment of tribal seafood consumption risks for areas that lack current or potential extensive areas of high quality intertidal shellfish habitat. The Framework established the 95th percentile consumption rate of Puget Sound-harvested fish and shellfish for adults of the Tulalip Tribe at 194 grams per day, of which almost half (96.4 grams) is from anadromous fish (primarily salmon). For preliminary application of the Framework to the Lower Duwamish Waterway Superfund site risk assessment, EPA concluded that adult salmon in the Lower Duwamish Waterway likely do not accumulate a substantial PCB body burden during the time spent in the waterway. Consequently, the salmon body burden of PCBs related to site contamination is expected to be low. Seafood consumption rates for resident seafood and PCB concentrations in those resources were hence used to assess PCB seafood consumption risks for the Lower Duwamish Waterway. As documented in OU 1 Attachment 9, EPA believes that the Lower Duwamish Waterway approach is reasonable for Commencement Bay as well. Without salmon, Commencement Bay seafood consumption risks would be based on consumption rates of resident seafood derived from Tulalip Tribes' data, a consumption rate of 97.6 grams per day.

- The Framework recommends that 70 years is the appropriate duration to use for lifetime exposure.

- The "high end" Tribal fishing scenario used in the 1997 ESD, which modified the PCB goals for the CB/NT Sediments OU, used a rate of 123 grams per day over 30 years and estimated the post-cleanup residual excess cancer risk associated with that level at 1.2 x 10-4. In the ESD, EPA stated that *"The analysis focused on cancer risks as the most conservative estimate of risks to human health. The risk assessment estimated cancer risks only, because a PCB cleanup level based on cancer risks was shown to be protective of non-cancer risks as*

> *well."* EPA is still evaluating whether the revised exposure assumptions could make a significant difference to non-cancer risk. Application of the Framework using the assumptions discussed above (97.6 grams per day over 70 years) results in a revised post-cleanup estimated residual excess individual lifetime cancer risk of 2.2 x 10-4.

Based on this evaluation, EPA does not believe that this difference is significant enough to call into question the protectiveness of the remedy nor to require any additional action at this time. EPA believes that the PCB SQO (300 µg/kg) remains protective.

Changes in Land Use. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. The Port of Tacoma prepared draft conceptual development plans in 2007, and made public pronouncements 2007-08, about a maritime industrial development footprint and schedule which posed a threat to ongoing response actions at the Occidental Site. EPA and Ecology communicated extensively with the Port of Tacoma about its concerns, and entered into AOC negotiations with the assistance of a neutral facilitator. The Port of Tacoma suspended work on the Blair-Hylebos development project in February 2009. In October 2009 the Port of Tacoma announced that its shipping customers will be adequately served by existing Port facilities.

Remedial Action Objectives. The RAOs from the ROD are still valid for the site.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
Answer: No.

There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed and information obtained, the remedy is incomplete but is functioning as intended where implemented; there is no information which calls into question the anticipated protectiveness of the remedy once fully implemented. The most important actions that remain to be completed include source control efforts, with a particular focus on the Arkema and Occidental Sites, and implementation of legally enforceable Institutional Controls to protect against future actions which could adversely impact areas of the waterway where sediment has been remediated. There is no other information that calls into question the protectiveness of the remedy. A meaningful long-term evaluation of remedy functionality will require all aspects of the remedy to be completed and sediment monitoring trends to remain favorable for some time.

4.2.7 Issues

This section identifies issues that, either currently or in the future, affect remedy protectiveness.

Table 2. Hylebos Waterway Issues of the 2009 Five-Year Review

Issue	Affects Protectiveness? (Y or N)	
	Current	Future
Arkema Site source control is needed to meet RA performance standards.	Y	Y

4.2.8 Recommendations and Follow-up Actions

Table 3 lists recommendations and follow-up actions for each issue identified in Table 2.

Table 3. Hylebos Waterway Recommended Follow-Up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Planned Completion Date
Source control at the Arkema site is needed to meet RA performance standards	Perform RI/FS and RD/RA for the Arkema Site to investigate and address contamination upland and beneath the waterway.	Port of Tacoma	EPA and Ecology	2013

4.2.9 Protectiveness Statement

The remedy is expected to be protective of human health and the environment upon completion. Most remedial action construction has been accomplished, and the additional actions needed for the remedy throughout the waterway to be protective described in the ROD and this report, are progressing toward completion.

4.3 Sitcum Waterway

Five-Year Review Summary Form - Sitcum Waterway

Issues: None.

Recommendations and Follow-up Actions: None.

Protectiveness Statement(s):

The remedy at the Sitcum Waterway Problem Area is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled.

Other Comments: None.

4.3.1 Background

The Sitcum Waterway is located between the Blair Waterway to the northeast and former Milwaukee Waterway, and Milwaukee Habitat Area, to the southwest (see Figure 4-1). Sitcum Waterway is a deep navigational waterway, created by dredging and filling native mudflats since 1910. The Port of Tacoma owns the submerged land and bottom sediment in the waterway and

the land adjacent to the waterway. The Port operates Terminal 7 as a container handling and bulk unloading facility.

The Sitcum Waterway Problem Area comprised a 55-acre area of contaminated marine sediments in the main navigational channel and berth areas (Figure 4-6). Sediments were contaminated with metals (arsenic, cadmium, copper, lead, nickel, and zinc) and PAHs above the SQOs identified in the CB/NT ROD. Primary contaminant sources included historical releases of metal ores handled at Terminal 7, and releases from a stormwater outfall (SI-172) that discharges runoff from an industrial and commercial area covering approximately 170 acres. Contaminated sediments were dredged and disposed of in the Milwaukee Waterway NCDF (Figure 4-7). The Milwaukee Waterway Habitat Area (Figure 4-7) and the Clear Creek Habitat Improvement Project (also known as the Clear Creek Phase 1 Area) (Figure 4-8) are the mitigation sites for the Sitcum Waterway Remediation Project.

4.3.2 Site Chronology

Key dates for Sitcum Waterway actions are as follows. Section 4.3.3 provides a description of the actions.

1991	EPA/Port of Tacoma AOC for RD/RA.
1993	ESD selects remedial action for Sitcum.
1993	EPA/Port of Tacoma entered into CD.
1995	Construction complete for all projects except Clear Creek.
1998	Construction complete for Clear Creek.
Nov 2003	*Data Report, First Round of Stage 1 Groundwater Quality Monitoring, Sitcum Waterway Remediation Project, Port of Tacoma, WA*, prepared by Hart Crowser.
Nov 2003	EPA approval *Data Report, First Round of Stage 1 Groundwater Quality Monitoring.*
Aug 2008	Groundwater *Data Report, Second Round of Stage 1 Groundwater Quality Monitoring, Sitcum Waterway Remediation Project, Port of Tacoma, WA*, prepared by Hart Crowser.
Oct 2008	EPA Approval of final *Data Report, Second Round of Stage 1 Groundwater Quality Monitoring, Sitcum Waterway Remediation Project, Port of Tacoma, WA*, prepared by Hart Crowser.
Jan 2009	Clear Creek Habitat Improvement Project, Monitoring Report 2008 (Grette Associates, January 2009).
Jan 2009	EPA approval of Clear Creek Habitat Improvement Project, Monitoring Report 2008.

4.3.3 Remedial Actions

Remedy Selection

Remedy selection for the CB/NT Sediments OU is described in Section 4.1.

Remedy Implementation (Sources)

The major sources of contaminants to the waterway were addressed by the cessation of black ore off-loading at Terminal 7 and implementation of source control efforts (including storm drain sediment clean out) associated with the storm drain SI-172.

Remedial Action (Sediments)

Subsequent to EPA's issuance of the 1989 CB/NT ROD, the remedial action for addressing contaminated sediments in the Sitcum Waterway Problem Area was approved in a 1993 Explanation of Significant Differences (ESD). Based on these documents and the EPA-approved Remedial Design, the Sitcum Waterway Remediation Project included the following:

- Dredging approximately 428,000 cy of contaminated sediments from Sitcum Waterway for disposal in the Milwaukee Waterway NCDF.[4]

- Dredging approximately 2.1 million cy of sediment from the Blair Waterway for construction of, and disposal in, the Milwaukee Waterway NCDF. Of the 2.1 million cy, 1,225,400 cy were designated as "clean" (appropriate for in-water disposal under DMMP) and targeted for construction of the Milwaukee Waterway nearshore fill berm. The remainder of the Blair Waterway sediments were targeted for disposal in the Milwaukee NCDF.

- Construction of a NCDF utilizing approximately 72 percent of the Milwaukee Waterway.

To compensate for the fill of the Milwaukee Waterway, construction of habitat mitigation at two locations: 1) the Milwaukee Habitat Area located in front of the nearshore fill closure berm in the Mouth of the Milwaukee Waterway, consisting of approximately 20 acres of intertidal habitat; and 2) an "additional mitigation area" consisting of approximately 9.5 acres of restored, off-site, refuge habitat for salmon and other fish from the Puyallup River. Subsequent to the ESD, the Clear Creek Habitat Improvement Project[5] was selected as the "additional mitigation area."

---

4 The bulk of this volume, approximately 396,000 yards, was to be removed from the "Phase 1 Area," or bottom sediments from Sitcum Waterway, the extent of which was limited by riprap and Pier 7 along the northern shoreline. The "Phase 2 Area," or areas of sediment over existing riprap and slopes under Pier 7, was to be removed to the extent technically feasible. The ESD estimated approximately 32,300 yards would be removed in the Phase 2 Area. After construction, Phase 2 was to be evaluated for potential future action. In the EPA-approved memorandum from the Port, dated October 1, 1995, it was determined that no further action would be required in the Phase 2 Area, and that the area beneath Pier 7 would continue to be evaluated for monitored natural recovery as specified in the OMMP. The area beneath Pier 7 is now known as Area B, while the original Phase 1 Area is now known as Area A. Area B is a 4.5 acre monitored natural recovery area.

5 Attachment A to the CD (1993) detailed a conceptual design for the "Clear Creek" Habitat Improvement Project (sometimes referred to as the Clear Creek Phase 1 Project) proposed for the "additional mitigation" required in the ESD. The Clear Creek

Final dredging and fill volumes were adjusted slightly during construction. EPA approved the Construction Completion Report for the dredging of Sitcum and Blair Waterways, for the Milwaukee NCDF, and for the Milwaukee Habitat Mitigation Area on July 25, 1995. EPA approved the Construction Completion Report for the Clear Creek Habitat Area on December 17, 1998.

As discussed above, the ESD was issued and a consent decree for implementation of the Sitcum Waterway Remediation Project was finalized in 1993. In the consent decree, the Port committed to operate and maintain the NCDF and habitat restoration areas in the long-term. Additionally, the consent decree had the following requirements:

1. **Paragraph 9.a.** The Port shall record a certified copy of the CD with the Registry of Deeds, Pierce County. (In a June 30, 2009 meeting between the Port and EPA, the EPA agreed that a Notice of the CD recorded on the properties affected by the Milwaukee NCDF, Milwaukee Habitat Area, and Clear Creek Phase 1 Habitat Area would suffice in place of recording a certified copy of the CD.) Thereafter, each deed, title, or other instrument conveying an interest in the property included in the [remediation project] shall contain a notice stating that the property is subject to this Consent Decree and shall reference the location of the Consent Decree and any restrictions applicable to the property under this Consent Decree.

2. **Paragraph 9.b. and Section X.** Obligations of the Port regarding providing access and implementation of institutional controls shall be binding on the Port and any Successor-In-Title. The Port shall record with the Registry of Deeds, Pierce County a notice of obligation to provide the "United States, the Natural Resource Trustees, and their representatives, including EPA and its contractors, access to the Sitcum Waterway Remediation Project area and any other property to which access is required for the implementation of this Consent Decree. Each subsequent instrument conveying an interest to any such property included in the [remediation project] shall reference the recorded location of such notice and covenants applicable to the property.

3. **Paragraph 9.c.** The Port and any Successor-in-Title shall provide notice to EPA and the State of a proposed conveyance of any interest in the affected properties at least 30 days prior to such conveyance.

4. **Paragraph 13.a.** The Port shall dedicate in perpetuity the property it owns, and property it leases from or otherwise obtains control of from the DNR at and beyond the mouth of the Milwaukee Waterway and at the Clear Creek Phase 1 Habitat area as habitat.

---

site is located near the mouth of Clear Creek, a left bank tributary of the Puyallup River near River Mile 2.9. The project was designed to provide refuge, feeding, and rearing habitat for juvenile salmonids and other wildlife in the lower reaches of the Puyallup River system. Project components included development of a pond/wetland habitat complex, excavation of a refuge bay, excavation of a tidal mudflat, improvement of upland habitat, and modification of the flood gate to facilitate passage of juvenile and adult salmonids and other fish.

Post-Construction Monitoring/Operation and Maintenance

The long-term monitoring efforts associated with the Sitcum Waterway Remediation Project are documented in the following reports:

- The Operations, Maintenance, and Monitoring Plan (OMMP) for the Sitcum Waterway Remediation Project (1994, updated 1995).
- Additional Response Action Plan, Terminal 7 Phase 2 Subarea (ARA) (ARA; 1995).
- Clear Creek Habitat Improvement Project OMMP (1995).
- Work Plan for Long-term Sediment Quality Monitoring in the Sitcum Waterway (Work Plan; 1996).

Results are summarized below for each of the four broad categories of long-term monitoring efforts.

Sediments within Sitcum Waterway

All long-term monitoring efforts required for surface sediments in Sitcum Waterway have been completed, as described in the second FYR. The last sediment monitoring effort occurred in 2003.

Groundwater Quality Monitoring Associated with the Milwaukee Nearshore Confined Disposal Facility

Groundwater quality monitoring is associated with the Milwaukee NCDF, which was filled with contaminated sediment and completed in 1995. The groundwater monitoring program was designed to detect and evaluate possible long-term changes in groundwater quality in the areas surrounding the containment facility to ensure compliance with the performance standards (marine chronic criteria or ambient surface water quality in adjacent surface water, whichever is greater) at the point of compliance. The monitoring provides information to determine whether certain constituents are being leached from the fill material and horizontally transported outside the fill area by groundwater. The point of compliance is the sediment/surface water interface outside of the berm and peninsulas. Stage 1 monitoring compares groundwater quality to baseline conditions. The first round of groundwater quality monitoring was completed in 2003, and the second round was completed in 2008 (*Data Report, Second Round of Stage 1 Groundwater Quality Monitoring, Sitcum Waterway Remediation Project, Port of Tacoma, WA*, prepared by Hart Crowser).

Based on Stage 1 monitoring results (2003 and 2008), the monitoring program indicates that the performance standard at the point of compliance has not been exceeded. There have been no increases above baseline conditions, and thus no statistically significant increases, at a given well for any of the indicator metals. These results indicate that the NCDF is functioning as intended, and that constituents are not being leached from the sediment fill.

As part of the 2008 Data Report, EPA received the corrected cumulative sum (CUSUM) charts for the first round of Stage 1 groundwater monitoring from 2003. Also, EPA concurred with the

data evaluations and conclusions in a Technical Memorandum (prepared by Hart Crowser for the Port of Tacoma; August 8, 2008) that recommended that it is no longer necessary to continue data collection for the major ions during future groundwater quality monitoring events.

The next monitoring event is scheduled for March 2013.

Milwaukee Habitat Area (Mitigation Site)

All long-term monitoring efforts required for the Milwaukee Habitat Area have been completed, as described in the second FYR.

Clear Creek Habitat Improvement Project (Mitigation Site)

The schedule for the post-construction environmental monitoring at the Clear Creek Habitat Improvement Project is presented in the OMMP (Port of Tacoma 1995). Comparisons of the results of the monitoring activities to the performance standards established in the OMMP can be found in the Year 1, 3, and 5 Monitoring Reports (Grette Associates 2000, 2002, 2004).

The year 2008 was Year 10 of monitoring for the Clear Creek Habitat Improvement Project. There are no performance standards associated with Year 10 monitoring. Monitoring in 2008 focused on two activities: water level monitoring and photo point documentation. Water levels in the Clear Creek pond/wetland complex were monitored continuously, via water level logger, throughout the month of May, and photographs documenting the status of the site were collected at established photo points in September and November 2008. Results of the monitoring indicate that regular tidal-induced water level fluctuations continue to occur within the complex and the site continues to be comprised of a diverse range of wetland, open water and upland habitat. A report documenting the results was submitted as a final for EPA approval in January 2009. These results represent the final scheduled monitoring activities for the Clear Creek Habitat Improvement Project site.

Long-term monitoring results show that the Clear Creek Habitat Improvement Project effectively provides a diverse range of habitat with wetland, open water, and upland components.

4.3.4 Progress since the Last Five-Year Review

Since the last five-year review, progress has been made on the institutional controls associated with the Sitcum Waterway Remediation Project, and the final scheduled monitoring activities for the Clear Creek Habitat Improvement Project have been completed.

Previous Protectiveness Statement

The protectiveness statement in the last Five-Year Review (2004) stated: "Because the remedial action is complete and protective, the site is protective of human health and the environment."

Status of Recommendations

A summary of the recommendations made in the previous five-year review (2004) and an evaluation of their progress are presented below.

- **Sitcum - EPA will work with the Port of Tacoma to ensure that adequate land use restrictions are in place for the Milwaukee Habitat and Clear Creek Habitat mitigation sites (ensuring that sites are maintained as mitigation sites in perpetuity) and the CDF in the former Milwaukee Waterway (ensuring that protectiveness is maintained in the future).**

  Almost Complete. In 2009, EPA worked with the Port of Tacoma to ensure that adequate land use restrictions were in place for the Milwaukee NCDF, the Milwaukee Habitat Area, and the Clear Creek Habitat Improvement Project. There are no institutional controls associated with the Sitcum Waterway. An institutional control study was completed (Institutional Control Study, Sitcum Waterway Remediation Project, Hart Crowser, October 20, 2009). The study recommended preparing and recording three or four Environmental Covenants, and filing Notices of Consent Decree on affected parcels. To date, the Environmental Covenant for the Milwaukee Nearshore Confined Disposal Facility has been signed, and submitted for recording. The remaining ECs have been drafted. Notices of Consent Decree have been submitted for recording by the Port of Tacoma.

- **Sitewide – Implementation of Institutional Controls for all waterways and review status of institutional controls already in place.**

  See previous bullet.

- **Sitewide – Review the results of monitoring at the mitigation sites and based on that data describe the contribution of those sites towards the recovery of ESA species**.

  Progress made towards this recommendation has been discussed in the second FYR. For the Milwaukee Habitat Mitigation site, habitat attributes monitored included: juvenile salmonid utilization; epibenthic plankton, algae, avifauna, and benthic infauna in the sediments; and, plant assemblage and coverage and avifauna in the upland habitat. Long-term monitoring results show that the Milwaukee Habitat Mitigation site provides high quality habitat; provides habitat available to juvenile salmonids throughout the tidal cycle; provides a range of habitat types to compensate for habitat losses for species of concern and indirectly benefits other species with similar or overlapping habitat requirements.

  For the Clear Creek Habitat Improvement Project, habitat attributes monitored included: water level monitoring, juvenile salmonid observations, vegetation monitoring, photo points, and waterfowl use. Long-term monitoring results show that the Clear Creek Habitat Improvement Project effectively provides a diverse range of habitat with wetland, open water, and upland components. The project provides refuge habitat for juvenile salmonids from the Puyallup river system; improves fish passage at the culvert at the mouth of Clear Creek; increases the acreage of wetland habitats; restores the influence of regular tidal flooding; increases refuge and feeding habitats for salmon; restores the connection of isolated or irregularly connected habitats to the Puyallup River system; and, increases habitats for waterfowl.

- **Sitewide – Develop a work plan to conduct fish tissue sampling for CB/NT after sediment Remedial Actions are complete. Provide results to Washington DOH to determine if they should continue with fish advisories after the sediment cleanup RAOs have been achieved.**

  See Section 4.8 of this Five-Year Review for a discussion on fish tissue sampling for the Sediments OU of the CB/NT Site.

4.3.5 Five-Year Review Process

Administrative Components

The Commencement Bay Nearshore/Tideflats Superfund Site FYR team was lead by Karen Keeley, the EPA RPM, Region 10. Emile Pitre and Jeffrey Powers, both with the USACE, Seattle District, assisted with the review as representatives of the support agency.

By February 2009, the review team had been formed, and had established the review schedule and its major components including:

- Document Collection and Review.
- Data Assessment/Analysis.
- Site Inspection.
- Interviews and Community Notification and Involvement.
- FYR Report Development and Review.

The FYR has a statutory completion date of December 29, 2009.

Community Involvement

EPA sent a postcard to stakeholders and neighbors on the CB/NT project mailing list (approximately 1,440 addressees) in February to notify them of the five-year review process. After checking in with several members of the community, some of them had not yet received the information. We then mailed a second postcard on March 19, 2009 to ensure that everyone had an opportunity to provide information to EPA. In addition, a display advertisement ran on page B3 of the Tacoma News Tribune Newspaper on February 6, 2009.

Interviews were completed with nearby property owners and interested parties. The purpose of the interviews was to identify issues and concerns related to the implementation and on-going operation of the site remedy.

Document Review

The types of documents reviewed included documents related to the analysis of institutional controls.

With regards to institutional controls, EPA requested (May 5, 2009) that the Port of Tacoma provide documentation of institutional controls, including an Institutional Control Study for the Sitcum Waterway Remediation Project. The IC study was completed in October 2009 (Hart Crowser, October 20, 2009), and covered the Milwaukee NCDF (disposal site for contaminated sediments), and the Milwaukee Habitat Area and the Clear Creek Habitat Area, which are the two mitigation sites associated with the Sitcum project. Documents provided to EPA include:

- Institutional Control Study (Institutional Control Study, Sitcum Waterway Remediation Project, Hart Crowser, October 20, 2009).
- Title search/title commitment documents showing the current status of the title for each affected parcel. Provided June 22 and 30, 2009.
- Copies of encumbrances on affected parcels referenced in Schedule B of the Title Commitment. Provided June 22 and 30, 2009.
- One Environmental Covenants was signed and submitted for recording: 1) Milwaukee NCDF. Work continues on three other Environmental Covenants: 2) Port-owned Milwaukee Habitat Area; 3) Non-Port-owned Milwaukee Habitat Area (within Port Management Area and outside of Port Management Area; and, 4) Clear Creek Habitat Improvement Project.
- Notice of Consent Decree recorded on all affected property titles (pursuant to Paragraph 9a of the CD) owned by the Port of Tacoma (i.e., parcels associated with the Milwaukee NCDF and Port-owned portions of the Milwaukee Habitat Area, and the parcels associated with the Clear Creek Habitat Area). Recording dates for the Notices of Consent Decree will be provided in the next five-year review.
- GIS maps were created for the Milwaukee NCDF and Habitat Area, and the Clear Creek Habitat Area, showing locations of the project, any area with contaminated sediments (applies only to the NCDF), tax parcel numbers, source information for survey/as-builts, and if relevant, state plane coordinates (IC Study; Hart Crowser, October 20, 2009). As a result of this process, errors in tax parcel designations and legal descriptions were corrected by Pierce County.
- As-builts for the Sitcum Waterway Remediation Project, including the habitat areas. These documents were provided in hard copy (tabloid size) and electronically (.pdf and computer-aided design and drafting [CADD] files).

Results of the IC Study concluded the following:

- No current or potential human health or ecological exposure threats to the confined sediments of the NCDF are indicated. This conclusion is further supported by results of the 2008 groundwater monitoring event to evaluate the performance and effectiveness of the NCDF.
- No uses or activities were identified that have lead to exposure to confined sediments of the NCDF, or violate achievement of performance standards at the mitigation sites.

- With the additional covenant restrictions and general deed notices completed as part of the Port's IC analysis efforts, proprietary and informational controls should provide adequate and appropriate protectiveness and effectiveness. The proprietary controls will be properly executed, run with the land, and are effective for binding future interest holders.
- The CD for the Sitcum Waterway Remediation Project remains an effective Enforcement Tool and IC for requiring certain administrative duties in support of the remedy.
- The Port of Tacoma did not note any encumbrances that negatively impact the site remedies. Several easements recorded on Milwaukee area parcels were related to the Blair dredge spoils pipeline used during construction of the NCDF. One easement provided by the Port to the City of Tacoma in the 1980s was abandoned when the Milwaukee Waterway was filled. Other easements associated with the subject properties were not in the vicinity of the NCDF or Milwaukee Habitat area. There are no easements associated with the Clear Creek Phase I Habitat Area parcels. All easements associated with the subject properties were provided to EPA on June 22, 2009 (Port 2009a).
- The Port of Tacoma recommended further enhancements of ICs and documentation of ICs (see Section 5.0 of the IC Study). In general, additional enhancements include clarifications to communication/notification protocols and ongoing environmental stewardship efforts.

The IC Study found that not all of the consent decree requirements related to Successors-in-Interest and notices had been recorded. The Port has committed to file notices of the consent decree on all tax parcels affected by the NCDF and two habitat mitigation sites. Additionally, the Port has agreed to file four Uniform Environmental Covenant Act environmental covenants on Port-owned or managed parcels comprising the NCDF and on both of the mitigation sites. The substantive restrictions and conditions that will be recorded on the NCDF property are listed below:

1. The Property shall be used for a NCDF and closure berm for sediments in accordance with the Consent Decree. That portion of the Property above the cap on the NCDF, and that portion of the Property above the closure berm, may be used for other uses, but shall not be used for any use inconsistent with the CDF and closure berm uses.

2. No person shall engage in any activity on the Property that damages or disturbs the integrity of the Milwaukee NCDF or closure berm on the Property or otherwise will result in the release or exposure to the environment of any hazardous substances contained in the Milwaukee NCDF, without the prior written approval of EPA. Examples of activities that may damage or disturb the integrity of the Milwaukee NCDF or closure berm on the Property are excavation, dredging, or drilling.

3. Any lease or other use of the Property shall be consistent with the Consent Decree and this Environmental Covenant.

4. Any deed, lease, or other instrument conveying any interest in the Property subsequent to the date of this Environmental Covenant shall be subject to the covenants and restrictions in this Environmental Covenant, and shall contain a notice stating that the Property is subject to the Consent Decree and this Environmental Covenant.

5. Any deed, lease, or other conveyance of any interest in the Property shall make adequate provisions for any continued monitoring or maintenance of the Milwaukee NCDF and closure berm on the Property required by the Consent Decree.

6. At least thirty (30) days prior to the conveyance of any ownership interest in the Property, Grantor shall give written notice of the Consent Decree and this Environmental Covenant to the grantee of such conveyance, and shall give written notice to EPA of the proposed conveyance, including the name and address of the grantee, and the date on which notice of the Consent Decree and this Environmental Covenant was given to the grantee.

7. Consistent with the Consent Decree, authorized representatives of EPA and the Natural Resource Trustees shall have the right to enter the Property at reasonable times to evaluate the remedial action taken on the Property pursuant to the Consent Decree, obtain samples, inspect records related to the remedial action, and assess compliance with the Consent Decree and this Environmental Covenant.

As of the date of this report, one environmental covenant (for the Milwaukee Nearshore Confined Disposal Facility) has been signed and submitted for recording, and two environmental covenants have been drafted. Environmental covenants for the habitat mitigation areas will primarily dedicate such lands in perpetuity for habitat uses as required by the consent decree. Based on the schedule in the IC Study, all of the notices of consent decree and environmental covenants will be recorded no later than December 31, 2009.

Data Review and Evaluation

Results from the long-term monitoring activities are discussed in the previous Section 4.3.3, Post-Construction Monitoring/O&M.

Site Inspection

Site inspections occurred as described in the IC Study.

Interviews

Interviews were performed by telephone for the overall CB/NT site. Parties identified for interviews included: Leslie Ann Rose, CHB. The following recommendations and suggestions were made:

- Establish a system to alert EPA when there is a planned disturbance of sediments or soils within operable units. The sites can be entered into the City of Tacoma land-use database to notify EPA when a person applies for a land-use permit within the operable units.
- To assign one EPA RPM for all operable units post-remediation.

4.3.6 Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?
Answer: Yes.

The remedial action is complete, long-term monitoring is complete, and all results (including the most recent post-cleanup sediment monitoring data in 2003) show that performance standards were met. Institutional controls are in place to address all areas of site-related constituents that are at levels that do not allow for unrestricted use/unrestricted exposure. Institutional controls are properly implemented and effective in preventing exposure and protecting the remedy, including mitigation habitat areas.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?
Answer: Yes.

Changes in Standards and To Be Considered. Applicable or relevant and appropriate requirements (ARARs) cited in the ROD were reviewed to evaluate changes in the ARARs since the last five-year review. There have been no changes in regulatory standards since the first five-year review.

Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics. The ROD described current and future land uses and identified likely exposure pathways; the descriptions are accurate for the site conditions at the time of this review.

Since the 1989 CB/NT ROD, new information has become available on Tribal seafood consumption rates and exposure durations for Tribal populations. This new information has been considered for the Sediments OU, as detailed in response to Question B in Section 4.2.6 (Hylebos Waterway).

Changes in Land Use. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Remedial Action Objectives. The RAOs from the ROD are still valid for the site.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
Answer: No.

There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed, the remedy is functioning as intended by the ROD as amended by the ESD. There have been no changes in the ARARs, standards or To Be Considered that should affect the protectiveness of the remedy. The remedy is still protective of human health and the environment. There is no other information that calls into question the protectiveness of the remedy

4.3.7 Issues

This section addresses issues that, either currently or in the future, prevent the remedial action from being protective.

Table 4. Sitcum Waterway Issues of the 2009 Five-Year Review

Issue	Affects Protectiveness? (Y or N)	
	Current	Future
None.		

4.3.8 Recommendations and Follow-up Actions

Table 5 lists recommendations and follow-up actions for each issue identified in Table 4.

Table 5. Sitcum Waterway Recommended Follow-Up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Planned Completion Date
None.				

4.3.9 Protectiveness Statement

The remedy at the Sitcum Waterway Problem Area is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled.

4.4 St. Paul Waterway

Five-Year Review Summary Form – St. Paul Waterway

Issues: None.

Recommendations and Follow-up Actions: None.

Protectiveness Statement(s): The remedial actions at the St. Paul Waterway Problem Area of the CB/NT Site have been successfully completed, all required long-term monitoring efforts have been completed, and the remedy remains protective of human health and the environment.

Other Comments: None.

4.4.1 Background

The St. Paul Waterway is located between the Puyallup River to the north and the Middle Waterway to the south (see Figure 4-1). The St. Paul Waterway Problem Area is a 17-acre area of contaminated marine sediments adjacent to the Simpson Tacoma Kraft Mill (former owners

include Champion International and St. Regis). Due to releases from the pulp and paper mill, sediments were contaminated with VOCs, SVOCs, PAHs, and organic debris.

4.4.2 Site Chronology

Key dates for St. Paul Waterway actions are as follows. Section 4.4.3 provides a description of the actions.

1987	Ecology, DNR, Simpson Tacoma Kraft, Champion International sign state court CD.
1988	St. Paul cleanup and habitat restoration project completed.
1990	Source control completion report.
1991	EPA approval of completion report for project; Federal CD in place.
1996	St. Paul Waterway problem area deleted from NPL.
2004	Long-term monitoring completed.

4.4.3 Remedial Actions

Remedy Selection

Remedy selection for the CB/NT Sediments OU is described in Section 4.1.

Remedy Implementation (Sources)

A source control completion report was approved in 1990. Key completed actions included relocation of the secondary treatment outfall, in-plant process modifications, stormwater control, woody debris control, and revision of the NPDES permit.

As noted above, the predominant sources of contamination to this waterway were operations conducted at the Kraft mill. Because the sources of contamination were easily identified and relatively straightforward to control, source control at this waterway actually pre-dates the 1992 Source Control Strategy (see Background). Even so, Ecology's source control investigations and actions all met the substantive requirements of the Source Control Strategy, concluding with a source control completion report approved by EPA in 1990. Key completed source control actions included relocation of the secondary treatment outfall, in-plant process modifications, industrial stormwater control, woody debris control, and revision of the NPDES permit.

Remedial Action (Sediments)

Remedial action at the site was designed to provide: 1) permanent isolation from the environment of toxic chemical contamination found in marine sediments, 2) protection of sediments from recontamination after cleanup, and 3) restoration of intertidal and shallow subtidal habitat. After analyzing the options available for cleanup, capping of contaminated sediments “in place” in the shallow water offshore of the mill was selected as the remedy. The cleanup action was integrated with natural resource restoration to produce new intertidal and shallow subtidal habitat in Commencement Bay.

The St. Paul Waterway Cleanup and Habitat Restoration Project was completed in 1988 (before the CB/NT ROD) by two PRPs under a state court CD with the Washington State Department of Ecology and DNR. The 17-acre area was contaminated with 4-methylphenol, other chemicals, and organic debris; the area was capped with 4 to 20 feet of clean sediment from the Puyallup River. Approximately 11.18 acres (Areas A and B) of the 17 acres contain chemical contamination beneath a clean sediment cap, and the remaining 5.82 acres contain organic accumulations beneath a clean sediment cap (Figure 4-7). More than 6 acres of new intertidal habitat were constructed over the portion of the cap along the shoreline. Clean, subtidal habitat was provided over the remaining 11 acres. Additional remedial action activities, such as source control efforts and habitat improvement actions, included: site preparation (e.g., piling removal); relocation of the mill's wastewater treatment plant outfall; dredging for the new outfall alignment; disposal of dredged material from the outfall project; removal of the former outfall and placement of the new outfall; dredging and disposal of sediments from the chip barge area; and habitat enhancement.

On September 30, 1989, the CB/NT ROD was signed, and it confirmed the capping/restoration methodology, source control, and comprehensive long-term monitoring as the selected remedy in the St. Paul Waterway Area. While the actions previously implemented under the 1987 State Consent Decree largely accomplished EPA's selected remedy for the cleanup of contaminated sediments as determined by the ROD, revisions to the Monitoring Plan were needed to ensure consistency of the St. Paul Waterway action with EPA's ROD and with the settlement of natural resources damage claims. In January 1991, EPA approved the Commencement Bay Nearshore/Tideflats Superfund Completion Report for St. Paul Waterway Sediment Remedial Action. The cleanup work and the Monitoring, Reporting and Contingency Plan, were agreed to in a 1991 CD among EPA, Simpson, Champion, and the Washington State DNR. The St. Paul Waterway Problem Area was deleted from the NPL on October 29, 1996 (a partial deletion of the CB/NT site).

The Federal CD specified the applicable performance standards for the remedial action (which applies to Areas A and B), as generally described below:

- The physical performance standard requires a minimum of three feet of clean sediment be maintained over Areas A and B of the sediment cap.
- The biological performance standard consists of not finding an adverse effect for benthic infaunal abundance. An interim chemical standard was used until 1994, when the biological performance standard ("biological indicators approach") went into effect.

Post-Construction Monitoring/Operation and Maintenance

Consistent with the requirements of the long-term monitoring plan, the physical, chemical, and biological characteristics of the project in the St. Paul Waterway Problem Area have been monitored for 15 years (1989 - 2004).

Over the first ten-year period (1989 - 1999), specific monitoring elements included bathymetric surveys (conducted annually), visual inspections, aerial photographs, surface and subsurface sediment chemistry sampling, water seep sampling, methane gas vent sediment sampling,

benthic and epibenthic community sampling, and macrophyte (algae) surveys. Results indicated that physical, chemical, and biological performance standards were achieved, and that the sediment cap is functioning as intended[6]. Chemical monitoring yielded relatively few detections and biological monitoring showed that abundance and diversity at the site was similar to background stations indicating a community similar to a typical healthy mudflat in Puget Sound. The project provides habitat for diverse biological communities, as well as algae. Shorebirds and salmon use the site for feeding and rearing.

In 1999, EPA approved an updated and revised Post-Ten Year Contingency Monitoring and Adaptive Management Plan for the St. Paul Waterway Area project. Over five years (2000 - 2004), the monitoring elements included ground surveying of intertidal transects in 2000, 2002, and 2004, and a comprehensive one-time final bathymetric survey covering all of Areas A and B in 2004) and visual inspections.

The overall changes in elevation between 2000 and 2004 across all stations, other than the 2004 nourishment area, averaged only 0.2 ft; the net change on these stations over the same time period was approximately -0.1 ft (which is close to the level of accuracy for the transect monitoring method, indicating that very little change had occurred at these stations).

In February 2004, a small-scale preventive beach nourishment project was implemented near Transect 4 as an adaptive management action (no trigger levels or performance standards were exceeded) in response to naturally differential movement of sediment at middle intertidal levels of the restored habitat. Approximately 2,600 cubic yards of 75 percent sandy gravel mixed with 25 percent 3- to 6-inch diameter cobble was placed across the nourishment foot print.

As of October 2004, all required long-term monitoring efforts were completed, and reports have been approved by EPA. The only long-term monitoring requirement remaining is the following: "Should any major storm (with winds from the north or southeast at 30 miles-per-hour or greater, which persists for more than four hours) or earthquake of significance occur, an intertidal transects survey coupled with a visual inspection will be conducted as soon as possible after the event." The monitoring plan describes the contingency planning process, which includes early notice, contingency planning, and contingency response procedures, for such occurrences.

The remedy for the St. Paul Waterway Problem Area has proven to be effective. Fifteen years of long-term physical, chemical and biological monitoring for the St. Paul cap and habitat restoration area have shown the cap to be functioning well at isolating contaminants and there has been no indication of recontamination. The project continues to provide habitat for a diverse population of marine organisms, and results indicate ongoing recruitment, biological diversity, and a self-sustaining habitat.

In conclusion, the remedial actions initiated for the St. Paul Waterway Problem Area of the CB/NT site has been successfully completed and the remedy implemented remains protective of human health and the environment.

---

6 Bathymetric surveys indicated some redistribution of cap material at the site. In general, the northern area of the project (near the river) was more depositional, and the southern area was somewhat erosional. In 1997, although the cap thickness standard had not been violated, coarser material was placed in a small area of the cap near Transect 5.

4.4.4 Progress since the Last Five-Year Review

Between December 2004 and December 2009, EPA completed an IC analysis to ensure that ICs are consistent with recent EPA guidance and recommendations.

Previous Protectiveness Statement

The protectiveness statement in the last Five-Year Review (2004) stated: "Because the remedial action is complete and protective, the site is protective of human health and the environment."

Status of Recommendations

A summary of the recommendations made in the previous five-year review (2004) and an evaluation of their progress are presented below.

- **St. Paul – EPA conduct an additional analysis of the institutional controls to ensure they are consistent with EPA's September 2004 "Strategy to Ensure Institutional Control Implementation at Superfund Sites."**

  Complete.

- **Sitewide – Implementation of Institutional Controls for all waterways and review status of institutional controls already in place.**

  Complete for St. Paul Waterway. Ongoing for other waterways.

- **Sitewide – Review the results of monitoring at the mitigation sites and based on that data describe the contribution of those sites towards the recovery of ESA species.** Complete.

  The St. Paul Waterway project provided a combined cleanup and habitat restoration project. A 17-acre area was remediated, providing 6 acres of new intertidal habitat, and 11 acres of subtidal habitat. Fish habitat enhancement elements were incorporated into the overall remedial design. Specifically, the remedial design enhanced the existing habitat through:

  - Using capping material that enhanced habitat function (e.g., suitable substrate and habitat for aquatic organisms in the environment).
  - Removing exposure to chemicals above the SQOs.
  - Permanently removing creosote-treated piling.
  - Implementing conservation measures during construction.

  Long-term monitoring results concluded that performance standards (including biological performance standards) were met for the remedial action, and the project provides habitat for diverse biological communities, as well as algae. Shorebirds and salmon use the site for feeding and rearing.

- **Sitewide – Develop a work plan to conduct fish tissue sampling for CB/NT after sediment Remedial Actions are complete. Provide results to Washington DOH to determine if they should continue with fish advisories after the sediment cleanup RAOs have been achieved.**

  See Section 4.8 of this Five-Year Review for a discussion on fish tissue sampling for the Sediments OU of the CB/NT Site.

4.4.5 Five-Year Review Process

Administrative Components

The Commencement Bay Nearshore/Tideflats Superfund Site FYR team was lead by Karen Keeley, the EPA RPM, Region 10. Emile Pitre and Jeffrey Powers, both with the USACE, Seattle District, assisted with the review as representatives of the support agency.

By February 2009, the review team had been formed, and had established the review schedule and its major components including:

- Document Collection and Review.
- Data Assessment/Analysis.
- Site Inspection.
- Interviews and Community Notification and Involvement.
- FYR Report Development and Review.

The FYR has a statutory completion date of December 29, 2009.

Community Involvement

EPA sent a postcard to stakeholders and neighbors on the CB/NT project mailing list (approximately 1,440 addressees) in February to notify them of the five-year review process. After checking in with several members of the community, some of them had not yet received the information. We then mailed a second postcard on March 19, 2009 to ensure that everyone had an opportunity to provide information to EPA. In addition, a display advertisement ran on page B3 of the Tacoma News Tribune Newspaper on February 6, 2009.

Interviews were completed with nearby property owners and interested parties. The purpose of the interviews was to identify issues and concerns related to the implementation and on-going operation of the site remedy.

Document Review

The only documents reviewed for this Five-Year Review were those reviewed as part of the institutional control analysis (e.g., the ROD, the 1991 CD, the currently-effective Contingency Monitoring and Adaptive Management Plan for the St. Paul Waterway, and implemented IC documents, including correspondence from Simpson dated June 5, 2005 and May 13, 2009).

EPA's September 30, 1989 ROD, describes the selected remedial action for the St. Paul Waterway. The ROD selected *in-situ* (or in-place) capping as one of four confinement options for contaminated sediment. *In-situ* capping involves containment and isolation of contaminated sediment through placement of clean material on top of existing substrate (see the ROD, Section 10.2.4). The ROD further provided that in-place capping is not appropriate for environments with a high potential for ship scour, current action, or wave action that could lead to cap erosion, or areas where maintenance dredging needs to occur, or where shipping traffic occurs or cannot be restricted (see the ROD, Section 10.2.4). EPA selected in-place capping as the confinement option appropriate for the St. Paul Waterway Problem Area (see the ROD, Section 10.2.4). The only site use restrictions specifically discussed in the ROD relate to fish advisories.

The 1991 CD, Section VI, Paragraph 40, "Transfer of Interest or Property" states, in part:

> "The obligations of each Settling Defendant who owns any interest in the Mill or property included in the St. Paul Waterway Problem Area, with respect to undertaking and maintaining the Work set forth in this Consent Decree and the attached Monitoring Plan, or developed there under, shall run with the land and shall be binding upon any and all persons who acquire any interest in the Mill or any property included in the St. Paul Waterway Problem Area. Within thirty (30) calendar days of the effective day of this Consent Decree, the Settling Defendants shall record a copy of this Decree with the Recorder's Office, Pierce County, Washington. A copy of the recorded notice shall be sent to EPA."

Additionally, Paragraph 41 of the Consent Decree permits free alienation of the property within the Problem Area with 60 days notice to EPA of such alienation. Paragraph 42 of the Consent Decree requires that any deed, title, or other instrument of conveyance regarding the Mill or St. Paul Waterway Problem Area shall contain a notice that such property is the subject of this Consent Decree. With regards to institutional controls, Simpson Tacoma Kraft filed a Notice of Consent Decree with Pierce County, Washington, in 1999 regarding Assessor's Tax Parcel 930716603. A copy of this record is in EPA records. The Washington Department of Natural Resources indicated that a Notice of Consent Decree, pursuant to the 1991 Consent Decree, could not be found, and that a notice would be recorded in December 2009. The actual recording date for the notice will be provided in the next five-year review.

Additionally, DNR and Simpson entered into a lease and a Material Deposition Agreement that includes all of the 17 acres included in the cleanup area. The lease references the obligations of the parties to maintain the remedy under the 1991 CD. The lease allows DNR to authorize other uses of the leased property not inconsistent with Simpson's uses.

Consistent with EPA's September 2004 "Strategy to Ensure Institutional Control Implementation at Superfund Sites," and EPA's draft "Recommended Evaluation of Institutional Controls: Supplement to the *Comprehensive Five-Year Review Guidance*," an additional analysis of the institutional controls at this deleted-from-the-NPL portion of the site was conducted as part of this Five-Year Review to ensure long-term protectiveness of the remedy. The IC analysis included document review and an evaluation of the impact of IC issues on protectiveness determinations. In June 2005, Simpson (McEntee, pers. comm., 6 June 2005) provided maps showing the locations of the remedial actions for the St. Paul Waterway Problem Area, which

included a legal description based on results of a recent survey of the affected area by Sitts & Hill/Engineers. The maps also provide information on the relevant tax parcel numbers and clarify the property that is under lease (DNR Lease Area # 22-00-2658) or contract (Material Deposition Agreement # 20-012631) to Simpson. The most recent updates to the DNR lease and DNR Material Deposition Agreement for the St. Paul project occurred with the DNR signature on both documents on March 6, 2006 and subsequently with both documents recorded with Pierce County on March 15, 2006. Copies of the documents are in the EPA Site File.

The evaluation of institutional controls concludes that ICs in place are satisfactory given circumstances of the St. Paul Waterway Problem Area cleanup and CD. However, the IC evaluation raises some questions about whether the existing decision document and/or ICs would be protective under potential future scenarios where there may be changes in land use either through lease agreements by Washington DNR, a subsequent owner of the Simpson Property, or property transfer from DNR. Over the next year, EPA will evaluate if additional ICS are needed, and whether a decision document modification is appropriate.

Data Review and Evaluation

Long-term monitoring (which applies to Areas A and B) has been completed for this site. No new data were made available for review.

Site Inspection

No site inspection was conducted.

Interviews

No interviews were performed.

4.4.6 Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?
Answer: Yes.

The remedial action and long-term monitoring efforts are completed, and performance standards have been met. Institutional controls are in place to address all areas of site-related constituents that are at levels that do not allow for unrestricted use/unrestricted exposure. Institutional controls are properly implemented and effective in preventing exposure and protecting the remedy. Future long-term monitoring efforts associated with the sediment cap will occur if there is a significant earthquake or wind storm.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?
Answer: Yes.

Changes in Standards and To Be Considered. Applicable or relevant and appropriate requirements (ARARs) cited in the ROD were reviewed to evaluate changes in the ARARs since

the last five-year review. A summary table is presented in OU 1 Attachment 2. There have been no changes in regulatory standards since the first five-year review.

Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics. The ROD described current and future land uses and identified likely exposure pathways; the descriptions are accurate for the site conditions at the time of this review.

Since the 1989 CB/NT ROD, new information has become available on Tribal seafood consumption rates and exposure durations for Tribal populations. This new information has been considered for the Sediments OU, as detailed in response to Question B in Section 4.2.6 (Hylebos Waterway).

Changes in Land Use. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Remedial Action Objectives. The RAOs from the ROD are still valid for the site.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
Answer: No.

There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed and information obtained from the site inspection, the remedy is functioning as intended by the ROD as amended by the ESD. There have been no changes in the ARARs, standards or To Be Considered that should affect the protectiveness of the remedy. The remedy is still protective of human health and the environment. There is no other information that calls into question the protectiveness of the remedy.

4.4.7 Issues

This section addresses issues that, either currently or in the future, prevent the remedial action from being protective.

Table 6. St. Paul Waterway Issues of the 2009 Five-Year Review

Issue	Affects Protectiveness? (Y or N)	
	Current	Future
None.		

4.4.8 Recommendations and Follow-up Actions

Table 7 lists recommendations and follow-up actions for each issue identified in Table 6.

Table 7. St. Paul Waterway Recommended Follow-Up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Planned Completion Date
None.				

4.4.9 Protectiveness Statement

The remedial actions at the St. Paul Waterway Problem Area of the CB/NT Site have been successfully completed, all required long-term monitoring efforts have been completed, and the remedy remains protective of human health and the environment.

4.5 Middle Waterway

Five-Year Review Summary Form – Middle Waterway

Issues: 1. Possible recontamination of surface sediments due to erosion and large burrowing organisms bringing the underlying, native sediments to the surface in Area C. Drainage from the Mylet property down-cutting, such that the underlying tideflat and wood debris are exposed in Area C.

2. Ineffectiveness of grade stake survey due to stakes missing during survey monitoring in Area C.

3. SQO exceedances for mercury in Areas A and B in NR areas where SQOs are expected to be met within a ten year timeframe.

4. SQO exceedance of bis(2-ethylhexyl)phthalate, with elevated (but below SQO) concentrations of mercury and PAH found in Area C sediments near the Mylet roof drain.

5. Beached logs have been a problem primarily for the recovering pickleweed and other vegetation at the upper tidal levels at the head of the waterway due to smothering or sediment gouging.

6. Institutional controls have not been fully implemented.

7. Year 5 monitoring results from summer of 2009 have not been included in this review and need to be evaluated to further assess status of sediments in the waterway.

Recommendations and Follow-up Actions:

1. Include chemical monitoring of burrows within drainage channels or other erosion features in future monitoring events. Evaluate options to prevent further erosion.

2. Replace with periodic topographic surveys to map the long-term effects of the outfall on the tideflat and remedy performance.

3. Continue monitoring and evaluate Year 5 data to evaluate potential causes of SQO exceedances in Areas A, and B.

4. Include chemical monitoring of burrows within drainage channels or other erosion features in future monitoring events. Evaluate options to prevent further erosion.

5. Develop a Memorandum of Understanding with Simpson. Also evaluate the possibility of installing a breakwater to replace the protective function if the former piling field.

6. Conduct an IC study; follow up with the USCG about status of final RNA; verify that easements have been executed and recorded with Pierce County.

7. Evaluate Year 5 data; discuss options and potential need for additional remedial action.

Protectiveness Statement: The remedial action in Middle Waterway has been completed, the remedy is currently protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled. In order for the remedy to remain protective in the long-term, the Sediment Quality Objectives need to be met according to the timeframes established in the Middle Waterway ESDs, or any exceedances need to be shown to be biologically insignificant in all enhanced natural recovery (ENR) and natural recovery areas, and ICs must be fully implemented.

Other Comments: None.

4.5.1 Background

The Middle Waterway is located in Commencement Bay and is bounded by the Thea Foss Waterway on the southwest and the St. Paul Waterway on the northeast. The waterway is approximately 3,500 feet long and 300 feet wide. The total area of Middle Waterway is approximately 49 acres. The head of the waterway consists of one of the few remaining natural intertidal mudflats in Commencement Bay.

The industrial transformation of this area began in the late 1880s. Historical industries on the Middle Waterway include metal foundries and machine works; shipbuilding, maintenance, and repair; wood and coal tar products; metal scrap yards; industrial laboratories; and other uses (e.g., trucking firms, stormwater discharge). Current land uses include tugboat and marine transport base operations, ship repair activities, warehousing and storage, log rafting and haul out. Contaminated sediments in Middle Waterway had high concentrations of mercury, copper and PAHs.

The Middle Waterway Action Committee (MWAC) was established to represent a group of Middle Waterway PRPs (Foss Maritime Company, Marine Industries Northwest, Inc., and Pioneer Industries). In April 1997, EPA and MWAC entered into an AOC for the Pre-Remedial Design and Remedial Design. Under the AOC, MWAC agreed to conduct additional sampling to determine the full nature and extent of contamination, evaluate data and remedial options, recommend a remedy to EPA and design the remedy selected by EPA. During the site investigation activities, Middle Waterway was divided into Area A (the mouth of the waterway), Area B (the mid-portion of the waterway) and Area C (the Head of the waterway). See figures 4-8 and 4-9. Each of these areas was subsequently divided into sub-areas known as Sediment Management Units (SMUs).

In August, 2003, EPA entered into two separate CDs for the cleanup of Middle Waterway. MWAC entered into a CD for implementation of the remedial action for Areas A and B. EPA, DNR, the City, and other parties, entered into a Remedial Design/Remedial Action CD to address the cleanup of Area C. After EPA approval of MWAC's design documents, cleanup activities began in Areas A and B during the summer of 2003 and were completed in February 2004.

EPA's preferred alternative in Area C was to leave contaminated subsurface sediments in place with long-term monitoring. The State of Washington (both Ecology and DNR) expressed a preference for removal of contaminated subsurface sediments in Area C. EPA also received support for active remediation in this area from the Commencement Bay community (e.g.,

CHB). The State proposed to undertake removal of the subsurface contaminated sediment in SMU 51a and was willing to fund the additional cleanup. Since the enhanced action did not conflict with, nor was it inconsistent with the EPA-selected remedy, EPA agreed to incorporate the additional cleanup as an enhancement to the selected remedy. In March 2003, EPA issued an ESD that specified a more extensive remedial action for SMU 51a in Area C. The enhanced remedy consisted of the removal of the contaminated subsurface sediments from SMU 51a with upland disposal of the removed material.

The cleanup work in Area C was conducted by DNR during the summer and fall of 2004. In August 2004, MWAC proposed to do some additional dredging, ENR, and pile removal and replacement in Areas A and B to address unanticipated post-remediation issues. This work was completed by January 2005.

4.5.2 Site Chronology

Key dates for Middle Waterway actions are presented below. Section 4.5.3 provides a description of the actions.

Apr 1997	AOC with Middle Waterway PRPs.
May 1998	Round 1A Sampling Event.
Sept 1999	Round 1B Sampling Event.
Aug 2000	ESD for selection of potential disposal sites.
Feb 2002	ESD identified selected remedies specifically for Middle Waterway.
Mar 2003	Two separate CDs signed by EPA and PRPs, one with MWAC for Areas A and B, and one with DNR and other parties for Area C.
Mar 2003	Explanation of Significant Differences for enhanced remedy in Area C.
Apr 2003	EPA approval of Final Design for Areas A and B.
June 2003	DNR removes abandoned barges along west shoreline.
July 2003	In-water Construction Begins for Areas A and B.
Feb 2004	Dredging, disposal, capping, ENR completed for Areas A and B.
Apr 2004	EPA approval of Final Design for Area C.
July 2004	In-water construction begins for Area C.
Aug 2004	MWAC identifies additional cleanup actions that need to be taken in Areas A and B; completes the initial Year 0 monitoring for OMMP.
Sept 2004	DNR completes dredging, disposal, and ENR in Area C; MWAC begins additional dredging work near the former Scow Shed.
Oct 2004	DNR completes Year 0 monitoring in Area C.
Oct 2004 - May 2005	DNR conducted additional Year 0 monitoring in Areas A and B to observe upland restoration, plantings and bank erosion.

Jan 2005	Placement of ENR material in Areas A and B in order to accelerate the sediment recovery process.
Jan 2005	MWAC completes Year 0 monitoring in Areas A and B following placement of ENR material.
Spring 2005	Completion of DNR's in-water planting in Area C.
Aug 2005	DNR completes Year 1 monitoring in Area C.
June 2007	MWAC completes Year 3 monitoring in Areas A and B.
Aug 2007	DNR completes Year 3 monitoring in Area C.
July 2008	MWAC completes Year 4 monitoring in Areas A and B.
Aug 2008	DNR completes Year 4 monitoring in Area C.

4.5.3 Remedial Actions

Remedy Selection

Remedy selection for the CB/NT Sediments OU is described in Section 4.1.

Remedy Implementation (Sources)

Ecology identified only one major source of problem chemicals to Middle Waterway, Marine Industries Northwest, Inc. (MINI) at the mouth of the waterway. In addition to Ecology's source control investigations around the waterway and controls implemented at MINI, the City developed a City-wide stormwater management program which includes regular business and industrial/hazardous waste inspections in the industrialized stormwater drainage basin for municipal outfall #200 discharging at the head of the waterway. No significant sources of problem chemicals have been identified in the stormwater discharge. On December 11, 2000, the Source Control Completion Report was issued, documenting that all Milestone criteria were met. Ecology issued a waste discharge permit to MINI for stormwater hydroblast treatment and wastewater discharge. In January 2005, Ecology reissued an NPDES permit that requires sediment quality monitoring in coordination with the long-term sediment monitoring program for Middle Waterway Areas A and B.

Remedial Action (Sediments)

Since the last Five-Year Review, remedial activities were completed as described below:

Areas A and B Remediation

As previously discussed, a series of ESDs were developed to identify cleanup specifics not detailed in the 1989 ROD. In February 2002, EPA issued an ESD for Middle Waterway that identified the specific cleanup actions to be performed throughout Middle Waterway. These actions included dredging, disposal in Blair Slip 1, capping, ENR, natural recovery and monitoring.

For Areas A and B, approximately 109,500 cubic yards (cy) of sediment and debris were dredged until SQOs were achieved or until MWAC and EPA concluded that an alternative action was more appropriate than further dredging. Dredged material was loaded onto a split-hull barge and transported to the disposal site. Of the total amount of material dredged, 108,998 cy were disposed of at the Slip 1 nearshore confined disposal (NCD) facility at the mouth of the Blair Waterway. The remaining material was debris (large concrete blocks) and was disposed of at a construction debris landfill.

Backfilling with surficial cap material known as "habitat mix" was required to eliminate habitat loss or conversion through the placement of clean material to return dredged areas close to their original grade. This was done in the subarea known as D-2. Thick-layer capping was required in areas where sediments with chemical concentrations exceeding the SQOs could not be completely removed because of existing structures that could not be relocated or because of slope stability issues. Thick-layer capping material was placed over approximately 2.2 acres of the waterway.

There were three components to the ENR remedy in Middle Waterway. The cleanup objective for the ENR with surficial cap area was to improve habitat conditions and address minor chemical exceedances. The cleanup objective for the dredging and ENR areas was to remove a majority of the contamination with dredging and augment the natural sedimentation rate in areas with residuals by introducing a layer of clean material. The cleanup objective for ENR only areas was to only augment the natural sedimentation rate by introducing a layer of clean material. Overall, approximately 6.5 acres in Areas A and B were treated with one of the three ENR actions.

Institutional controls (ICs) were also required for the thick layer cap areas to ensure that the cap material is maintained. The ICs required were: (1) work with the U.S. Coast Guard (USCG) to establish a "regulated navigation area" (RNA). This designation will help maintain the integrity of the thick layer cap by eliminating activities such as anchoring, dragging, trawling, or any other activity that would remove and or compromise the integrity of the cap; (2) attach the record plan drawing for capped areas at an individual property to the property's deed and or title.

The majority of construction activities in Areas A and B occurred between mid-July 2003 and mid-February 2004. Supplemental cleanup followed between August 2004 and January 2005. Placement of ENR material was the lone remedial action performed since the last Five-Year Review. As part of the construction activities completed in 2005, MWAC and EPA decided to place ENR material in SMUs 8, 10, and 11; as well as in Dredge Areas D-1, D-4, the northern portion of D-3, and the southern portion of D-5, to accelerate the sediment recovery process and ensure a more rapid recovery to the SQO.

Area C Remediation

The State of Washington (both Ecology and DNR) expressed a preference for removal of contaminated subsurface sediments in Area C. Approximately 3,125 cy of contaminated sediment was excavated and then the area was backfilled with clean material. In Area 51b, a thin layer cap was placed over approximately 1.5 acres to enhance natural recovery. No institutional

controls were required for Area C. All remedial actions were completed prior to the completion of the last Five-Year Review.

Post-Construction Monitoring/Operation and Maintenance

Areas A and B

The Year 0 monitoring occurred in two phases, in 2004 (Phase I) and 2005 (Phase II). Although the Year 0 monitoring occurred over 2 years, EPA and MWAC agreed that the Year 3 monitoring would occur in one phase in 2007. Per the requirement of EPA, Year 4 monitoring activities were conducted in 2008. The purpose of the Year 4 monitoring was to further evaluate surface sediment mercury concentrations within the areas treated with ENR, dredged with ENR, and natural recovery (NR) and to perform the same analyses as those conducted in Year 3. The results of Year 3 and Year 4 were combined into one report. Year 5 monitoring was conducted in the summer of 2009; however, the results are not available for inclusion in this FYR. The potential need for additional monitoring will be evaluated following the review of the 2009 Year 5 monitoring event.

<u>Year 0</u>

The following activities were conducted during Year 0 monitoring:

- Surface sediment sampling: Samples were collected in areas identified as ENR, dredged with ENR, dredged, and natural recovery.
    - ENR and dredged with ENR: The monitoring objective was to verify that the surface sediments continue to naturally recover and meet SQO chemical criteria within 10 years. As part of the construction activities completed in 2005, ENR material was placed in areas to accelerate the sediment recovery process. This material was tested prior to placement and the results were used to characterize surface sediment for this monitoring period. Additionally, surface samples in areas where ENR was placed prior to 2005 were collected. The samples collected were not submitted for chemical analyses because visual observations indicated no mixing occurred between the ENR material and the sediment surface.
    - Dredged: The remedy was designed to remove contaminated sediments above SQO and backfill to the original grade with surficial cap material. Surface samples consisted of surficial cap material that was used to backfill the area. No samples were collected as it was assumed to be clean sand and chemicals tend to affix to smaller sized particles.
    - Natural Recovery: The monitoring objective was to verify that the surface sediments continue to naturally recover and meet SQO chemical criteria within 10 years. Samples were targeted for collection within the intertidal and subtidal portions of the area. Samples could not be collected during the Phase I event for analysis due to the presence of large concrete rubble, bricks, gravel, and cobble covering the intertidal and subtidal area. MWAC and EPA agreed that during Phase II, MWAC would collect the intertidal samples from land during an extreme

low tide and would attempt to collect a subtidal sample from various locations offshore of the toe of the slope. The intertidal composite sample was collected during Phase II. Eight attempts were made to collect a subtidal sample by boat offshore of the slope, but no sample could be collected due to the presence of rock and debris. As such, the intertidal sample was used to characterize the NR area of this monitoring phase. Per the OMMP, PCB and DDT analyses were conducted in addition to the metals and PAHs because these compounds were found in exceedance of the SQOs in SMUs adjacent to the NR area during previous investigations. Results from the intertidal composite sample indicated no exceedances of the SQOs.

- Visual observations: Observations were conducted in the ENR with surficial cap area. The monitoring objective was to verify that the layer of surficial material remained in the general area in which it was placed and that the remedy as performing as designed. It was concluded that the surficial material was present in all areas and no areas of concern were identified.

<u>Year 3</u>

The following activities were conducted during Year 3 monitoring:

- Surface sediment sampling: Samples were collected in areas identified as ENR, dredged with ENR, dredged, and natural recovery.
    - ENR and dredged with ENR: The majority of sample locations did not show exceedances of metals or PAHs above the SQOs. Three sampling locations (MWW-304, MWW-319, and MWW-321) showed mercury exceedances less than or equal to 1.5 times the SQO. These were the only locations above the SQO.
    - Natural Recovery: The intertidal composite sample in Year 3 was mistakenly taken from the 10 to 20 centimeter (cm) interval instead of the 0 to 10 cm interval. The results were less than or equal to 1.5 times the SQO for lead, benzo(a)anthracene, benzo(g,h,i)perylene, fluoranthene, and indeno(1,2,3-c,d)pyrene. The composite sample was not representative of the material in the 0 to 10 cm interval. This sample did not meet the performance criteria of the OMMP. However, since the sample was collected from the wrong depth interval, it cannot be used to evaluate natural recovery trends. A subtidal discrete sample was also collected and results indicated an exceedance of the mercury SQO at less than or equal to 1.5 times the SQO. This sample also did not meet the performance criteria of the OMMP.
- Visual observations: Observations were conducted in the ENR with surficial cap area. It was concluded that the surficial material was present in all areas and no areas of concern were identified. Results indicated that there was a thin layer of silt overlying a medium to coarse sand and gravel mixture, which is the composition of the placed surficial cap material.
- Hydrographic/land surveys and visual dive inspections: Surveys and inspections were conducted for thick-layer cap areas. The monitoring objective was to verify that the thick-layer cap has remained in place and continues to function as designed. Overall, the survey results indicate the cap material has remained in place in all areas, that silt and wood debris is

accumulating over the cap material in Area D-1, and that silt is accumulating over the cap in Area D-6. In Area D-9, monitoring results indicate the material accumulating over the cap is potentially backfill material because the diver survey identified minimal accumulation of silt over the cap armor. Chemistry results show the silt accumulating over the cap material meets SQO criteria, except for the sample collected in Area D-6 (1.4 times the SQO for mercury).

Year 4

The following activities were conducted during Year 4 monitoring:

- Surface sediment sampling: Samples were collected in areas identified as ENR, dredged with ENR, dredged, and natural recovery.
    - ENR and dredged with ENR: The sample locations did not show exceedances of mercury, metals or PAHs above the SQOs.
    - Natural Recovery: Two sample locations (MWW-315 [subtidal discrete] and MWW-316 [intertidal composite]) showed mercury exceedances. The results for MWW-316 detected mercury concentrations 1.86 times the SQO. The results for MWW-315 detected mercury concentrations 6.10 times the SQO. This level is greater than the concentrations identified in Area B that passed biological testing during the pre-RA sediment investigations. This area will be further evaluated during the Year 5 monitoring event.
- Visual observations: Observations were conducted in the ENR with surficial cap area. It was concluded that the surficial cap material was present in all areas and no areas of concern were identified. Results indicated that there was a thin layer of silt overlying a medium to coarse sand and gravel mixture, which is the composition of the placed surficial cap material.

Overall, results of the Year 0, Year 3, and Year 4 monitoring indicate that the RA was successful in significantly decreasing PAH and metals concentrations in Middle Waterway sediments. Prior to the RA, mercury surface sediment concentrations exceeded the SQO in 45 locations, ranging from 1.02 to 50 times the SQO. Year 3 monitoring showed mercury had minor exceedances at five locations, ranging from 1.1 to 1.5 times the SQO. Year 4 monitoring showed mercury had exceedances at two locations in the NR area, at 1.86 and 6.10 times the SQO. The NR area is required to meet the SQO in ten years, so these exceedances will continue to be monitored. Confirmatory biological testing performed on sediments in Area B as part of pre-remedial design activities demonstrated that surface sediment mercury concentrations as high as 4.4 times the SQO were not associated with adverse biological impacts. The area exceeding the concentrations that were found to have no biological impact (i.e., within the subtidal portion of the NR area [MWW-315]) will continue to be monitored during the scheduled Year 5 monitoring activities in 2009. Results from Year 5 will be evaluated and the need to conduct an additional response action will be determined at that time by MWAC and EPA.

Area C

The remedial action was completed by October 2004. Monitoring was conducted in 2004 for Year 0, in 2005 for Year 1, in 2007 for Year 3, and in 2008 for Year 4. Year 5 monitoring was

conducted in the summer of 2009; however, the results are not available for inclusion in this FYR. The potential need for additional monitoring will be evaluated following the 2009 Year 5 monitoring event. The frequency and timing of future monitoring in Area C will be discussed with EPA relative to monitoring conducted by other parties for Middle Waterway Area A and Area B.

Year 0

The following activities were conducted during Year 0 monitoring:

- Surface sediment sampling: Samples were collected in SMU 51a and SMU 51b. There were no exceedances of SQOs with the exception of benzoic acid in several samples. Elevated benzoic acid concentrations were detected in every sample including laboratory blanks. The laboratory report narrative indicates that calibration criteria for the semivolatile organic analyses exceeded QA control limits.

- Core sediment sampling: Samples were collected in an area of SMU 51. A contaminated sediment layer was encountered during the excavation done as part of the remedial action. The contaminated layer exhibited sheen and petroleum hydrocarbon-like odors and became a focus for removal during excavation in SMU 51a. The deepest sample obtained from the core was most likely to be contaminated based on what was observed during construction. However analytical results for the deepest sample were comparable to those for surface sediments samples, with few detected constituents.

- Visual Observations: Observations were conducted to document the physical characteristics of the restored tideflat for future evaluation of potential erosion, sediment deposition, and extent of intermixing with underlying sediments.

    - Surface Sediment Thickness and Composition: Worm tubes and other burrows were identified on the surficial backfill/cap surface within days to weeks of placement, indicating reoccupation of the new near-surface sediments by the benthic community. There was a sharp interface between the surficial backfill/capping material placed during construction and the underlying sediments. Small localized depressions were noted.
    - Erosion: Areas of note were limited to minor slope raveling in the upper portion of the SMU 51a outfall channel, gullying near the head of the outfall channel, and bank erosion at the southeastern edge of SMU 51a. Little or no erosion has been observed throughout the remaining tideflat areas of SMU 51a and SMU 51b. Virtually no lateral migration of the outfall channel occurred

Year 1

The following activities were conducted during Year 1 monitoring:

- Surface sediment sampling: Samples were collected in SMU 51a and SMU 51b. There were no exceedances of SQOs or one-half SQO values. The Year 1 data confirm the SMU 51a backfill and SMU 51b thin-layer capping are performing as anticipated. There is no

indication of release or migration of chemical constituents associated with remedial actions in Area C.

- Visual Observations: Observations were conducted to document the physical characteristics of the restored tideflat for future evaluation of potential erosion, sediment deposition and extent of intermixing with underlying sediments.
    - Surface Sediment Thickness and Composition: The backfill and capping materials have blended with the surrounding tideflat and the surface has become more even. Small localized depression pockets (less than about 6 inches deep) noted during Year 0 monitoring have continued to blend and disappear. An abundance of small holes up to several millimeters in diameter were also present throughout the cap and backfill as a result of burrows from near-surface biological recruitment. A distinct, sharp interface remains between the surficial backfill and capping material and the underlying sediments. The depth to the interface with underlying backfill in SMU 51a and native sediments in SMU 51b varied from about 6 to 12 inches, consistent with the original placement thicknesses. There was no indication that the surficial backfilling or capping layers had been compromised by erosion or subsidence.
    - Erosion: Areas of note were limited to upland bank erosion at the southeastern edge of SMU 51a from wave undercutting and gullying near Outfall No. 200. Very minor sideslope erosion previously noted in Year 0 was still present on the eastern bank of the upper portion of the outfall discharge channel. A number of the shrubs and trees along the bank were partially washed out or were in danger of being washed out. These shrubs and trees were replanted in March 2005, and jute mats were installed in May 2005. No additional erosion was noted during Year 1 visual monitoring and the bank slope appeared stable. Gully features up to 1 foot wide and 1 foot deep near the outfall have stabilized and become partially vegetated over the last year as upland plantings (and invasive species) have propagated. Also, a curb was installed in 2004 near the East 11th Street edge of the upland area to retain runoff and prevent additional erosion. Minor erosion features on the eastern side slope of the outfall channel stabilized and adjusted with tidal exchange, and were no longer visible as of May 2005. One location about 220 feet downstream of the outfall has experienced minor lateral movement of less than about 4 feet. The project design and OMMP anticipated that some degree of lateral channel migration is expected, and this condition does not indicate that the integrity of the backfill in SMU 51a has been compromised.

<u>Year 3</u>

The following activities were conducted during Year 3 monitoring:

- Surface sediment sampling: Samples were collected in SMU 51a and SMU 51b. There was one exceedance of SQO. The exceedance was bis(2-ethylhexyl)phthalate (1.07 times the SQO). The sample was collected as a composite from crab burrows in the side walls of the channel leading from the Mylet roof drain along the shoreline. A sample from the Mylet roof drain channel contained concentrations of PAH and mercury higher than other locations in

SMU 51a and 51b, but they were still below SQOs. The channel has eroded through the thin-layer cap and into the underlying sediment. Therefore, the PAH in this sample may be from the exposed subsurface sediment or the drainage from Mylet. It should be noted PAHs were not elevated in the sample from the cap surface in this area.

- Visual Observations: Observations were conducted to document the physical characteristics of the restored tideflat for future evaluation of potential erosion, sediment deposition, and extent of intermixing with underlying sediments.
    - Surface Sediment Thickness and Composition: The backfill and capping materials form a relatively smooth surface even with the surrounding tideflat. Large holes ranging in diameter from 18 to 24 inches were observed in several areas. Based on their size and appearance, these holes appear to have been caused by someone digging for clams, or other invertebrates for either food or bait. The burrow features noted are not expected to affect the performance of the backfill or thin-layer cap. These features will continue to be visually monitored. Chemical monitoring of burrows within drainage channels or other erosion features should be included in future monitoring events. The depth to the interface with native sediments in SMU 51b varied from about 6 to 12 inches, consistent with the original placement thicknesses. In SMU 51a this interface was not as evident, although a fine-grained layer of fairly unconsolidated material approximately 12 to 20 inches thick was present with an underlying consolidated sand layer.
    - Erosion: Areas of note were limited to the area previously observed including the upland bank erosion at the southeastern edge of SMU 51a from wave undercutting, migration of the drainage channel from Outfall No. 200, and channel development from drains coming from the Mylet property. Channel realignment is occurring where the channel merges with other off-site tideflat drainage channels to the southeast and is not adversely affecting the thin-layer cap in SMU 51b. A drainage channel has formed below the roof drain outfall from the Mylet property and appears to have deepened.
- Survey: A survey was conducted to evaluate tideflat grade changes. No trends in loss or accumulation of material at the cap surface were detected using the topographic survey. A grade stake survey was used to identify any trends in sediment transport associated with the outfall discharge. Of the four reference points, all four markings (rebar) were missing at the time of the survey.

<u>Year 4</u>

The following activities were conducted during Year 4 monitoring:

- Visual Observations: Observations were conducted to document the physical characteristics of the restored tideflat for future evaluation of potential erosion, sediment deposition, and extent of intermixing with underlying sediments.
    - Sediment Thickness and Composition: The backfill and capping materials form a relatively smooth surface even with the surrounding tideflat. Large holes ranging

in diameter from 18 to 24 inches were observed in several areas. Based on their size and appearance, these holes appear to have been caused by someone digging for clams, or other invertebrates for either food or bait. More digging activity was noted in Year 4 than observed in previous events. Large burrowing organisms may contribute to bioturbation of the capping material and may bring the underlying, native sediments to the surface. The burrow features noted are not expected to affect the performance of the backfill or thin-layer cap. Chemical monitoring of burrows within drainage channels or other erosion features should be included in future monitoring events. The thin cap material still occurs as a discrete layer in the areas where observations were made.

- Erosion: Areas revisited were the runoff drainage channels that have formed below the Mylet property and the discharge channel associated with the City Outfall No. 200. Drainage from the Mylet property has caused two channels to form. The western channel has significant down-cutting such that the underlying tideflat and wood debris are exposed. Channel locations and down-cutting depths do not appear to be different than what was observed in Year 3. Options to prevent further erosion should be evaluated. Channel alignment associated with Outfall 200 showed no significant channel migration, erosion, or change in channel invert elevations during Year 4 monitoring.

- Survey: A survey was conducted to evaluate tideflat grade changes and channel migration and elevation in the vicinity of the City Outfall No. 200. Annual measurements have shown consistent level changes in elevation since construction. Rebar markings at two of the four locations were no longer present during survey monitoring. It was recommended in the Year 4 monitoring report that the grade stake survey be replaced by periodic topographic surveys to map the long-term effects of the outfall on the tideflat and remedy performance.

Overall, the physical characteristics of the remedy in Problem Area C exhibit long-term integrity, with the exception of the localized down-cutting along the Mylet runoff drainage channel. The backfill and thin-layer cap in SMUs 51a and 51b, respectively, have maintained similar physical features over the last 4 years. There has been minor channel migration associated with the City Outfall No. 200, but with no effect on the remedy in SMU 51a. Stormwater discharge from the Mylet property in SMU 51b has created several channels; the western channel has sufficient periodic flow such that the performance of the thin-layer cap is affected in a localized area of down-cutting.

Elevated concentrations of bis(2-ethylhexyl)phthalate, mercury, and PAH were found in the sample collected as a composite from crab burrows in the side walls of the channel leading from the Mylet roof drain along the shoreline. The channel has eroded through the thin-layer cap and into the underlying sediment. The PAH in this sample may be from the exposed subsurface sediment or the drainage from Mylet. Results from future Area C sample analyses will continue to be evaluated for indications of potential recontamination from all sources, including local stormwater and possible upland sources.

The following tables display the summary of chemistry monitoring data for Areas A and B, and C.

Table 8. Chemistry Monitoring Data Summary for Areas A and B

PRE-REMEDIATION												
Chemical	**unit**	**SQO[1]**	**No. of Results**	**Min**	**Max**	**Average**	**Std**	**No. of Exceedances[2]**	**Min EF[3]**	**Max EF**	**No. of Sample Stations with Exceedances**	**No. of Chemicals with Exceedances**
Arsenic	mg/kg	57	68	3.4	597	61.00	96.39	18	1.04	10.47		
Copper	mg/kg	390	75	28.2	2900	465.10	584.79	26	1.03	7.44		
Lead	mg/kg	450	68	11.5	8290	476.29	1172.67	13	1.14	18.42		
Mercury	**mg/kg**	**0.59**	**75**	**0.14**	**29.2**	**2.50**	**5.00**	**45**	**1.02**	**49.49**		
Silver	mg/kg	6.1	68	0.6	6.2	1.10	0.75	1	1.02	1.02		
Zinc	mg/kg	410	68	40.3	4810	497.18	883.19	19	1.03	11.73		
2,4-Dimethylphenol	µg/kg	29	52	0.92	80	13.51	14.59	3	1.48	2.76		
2-Methylnaphthalene	µg/kg	670	59	14	940	176.19	138.83	1	1.40	1.40		
2-Methylphenol	µg/kg	63	52	1.1	260	18.62	38.10	3	1.22	4.13		
4,4'-DDD	µg/kg	16	54	1.5	23	7.01	3.56	2	1.13	1.44		
4,4'-DDE	µg/kg	9	54	1.5	93	7.89	11.99	3	1.11	10.33		
4-Methylphenol	µg/kg	670	52	11	690	117.35	109.33	1	1.03	1.03		
Acenaphthene	µg/kg	500	59	24	1200	223.47	225.14	5	1.06	2.40		
Acenaphthylene	µg/kg	1300	59	26	1800	204.29	278.31	1	1.38	1.38		
Anthracene	µg/kg	960	59	26	1900	492.19	402.29	5	1.04	1.98		
Benzo(a)anthracene	µg/kg	1600	59	46	3400	900.95	736.65	9	1.13	2.13		
Benzo(a)pyrene	µg/kg	1600	59	47	2400	801.47	580.41	6	1.13	1.50		
Benzo(b)fluoranthene	µg/kg	3600	58	24	5000	1315.31	1023.00	4	1.03	1.39		
Benzo(g,h,i)perylene	µg/kg	720	59	12	1300	336.34	249.92	5	1.01	1.81		
Benzo(k)fluoranthene	µg/kg	3600	58	24	5000	1283.07	1024.94	4	1.03	1.39		
Benzoic acid	µg/kg	650	52	19	3100	261.75	467.64	4	1.12	4.77		
Benzyl alcohol	µg/kg	73	52	1.1	520	22.81	72.49	2	1.16	7.12		
bis(2-Ethylhexyl)phthalate	µg/kg	1300	51	61	4000	430.69	562.40	1	3.08	3.08		
Butylbenzylphthalate	µg/kg	900	51	5.5	1000	103.21	157.84	1	1.11	1.11		
Chrysene	µg/kg	2800	59	61	3500	1100.86	855.54	4	1.04	1.25		
Dibenzo(a,h)anthracene	µg/kg	230	59	5.3	2100	120.58	275.73	5	1.13	9.13		
Dibenzofuran	µg/kg	540	51	14	1200	210.49	186.60	2	1.13	2.22		
Fluoranthene	µg/kg	2500	59	44	7800	2148.71	1961.95	17	1.12	3.12		
Fluorene	µg/kg	540	59	16	1500	279.36	274.50	5	1.02	2.78		
Indeno(1,2,3-cd)pyrene	µg/kg	690	59	14	1200	327.88	236.45	5	1.07	1.74		
Naphthalene	µg/kg	2100	59	32	2200	406.98	381.06	1	1.05	1.05		
n-Nitrosodiphenylamine	µg/kg	28	51	15	66	23.37	10.28	7	1.04	2.36		
Pentachlorophenol	µg/kg	360	52	1.5	800	76.91	166.21	3	1.78	2.22		
Phenanthrene	µg/kg	1500	59	81	4000	1134.08	895.23	11	1.13	2.67		
Phenol	µg/kg	420	52	17	620	103.88	110.61	2	1.21	1.48		
Pyrene	µg/kg	3300	59	130	5900	1888.98	1467.86	9	1.06	1.79		
Total HPAH (SMS)	µg/kg	17000	45	658	33560	9132.96	7367.57	7	1.05	1.97		
Total LPAH (SMS)	µg/kg	5200	45	206	9640	2398.13	1728.73	2	1.35	1.85		
Total PCBs (SMS)	µg/kg	300	40	30	1300	144.63	222.37	3	1.37	4.33		
TOTAL											**62**	**39**

Notes:

[1]SQO = Commencement Bay Sediment Quality Objectives
[2]Exceedance = Result greater than the SQO

[3]EF = Exceedance Factor = Chemical Concentration/SQO

Green shading = Chemical that exceeded SQO during Year 3 and Year 4 Monitoring Events.

[This page intentionally left blank]

Table 8. Chemistry Monitoring Data Summary for Areas A and B (continued)

POST-REMEDIATION												
Chemical	unit	SQO[1]	No. of Results	Min	Max	Average	Std	No. of Exceedances[2]	Min EF[3]	Max EF	No. of Sample Stations with Exceedances	No. of Chemicals with Exceedances
YEAR 0												
Mercury	mg/kg	0.59	10	0.051	0.5	0.14	0.13	0	NA	NA	NA	
TOTAL												0
YEAR 3												
Mercury	mg/kg	0.59	24	0.013	0.9	0.40	0.26	5	1.07	1.53		
TOTAL											5	1
YEAR 4												
Mercury	mg/kg	0.59	22	0.034	3.6	0.43	0.75	2	1.86	6.10		
TOTAL											5	1

Notes:

[1]SQO = Commencement Bay Sediment Quality Objectives

[2]Exceedance = Result greater than the SQO

[3]EF = Exceedance Factor = Chemical Concentration/SQO

Green shading = Chemical that exceeded SQO during Year 3 and Year 4 Monitoring Events.

Table 9. Chemistry Monitoring Data Summary for Area C

			Pre-Remediation			Post-Remediation		
Chemical	unit	SQO[1]	Max	No. of Exceedances[2]	Max EF[3]	Max	No. of Exceedances[2]	Max EF[3]
Arsenic	mg/kg	57	76	1	1.33			
Cadmium	mg/kg	5.1	7.93	1	1.55			
Copper	mg/kg	390	8550	6	21.92			
Lead	mg/kg	450	2750	2	6.11			
Mercury	mg/kg	0.59	29.6	22	50.17			
Nickel	mg/kg	140	1780	3	12.71			
Zinc	mg/kg	410	1860	9	4.54			
1,2-Dichlorobenzene	ug/kg	50	*99 U*	1	1.98			
1,2,4-Trichlorobenzene	ug/kg	51	*2000 U*	1	39.22			
2,4-Dimethylphenol	ug/kg	29	470	13	16.21			
2-Methylnaphthalene	ug/kg	670	560000	9	835.82			
2-Methylphenol	ug/kg	63	270 J	3	4.29			
4,4'-DDE	ug/kg	9	22 P	1	2.44			
4,4'-DDT	ug/kg	34	*40 U*	3	1.18			
Acenaphthene	ug/kg	500	540000 D	16	1080.00			
Acenaphthylene	ug/kg	1300	63000 G	10	48.46			
Anthracene	ug/kg	960	140000	15	145.83			
Benz(a)anthracene	ug/kg	1600	110000	24	68.75			
Benzo(a)pyrene	ug/kg	1600	87000	25	54.38			
Benzo(g,h,i)perylene	ug/kg	720	55000	31	76.39			
Total benzofluoranthenes	ug/kg	3600	79000	21	21.94			
Benzoic acid	ug/kg	650	*5000 U*	5	7.69			
Benzyl alcohol	ug/kg	73	440 J	2	6.03			
Bis(2-ethylhexyl)phthalate	ug/kg	1300	6400	8	4.92	1400 [4]	1	1.08
Butyl benzyl phthalate	ug/kg	900	*6200 U*	1	6.89			
Chrysene	ug/kg	2800	100000	21	36.71			
Di-n-butyl phthalate	ug/kg	1400	*6200 U*	1	4.43			
Di-n-octyl phthalate	ug/kg	6200	*6200 U*	1	1.00			
Dibenzo(a,h)anthracene	ug/kg	230	11000 J	24	47.83			
Dibenzofuran	ug/kg	540	35000	6	64.81			
Diethyl phthalate	ug/kg	200	*6200 U*	1	31.00			
Dimethyl phthalate	ug/kg	160	*6200 U*	3	38.75			
Ethylbenzene	ug/kg	10	*10 U*	16	1.00			
Fluoranthene	ug/kg	2500	220000	32	88.00			
Fluorene	ug/kg	540	160000	17	296.30			
Hexachlorobenzene	ug/kg	22	*24 U*	1	1.09			
Hexachlorobutadiene	ug/kg	11	*16 U*	2	1.45			
Indeno(1,2,3-cd)pyrene	ug/kg	690	41000 L	30	59.42			
Naphthalene	ug/kg	2100	230000	12	109.52			
N-Nitrosodiphenylamine	ug/kg	28	*2000 U*	9	71.43			
Pentachlorophenol	ug/kg	360	*420 U*	1	1.17			
Phenanthrene	ug/kg	1500	500000	32	333.33			
Phenol	ug/kg	420	540	1	1.29			
Pyrene	ug/kg	3300	620000 D	31	187.88			
Total HPAHs	ug/kg	17000	983000	24	57.82			
Total LPAHs	ug/kg	5200	3483000	23	669.81			
Total PCBs	ug/kg	300	2800	4	9.33			

[1]SQO = Commencement Bay Sediment Quality Objectives
[2]Exceedance = Result greater than SQO
[3]EF = Exceedance Factor = Chemical Concentration/SQO
J = Estimated value.
U = Value not detected.
D = Value was from an analysis at a secondary dilution factor.
L = Value less than maximum shown.
G = Estimate greater than value shown.
P = The percent difference in sample concentration between the two GC columns is > 25%.
Pre-remediation sampling included 80 total samples - 22 samples had no exceedances for tested analytes.
Italicized values were non-detected results that exceeded the SQO due to dilutions or instrumentation limitations. They do not necessarily indicate results above the SQO.
Data includes post-remediation sampling that occurred in 2004, 2005, and 2007. 65 total samples (including field duplicates) were collected.
Post-remediation maximum values include only constituents with SQO exceedances.
[4] The Bis(2-ethylhexyl)phthalate exceedance occurred in 2007.

4.5.4 Progress since the Last Five-Year Review

Results from the OMMP activities are discussed in the previous Section 4.5.3, Post-Construction Monitoring/O&M

Previous Protectiveness Statement

The protectiveness statement in the last Five-Year Review (2004) stated:

> "The remedial action is currently protective of human health and the environment because all of the required remedial actions have been competed. However, in order for the remedy to be protective in the long-term, the SQOs need to be met in all ENR and natural recovery areas."

Status of Recommendations

There were no Middle Waterway-specific recommendations in the previous five-year review (2004). A summary of the sitewide recommendations made in that five-year review and an evaluation of their progress at Middle Waterway are presented below.

- **Sitewide – Implementation of OMMPs for Hylebos, Middle and Thea Foss and Wheeler-Osgood Waterways to ensure effectiveness of remedial actions and mitigation activities.**

  Ongoing. OMMP implementation has occurred according to schedule. Overall, results of the Year 0, Year 3, and Year 4 monitoring indicate that the RA in Areas A and B was successful in significantly decreasing PAH and metals concentrations in Middle Waterway sediments. Prior to the RA, mercury surface sediment concentrations exceeded the SQO in 45 locations, ranging from 1.02 to 50 times the SQO. Year 3 monitoring showed mercury had minor exceedances at five locations, ranging from 1.1 to 1.5 times the SQO. Year 4 monitoring showed mercury had exceedances at two locations in the NR area at 1.86 and 6.10 times the SQO. Confirmatory biological testing performed on sediments in Area B as part of pre-remedial design activities demonstrated that surface sediment mercury concentrations as high as 4.4 times the SQO were not associated with adverse biological impacts. The area exceeding the concentrations that were found to have no biological impact will continue to be monitored during the scheduled Year 5 monitoring activities in 2009. Results from Year 5 will be evaluated and the need to conduct an additional response action will be determined at that time by EPA.

  Overall, the physical characteristics of the remedy in Problem Area C exhibit long-term integrity, with the exception of the localized down-cutting along the Mylet runoff drainage channel. The backfill and thin-layer cap in SMUs 51a and 51b, respectively, have maintained similar physical features over the last 4 years. There has been minor channel migration associated with the City Outfall No. 200, but with no effect on the remedy in SMU 51a. Stormwater discharge from the Mylet property in SMU 51b has created several channels; the western channel has sufficient periodic flow such that the performance of the thin-layer cap is affected in a localized area of down-cutting.

Based on the concentrations and distribution of PAHs detected during post-construction monitoring, it is unlikely that the PAH detections indicate an upland source, at least near Area C. There is no indication of increasing PAH concentrations toward the outfall or other patterns that would indicate an upstream source. DNR believes that the source is tidal water carrying particulates with PAHs from off-site industrial activities. Results from future Area C sample analyses will continue to be evaluated for indications of potential recontamination from all sources, including local stormwater and possible upland sources.

- **Sitewide – Implementation of Institutional Controls for all waterways and review status of institutional controls already in place**.

  Ongoing. There is no sitewide IC plan. Additional details regarding institutional controls can be found in the Data Review and Evaluation section below. A regulated navigation area (RNA) request has been prepared for the thick-layer cap areas and was submitted to the USCG in the spring of 2005. The USCG issued a Notice of Proposed Rulemaking for the Establishment of an RNA for the Middle Waterway cap areas. Publication of the Notice in the Federal Register as a final rule has been delayed due to location discrepancies identified on the USCG charts. MWAC, EPA, and the USCG need to follow up to resolve the discrepancies. The RNA will prohibit activities such as anchoring, dragging, trawling, or other activities that involve disrupting the function of the thick-layer caps.

  For each property where access or land/water use restrictions are needed pursuant to Section IX of the CD, an easement running with the land has been executed and recorded with the Auditor's Office of Pierce County. The easement grants a right of access to the property for conducting any activity related to the CD, and grants the right to enforce land/water use restrictions as defined in the CD.

  An Institutional Control study should be conducted to assess the status of the required ICs and verify that they are in place.

- **Sitewide – Review the results of monitoring at the mitigation sites and based on that data describe the contribution of those sites towards the recovery of ESA species.**

  Ongoing. For Areas A and B, the fish habitat enhancement elements were incorporated into the overall remedial design. Specifically, the remedial design enhanced the existing habitat through:

  - Backfilling slopes with material beneficial to salmon.
  - Using capping material that enhanced habitat function (e.g., suitable substrate and habitat for aquatic organisms in the environment).
  - Removing chemicals above the SQOs.
  - Removing over-water structures.
  - Permanently removing creosote-treated piling.
  - Implementing conservation measures during construction.

For Area C, the infaunal and epifaunal communities colonizing the near-surface sediments comprising the SMU 51a backfill and SMU 51b thin-layer cap appear to be maturing. Deeper burrowing animals were present in 2008 along with juvenile softshell clams and Macoma spp. (*M. nasuta and M. secta*). Burrowing shrimp and shore crab are abundant. Diatoms, small filamentous algae, and ulvoid algae are well developed on the sediment surface and appear to contribute significantly to the productivity of the tideflat. The erosion channels from the Mylar drains continue to affect the performance of the thin-layer cap through the removal of the placed habitat mix and exposure of wood debris and historical sediments. Beached logs have been observed in several years, but not all. When they have showed up, they have been a problem primarily for the recovering pickleweed and other vegetation at the upper tidal levels at the head of the waterway due to smothering or sediment gouging (i.e., where the plants are displaced). Flotsam and jetsam (aka garbage, wood debris (primarily bark), and anything else that floats) appear to also cause some smothering of nearshore vegetation at the head of the waterway.

- **Sitewide – Develop a work plan to conduct fish tissue sampling for CB/NT after sediment Remedial Actions are complete. Provide results to Washington DOH to determine if they should continue with fish advisories after the sediment cleanup RAOs have been achieved.**

  See Section 4.8 of this Five-Year Review for a discussion on fish tissue sampling for the Sediments OU of the CB/NT Site.

4.5.5 Five-Year Review Process

Administrative Components

The Middle Waterway Superfund Site FYR team was led by Nancy Harney, the EPA Remedial Project Manager (RPM), Region 10. Emile Pitre with the USACE, Seattle District, assisted with the review as representatives of the support agency.

By February 2009, the review team had been formed, and had established the review schedule and its major components including:

- Document Collection and Review.
- Data Assessment/Analysis.
- Site Inspection.
- Interviews and Community Notification and Involvement.
- FYR Report Development and Review.

The FYR has a statutory completion date of December 29, 2009.

Community Involvement

EPA sent a postcard to stakeholders and neighbors on the CB/NT project mailing list (approximately 1,440 addressees) in February to notify them of the five-year review process.

After checking in with several members of the community, some of them had not yet received the information. We then mailed a second postcard on March 19, 2009 to ensure that everyone had an opportunity to provide information to EPA. In addition, a display advertisement ran on page B3 of the Tacoma News Tribune Newspaper on February 6, 2009.

Interviews were completed with interested parties. The purpose of the interviews was to identify issues and concerns related to the implementation and on-going operation of the site remedy.

Document Review

A review of reports pertinent to this Five-Year Review was conducted by the review team. The types of documents reviewed included decision documents; risk assessment documents; annual data reports; technical memoranda; and other supporting materials. OU 1 Attachment 1 is a complete list of documents reviewed during this FYR.

Data Review and Evaluation

Results from the OMMP activities are discussed in the previous Section 4.5.3, Post-Construction Monitoring/O&M. There is no IC plan currently in place. A regulated navigation area (RNA) request has been prepared for the thick-layer cap areas and was submitted to the USCG in the spring of 2005. The USCG issued a Notice of Proposed Rulemaking for the Establishment of an RNA for the Middle Waterway cap areas. Publication of the Notice in the Federal Register as a final rule has been delayed due to location discrepancies identified on the USCG charts. MWAC, EPA, and the USCG plan to follow up to resolve the discrepancies. The RNA will prohibit activities such as anchoring, dragging, trawling, or other activities that involve disrupting the function of the thick-layer caps.

For each property where access or land/water use restrictions are needed pursuant to Section IX of the CD, and easement running with the land has been executed and recorded with the Auditor's Office of Pierce County. The easement grants a right of access to the property for conducting any activity related to the CD, and grants the right to enforce land/water use restrictions as defined in the CD.

Interviews

Interviews were performed by telephone. Parties were identified for the interviews based on the following criteria:

- Parties adjacent to the site or effected by site related contaminants.
- Public entities/utilities affected by operation of the remedy.
- Interested and concerned citizens or citizen groups.

Parties identified for interviews included:

- Leslie Ann Rose with CHB.

The following recommendations and suggestions were made:

- Establish a system to alert EPA when there is a planned disturbance of sediments or soils within operable units. The sites can be entered into the City of Tacoma land-use database to notify EPA when a person applies for a land-use permit within the operable units.
- To assign one EPA RPM for all operable units post-remediation.
- In response to the increased mercury concentrations CHB would like to see annual monitoring through Year 10, so we have a good baseline. MINI may be a source as their best management practices (BMPs) are inconsistent, and there could be midnight dumping from other sources. CHB has increased the frequency of the Baykeeper going into Middle waterway to inspect activities that may be contributing to the mercury results.

4.5.6 Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?
Answer: Yes.

The current remedy is functioning as intended by the ROD. The current state of each ROD cleanup objective and any indicators of remedy problems are described below:

- **Sediment Quality Goal: the sediment quality goal is a conceptual target condition for Puget Sound, defined by element P-2 of the 1989 Puget Sound Water Quality Management (PSWQA) Plan as the absence of acute or chronic adverse effects on biological resources or significant human health risk.** Overall, the sediment concentrations have decreased since pre-remedial action. Quantitative data has not been collected to show an absence of acute or chronic adverse effects on biological resources or significant human health risk. In Areas A and B, surficial ENR material has remained in the general area in which it was placed and the remedy is performing as designed. In Area C, there are finely structured, hair-like algae and various ulvoids algae species that have formed an almost continuous cover over the tideflat. These algal mats tend to trap fine silts and provide substrate for other plants and invertebrates.

- **Sediment Quality Objective**: **the sediment quality objective is a discrete and measurable target for project cleanup related to the Puget Sound goal. The objective is measurable in terms of specific human health risk assessments and environmental effects tests, and associated interpretive guidelines. The resulting biological effect levels or chemical concentrations are scientifically acceptable definitions of the sediment quality goal using available information.** Sediment Quality Objectives were generally met throughout the site immediately following the remedial action. As stated in the ROD, the results of the risk assessments during the remedial investigation were used in the FS to develop sediment cleanup guidelines to protect human health and the environment.

  In Area C, drainage from the Mylet property has caused two channels to form in the thin-layer cap. The western channel has significant down-cutting such that the underlying tideflat and wood debris are exposed. Channel locations and down-cutting depths do not appear to

change between Year 3 and Year 4. To date, sediment concentrations remain below the SQO, with the exception of BEHP [bis(2-ethylhexyl)phthalate]. However, options to prevent further erosion should be evaluated to ensure protectiveness of the cap.

- **Sediment Remedial Action Level (SRAL): the sediment remedial action level differentiates areas that exceed the sediment quality objective, but are predicted to recover naturally, from those that are more significantly contaminated and therefore require active remediation to achieve the sediment quality objective. The intent of any active remediation of sediments is to achieve a net environmental and public health benefit and therefore requires consideration of habitat issues.** The SRAL is used to evaluate natural recovery areas. In Areas A and B there were two sample locations (MWW-315 [subtidal discrete] and MWW-316 [intertidal composite]) that showed mercury exceedances in Year 4 (2008). Sample results from these locations increased compared to the previous year's mercury results. From Year 3 to Year 4, MWW-315 had mercury concentrations go from 1.5 times the SQO to 6.10 times the SQO. The latter level is greater than the concentrations identified in Area B that passed biological testing during the pre-RA sediment investigations. This area will be further evaluated during the Year 5 monitoring event. From Year 0 to Year 4, MWW-316 had mercury concentrations go from 0.83 times the SQO to 1.86 times the SQO. The latter level is less than the concentrations identified in Area B that passed biological testing during the pre-RA sediment investigations. Further evaluation of Areas A and B during the Year 5 monitoring event will help determine the extent of natural recovery.

- **Source Control Level: the goals and objectives of source control are defined as targets that will achieve respective sediment goals and objectives. Source control will be implemented according to applicable or relevant and appropriate requirements (ARARs) and All Known, Available, and Reasonable Treatment (AKART) Systems. Compliance with the sediment quality objective will be confirmed through monitoring.** Data indicates there may be source control issues in Middle Waterway. In Area A and B, the elevated mercury concentrations in the ENR areas could be attributed to site activities not yet identified such as prop wash, dry dock activities, and NPDES releases. There is also the possibility that increases in mercury concentrations from Year 0 may be attributed to the natural redistribution of sediments which had concentrations that were above the SQO. Although exceedances were observed, they are generally below the levels found to have impacts from biological testing conducted during pre-remedial design. Ongoing evaluation is required to determine the impacts of this recontamination and the need to address it.

- There is no site specific habitat mitigation objective outlined in the ROD. Habitat function and enhancement of fisheries resources is incorporated as part of the overall project cleanup objective. Habitat mitigation objectives and goals are site-specific and were developed for the site prior to construction. Generally the mitigation sites are performing in accordance with the project goals.

- Institutional controls are related to the long-term integrity of the thick-layer cap areas. A regulated navigation area (RNA) request has been prepared for the thick-layer cap areas and was submitted to the USCG in the spring of 2005. A final rule has been delayed due to location discrepancies identified on the USCG charts. MWAC, EPA, and the USCG are

working on resolving the discrepancies. The RNA will prohibit activities such as anchoring, dragging, trawling, or other activities that involve disrupting the function of the thick-layer caps. The DOH has a flatfish and rockfish consumption advisory in place for the Commencement Bay Waterways.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?
Answer: Yes.

Changes in Standards and To Be Considered. Applicable or relevant and appropriate requirements (ARARs) cited in the ROD were reviewed to evaluate changes in the ARARs since the last five-year review. A summary table is presented in OU 1 Attachment 2. There have been few changes in regulatory standards since the last five-year review: Puget Sound steelhead were listed as threatened on May 11, 2007.

Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics. The ROD described current and future land uses and identified likely exposure pathways; the descriptions are accurate for the site conditions at the time of this review. Although the majority of the apparent effect threshold (AET) values have remained unchanged since the date of the original ROD a recent set of unpromulgated AET values appear pertinent to the Five-Year Review process. These values were prepared in 1998 by the DMMP based on biological tests of polychaetes (Neanthes), and bivalves. Approximately 45 percent of the AET values listed in OU 1 Attachment 3 would be lowered by these unofficial standards. If made official, these changes would presumably affect the assessment of the cleanup values established in the original ROD. Because the 1998 values are not promulgated, the AET standards for the Puget Sound remain unchanged and will not affect the cleanup remedies in places at the Commencement Bay and Near Shore/Tidal Flats site. The assessment of changes made to AET values may be partially incomplete as the most recent AET values are in mg/kg organic carbon, while the AET values in the ROD are in mg/kg dry weight. In addition, only the SQO for PCBs was based on human health risk assessment (ecologically-based cleanup levels for all other toxins were deemed protective of human health). It should be noted that since the ROD, the DMMP has listed both Chlordane and Dioxins/Furans as bioaccumulative chemicals. Neither chemical was evaluated for human health risks in the RI/FS.

Since the 1989 CB/NT ROD, new information has become available on Tribal seafood consumption rates and exposure durations for Tribal populations. This new information has been considered for the Sediments OU, as detailed in response to Question B in Section 4.2.6 (Hylebos Waterway).

Changes in Land Use. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Remedial Action Objectives. The RAOs from the ROD are still valid for the site.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
Answer: No. There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed and information obtained from the site inspection, the remedy is functioning as intended by the ROD as amended by the ESD because the remedial action was successful in significantly decreasing PAH and metals concentrations in Middle Waterway sediments. In Areas A and B, exceedances of mercury have been identified in five locations during the course of two monitoring events (Years 3 and 4 post-construction) in both the ENR and natural recovery areas. This represents considerable improvement from Year 1, when 45 areas exceeded the cleanup goals. According to the ESD, there is a 10 year timeframe to meet the overall sediment cleanup objectives. Based on the completion of construction activities in Areas A and B in 2004 to early 2005, there is approximately another five years remaining to determine if the remedy has been successful. In the interim, sediment concentrations will continue to be monitored and the need for further remedial action will be assessed.

In Area C, the SMU 51a backfill and the SMU 51b thin-layer capping are performing as anticipated. There is possible recontamination of surface sediments due to erosion and large burrowing organisms bringing the underlying, native sediments to the surface. Based on this, the remedy may be impacted; however, further evaluation is needed.

There have been no promulgated changes in the ARARs, standards or To Be Considered, only non-promulgated changes to the AET database from which the SQOs were derived. There is no other information that calls into question the protectiveness of the remedy.

4.5.7 Issues

This section identifies issues that need to be addressed that may either currently, or in the future, affect protectiveness of the sediment remedies.

Table 10. Middle Waterway Issues of the 2009 Five-Year Review

Issue	Affects Protectiveness? (Y or N)	
	Current	Future
Possible recontamination of surface sediments due to erosion and large burrowing organisms bringing the underlying, native sediments to the surface in Area C. Drainage from the Mylet property down-cutting such that the underlying tideflat and wood debris are exposed in Area C.	N	Y
Ineffectiveness of grade stake survey due to stakes missing during survey monitoring in Area C.	N	Y
SQO exceedances for mercury in Areas A and B in natural recovery areas where SQOs are expected to be met within a ten year timeframe.	N	Y
SQO exceedance of bis(2-ethylhexyl)phthalate, with elevated (but below SQO) concentrations of mercury and PAH found in Area C sediments near the Mylet roof drain.	N	Y
Beached logs have been a problem primarily for the recovering pickleweed and other vegetation at the upper tidal levels at the head of the waterway due to smothering or sediment gouging.	N	Y
Institutional controls have not been fully implemented.	N	Y
Year 5 monitoring results from summer of 2009 have not been included in this review and need to be evaluated to further assess status of sediments in the waterway.	N	Y

4.5.8 Recommendations and Follow-up Actions

Table 11 lists recommendations and follow-up actions for each issue identified in Table 10.

Table 11. Middle Waterway Recommended Follow-Up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Planned Completion Date
Possible recontamination of surface sediments due to erosion and large burrowing organisms bringing the underlying, native sediments to the surface in Area C. Drainage from the Mylet property down-cutting such that the underlying tideflat and wood debris are exposed in Area C.	Include chemical monitoring of burrows within drainage channels or other erosion features in future monitoring events. Evaluate options to prevent further erosion.	DNR	EPA	March 31, 2010
Ineffectiveness of grade stake survey due to stakes missing during survey monitoring in Area C.	Replace with periodic topographic surveys to map the long-term effects of the outfall on the tideflat and remedy performance.	DNR	EPA	June 30, 2010

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Planned Completion Date
SQO exceedances for mercury in Areas A and B in NR areas where SQOs are expected to be met within a ten year timeframe.	Continue monitoring and evaluate Year 5 data to evaluate potential causes of SQO exceedances in Areas A and B.	MWAC	EPA	March 31, 2010
SQO exceedance of bis(2-ethylhexyl)phthalate, with elevated (but below SQO) concentrations of mercury and PAH found in Area C sediments near the Mylet roof drain.	Include chemical monitoring of burrows within drainage channels or other erosion features in future monitoring events. Evaluate options to prevent further erosion.	DNR	EPA	March 31, 2010
Beached logs have been a problem primarily for the recovering pickleweed and other vegetation at the upper tidal levels at the head of the waterway due to smothering or sediment gouging.	Develop a Memorandum of Understanding with Simpson. Also evaluate the possibility of installing a breakwater to replace the protective function of the former piling field.	DNR	EPA	June 30, 2010
Institutional controls have not been fully implemented.	Conduct an IC study; follow up with the USCG about status of final RNA; verify that easements have been executed and recorded with Pierce County.	MWAC, DNR	EPA	June 30, 2010
Year 5 monitoring results from summer of 2009 have not been included in this review and need to be evaluated to further assess status of sediments in the waterway.	Evaluate Year 5 data; discuss options and potential need for additional remedial action.	MWAC, DNR	EPA	March 31, 2010

4.5.9 Protectiveness Statement

The remedial action in Middle Waterway has been completed, the remedy is currently protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled. In order for the remedy to remain protective in the long-term, the Sediment Quality Objectives need to be met according to the timeframes established in the Middle Waterway ESDs, or any exceedances need to be shown to be biologically insignificant in all ENR and natural recovery areas, and ICs must be fully implemented.

4.6 Olympic View Resource Area

Five-Year Review Summary Form – Olympic View Resource Area

Issues: None.

Recommendations and Follow-up Actions: None.

Protectiveness Statement(s):

The remedy at the Olympic View Resource Area is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled.

Other Comments: None.

4.6.1 Background

The Olympic View Resource Area (OVRA) is offshore of the peninsula between the Thea Foss and Middle Waterways (Figure 4-12). The OVRA site (Figure 4-13) was not identified as a problem area in the CB/NT ROD, but sediment contamination was identified in 1998. Pursuant to an EPA AOC, the City performed a non-time-critical removal action to address approximately 3 acres of contaminated marine sediments at OVRA. EPA's Action Memorandum was signed in July 2001.

The primary contaminant of concern (COC) found in sediments at the OVRA site was polychlorinated dibenzo-p-dioxins and dibenzofurans (hereinafter referred to as dioxins). Sediments contaminated with certain metals (arsenic, copper, mercury, and zinc), PCBs, and PAHs were more localized and did not exhibit the broader distribution shown for dioxin-contaminated sediments. The CB/NT SQOs were used as cleanup standards for OVRA, as well as a site-specific sediment quality criterion of 20 parts per trillion (ppt) Toxicity Equivalent Quotient (TEQ) dioxins.[7] TEQ is the expression of toxicity based on the overall toxicity of specific congeners of a multiple congener containing compound.

4.6.2 Site Chronology

Key dates for Olympic View Resource Area actions are as follows. Section 4.6.3 provides a description of the actions.

July 2001	Action Memorandum to implement non-time-critical removal.
July 2001	EPA Action Memorandum.
July 2001	EPA/City AOC for removal action.
Oct 2002	Construction complete.
Aug 2003	Long-term Monitoring and Reporting Plan approved.

7 As set forth in the Action Memorandum for OVRA, the sediment quality criterion of 20 ppt TEQ dioxins will ensure that the average remaining concentration at the OVRA will not exceed the site-specific background concentration of 7.4 ppt TEQ dioxins. This SQO and the background approach used to derive it are not necessarily applicable to other Superfund sites or problem areas identified in the CB/NT ROD.

Fall 2003	Perform Year 1 physical and chemical monitoring.
Apr 2004	Final Year 1 Annual Monitoring Report.
Apr 2004	EPA approval of Year 1 Annual Monitoring Report.
Nov 2004	Final Year 2 Annual Monitoring Report.
Dec 2004	EPA approval of Year 2 Annual Monitoring Report.
Feb 2006	Final Year 3 Annual Monitoring Report.
Mar 2006	EPA approval of Year 3 Annual Monitoring Report.
Sept 2006	Final Year 4 Annual Monitoring Report.
Sept 2006	EPA approval of Year 4 Annual Monitoring Report.
Oct 2007	Final Year 5 Annual Monitoring Report
Oct 2007	EPA approval of Year 5 Annual Monitoring Report
2008	OVRA revised Photopoint Map
Aug 2008	Annual Qualitative Monitoring Report Form/Photos
Aug 2009	Annual Qualitative Ground Survey Form/Photos

4.6.3 Remedial Actions

Remedy Selection

Remedy selection for the CB/NT Sediments OU is described in Section 4.1.

Remedy Implementation (Sources)

Past releases by the former Puget Sound Plywood Company are considered to be the primary source of the most significant contaminants found on the site. The plant operation historically discharged stormwater and process wastewater directly in Commencement Bay. Disposal of other solid and contaminated wastes from the facility is believed to have occurred in the intertidal and subtidal layer within the OVRA. Investigation by Ecology has resulted in a determination that there is no ongoing source of contamination to the site from the upland property adjacent to the OVRA.

Remedial Action (Sediments)

The primary removal action objective for the OVRA was to:

> Significantly reduce the potential risk to human health and/or marine ecological receptors resulting from potential exposure to contaminants present in sediments in the project area by removing and disposing of the contaminated sediment at an acceptable disposal site, and/or capping contaminated sediments in place in the project area.

The elements of the removal action for the OVRA were:

- Removal of contaminated sediments with disposal at an off-site upland facility, followed by capping or backfilling of remaining sediments (intertidal; Areas A through D) and capping of contaminated sediments (subtidal; Area E), for a total of 1.3 capped acres.
- Achievement of a sitewide dioxin concentration less than background.
- Removal of debris and pilings.
- Sediment re-sampling of one station during design.
- Implementation of institutional controls.
- Perform long-term monitoring.

The City developed a cleanup plan and design documents. The cleanup project occurred in 2002 over approximately 2.3 acres. Approximately 600 wooden piles and 11,438 tons of contaminated sediment and debris were removed from the nearshore area and disposed of in an off-site upland landfill. Approximately one acre of marine sediments was capped with clean material. EPA approved the Removal Action Completion Report in March 2003, agreeing that the objectives of the removal action were achieved, including:

- Removal or long-term isolation of chemical materials from the environment.
- Elimination or significant reduction of potential human health and environmental risks.

Post-Construction Monitoring/Operation and Maintenance

In 2003, EPA approved the Final Long-term Monitoring and Reporting Plan (LMRP) for the OVRA. The goals of the long-term monitoring program for the OVRA are to ensure that the selected cleanup action continues to be protective of human health and the environment. The specific objectives of the LMRP are to ensure that:

- The sediment cap continues to isolate toxic concentrations of previously identified chemicals of concern (COCs) in underlying sediments from marine biota and other biological receptors.
- The sediment cap is not recontaminated with COCs from underlying sediments.

The LMRP describes the physical integrity monitoring (elevation surveys and visual inspections) and sediment chemical monitoring, and the associated performance standards that apply to the site. The LMRP also details the process for contingency planning and response in the event that performance standards are not met.

In 2003 (Year 1), the first long-term monitoring effort was completed, and EPA approved the final report in 2004. Physical integrity monitoring (i.e., conventional and bathymetric transect surveys results and visual inspections) showed that erosion is not occurring to an extent that would compromise the ability of the cap to physically isolate contaminated sediments from environmental receptors. Sediment quality monitoring (i.e., surface chemistry results) showed

that contaminants are not moving upward to the top of the cap via diffusion or other transport mechanisms. None of the performance standards for physical or chemical monitoring results were exceeded.

In 2003, some of the early warning values for physical integrity monitoring were exceeded at Transect 1, which crosses the capped Area B. In response, EPA required the City to resurvey Transect 1 in April 2004 (rather than waiting until 2005, when the next survey was scheduled). EPA also required the City to establish a new transect (Transect 0) approximately 50 ft from Transect 1, which would provide baseline data that could be used in 2005 to provide more comprehensive coverage of the area of the cap where the erosion was observed. These actions were implemented, as described below.

In 2004 (Year 2), visual inspections of the sediment cap were completed in April and August, a new transect near capped Area B was surveyed in April (Transect 0; baseline data collected for future comparisons), and Transect 1 near capped Area B was resurveyed in April. The 2004 results were submitted on October 28, 2004, and approved as final by EPA in December 2004. No performance standards were exceeded. Results for Transect 1 showed that one of four stations exceeded the early warning trigger, but that single station did not exceed the performance standard for Area B. Using the final as-built as a baseline, it is noted that the majority of the loss occurred in Year 1 (loss of -0.9 ft) as compared to Year 2 (loss of an additional -0.1 ft).

Long-term monitoring continued in 2005 (Year 3), 2006 (Year 4), and 2007 (Year 5). Physical survey monitoring results show no exceedance of the Performance Standards, and no exceedances of the Early Warning Values, for the sediment cap (i.e., cap thickness has been maintained). Visual inspections show that the erosion protection material over the sediment cap appears to have remained stable. Therefore, the removal action has been successful, to date, in the physical isolation of contaminated sediments from environmental receptors. Surface sediment quality monitoring results show that none of the chemical analytes (metals, PCBs, dioxins/furans) have exceeded the Early Warning Values or the Performance Standards. Therefore, sediment quality monitoring has confirmed that contaminants are not moving upward to the top of the cap via diffusion or other transport mechanisms.

In summary, five years of monitoring results have confirmed the continued success of the removal action at the OVRA. Results suggest that no contingency actions are required. Per the LMRP, Year 5 represents the final planned monitoring event. The five years of physical integrity and surface sediment quality monitoring data have consistently shown that the sediment cap has isolated toxic concentrations previously identified COCs in underlying sediments from marine biota and other biological receptors; and that it has not recontaminated with COCs from underlying sediments. In Year 5 (2007), sediment results showed that all chemicals were below sediment quality criteria – metal concentrations (arsenic, copper, mercury, lead, and zinc) were significantly less than sediment quality criteria; PCBs were undetected; and, dioxin TEQs ranged from 0.7 to 2.6 ppt, substantially less than the sediment quality criterion of 20 ppt TEQ dioxins and lower than the site-specific background concentration of 7.4 ppt TEQ dioxins.

At this time, no additional long-term monitoring is proposed, but the City will continue to implement annual visual inspections with subsequent electronic mail reports to EPA (see City of

Tacoma 2008 and 2009 forms/photos). After reviewing the Year 5 report submitted by the City of Tacoma, CHB provided a letter (November 2007) to EPA that stated the following: "CHB concludes that the performance criteria for the Olympic View site have been met in Year 5 and no contingency actions are required at this time."

In 2007, the DNR directed construction of an intertidal habitat restoration project referred to as the Olympic View Triangle. This project was located south and west of Area B of the Olympic View Resource Area. The City of Tacoma and EPA were given the opportunity to comment and provide oversight of the project, which was completed in July 2007. There is no information that the project adversely affected the OVRA site. Documents for this project are in the Section 29.1.12.3 of the site file.

4.6.4 Progress since the Last Five-Year Review

Results from the OMMP activities are discussed in the previous Section 4.6.3, Post-Construction Monitoring/O&M.

Previous Protectiveness Statement

The protectiveness statement in the last Five-Year Review (2004) stated: "Because the remedial action is complete and protective, the site is protective of human health and the environment."

Status of Recommendations

There were no recommendations made for Olympic View Resource Area in the previous Five-Year Review (2004).

4.6.5 Five-Year Review Process

Administrative Components

The Commencement Bay Nearshore/Tideflats Superfund Site FYR team was lead by Nancy Harney, Karen Keeley, Tamara Langton, Kira Lynch, Kevin Rochlin, and Jonathan Williams, the EPA Remedial Project Managers (RPMs), Region 10. Emile Pitre and Jeffrey Powers, both with the USACE, Seattle District, assisted with the review as representatives of the support agency.

By February 2009, the review team had been formed, and had established the review schedule and its major components including:

- Document Collection and Review.
- Data Assessment/Analysis.
- Site Inspection.
- Interviews and Community Notification and Involvement.
- FYR Report Development and Review.

The FYR has a statutory completion date of December 29, 2009.

Community Involvement

EPA sent a postcard to stakeholders and neighbors on the CB/NT project mailing list (approximately 1,440 addressees) in February to notify them of the five-year review process. After checking in with several members of the community, some of them had not yet received the information. We then mailed a second postcard on March 19, 2009 to ensure that everyone had an opportunity to provide information to EPA. In addition, a display advertisement ran on page B3 of the Tacoma News Tribune Newspaper on February 6, 2009.

Interviews were completed with nearby property owners and interested parties. The purpose of the interviews was to identify issues and concerns related to the implementation and on-going operation of the site remedy.

Document Review

A review of reports pertinent to this Five-Year Review was conducted by the review team. The types of documents reviewed included long-term monitoring reports provided by the City to EPA.

With regards to institutional controls, the objective of the OVRA site institutional controls is to prohibit activities that would disturb the capped areas of the site. These controls were developed based on reasonably expected future uses of the site for non-commercial purposes. The City will continue to maintain site access and related institutional controls. These controls are detailed in Section 8 of the LMRP and in the 2004 FYR for the CB/NT Site.

Revisions and updates include the following:

- DNR Environmental Reserve - In 2000, OVRA was established as an environmental reserve by DNR under Revised Code of Washington (RCW) 79.68.060. In 2003, the Commissioner of Public Lands rescinded that order, and then invoked a new order in May 2004 that withdraws the OVRA project area from leasing under RCW 79.90.460. This withdrawal is intended to protect this area from further commercial use and potential development or commercial leasing. A copy of this document is provided in Appendix E of the Year 2 Annual Monitoring Report for the OVRA.
- DNR Aquatic Lands Lease Amendment – In 2005, Lease No. 22-A02787 (originally entered on May 1, 2002), between the City of Tacoma and DNR, was amended (effective date October 15, 2005; signature date December 12, 2005 and January 4, 2006). A copy of this document is in the OVRA site file.
- City of Tacoma, Government Made Easy (govME) website. The City of Tacoma has added information about the OVRA site to its govME website (http://wspwit01.ci.tacoma.wa.us/govME/Admin/Inter/StartPage/default.aspx) , which allows users to see locations of cleanup projects in relation to tax parcel numbers, as well as many other layers.
- Public Access, Signage, and Marker Buoys - Signs were placed at OVRA in January 2004. The signs describe the cleanup action, show a map of the capped areas, and provide contact information.

- The National Oceanic and Atmospheric Administration has summarized information for the Olympic View Resource Area at this link: http://www.cbrestoration.noaa.gov/olympic_view.html

Data Review and Evaluation

Results from the long-term monitoring activities are discussed in the previous Section 4.6.3, Post-Construction Monitoring/O&M.

Site Inspection

Site inspections have occurred annually. No issues were identified.

Interviews

Interviews were performed by telephone for the overall CB/NT site. Parties identified for interviews included:

- Leslie Ann Rose with CHB.

The following recommendations and suggestions were made:

- Establish a system to alert EPA when there is a planned disturbance of sediments or soils within operable units. The sites can be entered into the City of Tacoma land-use database to notify EPA when a person applies for a land-use permit within the operable units.
- To assign one EPA RPM for all operable units post-remediation.

4.6.6 Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?
Answer: Yes.

The remedial action is complete, five years of long-term monitoring is complete, and all results show that performance standards were met. Institutional controls are in place to address all areas of site-related constituents that are at levels that do not allow for unrestricted use/unrestricted exposure. Institutional controls are properly implemented and effective in preventing exposure and protecting the remedy.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?
Answer: Yes.

Changes in Standards and To Be Considered. Applicable or relevant and appropriate requirements (ARARs) cited in the ROD were reviewed to evaluate changes in the ARARs since the last five-year review. There have been no changes in regulatory standards since the first five-year review.

Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics. The Action Memorandum described current and future land uses and identified likely exposure pathways; the descriptions are accurate for the site conditions at the time of this review.

Since the 1989 CB/NT ROD, new information has become available on Tribal seafood consumption rates and exposure durations for Tribal populations. This new information has been considered for the Sediments OU, as detailed in response to Question B in Section 4.2.6 (Hylebos Waterway).

Changes in Land Use. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Remedial Action Objectives. The RAOs from the Action Memorandum are still valid for the site.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
Answer: No.

There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed and information obtained from the site inspection, the remedy is functioning as intended by the Action Memorandum. There have been no changes in the ARARs, standards or To Be Considered that should affect the protectiveness of the remedy. The remedy is still protective of human health and the environment. There is no other information that calls into question the protectiveness of the remedy.

4.6.7 Issues

This section addresses issues that, either currently or in the future, prevent the remedial action from being protective.

Table 12. Olympic View Resource Area Issues of the 2009 Five-Year Review

Issue	Affects Protectiveness? (Y or N)	
	Current	Future
None.		

4.6.8 Recommendations and Follow-up Actions

Table 13 lists recommendations and follow-up actions for each issue identified in Table 12.

Table 13. Olympic View Resource Area Recommended Follow-Up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Planned Completion Date
None.				

4.6.9 Protectiveness Statement

The remedy at the Olympic View Resource Area is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled.

4.7 Thea Foss and Wheeler-Osgood Waterways

Five-Year Review Summary Form – Thea Foss and Wheeler-Osgood Waterways

Issues:

Source control does not appear adequate to prevent recontamination.

Recommendations and Follow-up Actions:

Continue to monitor and evaluate sources of phthalates and PAHs to sediments.

Protectiveness Statement(s):

The remedy at the Thea Foss and Wheeler-Osgood Waterways currently protects human health and the environment because the sediment remedial action significantly reduced sediment concentrations and most of the required institutional controls are in place to protect the integrity of the sediment cap. However, in order for the remedy to be protective in the long-term, additional source control activities need to be identified and implemented to reduce the extent of recontamination in the waterway and the USCG institutional control needs to be completed to help protect the long-term integrity of the sediment cap.

Other Comments: None.

4.7.1 Background

The Thea Foss Waterway is the westernmost waterway in Commencement Bay, and is adjacent to the downtown core of the city of Tacoma. This waterway extends north to south and makes up about 1.5 miles of downtown shoreline (110 acres) for the City. The Wheeler-Osgood Waterway is approximately 0.3 miles long, runs east to west, entering the Thea Foss Waterway approximately halfway down the east shoreline just south of the 11th Avenue Bridge and north of J.M. Martinac Shipbuilding. See figures 4-11 and 4-12. The land use along the waterways was primarily industrial dating from the early 1890s until the 1980s.

In the past 25 years, the City and other entities have worked to enhance public access and create green spaces along the Thea Foss Waterway. A significant urban renewal project is underway along the waterway. Marinas have been upgraded and new development has occurred, such as the Tacoma Glass Museum, a renovated Albers Mill, and Thea's Landing condominiums. There

remain active, commercial businesses along the waterway, such as, marinas, J.M. Martinac, Johnny's Restaurant and Johnny's Seafood, and Colonial Fruit and Produce. The majority of the submerged lands of the Thea Foss Waterway are state-owned aquatic lands, managed by DNR. The Wheeler-Osgood Waterway is privately owned.

Contaminants found at elevated levels in the Thea Foss and Wheeler-Osgood Waterways include zinc, lead, mercury, cadmium, copper, nickel, PAHs, 2-methylphenol, 4-methylphenol, bis[2-ethylhexyl] phthalate (BEP), butyl benzene phthalate, and PCBs. In addition to these contaminants, non-aqueous phase liquid (NAPL) seeps have been found at the head of the Thea Foss Waterway.

4.7.2 Site Chronology

Key dates for Thea Foss and Wheeler-Osgood Waterway actions are presented in the chronology below. Section 4.7.3 provides a description of the actions.

Mar 1994	City of Tacoma signed an AOC for pre-remedial and remedial design activities on the Thea Foss and Wheeler-Osgood Waterways cleanup.
1996	Department of Ecology discovered that a French drain (termed the "DA-1 Line") installed beneath A-street in 1986, as part of the I-705 construction, contained coal tar derived material and was connected to the Twin 96-inch outfalls at the Head of Thea Foss Waterway. Initial remedial actions appear to have reduced the discharge of coal tar constituents (PAHs) to the waterway.
Aug 2000	ESD identified the selected remedy for the Thea Foss, Wheeler-Osgood and Hylebos Waterways.
June 2002	Special Notice Letters were sent to 71 PRPs.
Nov 2002	City conducted six cleanup actions under a UAO.
Dec 2002 - May 2003	Department of Ecology remediated west bank and upland coal tar releases associated with the Standard Chemical site.
May 2003	CDs for the City and Utilities were entered into Federal court. EPA agreed to two separate CDs for the City and the parties known as the "Utilities." Cleanup of the entire waterway would be completed but it was divided into two work zones at 70+10, just north of the State Route (SR) 509 bridge.
June 2003	City hired Manson Construction Company as its RA contractor. Commenced work on RA related infrastructure at Simpson Timber Company.
2003	After alternative stormwater drainage actions were completed, the DA-1 line was permanently cut-off from the Twin 96-inch discharge pipes.
July 2003	Utilities' remedial design completed.
Sept 2003	EPA approved the Utilities' 100 percent Design Analysis Report and start of remedial action activities.

Mar 2004	Biological Opinion from NOAA that no adverse effects would occur from this project obtained for City's RA.
Nov 2003	EPA approved final RD for the City.
Feb 2004	Utilities' in-water remedial action activities completed.
July 2004	Utilities' Year 0 OMMP monitoring activities completed.
Sept 2004	ESD identified a temporary storage area for material dredged from the St. Paul CDF, in-water alternatives for capping material, clarification of mitigation projects, volume of dredge material, project costs and project institutional controls.
Sept 2004	Recontamination of the sediment surface on top of the Utilities' cap discovered. The cause of the recontamination was dredging of contaminated sediment on the north side of the Utilities' work area. This triggered more frequent observations than anticipated by the EPA-approved OMMP. Physical observations made in September, and December 2004, and April 2005.
May 2005	Utilities' Year 1 OMMP monitoring activities completed.
Dec 2005	Additional cap material placed in the northern Section of the Head of Thea Foss due to recontamination of the Utilities' cap.
Feb 2006	City's in-water remedial action activities completed.
June 2006	Utilities' Year 2 OMMP monitoring activities completed.
Oct 2006	City's Year 0 OMMP monitoring activities completed.
Jan - Feb 2007	Utilities' Year 2 supplemental OMMP monitoring activities completed. Inspections performed following a rainfall event that exceeded the 100-year, 24-hour design of the scour protection apron.
May 2007	Utilities' Year 3 OMMP monitoring activities completed.
July 2007	City's Year 1 OMMP Habitat Mitigation Area monitoring activities completed.
Dec 2007	City's Year 1 OMMP monitoring activities completed.
Aug 2008	Utilities' Year 4 OMMP monitoring activities completed.
June 2008	City's Year 2 OMMP monitoring activities completed for sediment and cap performance and early warning monitoring preliminary findings.
Dec 2008	City's Year 2 OMMP monitoring activities completed.

4.7.3 Remedial Actions

Remedy Selection

Remedy selection for the CB/NT Sediments OU is described in Section 4.1.

Remedy Implementation (Sources)

Overall, the ROD identified three separate problem areas for this waterway, and Milestone Reports were issued over the time-period between 1992 and 2003, with separate Source Control Completion Reports for each problem area (May 28, 1997, for Mouth of Foss; June 16, 2000, for Wheeler-Osgood; and June 30, 2003, for Head of Foss). Overall, Ecology initially identified the following "major" sources to these problem areas:

- Municipal storm drain 254 (Wheeler-Osgood).
- "D" Street Petroleum (Mouth of Foss).
- Tacoma Coal Gasification (Head of Foss).
- J. M. Martinac (Head of Foss).
- Municipal storm drains 237A, 237B, 230, 235, and 245/248 (Head of Foss).

As the result of sediment investigation and upland source investigations, the relative priorities of problem chemicals identified and prioritized in the 1989 ROD shifted, particularly at the Head of Thea Foss. For instance, ongoing sources of metals were discovered to be small in comparison to historic discharges and depositions of metals. This discovery, combined with assessments of waterway dynamics and source loading, made metals less of a source control priority than PAHs and phthalates for preventing and reducing recontamination potential.

Investigations also identified the source of coal tar derived materials present in waterway sediments was likely the Standard Chemical Company that operated on the west bank of the waterway from approximately 1915 to 1923. Historical records indicated that this company acquired coal tar from manufactured gas plants throughout the Pacific NW and processed this material into products such as creosote. The DA-1 line discharges of coal tar derived material also contributed to PAH contamination of waterway sediments.

The City has implemented significant enhancements for its stormwater program to prevent recontamination. This includes: enhanced monitoring of stormwater in major drains, inspections, and public education. In addition to the City's stormwater source control efforts, control of other sources outside the City's jurisdiction must be coordinated by other Federal, state, and local authorities. Reductions of air and marina pollution are expected through Ecology's Air Program and through the Marina Source Control Program. Reductions in air pollution will decrease the direct loads from atmospheric fallout to the surface of the waterway and will decrease the pollutant loads washed off upland surfaces. Upland and in-water remedial actions implemented by Ecology and the Utilities in 2003 and 2004 were directed at controlling tar seeps in the head of the waterway.

In 1998, the City began monitoring stormwater solids in the major drains and in 2001 began a comprehensive sampling program for whole water effluent and accumulated solids. This program was approved under an AOC Addendum and also included in the CD as part of the long-term monitoring of the site. Whole water is analyzed for selected semi-volatiles (PAHs and phthalates), selected metals (lead, mercury and zinc), hardness, pH and total suspended solids and sediment samples are analyzed for the same constituents, plus total solids, TOC,

Pesticides/PCBs, NWTPH-Dx and grain size. The City samples 10 storms per year per drain as well as dry and wet-weather base flows. Stormwater solids from in-line sediment traps are removed annually from August through March or April, depending on seasonal rainfall. Annual reports, including an evaluation of the data relative to continuing source control efforts are prepared for EPA and the Washington State Ecology. Results from the monitoring of sediments and effluent discharges are used first as indicators of source control effectiveness from drain-to-drain and then as guidance to the City about where and how to focus additional investigations and control work.

In 2002-2003, at the Standard Chemical site, Ecology implemented a cleanup for the coal tar and creosote sources on the uplands at the Head of the Thea Foss Waterway to remove the source of NAPL from the west bank at the Head of the Thea Foss Waterway. The resultant removal of contaminated bank and debris in February 2003, included some intertidal, and nearshore subtidal material as well. Ecology coordinated the design and implementation of this source control action with the remedy designed for adjacent sediments in the head of the waterway. Furthermore, by 2003, Ecology working with the City of Tacoma and Washington State Department of Transportation had cut-off the DA-1 Line PAH discharges to the waterway.

In 2001-2004, the City worked with Ecology to identify and address several sources of heavy PAHs to stormwater in drains 245 and 248 along the east side of the waterway. This removal and cleanup project, also known as the "D" Street Pipeline, is being carried out under the State's Model Toxics Control Act (MTCA). Sources of PAHs infiltrating City stormwater include leaking underground storage tanks with various contents and an abandoned railway fuel line dating back to 1910. As Ecology manages the cleanup of sources, the City has also performed capital improvements to the public stormwater lines to prevent infiltration and control the load of PAHs reaching sediments. The City monitors in-line PAH conditions closely and maintains sorbents to capture any PAH infiltration that may occur.

In the course of developing the remedial design for waterway sediments under the AOC, the City identified marinas as a source of contamination to waterway sediment for PAHs and phthalates. The predicted impacts of marinas to sediment were cause for concern because marinas are an important part of the existing waterway as well as critical to the City's plans for downtown redevelopment. The City and the Foss Waterway Development Authority began working with the DNR, Ecology, and marina owners, operators and clients on ways to manage and minimize the predicted impacts of marinas on sediments.

The need for additional source controls is driven by the need to protect post-remediation sediment quality in the waterways from urban contaminants conveyed in municipal stormwater. This is evaluated using multiple lines of evidence: long-term outfall monitoring, computer model predictions, and post-construction sediment quality monitoring. The City continues to evaluate potential sources of concern in the Thea Foss basin through monitoring of stormwater, baseflow, and particulate matter in seven outfalls. City staff responded to 776 spills/complaints in 2008 including conducting investigations as well as providing technical assistance. Information from various source control field activities is entered into a database which continues to expand. The City is continuing to work on the evaluation of possible stormwater treatment options. A final report will be prepared in 2009 to evaluate the performance of this

treatment system. As additional sediment sampling results become available the areas and needs for further source control measures will be identified.

Remedial Action (Sediments)

The Utilities remedial action activities are not discussed in this Section because the activities were completed during the last five-year review. Since the last Five-Year Review, remedial activities were completed by the City during two field seasons, as described below.

City's 2004-2005 Remediation Session

The remediation session activities that were completed in the 2004-2005 construction season are summarized below. For all activities involving removal of contaminated materials, associated surveying and sediment verification sampling were also performed. Hydraulically dredged sediment was transported to the CDF via pipeline and any mechanically dredged sediment was transported by barge. Where appropriate, the location of each activity is given.

- Dredging and partial backfilling, RA 2.
- Dredging. Backfilling was targeted for 2005-2006 season, RA 4.
- Debris removal, RA 5, 6, 17.
- Dredging and capping on western slope, RA 6.
- Dredging, slope excavation and capping, RA 8.
- Dredging (Head of Wheeler Osgood Waterway). Backfilling was targeted for 2005-2006 season, RA 12.
- Substructure removal actions of timbers, float, debris, and asbestos containing materials at Martinac Shipyard in June 2004. The material was transported to landfills via truck, RA 14.
- Underpier capping, RA 14.
- Dredging and slope capping, RA 15.
- Timber pile and float removal followed by dredging, RA 16.
- Initial dredging, RA 18.
- Dredging, slope capping, and grout cap placement. Removal of timber pilings and dolphins was also conducted, RA 19.
- Removal and replacement of docking. Dredging and capping activities were also completed, RA 20.
- Sheetpile wall construction, RA 20.

- Dredging and capping, RA 21, 22.
- Rock buttress construction on the north side of the wall adjacent to the Utilities' work area at the southern end of the project area.
- CDF dredging. Removed materials were placed on the Puyallup River delta.
- CDF Offset and containment berm construction.
- Well decommissioning actions were completed in the Middle Waterway Tideflat Habitat in September 2004. The 100 foot well was cut off at grade and filled with grout.
- Habitat area construction was completed on the point between Johnny's Dock Marina and Foss Landing Marina in September 2004.
- Piling removal and filling in North Beach habitat area.
- Building demolition and soil and sediment sampling at the Middle Waterway Tideflat Habitat.
- Soil characterization at the Puyallup River Side Channel Habitat Site.
- Miscellaneous upland access construction activities.

Generally, work was conducted as designed, with modifications documented in the 2004-2005 Remedial Action Construction report (City of Tacoma, 2005). Water quality requirements were generally met. To accomplish these efforts, a two week extension to the season was requested and received. Data indicated the top of the Utilities' cap was recontaminated at levels above the CB/NT SQOs. A temporary dredging recontamination source was identified in late 2004. The area impacted by the dredging recontamination was capped in December 2005 and the Utilities' OMMP was revised to account for the presence of this contamination. An additional source of recontamination is on-going stormwater outfalls.

City's 2005-2006 Remediation Session

The remediation session activities that were completed in the 2005-2006 construction season are summarized below. For all activities involving removal of contaminated materials, associated surveying and sediment verification sampling were also performed. Unless specified otherwise, dredged sediments were removed using a hydraulic dredge and materials were transported by enclosed barge or pipeline for disposal in the CDF. Where appropriate, the location of each activity is given.

- Slope Rehabilitation consisted of the removal of anthropogenic debris (i.e., concrete, piling, etc.) and/or placement of import material (i.e., armoring, habitat mix, etc.) to stabilize, flatten, and/or provide more suitable habitat, RA 10, 11, 13, 15.
- Natural Recovery occurred in northern portions, RA 5, 6, 7.

- ENR consisted of the placement of a thin layer of channel sand cap material to facilitate natural recovery within 10 years of completion of the remedial action, RA 7.

- Habitat enhancement. This consisted of modifications to existing shoreline areas to enhance habitat development. Activities included constructing a benched area at a specific elevation, modifying the substrate, and/or installing large woody debris and/or plants, RA 8, 20.

- Backfilling, RA 2, 4, 6, 12.

- Channel sand cap placement in following RA areas and sheen source removal area, RA 1A, 6, 7A, 9, 16, 17, 18, 19A, 19B, 20, 21, 22.

- Slope cap placement, RA 1B, 3, 5, 8, 14, 19A, 19B, 20.

- Dredged to clean, RA 5, 6, 16, and 17.

- Grout mat placement. .The mat was placed to confine sediment with chemical concentrations greater than the SQOs. The mat is comprised of one or two six-inch thick layers of concrete, established by injecting grout into a fabric sheath that has been placed over a remedial area, RA 3, 19A, 19B.

- North Beach Habitat was completed in January 2006. Pickleweed and salt grass was planted by the end of May 2006. The final plantings in the Middle were done in July 2006.

- Hylebos Creek Mitigation Site construction was completed in January 2006 with the installation of a prefabricated wooden pedestrian bridge spanning the creek for trail access. Actions leading up to the completion included the excavation of the channel, placement of large woody debris (LWD), the demolition and removal of a pre-existing single lane bridge in Aug 2005, the installation of a silt fence along the east bank after the hillside was cleared and grubbed, and the implementation of erosion control measures including the installation of straw filled "wattles," a biodegradable jute mat, and mulch.

- Middle Waterway Tideflat Habitat construction was completed in February 2006. Concrete debris was removed from the shoreline and broken down in October 2005 before soil excavation began in the tidal areas and dendritic channels. Untreated timber piling and a float were removed as soil excavation progressed. During excavation at the south end of the area, two underground storage tanks containing heavy heating oil were uncovered and removed for offsite disposal. Riparian topsoil along with a biodegradable jute mat and LWD were placed. .An irrigation system was also installed. The final plantings in the Middle Waterway Tideflat Habitat were done in July 2006.

- Puyallup River Side Channel construction was completed in February 2006. Excavation at the southern end began in May 2005 when lead contaminated soil was removed from the area. The levee base was constructed simultaneously as excavation progressed from the north end of the site. Unexploded ordnance were discovered and investigated multiple times during the excavation process, and an Army Explosive Ordnance Disposal team from Ft. Lewis detonated them either on site or offsite. Approximately 12 drums holding grease

containing solvents were discovered, removed, and disposed of along with the surrounding grease impacted soil. Metal debris was also removed upon discovery and placed on the adjacent Tacoma Metals site, awaiting treatment and disposal. A planned and controlled levee breach led to the completion of area construction. The final plantings were completed in March 2006, and hydroseeded in April 2006.

Generally, work was conducted as designed, with modifications documented in the 2005-2006 Remedial Action Construction report. Water quality requirements were generally met. To accomplish these efforts, a two week extension to the season was requested and received. Upon completion of all the cleanup and habitat work, EPA issued a formal written demand for payment of stipulated penalties and the additional mitigation acreage required to comply with the biological opinion. Pursuant to Paragraph 73 of the Consent Decree, the City failed to perform remedial action construction in accordance with the originally-approved schedule, and was therefore liable for stipulated penalties associated with those missed deadlines. The City agreed to perform habitat restoration work instead, which is being overseen by NOAA. In June 2009 the City provided EPA with a detailed draft proposal outlining how the City plans to provide the 0.63 acres of habitat mitigation described above. This mitigation proposal was approved by EPA in 2009.

Post-Construction Monitoring/Operation and Maintenance

City's Area

Following the completion of the City's field activities, the OMMP (City of Tacoma, 2006b) was finalized based on as-built conditions. The monitoring activities completed during this review time frame include Year 0 (2006), Year 1 (2007), and Year 2 (2008). As results of each round are discussed, any modifications are presented in the Data reports or by memo.

Year 0

The activities conducted during Year 0 monitoring are summarized below.

- **Natural Recovery sampling:** No detections were above SQOs except the following.

  1. BEHP was detected at 1.5 times the SQO in the natural recovery area near RA 4.

  2. Pyrene was detected at 1.25 times the SQO in the natural recovery area east of RA 5.

  3. Pyrene, benzo(a)anthracene, and N-nitrosodiphenylamine were detected at concentrations that were at or below 2 times the SQO in the natural recovery area north of RA 12.

  4. BEHP, 1,2-dichlorobenzene, and PCBs were detected at concentrations that were less than 2 times the SQO in the natural recovery area east of RA 12.

  5. BEHP was detected at concentrations that were 2 and 3 times the SQO in the natural recovery area east of RA 16.

  6. Mercury, butylbenzyl phthalate, and PAHs were detected at concentrations that were at or

below 2 times the SQO in the natural recovery area east of RA 16.

- **CDF tidal study:** A 72-hour tidal study was completed to assess tidal effects on groundwater levels in and around the CDF.

  1. The data for shallow wells installed in the containment, offset berms, shallow and intermediate wells west of the CDF indicate a rapid to moderately rapid response in groundwater elevation in response to tidal fluctuations with calculated lag times ranging from 15 to 45 minutes. The change in groundwater elevations ranged from 4 to 7 ft. Two wells installed within the CDF had a limited response to tidal fluctuations with a lag time of 135 to 165 min. The change in groundwater elevations ranged from 3 to 6 in. The information from groundwater responses to tidal fluctuations indicates that the silt and fine sand comprising the dredged fill material placed in the CDF limits the hydraulic connection between groundwater within the CDF and groundwater and surface water surrounding the CDF and the potential transport of contaminants out of the dredged fill material. Shallow and intermediate depth groundwater, downgradient of the dredged sediment placed in the CDF is most likely to be impacted by saltwater washout effects and to transport contaminants from the CDF.

- **Low tide slope cap inspection:** No disturbances to the cap were identified except for the following list below.

  1. Geotextile and metal or foundry slag was present at the surface of the capped area in RA 3. This area was identified as a slope area requiring maintenance.

  2. Piling or debris was present at the surface of the capped area in RA 8. This area was identified as a slope area requiring maintenance.

  3. Two depressions were identified in RA 19A and at the adjacent habitat enforcement area. The depressions will be monitored as part of subsequent inspections. A piling is present at the surface of the existing, adjacent habitat enforcement area. Although the piling is not present within a capped area, this area was identified as a slope area requiring maintenance.

  4. A piling was present at the surface of the capped area in RA 20. This area was identified as a slope area requiring maintenance.

  5. A low tide inspection was performed at Outfall 230 and found fabric blanket and concrete debris at the slope cap surface. Additionally, the armoring of the apron in front of Outfall 230 appeared to have settled or moved down slope.

- **Habitat Survey:** Baseline conditions are discussed below.

  1. **North Beach Habitat:** The qualitative ground survey confirmed that the site was constructed and planted in general accordance with the approved plans. Minor repairs to the goose exclusion grids are needed along with some minor weeding of the area. It was found that some willows were planted farther back from the top of the bank than intended in the plan and it was decided that some additional willow plantings may be necessary to

ensure adequate coverage, along with more distichilis. Erosion on the north beach was identified in late 2006. Additional LWD was placed as an erosion protection measure August 2007 in accordance with discussions with the Washington Department of Fish and Wildlife, NOAA, and Ecology. It appears that the erosion has stabilized, as the vegetation on the containment berm is becoming more established which helps to minimize additional erosion.

2. **Middle Waterway Tideflat Habitat:** Salinity monitoring indicated that the sprinkler system is functioning as designed and that conditions are favorable for establishment of a brackish marsh in the sprinkled zone. The qualitative ground survey confirmed that the site was constructed and planted in general accordance with the approved plans. Minor repairs to the goose exclusion grids are needed and limited weeding was completed in Year 0. There was some bark and other wood debris accumulating within the goose exclusion grid that was removed as needed to prevent impact to the plants.

3. **Puyallup River Side Channel:** Monitoring identified one small area of erosion on the outside of the old levee, but no action was deemed necessary at the time. A small temporary shelter, believed to be a fishing camp, remains on the north half of the old levee. The City has been in contact with Puyallup Tribe representatives on this issue.

4. **Hylebos Creek Mitigation Site:** The qualitative ground survey confirmed that the site was constructed and planted in general accordance with the approved plans. Minor weeding and the repair of one of the LWD anchors are needed at this time.

5. **Johnny's Dock Habitat Enhancement:** Year 0 monitoring included the relocation of 70 tufted hairgrass to a somewhat lower elevation to help the plants establish at an elevation more optimum for growth.

6. **Head of the Thea Foss Shoreline Habitat:** Year 0 maintenance activities included weeding, and repairing goose exclusion grids as well as planting willow stakes harvested from Swan Creek, and planting 238 tufted hairgrass.

7. **SR 509 Esplanade Riparian Habitat:** The sprinkler system had been extended in Year 0 after initial construction was completed to the north and south ends of the planting area. Year 0 maintenance activities also included weeding of the area and planting.

8. **Log Step Habitat Enhancement:** Year 0 maintenance activities included tightening the anchors on the LWD, weeding, and planting 32 tufted hairgrass.

- **Cap Area Chemical Performance:** This monitoring is designed to evaluate the long-term effectiveness of the caps constructed.

  1. All samples with detected chemical concentrations were less than the SQOs.

Year 1

The activities conducted during Year 1 monitoring are summarized below.

- **Quarterly CDF Monitoring:** No seeps, sheens, or other indications of contamination were identified. Stored logs and some ponded water were observed on the surface of the CDF cap. At the containment berm the maximum observed loss of topsoil due to erosion was a height of approximately 3.50 feet. Some riprap is exposed on the upper slope of the beach, but the containment berm does not appear to be compromised. No deficiencies were identified upon inspection of the offset berm and CDF cap.

- **Habitat Survey:** In Year 1, monitoring included qualitative and quantitative ground surveys, photo documentation, elevation monitoring, salinity monitoring for two sites, and salmonid and invertebrate monitoring. The following presents a summary of the observations in year 1 by site:

  1. **North Beach Habitat:** This site meets the performance criteria for juvenile salmonid presence. The qualitative ground survey confirmed that the site was establishing well. Minor repairs to the goose exclusion grids were completed along with some minor weeding of the area and removal of trash and other debris. Based on calculated quantitative vegetation analyses, the site meets the performance criteria for vegetation survival and establishment. The average change in sediment elevation relative to baseline was +0.5 in. This meets the performance standard for this element.

  2. **Middle Waterway Tideflat Habitat:** Salinity monitoring indicated that the sprinkler system is functioning as designed and that conditions are favorable for establishment of a brackish marsh in the sprinkled zone. The site meets the performance criteria for juvenile salmonid presence. The qualitative ground survey confirmed that the site was establishing well. Minor repairs to the goose exclusion grids are needed and limited weeding was completed in Year 1. It was noted that some erosion from seeps and springs in the marsh area was identified, but it was acknowledged as minor and consistent with the amount that would be expected in this setting. There was some bark and other wood debris accumulating within the goose exclusion grid that was removed as needed to prevent impact to the plants. Based on quantitative vegetation analyses, the site meets the performance criteria for vegetation survival and establishment but additional *Carex* sp. were planted to stimulate site development and to ensure the establishment of the habitat area. Four new planting nodes including pickleweed, distichilis, and tufted hairgrass were also constructed to accelerate colonization in accordance with the approved design. The average change in sediment elevation relative to baseline was -0.458 in. This meets the performance standard for this element.

  3. **Puyallup River Side Channel:** This site met the performance criteria for juvenile salmonid presence. Invertebrate monitoring indicated that prey species are also present at the site. The qualitative ground survey confirmed that the site was establishing well. Mulching and minor weeding of the area was completed along with the removal of trash and other debris. Other monitoring activities at this site included photo documentation. Based on the data from this year and calculated quantitative vegetation analyses, the site

did not meet the performance criteria for riparian vegetation establishment. As noted in the Preliminary Finding Memorandum, the transect within the riparian area contains the walking path that is used for access for maintenance activities such as watering and mulching. This is unavoidable since the planting area is approximately 15 ft wide with the walking path in the middle. For the groundcover estimates, this was dealt with by shifting the orientation of the quadrant away from the pathway. Overall, the qualitative evaluation indicated that the plant health and survival were good and there were some species volunteering at the site. Therefore, the City did not recommend additional planting at the time. During the inspection of the elevation stakes it was noted that there had been four inches of sediment erosion in one location, and between 1.5 and 4.5 in of sedimentation at remaining locations. Sediment deposition is anticipated at this site, and therefore there is no performance criteria associated with elevation at this site.

4. **Hylebos Creek Mitigation Site:** Juvenile salmonids were not observed at this site during the early monitoring event in May, but many fish were observed during the late May monitoring event. While a strict interpretation would indicate that this site does not meet the performance criteria for juvenile salmonid presence, it should be considered that this is perhaps an indication that the salmonids used this site later in the migration period due to weather conditions or other variable specific to the creek system. Invertebrate monitoring indicated that prey species are also present at the site. The qualitative ground survey confirmed that the site was establishing well and overall, the site appeared to be in excellent condition. Minor weeding was completed and only the repair of one of the LWD anchors is needed at this time. Based on the qualitative vegetation analyses, the site meets the performance criteria for vegetation survival and establishment but additional alder were placed on the hillside to accelerate development of shading and root establishment for slope stabilization. According to the OMMP, the performance criterion relative to elevation changes at this site indicate that the average elevation change along the centerline transect of the channels must be less than 0.2 ft from as-built elevations. Based upon this criterion, the site does not meet this performance criterion (average change in south lobe relative to as-built elevations was 0.55 ft and in the north lobe was 0.47 ft). However, if the elevations are compared to either the design elevations or the Year 0 elevations, the site does meet the performance criteria. With this additional analysis as well as other habitat information available for the site such as salmonid presence, this issue and any required contingency actions will be further discussed after the site has time to equilibrate.

5. **Johnny's Dock Habitat Enhancement:** The qualitative ground survey in Year 1 confirmed that the site was continuing to establish well and overall, the site appeared to be in excellent condition. Minor repairs to the goose exclusion grids were completed in Year 1.

6. **Head of the Thea Foss Shoreline Habitat:** The qualitative ground survey in Year 1 confirmed that the site was continuing to establish well and that overall, the site appeared to be in very good condition in Year 1. Minor repairs to the goose exclusion grids were completed along with weeding, and trash removal in the area in Year 1.

7. **SR 509 Esplanade Riparian Habitat**: The qualitative ground survey confirmed that the site was generally continuing to establish well in Year 1 monitoring. The sprinkler had not been functioning properly at the time of the inspections, and there was some water stress observed. City Maintenance crews later repaired/maintained the sprinkler system. In Year 1 monitoring, the site appeared to be in fair condition overall, but increased watering was expected to improve the situation. Minor weeding and mulching, along with trash removal were the only maintenance activities completed.

8. **Log Step Habitat Enhancement:** The qualitative ground survey in Year 1 confirmed that the site was continuing to establish well and overall, the site appeared to be in excellent condition. Minor weeding was the only maintenance activity completed in Year 1.

Year 2

The activities conducted in City's area during Year 2 monitoring are summarized below.

- **Natural Recovery sampling:** Natural recovery samples that were collected from sample locations north of the 11th Street Bridge (including RA 5, 6, and 7) have met the performance monitoring criteria specified in the OMMP. The Year 2 natural recovery performance monitoring surface samples (0-10 cm) collected, generally detected chemical concentrations that were less than the SQOs, indicating natural recovery is occurring. Sampling will continue in Year 4 to confirm trends observed. These results, in conjunction with the early warning samples discussed below, will be used to determine additional sampling requirements. The following exceedances of SQOs in natural recovery areas were observed:

  1. Natural recovery station NR-11 located north of the 11th Street Bridge had a di(2-ethylhexyl)phthalate (DEHP) concentration exceeding the SQO in the Year 2 natural recovery performance surface sample. However, the DEHP concentration at this natural recovery location has consistently dropped over time from the sample collected during the RI, to the Year 2 sample. Additionally, the co-located Year 2 early warning sample had a DEHP concentration less than the concentration detected in the Year 2 natural recovery performance monitoring sample, indicating that the DEHP concentration is likely to continue to decrease in the future.

  2. Natural recovery station NR-20 (from the Head of Wheeler Osgood) contained DEHP at concentrations greater than the SQO. Additionally, the slope rehabilitation sample collected adjacent to the station also had DEHP detected at a concentration exceeding the SQO.

3. Natural recovery station NR-25 (Delin Dock Marina) contained seven analytes with detected concentrations exceeding SQOs. Butyl benzyl phthalate and benzyl alcohol in the early warning sample also exceeded the early warning threshold concentrations. In supplemental baseline sampling, Mercury, PAHs, butylbenzyl phthalate, and BEHP were detected at concentrations exceeding the SQOs. The trends in sample concentrations at this station may, in part, be the result of the heterogeneity in the sediment in this natural recovery area.

4. Three Year 2 natural recovery/slope rehabilitation performance monitoring composite samples were collected from the shoreline slopes of the Wheeler-Osgood Waterway. The baseline and Year 2 sample collected from station SR 11 have demonstrated that the southern shoreline of the Wheeler-Osgood Waterway meets performance monitoring criteria and that it has naturally recovered. Future monitoring at station SR 11 is not required as the natural recovery process is complete.

5. At station SR 10, the detected chemical concentrations in the baseline and Year 2 samples had detected concentrations below the SQOs. However, the field duplicate collected at SR 10 during Year 2 had PCBs detected at a concentration exceeding SQOs. The differing PCB concentrations in the parent and duplicate sample from this station are likely the result of the heterogeneity in the sediment in this portion of the waterway and that PCBs were present in a subcomponent of the duplicate sample. The need for additional sampling is being determined by EPA.

6. The detected chemical concentrations in samples collected from station SR 13 located at head of the Wheeler-Osgood Waterway were substantially below the SQO in the baseline and Year 2 performance monitoring samples except for DEHP. The station is located adjacent to City Outfall 254 which has a likely, recent upland source of DEHP identified though the City's stormwater source control program. A sample of sediment was collected by the City from a catch basin at a newer correctional facility in the drainage basin for Outfall 254. DEHP was detected at a concentration exceeding 600,000 µg/kg, as reported in the City's Stormwater Source Control Report in 2006. A new building is located at the facility that has a large membrane roof that may be a source of DEHP to the stormwater catch basin. The City of Tacoma plans to revisit businesses within this outfall drainage basin to evaluate possible DEHP sources. Additionally, the City of Tacoma performed a comprehensive cleaning of the stormwater lines draining to this outfall in 2005 and 2006. This station will be monitored again as part of Year 4 OMMP monitoring.

- **Channel Sand and Slope Cap Areas Sampling:** Capped areas were sampled in accordance with the OMMP. The comparison of baseline and Year 2 performance monitoring samples shows that there has been a general increase in the chemical concentrations in surface samples collected from channel sand cap areas identified above from the baseline monitoring event to Year 2 monitoring. This was expected since the capping material placed during construction was native material from an upland source. However, the chemical concentrations in the Year 2 performance monitoring samples are generally below the SQOs, with the following exceptions:

1. The chemical concentrations in the channel sand cap performance monitoring surface sample located in the western portion of RA 6, adjacent to City of Tacoma Outfall 230, were greater than the SQOs for four SVOCs including benzo(g,h,i)perylene, indeno (1,2,3-cd)pyrene, DEHP, and benzyl alcohol. The corresponding early warning sample also had SQO exceedances for the four SVOCs, plus one additional SVOC, dibenzo(a,h)anthracene. The City continues to monitor sediment and stormwater from Outfall 230. Based on these results, no supplemental monitoring of this area appears warranted at this time. The channel sand cap location in RA 6 will be monitored again as part of Year 4 OMMP monitoring.

2. One slope cap sample from RA 8 had a detected benzyl alcohol concentration greater than the SQO. Elevated benzyl alcohol detections in the Year 2 sediment samples are anomalous relative to previous sampling events. As a result, the City laboratory has conducted further evaluation into these benzyl alcohol detections. A technical memorandum titled, "Evaluation of the detection and extraction methods used for the analysis of benzyl alcohol in Thea Foss Waterway OMMP sediment samples" has been prepared by the City which summarizes the evaluation of several factors that could have potentially resulted in the increased detection of benzyl alcohol in Year 2.

3. The channel sand cap surface sample located at the south end of RA 19A and the Thea Foss Waterway detected concentrations of phenanthrene and DEHP that were greater than the SQOs. The co-located early warning sample had these chemicals and additional SVOCs detected at concentrations greater than the SQOs. This area is likely a depositional area within the Thea Foss Waterway that is a result of installation of the sheet pile wall. Based on these results, no supplemental monitoring of this area appears warranted at this time. The channel sand cap location in RA 19A will be monitored again as part of Year 4 OMMP monitoring.

- **Baseline CDF Monitoring:** Baseline monitoring for the CDF was completed during Years 1 and 2. With completion of these two years of quarterly baseline monitoring, a Baseline Water Quality Conditions Report was prepared and submitted to EPA for review on March 16, 2009. Following EPA's approval of the Baseline Water Quality Conditions Report and the groundwater baseline conditions, the City will submit a Performance Monitoring Plan for the CDF for review and approval that will include proposals for both long-term water quality monitoring and cap and berm monitoring.

- **Low tide slope cap inspection:** The following are anomalies observed during the low-tide cap inspections:

1. Isolated pilings at approximately -3 feet MLLW in RA 8 were observed. The presence of these pilings are being evaluated to determine whether any repair actions are needed to remove or confine several pilings that are located at the surface of the capped area. A separate memorandum evaluating options for this area is being prepared for submittal to EPA for review.

2. Small depressions were present at the surface of the cap in RA 8 (monitoring interval 2), RA 14 (monitoring interval 3), RA 19A (monitoring interval 2), and RA 20 (monitoring

interval 1). These depressions will be monitored as part of subsequent low tide slope cap inspections to identify whether additional settlement or material movement has occurred in these areas.

3. A float with a shed was observed to be grounded on the surface of the slope cap at Johnny's Dock Marina. Following notification from the City in July 2008, Johnny's Dock Marina moved the float so that it is no longer grounded; this was confirmed in an inspection by the City.

4. Based on the Year 2 hydrographic survey work, two types of areas have been identified that will be further evaluated in the Year 4 hydrographic survey analysis to identify whether changes in the surface elevation are occurring. These areas included: 1) those that exhibit decreases in the cap surface elevation from baseline to Year 2 that are greater than six inches but less than one foot; and 2) those that exhibit decreases in the cap surface elevation from baseline to Year 2 that are greater than one foot but are small localized, and non-contiguous. Areas fitting the type 1 description exist in RA 17, RA 19A, and RA 19B and are contiguous. Areas described as type 2 exist in RA 1, RA 3, and RA 8. These areas will be further evaluated in the Year 4 hydrographic survey analysis.

- **Early Warning Monitoring:** The following observations are noted.

1. The comparison for Year 2 channel sand cap performance monitoring surface samples to the co-located early warning samples at stations 01, 26, and 29 generally indicated comparable, but slightly higher concentrations in the early warning samples. Early warning samples will continue to be collected to evaluate changes in sources over time.

2. The results for channel sand cap performance and early warning samples for stations 27 and 30 had all detected concentrations less than SQOs, but had higher concentrations for several analytes in the early warning samples when compared to the channel sand cap performance samples.

3. Samples for stations 31 and 33 located in the southern portion of the Thea Foss Waterway had detected concentrations of DEHP that were greater than the SQO in the early warning samples, but not in the channel sand cap performance samples. This may indicate that recontamination is from top-down sources. DEHP concentrations in the early warning samples did not exceed the early warning threshold concentration. Butyl benzyl phthalate was detected below the SQO in both early warning and channel sand cap performance samples at station 31; however the butyl benzyl phthalate concentration was higher in the early warning sample when compared to the channel sand cap performance sample. The remaining detected concentrations in both the early warning and performance samples from these stations were well below SQOs.

4. Channel sand cap performance and early warning samples from the remaining two channel sand cap sample stations 23 and 32 had chemical concentrations for some constituents that were greater than the SQOs. Benzo(g,h,i)perylene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, DEHP, and benzyl alcohol were

detected at concentrations at or greater than the SQOs in the channel sand cap performance monitoring sample and early warning sample at station 23. Benzyl alcohol was detected at a concentration of 1.78 times the SQO in the channel sand cap performance sample but was only 1.07 times the SQO in the co-located early warning sample. Both dibenzo(a,h)anthracene and benzyl alcohol concentrations in early warning sample at station 23 exceed the early warning threshold concentrations set forth in the OMMP.

5. Channel sand cap performance sample at station 32 had phenanthrene and DEHP at concentrations greater than the SQOs, while the early warning sample had acenapthene, anthracene, fluorine, phenanthrene, total low molecular weight polynuclear aromatic hydrocarbons (LPAHs), pyrene, and DEHP at concentrations greater than the SQOs. The DEHP concentration in the early warning sample at station 32 also exceeded the threshold concentration.

6. The detected concentrations for Year 2 natural recovery, ENR performance monitoring surface samples and co-located early warning samples at stations 06, 07, 08, 09, 10, 16, and 17 were less than the SQOs. The overall, relatively minor variability in concentrations and trends between early warning and natural recovery performance monitoring samples could be the result of the heterogeneity of sediment at the sample locations or even analytical variability, but indicate that the chemical concentrations have generally stabilized at concentrations less than the SQOs.

7. The DEHP concentration was at the SQO in the performance monitoring sample from station NR-12 collected as part of Year 2 monitoring. DEHP was detected in the collocated Year 2 early warning sample at a concentration greater than the SQO. The remaining detected concentrations in the sample pair were well below the SQOs.

8. Chemical concentrations in sample NR-13 and the co-located early warning sample did not exceed the SQOs. However, DEHP was detected in both samples at a concentration at the SQO. Benzyl alcohol was also detected at a concentration at the SQO in the performance monitoring surface sample but was slightly lower in the early warning sample.

9. The results for stations 11 and 20 had detected DEHP concentrations that were greater than the SQOs in both the early warning samples and natural recovery performance samples. The DEHP concentrations in the early warning samples were less than the concentration in the co-located natural recovery performance samples.

10. In early warning sample in NR-19, 12 SVOCs were detected at concentrations greater than SQOs, including 2-metylnaphthalene, acenapthene, anthracene, fluorine, phenanthrene, total LPAH, benzo(a)anthracene, dibenzo(a,h)anthracene, fluoranthene, pyrene, total high molecular weight polynuclear aromatic hydrocarbons (HPAHs), and n-nitrosodiphenylamine. N-nitrosodiphenylamine in the early warning sample also exceeded the threshold concentration set forth in the OMMP. The corresponding natural recovery sample had detections of these 12 SVOCs that were well below the SQO. Detected concentrations in the early warning sample may be the result of heterogeneity in

the sediment in this portion of the Wheeler-Osgood Waterway or associated with a subcomponent of the early warning sample.

11. The detected concentrations of some constituents in both the early warning and natural recovery performance monitoring samples from station NR-25 were greater than the SQOs. Seven analytes, including phenanthrene, fluoranthene, pyrene, total HPAH, butyl benzyl phthalate, DEHP, and total PCBs, were detected at concentration exceeding the SQOs. The early warning sample in NR-25 had 10 analytes detected at concentrations greater than the SQOs that included six of the seven analytes present in the natural recovery performance sample (i.e., excluding PCBs) and also included anthracene, total LPAH, benzo(a)anthracene, and benzyl alcohol. In general, detected analyte concentrations were higher in the early warning sample when compared to the natural recovery performance sample. In addition, butyl benzyl phthalate and benzyl alcohol concentration in the early warning sample exceed the early warning threshold concentrations.

12. Four early warning samples collected from the dredge to clean areas located in RAs 5 and 6 detected chemical concentrations that did not exceed the SQO criteria. One early warning sample collected from RA 6 detected concentrations of six SVOCs, including DEHP, 2,4-dimethylphenol, benzyl alcohol, hexachlorobenzene, hexachlorobutadiene, and n-nitrosodiphenylamine, that were greater than the SQOs. Six dredging confirmation samples were collected over the course of dredging this area during the remedial action. None of the dredging confirmation samples had SQO exceedances of the six SVOCs and only DEHP and 2,4-dimethylphenol were detected in the dredging confirmation samples. The City is planning to visit businesses to evaluate potential sources of these contaminants. Additionally, the City plans to reevaluate the threshold concentrations for these chemicals. As these were not chemicals of concern in the Thea Foss and Wheeler-Osgood Waterways during the remedial design, threshold concentrations were not modeled and calculated for these chemicals but were simply set at the same concentrations as the SQOs. It is likely that recalculated threshold concentrations for these chemicals would be higher than the SQOs. The early warning sample location will be monitored again as part of Year 4 OMMP monitoring.

- **Sediment Profile Imaging (SPI) Findings:** The benthic habitat classification is the same for the entire area: very fine sand surface over a silt/clay base. Evidence of the gravel cap was seen at depth at a few of the stations, but the sediment surface seen by biological receptors is very similar throughout the entire waterway due to natural depositional processes. All of the remedial areas sampled showed evidence of mature infaunal communities present and benthic ecosystem recovery processes except for the two at the mouth of the waterway closest to Commencement Bay. At these locations, the later successional recolonization of opportunistic Stage 1 assemblages indicates that there is additional organic input to the system through natural depositional processes. The dredge to clean and channel sand cap areas have had enough natural deposition over the final treatment sediment-water interface to allow mature infaunal communities to develop. Channel sand cap materials were detected at some of the locations by SPI technology; however, it is very difficult to discern the interface between recently deposited sediments and the underlying materials exposed by dredging in the dredge to clean areas. No further action is warranted

based on the results of benthic recolonization monitoring performed in Year 2. SPI results do not require verification; therefore, analysis of the archived sediment samples does not appear warranted. Benthic recolonization monitoring will be performed again as part of Year 4 OMMP.

- **Habitat Survey:** Baseline conditions are discussed below.

  1. **North Beach Habitat:** The qualitative ground survey confirmed that overall, the site was establishing well. Five elevation stakes are in place at the site. The average change in sediment elevation relative to baseline was +1.0 inches; this meets the performance standard for this element. After completion of the qualitative site survey in July 2006, some increasing erosion of an area was identified. The City verbally informed EPA about the increasing erosion in August 2006. A site meeting to further evaluate the conditions was conducted on December 7, 2006. The consensus at the meeting was that the movement of material at the site was not unusual, and that it had likely not reached a state of equilibrium. Additional LWD was placed in August 2007 following the approved plan and quarterly photographs were taken at established photo points to track continued movement. The City continued with the scheduled monitoring through 2008. It generally appears at this time that the erosion has stabilized. The erosion will continue to be tracked to reevaluate the situation and determine whether additional monitoring or follow-up actions are required. The sloughed areas on the berm affect the quantitative evaluation of the site, given the impact that the erosion has on plant establishment. The well-draining nature of the berm materials is also affecting plant establishment to some degree in places. All performance criteria were achieved in this monitoring phase. Minor repairs to the goose exclusion grids were conducted along with some minor weeding of the area, tightening of the anchors on the large woody debris, and removal of trash and other debris. During Year 1 quantitative monitoring performed in July 2007, minimal plant survival was observed in the three pilot nodes at the North Beach Habitat area. In June 2008, during Year 2 Quantitative Monitoring, it was noted that there was no remaining vegetation in these pilot node areas. This is likely due to their greater exposure and a reduced amount of organics in the substrate. An onsite meeting with the agencies was held on August 14, 2008, to discuss potential alternatives for establishment of vegetation in these pilot areas. As outlined in the Preliminary Findings Memorandum, options were discussed, and the City is awaiting final instruction from EPA. In accordance with the design documents, four additional planting nodes were required to be constructed at the St. Paul Beach and Peninsula portions of the North Beach Habitat in the first or second season following construction completion to accelerate colonization of the site. The nodes were to be planted with a combination of *Salicornia virginica, Distichlis spicata,* and *Deschampsia caespitosa*. Due to the erosion and shifting of the beach materials occurring at the site, the City requested reconsideration of this activity since the area does not appear to be conducive to establishment of the species indicated. The exposure appears to be great, as evidenced by the lack of plants surviving in the pilot node at the point. In addition, the substrate is likely too rocky/cobbley for these species and there is not enough organic material available. In June 2008, the City sent an email notification to the agencies identifying these questions/concerns related to vegetation establishment at the North Beach Habitat. In the email, the City requested authorization to eliminate the requirement to continue maintenance of the goose exclusion grids at the

three pilot locations. The City proposed continued monitoring of these areas for volunteer vegetation that might become established as the overall site develops and comes to equilibrium. In addition, the City requested a reconsideration of the locations and proposed species for the additional planting nodes. A site meeting was held in August 2008. Several concerns and options for adaptive management in this site area were discussed, including the following:

1a. Relocating the pilot node at the tip of the peninsula to another area where the beach is shifting less. One possibility is an area to the west of the current node location where a natural low area has formed. The area was visually monitored over the fall and early winter to determine whether the beach has stabilized or is continuing to shift seasonally, which would impact node sustainability. Based on these observations, there does not appear to be an issue of shifting materials in the area west of the LWD. Therefore, it appears that this might be the optimal location for the additional planting nodes required in the design report. With agency concurrence, the appropriate species for this location/elevation can be determined.

1b. A revised planting approach could be considered. It was suggested that mature pickleweed plants be harvested from one of the existing restoration sites in the area such as the City's Middle Waterway Natural Resource Damage Assessment restoration site. These plants could be planted in 5-gallon buckets of good, organic soil and allowed to stabilize to avoid shock. Once stable, the bucket could be buried in the ground at the pilot node locations to see if, with good organic substrate, plants could establish at these locations. Next steps would be based on the results of this assessment. The City will initiate this test pending agency approval

2. **Middle Waterway Tideflat Habitat:** The qualitative ground survey confirmed that the site was establishing well. Some erosion from seeps, springs, and other influences in the marsh area was identified, but is minor and consistent with the amount that would be expected in this setting. Minor repairs to the goose exclusion grids were performed, along with some limited weeding and debris removal. There is some bark and other wood debris throughout the site which was removed as needed to prevent impact to the plants. Sprinkler heads were repaired or replaced as needed to ensure optimal performance of the irrigation system. Quantitative vegetation monitoring was conducted and based on the analyses performed the site meets the performance criteria for vegetation survival and establishment. During the inspection it was noted that there had been up to 0.50 inch of sediment accumulation at one location, and up to 8.5 inches of erosion at another location. At this location (E4), the elevation stake was located at the edge of a localized area of erosion. Two different depths were therefore noted on the field form. The average change in sediment elevation relative to baseline using the larger of the two measurements for E4 was -1.625 inches. This meets the performance standard for this element.

3. **Puyallup River Side Channel:** The qualitative ground survey confirmed that the site was establishing well and the plants were becoming better established in the riparian areas relative to the previous year's monitoring. Minor weeding of the area was the only maintenance activity identified at this time. A small spit of sedimentation remains inside of the side channel off of the downstream remnant levee Section. Also, additional willow stakes were planted in November to replace those that had been impacted by willow weevil. Overall, this site appeared to be in good condition. Quantitative vegetation monitoring was conducted and based on the analyses performed the site meets the performance criteria for riparian vegetation establishment. Six elevation stakes are in place at the site and the average change in sediment elevation relative to baseline was +1.833 inches. Sediment deposition is anticipated at this site, and therefore there is no performance criteria associated with elevation at this site. In accordance with the OMMP, the sedimentation rate at this site will be evaluated for five years. After that time, if the rate is determined to be unacceptably high, contingency planning may be initiated through the Adaptive Management Team to evaluate site alternatives to create a flow through system.

4. **Hylebos Creek Mitigation Site:** The qualitative ground survey confirmed that the site was establishing well. No obstruction to fish passage was identified in the channel areas. Overall, this site appeared to be in excellent condition. Quantitative vegetation monitoring was conducted and based on the analyses performed the site meets the performance criteria for vegetation survival and establishment. Six elevation stakes are in place at the site and the average change in sediment elevation relative to baseline was -0.333 inches. A transect survey of the centerlines of both the north and south nodes was performed on Jun 30, 2008. Between the time that construction of this site was completed in September 2005 and the time of the baseline survey of the elevation stakes in the nodes was completed in July 2006, the site had silted in such that the elevations at Year 0 were closer to, but still below the approved design elevations at all but one location surveyed (near the north lobe). According to the OMMP, the performance criteria relative to elevation changes at this site indicate that the average elevation change along the centerline transect of the channels must be less than 0.2 feet from as-built elevations. Based upon these criteria, the site does not meet these performance criteria (average change in south lobe relative to as-built elevations was 0.51 feet and in the north lobe was 0.37 feet). However, if the elevations are compared to either the design elevations or the Year 0 elevations, the site does meet the performance criteria. The site will continue to be monitored. After that time, if the rate is determined to be unacceptably high, contingency planning may be initiated through the Adaptive Management Team to evaluate site alternatives.

5. **Johnny's Dock Habitat Enhancement:** The qualitative ground survey confirmed that the site was becoming well established. Overall, the site appeared to be in excellent condition. Removal of the goose exclusion grids, minor trash removal, and tightening of the anchors on the large woody debris were the only maintenance activities required and performed.

6. **Head of the Thea Foss Shoreline Habitat:** The qualitative ground survey confirmed that the site was becoming well established. Overall, the site appeared to be in excellent condition. Goose exclusion grid removal, weeding, and trash removal were the only maintenance activities required and performed.

7. **SR 509 Esplanade Riparian Habitat:** The qualitative ground survey confirmed that the site was generally continuing to establish well. The sprinkler system did not appear to have been functioning properly at the time of the inspection, but was subsequently inspected and repaired. Overall, the site appeared to be in very good condition, but increased watering was expected to improve the situation. Minor weeding and mulching were the only maintenance activities required. Transient trash is a notable item at this site. A park and esplanade are being developed in 2009 on the adjacent site and the project team will coordinate with developers to minimize impacts on this site.

8. **Log Step Habitat Enhancement:** The qualitative ground survey confirmed that the site was becoming well established. Overall, the site appeared to be in excellent condition. Minor weeding, checking the anchors on the large woody debris, and minor repair or removal of the goose exclusion grid were the only maintenance activities required and performed at this site.

Utilities' Area

Following the completion of the Utilities' field activities, the OMMP (Tetra Tech FW, Inc) was finalized based on as-built conditions. The monitoring activities completed during this review time frame include Year 1 (2005), Year 2 (2006), Year 3 (2007), and Year 4 (2008). The Utilities' OMMP sampling program was designed to collect data to meet the following objectives:

- Evaluate the effectiveness of the hybrid cap installed over contaminated sediments (principally by coring).
- Determine compliance with the SQOs (by collection of compliance sediment samples (0 to 10 cm).
- Assess source control effectiveness (by collection of early warning sediment samples (0 to 2 cm).

OMMP results are briefly summarized below.

<u>Year 1</u>

- Recontamination: Because of the recontamination of the sediment surface on top of the Utilities' cap at locations north of the SR 509 Bridge discovered in September 2004, supplemental sampling was completed that was not part of the Year 1 OMMP monitoring schedule. The subsequent observations were used to assist in assessing the sources of sediment recontamination on the cap. Recontamination constituents included PAHs, phthalates, pesticides, and PCBs. In December 2005, the City placed additional cap material in the northern Section of the Head of Thea Foss because of the dredging recontamination of

the Utilities' cap. Results of surface sediment sampling indicated the SQOs were exceeded in one or more compliance samples. The highest exceedance factors were detected in samples from stations S-15 and WC-11 located near the sheet pile wall. SQO exceedance factors ranged between 1.4 (naphthalene and 4,4-DDD) and 8.4 (acenapthene). In addition, sediment concentrations were higher than the SQOs in one or more early-warning samples (0-2 cm) at other locations at the head of the Waterway. The highest exceedance factors were detected in samples from stations RC-1, RC-9, RC-11, and RC-12. SQO exceedance factors ranged between 1.3 (total PCBs) and 6.3 (BEHP).

Year 2

- Cap Survey: The physical assessment of the waterway cap was conducted with a hydrographic survey. There was an increase in elevation where capping material was placed by the City in 2005. This high spot was removed in 2006. There was a decrease in elevation in an area that had capping material placed shortly before the survey was conducted. This was attributed to consolidation of the deposited capping material and/or the underlying sediment, and is consistent with the consolidation calculations made during design. EPA requested further monitoring of two areas with differences greater than one foot as part of the Year 3 monitoring activities.

  A supplemental inspection was performed following a rainfall event that exceeded the 100-year, 24-hour design of the scour protection apron. The purpose was to inspect the scour protection apron at the head of the waterway in front of the Twin 96ers and in front of outfalls 235 and 243. Though there were signs of displacement in the scour protection apron in front of outfall 235, there was no evidence suggesting the underlying cap is being affected or that the concrete apron has been undermined by the high velocity discharge from the outfall.

- Cap Sampling: Benthic fauna and flora were observed at all waterway cap locations. The compliance sample locations within the City recontamination capping area accumulated 1 cm of fine-grained material on top of the cap material placed in 2005. All of the waterway cap compliance samples and the two slope cap composites on the east side of the waterway contained samples with one or more chemistry results exceeding an SQO. SQOs were exceeded in one or more compliance samples south of the bridge for individual PAHs, total HPAH, BEHP, and phenol. BEHP exceeded the SQO in all compliance samples south of the bridge. Most of the maximum exceedance factors were detected at station WC-02 located in the southeast corner of the head of the waterway. This location is in a depositional area from the outfalls located at the Head (Twin 96ers) and is adjacent to the scour protection apron.

- Early Warning Sampling: All 15 of the early-warning samples contained BEHP above the SQO. Samples collected at RC-01, RC-02, RC-04, and RC-13 contained concentrations of individual PAHs and/or total HPAH that exceeded the SQOs. Consistently, the concentrations of contaminants were higher in the 0 to 2 cm sample than in the 0 to 10 cm sample. Slope cap samples contained contaminants detected at concentrations well below SQOs, with the exception of SC-03 and SC-04 for BEHP. Samples were also taken from the bottom increments of six core samples and contained concentrations of contaminants well below the SQOs.

- SPI findings: Bioassay testing indicated sediment contamination had an impact on the mussel larvae in three of four sampling locations, on sand fleas in one of the four sampling locations, and no impact on the juvenile worms. Recolonization was primarily assessed by SPI. The results indicated that sediment quality in the southern end of the area surveyed is compromised by the nature of material being discharged by the Twin 96ers at the southern end of the waterway. The more recent deposition of organically enriched, fine-grained material has limited the utility of the area as suitable habitat for mature benthic communities and also eliminated the original benefit of placing the habitat mix.

Year 3

- Visual Observations: Observations of the scour protection apron and slope cap indicated they were functioning as intended and no obvious signs of significant erosion were occurring. Gas bubbles were observed throughout the head of the waterway and in the vicinity of the SR 509 seep area but no non-aqueous phase liquid sheens were observed. Visual observations of the former SR 509 bridge seep area indicated the impermeable cap is preventing the upward migration of tar that would cause visual sheens.

- Cap Sampling: Waterway cap compliance samples were collected to monitor the area of additional capping material (north of the SR 509 bridge) and to evaluate BEHP and PAH trends in the area beneath and south of the SR 509 bridge. Surface samples (0 – 10 cm) collected north of the SR 509 bridge were all below SQOs. BEHP concentrations were above SQOs in all compliance samples collected south of the bridge with the highest concentration located at a depositional area adjacent to the Twin 96ers. In addition, SQOs were exceeded in the compliance sample at WC-02 for individual PAHs and total HPAH. This is a depositional area adjacent to the scour protection apron from the Twin 96ers.

- Early Warning Sampling: All 14 of the early-warning samples contained BEHP above the SQO. Samples collected at RC-01, RC-02, RC-08, RC-13, and RC-14 contained concentrations of individual PAHs and/or total HPAH that exceeded the SQOs. Consistently, the concentrations of contaminants were higher in the 0 to 2 cm sample than in the 0 to 10 cm sample.

Year 4

- Visual observations: Observations concluded the scour protection apron is functioning as intended as there were no signs of significant erosion. Gas bubbles were observed throughout the Head of the waterway and in the vicinity of the former SR 509 seep area, but no non-aqueous phase liquid sheens were observed. The scour protection adjacent to Outfalls 235 and 243 show no further signs of erosion or displacement. The results of the hydrographic survey indicate that the minimum cap thickness criterion is being met and no further evaluation or remediation is necessary at this time. By May 2008, 12 to 13 cm of finer grained material had accumulated on the Utilities cap south of SR 509 bridge and 1 to 7 cm of sediment had accumulated in the City recontamination capping area north of the bridge.

- Core Sampling: All six core samples were below SQOs in all intervals. This indicates that

there is no evidence of bottom-up recontamination and the cap is performing as designed. The additional cap material placed in the area north of the SR 509 bridge appears to be effectively isolating the recontamination caused by dredging activities.

The Year 4 monitoring report concluded the recontamination is from top-down sources. Data indicates the discharges from stormwater outfalls in the Head of the waterway are the source of the recontamination. This finding is based on:

- Observing finer grained sediment on top of the capping material.
- All early-warning samples exceeding SQOs for BEHP.
- Most compliance samples exceeding SQOs for BEHP (except WC-03).
- SQOs were exceeded for individual PAHs and total HPAH at 3 locations.
- Year 4 BEHP results being significantly greater than Year 2 BEHP results in the intertidal slope cap composite samples on the east side of the waterway.
- Similar concentration trends between HPAHs and BEHP in early warning sediment samples between the baseline and Year 4 indicate a similar source.
- The similarity of the HPAH and BEHP trend relationship in early warning sediment samples with the trend relationship of stormwater in-pipe sediment-trap samples collected near the end of the Twin 96ers (indicating the Twin 96ers are a primary source of PAHs and BEHP to the Head of the waterway).

4.7.4 Progress since the Last Five-Year Review

Results from the OMMP activities are discussed in the previous Section 4.7.3, Post-Construction Monitoring/O&M.

Previous Protectiveness Statement

The protectiveness statement in the last Five-Year Review (2004) stated:

> "Remedial actions at the Thea Foss and Wheeler-Osgood Waterways are under construction. The remedy is expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled through temporary soil capping and dust control during remediation activities."

Status of Recommendations

A summary of the recommendations made in the previous five-year review (2004) and an evaluation of their progress are presented below.

- **Thea Foss - Analyze data to be received in January 2005 and make recommendations for further actions on the recontaminated portion of the Utilities cap.**

  Ongoing. Based on the pre-design study and analysis, the re-accumulation of phthalates is predicted to occur until a stabilization level is reached. The revised model indicated the

DEHP concentration would stabilize at an equilibrium concentration approximately four times the SQO. Several agencies formed the Sediment Phthalate Work Group to discuss and evaluate phthalates and their effect on sediments. This group determined that for expected phthalate re-accumulation, focused monitoring should be conducted to determine the extent of accumulation at levels of concern; whether these areas reach stable phthalate levels; and appropriate site-specific management approaches for these areas. Based on the monitoring results, modeling performed as part of the remedial design process, and the findings and recommendations of the Sediment Phthalate Work Group, the City has proposed additional monitoring in 2009 within the Head of the Thea Foss Waterway. The proposed monitoring would focus on and test for phthalates and PAHs; those analytes that are at concentrations above the SQOs.

- **Thea Foss - Complete Bunker mitigation site design and implement mitigation actions.**

  Complete. All excavation was completed in September 2005. The replacement bridge was set in place in January 2006.

- **Thea Foss - Track and ensure timely U.S. Army Corps of Engineer review of the Puyallup River Side Channel property transfer transaction to ensure that this mitigation site can be built.**

  Complete. At the end of March 2005, the Corps forwarded the required real estate documents to the City for execution. The transaction was completed and the project cleared for construction. The City and the Corps entered into a Cooperation Agreement for the Puyallup River Side Channel project to outline the terms and obligations related to construction and maintenance of the site.

- **Thea Foss (Utilities Work Area) - Track the deauthorization language on the Water Resources and Development Act in Congress to ensure that the language deauthorizing the Head of the waterway is passed.**

  Complete. The deauthorization request for the Utilities' Work Area was approved as part of the Water Resources Development Act Bill of 2007. However, it was noted that there are a few areas in the City part of the waterway, where construction of caps was completed above authorized navigation depth. EPA and USACE requested the City to request deauthorization of these areas as well. The City submitted a description of the area, which was approved y USACE. The City will continue to work with USACE and congressional representatives to determine an appropriate mechanism for deauthorization.

- **Sitewide – Implementation of OMMPs for Hylebos, Middle and Thea Foss and Wheeler-Osgood Waterways to ensure effectiveness of remedial actions and mitigation activities.**

  Complete. OMMPs were completed in 2003 for the Utilities portion of the waterway and in 2006 for the City of Tacoma portion of the waterway. Annual monitoring is ongoing.

- **Sitewide – Implementation of Institutional Controls for all waterways and review status of institutional controls already in place.**

  Complete. Institutional Controls Plan for the City's Work Area and the Utilities' Work Area were approved in September 2006. Additional details are provided in the Data Review and Evaluation section below.

- **Sitewide – Review the results of monitoring at the mitigation sites and based on that data describe the contribution of those sites towards the recovery of ESA species.**

  Complete. All performance standards were achieved during the Year 1 habitat mitigation area monitoring except for the lack of salmonids observed in the Hylebos Creek Mitigation Site during the outmigration period. Juvenile salmonids were not found during the early May 2007 monitoring event, but many were seen at the late May 2007 event indicating that perhaps the salmonids are using this site later in the migration period. All performance standards were achieved during the Year 2 habitat mitigation area monitoring except for the average change along the centerline transect of channels at the Hylebos Creek Mitigation Site was greater than 0.2 feet from the as-built elevation. According to the OMMP the average change must be less than 0.2 feet from the as-built elevations. Average change in the south lobe relative to as-built elevations was 0.51 feet and in the north lobe it was 0.37 feet. However, if the elevations are compared to either the design elevations or the Year 0 elevations, the site does meet the performance criteria. In addition, all sites are subject to ongoing maintenance including invasive removal. Maintenance to meet the performance criteria occurs where non-native or invasive vegetation cover is greater than 10 percent.

- **Sitewide – Develop a work plan to conduct fish tissue sampling for CB/NT after sediment Remedial Actions are complete. Provide results to Washington DOH to determine if they should continue with fish advisories after the sediment cleanup RAOs have been achieved.**

  See Section 4.8 of this Five-Year Review for a discussion on fish tissue sampling for the Sediments OU of the CB/NT Site.

4.7.5 Five-Year Review Process

Administrative Components

The Commencement Bay Nearshore/Tideflats Superfund Site FYR team was lead by Kira Lynch, the EPA Remedial Project Manager (RPM), Region 10. Emile Pitre with the USACE, Seattle District, assisted with the review as representatives of the support agency.
By February 2009, the review team was formed, and had established the review schedule and its major components including:

- Document Collection and Review.
- Data Assessment/Analysis.
- Site Inspection.

- Interviews and Community Notification and Involvement.
- FYR Report Development and Review.

The FYR has a statutory completion date of December 29, 2009.

Community Involvement

EPA sent a postcard to stakeholders and neighbors on the CB/NT project mailing list (approximately 1,440 addressees) in February to notify them of the five-year review process. After checking in with several members of the community, some of them had not yet received the information. We then mailed a second postcard on March 19, 2009 to ensure that everyone had an opportunity to provide information to EPA. In addition, a display advertisement ran on page B3 of the Tacoma News Tribune Newspaper on February 6, 2009.

Interviews were completed with nearby property owners and interested parties. The purpose of the interviews was to identify issues and concerns related to the implementation and on-going operation of the site remedy.

Document Review

A review of reports pertinent to this Five-Year Review was conducted by the review team. The types of documents reviewed included decision documents; risk assessment documents; annual data reports; technical memoranda; and other supporting materials. OU 1 Attachment 1 is a complete list of documents reviewed during this FYR.

Data Review and Evaluation

Results from the OMMP activities are discussed in the previous Section 4.7.3, Post-Construction Monitoring/O&M. Institutional Controls Plan for the City's Work Area and the Utilities' Work Area were approved in September 2006. The City provided copies to the Washington State Department of Transportation with the intent to assure that maintenance of the 11th Street Bridge and the SR 509 Bridge is undertaken in a manner the protects the remedial actions within the waterways. Project representatives also continue to work with the City's Building and Land Use Services division to implement procedures to ensure that future development in and adjacent to the Foss Project areas where remedial actions and habitat mitigation work have been completed, are undertaken in a manner that protects the remedy and the habitat. Working drawings of navigational charts from the National Oceanic and Atmospheric Administration (NOAA) show the modified shoreline. Drawings should be updated in mid-summer 2009.

A request was submitted to the U.S. Coast Guard (USCG) to establish a regulated navigational area (RNA) in the Thea Foss Waterway prohibiting anchorage and other activities that could disturb the cap. The City requested an update in February 2009. The USCG path forward for finalizing this request is that they will publish a Supplemental Notice to include a buffer around the cap areas, particularly at RA-1 and RA-3. They will also be requesting letters of concurrence/support from the various stakeholders. The City is also working with the USCG on the potential placement of additional signage in the waterway.

The City is implementing a stormwater monitoring and source control program for the municipal storm drains entering the Thea Foss and Wheeler-Osgood Waterways to help provide long-term protection of sediment quality in the waterways. The City continues to pursue control of sources to stormwater and continues to evaluate enhanced BMPs and their effectiveness on reducing COC loads to the waterway.

Interviews

Interviews were performed by telephone. Parties were identified for the interviews based on the following criteria:

- Parties adjacent to the site or effected by site related contaminants.
- Public entities/utilities effected by operation of the remedy.
- Interested and concerned citizens or citizen groups.

Parties identified for interviews included:

- Leslie Ann Rose with CHB.

The following recommendations and suggestions were made:

- Establish a system to alert EPA when there is a planned disturbance of sediments or soils within operable units. The sites can be entered into the City of Tacoma land-use database to notify EPA when a person applies for a land-use permit within the operable units.
- To assign one EPA RPM for all operable units post-remediation.

4.7.6 Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?
Answer: No.

The current remedy is not functioning as intended by the ROD. The current state of each ROD cleanup objective and any indicators of remedy problems are described below:

- **Sediment Quality Goal: the sediment quality goal is a conceptual target condition for Puget Sound, defined by element P-2 of the 1989 Puget Sound Water Quality Management (PSWQA) Plan as the absence of acute or chronic adverse effects on biological resources or significant human health risk.** Overall, the sediment concentrations have decreased since pre-remedial action. Quantitative data has not been collected to show an absence of acute or chronic adverse effects on biological resources or significant human health risk. Recolonization was primarily assessed by SPI. In general, all of the City's stations except for the two at the mouth of the waterway closest to Commencement Bay, showed evidence of mature benthic communities at depth. The Utilities' results indicated that sediment quality in the southern end of the area surveyed is compromised by the nature of material being discharged by the Twin 96ers at the southern

end of the waterway. The more recent deposition of organically enriched, fine-grained material has limited the utility of the area as suitable habitat for mature benthic communities and also eliminated the original benefit of placing the habitat mix. EPA plans to design and conduct a focused bay-wide fish tissue sampling effort at the conclusion of remedial actions to provide information to the Tacoma Pierce County Health Department in determining whether they will maintain the fish use advisories after EPA's remedial actions are completed.

- **Sediment Quality Objective: the sediment quality objective is a discrete and measurable target for project cleanup related to the Puget Sound goal. The objective is measurable in terms of specific human health risk assessments and environmental effects tests, and associated interpretive guidelines. The resulting biological effect levels or chemical concentrations are scientifically acceptable definitions of the sediment quality goal using available information.** Sediment Quality Objectives were generally met throughout the site immediately following the remedial action. As stated in the ROD, the results of the risk assessments during the remedial investigation were used in the FS to develop sediment cleanup guidelines to protect human health and the environment.

- **Sediment Remedial Action Level: the sediment remedial action level differentiates areas that exceed the sediment quality objective, but are predicted to recover naturally, from those that are more significantly contaminated and therefore require active remediation to achieve the sediment quality objective. The intent of any active remediation of sediments is to achieve a net environmental and public health benefit and therefore requires consideration of habitat issues.** Some analyte concentrations in the natural recovery areas appear to have increased while other analyte concentrations appear to have decreased in the Year 2 samples compared to the baseline samples. There is broad variability in data trends from station to station, as described in Section 4.7.3, Post-Construction Monitoring/O&M. The need for additional monitoring at most stations is necessary to further evaluate data trends.

- **Source Control Level: the goals and objectives of source control are defined as targets that will achieve respective sediment goals and objectives. Source control will be implemented according to applicable or relevant and appropriate requirements (ARARs) and AKART systems. Compliance with the sediment quality objective will be confirmed through monitoring.** Data indicates the discharges from stormwater outfalls in the Head of the waterway are likely the source of the PAH and DEHP recontamination. Two areas (near outfall 230 and in RA 19) in the main body of the waterway also appear to becoming recontaminated with PAHs and DEHP, but the exact sources have not been quantified at this time. The Sediment Phthalate Work Group determined that because of the ubiquitousness of DEHP in modern society and urban atmospheres, it is not amenable to standard stormwater treatment approaches. No treatment methodologies have been identified to date which would be able to significantly remove these fine particulates. Even if effective control technologies and the space to implement them existed, the Work Group concluded that phthalates would still reaccumulate in sediments.

- There is no site specific habitat mitigation objective outlined in the ROD. Habitat function and enhancement of fisheries resources is incorporated as part of the overall project cleanup

objective. Habitat mitigation objectives and goals are site-specific and were developed for the site prior to construction. Generally, the mitigation sites are performing in accordance with the project goals.

- The City provided copies of their Institutional Controls Plans for the waterway to the Washington State Department of Transportation with the intent to assure that maintenance of the 11th Street Bridge and the SR 509 Bridge is undertaken in a manner that protects the remedial actions within the waterways. Project representatives also continue to work with the City's Building and Land Use Services division to implement procedures to ensure that future development in and adjacent to the Foss Project areas are undertaken in a manner that protects the remedy and the habitat. Working drawings of navigational charts from the National Oceanic and Atmospheric Administration (NOAA) show the modified shoreline. Drawings should be updated in mid-summer 2009. The DOH has a flatfish and rockfish consumption advisory in place for the Commencement Bay Waterways.

  A request was submitted to the U.S. Coast Guard (USCG) to establish a regulated navigational area in the Thea Foss Waterway prohibiting anchorage and other activities that could disturb the cap. The City is also working with the USCG on the potential placement of additional signage in the waterway. The City continues to pursue control of sources to stormwater and continues to evaluate enhanced BMPs and their effectiveness on reducing COC loads to the waterway.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?
Answer: Yes.

Changes in Standards and To Be Considered. Applicable or relevant and appropriate requirements (ARARs) cited in the ROD were reviewed to evaluate changes in the ARARs since the last five-year review. A summary table is presented in OU 1 Attachment 2. There have been few changes in regulatory standards since the last five-year review: Puget Sound steelhead was listed as threatened on May 11, 2007.

Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics. The ROD described current and future land uses and identified likely exposure pathways; the descriptions remain accurate for the site conditions at the time of this review. Although the majority of the apparent effect threshold (AET) values have remained unchanged since the date of the original ROD a recent set of unpromulgated AET values appear pertinent to the Five-Year Review process. These values were prepared in 1998 by the DMMP based on biological tests of polychaetes (*Neanthes* sp.), and bivalves. Approximately 45 percent of the AET values listed in OU 1 Attachment 3 would be lowered by these unofficial standards. If made official, these changes would presumably affect the assessment of the cleanup values established in the original ROD. Because the 1998 values are not promulgated the AET standards for the Puget Sound remain unchanged and will not affect the cleanup remedies in places at the Commencement Bay Nearshore/Tideflats site.

The assessment of changes made to AET values may be partially incomplete as the most recent AET values are in mg/kg organic carbon, while the AET values in the ROD are in mg/kg dry

weight. In addition, only the SQO for PCBs was based on human health risk assessment (ecologically-based cleanup levels for all other toxins were deemed protective of human health).

It should also be noted that since the ROD, the DMMP has listed both Chlordane and Dioxins/Furans as bioaccumulative chemicals. Neither chemical was evaluated for human health risks in the RI/FS.

Finally, since the 1989 CB/NT ROD, new information has become available on Tribal seafood consumption rates and exposure durations for Tribal populations. This new information has been considered for the Sediments OU, as detailed in response to Question B in Section 4.2.6 (Hylebos Waterway).

Changes in Land Use. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Remedial Action Objectives. The RAOs from the ROD are still valid for the site.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
Answer: No. There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed and information obtained from the site inspection, the sediment remedial action significantly reduced sediment concentrations and sediment concentrations remain below SQOs in most areas of the waterway; however, some recontamination is occurring near where the City's stormwater outfalls are located which leads to the conclusion that the remedy is not functioning as intended by the ROD as amended by the ESD. Recontamination constituents included PAHs, phthalates, pesticides, and PCBs. DEHP was detected at concentrations exceeding the SQO at 15 of 18 stations within the Head of the Thea Foss Waterway at enrichment ratios ranging from 1.23 to 6.15 times the SQO. Based on these data, the source control objective appears to not have been met, and the remedy has been impacted. The levels are low enough so as not to pose an immediate risk, however there is insufficient data to evaluate the overall long-term sediment quality goal in terms of protection of human health and the ecological environment, and if the sources are not identified and addressed the long-term protectiveness of the remedy is in question. Also, the USCG institutional control to help protect the long-term integrity of the cap has not been completed. There have been no promulgated changes in the ARARs, standards or To Be Considered, only non-promulgated changes to the AET database from which the SQOs were derived. There is no other information that calls into question the protectiveness of the remedy.

4.7.7 Issues

This section addresses issues that, either currently or in the future, prevent the source and groundwater RAs from being protective.

Table 14. Thea Foss and Wheeler-Osgood Waterways Issues of the 2009 Five-Year Review

Issue	Affects Protectiveness? (Y or N)	
	Current	Future
Source control does not appear adequate to prevent recontamination.	Y	Y

4.7.8 Recommendations and Follow-up Actions

Table 15 lists recommendations and follow-up actions for each issue identified in Table 14.

Table 15. Thea Foss and Wheeler-Osgood Waterways Recommended Follow-Up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Planned Completion Date
Source control does not appear adequate to prevent recontamination.	Continue to monitor and evaluate sources of phthalates and PAHs to sediments.	City and Utilities	EPA	December 29, 2014

4.7.9 Protectiveness Statement

The remedy at the Thea Foss and Wheeler-Osgood Waterways currently protects human health and the environment because the sediment remedial action significantly reduced sediment concentrations and most of the required institutional controls are in place to protect the integrity of the sediment cap. However, in order for the remedy to be protective in the long-term, additional source control activities need to be identified and implemented to reduce the extent of recontamination in the waterway and the USCG institutional control needs to be completed to help protect the long-term integrity of the sediment cap.

4.8 CB/NT Sediments OU-wide Issue

Five-Year Review Summary Form – CB/NT Sediments OU, OU-wide Issue

Issues:

Recent fish tissue data for bioaccumulative chemicals have not been collected in Commencement Bay. Thus, it is not known whether contaminant levels in fish tissues have been reduced since the remedies have been implemented, particularly for PCBs (which have a human-health based Sediment Quality Objective), and whether fish advisories should be continued, modified, or removed.

Recommendations and Follow-up Actions:

Develop and implement a sampling plan for collection and analysis of bay-wide fish tissue data for bioaccumulative chemicals (particularly for PCBs, which have a human-health based Sediment Quality Objective). Provide results to appropriate state and local agencies to evaluate protectiveness of health-based fish consumption advisories for Commencement Bay.

Protectiveness Statement:

Taken as a whole, the remedies for the Sediments OU are expected to be protective when completed. In the interim, until site remedial objectives are met, site use restrictions (i.e., fish and shellfish consumption advisories) shall remain in effect to limit human exposure to contaminated seafood. The absence of fish tissue contaminant data does not mean that the remedy is not protective (see p. 4-14, OSWER No. 9355.7-03B-P). Future fish tissue sampling results will be used along with other lines of evidence to ensure that the remedies are protective in the long-term.

4.8.1 CB/NT Sediments OU 01, OU-wide Issue and Recommendation

For the CB/NT Sediments OU, the ROD specifies that site use restrictions, such as advisories against seafood consumption, will be implemented to protect human health until recovery is complete. In reviewing progress since the last five-year review, a summary of the recommendation made in the previous five-year review (2004) and an evaluation of its progress are presented below.

Sitewide – Develop a work plan to conduct fish tissue sampling for CB/NT after sediment remedial actions are complete. Provide results to Washington DOH to determine if they should continue with fish advisories after the sediment cleanup RAOs have been achieved. Not completed. Work was not completed due to EPA resource constraints.

The above Sediments OU-wide recommendation regarding fish tissue sampling was provided in the second five-year review (EPA 2004) for the Sediments OU of the CB/NT site. The second five-year review did not provide a technical basis or rationale for including this recommendation, although the review included the following language:

> "A specific cleanup objective based on fish tissue data was not a requirement identified in the ROD. EPA plans to design and conduct a focused bay-wide fish tissue sampling effort at the conclusion of remedial actions to provide information to the Tacoma Pierce County Health Department in determining whether they will maintain the fish use advisories after EPA's remedial actions are completed."

No additional information on fish tissue sampling was provided in the second five-year review, and no information on fish tissue sampling was provided in the first five-year review for the CB/NT site.

For this third five-year review, EPA re-evaluated the above recommendation for the Sediments OU, and provides clarifying information below.

As described in the CB/NT ROD (EPA 1989; Declaration, p. 1), the overall goal of the selected remedy is "to protect the marine environment and thereby reduce associated public health concerns." The selected remedy "is protective of the marine environment and related human health concerns" (ROD; Declaration, p. 2). The subsequent PCB ESD (EPA 1997; p.4) reiterated that the cleanup goal for the Commencement Bay problem areas is to achieve reduction of contaminant concentrations in sediments [emphasis added] to levels that will support a healthy marine environment and will protect the health of people eating seafood from the Bay.

Neither the CB/NT ROD nor the PCB ESD specifies a cleanup goal or cleanup level for contaminants in seafood tissue. As set forth in the ROD and described in Section 4.1.1 of this Five-Year Review, *Sediment Quality Objectives* for all problem chemicals were set based on an evaluation of the ecological and human health risks posed by these chemicals. Only the SQO for PCBs was based on the human health risk assessment (EPA 1989; EPA 1997). SQOs for all other chemicals were based on the ecological risk assessment, *because the ecologically-based cleanup levels were determined to be also protective of human health* [emphasis added].

The ROD specifies five key elements of the selected remedy for sediments (see Section 4.1.2 of this Five-Year Review). The ROD does not include fish tissue sampling as a specific element of the selected remedy (see Sections 10.2.5 and 10.3 of the ROD). Subsequent ESDs for the individual waterways, including the PCB ESD (EPA 1997), do not discuss fish tissue sampling for the Sediments OU. The CB/NT Superfund Consent Decrees entered into with PRPs did not include specific requirements for a fish tissue sampling effort. In September 2009, a federal court approved and entered a consent decree between the United States and five Hylebos Waterway PRPs. *U.S. v. Detrex et al*., No. 09-0544 (W.D. Wash. Sept. 2, 2009). The Consent Decree recovered $2.33 million in past and future response costs associated with remedial action at the Mouth and Head of the Hylebos Waterway. The recovered costs were placed in a special account established for the purpose of funding response actions, such as the fish tissue study recommended in the previous five-year review for the CB/NT Site.

In reviewing the CB/NT ROD, it can be surmised that the OU-wide recommendation for fish tissue sampling in the second five-year review was intended to address the "Site Use Restrictions" element of the remedy. The ROD describes site use restrictions as follows:

> "Site use restrictions, such as advisories against seafood consumption, will be implemented to protect human health until recovery is complete."
> [Declaration, p. 2]

> "Site use restrictions: protect human health by limiting access to edible resources prior to and during implementation of source and sediment remedial activities." [Section 8]
>
> "Site use restrictions consist mainly of public warnings and educational programs intended to reduce potential exposure to site contamination, particularly ingestion of contaminated seafood. Local health advisories are an integral part of the overall remedy because the ultimate objectives will be achieved over a 15-20 year period." [Sections 8.2 and 10.2.1]
>
> "Site use restrictions (e.g., public warnings and fisheries advisories to reduce potential human exposure) implemented by state and local health authorities." [Section 2.4.2]

Thus, the ROD for the Sediments OU specifies site use restrictions in the form of fish advisories to limit human exposure to contaminated seafood until the remedial objectives are met. Fish and shellfish advisories were put in place shortly after the ROD and remain in effect. While the advisories are intended to limit human exposure and are the best tool available to do so, fish consumption advisories are not enforceable under law. In Commencement Bay, there is anecdotal evidence that some people do not follow the consumption advice provided in the advisories. This is one reason why EPA has continued to report the Superfund Human Exposure Environmental Indicator for the CB/NT Site as "Not Controlled," despite the success of the remedial actions taken to date and the use restrictions that are in place. After reviewing the status of the remedial actions in the Sediments OU, it is EPA's assessment that the overall remedy for sediments is expected to be protective once all actions (including monitored natural recovery) are complete. In the interim, until site remedial objectives are met, site use restrictions (i.e., fish and shellfish consumption advisories) shall remain in effect to limit human exposure to contaminated seafood.

EPA believes that a fish tissue sampling effort is necessary to evaluate progress toward remedial objectives and whether fish advisories should be continued, modified, or removed. EPA envisions developing a sampling plan for collection and analysis of bay-wide fish tissue data for the overall site. EPA believes that it would be appropriate to initiate the fish tissue sampling effort at this time, since the majority of remedial actions within the Sediments OU have been completed (by 2008), and the PCB-contaminated sediments have been addressed by these actions.

Moreover, since sediment quality monitoring is the primary means of assessing whether ROD objectives have been met, fish tissue data could be used for informational purposes to evaluate short-term risk reduction for human health since the remedies have been implemented (e.g., do data suggest a reduction in fish tissue levels?). In Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites, EPA (2002) notes "While it is generally more practical to use measures such as contaminant concentrations in sediment to identify areas to be remediated, other measures should be used to ensure that human health and/or ecological risk reduction goals are being met. Such measures may include direct measurements of indigenous fish tissue concentrations…"

4.8.2 Issues

This section addresses issues that, either currently or in the future, prevent the remedial action from being protective.

Table 16. CB/NT Sediments OU, OU-wide Issue of the 2009 Five-Year Review

Issue	Affects Protectiveness? (Y or N)	
	Current	Future
Recent fish tissue data for bioaccumulative chemicals have not been collected in Commencement Bay. Thus, it is not known whether contaminant levels in fish tissues have been reduced since the remedies have been implemented, particularly for PCBs (which have a human-health based Sediment Quality Objective), and whether fish advisories should be continued, modified, or removed.	N	Y

4.8.3 Recommendations and Follow-up Actions

Table 17 lists recommendations and follow-up actions for each issue identified in Table 16.

Table 17. CB/NT Sediments OU, OU-wide Recommended Follow-Up Action

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Planned Completion Date
Recent fish tissue data for bioaccumulative chemicals have not been collected in Commencement Bay. Thus, it is not known whether contaminant levels in fish tissues have been reduced since the remedies have been implemented, particularly for PCBs (which have a human-health based Sediment Quality Objective), and whether fish advisories should be continued, modified, or removed.	Develop and implement a sampling plan for collection and analysis of bay-wide fish tissue data for bioaccumulative chemicals (particularly for PCBs, which have a human-health based Sediment Quality Objective). Provide results to appropriate state and local agencies to evaluate protectiveness of health-based fish consumption advisories for Commencement Bay.	EPA	EPA	December 29, 2014

4.8.4 Protectiveness Statement

Taken as a whole, the remedies for the Sediments OU are expected to be protective when completed. In the interim, until site remedial objectives are met, site use restrictions (i.e., fish and shellfish consumption advisories) shall remain in effect to limit human exposure to contaminated seafood. The absence of fish tissue contaminant data does not mean that the remedy is not protective (see p. 4-14, OSWER No. 9355.7-03B-P). Future fish tissue sampling results will be used along with other lines of evidence to ensure that the remedies are protective in the long-term.

5 REMEDIAL ACTIONS AND FIVE-YEAR REVIEW PROCESS FOR CB/NT ASARCO OPERABLE UNITS 20, 22, AND 19

Five-Year Review Summary Form - Asarco Operable Units 20, 22, and 19

Issues:

Asarco Smelter

None.

Ruston/North Tacoma Study Area

1. Based on phone calls received by EPA and Ecology, there is a subset of the people in the study area who do not know anything about the site, fact that yards in the study area may be contaminated, the yard cleanup program and the required institutional controls.

2. The site development may bring new people as well as different land uses to the area. This could result in differing exposures than those currently accounted for in the ROD.

3. There may be recontamination of the yards that have been remediated in the Study Area.

4. Potential for properties outside the Study area to be contaminated is being addressed by Ecology.

5. Ecology has requested that EPA review the remedy for the site to ensure that it is still protective.

Asarco Sediments

1. The habitat basin is functioning as designed even though part of the breakwater collapsed in the 2001 Nisqually earthquake. Because the "shelf" holding the breakwater is no longer there, replacement would require a significant reduction in size of the habitat basin.

Recommendations and Follow-up Actions:

Asarco Smelter

None.

Ruston/North Tacoma Study Area

1. Review the institutional controls/education component for the Ruston/North Tacoma Study Area and determine what changes are needed to ensure that people are aware of the controls and that they are carried forward.

2. Review ongoing site and area development and ensure that changes in the area do not impact remedy protectiveness.

3. Resample a subset of properties to ensure that recontamination has not occurred.

4. EPA will document these activities.

5. EPA has agreed to conduct a more in depth review of the remedy for the site to ensure its protectiveness. This review will be completed by July 27, 2010. The review will use the criteria in the "Comprehensive Five-Year Review Guidance (OSWER No. 9355.7-03B-P, June 2001 and also consider strategies that Ecology has developed for addressing arsenic and lead throughout the State and within the Tacoma Smelter Plume.

Asarco Sediments

1. EPA will need to determine whether the habitat basin should be repaired or left as it is.

Protectiveness Statement(s):

Asarco Smelter

Remedial actions at the Asarco Smelter are expected to be protective of human health and the environment when the remedy is completed. In the interim, exposure pathways that could result in unacceptable risks are being prevented because the site is fenced and access to the site is controlled by cell phone operated gates, monitoring during the day, and police patrols in the evenings. Dust control and other dust suppression activities (temporary capping, spraying tackifiers) are used to ensure that site contaminants remain on site.

Ruston/North Tacoma Study Area

Remedial actions for the Ruston/North Tacoma Study Area are expected to be protective of human health and the environment when the remedy is completed. In the interim, exposure pathways on the unremediated properties are only controlled through the compliance with the education program (hand washing, wetting soil, etc). ***Asarco Sediments***

Remedial actions for the Asarco Sediments are expected to be protective of human health and the environment when the remedy is completed. For the area of sediments offshore of the Smelter where capping has been done, the remedy is already protective of human health and the environment. For the remaining sediments offshore of the Smelter and the Yacht Basin, implementation of the remedy is expected to occur in the next two to three years using money obtained from the Asarco bankruptcy settlement.

Other Comments: None.

5.1 Background

This section covers the activities associated with the contamination resulting from the operation of the Asarco Smelter.

The Asarco Area Site (the Site) consists of the former Asarco copper and lead smelter facility ("Smelter Facility" or "facility") and the surrounding area (described below). The Smelter Facility is located along the Commencement Bay shoreline within the municipal boundaries of Ruston and Tacoma, Washington. The upland portion of the Smelter Facility is approximately 100 acres in size, and encompasses a 67- acre smelter and a 23- acres slag Breakwater Peninsula. Approximately 30 acres of offshore intertidal and subtidal lands are also under Asarco ownership. Additional offshore areas are owned by the State of Washington and are managed by DNR. The Asarco site includes an estimated population of approximately 5,000 people, and about 1,820 housing units.

Contamination of the smelter resulted from spills and dumped material from smelter operations. Contaminants include copper, lead and arsenic. In addition, much of the smelter property and the peninsula are constructed entirely of slag from the smelting process. Ruston and North Tacoma were contaminated from airborne emissions from smelting operations. Contaminants are primarily arsenic and lead in soils. Offshore sediments were contaminated by contaminated runoff from the smelter site, contaminated groundwater discharges, and slag spills. Contaminants include copper, arsenic and lead.

The Records of Decision divided the site into the following operable units: The Smelter Facility Operable Unit 20 (formerly OU 2) consists of the Smelter Property and the slag peninsula. The Ruston/North Tacoma Study Area Operable Unit 22 (formerly OU 4) consists of contaminated properties in an approximate one square mile area surrounding the smelter. Asarco Sediments/Groundwater Operable Unit 19 (formerly OU 6) encompasses sediments offshore of the smelter and the Yacht Basin formed by the slag peninsula. See Section 3 for more detailed information.

5.2 Site Chronology

Key dates for Asarco Area actions are as follows. Section 5.3 provides a description of the actions.

Asarco Smelter

September 1986	AOC for RI/FS and Phase I site stabilization signed.
1988	Phase I site-stabilization (demolition) activities completed.
December 1990	Interim ROD for Phase II site-stabilization (demolition) and surface water controls issued.
May 1992	Demolition CD signed by Asarco and EPA.
January 1993	Smelter stack demolition completed.

January 1995	Final RI/FS report for OU 02 (including groundwater) submitted and approved.
March 1995	ROD signed.
February 1996	CD for RD/RA signed.
April 1996	RD initiated.
2000	EPA and Ecology approved Asarco's request to change land use assumptions from industrial to residential.
2003	CD with US and Asarco entered in Arizona regarding Asarco's fraudulent conveyance of one of its assets. Settlement resulted in setting up a $100 million Trust Fund to be used for Asarco's environmental liabilities.
2004	Final site buildings demolished with the demolition of the Fine Ores Bin.
2005	Onsite containment facility completed.
2005	Asarco declares bankruptcy.
August 2006	Point Ruston purchases smelter property. The Second Amendment to the Asarco Tacoma Smelter Consent Decree added Point Ruston to the Consent Decree. Point Ruston begins site remediation as residential development.

Ruston/North Tacoma Study Area

1989	AOC for Expedited Response Actions in Ruston/North Tacoma signed.
June 1993	ROD for Ruston/North Tacoma Study Area issued.
August 1993	UAO for design issued for the Ruston/North Tacoma Study Area.
October 1993	Sampling for cleanup began.
Spring 1994	Yard cleanup began. Cleanup is still ongoing.
May 1995	CD for RD/RA signed.
2003	CD with US and Asarco entered in Arizona regarding Asarco's fraudulent conveyance of one of its assets. Settlement resulted in setting up a $100 million Trust Fund to be used for Asarco's environmental liabilities.
September 2009	EPA began planning for taking over yard remediation from Asarco. EPA receives funding from the American Reinvention and Recovery Act to complete yard remediation.

Asarco Sediments

1994	AOC for Groundwater, Surface Water, Soil and Marine Sediments monitoring and sampling signed.
1996	Phase 1/Phase 2 Expanded RI/FS Sediment Activities completed.
1997	Placement of pilot cap in a small portion of the offshore contaminated sediments area.
1999	Asarco Sediment/Groundwater Task Force concluded their evaluation of potential groundwater impacts to Commencement Bay waters and sediments.
2000	Year 2 Pilot Cap Monitoring Report completed.
2000	Refinement of the Proposed Remedy Report completed.
Jan 2000	Proposed Plan issued.
July 2000	ROD signed.
2002	UAO issued to Asarco to implement 2000 ROD.
2003	CD with US and Asarco entered in Arizona regarding Asarco's fraudulent conveyance of one of its assets. Settlement resulted in setting up a $100 million Trust Fund to be used for Asarco's environmental liabilities.
Sept 2004	RD Completed.
Nov 2006	Point Ruston began capping the sediments offshore of Asarco.
Jan 2007	Point Ruston completed placement of sediment soft cap on offshore contaminated sediments.

5.2.1 History of Enforcement Actions

Asarco stopped operating its Tacoma smelter in 1985. Pursuant to an AOC dated September 1986, Asarco agreed to perform immediate site stabilization activities at the Asarco Tacoma Smelter and to conduct an RI/FS of the Asarco Smelter and the surrounding area to determine the nature and extent of contamination and to evaluate alternatives for remediation of the Asarco Tacoma Smelter and surrounding areas. The requirements of that AOC have been satisfied. Pursuant to an AOC for Ground Water, Surface Water, Soil and Marine Sediments Monitoring and Sampling, Docket No. 10-94-0221, as amended, Asarco agreed to conduct certain monitoring and sampling both on the Asarco Tacoma Smelter and the off-shore sediments to further evaluate contamination of the groundwater and marine sediments. The requirements of that AOC, other than payment of oversight costs, have been satisfied.

Pursuant to a CD entered in *United States v. Asarco Incorporated*, Civil No. C91-5528 B, Western District of Washington, on May 19, 1992, Asarco agreed to conduct interim remedial actions at the Asarco Tacoma Smelter including the demolition of most of the remaining

structures. The requirements of that CD have been satisfied. Pursuant to a CD entered in the *United States v. Asarco Incorporated*, Civil No. C91-5528 B, Western District of Washington, on February 16, 1996, Asarco agreed to conduct remedial actions at the Asarco Tacoma Smelter, originally planned to be completed by December 2003. In 1995, Asarco entered a CD to perform cleanup of the residential yards in the Ruston/Tacoma Study Area surrounding the Smelter. In January 1997, Asarco entered a CD to perform cleanup work at the Asarco Tacoma Smelter site.

In 1999, Asarco approached EPA and requested a schedule extension for the Asarco Smelter and Ruston/North Tacoma CDs and a deferral of oversight costs on all of its agreements with EPA due to financial constraints. EPA agreed to extend the Smelter schedule and defer oversight costs if Asarco agreed to: a) increase the amount of residential yards it would remediate each year under the Ruston/North Tacoma CD; and b) amend the Smelter CD to add lump sum penalties if Asarco missed milestone cleanup dates for both the Smelter and Sediments remedial actions. Upon reaching agreement on these terms, EPA and Asarco modified the Smelter and Ruston CDs, and the Sediments AOC. As modified by Amendment One to the Smelter CD, entered on November 2, 2000, and the Modification Agreement, dated November 1999, the requirements for the Smelter CD, not including long-term monitoring, were to be completed by November 1, 2005.

Pursuant to *United States v. Asarco, Inc and Southern Peru Holding Corporation*, in January 2003, Asarco and its parent company, Grupo Mexico, signed a CD with the United States deferring enforcement of their national environmental liabilities in exchange for setting up a $100 million trust fund (the Trust) to be used for Asarco's environmental liabilities around the country. Under the Trust, EPA agreed to not move to enforce outstanding actions against Asarco for a three year period. The Trust was to be paid out over 8 years ($12.5 million per year plus interest) for Asarco's liability nation-wide. Due to the three-year enforcement bar in the Arizona CD, site activities at the Asarco Smelter, Sediments and Study Area slowed due to lack of funding although yard cleanups continued at a rate of 100 to 150 per year due to contributions from the Trust.

In August 2005, Asarco sought bankruptcy protection under Chapter 11 of the bankruptcy code. See Section 5.4 for more information about the bankruptcy and its impact on remedy implementation.

5.3 Remedial Actions

5.3.1 Remedy Selection

The three cleanup RODs for the Asarco Area site selected remedial actions for cleaning up the contamination from almost a century of smelter operations. The goals for the remedial action for the Asarco Smelter cover uplands, groundwater and surface water. For soil, dust, and slag, the goals are to prevent ingestion and inhalation of contaminated soil and slag, reduce releases of contaminates to groundwater and surface water, and limit the impacts of slag to offshore sediments. The goals for surface water and groundwater are to prevent ingestion of potentially potable groundwater, reduce the discharge of contaminated groundwater to Commencement Bay, and reduce leaks and spills of contaminated surface water from drainage systems.

The goal of the remedial action for the Ruston/North Tacoma Study Area is to reduce the risk of exposure to lead and arsenic above the selected action levels.

The goal of the Asarco sediment remedial action is to restore and preserve aquatic habitat by limiting exposure to contaminated sediments.

Asarco Smelter

The selected remedy in the ROD is summarized below:

- Excavation of soil and granular slag from five source areas. Soil that fail the Toxic Characteristic Leaching Procedure (TCLP) will be excavated from stack hill, the cooling ponds, arsenic kitchen, the former copper refinery, and fine ore bins building, and disposed of on site.
- Construct a RCRA Subtitle C on site containment facility (OCF) on the property for disposal of contaminated material from the source areas. The facility will be designed to hold approximately 240,000 cy of material.
- Construct surface and groundwater diversion and controls to protect the OCF from water infiltration.
- Grade and prepare site for capping using residential material from the Study Area as sub-base.
- Incorporate plans for future development into the cap design.
- Armor the shoreline around the plant site to prevent further erosion of the shore.
- Mitigate for shoreline armoring activities where they adversely impact intertidal lands.

Ruston/North Tacoma Study Area

The remedy addresses the principal threat posed by soil and dust in the Study Area, and contains the following elements:

- Designation of "action levels" for arsenic or lead in soil. Engineering measures will address properties or areas that exceed action levels.
- Sampling of individual properties to determine if soil exceeds the action levels.
- Excavation and off-site disposal of contaminated soil and slag from properties that exceed action levels. Contaminated soil below 18 inches will not be excavated but will be capped.
- Replacement of excavated soil and slag with clean soil and gravel.
- Asphalt capping or soil removal and replacement with gravel of contaminated dirt alleys and parking areas.
- Fencing and planting low lying shrubs in steep areas that cannot be excavated.
- Soil collection program for soil above action levels that is not excavated during the cleanup (e.g., soil below 18 inches that is uncovered in the future).

- The development and implementation of Community Protection Measures (CPMs). CPMs are administrative requirements that will address soil that is not excavated but that contains concentrations of contaminants above 20 ppm arsenic and 250 ppm lead, but below the 230 ppm arsenic and 500 ppm lead action levels.

Asarco Sediments

The selected remedy for the Asarco Sediments/Groundwater Operable Unit includes the two major elements, groundwater and sediments.

EPA determined in a Groundwater Task Force, comprised of Asarco, EPA and other regulatory agencies, that additional groundwater remedial actions, over and above those already being implemented under the Smelter facility ROD, were not necessary.

The Selected Remedy for marine sediments included the following elements:

- Dredge contaminated sediment in the Yacht Basin and place the dredged sediment beneath a low-permeability soil cap to be constructed on the upland portion of the Facility [the smelter property]. The sediments will be contained under the low-permeability cap at an elevation such that groundwater will not come in contact with the sediment. The areas for dredging and capping are severely impacted areas where chemical concentrations exceeded CSLs and multiple biological impacts (e.g., more than one biological test exhibited a significant effect) were observed. This also included all areas where benthic community structure indicated a stressed environment.

- Monitor the dredged area in the Yacht Basin to verify that it does not become recontaminated.
- Cap contaminated sediments in selected offshore areas.
- Monitor the sediment caps to confirm that they remain in place, continue to isolate the underlying contaminated sediment, become recolonized with healthy biological communities, and do not become recontaminated.
- Use institutional controls to prevent activities that could damage the sediment caps.
- Monitor the areas outside the capped and dredged areas to confirm that these areas meet RAOs.
- Continue to monitor groundwater to evaluate the long-term effects that the Facility cleanup will have on future groundwater quality.
- Implement institutional controls to restrict future use of Smelter facility groundwater.

5.3.2 Remedy Implementation

Asarco Smelter

Smelter remediation started in 1993 with the implosion of the stack, followed by the demolition of the buildings and structures on the site. Asarco began design of the final remedial action for the site in 1997, and began the remediation in 1998.

All buildings and structures on the site have been demolished. The OCF has been constructed, all of the source area material from the site has been placed in it, and the OCF has been capped and closed. Leachate from the OCF is collected in an onsite tank and disposed of as needed.

As part of shoreline work, EPA was required to comply with the Endangered Species Act. To comply with some the provisions of ESA, all in-water remediation work was restricted to established "fish windows" that are designated times when remedial action construction activities are allowed to occur. Dredging activities during shoreline armoring were required to be done inside silt curtains to ensure that young salmon where not impacted. Divers were used to chase fish out of the curtained area prior to work commencing.

In addition, Section 404 of the CWA is an ARAR for the Site. This requires that mitigation must occur for any remedial action(s) that cannot be avoided or minimized. To meet the requirements, the shoreline was sloped upward to form beaches rather than just being armored. A five-acre habitat beach was required to mitigate for areas where covering intertidal area could not be avoided.

Shoreline armoring except for the mid section of the site (which will be completed by Point Ruston) had been completed on the slag peninsula and the site, with the exception of the tip of the slag peninsula. This included the construction of the habitat basin on the slag peninsula. In 2001, the Nisqually earthquake caused a portion of the breakwater forming the habitat beach in the mitigation site to collapse. The shelf that the rock was sitting on collapsed. Therefore any repair would require a significant reduction in size of the basin. The basin continues to function as designed without that section of breakwater.

Ruston/North Tacoma Study Area

Sampling began in October 1993, and cleanup activities were initiated in the spring 1994. The Study Area was divided into four Zones, based on known soil arsenic concentrations, in an effort to focus sampling and cleanup activities in the most contaminated areas first. According to the ROD, Zones 1 to 3 corresponded to the area where "properties were most likely to exceed action levels." "Sampling in the outer zone, Zone 4, was to be performed as needed to supplement the RI data, or at the request of the property owner." Sampling of all properties in Zones 1 - 3, the preliminary remediation area, is required in the ROD and was completed in 2003 with the exception of a few refusals. Remedial action in Zones 1 - 3 was completed in 2004, again with the exception of a few refusals. The ROD describes that sampling in Zone 4 should occur where "needed or as requested by the property owner." Sampling in Zone 4 was started as a voluntary program at the request of property owners. Sampling and remediation of Zone 4 where permission was granted is now completed. Because the RI data did not accurately predict the

number of contaminated properties in Zone 4, and approximately 40 to 50 percent of properties in Zone 4 required remediation. EPA will be sampling the remainder of the Zone 4 properties and remediating those as required.

A community protection measures program (institutional controls) was developed for the Study Area and implemented by a program coordinator from the Tacoma Pierce County Health Department, the coordinator for the Asarco Information Center, and a work group consisting of representatives from government agencies, a local interest group, local officials, and Asarco personnel. The program is referred to as "PACE" – the Program for Area Cleanup Education and meets on a quarterly basis. The objective of the PACE program was to provide owners and residents in the Study Area with educational materials and guidance on the management of soils in the area. The PACE program was being implemented in accordance with its requirements. Asarco also provided a soil repository program to allow local residents to dispose of residential soils for free if they were removing dirt from their yards. The program was not used often. The PACE program was suspended following Asarco's bankruptcy as a result of lack of funds as described below. EPA plans on implementing all Institutional Controls and community protection measures that are still needed within the next two years.

5.3.3 Post-Construction Monitoring/Operation and Maintenance

The Asarco Smelter cleanup is ongoing and O&M activities are not yet implemented.

The Ruston/North Tacoma Study Area remediation is still ongoing and O&M activities are not yet implemented.

The Asarco Sediments remediation is still ongoing and O&M activities are not yet implemented.

5.4 Progress since the Last Five-Year Review

Asarco Smelter

As of September 2009, the following progress has been made on the Smelter remediation:

The onsite containment facility (OCF) has been constructed, all of the source area material from the site has been placed in it, and the OCF has been capped and closed. Leachate from the OCF is collected in an on site tank and disposed of as needed. Shoreline armoring except for the mid section of the site (which will be completed by Point Ruston) had been completed on the slag peninsula and the site, with the exception of the tip of the slag peninsula. This included the construction of a habitat basin on the slag peninsula. In 2001, the Nisqually earthquake caused a portion of the breakwater forming the habitat beach in the mitigation site to collapse. The shelf that the rock was sitting on collapsed. Therefore any repair would require a significant reduction in size of the basin. The basin continues to function as designed without that section of breakwater.

Stack Hill has been remediated to residential standards, and platted into residential sites. The first houses have been constructed on the upper portion of Stack Hill.

The last five-year review projected that site capping would be completed in 2007. The remediation schedule has changed significantly since Asarco filed for bankruptcy. (See section on **Asarco Bankruptcy and Post Bankruptcy Development** below.)

The Asarco plan was to complete site capping and provide building pads for future development. Point Ruston LLC, the current site owners, proposed to combine the development of the site with site capping, so that the buildings and hardscapes of the development become the cap. This proposal was accepted by EPA in the settlement with Point Ruston. However, in order for occupancy to occur, Point Ruston LLC must have approved designs and plans in place to show that capping can be done appropriately, and that future residents will be protected on the site.

Since 2006, Point Ruston LLC prepared designs that allow the site development to meet the requirements of the site cap. Buildings with concrete foundations and roofs satisfy the needs for a permanent impermeable barrier for the site. Special asphalt will be used for road surfaces that meet the permeability requirements for a RCRA cap. Transitions between surfaces have been designed to ensure that cap integrity is maintained. Finally, extensive oversight by EPA of construction ensures that construction is done correctly. Construction of the foundations of two condominiums started on the site in 2008. These will be integrated into the sitewide cap.

EPA and its contractor CH2M Hill conducted a review of the design for the sitewide cap focusing on constructability and maintenance. The review was held on August 18 and 19, 2009. The major issues and recommendations raised include:

1. The long-term maintenance of joints and cracks in a concrete and asphalt cap to maintain impermeability to surface infiltration will be extremely labor intensive, difficult, and costly.

2. Construction QC will be a major issue to ensure that concrete and asphalt are properly constructed to avoid cracks and ensure impermeability.

3. The construction methods employed while during occupancy must ensure that onsite exposure is the equivalent to exposure once the site is completed.

4. The use of impermeable asphalt rather than concrete may be preferable. Putting in a geocomposite liner and drainage system under the solid surfaces to meet the impermeability requirements may be a more cost-effective alternative.

These results have been discussed with Point Ruston to ensure that the remedy will be protective when implemented and remain protective. Point Ruston is determining how best to incorporate these recommendations.

Ruston/North Tacoma Study Area

As of the end of 2008, progress on cleanup was as shown below.

Number of properties with sampling completed	Residences, parks, vacant lots	2781
	Right of ways	945
Number of properties with remediation completed	Residences, parks, vacant lots	1855
	Right of ways	442
Number of Zones 1 - 3 properties where owners refused sampling	Zone 1 - 3	2
Number of Zone 4 properties where owners did not agree to sampling	Zone 4	227
Number of Zones 1 - 3 sampled properties where owners refused remediation	Zones 1 - 3	2
Number of Zone 4 sampled properties where owners did not agree to remediation	Zone 4	31

As stated previously, the RI data did not accurately predict the number of contaminated properties in Zone 4, and approximately 40 to 50 percent of properties in Zone 4 require remediation. EPA will be requiring sampling and, if needed, remediation of the remainder of these properties.

At the end of 2009 all properties with the exception of those where owners refused sampling or remediation will be completed. After 2009, EPA will be taking over the Ruston/North Tacoma Study Area remediation. EPA is currently working on obtaining access for sampling and remediation from the property owners of unsampled and unremediated yards. EPA expects that construction will start in the spring of 2010.

Currently, all site information is managed by Asarco. Since this is the last year they will be onsite, the community protection measures need to be reviewed, revised as needed and implemented. These include the following: a long-term program for property tracking needs to be developed. The data on individual sites needs to be digitized and a means of making the data available electronically to interested parties needs to be determined.

Asarco Sediments

Prior to bankruptcy, Asarco had completed the remedial design for capping offshore sediments and excavation of the Yacht Basin, but no progress on implementing the remedy had occurred.

The agreement with Point Ruston LLC called for capping the offshore sediments with a sediment cap within a year of signing the agreement, excavating shallow sediments in the Yacht Basin prior to approval of the second phase of development, and completing the hard cap (the part of the sediment cap that joins the sediment cap with the shoreline armoring) within seven years of the agreement. Point Ruston LLC placed approximately 10 acres of sediment to cap offshore sediments between November 2006 and February 2007. The cap could not be extended underneath the docks because the pilings blocked the sediment capping materials from entering between them. As of July 2009, Point Ruston LLC and DNR are working together to remove the docks. Dock removal is dependent on DNR receiving funding for the project.

EPA has taken over the remediation of the Yacht Basin. Because the design was completed by Asarco, EPA is having the design reviewed and modified as needed so that it can be reissued as an EPA design. EPA will be using funds from the Asarco Bankruptcy settlement to remediate this area (see below for details of the settlement). While no start date has been set, the remedial action is expected to begin in the 2-3 years.

The sediment design may need to be modified with alternate dredging methodologies, or may need to provide a phased approach to take into account the need to work around boats, boat houses and docks in the Yacht Basin. In addition, as there is a potential that contaminants migrated from the mouth of the Yacht Basin since RI/FS sampling, some sediment sampling may be necessary.

Asarco Bankruptcy and Post Bankruptcy Development

Asarco Filed Bankruptcy in 2005

Asarco filed for protection under Chapter 11 of the Bankruptcy Code on August 9, 2005. Within months of filing, numerous creditors filed over $10 billion worth of claims. The United States and numerous states filed claims for environmental damages totaling over $6 billion. The asbestos plaintiffs' claims were over $2 billion.

Sale of Asarco Smelter to Point Ruston

On December 8, 2005, Asarco entered into an agreement with MC Construction Consultants, Inc. ("MC Construction"), to sell approximately 97 acres of its real property located in Tacoma and Ruston, Washington. The purchased property includes parts of the former Asarco Smelter Site, and parts of the Asarco Sediments/Groundwater Site.

MC Construction subsequently assigned to Point Ruston, LLC ("Point Ruston") its rights under the Tacoma Purchase Agreement. Point Ruston is a limited liability company incorporated in Washington, with its principal place of business in Tacoma, Washington.

Within a year of Asarco's filing for bankruptcy protection, Region 10 and DOJ negotiated an amendment with Point Ruston, LLC to purchase the property and take over the cleanup of the Smelter property and some other outlying areas. Pursuant to the Second Amendment to the Asarco Smelter Consent Decree, and a Lien Release Agreement simultaneously entered with Asarco and approved by the Bankruptcy Court, Point Ruston, a local real estate developer,

agreed to perform the majority of remaining remedial work on the Smelter Site and Slag Peninsula, and some work on the Asarco Sediments.

The settlement with Point Ruston called for them to remediate the Asarco smelter, cap the slag peninsula, remediate offshore sediments, and excavate shallow sediments in the Yacht Basin (a small part of the excavation remedy). As part of settlement negotiations, Point Ruston proposed that the site buildings and hardscapes be integrated with the site cap. This would require the site to be remediated in phases. EPA approved this proposal subject to approval of controls and construction methods that would both protect public health and the environment, and be protective of people living on the site.

The following schedule was provided in the agreement.

Cap Nearshore/Offshore Sediment with Sand/Silt Cap (approx. 10.5 acres)	One year from Effective Date of Second Amendment[1]
Cap Slag Peninsula	Prior to EPA Certification of the First Phase[2]
Construction of temporary site cap	Prior to EPA Certification of the First Phase[2]
Excavation of shallow sediments in Yacht Basin per SOW requirements	Prior to EPA Certification of the Second Phase[2]
Site Cap 50 percent complete	Four years from Effective Date of Second Amendment[1]
Complete Site Cap	Seven years from Effective Date of Second Amendment[1]
Complete Sediment Cap	Seven years from Effective Date of Second Amendment[1]

1 The "Second Amendment" is the 2006 Consent Decree with Point Ruston
2 Certification refers to EPA issuing a Certification of Completion for a phase of the project. Certification must be issued before occupancy is allowed.

In June 2009, the bankruptcy court approved a settlement between Asarco and the United States that would settle EPA's claims against Asarco for the three operable units related to the Asarco Smelter for $27 million plus interest. The proposed settlement would provide for the payment of the $27 million to an EPA special account for the remainder of Federal remedial work at the three Asarco Tacoma Smelter Operable Units. The settlement is part of a reorganization plan that is pending approval by the U.S. District Court in the Southern District of Texas.

Previous Protectiveness Statement

The Asarco Smelter protectiveness statement in the last Five-Year Review (2004) stated:

> "Remedial actions at the Asarco Smelter are expected to be protective of human health and the environment upon completion. In the interim, exposure pathways that could result in unacceptable risks are being controlled."

The Ruston/North Tacoma Study Area protectiveness statement in the last Five-Year Review (2004) stated:

> "For the properties that have been remediated the remedial actions are protective of human health and the environment. For un-remediated properties the remedial action is not protective because the properties have not been remediated. The properties need to be remediated to ensure protectiveness."

The Asarco Sediments protectiveness statement in the last Five-Year Review (2004) stated: "The remedy for the Asarco Sediments is not protective because no part of the remedy has been implemented. The remedy will need to be implemented to ensure protectiveness."

Status of Recommendations

A summary of the recommendations made in the previous five-year review (2004) and an evaluation of their progress are presented below.

- **Sitewide – Implementation of Institutional Controls and review status of institutional controls already in place.**

  Institutional controls and community protection measures to ensure that the remedy remains protective still need to be developed and implemented for the Ruston/North Tacoma Study Area. Informational mailings for properties that have arsenic and lead contamination above state standards, but below excavation levels have been sent out, but will need to continue now that EPA has taken over the remediation of this operable unit.

  Institutional controls to ensure that the remedy remains protective are being developed by Point Ruston for the Asarco Smelter. These will be placed on the property prior to site occupancy.

- **Ruston/North Tacoma - The potential for recontamination has not been addressed. A subset of Zones 1 and 2 properties should be resampled to determine whether recontamination has occurred since remediation.**

  Yard remediation has been conducted by Asarco using limited Trust monies. Focus since the last review has been on the completion of properties. Sampling of completed yards will be conducted over the next year by EPA as this project nears completion.

- **Ruston/North Tacoma - EPA and Ecology will meet to discuss properties outside of the study area with arsenic concentrations greater than 230 ppm.**

  Ecology has requested that they have jurisdiction of properties outside of the study area as part of their Tacoma Plume Project. EPA has agreed with this request. EPA will determine how to document this agreement.

- **Asarco Tacoma Smelter/Asarco Sediments - Remedy implementation is dependent on the availability of Trust monies and financial status of Asarco.**

  Point Ruston LLC has assumed responsibility for capping of the sediments offshore of the smelter, and excavating shallow sediments in the Yacht Basin. The soft capping of the sediments offshore of the smelter has been completed by Point Ruston as described above.

  The funds needed to conduct the remediation of the Yacht Basin sediments are part of EPA's claim in bankruptcy. EPA is currently reviewing the Asarco design to determine what additional actions may be needed for sediments, and preparing the documents needed to have the Yacht Basin design converted to an EPA lead project.

- **Asarco Smelter - Rebuild the shoreline armoring that comprises a portion of the mitigation site which collapsed during the Nisqually earthquake in 2001; repair is dependent on Trust monies.**

  Trust monies have not been available to rebuild shoreline armor. The habitat basin is functioning as designed even though part of the breakwater collapsed in the 2001 Nisqually earthquake. Because the "shelf" holding the breakwater is no longer there, replacement would require a significant reduction in size of the habitat basin.

  EPA will determine if the best solution is to leave the armoring in its current condition.

- **Asarco Smelter - Monitor redevelopment plans to ensure that future development is protective of the environmental and cleanup remedy.**

  This has been a major focus of the ongoing Point Ruston design review. This will need to continue as the remedy is designed and implemented. Occupancy may occur in the next year. On August 18, 2009, EPA and its oversight contractor CH2M Hill conducted a review of the constructability of the project, and safety review of the project as it relates to potential occupants on August 18, 2009. The major conclusions were the following:

  1. The long-term maintenance of joints and cracks in a concrete and asphalt cap to maintain impermeability to surface infiltration will be extremely labor intensive, difficult, and costly.

  2. Construction QC will be a major issue to ensure that concrete and asphalt are properly constructed to avoid cracks and ensure impermeability.

  3. The construction methods employed during occupancy must ensure that onsite exposure is the equivalent to exposure once the site is completed.

4. The use of impermeable asphalt rather than concrete may be preferable. Putting in a geocomposite liner and drainage system under the solid surfaces to meet the impermeability requirements may be a more cost effective alternative.

Asarco Smelter Sediments

There were no recommendations for the Asarco Smelter Yacht Basin Sediments in the last five-year review (2004).

5.5 Five-Year Review Process

Administrative Components

The Commencement Bay Nearshore/Tideflats Superfund Site FYR team was lead by Nancy Harney, Karen Keeley, Tamara Langton, Kira Lynch, Kevin Rochlin, and Jonathan Williams, the EPA Remedial Project Managers (RPMs), Region 10. Emile Pitre and Jeffrey Powers, both with the USACE, Seattle District, assisted with the review as representatives of the support agency.

By February 2009, the review team had been formed, and had established the review schedule and its major components including:

- Document Collection and Review.
- Data Assessment/Analysis.
- Site Inspection.
- Interviews and Community Notification and Involvement.
- FYR Report Development and Review.

The FYR has a statutory completion date of December 29, 2009.

Community Involvement

EPA sent a postcard to stakeholders and neighbors on the CB/NT project mailing list (approximately 1,440 addressees) in February to notify them of the five-year review process. After checking in with several members of the community, some of them had not yet received the information. A second postcard was sent on March 19, 2009, to ensure that everyone had an opportunity to provide information to EPA. In addition, a display advertisement ran on page B3 of the Tacoma News Tribune Newspaper on February 6, 2009.

Document Review

A review of reports pertinent to this Five-Year Review was conducted by the review team. The types of documents reviewed included decision documents; risk assessment documents; annual data reports; technical memoranda; and other supporting materials. OU 1 Attachment 1 is a complete list of documents reviewed during this FYR.

Data Review and Evaluation

No additional data review and evaluation occurred since remedial action is on-going and data review and evaluation is part of ongoing activities.

Site Inspection

The project manager for the site conducts site visits to review activities at the site a minimum of once per month. No separate visits were made to the site as part of this review. In addition, oversight activities by EPA's contractor CH2M Hill of the remedial actions on the smelter site, the sediment capping and the Ruston/North Tacoma cleanup are conducted as needed to ensure that site activities are carried out in accordance with approved plans and specifications, and in a manner that is protective of public health and the environment.

Interviews

No interviews were conducted.

5.5.1 Technical Assessment

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

Asarco Smelter
Answer: Yes.

Site remediation is still ongoing under Point Ruston LLC, the new site owners. Under the terms of the agreement, Point Ruston has seven years from the settlement date to complete the site cap and offshore sediment remediation. The remedy has not been fully constructed and is not yet fully functional, but where implemented it is functioning as intended [and there is no information that calls into question the protectiveness of the remedy once it is implemented as designed]. In the interim, exposure pathways that could result in unacceptable risks are being prevented because the site is fenced and access to the site is controlled by cell phone operated gates, monitoring during the day, and police patrols in the evenings. Dust control and other dust suppression activities (temporary capping, spraying tackifiers) are used to ensure that site contaminants remain on site. Plans outlining Institutional Control requirements for remedy protection, O&M of the site cap, and funding requirements for site maintenance are being developed. These will be implemented prior to site occupancy.

Ruston/North Tacoma Study Area
Answer: Yes.

The site remediation is still ongoing, and is expected to continue for the next several years. Remediation has occurred without incident, and where implemented the remedy is functioning as intended by the decision documents. As the sites now being remediated are further away from the stack, sampling is indicating contamination in parts of yards rather than the entire yard as was found in Zones 1 to 3.

Legally enforceable institutional controls have not yet been developed and implemented that will ensure that the remedy remains protective after all yards have been remediated. Not all of the community protection measures described in the ROD have been implemented. These are required to ensure that the remedy remains protective after implementation.

Asarco Sediments
Answer: Yes.

The remedy has not been fully constructed, but remedy implementation is progressing and completion is expected in the next two or three years. The soft cap has been placed over the sediments offshore of the smelter. However, the area between the soft cap and the shoreline armoring, where hard capping is required, has not been capped, and neither have the areas under the docks. The sediment remedy has not been implemented in the Yacht Basin.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

Asarco Smelter
Answer: Yes.

Changes in Standards and To Be Considered. Applicable or relevant and appropriate requirements (ARARs) cited in the ROD were reviewed to evaluate changes in the ARARs since the last five-year review. There have been no changes in regulatory standards since the first five-year review.

Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics. The ROD described current and future land uses and identified likely exposure pathways; the descriptions are accurate for the site conditions at the time of this review.

Changes in Land Use. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Remedial Action Objectives. The RAOs from the ROD are still valid for the site.

Ruston/North Tacoma Study Area
Answer: Yes.

In their comments on the first FYR (1999), Ecology informed EPA that they had changed their interpretation of MTCA since the signing of the Ruston/North Tacoma ROD, and that the cleanup decision no longer complies with the cleanup requirements for residential soils under MTCA.

Specifically, Ecology stated that:

> "Under WAC 173-340-740(1)(a), some form of "treatment, removal, or containment remedy" must be employed for residential soils containing hazardous substances in excess of soils cleanup levels (e.g., 20 ppm arsenic). We believe this applies to each exposure unit, that is, each residential property. Under

> WAC 173-340-440(2), institutional controls cannot be used as a substitute for cleanup actions that are otherwise technically possible. In short, we do not believe that reliance on institutional controls to reduce exposure to and risk from arsenic in surface residential soils at levels between 20 ppm and 230 ppm counts as a form of "treatment, removal, or containment" under the applicable regulation."

EPA provided the following response in the 2004 review:

> "Under the National Contingency Plan, EPA is required to consider newly promulgated or modified requirements after the ROD has been signed to evaluate whether the remedy is still protective of human health and the environment (55 Federal Register 8757 (March 8, 1990)). Although Ecology's change in interpretation is not a promulgated change to MTCA, EPA considered Ecology's revised position. EPA believes that the 230 ppm action level for this site is still within EPA's acceptable risk range for carcinogens given consideration of exposure, technical, and uncertainty factors, and still protective of human health."

For this 2009 review, the arsenic cleanup number was again revisited. The assumptions and slope factor for arsenic that were used to determine the site levels in the ROD are still valid.

At Ecology's request, EPA has agreed to conduct a more in depth review of the remedy for the site to ensure its protectiveness. This review will be completed by the summer of 2010. *See* Superfund State Contract between the EPA and the State of Washington for CB N/T Superfund Site Operable Unit 4 (Ruston North Tacoma Study Area), Section 3(D).

Changes in Standards and To Be Considered. Applicable or relevant and appropriate requirements (ARARs) cited in the ROD were reviewed to evaluate changes in the ARARs since the last five-year review. There have been no changes in regulatory standards since the first five-year review.

Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics. The ROD described current and future land uses and identified likely exposure pathways; the descriptions are accurate for the site conditions at the time of this review.

Changes in Land Use. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Remedial Action Objectives. The RAOs from the ROD are still valid for the site.

Asarco Sediments
Answer: Yes.

Changes in Standards and To Be Considered. Applicable or relevant and appropriate requirements (ARARs) cited in the ROD are currently being reviewed as part of the design review and were not completed for this review.

Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics. These are currently being reviewed as part of the design review and were not completed for this review.

Changes in Land Use. There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Remedial Action Objectives. The RAOs from the ROD are still valid for the site.

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

Asarco Smelter - No
Answer: No.

Based on current information, no information calls into question the protectiveness of the remedy. However, the recommendations described in Section 5.4 will need to be addressed to ensure that the remedy is properly constructed.

1. The long-term maintenance of joints and cracks in a concrete and asphalt cap to maintain impermeability to surface infiltration will be extremely labor intensive, difficult, and costly.

2. Construction QC will be a major issue to ensure that concrete and asphalt are properly constructed to avoid cracks and ensure impermeability.

3. The construction methods employed while during occupancy must ensure that onsite exposure is the equivalent to exposure once the site is completed.

4. The use of impermeable asphalt rather than concrete may be preferable. Putting in a geocomposite liner and drainage system under the solid surfaces to meet the impermeability requirements may be a more cost effective alternative.

Ruston/North Tacoma Study Area
Answer: Yes.

Based on RI data, the ROD was based on the assumption that the majority of Zone 4 properties would not require remediation. This was the basis for the statement in the ROD to sample "as needed to supplement the RI sampling results or at the request of property owners." Based on sampling that has occurred to date, approximately 50 percent of the properties in Zone 4 require remediation. The ROD assumption that Zone 4 was relatively clean is not correct. EPA will require that these yards be sampled, and as needed, remediated. In addition to posing an unacceptable risk to residents of the property, unremediated properties may be a source for recontamination of clean properties.

There is anecdotal evidence based on calls that the EPA and Department of Ecology have received, that there are people in the Study Area that do not know anything about the cleanup, or institutional controls. This is in spite of the fact that there have been multiple public meetings held and fact sheets mailed over the years since the project began.

As discussed above, at Ecology's request, EPA has also agreed to conduct a more in depth review of the remedy for the site to ensure its protectiveness. This review will be completed by the summer of 2010. *See* Superfund State Contract between the EPA and the State of Washington for CB N/T Superfund Site Operable Unit 4 (Ruston North Tacoma Study Area), Section 3(D).

Asarco Sediments - No
Answer: No.

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

Technical Assessment Summary

Asarco Smelter

The remedy has not been fully constructed and is not yet fully functional, but where implemented it is functioning as intended and there is no information that calls into question the protectiveness of the remedy once it is implemented as designed. EPA expects the remedy will be completed in a timely manner by Point Ruston. There have been no changes in the ARARs, standards, or To Be Considered that should affect the protectiveness of the remedy. The recommendations made on constructability will need to be followed to ensure that the remedy is properly constructed.

Ruston/North Tacoma Study Area

According to the data reviewed and information obtained from site inspections, the remedy where implemented is functioning as intended by the ROD; however, the remedy has not been fully implemented, and neither have the institutional controls and community protection measures needed to ensure the remedy remains protective after completion. Because the percentage of properties requiring remediation in Zone 4 is higher than expected, EPA intends to require sampling and remediation in this area rather than allowing sampling to be at the request of the property owner as has been the protocol to date. For the remaining yards requiring remediation, remediation will be required for protection of public health and the environment at these properties, and to prevent recontamination of clean properties. There have been no changes in the ARARs, standards or To Be Considered that should affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy once it is implemented as designed.

Asarco Sediments

According to the data reviewed and information obtained from the site inspection, the remedy where implemented is functioning as intended by the ROD, and completion is expected in the next two or three years. There have been no changes in the ARARs, standards or To Be Considered that should affect the protectiveness of the remedy. The remedy is not protective of human health and the environment because the remedy has not been fully implemented. There is no other information that calls into question the protectiveness of the remedy once it is implemented as designed.

5.5.2 Issues

This section addresses issues that, either currently or in the future, prevent the source and groundwater RAs from being protective.

Table 18. Asarco Issues of the 2009 Five-Year Review

Issue	Affects Protectiveness? (Y or N)	
	Current	Future
Asarco Smelter		
None.	Y	Y
Ruston/North Tacoma Study Area		
Based on phone calls received by EPA and Ecology, there is a subset of the people in the study area who do not know anything about the site, the fact that yards in the study area may be contaminated, the yard cleanup program, and the required institutional controls.	Y	Y
The site development may bring new people as well as different land uses to the area. This could result in differing exposures than those currently accounted for in the ROD.	N	Y
There may be recontamination of the yards that have been remediated in the Study Area.	N	Y
Potential for properties outside the Study Area to be contaminated is being addressed by Ecology.	N	Y
Ecology has requested that EPA review the remedy for the site to ensure that it is still protective.	N	Y
Asarco Sediments		
The habitat basin is functioning as designed even though part of the breakwater collapsed in the 2001 Nisqually earthquake. Because the "shelf" holding the breakwater is no longer there, replacement would require a significant reduction in size of the habitat basin.	N	N

5.5.3 Recommendations and Follow-up Actions

Table 19 lists recommendations and follow-up actions for each issue identified in Table 18.

Table 19. Asarco Recommended Follow-Up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Over-sight Agency	Planned Completion Date
Asarco Smelter				
None.				
Ruston/North Tacoma Study Area				
Based on phone calls received by EPA and Ecology, there is a subset of the people in the study area who do not know anything about the site, the fact that yards in the study area may be contaminated, the yard cleanup program, and the required institutional controls.	Review the institutional controls/education component for the Ruston/North Tacoma Study Area and determine what changes are needed to ensure that people are aware of the controls and that they are carried forward.	EPA	EPA	January 2011
The site development may bring new people as well as different land uses to the area. This could result in differing exposures than those currently accounted for in the ROD.	Review ongoing site and area development and ensure that changes in the area do not impact remedy protectiveness.	EPA	EPA	ongoing
There may be recontamination of the yards that have been remediated in the Study Area.	Resample a subset of properties to ensure that recontamination has not occurred.	EPA	EPA	June 2010
Potential for properties outside the Study Area to be contaminated is being addressed by Ecology.	EPA will document these activities.	EPA	EPA	January 2011

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Over-sight Agency	Planned Completion Date
Ecology has requested that EPA review the remedy for the site to ensure that it is still protective.	EPA has agreed to conduct a more in depth review of the remedy for the site to ensure its protectiveness. This review will be completed by July 27, 2010. The review will use the criteria in the "Comprehensive Five-Year Review Guidance (OSWER No. 9355.7-03B-P, June 2001 and also consider strategies that Ecology has developed for addressing arsenic and lead throughout the State and within the Tacoma Smelter Plume.	EPA	EPA	August 2010
Asarco Sediments				
The habitat basin is functioning as designed even though part of the breakwater collapsed in the 2001 Nisqually earthquake. Because the "shelf" holding the breakwater is no longer there, replacement would require a significant reduction in size of the habitat basin.	EPA will need to determine whether the habitat basin should be repaired or left as it is.	EPA	EPA	January 2011

5.5.4 Protectiveness Statement

Asarco Smelter

Remedial actions at the Asarco Smelter are expected to be protective of human health and the environment when the remedy is completed. In the interim, exposure pathways that could result in unacceptable risks are being prevented because the site is fenced and access to the site is controlled by cell phone operated gates, monitoring during the day, and police patrols in the evenings. Dust control and other dust suppression activities (temporary capping, spraying tackifiers) are used to ensure that site contaminants remain on site.

Ruston/North Tacoma Study Area

Remedial actions for the Ruston/North Tacoma Study Area are expected to be protective of human health and the environment when the remedy is completed. In the interim, exposure pathways on the unremediated properties are only controlled through the compliance with the education program (hand washing, wetting soil, etc).

Asarco Sediments

Remedial actions for the Asarco Sediments are expected to be protective of human health and the environment when the remedy is completed. For the area of sediments offshore of the Smelter where capping has been done, the remedy is already protective of human health and the environment. For the remaining sediments offshore of the Smelter and the Yacht Basin, implementation of the remedy is expected to occur in the next two to three years using money obtained from the Asarco bankruptcy settlement.

6 REMEDIAL ACTIONS AND FIVE-YEAR REVIEW PROCESS FOR CB/NT TACOMA TAR PITS OPERABLE UNIT 03

Five-Year Review Summary Form – CB/NT Tacoma Tar Pits Operable Unit 03

Issues:

1. A small pavement failure was observed in the asphalt road leading to the top of the capped engineered waste pile, as shown in Operable Unit 3 (OU 3) Attachment 5, photo 8. This feature represents a potential pathway for surface water erosion of the cap. (NOTE: this is a separate pavement failure than the one noted in – and repaired after – the 2003 Five-Year Review).

2. Hydraulic conductivity testing of asphalt pavement covers has not been performed in accordance with the Inspection and Maintenance Manual. This was recommended in the 2003 Five-Year Review report.

3. The TTP-3M (East Branch) Area benzene plume within the site boundary has not appreciably diminished in size or concentration over the past several years. In addition, although this plume appears to be contained especially when looking at non-detect benzene concentrations in downgradient monitoring well DOF-19, Figure 6-5 shows a sewer line trench in hydraulic connection with the benzene plume which may convey the plume away from DOF-19.

4. The TTP-18M (North Branch) Area benzene plume appears to be contained or captured as seen through decreasing benzene concentrations; however, the concentrations are well above the ROD groundwater cleanup performance criterion for benzene (53 µg/L) and are also outside the site boundary.

5. The ROD groundwater remedy and RAOs focused on treatment and containment of the contaminated plume, but do not appear to have considered groundwater restoration.

6. Property owner compliance with site institutional control requirements is not optimal.

Recommendations and Follow-up Actions:

1. Repair the pavement hole.

2. Implement asphalt pavement permeability testing or develop and conduct an alternative way of systematically assessing asphalt pavement conditions and permeability and revise the Inspection and Maintenance Manual accordingly.

3. Optimize the TTP-3M (East Branch) Area system and conduct a capture zone analysis in order to reach the ROD groundwater cleanup criterion for benzene and reduce the size of the plume. A determination is also needed on the fate and transport of the benzene plume and its hydraulic relationship to the sewer line trench along the southern boundary of the site.

4. Optimize the TTP-18M (North Branch) Area system and conduct a capture zone analysis in order to reach the ROD groundwater cleanup criterion for benzene and reduce the size of the plume. An additional monitoring well may also be needed just beyond the stagnation point of Extraction Well A to help determine effectiveness.

5. Evaluate whether groundwater restoration at this site is feasible and necessary to 1) comply with ARARs, CERCLA, and EPA's CERCLA groundwater policies, and 2) ensure long-term protectiveness.

6. Request site property owners to comply with all Consent Decree conveyance of site/institutional control requirements. Voluntary compliance with the state of Washington's Uniform Environmental Covenants Act (UECA) should also be requested to ensure the long-term effectiveness of site institutional controls.

Protectiveness Statement(s): The results of this Five-Year Review indicate that the Tacoma Tar Pits remedy is functioning as intended and is currently protective of human health and the environment because 1) sources of contamination (e.g., waste materials and contaminated soils) have been excavated, disposed of off site or treated and contained on site, 2) low permeability caps and surface water controls have been placed across critical areas of the site, 3) institutional controls are in place, and 4) contaminated groundwater is not used as a drinking water source and does not appear to be discharging to the Puyallup River. In order for the remedy to remain protective over the long-term, the follow-up actions recommended in this report need to be performed which include 1) continuing maintenance of the cap, cover and ancillary surface water drainage features, 2) continuing operation and optimization of the groundwater extraction, treatment and monitoring systems to reduce the size and concentration of the benzene plume, and 3) optimizing property owner compliance with institutional control requirements.

Other Comments: None.

6.1 Background

6.1.1 Site Location

The Tacoma Tar Pits site is designated as Operable Unit (OU) 3, an uplands component of the overall Commencement Bay/Nearshore Tideflats (CB/NT) Superfund Site in Tacoma. The site is situated within a peninsula of land between the Puyallup River and the Thea Foss Waterway, approximately three-quarters of a mile north of Interstate 5 (Figure 6-1). The total area of the site encompasses approximately 52 acres.

Several active facilities are located within the site boundary including Simon Metals (formerly known as Joseph Simon & Sons, or JS&S) on about 9 acres of the east interior of the site, a portion of the Tri-Pak transloading facility and UPRR tracks on the northeast, the approximately 14-acre NWDC property on the northwest (site of the former Hygrade meat packing plant), BNSF railroad tracks on the southwest, a PSE natural gas regulator station on the south, and an APP cardlock fueling station on the far southeastern portion of the site. The remainder of the site is occupied by an 8-acre capped engineered waste pile containing stabilized soils and wastes, two lined detention ponds, and light industrial buildings. Figure 6-2 shows most of these facilities and site features.

6.1.2 Hydrogeology

The Tacoma Tar Pits site is located in the Puyallup River delta. The site is underlain by a layered sequence of unconsolidated silts and sands. With the exception of the 30- to 40-foot-high capped engineered waste pile that holds stabilized waste material excavated from the site during the remedial action (RA), the on site topographic relief is nearly flat.

There are three shallow aquifers (Fill, Sand, and Lower) and one deep aquifer at the site. The Fill Aquifer is the uppermost aquifer and consists predominantly of several feet of hydraulic fill materials from past dredging of nearby waterways. Fine-grained native deltaic deposits are present below the Fill Aquifer and act as an aquitard that separates the Fill Aquifer from the lower Sand Aquifer. The Sand Aquifer consists of native fine- to medium-grained sand and is typically in the range of 5- to 10-feet thick. The Sand Aquifer is underlain by a discontinuous fine-grained unit known as the Lower Aquitard. The Lower Aquitard is underlain by the Lower

Aquifer. The Lower Aquifer is composed of interbedded sand and sand with gravel with discontinuous zones of silt, clay, and silty sand.

A Deep Aquifer (greater than 400 feet deep) is known to exist below the site. Studies conducted at the site indicate that upward vertical gradients between this deeper and the above-referenced shallower aquifers inhibit downward migration of contaminants.

Groundwater occurs several feet below ground surface at the Tacoma Tar Pits site. Groundwater levels vary in response to the tidal action in Commencement Bay and adjacent waterways. Groundwater levels also vary seasonally with the highest levels in the wet winter months and the lowest levels in the drier summer months.

Groundwater flow directions vary depending on location, season, and tide stage. In general, however, groundwater typically flows east (northwest and central portions of the site) and south (southeast portion of the site).

Shallow groundwater in the vicinity of the site is not used for drinking water purposes and it is unlikely that drinking-water wells will be installed in the future because of the industrial nature of the area and the availability of municipal water. The Deep Aquifer is tapped by two artesian wells on the NWDC property. One of these wells (Hygrade Well No. 2) is tested once every two years and has not been found to be contaminated. The other well is located approximately 20 feet to the west of Hygrade Well No. 2, outside the NWDC perimeter fence. When last sampled, it was not found to be contaminated. Neither well is currently being used as a drinking water source nor are they likely to be used for this purpose in the future.

6.2 Site Chronology

Important events and dates for the Tacoma Tar Pits site are described below. Section 6.3 provides a further description of the remedial actions conducted at the site.

1900 - 1924 (approx.)	Tide flats at the site were covered with imported or dredged fill for foundation support for a meat packing plant and railroad lines. Further infilling of topographic low points continued beyond these dates to as recently as the 1970s.
1924 - 1966	A coal gasification plant was constructed on site, which operated until 1956. Principal site contamination, including that derived from coal ash, coal tar liquor, and coal tar solids and semisolids, resulted from on site waste disposal of this material from the coal gasification process. The plant was dismantled in 1966.
1967	A metals recycling company (currently Simon Metals) began operation at the site. During its early operation auto fluff and transformers containing oils with polychlorinated biphenyls (PCBs) were recycled; PCBs were believed to have leaked during the recycling process and are a Contaminant of Concern (COC) listed in the 1987 Record of Decision (ROD).

1981	EPA Field Investigation Team performs a Potential Hazardous Waste Preliminary Assessment; contaminated soils are found.
1983	CB/NT site placed on the NPL; the Tacoma Tar Pits site is OU 3 of the CB/NT site.
1984 - 1987	EPA initiates a Remedial Investigation (RI). Potentially Responsible Parties (PRPs) continue and complete the RI, a Feasibility Study (FS) and a Risk Assessment.
1987	ROD issued for site. The selected remedy principally called for excavation and stabilization of the most severely coal tar-affected soils, and placement underneath an engineered cap, plus surface water controls. Contingency built in for groundwater treatment if continued monitoring showed COCs to continue to exceed cleanup criteria.
1988	An Administrative Order on Consent (AOC) was issued by EPA to Washington Natural Gas (WNG) and JS&S to implement treatability studies. Amendments to the AOC were issued in October and December 1988, and in June 1989.
1991	WNG completes post-RI "extent of contamination" study and bench- and pilot-scale treatability studies.
1991	A Consent Decree (CD) was negotiated between EPA and the PRPs. The CD identified WNG, who later merged with PSE, as the performing PRP for the Remedial Design (RD) and implementation of the RA.
1991	EPA issues an Explanation of Significant Differences (ESD) reflecting an expansion of the remediation area and volume of material compared to the 1987 ROD quantities, based on subsequent findings.
1991 - 1994	WNG conducts a multiphase RD some of which overlaps with the RA, described below.
1992 - 1995	RA implemented which principally consisted of excavation and stabilization of approximately 185,000 cubic yards of material, subsequently placed in a stabilized, low permeability and low leachability waste pile which was then capped. Excavated areas were backfilled with clean, imported compacted sand and gravel. During the RA, two asphalt-lined detention ponds were also constructed which collect surface water runoff from the site. See Section 6.3 for further details of the remedy.
1995	EPA issues second ESD addressing remedy revisions triggered by field conditions encountered during remediation (this ESD addressed modifications to treatability mixes, covers, schedule, and a further increase in treatment volume).
1995 - Present	Post-RA water quality monitoring and operation/maintenance activities.
1998	EPA issues First Five-Year Review Report.

1998	EPA directs PSE (now merged with WNG) to design and install groundwater extraction and treatment system to address contaminant concentrations in groundwater that continue to exceed the ROD cleanup criteria, e.g., benzene.
2002	Groundwater extraction and treatment system constructed and operating full time.
2003	EPA issues Second Five-Year Review Report.
2003	Construction began on the NWDC on the former Hygrade meat packing plant property; facility expansion began in 2008 and was completed in 2009.
2009	Groundwater monitoring and remediation optimization study completed (in draft form at time of this Five-Year Review).
2009	EPA issues Third Five-Year Review Report (this document).

6.3 Remedial Actions

6.3.1 Remedy Selection

A ROD was issued for the Tacoma Tar Pits site in December 1987 (EPA 1987). The selected remedy consisted of the following components:

- Excavation and treatment of contaminated soils characterized as Extremely Hazardous Wastes due to a total polycyclic aromatic hydrocarbon (PAH) content exceeding one percent (based on State of Washington Dangerous Waste Regulations, WAC 173-303-100).
- Excavation and stabilization of all surface soils (defined as less than three feet deep) containing contaminants that exceed a 1x10-6 lifetime cancer risk level.
- Capping of the stabilized materials with a low permeability cover system to reduce surface water infiltration and human exposure.
- Reduction of surface water transport of contaminants by channeling and managing surface water run-on and run-off.
- Removal and treatment of ponded water to achieve cleanup goals.
- Provisions for institutional controls to assure integrity of the engineered waste pile cap and prevent future use of on site groundwater.
- Provisions for post-RA groundwater monitoring to evaluate the effectiveness of the RA with respect to groundwater quality and to evaluate the need for groundwater extraction and treatment in the event that groundwater quality goals are not achieved through implementation of the soils remedy.

The ROD-identified cleanup levels for soil, surface water, and groundwater are based on Applicable or Relevant and Appropriate Requirements (ARARs) and the results of the Risk Assessment (see Section 3.5.3 for further discussion on the Risk Assessment). These cleanup levels are presented by media as follows:

Soil

Lead – 166 mg/kg.

PCBs – 1 mg/kg.

ROD-PAHs – 1 mg/kg (individual[8]).

ROD-PAHs – 5 mg/kg (total).

Benzene – 56 mg/kg.

Surface Water (on Site)

Lead – 172 µg/L.

PCBs – 2 µg/L.

ROD-PAHs – 219 µg/L (total).

Benzene – 5,300 µg/L.

Surface Water (at Site Boundary)

Lead – 3.2 µg/L.

PCBs – 0.2 µg/L.

ROD-PAHs – 5 µg/L (individual).

ROD-PAHs – 30 µg/L (total).

Benzene – 53 µg/L.

Groundwater (for Sand and Fill Aquifers)

Lead – 50 µg/L.

PCBs – 0.2 µg/L.

ROD-PAHs – 5 µg/L (individual)

ROD-PAHs – 30 µg/L (total).

Benzene – 53 µg/L.

8 ROD individual PAHs include benzo(a)pyrene, benzo(a)anthracene, beno(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

6.3.2 Explanation of Significant Differences

An ESD was issued in 1991 (EPA 1991) as a result of studies conducted subsequent to the 1987 ROD. Revisions to the ROD included an expansion of the remediation area, an increase in the volume of contaminated materials to be excavated, consolidated and stabilized, importation of clean backfill to be placed in excavated areas including the capped engineered waste pile area to raise the bottom above the seasonally high water table, and expansion of the capped area to include the Simon Metals property. This ESD also added more specificity to the remedy requirements by providing area- and contaminant-specific criteria for excavation and treatment of waste materials.

Another ESD was issued in 1995 (EPA 1995) based on field conditions encountered during remediation. These changes included modifications to treatability and stabilization mixes, an increase in the volume to be treated, the addition of a multi-layered geosynthetic cover over the engineered waste pile area, and cement concrete pavement in addition to asphalt to be placed in certain areas of the Simon Metals property.

None of the ESD changes fundamentally changed the nature of the selected remedy described in the 1987 ROD.

6.3.3 Remedy Implementation

Soil

Major components of the implemented soil remedy included contaminated soil excavation, screening and stockpiling, stabilization and placement, and capping. The RA included excavation of soil, auto fluff, and tarry materials containing ROD indicator contaminants (as listed in Section 6.3.1) above cleanup criteria. Excavated material was stockpiled and characterized to determine stabilization requirements. Oversized debris (wire, metal, concrete, wood, etc.) was screened or manually removed prior to treatment, some of which was placed in the stabilized waste pile and some disposed of off site.

The contaminated materials under the original waste pile area were excavated to the top of the underlying clay layer and were backfilled with clean materials. The clean backfill was placed well above the seasonally high water table, and stabilized wastes were placed on top of the clean material. Materials were stabilized using either a pug mill or a custom-designed and built batch mix plant. The primary stabilizing agent was Portland cement, although tarry materials were stabilized with a combination of cement and the proprietary ingredient “P-27” manufactured by the Silicate Technology Company. The end result of either stabilization process was a roller compactable material which was placed and compacted within the waste pile on top of the clean fill. Plates were installed on top of the pile to monitor settlement. Little settlement was observed.

According to the ROD, an estimated 45,000 cubic yards of material was to be excavated and stabilized on site. Ultimately a total of 185,170 cubic yards of non-tarry soil, tarry material, and auto fluff were excavated and stabilized during the remediation. The additional volume of

material was from peripheral areas and the metals recycling operating areas, as well as expansion of hot spot excavations as RA construction progressed.

Cap materials varied by location. The engineered waste pile received a cap composed of soil and turf over two low permeability geosynthetic layers of 60-mil high-density polyethylene (HDPE), and received a 60-mil HDPE liner over a geosynthetic clay liner on the side slopes of the pile. Asphalt and concrete paving was placed to cover the surfaces of the metals recycling facility. The asphalt consists of a minimum of 1.5 inches of low permeability asphalt protected by a minimum of 1.5 inches of an asphalt wear surface. Reinforced concrete slabs, generally eight inches thick, were used in high-traffic areas. The two detention basins are lined with low permeability asphalt and have a minimum thickness of three inches. See Figure 6-3 for locations of various implemented remedial actions.

Surface Water

Components of the surface water remedy included temporary handling of storm water during remedial construction, and construction of the permanent storm water drainage system. The permanent storm water drainage system consists of both the waste pile drainage system and the metals facility drainage system. Box culverts collect surface water draining from the capped waste pile, which direct drainage to Detention Basin No. 1 via a buried culvert. A series of catch basins and buried pipes collect surface water draining from the metals facility and divert it to a covered manhole in Detention Basin No. 2. This basin contains an oil water separator. Both detention basins drain into the BNSF ditch through restricting orifices, then to the Cleveland Way pumping station, and ultimately on to the Puyallup River. Both Simon Metals and PSE have National Pollutant Discharge Elimination System (NPDES) permits for their surface water discharge from the detention basins on site.

Groundwater

Components of the groundwater extraction and treatment system include the groundwater treatment plant, extraction wells, and piping. As indicated in Section 6.3.1, the ROD anticipated the need for groundwater remediation if the initial RA did not achieve ROD groundwater quality criteria at the site boundary in a timely manner. In October 1998, EPA directed PSE to implement a groundwater remedy at two locations where benzene concentrations continued to exceed ROD criteria. These locations, known as the "TTP-3M Area or East Branch" and the "TTP-18M Area or North Branch" were named after monitoring wells near the center of the two benzene plumes (Figure 6-4). The TTP-3M (East Branch) Area is located in the south portion of the site, while the TTP-18M (North Branch) Area is located in the central portion of the northeast site boundary.

In 2002, a groundwater extraction and treatment system was installed. It was designed to treat up to 25 gallons per minute (gpm) of on site contaminated groundwater and prevent it from migrating off site and potentially impacting the Puyallup River. The system consisted of the treatment plant, four extraction wells (two in each of the two benzene plumes), and ancillary piping. The groundwater treatment plant utilizes air stripping to eliminate benzene from groundwater, and uses granular activated carbon to sorb volatile organic compounds (VOCs) from the vapor stream. Treated groundwater effluent is discharged to the City of Tacoma

publicly owned treatment works (POTW). The system was operating full time by September 2002.

6.3.4 Post-Construction Monitoring/Operation and Maintenance

The O&M program encompasses two main elements: 1) the initial remedy consisting of low permeability covers and storm water drainage systems completed in 1995, and 2) the groundwater extraction and treatment system completed in 2002.

Inspection and Routine Maintenance/Surface Water Monitoring

Inspection and routine remedy maintenance follows the *Inspection and Maintenance Manual* (Ebasco 1995) for the components of the initial remedy. The manual calls for routine inspection of the following items: metals facility drainage system including Detention Basin No. 2, asphalt and concrete pavements, waste pile cover drainage and turf, and waste pile drainage system including Detention Basin No. 1. Inspection frequency generally occurs every six months for the engineered waste pile cover drainage and turf, to annually for most other items. Also, the manual calls for routine inspection after heavy rainfall events, which do occur.

Surface water quality monitoring is conducted semi-annually (March and September) at approximately 65 feet upstream of where the BNSF ditch enters a buried culvert. The BNSF ditch is located on the south side of the site, and receives surface water runoff from the site exiting the two detention basins.

Groundwater Monitoring Program

Post-remediation groundwater monitoring between March 2002 and the present was completed in accordance with the *Revised Water Quality Monitoring Program* by Dalton, Olmsted and Fuglevand, Inc. (DOF; the PRP's remediation contractor), approved by EPA in January 2002 (DOF 2002). Quarterly groundwater monitoring events usually occur during the months of March, June, September and December of each year.

Groundwater Extraction and Treatment System

O&M of the groundwater extraction and treatment system is conducted in accordance with the *Groundwater Remediation System, Operation and Maintenance Plan* (Alta Geosciences 2003). Typical maintenance items for the pump and treat system include the following inspections and operational checks: 1) weekly monitor general plant operations and resupply biofouling treatment chemicals if needed, 2) monthly check meter functions and the need for replacement of vapor phase carbon, and 3) other system checks monitored remotely to verify the plant is operating properly.

In addition to the above O&M activities, the City of Tacoma reviews and renews PSE's Industrial Wastewater Discharge Permit (PSE 2007) every five years, and inspects and performs compliance sampling twice a year.

6.3.5 Remedy and O&M Costs

The initial remedy cost $39,319,000, and the construction of the groundwater extraction and treatment system cost an additional $200,000 (EPA 2003).

Costs associated with post-construction water quality monitoring, inspections and O&M of the groundwater extraction and treatment system have averaged $200,000 per year.

6.4 Progress Since the Last Five-Year Review

This Section provides a summary of the actions taken since the last Five-Year Review.

6.4.1 Previous Protectiveness Statement

The Tacoma Tar Pits protectiveness statement in the last Five-Year Review (2003) stated: "The remedy for the Tacoma Tar Pits site protects human health and the environment in the short-term." The protectiveness statement also stated: "Groundwater continues to be contaminated beneath the interior of the site as anticipated by the ROD. Presently, groundwater contamination does not present a threat to human health and the environment because shallow groundwater is not 1) used for any purpose in the vicinity of the site, or 2) [is not] discharging into local surface water bodies where it could potentially impact ecological receptors."

In addition, it stated that for the remedy to be protective in the long-term, the following actions need to be taken: 1) ongoing annual inspections and O&M procedures must continue to ensure on site remedy elements such as low permeability caps and surface water control structures remain functional, 2) the recently constructed groundwater extraction and treatment system must continue to be operated to control and eliminate the off site extension of benzene plumes in the TTP-3M and TTP-18M areas. Additional extraction wells or other optimization actions may ultimately be required if it is determined that the existing extraction configuration is not adequate."

6.4.2 Status of Recommendations

The 2003 Five-Year Review report recommended specific actions be taken, as part of or in addition to the regular O&M program, to address concerns about short- and long-term remedy protection. The status of each action is summarized below:

- **A small asphalt pavement failure had occurred in the road accessing the top of the stabilized waste pile. A recommendation was made to repair the pavement failure by November 2003 before the winter 2003-2004 rainy season began.**

  Several asphalt pavement failures or "holes" were reportedly repaired on the waste pile access road in October 2003. During the Third Five-Year Review site inspection conducted on June 3, 2009, one small pavement failure similar to the ones previously described and repaired was observed on the access road which will require similar repair.

- **Hydraulic conductivity testing of asphalt pavement covers has not been performed every five years as required by the *Inspection and Maintenance Manual* (Ebasco 1995). A recommendation was made to follow the scheduled frequency for hydraulic conductivity testing, or an alternative way of systematically assessing asphalt pavement condition and permeability should be developed.**

  This issue is still outstanding. There has been reluctance by the PRP's remediation contractor, DOF, to core through the asphalt because, even though the cored holes would be plugged, they may to some degree cause preferential flow paths through the asphalt circumventing what is believed to be a very impermeable asphalt surface. DOF reports testing of surface water in the BNSF ditch and in shallow monitoring wells in and near the asphalt surface indicate that the ROD groundwater criteria are met in the shallow fill aquifer which would be most prone to potential seepage through the asphalt.

- **A recommendation was made for vegetative growth, observed in some surface water drainage channels, and its potential impact to surface water drainage, to be assessed during the next annual inspection. A maintenance plan should be identified if needed.**

  Vegetative growth has been periodically removed from armored drainage channels along the capped engineered waste pile. DOF has observed the drainage channels during periods of heavy rainfall and has determined the vegetation does not hinder drainage in any way. During the site inspection conducted on June 3, 2009, vegetative growth was observed in portions of the armored drainage channels. To date, a maintenance plan has not been developed to address vegetative growth. If EPA and PSE decide that a vegetative management plan is necessary for the site, control of Spotted Knapweed should be a component of that plan as it is designated for control in the Tacoma CB/NT area.

- **As of 2003, benzene concentrations in off site well TTP-14M *[sic, there is no TTP-14M; referenced well is AGI-14M]* had been on an increasing trend. A recommendation was made for continued monitoring, with additional investigations and/or groundwater extraction should be initiated by 5/30/04 should the increase in benzene concentrations continue.**

  Site groundwater has been monitored quarterly between 1991 to the present. Since the last Five-Year Review, 21 groundwater monitoring events have taken place up to the last available data for this review in December 2008. Benzene at well AGI-14M, part of the TTP-18M (North Branch) Area, increased from near 0 in early-2001 to about 1,500 µg/L in mid-2003, at which time it peaked. This significant increasing trend was observed during the time the 2003 Five-Year Review report was being prepared. Since mid-2003, the concentration has been on an equally significant decline; benzene at AGI-14M was 1.1 µg/L in January 2009. The declining concentration is directly and indisputably linked to groundwater extraction at nearby Extraction Well A. Well AGI-14M serves as a representative well showing general reduced concentrations and contraction of the benzene plume of the TTP-18M (North Branch) Area. See Section 6.5.8 (Data Review and Evaluation) for further discussions on the benzene plume in the TTP-18M (North Branch) Area.

- **Because the groundwater extraction and treatment system was new and its effectiveness unproven in 2003, a recommendation was made to continue operating and optimizing the system and continue monitoring groundwater quality and hydraulic capture on a quarterly basis.**

  The groundwater extraction and treatment system has been in continuous operation for 6.5 years except for routine and non-routine downtime totaling no more than 9 percent for any given operational quarter. Causes for system downtime have been corrected – for example protecting against freeze damage and improvements to software to prevent unnecessary alarm trips.

  In early 2009, Monitoring and Remediation Optimization Software developed by the Air Force Center for Engineering and the Environment, was utilized by the PRP's remediation contractor, DOF, to assess trends and further evaluate groundwater monitoring data (DOF 2009c). See Section 6.5.8 (Data Review and Evaluation) for the results of this study, and OU 3 Attachment 2 for the draft DOF report.

- **In the Third Five-Year Review, include CB/NT OU 3 Tacoma Tar Pits as part of this review.**

  This recommendation has been implemented as part of this Five-Year Review.

6.4.3 O&M Program Actions

Since the last Five-Year Review, the O&M activities discussed in Section 6.3.4 have continued for all components of the site remedy pursuant to their EPA-approved plans. Inspections have continued to occur and routine and non-routine repairs have been made to both the capping and groundwater- related remedies. The engineered waste pile cap and surface water components are routinely inspected at least twice per year and more on years with noted heavy precipitation events such as in 2005 when five inspections occurred.

Because the groundwater plant is an active remediation system, it generally requires more routine maintenance than the passive engineered waste pile cap and surface water diversion and detention components. The system appeared to operate with maximum flow and minimal downtime or operational issues in 2005, and system monitoring has always shown the discharge criteria to be met pursuant to PSE's Industrial Wastewater Discharge Permit.

Between 2005 and mid-2008, average flow had declined from about 12 to 6 or 7 gpm, and system operational time had decreased from about 97 percent to 63-78 percent in the 1st and 2nd Quarters of 2008. Data from the last two quarters in 2008 indicate operational time and flow rates are back up to 91-97 percent and 10-11 gpm, respectively. In 2007 and the first half of 2008, the extraction and treatment system was shut down for longer than average periods due to "cold weather issues" including freezing of influent and effluent lines. For example, in January 2007, a pipe line breach caused untreated groundwater to pool on the land surface beside well TW-1. In that instance, an above-ground insulated polyvinyl chloride (PVC) pipe fractured due to freezing conditions, but the system was shut down within 1.5 hours of the occurrence.

In addition to monitoring and maintenance by the PRP's remediation contractor, DOF, the City of Tacoma's Public Works Department inspected and performed compliance sampling twice a year in accordance with PSE's discharge permit. See the discussion in Section 6.5.7 (Interviews) on the results of their last inspection.

6.4.4 Other Actions

There have been other actions undertaken beyond the O&M program since the last Five-Year Review to address ongoing or potential issues at the site, and to ensure protectiveness of the remedy.

APP Cardlock Fueling Station Diesel Spill

Soil "hot spot" removal actions were conducted as part of the OU 3 initial remedy at the APP cardlock fueling station area located at the far southeastern portion of the Tacoma Tar Pits site. As mentioned earlier in this report, in the late 1990s an approximate 3,000 gallon diesel fuel spill occurred on this property. This spill, and subsequent diesel spills on this property, continue to be addressed by the property owner and the Washington State Department of Ecology (Ecology) apart from the OU 3 remedy. EPA periodically monitors the progress of the diesel cleanup.

Northwest Detention Center

The NWDC is located on the former Hygrade meat packing plant property in the northwest portion of the Tacoma Tar Pits site, and is used to temporarily detain individuals who are awaiting determination of their immigration status. The property is comprised of seven tax parcels that cover approximately 14.25 acres. This property was included as part of the Tacoma Tar Pits Superfund site because of suspected contamination emanating from the former Tacoma Historical Coal Gasification Plant operations and the metals recycling facility located south and downgradient of the NWDC. Groundwater was found to be contaminated and subsequently monitored; however, little soil contamination was found. Except for a small section at the southeast corner, the vast majority of this property, including soils beneath the current NWDC facility, did not require excavation or capping under the Superfund remedy.

After demolition of the Hygrade buildings and prior to construction of the initial detention facility, soils contaminated with total petroleum hydrocarbons (TPH) and carcinogenic polyaromatic hydrocarbons (cPAHs) unrelated to the Superfund cleanup were discovered in three areas of the former Hygrade property. In 2002, the property owner entered into Ecology's Voluntary Cleanup Program (VCP) to address this soil contamination. Impacted soil and debris were excavated from the three areas, backfilled with clean materials, and capped. Cleanup of the three areas was completed in early January 2003. Ecology issued an opinion letter on March 7, 2003 stating the cleanup actions met state cleanup requirements and that no further cleanup actions were needed prior to redeveloping the property as long as the property owner entered into and complied with a Restrictive Covenant (Ecology 2003a and 2003b). On March 27, 2003, the property owner recorded the Restrictive Covenant which prohibited uses of the cleaned and capped VCP areas and property groundwater. Groundwater investigation and remediation was not required by the VCP; however, groundwater use on this property is restricted and groundwater continues to be monitored as part of the Superfund remedy.

Construction of the initial NWDC facility was completed in late 2003. The Department of Homeland Security, Immigration and Customs Enforcement (ICE) currently lease the NWDC from the property owner. When first constructed, the NWDC was designed to hold approximately 500 - 1,000 detainees. In 2008, preparations began for expansion of the facility to include a new wing to house an additional 553 detainees. Expansion construction was completed in summer 2009.

Request for Emergency Inspection and Other Community Concerns

On December 10, 2008 EPA received a request from the Bill of Rights Defense Committee (BORDC) – Tacoma to conduct an emergency inspection of the NWDC expansion area (BORDC 2008a). The BORDC contended that expansion grading, excavating, auguring and soils compression activities breached the VCP surface cap allowing contaminated subsurface groundwater and highly contaminated soils to be exposed in violation of Ecology's Restrictive Covenant. The request included photos where BORDC had observed areas of contamination due to expansion activities.

On December 11, EPA received an inquiry from Citizen's for a Healthy Bay (CHB) regarding the BORDC concerns along with an e-mail forwarded from a local citizen complaining of odor and "ooze" at the site. This citizen also contended that there was no "bottom" to the engineered waste pile to the south of the NWDC facility allowing site (soil) contaminants to readily come in contact with groundwater.

In early September 2009, Ecology forwarded to EPA a complaint received from a local citizen concerned that the expansion activities violated the aforementioned Restrictive Covenant and allowed contaminants to seep into the facility buildings "causing an unbearable hazard."

Coordinated Inspections and Investigations

In response to citizen concerns received on December 10 and 11, the City of Tacoma, Ecology and EPA immediately launched a coordinated inspection of the NWDC expansion area. Since then a number of additional inspections were conducted by or on behalf of EPA, Ecology, the City of Tacoma, and the Washington State Department of Labor and Industry as expansion efforts continued through spring 2009. As part of soil excavations, the Tacoma-Pierce County Health Department (TPCHD) required the NWDC property owner to stockpile and sample excavated soils prior to their removal to the Pierce County Land Recovery, Inc., (LRI) landfill located in Graham, Washington. EPA and Ecology obtained copies of the sampling results from the property owner as they became available to ensure that on site construction workers, and NWDC staff and detainees, were safe from exposure to any contaminated materials that may have been found. In addition, EPA conducted limited soil and surface water sampling in April 2009 (E&E 2009).

In addition to inspections and analyses related to the NWDC expansion, the City of Tacoma continues its extensive surface and storm-water monitoring and compliance program of the entire tideflats area which includes the Tacoma Tar Pits site. EPA also continues to monitor groundwater downgradient of the NWDC facility.

See Sections 6.5.8 (Data Review and Evaluation) for a discussion on the impacts of the NWDC construction including soil sampling results and risks associated with the recent expansion efforts. Also see OU 3 Attachment 3 for further discussion on the BORDC emergency inspection request and other community concerns related to the construction and expansion of the NWDC.

6.5 Five-Year Review Process

This section describes the process taken to conduct this third Five-Year Review of the Tacoma Tar Pits site, and provides an evaluation of the data and the progress made to ensure the protectiveness of the remedy.

6.5.1 Deadline for Five-Year Review

The initial statutory deadline for this third Tacoma Tar Pits site Five-Year Review was September 2008. However, as mentioned in Section 6.4.2, the previous CB/NT Five-Year Review report recommended that all CB/NT areas conduct their five-year reviews at the same time and the results published in one consolidated report. This third Five-Year Review of the Tacoma Tar Pits site, therefore, was delayed by one year to comply with this recommendation. The consolidated CB/NT Superfund Site Five-Year Review Report has a statutory completion date of December 29, 2009.

6.5.2 Components of Review

By February 2009, the review team had been formed, and had established the review schedule and its major components including:

- Community Notification and Involvement.
- Document Collection and Review.
- Identification and Evaluation of Institutional Controls.
- Site Inspection.
- Interviews.
- Data Review and Evaluation.
- Five-Year Review Report Development and Review.

6.5.3 Community Notification and Involvement

In February 2009, EPA sent a postcard to stakeholders and neighbors on the CB/NT project mailing list (approximately 1,440 addressees) to notify them of the five-year review process, and to solicit their questions and concerns. After checking in with several members of the community, some of them had not yet received the information. EPA then mailed a second postcard on March 19, 2009 to ensure that everyone had an opportunity to provide information to EPA. In addition, a display advertisement ran on page B3 of the Tacoma News Tribune Newspaper on February 6, 2009.

Prior to and after the postcards were mailed, EPA worked with local community groups and citizens concerned with the expansion of the NWDC and potential risks from site contaminants for detainees. See further discussions on this topic in Sections 6.4.4, Other Action, 6.5.8, Data Review and Evaluation and in OU 3 Attachment 3.

6.5.4 Document Collection and Review

A review of reports pertinent to this five-year review was conducted by the review team. The types of documents reviewed included decision documents; risk assessment documents; annual data reports; technical memoranda; and other supporting materials. OU 03 Attachment 1 is a complete list of documents reviewed during this Five-Year Review.

6.5.5 Identification of Institutional Controls

Identification of land-use restrictions or institutional controls (ICs) associated with properties comprising the Tacoma Tar Pits site was conducted by the PRP's remediation contractor, DOF, and reviewed by EPA and their support agency, USACE (DOF 2009b). The purpose of this review was to ensure that institutional controls are appropriate, in place and are effective across the site.

As part of the remedy, the ROD and ESDs for the Site require ICs to prevent or require stringent control of future excavation activities at the Site, and to prevent future use of shallow groundwater except for monitoring purposes.

The ICs are identified within enforcement documents e.g., Consent Decrees, entered into between EPA and the owners of property located within the Site. The language of the ICs in these documents is summarized below:

1. The restrictions and obligations set forth in the enforcement documents are to run with the land and binding upon any and all persons who acquire any interest in any property included in the Site.

2. The enforcement documents are to be recorded with the Pierce County Auditor's office and a copy of each document is to be provided to the City of Tacoma Planning Department.

3. EPA is to be provided with a copy of the notice of each enforcement document recorded with Pierce County.

4. Any deed, title, or other instrument of conveyance regarding the Site is to include information indicating that the Site is the subject of the enforcement document, and that there are restrictions on use of the property as referenced in the enforcement document, including a prohibition against pumping of groundwater in shallow aquifers for purposes other than monitoring.

5. Each lease of property within the Site is to reference the enforcement document and have the lessee's interest subject to the enforcement document or, in the alternative, the lessee could become a signatory to, and so bound by, the enforcement document.

6. With regard to property contained within the capped portions of the Site, each enforcement document involving a property owner states:

   a) hazardous substances remain under the cap at the Site, and

   b) post-remedial action and use is restricted such that use of such property must never be allowed to disturb the integrity of the cap, of any component of any containment system or the function of the Site's monitoring system, unless the Regional Administrator for EPA, Region 10, finds that the disturbance:

      (i) is necessary to the proposed use of such property and will not increase the potential hazard to human health or the environment; or

      (ii) is necessary to reduce a threat to human health or the environment.

In addition to ICs required via EPA enforcement documents, Ecology entered into its own enforcement document with the property owner that currently houses the NWDC. As explained earlier in this report, only a small section of the southeast corner of the NWDC property required excavation and capping of contaminated soils under the Superfund cleanup. The NWDC property owner, however, cleaned up three areas of TPH-contaminated soils under Ecology's VCP. Upon completion of this cleanup, Ecology entered into a Restrictive Covenant with the property owner that restricted the use of these three areas. The ICs stipulated in the Ecology enforcement document are similar to those in the EPA enforcement documents.

See Section 6.5.8 for a discussion on the IC review findings. See Figure 6-3 for the location of areas of the site where institutional controls apply, and Figure 6-6 for locations of the 16 tax parcels that are within the site boundaries. The IC review approach, data sources and copies of tax parcel documents, e.g., statutory warranty deeds, are included in OU 03 Attachment 4.

6.5.6 Site Inspection

A site inspection was conducted for the Tacoma Tar Pits component of the CB/NT Superfund Site on June 3, 2009. Representatives of the EPA and their support agency, USACE, PSE and their remediation contractor, DOF, Simons Metals, and City of Tacoma Public Works Department were on hand to physically observe the conditions of the site and components of the remedy. The site inspection team roster, site inspection checklist, and pertinent photographs, are included as OU 3 Attachment 5.

6.5.7 Interviews

With two exceptions, interviews were performed informally during the site inspection on June 3, 2009 and the results documented in OU 3 Attachment 5. One interview was conducted by telephone on April 22, 2009 and another on June 23, 2009. Parties were identified for the interviews based on the following criteria:

- Parties directly or indirectly responsible for remedial O&M program.
- Parties adjacent to the site or effected by site related contaminants.
- Utilities affected by operation of the remedy.

Parties identified for interviews included:

- John Rork, PSE Project Manager.
- Matt Dalton, Dalton, Olmsted & Fuglevand (PSE Consultant).
- Mark Burley, Simons Metals.
- Vida Piera, City of Tacoma Public Works Department (via telephone interview and during site inspection).
- Bill Sullivan, Tribal Environmental Director, Puyallup Tribe (via telephone interview).

The following recommendations were made by the City of Tacoma Public Works Department to PSE regarding the operation of the groundwater treatment plant during the site inspection and in follow-up letters pursuant to PSE's Industrial Wastewater Discharge Permit which discharges effluent to Tacoma's Central Treat Plant #1 (a POTW):

- PSE must obtain approval from the City of Tacoma prior to modifying the pre-treatment system.
- A non-mechanical type flow meter should replace the existing flow meter to measure discharge quantities of treatment water to the POTW to obtain greater accuracy.
- As required by the approved treatment plant design, a sequestering agent should be used to reduce precipitates or scale from forming.
- Service the BF 1 and BF 2 bag filters or replace the pressure gauges.
- Determine the purpose of the 8-inch private storm line originating north of the capped engineered waste pile area, then passing underneath it and terminating within the Simon Metal's northwest detention pond.

PSE is expected to address these issues to the City's satisfaction.

6.5.8 Data Review and Evaluation

The following section provides an evaluation of the actions conducted and the data collected and reviewed at the site since the last Five-Year Review.

Initial Remedy Components: Soil Capping and Surface Water Drainage

Overall, the soil capping and surface water drainage components of the initial remedy appear to be functioning well and in accordance with their design, and it appears the PRP's remediation contractor, DOF, is proactive in identifying and correcting most potential issues. The cap limits surface water infiltration, as evidenced by the active armored drainage channels along the

engineered waste pile and detention basins during and after periods of precipitation. ROD soil cleanup criteria have been achieved, as well as surface water cleanup criteria as measured at the site boundary in the BNSF ditch.

In 2003, several holes were observed along the sides of the paved waste pile roadway where the edge of the road abuts the ecology blocks on the road periphery. These holes were the ones identified during the 2003 Five-Year Review (described there as a "small pavement failure"). That review recommended repair "before the rainy season begins (e.g., November 2003)." Repairs were made by the end of October 2003 to the holes specifically referenced; however, a new hole was observed during the June 2009 site inspection indicating this issue is recurring. The new hole in the paved roadway should be repaired as soon as possible. In addition, some vegetative growth was observed in portions of the armored drainage channels during the June 3rd site inspection; however, it did not appear to be hindering drainage in any way.

Also noted in the 2003 Five-Year Review Report was a recommendation to follow the *Inspection and Maintenance Manual's* schedule for hydraulic conductivity testing every five years, or develop an alternative way of systematically assessing asphalt pavement conditions and permeability and revising subject manual accordingly. This has not yet been done, as noted under Section 6.4.2 (Status of 2003 Recommended Actions), due to reluctance by the PRP's remediation contractor, DOF, to core through the asphalt because, even though the cored holes would be plugged, they may to some degree cause preferential flow paths through the asphalt circumventing what is believed to be a very impermeable asphalt surface.

Groundwater Remedy Components: Monitoring and Extraction and Treatment System.

Site groundwater has been monitored quarterly between 1991 to the present. Since the last Five-Year Review, 21 groundwater monitoring events have taken place up to the last available data for this review in December 2008. The groundwater extraction and treatment system has been in continuous operation for 6.5 years except for routine and non-routine downtime totaling no more than 9 percent for any given operational quarter. See Section 6.4.3, O&M Program Actions, for more information on the operating performance and maintenance of the extraction and treatment system since the last Five-Year Review.

Monitoring data indicates that ROD cleanup criteria have been achieved for all indicator contaminants in two of the site aquifers (the Fill and Lower Aquifers). The ROD cleanup criteria for lead, PCBs and PAHs have also been achieved in the Sand Aquifer; only benzene exceeds the ROD criterion of 53 µg/L in the Sand Aquifer. As such, lead and PCBs were eliminated from the groundwater monitoring program and benzene has been the primary focus of the groundwater monitoring program since before the last Five-Year Review. PAHs are still being monitored and are present at some locations, but concentrations are typically low and are co-located with benzene.

As mentioned in Section 6.4.2 of this report (Status of 2003 Recommended Actions), in early 2009 Monitoring and Remediation Optimization Software (MAROS) was utilized by the PRP's remediation contractor, DOF, to further assess benzene data and water quality trends, and the apparent impacts the groundwater extraction and treatment is having on the benzene plume.

Overall, according to monitoring data and the draft MAROS study and as illustrated in Figure 6-4, the footprint of the benzene groundwater plume across the site has reduced in size since groundwater extraction began in 2002 and benzene concentrations have decreased in some locations. The extraction and treatment system has reduced benzene concentrations from maximums of approximately 700 µg/L to 319-467 µg/L in the TTP-18M (North Branch) Area of the groundwater plume and from approximately 6,500 µg/L to about 2,500 µg/L in the TTP-3M (East Branch) Area of the groundwater plume. However, dissolved benzene mass in some locations has increased and benzene concentrations across the site as a whole have fluctuated more or less around their current concentrations since late 2003 with concentrations still above the ROD cleanup criteria of 53 µg/L.

A summary of the trends and draft MAROS study findings focusing on the behavior of the TTP-3M and TTP-18M (East and North Branch, respectively) Areas of the benzene plume is included below:

TTP-3M (East Branch) Area Groundwater Quality Trends

Groundwater quality trends are mixed in the TTP-3M (East Branch) Area. No trend is evident in the East Branch source area (a tar pit was once located at about the position of East Branch Extraction Well C shown in Figure 6-4), and concentrations in the downgradient wells may be decreasing or increasing depending on the specific location. Draft MAROS study results indicated that while the distance between the above mentioned former source area and the center of the plume mass has decreased, dissolved benzene mass in the Sand Aquifer has actually increased over time despite active extraction within the East Branch. Remedial construction impacts were cited in the draft MAROS study as a potential cause of the mixed benzene trends in the East Branch. The November 2008 water quality monitoring report indicated the East Branch's close proximity to the former tar pit source area and the finer-grained nature of the Sand Aquifer as likely causes for this branch's slower response to groundwater and benzene extraction.

The draft MAROS study conclusion of increasing dissolved benzene mass in the Sand Aquifer is problematic, particularly if future monitoring were to indicate loss of hydraulic containment and transport of benzene off site. Monitoring data seems to indicate that benzene in the East Branch has not migrated beyond the site boundary. For example, benzene concentrations in groundwater dissipate to non-detect levels over a relatively short distance in the Sand Aquifer between wells DOF-26M (679 µg/LL on 9/08) and DOF-19M (<0.5 µg/L on 9/08). It is not clear at the time of this Five-Year Review, however, if it is the extraction system containing the benzene plume or if the utility trench containing two large diameter sewer pipes that run between these two wells toward the northeast acts as a preferential flow path for benzene, as depicted on Figure 6-5. In order to reach the ROD groundwater cleanup criterion for benzene and reduce the size of the plume, optimization of the TTP-3M (East Branch) Area system and a capture zone analysis is required. In addition, a determination is needed on the fate and transport of the benzene plume and its hydraulic relationship to the sewer line trench along the southern boundary of the site.

TTP-18M (North Branch) Area Groundwater Quality Trends

Groundwater quality trends indicate that water quality conditions at the TTP-18M (North Branch) Area site boundary have substantially improved since the last Five-Year Review. The increasing benzene concentration trend in off site well AGI-14M noted in 2003 has since been on an equally significant decline; 1,500 µg/L in mid-2003 to 1.1 µg/L in January 2009. The draft MAROS study also indicated that both dissolved benzene mass and distance between the North Branch source area and the center of the mass have decreased with time. Improvements in water quality trends and conditions were attributed to both dissipation of remedial construction impacts since 1995, and operation of the groundwater extraction and treatment system.

Although the North Branch benzene plume appears to be contained or captured as seen through decreasing benzene concentrations, the concentrations are well above the ROD groundwater cleanup performance criterion for benzene (53 µg/L) and are also outside the site boundary. In order to reach the ROD groundwater cleanup criterion for benzene and reduce the size of the plume, optimization of the TTP-18M (North Branch) Area system and a capture zone analysis is required. Also, an additional monitoring well may be needed just beyond the stagnation point of Extraction Well A to help determine effectiveness.

See OU 3 Attachment 2 for details regarding the groundwater quality update using MAROS, and OU 3 Attachment 6 for further details pertaining to the review of site monitoring and maintenance reports.

Evaluation of Institutional Controls

Overall, the ICs identified in the Site's ROD, ESDs and in various enforcement documents are appropriate and appear to be effective in maintaining the remedy in the short-term based on the results of the technical portion of the five-year review. Below is a summary of the review findings:

- Most of the deeds noted the applicable enforcement document(s) but did not indicate that specific land-use restrictions were identified within them.

- Only one of the deeds (CSC of Tacoma now The GEO Group, Inc.; multiple parcels) had the actual IC language within it that would directly inform adjacent property owners, future purchasers and tenants, and even current property owners of the land and groundwater-use restrictions.

- Two of the deeds (UPRR and 1616 St. Paul) do not cite or include the applicable enforcement documents, nor do they identify any ICs.

- The parcel southeast of the NWDC (parcel no. 0320044006) was deeded to both the City of Tacoma (on March 26, 2003) and to CSC (on March 28, 2003 by the previous property owner DVR, LLC.

- Parcel numbers are not shown in Pierce County or City of Tacoma records for the River Street Right of Way (commonly referred to as the BNSF ditch). A portion of this property is

within the capped portion of the initial remedy, and BNRR was a signatory to EPA Consent Decree C89-155B which contained the aforementioned ICs requirements for this property.

- The City of Tacoma's Planning Department does not appear to have any of the enforcement documents or a listing of the ICs for the Site.

Although the ICs appear to be appropriate and effective in protecting the remedy in the short-term, improvements can be made to ensure that ICs remain intact and that future property owners will comply with the land-use restrictions in the long-term. For example, the state of Washington has enacted the Uniform Environmental Covenants Act (UECA) at Chapter 64 of the Revised Code of Washington (RCW). Restrictive covenants which are prepared and recorded in accordance with UECA provide some assurance that persons who obtain an interest in property will be bound by these restrictive covenants. The enforcement documents for the Tacoma Tar Pits site preceded UECA and, as a result, do not require adhering to UECA. Given that UECA provides certain assurances for binding successors-in-interest, it may be prudent to seek to have property owners at the Site prepare and record restrictive covenants in accordance with UECA. On the other hand, the enforcement documents are in the form of consent decrees so that compelling a property owner to abide by UECA would involve 1) voluntary compliance, 2) negotiating, filing and entering modification to the consent decree, 3) negotiating an administrative order on consent which commits the property owner to compliance with UECA, or 4) issuing an administrative order requiring compliance by the property owner with UECA. As a result, the benefit of UECA, including providing potentially better assurance of compliance with restrictions on property use, should be weighed against the risks associated with the present ICs and the resources involved in achieving adherence to UECA.

Northwest Detention Center Impacts and Risks

Over the past year there has been a lot of community concern over recent construction activities at the NWDC facility as mentioned in Section 6.4.4 (Other Actions). Fortunately, based on a review of site documents and construction plans, as well as observations and interviews conducted during recent expansion activities, community concerns regarding impacts on the Superfund remedy and the potential risks to detainees and on site workers from contact with contaminated soil and groundwater were not substantiated. More information is provided below:

Observed Areas of Contamination

Concerns over odor and "ooze" at the site were not observed or substantiated. In addition, several of the photos submitted with the December 10 and 11 notices were not on the Tacoma Tar Pits site. Ecology and City of Tacoma inspectors located each area and worked with the applicable property owner to address suspected contamination where warranted. Additional off site photos submitted in January 2009 were also investigated.

Bottom of the Waste Pile

Concerns with the "bottom-less" engineered waste pile south and downgradient of the NWDC facility were also not substantiated as the "feet" of the engineered and stabilized waste pile are well above the water table. The contaminated materials under the original waste pile area were

excavated to the top of the underlying clay layer and were backfilled with clean materials. The clean backfill was placed well above the seasonally high water table, and stabilized wastes were placed on top of the clean material. Plates were installed on top of the pile to monitor settlement. Little settlement was observed.

The goal during development of the engineered waste pile design was to stabilize the waste materials so that if they did contact water, they would not leach above the 1987 ROD surface and groundwater performance criteria. The design testing program was extensive (many mix designs and leaching tests were conducted) and confirmed by testing completed during remedial actions (many field coupons were collected and tested). To date, there is no evidence that the capped and stabilized engineered waste pile materials are having any impact on groundwater.

Impacts on Superfund Remedy

The initial construction and subsequent expansion of the NWDC facility did not impact the Superfund remedy. The facility's construction footprint did not breach the capped engineered waste pile south of the facility or any other capped portion of the site pursuant to the Superfund remedy. In addition, construction efforts did not impact the groundwater monitoring system or groundwater. Groundwater from the NWDC property is currently below ROD cleanup criteria and in the case of benzene, is non-detect according to data from downgradient monitoring wells located between the NWDC facility and the capped engineered waste pile to the south and east.

Excavation Risks

As discussed under Section 6.4.4 (Other Actions), the TPCHD required the NWDC property owner to stockpile and sample excavated soils prior to their removal to the LRI landfill. The samples and analytical results were reviewed by Ecology and EPA. Results indicated that adverse effects from exposure to soils during excavation are not anticipated.

Vapor Intrusion Risks

The construction and expansion of the NWDC did add a potential new exposure pathway for detainees and workers within the detention facility buildings via vapor intrusion from subsurface contamination. As such, a screening evaluation was conducted by an EPA risk assessor during this Five-Year Review using soil sampling data taken from expansion excavations.

Of the sixteen individual PAHs that EPA currently evaluates for human health, only seven of these are considered volatile for purposes of vapor intrusion, and of those, only naphthalene, a contaminant of concern during excavations, has inhalation toxicity values (cancer and noncancer) in EPA's Regional Screening Levels tables. Mercury (elemental), which is also volatile, was also found in excavation soil samples. Benzene, the primary focus of the groundwater monitoring program, was not detected in groundwater or excavation soils. Therefore, the screening evaluation for vapor intrusion at the NWDC was limited to naphthalene and elemental mercury in subsurface soil.

Results of this screening evaluation found that unacceptable risks to detainees and onsite workers from exposure to estimated indoor air concentrations from vapor intrusion is not likely. No additional review is necessary unless new information suggests otherwise (Bailey 2009).

Utility Trench Area Risks

In addition to soil sampling conducted on behalf of the NWDC property owner, EPA's contractor, Ecology and Environment (E&E), conducted limited soil and surface water sampling in April 2009 due to observance of "tar-like chips" during excavation of the utility trench area on the far eastern boundary of the NWDC property. Results of the two "obsidian-like" soil samples showed exceedances of ROD cleanup levels for Aroclor 1260 (a PCB) and for benzo (a)pyrene (a PAH). E&E concluded that these exceedances do not likely pose a risk to detainees or on site workers since the samples are not representative of actual exposure to soil because of their solid nature, i.e., those risks due to direct contact with the solid material would be less than with typical soil in the utility trench area (E&E 2009). The same EPA risk assessor who conducted the screening evaluation of the potential vapor intrusion pathway discussed above, reviewed E&E's sampling data and analyses. Although the EPA risk assessor generally agreed with E&E's conclusion, she observed that there remains a question as to what actual, representative soil samples from this utility trench area might contain (Bailey 2009).

Although there is still a question about the soils in the utility trench area, a reasonable assumption can be made that they do not pose a direct exposure risk to detainees or on site workers since 1) soils excavated from the utility trench area were apparently combined and sampled by the PRP's remedial contractor along with other excavation soils prior to off site disposal, and 2) according to the property owner, the trench was backfilled with clean materials and hydro seeded or capped with 3 to 4 inches of 5/8" crushed rock for a perimeter road. Therefore, based on current information, it is not recommended that additional soil sampling in the utility trench area be obtained at this time.

More information on the assumptions, methods used, and the results and conclusions drawn from the soil screening evaluation can be found in OU 3 Attachment 7.

6.6 Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?
Answer: Yes. The remedy is functioning as intended by the decision documents based on a review of site data, interviews, and observations made during site inspections.

6.6.1 Soil and Surface Water

Soil was remediated to cleanup criteria and stabilized on site in a capped engineered waste pile with ancillary surface water drainage and collection features. The cap and surface drainage features are generally in good condition and routinely inspected and repaired when required to maintain their intended functions. The cap limits surface water infiltration, as evidenced by the armored drainage channels along the engineered waste pile and detention basins during and after periods of precipitation. Surface water cleanup criteria identified in the ROD have been achieved as measured at the site boundary in the BNSF ditch.

A small hole was observed during the June 3rd site inspection in the paved access road to the capped engineered waste pile which needs to be repaired as soon as possible. Some vegetative growth was also observed in portions of the armored drainage channels; however, it did not

appear to be hindering drainage in any way. In addition, there has been reluctance by the PRP's remediation contractor, DOF, to conduct scheduled hydraulic conductivity testing of asphalt covers as coring could cause preferential flow paths to the shallow fill aquifer. However, as was noted in the 2003 Five-Year Review, the PRP needs to implement this testing or develop and conduct an alternative way of systematically assessing asphalt pavement conditions and permeability and revise the *Inspection and Maintenance Manual* accordingly.

Although the above issues need to be addressed, the soil capping and surface water remedy component is functioning as intended. Specific recommendations to address issues are provided in Section 6.8.

6.6.2 Groundwater

Site groundwater has been monitored quarterly between 1991 to the present, and the groundwater extraction and treatment system has been in operation since September 2002. Monitoring data indicates that ROD cleanup criteria have been achieved for all indicator contaminants in two of the site aquifers (the Fill and Lower Aquifers). The ROD cleanup criteria for lead, PCBs and PAHs have also been achieved in the Sand Aquifer; only benzene exceeds the ROD criterion of 53 µg/L. As such, benzene in the Sand Aquifer has been the focus of the groundwater monitoring program since before the last Five-Year Review, and was the focus of the draft MAROS water quality study prepared by the PRP's remediation contractor, DOF, in early 2009.

According to monitoring data and the draft MAROS study, the footprint of the benzene groundwater plume across the site has reduced in size since groundwater extraction began in 2002 and benzene concentrations have decreased in some locations. However, dissolved benzene mass in some locations has increased and benzene concentrations across the site as a whole have fluctuated more or less around their current concentrations since late 2003 with concentrations still above the cleanup criteria of 53 µg/L.

In the TTP-3M (East Branch) Area of the groundwater plume, dissolved benzene mass in the Sand Aquifer has actually increased over time despite active extraction. Benzene concentrations in the East Branch have increased or decreased depending on sample locations. Although monitoring data suggests that the East Branch plume is contained within the site boundary, it is not certain if this attributable to the extraction and treatment system or to a preferential flow path along the sewer line trench adjacent to the site's southern boundary. In the TTP-18M (North Branch) Area of the groundwater plume, benzene mass and concentrations have decreased since the last Five-Year review; however, concentrations are still well above the ROD groundwater cleanup level for benzene and are also outside the site boundary.

Although the above groundwater issues need to be addressed in order to reach the ROD groundwater cleanup criterion for benzene and reduce the size of the plume, the groundwater remedy component is functioning as intended. Specific recommendations to address issues are provided in Section 6.8.

6.6.3 Institutional Controls

Institutional controls are in place across the site and protect the remedy in the short-term. However, based on the preliminary title search conducted by the PRP's remediation contractor, DOF, it does not appear that site property owners have complied with all Consent Decree conveyance of site/institutional control requirements. A specific recommendations to address this IC issue is provided in Section 6.8.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?
Answer: Yes. There have been changes in the standards, exposure pathways, toxicity, and land use since the 1987 ROD; however, those identified in the ROD are still valid and none of the changes negatively impact the protectiveness of the remedy.

Changes in Standards and To Be Considered (TBCs). Applicable or relevant and appropriate requirements (ARARs) cited in the ROD were reviewed to evaluate changes since the ROD was signed in 1987. In addition, requirements promulgated after the 1987 ROD were also evaluated to determine if they were ARARs or TBCs necessary to ensure that the remedy is protective of human health and the environment. A summary table, including evaluation of each ARAR and TBC, is presented in OU 3 Attachment 8. Changes in requirements are summarized below:

Lead in Surface Water and Groundwater

The 1987 ROD cleanup level for lead in surface water at the site boundary is 3.2 µg/L and was based on the federal Chronic Freshwater Ambient Water Quality Criteria (CFAWQC) and the detection limit at that time. Since the ROD, the CFAWQC detection limit has changed and the current CFAWQC cleanup or "action" levels for lead in surface water at a site boundary is 2.5 µg/L. Similarly, the onsite surface water action level for lead, based on the estimated acute freshwater ambient water quality criterion at the time of the ROD, has been reduced from 172 µg/L to 65 µg/L. This reduction in lead action levels in surface water, however, does not call into question the validity of the remedy as the surface water lead concentration, last measured in March 2008 in the BNSF ditch, was 1.7 µg/L

The 1987 ROD cleanup level for lead in the shallow Sand and Fill groundwater aquifers is 50 µg/L and was based on the Safe Drinking Water Act (SDWA) Maximum Contaminant Level (MCL) at that time. Since the ROD, the MCL for lead in groundwater was reduced to 15 µg/L. This change does not appear to question the validity of the remedy because maximum lead concentration in site groundwater was 14.4 µg/L within the Sand and Fill aquifers when last measured in 2001 (total [unfiltered] lead was approved by EPA to be eliminated from the groundwater monitoring program after 2001). The lower aquifers have historically shown little to no contamination present (a maximum lead concentration of 1.5 µg/L was reported in 2001).

PCBs in Surface Water and Groundwater

The 1987 ROD PCB cleanup level for surface water at the site boundary and groundwater in the Sand and Fill aquifers is 0.2 µg/L and was based on the federal chronic freshwater ambient water quality criterion and the detection limit at that time. Since the ROD, the state of Washington's

PCB criteria for chronic freshwater exposure has been reduced to 0.014 µg/L. A review of historical surface water and groundwater data for the site showed PCB concentrations to be non-detect. Given this, the reduction in the State's PCB criteria does not appear to affect the validity of the site remedy.

Noxious Weeds

Spotted Knapweed has been observed on top of the engineered waste-pile cover since the last Five-Year Review. Spotted Knapweed is on the Washington State Class B Noxious Weed List, and is designated for control in the Tacoma area. This requirement, however, was not deemed an ARAR or a TBC requirement at the Tacoma Tar Pits site as it does not cause the remedy to be less protective against exposure to hazardous substances for humans or avian receptors, or cause contamination of the groundwater.

None of the above changes in standards or TBCs appear to affect the validity of the remedy in place for the Tacoma Tar Pits site, nor are they significant enough to warrant revisions to the 1987 ROD ARARs to ensure protectiveness of the remedy.

Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics. The 1987 ROD described likely contamination migration, exposure pathways, and receptors. These descriptions are still accurate and valid for the site conditions at the time of the remedy and this review. The construction and expansion of the NWDC did add a potential new exposure pathway for detainees and workers within the detention facility buildings via vapor intrusion from subsurface contamination. However, results of the screening evaluation conducted as part of this Five-Year Review found that unacceptable risks to detainees and on site workers from exposure to estimated indoor air concentrations from vapor intrusion is not likely. No additional review is necessary unless new information suggests otherwise.

Although not a change in exposure pathways or receptors, the two "obsidian-like" samples taken from the utility trench excavation area at the far eastern boundary of the NWDC property were also evaluated for potential risks from direct contact with contaminated soils. The results of this evaluation concluded that utility trench soils do not appear to pose a direct exposure risk to detainees or on site workers given current information.

In regards to sitewide contaminant characteristic changes, the reference doses for chronic oral exposure and inhalation exposure for benzene were last revised in April 2003 and are 0.004 mg/kg/day and 0.03 mg/m^3, respectively. These changes, however, do not affect the validity of the remedy.

Changes in Land Use. The plan to construct the initial NWDC facility on the former Hygrade meat packing plant property was briefly discussed in the last Five-Year Review Report. At that time it was determined that the construction footprint would not negatively impact the Superfund remedy and site conditions were not a threat to the health of individuals who were to be employed or detained at the facility. This determination was based on the following assumptions: 1) most Hygrade property soils did not require remediation under Superfund (TPH-contaminated soils found after Hygrade buildings were demolished were cleaned up by the property owner pursuant to Ecology's VCP prior to construction of the initial NWDC facility),

2) groundwater monitoring data from beneath the former Hygrade property met ROD groundwater cleanup criteria, 3) groundwater was not being used for drinking water or any other purpose except for monitoring, and 4) soils in the adjacent capped engineered waste pile were physically and chemically stabilized and encapsulated beneath an engineered cover system such that there was no opportunity for human exposure to these materials from windblown dust or contaminated surface water runoff.

Based on a review of available site information and on inspections conducted since December 2008, these same assumptions hold true for the recent expansion efforts. Results of the screening evaluation of soil samples taken during excavation support the same risk determination. Given the above, the change in land use does not negatively impact the validity or protectiveness of the remedy.

Remedial Action Objectives (RAOs). The RAOs in the 1987 ROD were not defined in explicit descriptive terms for the Tacoma Tar Pits site. Instead, numerical maximum allowable contaminant concentrations for indicator contaminants and impacted media served as the RAOs (EPA 1987; ROD Table 2). The numerical RAOs for soil and surface water have been met and remain valid; however, not all of the numerical RAOs for groundwater have been met. In addition, the ROD groundwater remedy and RAOs focused on treatment and containment of the contaminated plume, but do not appear to have considered restoration. As a result, EPA needs to evaluate whether groundwater restoration at this site is feasible and necessary to 1) comply with ARARs, CERCLA, and EPA's CERCLA groundwater policies, and 2) ensure long-term protectiveness.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?
Answer: No.

6.6.4 Technical Assessment Summary

According to the data reviewed from technical documents and reports, as well as information obtained from interviews, site inspections and investigations, the site remedy is functioning as intended by the 1987 ROD.

The soil and surface water components of the selected Superfund remedy were completed in 1995, and soil and surface water cleanup criteria have been achieved. A small hole was observed during the June 3, 2009 site inspection in the paved waste pile access road which needs to be repaired as soon as possible. Vegetative growth was also observed in portions of the armored drainage channels; however, it did not appear to be hindering drainage in any way. The PRP's remediation contractor, DOF, has not yet performed hydraulic conductivity testing as suggested in the last Five-Year Review.

Groundwater monitoring data and the draft MAROS water quality study indicate that the footprint of the benzene groundwater plume across the site has reduced in size, and benzene concentrations have decreased in some locations. However, dissolved benzene mass in some locations has increased and benzene concentrations across the site as a whole have fluctuated

more or less around their current concentrations since late 2003 with concentrations still above the cleanup criteria of 53 µg/L.

Institutional controls are in place across the site and protect the remedy in the short-term. To ensure protectiveness in the long-term, property owners must at a minimum comply with all Consent Decree conveyance of site/institutional control requirements. Pursuing voluntary compliance with the state of Washington's UECA would be optimal.

This Five-Year Review also found that the initial construction and subsequent expansion of the NWDC facility did not impact the Superfund remedy. This conclusion is based on a review of site documents and construction plans, as well as observations and interviews conducted during recent expansion activities. It did, however, add a potential new exposure pathway for detainees and workers within the detention facility buildings via vapor intrusion from subsurface contamination. As such, a screening evaluation was conducted by an EPA risk assessor during this Five-Year Review using soil sampling data taken from expansion excavations. Results of this screening evaluation found that unacceptable risks to detainees and onsite workers from exposure to estimated indoor air concentrations from vapor intrusion is not likely.

The numerical RAOs for soil and surface water have been met and remain valid; however, not all of the numerical RAOs for groundwater have been met. There is also some question about the RAOs for groundwater regarding restoration of the contaminated plume which warrants further evaluation to ensure long-term protectiveness.

There is no other information at the time of this Five-Year Review that would call into question the protectiveness of the site remedy.

6.7 Issues

The following issues were identified during this Five-Year Review:

Table 20. Tacoma Tar Pits Issues of the 2009 Five-Year Review

Issue	Affects Protectiveness? (Y or N)	
	Current	Future
A small pavement failure was observed in the asphalt road leading to the top of the capped engineered waste pile, as shown in OU 3 Attachment 5, Photo 8. This feature represents a potential pathway for surface water erosion of the cap. (NOTE: this is a separate pavement failure than the one noted in – and repaired after – the 2003 Five-Year Review).	N	Y
Hydraulic conductivity testing of asphalt pavement covers has not been performed in accordance with the *Inspection and Maintenance Manual*. This was recommended in the 2003 Five-Year Review Report.	N	Y
The TTP-3M (East Branch) Area benzene plume within the site boundary has not appreciably diminished in size or concentration over the past several years. In addition, although this plume appears to be contained especially when looking at non-detect benzene concentrations in downgradient monitoring well DOF-19, Figure 6-5 shows a sewer line trench in hydraulic connection with the benzene plume which may convey the plume away from DOF-19.	N	Y
The TTP-18M (North Branch) Area benzene plume appears to be contained or captured as seen through decreasing benzene concentrations; however, the concentrations are well above the ROD groundwater cleanup performance criterion for benzene (53 µg/L) and are also outside the site boundary.	N	Y
The ROD groundwater remedy and RAOs focused on treatment and containment of the contaminated plume, but do not appear to have considered groundwater restoration.	N	Y
Property owner compliance with site institutional control requirements is not optimal.	N	Y

6.8 Recommendations and Follow-up Actions

Table 21 lists recommended follow-up actions to address each issue identified in Table 20.

Table 21. Tacoma Tar Pits Recommended Follow-Up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Planned Completion Date
A small pavement failure was observed in the asphalt road leading to the top of the capped engineered waste pile, as shown in OU 3 Attachment 5, Photo 8. This feature represents a potential pathway for surface water erosion of the cap. (NOTE: this is a separate pavement failure than the one noted in – and repaired after – the 2003 Five-Year Review).	Repair the pavement hole.	PSE	EPA	2009
Hydraulic conductivity testing of asphalt pavement covers has not been performed in accordance with the *Inspection and Maintenance Manual*. This was recommended in the 2003 Five-Year Review Report.	Implement asphalt pavement permeability testing or develop and conduct an alternative way of systematically assessing asphalt pavement conditions and permeability and revise the *Inspection and Maintenance Manual* accordingly.	PSE	EPA	2010
The TTP-3M (East Branch) Area benzene plume within the site boundary has not appreciably diminished in size or concentration over the past several years. In addition, although this plume appears to be contained especially when looking at non-detect benzene concentrations in downgradient monitoring well DOF-19, Figure 6-5 shows a sewer line trench in hydraulic connection with the benzene plume which may convey the plume away from DOF-19.	Optimize the TTP-3M (East Branch) Area system and conduct a capture zone analysis in order to reach the ROD groundwater cleanup criterion for benzene and reduce the size of the plume. A determination is also needed on the fate and transport of the benzene plume and its hydraulic relationship to the sewer line trench along the southern boundary of the site.	PSE	EPA	2011

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Planned Completion Date
The TTP-18M (North Branch) Area benzene plume appears to be contained or captured as seen through decreasing benzene concentrations; however, the concentrations are well above the ROD groundwater cleanup performance criterion for benzene (53 µg/L) and are also outside the site boundary.	Optimize the TTP-18M (North Branch) Area system and conduct a capture zone analysis in order to reach the ROD groundwater cleanup criterion for benzene and reduce the size of the plume. An additional monitoring well may also be needed just beyond the stagnation point of Extraction Well A to help determine effectiveness.	PSE	EPA	2011
The ROD groundwater remedy and RAOs focused on treatment and containment of the contaminated plume, but do not appear to have considered groundwater restoration.	Evaluate whether groundwater restoration at this site is feasible and necessary to 1) comply with ARARs, CERCLA, and EPA's CERCLA groundwater policies, and 2) ensure long-term protectiveness.	EPA	EPA	2012
Property owner compliance with site institutional control requirements is not optimal.	Request site property owners to comply with all Consent Decree conveyance of site/institutional control requirements. Voluntary compliance with the state of Washington's UECA should also be requested to ensure the long-term effectiveness of site institutional controls.	Site Property Owners	EPA	2012

In addition to the above recommendations/follow-up actions to address site issues, the following actions should also be considered to ensure the protectiveness of human health and the environment:

- If EPA and PSE decide that a vegetative management plan is necessary for the site, control of Spotted Knapweed should be a component of that plan as it is designated for control in the Tacoma CB/NT area.
- Include the CSC/GEO Group, Inc.-owned Northwest Detention Center property, the City of Tacoma/CSC-owned parcel southeast of the Detention Center, and the 1616 St. Paul parcel north of the Detention Center as part of the Tacoma Tar Pits site on the City of Tacoma's GOV.ME GIS website.

6.9 Protectiveness Statement

The results of this Five-Year Review indicate that the Tacoma Tar Pits remedy is functioning as intended and is currently protective of human health and the environment because 1) sources of contamination (e.g., waste materials and contaminated soils) have been excavated, disposed of off site or treated and contained on site, 2) low permeability caps and surface water controls have been placed across critical areas of the site, 3) institutional controls are in place, and 4) contaminated groundwater is not used as a drinking water source and does not appear to be discharging to the Puyallup River. In order for the remedy to remain protective over the long-term, the follow-up actions recommended in this report need to be performed which include 1) continuing maintenance of the cap, cover and ancillary surface water drainage features, 2) continuing operation and optimization of the groundwater extraction, treatment and monitoring systems to reduce the size and concentration of the benzene plume, and 3) optimizing property owner compliance with institutional control requirements.

7 SUMMARY OF ISSUES

This section summarizes issues that were discussed in previous sections.

Table 22. Summary of Issues for the 2009 Five-Year Review

Issue	Affects Protectiveness? (Y or N)	
	Current	Future
OU 1 OU-wide – Recent fish tissue data for bioaccumulative chemicals have not been collected in Commencement Bay. Thus, it is not known whether contaminant levels in fish tissues have been reduced since the remedies have been implemented, particularly for PCBs (which have a human-health based Sediment Quality Objective), and whether fish advisories should be continued, modified, or removed.	N	Y
OU 1 Hylebos Waterway – Arkema Site source control is needed to meet RA performance standards.	N	Y
OU 1 Middle Waterway – Possible recontamination of surface sediments due to erosion and large burrowing organisms bringing the underlying, native sediments to the surface in Area C. Drainage from the Mylet property down-cutting, such that the underlying tideflat and wood debris are exposed in Area C.	N	Y
OU 1 Middle Waterway - Ineffectiveness of grade stake survey due to stakes missing during survey monitoring in Area C.	N	Y
OU 1 Middle Waterway - SQO exceedances for mercury in Areas A and B in NR areas where SQOs are expected to be met within a ten year timeframe.	N	Y
OU 1 Middle Waterway – SQO exceedance of bis(2-ethylhexyl)phthalate, with elevated (but below SQO) concentrations of mercury and PAH found in Area C sediments near the Mylet roof drain.	N	Y
OU 1 Middle Waterway - Beached logs have been a problem primarily for the recovering pickleweed and other vegetation at the upper tidal levels at the head of the waterway due to smothering or sediment gouging.	N	Y
OU 1 Middle Waterway - Institutional controls have not been fully implemented.	N	Y
OU 1 Middle Waterway - Year 5 monitoring results from summer of 2009 have not been included in this review and need to be evaluated to further assess status of sediments in the waterway.	Y	Y
OU 1 Thea Foss and Wheeler-Osgood Waterways - Source control does not appear adequate to prevent recontamination.	Y	Y
OUs 2, 4, 6 Ruston/North Tacoma Study Area - Based on phone calls received by EPA and Ecology, there is a subset of the people in the study area who do not know anything about the site, the fact that yards in the study area may be contaminated, the yard cleanup program and the required institutional controls.	Y	Y
OUs 2, 4, 6 Ruston/North Tacoma Study Area - The site development may bring new people as well as different land uses to the area. This could result in differing exposures than those currently accounted for in the ROD.	N	Y
OUs 2, 4, 6 Ruston/North Tacoma Study Area - There may be recontamination of the yards that have been remediated in the Study Area.	N	Y

Issue	Affects Protectiveness? (Y or N)	
	Current	Future
OUs 2, 4, 6 Ruston/North Tacoma Study Area - Potential for properties outside the Study area to be contaminated is being addressed by Ecology.	N	Y
OUs 2, 4, 6 Ruston/North Tacoma Study Area - Ecology has requested that EPA review the remedy for the site to ensure that it is still protective.	N	Y
OUs 2, 4, 6 Sediments - The habitat basin is functioning as designed even though part of the breakwater collapsed in the 2001 Nisqually earthquake. Because the "shelf" holding the breakwater is no longer there, replacement would require a significant reduction in size of the habitat basin.	N	N
OU 3 Tacoma Tar Pits - A small pavement failure was observed in the asphalt road leading to the top of the capped engineered waste pile, as shown in OU 3 Attachment 5, Photo 8. This feature represents a potential pathway for surface water erosion of the cap. (NOTE: this is a separate pavement failure than the one noted in – and repaired after – the 2003 Five-Year Review).	N	Y
OU 3 Tacoma Tar Pits - Hydraulic conductivity testing of asphalt pavement covers has not been performed in accordance with the *Inspection and Maintenance Manual*. This was recommended in the 2003 Five-Year Review Report.	N	Y
OU 3 Tacoma Tar Pits - The TTP-3M (East Branch) Area benzene plume within the site boundary has not appreciably diminished in size or concentration over the past several years. In addition, although this plume appears to be contained especially when looking at non-detect benzene concentrations in downgradient monitoring well DOF-19, Figure 6-5 shows a sewer line trench in hydraulic connection with the benzene plume which may convey the plume away from DOF-19.	N	Y
OU 3 Tacoma Tar Pits - TTP-18M (North Branch) Area benzene plume appears to be contained or captured as seen through decreasing benzene concentrations; however, the concentrations are well above the ROD groundwater cleanup performance criterion for benzene (53 µg/L) and are also outside the site boundary.	N	Y
OU 3 Tacoma Tar Pits - The ROD groundwater remedy and RAOs focused on treatment and containment of the contaminated plume, but do not appear to have considered groundwater restoration	N	Y
OU 3 Tacoma Tar Pits - Property owner compliance with site institutional control requirements is not optimal.	N	Y

8 SUMMARY OF RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 23 lists recommendations and follow-up actions for each issue identified in Table 22.

Table 23. Summary of Recommended Follow-Up Actions

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Over-sight Agency	Planned Completion Date
OU 1 OU-wide – Recent fish tissue data for bioaccumulative chemicals have not been collected in Commencement Bay. Thus, it is not known whether contaminant levels in fish tissues have been reduced since the remedies have been implemented, particularly for PCBs (which have a human-health based Sediment Quality Objective), and whether fish advisories should be continued, modified, or removed.	Develop and implement a sampling plan for collection and analysis of bay-wide fish tissue data for bioaccumulative chemicals (particularly for PCBs, which have a human-health based Sediment Quality Objective). Provide results to appropriate state and local agencies to evaluate protectiveness of health-based fish consumption advisories for Commencement Bay.	EPA	EPA	December 29, 2014
OU 1 Hylebos Waterway - Arkema Site source control is needed to meet RA performance standards.	Perform RI/FS and RD/RA for the Arkema Site to investigate and address contamination upland and beneath the waterway.	Port of Tacoma	EPA	2013
OU 1 Middle Waterway - Possible recontamination of surface sediments due to erosion and large burrowing organisms bringing the underlying, native sediments to the surface in Area C. Drainage from the Mylet property down-cutting such that the underlying tideflat and wood debris are exposed in Area C.	Include chemical monitoring of burrows within drainage channels or other erosion features should be included in future monitoring events. Evaluate options to prevent further erosion.	DNR	EPA	March 31, 2010
OU 1 Middle Waterway - Ineffectiveness of grade stake survey due to stakes missing during survey monitoring in Area C.	Replace with periodic topographic surveys to map the long-term effects of the outfall on the tideflat and remedy performance.	DNR	EPA	June 30, 2010

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Over-sight Agency	Planned Completion Date
OU 1 Middle Waterway - SQO exceedances for mercury in Areas A and B in NR areas where SQOs are expected to be met within a ten year timeframe.	Continue monitoring and evaluate Year 5 data to evaluate potential causes of SQO exceedances in Areas A and B.	MWAC	EPA	March 31, 2010
OU 1 Middle Waterway - SQO exceedance of bis (2-ethylhexyl) phthalate, with elevated (but below SQO) concentrations of mercury and PAH found in Area C sediments near the Mylet roof drain.	Include chemical monitoring of burrows within drainage channels or other erosion features in future monitoring events. Evaluate options to prevent further erosion.	DNR	EPA	March 31, 2010
OU 1 Middle Waterway - Beached logs have been a problem primarily for the recovering pickleweed and other vegetation at the upper tidal levels at the head of the waterway due to smothering or sediment gouging.	Develop a Memorandum of Understanding with Simpson. Also evaluate the possibility of installing a breakwater to replace the protective function if the former piling field.	DNR	EPA	June 30, 2010
OU 1 Middle Waterway - Institutional controls have not been fully implemented.	Conduct an IC study; follow up with the USCG about status of final RNA; verify that easements have been executed and recorded with Pierce County.	MWAC, DNR	EPA	June 30, 2010
OU 1 Middle Waterway - Year 5 monitoring results from summer of 2009 have not been included in this review and need to be evaluated to further assess status of sediments in the waterway.	Evaluate Year 5 data; discuss options and potential need for additional remedial action.	MWAC, DNR	EPA	March 31, 2010
OU 1 Thea Foss and Wheeler-Osgood Waterways - Source control does not appear adequate to prevent recontamination.	Continue to monitor and evaluate sources of phthalates and PAHs to sediments.	EPA	EPA	December 29, 2014
OUs 2, 4, 6 Ruston/North Tacoma Study Area - Based on phone calls received by EPA and Ecology, there is a subset of the people in the study area who do not know anything about the site, the fact that yards in the study area may be contaminated, the yard cleanup program and the required institutional controls.	Review the institutional controls/education component for the Ruston/North Tacoma Study Area and determine what changes are needed to ensure that people are aware of the controls and that they are carried forward.	EPA	EPA	January 2011

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Over-sight Agency	Planned Completion Date
OUs 2, 4, 6 Ruston/North Tacoma Study Area - The site development may bring new people as well as different land uses to the area. This could result in differing exposures than those currently accounted for in the ROD.	Review ongoing site and area development and ensure that changes in the area do not impact remedy protectiveness.	EPA	EPA	ongoing
OUs 2, 4, 6 Ruston/North Tacoma Study Area - There may be recontamination of the yards that have been remediated in the Study Area.	Resample a subset of properties to ensure that recontamination has not occurred.	EPA	EPA	June 2010
OUs 2, 4, 6 Ruston/North Tacoma Study Area - Potential for properties outside the Study area to be contaminated is being addressed by Ecology.	EPA will document these activities.	EPA	EPA	January 2011
OUs 2, 4, 6 Ruston/North Tacoma Study Area - Ecology has requested that EPA review the remedy for the site to ensure that it is still protective.	EPA has agreed to conduct a more in depth review of the remedy for the site to ensure its protectiveness. This review will be completed by July 27, 2010. The review will use the criteria in the "Comprehensive Five-Year Review Guidance (OSWER No. 9355.7-03B-P, June 2001 and also consider strategies that Ecology has developed for addressing arsenic and lead throughout the State and within the Tacoma Smelter Plume.	EPA	EPA	August 2010
OUs 2, 4, 6 Sediments - The habitat basin is functioning as designed even though part of the breakwater collapsed in the 2001 Nisqually earthquake. Because the "shelf" holding the breakwater is no longer there, replacement would require a significant reduction in size of the habitat basin.	EPA will need to determine whether the habitat basin should be repaired or left as it is.	EPA	EPA	January 2011

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Over-sight Agency	Planned Completion Date
OU 3 Tacoma Tar Pits - A small pavement failure was observed in the asphalt road leading to the top of the waste pile, as shown in OU 3 Attachment 5, photo 8. This feature represents a potential pathway for surface water erosion of the cap. (NOTE: this is a separate pavement failure than the one noted in – and repaired after – the 2003 Five-Year Review).	Repair the pavement hole.	PSE	EPA	2009
OU 3 Tacoma Tar Pits - Hydraulic conductivity testing of asphalt pavement covers has not been performed in accordance with the *Inspection and Maintenance Manual*. This was recommended in the 2003 Five-Year Review Report.	Implement asphalt pavement permeability testing or develop and conduct an alternative way of systematically assessing asphalt pavement conditions and permeability and revise the *Inspection and Maintenance Manual* accordingly.	PSE	EPA	2010
OU 3 Tacoma Tar Pits - The TTP-3M (East Branch) Area benzene plume within the site boundary has not appreciably diminished in size or concentration over the past several years. In addition, although this plume appears to be contained especially when looking at non-detect benzene concentrations in downgradient monitoring well DOF-19, Figure 6-5 shows a sewer line trench in hydraulic connection with the benzene plume which may convey the plume away from DOF-19.	Optimize the TTP-3M (East Branch) Area system and conduct a capture zone analysis in order to reach the ROD groundwater cleanup criterion for benzene and reduce the size of the plume. A determination is also needed on the fate and transport of the benzene plume and its hydraulic relationship to the sewer line trench along the southern boundary of the site.	PSE	EPA	2011

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Over-sight Agency	Planned Completion Date
OU 3 Tacoma Tar Pits - The TTP-18M (North Branch) Area benzene plume appears to be contained or captured as seen through decreasing benzene concentrations; however, the concentrations are well above the ROD groundwater cleanup performance criterion for benzene (53 µg/L) and are also outside the site boundary.	Optimize the TTP-18M (North Branch) Area system and conduct a capture zone analysis in order to reach the ROD groundwater cleanup criterion for benzene and reduce the size of the plume. An additional monitoring well may also be needed just beyond the stagnation point of Extraction Well A to help determine effectiveness	PSE	EPA	2011
OU 3 Tacoma Tar Pits - The ROD groundwater remedy and RAOs focused on treatment and containment of the contaminated plume, but do not appear to have considered groundwater restoration	Evaluate whether groundwater restoration at this site is feasible and necessary to 1) comply with ARARs, CERCLA, and EPA's CERCLA groundwater policies, and 2) ensure long-term protectiveness.	EPA	EPA	2012
OU 3 Tacoma Tar Pits - Property owner compliance with site institutional control requirements is not optimal.	Request site property owners to comply with all Consent Decree conveyance of site/institutional control requirements. Voluntary compliance with the state of Washington's Uniform Environmental Covenants Act (UECA) should also be requested to ensure the long-term effectiveness of site institutional controls.	Site Property Owners	EPA	2012

9 SUMMARY OF PROTECTIVENESS STATEMENTS

This section summarizes all protective statements from previous sections.

9.1 CB/NT Sediments, Hylebos Waterway

For the Hylebos Waterway, the remedy is expected to be protective of human health and the environment upon completion. Most remedial action construction has been accomplished, and the additional actions needed for the remedy throughout the waterway to be protective described in the ROD and this report, are progressing toward completion.

9.2 CB/NT Sediments, Sitcum Waterway

For the Sitcum Waterway, the remedy is protective of human health and the environment, and the exposure pathways that could result in unacceptable risks are being controlled.

9.3 CB/NT Sediments, St. Paul Waterway

For the St. Paul Waterway, the remedial actions have been successfully completed, all required long-term monitoring efforts have been completed, and the remedy remains protective of human health and the environment.

9.4 CB/NT Sediments, Middle Waterway

For the Middle Waterway, all remedial actions have been completed, the remedy is currently protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled. In order for the remedy to remain protective in the long-term, the Sediment Quality Objectives need to be met according to the timeframes established in the Middle Waterway ESDs, or any exceedances need to be shown to be biologically insignificant in all ENR and natural recovery areas, and ICs must be fully implemented.

9.5 CB/NT Sediments, Olympic View Resource Area

For the Olympic View Resource Area, the remedy is protective of human health and the environment, and exposure pathways that could result in unacceptable risks are being controlled.

9.6 CB/NT Sediments, Thea Foss and Wheeler-Osgood Waterways

For the Thea Foss and Wheeler-Osgood Waterways, the remedy currently protects human health and the environment because the sediment remedial action significantly reduced sediment concentrations and most of the required institutional controls are in place to protect the integrity of the sediment cap. However, in order for the remedy to be protective in the long-term, additional source control activities need to be identified and implemented to reduce the extent of recontamination in the waterway and the USCG institutional control needs to be completed to help protect the long-term integrity of the sediment cap.

9.7 CB/NT Sediments, OU-wide

Taken as a whole, the remedies for the Sediments OU are expected to be protective when completed. In the interim, until site remedial objectives are met, site use restrictions (i.e., fish and shellfish consumption advisories) shall remain in effect to limit human exposure to contaminated seafood. The absence of fish tissue contaminant data does not mean that the remedy is not protective (see p. 4-14, OSWER No. 9355.7-03B-P). Future fish tissue sampling results will be used along with other lines of evidence to ensure that the remedies are protective in the long-term.

9.8 CB/NT Asarco

9.8.1 Asarco Smelter

For the Asarco Smelter and Groundwater, remedial actions are expected to be protective of human health and the environment when the remedy is completed. In the interim, exposure pathways that could result in unacceptable risks are being prevented because the site is fenced and access to the site is controlled by cell phone operated gates, monitoring during the day, and police patrols in the evenings. Dust control and other dust suppression activities (temporary capping, spraying tackifiers) are used to ensure that site contaminants remain on site.

9.8.2 Ruston/North Tacoma Study Area

For the Ruston/North Tacoma Study Area, remedial actions are expected to be protective of human health and the environment when the remedy is completed. In the interim, exposure pathways on the unremediated properties are only controlled through the compliance with the education program (hand washing, wetting soil, etc).

9.8.3 Asarco Sediments

For the Asarco Sediments, remedial actions are expected to be protective of human health and the environment when the remedy is completed. For the area of sediments offshore of the Smelter where capping has been done, the remedy is already protective of human health and the environment. For the remaining sediments offshore of the Smelter and the Yacht Basin, implementation of the remedy is expected to occur in the next two to three years using money obtained from the Asarco bankruptcy settlement.

9.9 CB/NT Tacoma Tar Pits

The results of this Five-Year Review indicate that the Tacoma Tar Pits remedy is functioning as intended and is currently protective of human health and the environment because 1) sources of contamination (e.g., waste materials and contaminated soils) have been excavated, disposed of off site or treated and contained on site, 2) low permeability caps and surface water controls have been placed across critical areas of the site, 3) institutional controls are in place, and 4) contaminated groundwater is not used as a drinking water source and does not appear to be discharging to the Puyallup River. In order for the remedy to remain protective over the long-term, the follow-up actions recommended in this report need to be performed which include

1) continuing maintenance of the cap, cover and ancillary surface water drainage features, 2) continuing operation and optimization of the groundwater extraction, treatment and monitoring systems to reduce the size and concentration of the benzene plume, and 3) optimizing property owner compliance with institutional control requirements.

10 NEXT REVIEW

The next five-year review for the CB/NT Superfund Site is required by December 2014, five years from the date of this review.

Figures

Figure 1-1	Conceptual Site Model
Figure 4-1	Commencement Bay Nearshore/Tideflats Vicinity Map
Figure 4-2	Head of Hylebos Waterway
Figure 4-3	Mouth of the Hylebos Waterway Segments 3 and 4
Figure 4-4	Mouth of the Hylebos Waterway Segment 5
Figure 4-5	Sitcum Waterway
Figure 4-6	Clear Creek Habitat Area
Figure 4-7	St. Paul Waterway
Figure 4-8	Head of Middle Waterway Vicinity Map
Figure 4-9	Head of Middle Waterway
Figure 4-10	Mouth of Middle Waterway
Figure 4-11	Olympic View Resource Area Vicinity Map
Figure 4-12	Olympic View Resource Area, Site Areas and Survey Monitoring Transects
Figure 4-13	Main and Head Thea Foss Waterway
Figure 5-1	Asarco Site Location Map
Figure 5-2	Ruston/North Tacoma Study Area
Figure 6-1	Tacoma Tar Pits Site Vicinity Map
Figure 6-2	Tacoma Tar Pits Site Features
Figure 6-3	Site Boundary and Areas Where Institutional Controls Apply
Figure 6-4	Tacoma Tar Pits Benzene Plume, January 2009
Figure 6-5	Benzene Concentrations in Eastern Branch
Figure 6-6	Tacoma Tar Pits Tax Parcels and Numbers

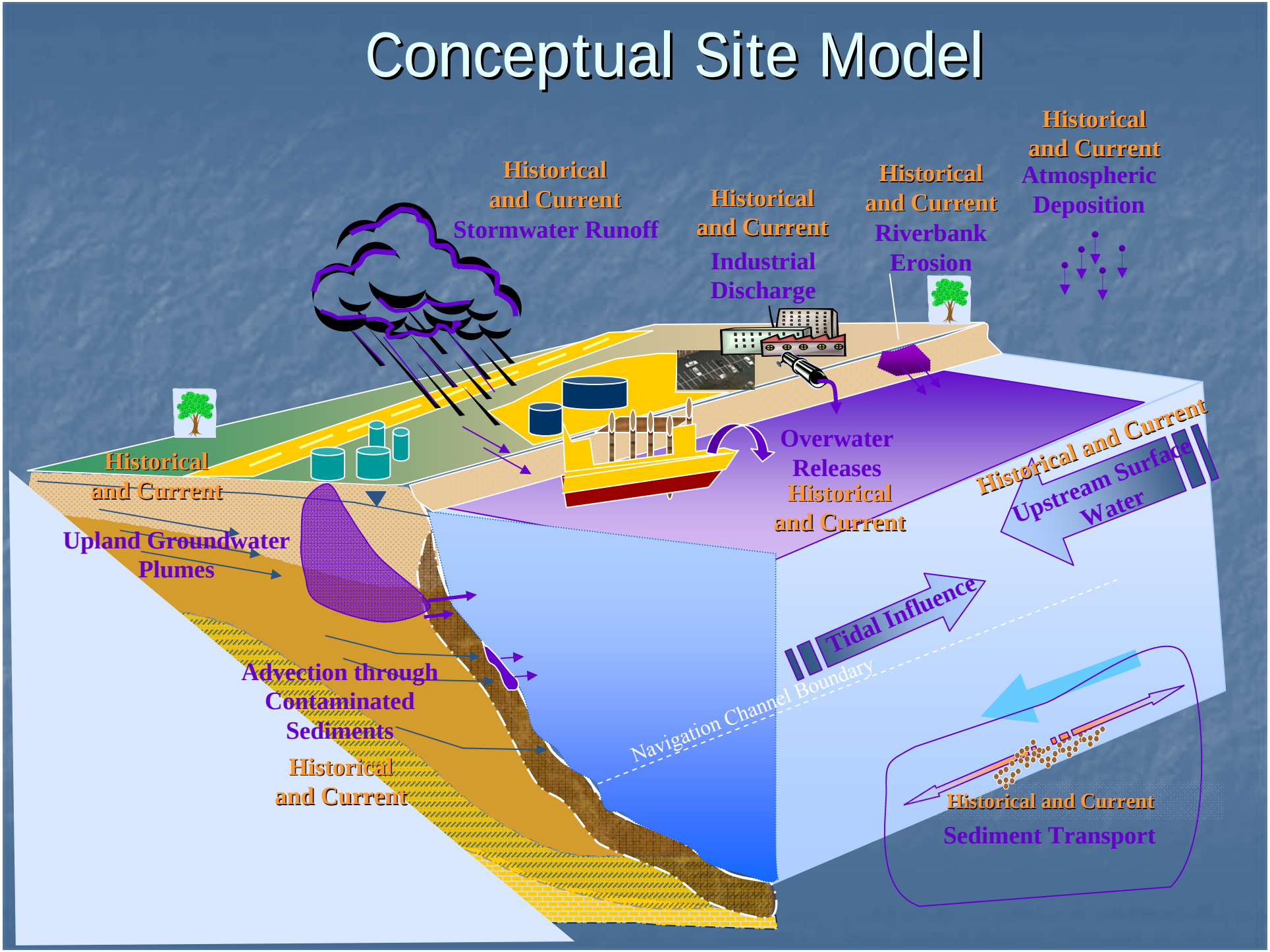


Figure 1-1. Conceptual Site Model (Source: Environmental Protection Agency, Region 10, November 2009)

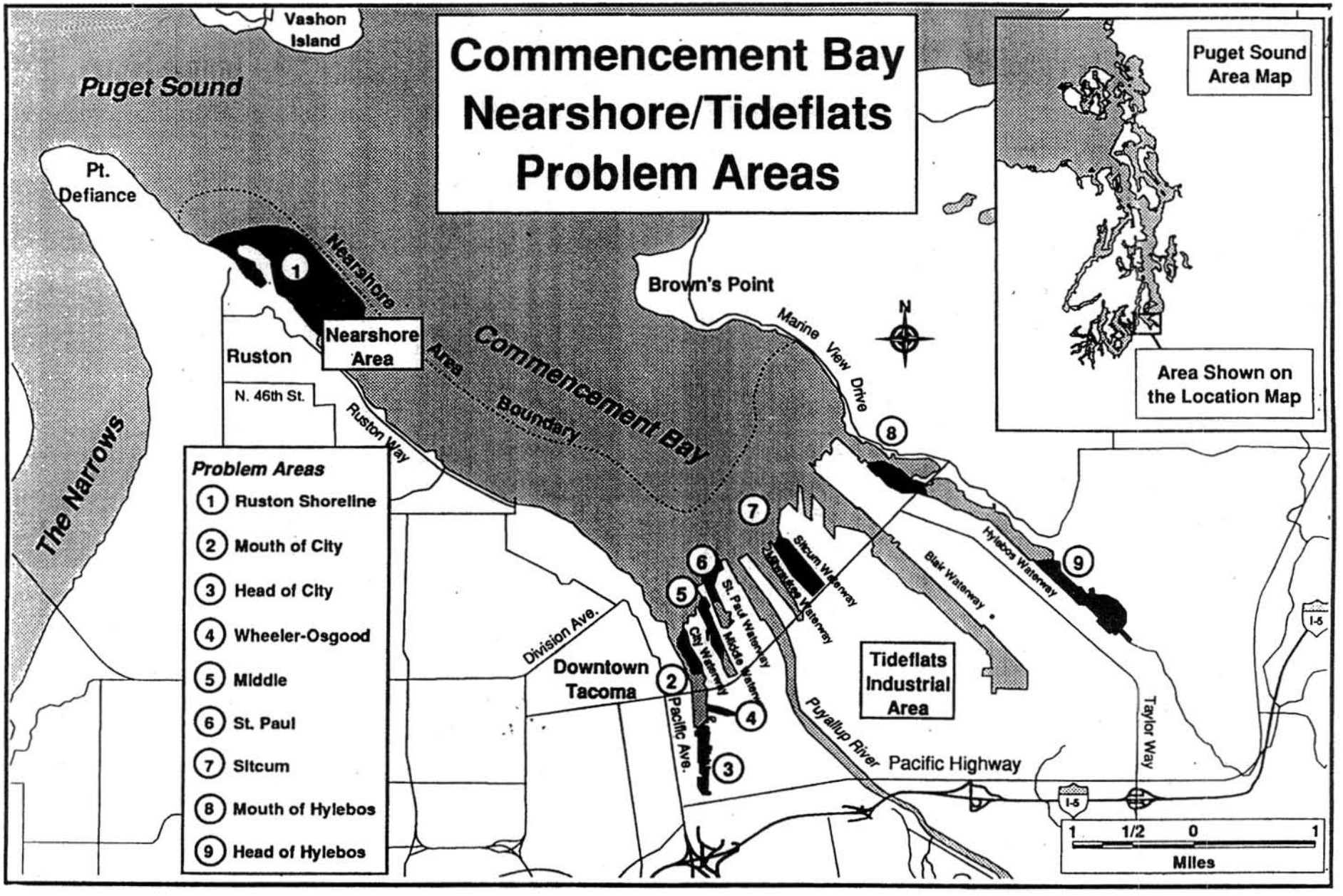


Figure 4.1. Commencement Bay Nearshore/Tideflats Vicinity Map (Source: Environmental Protection Agency, 1989)

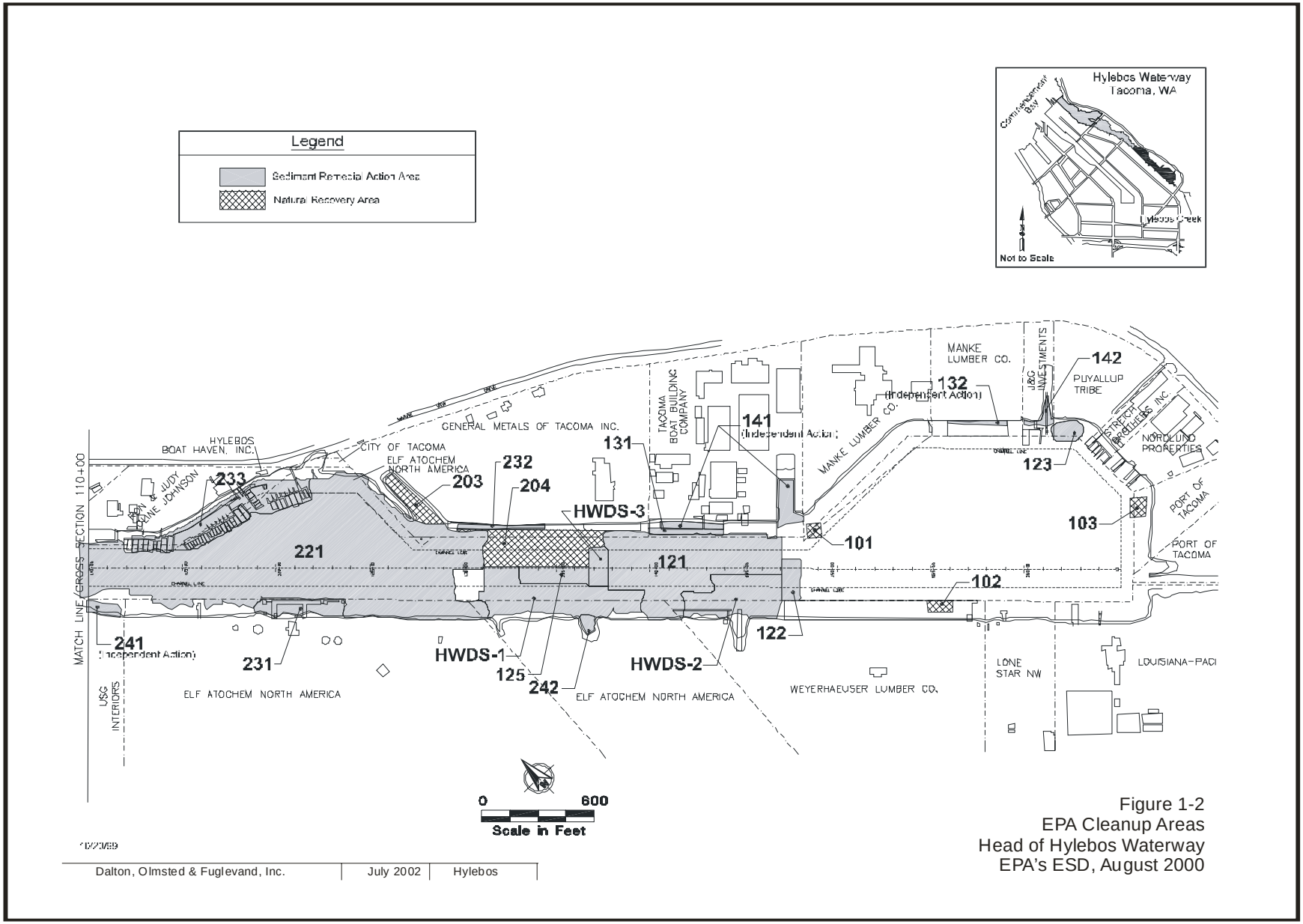
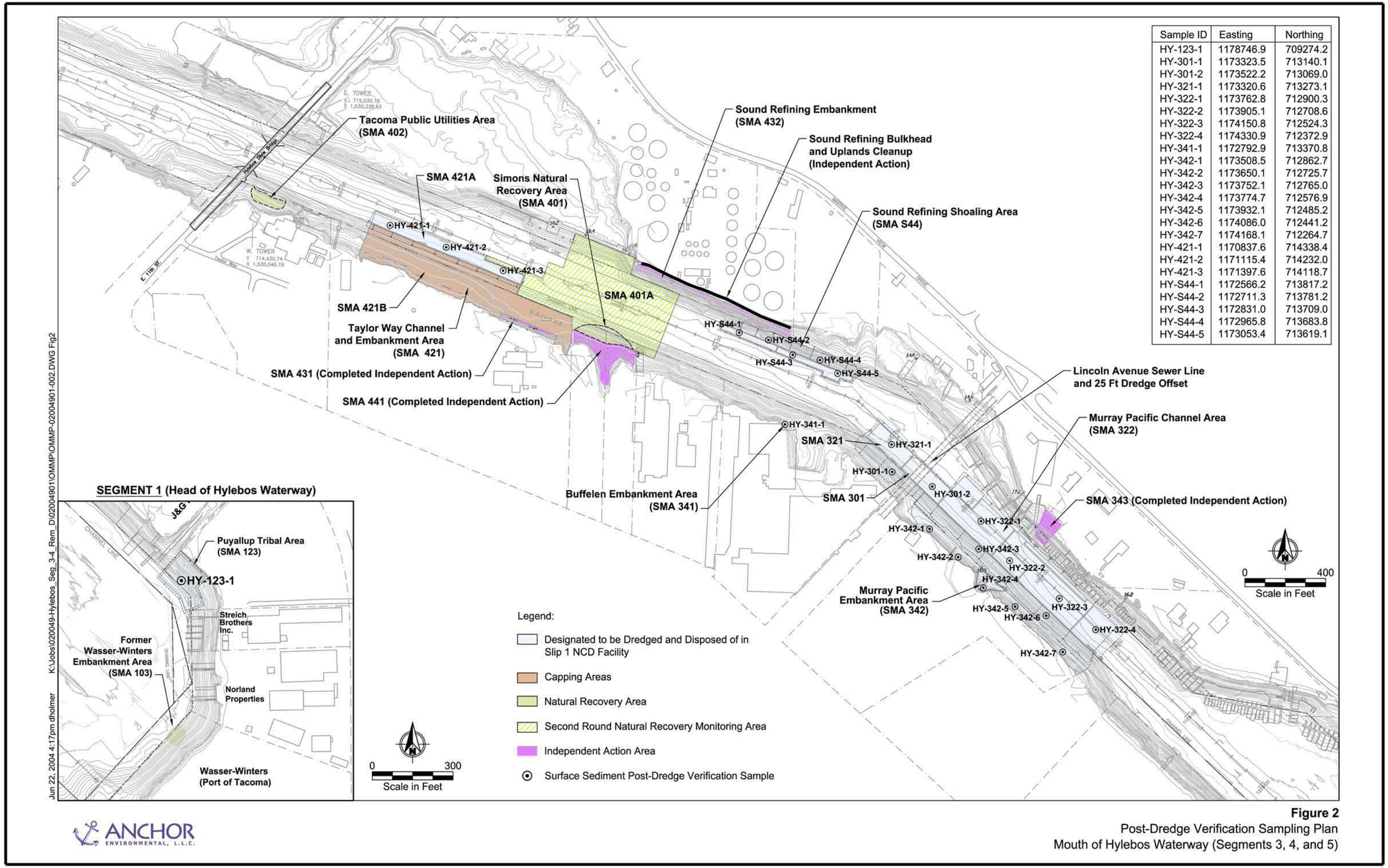


Figure 1-2
EPA Cleanup Areas
Head of Hylebos Waterway
EPA's ESD, August 2000

Figure 4-2. Head of Hylebos Waterway (Source: Environmental Protection Agency, 2000)



Sample ID	Easting	Northing
HY-123-1	1178746.9	709274.2
HY-301-1	1173323.5	713140.1
HY-301-2	1173522.2	713069.0
HY-321-1	1173320.6	713273.1
HY-322-1	1173762.8	712900.3
HY-322-2	1173905.1	712708.6
HY-322-3	1174150.8	712524.3
HY-322-4	1174330.9	712372.9
HY-341-1	1172792.9	713370.8
HY-342-1	1173508.5	712862.7
HY-342-2	1173650.1	712725.7
HY-342-3	1173752.1	712765.0
HY-342-4	1173774.7	712576.9
HY-342-5	1173932.1	712485.2
HY-342-6	1174086.0	712441.2
HY-342-7	1174168.1	712264.7
HY-421-1	1170837.6	714338.4
HY-421-2	1171115.4	714232.0
HY-421-3	1171397.6	714118.7
HY-S44-1	1172566.2	713817.2
HY-S44-2	1172711.3	713781.2
HY-S44-3	1172831.0	713709.0
HY-S44-4	1172965.8	713683.8
HY-S44-5	1173053.4	713619.1

Figure 2
Post-Dredge Verification Sampling Plan
Mouth of Hylebos Waterway (Segments 3, 4, and 5)

Figure 4-3. Mouth of the Hylebos Waterway Segments 3 and 4 (Source: Anchor, 2004)

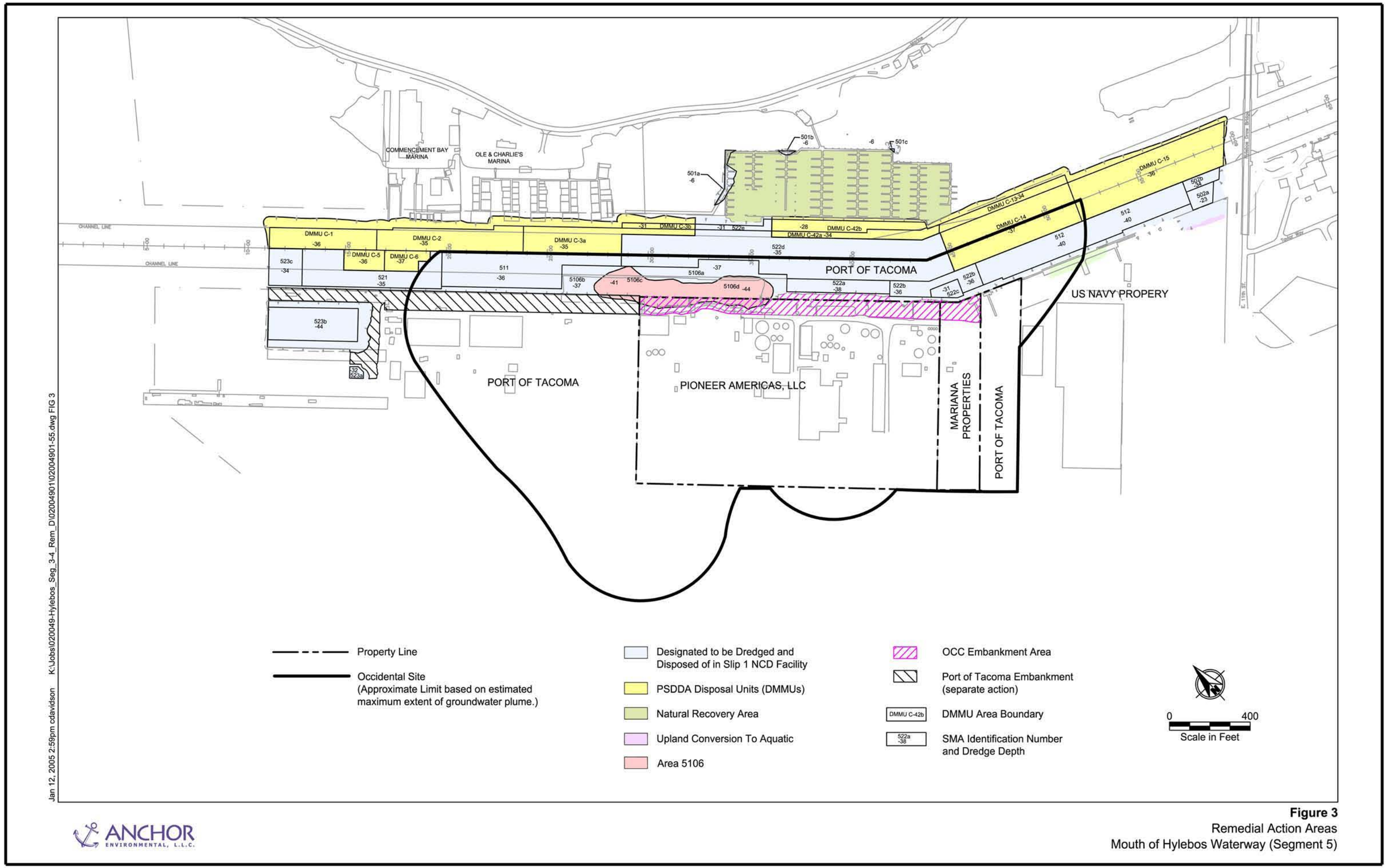


Figure 4-4. Mouth of the Hylebos Waterway Segment 5 (Source: Anchor, 2005c)

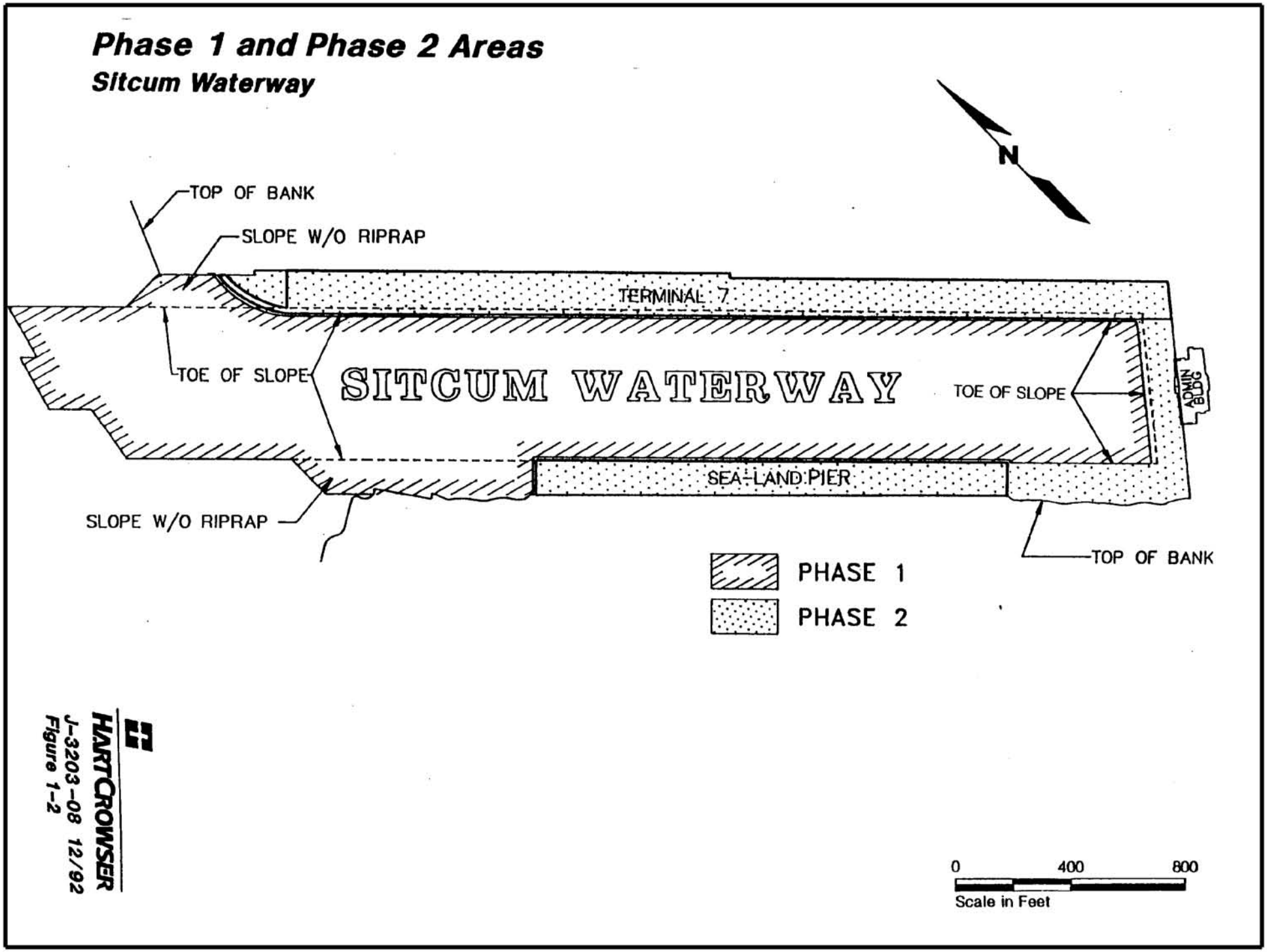


Figure 4-5. Sitcum Waterway (Source: Hart Crowser, 1994)

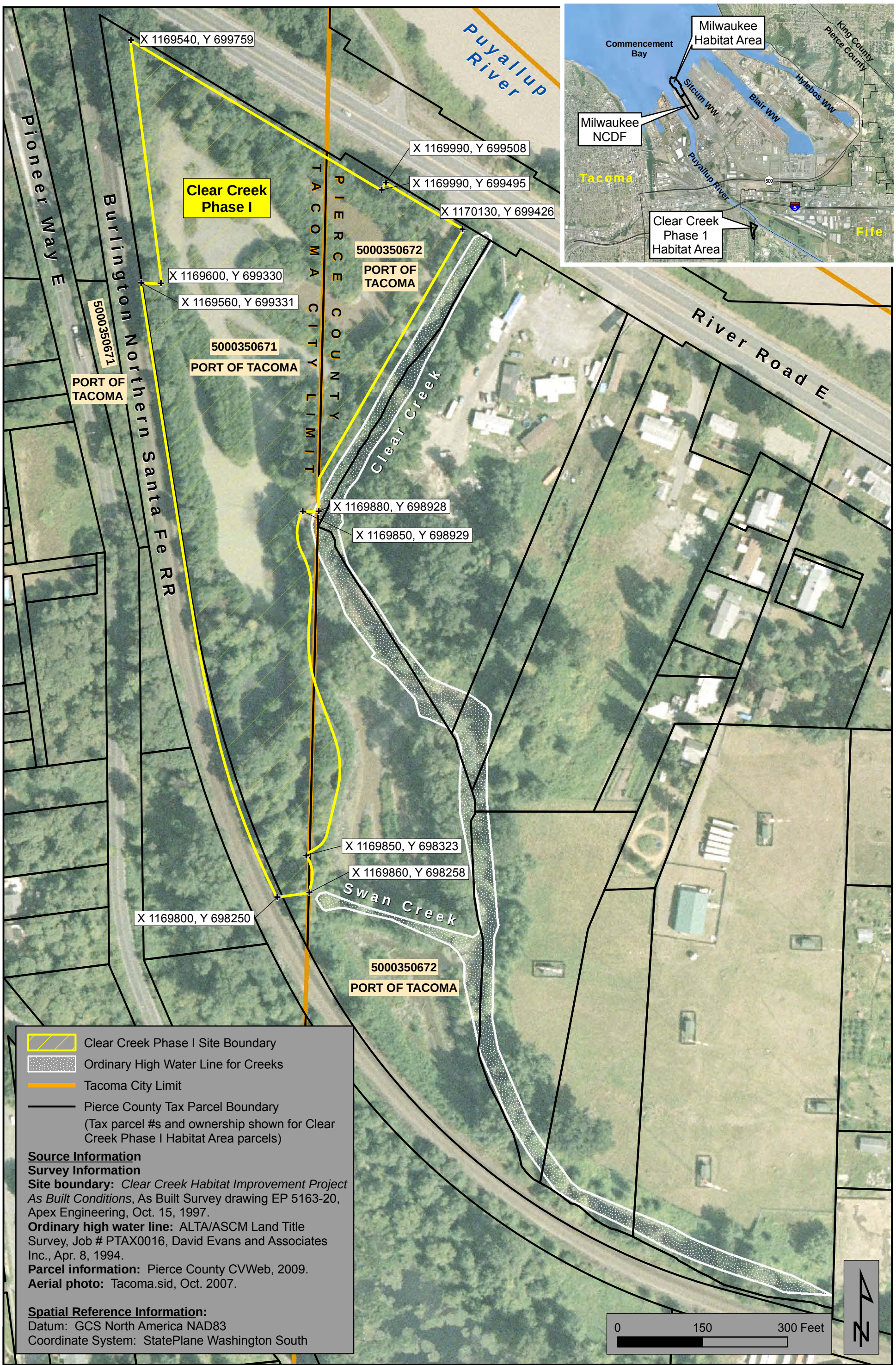


Figure 4-6. Clear Creek Habitat Area (Source: Hart Crowser, 2009)

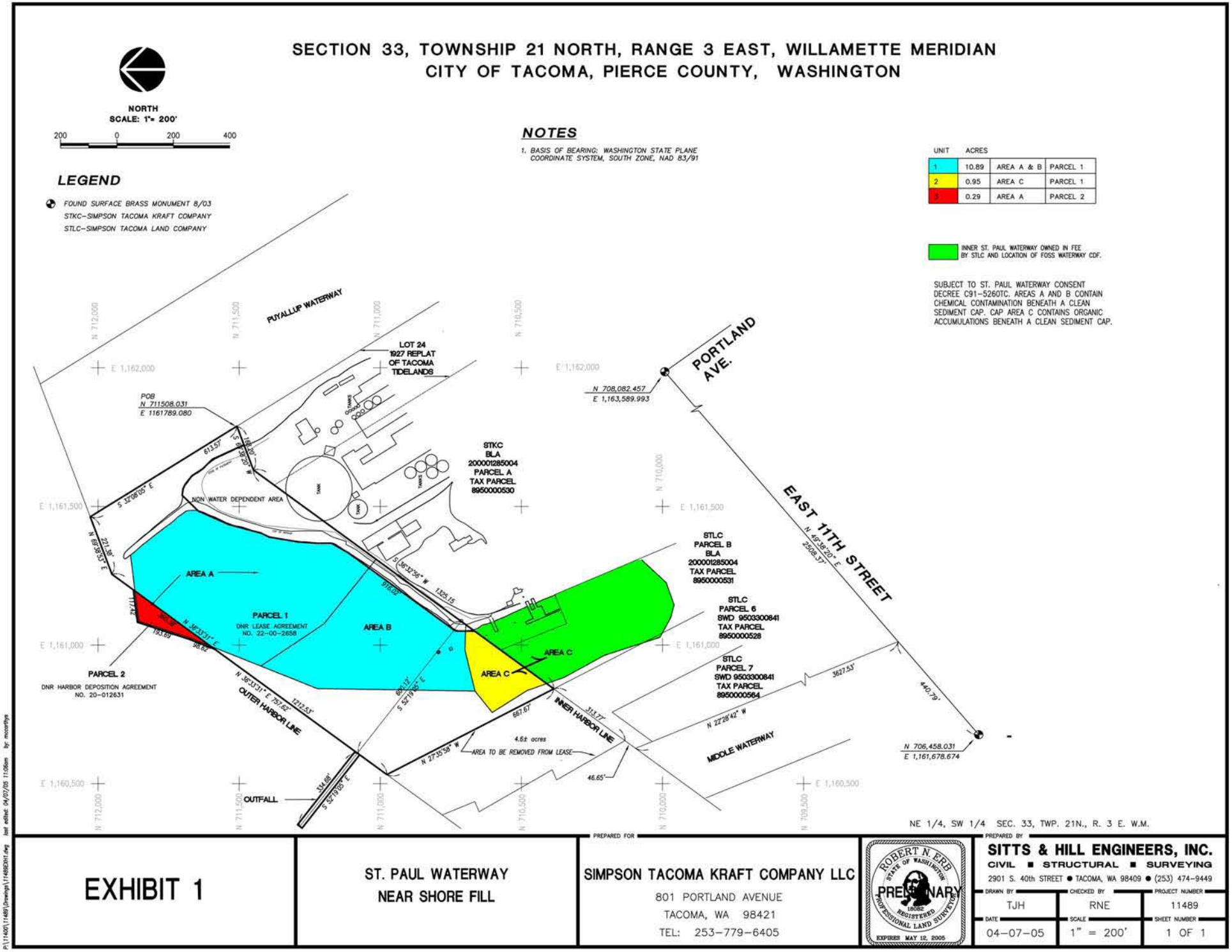
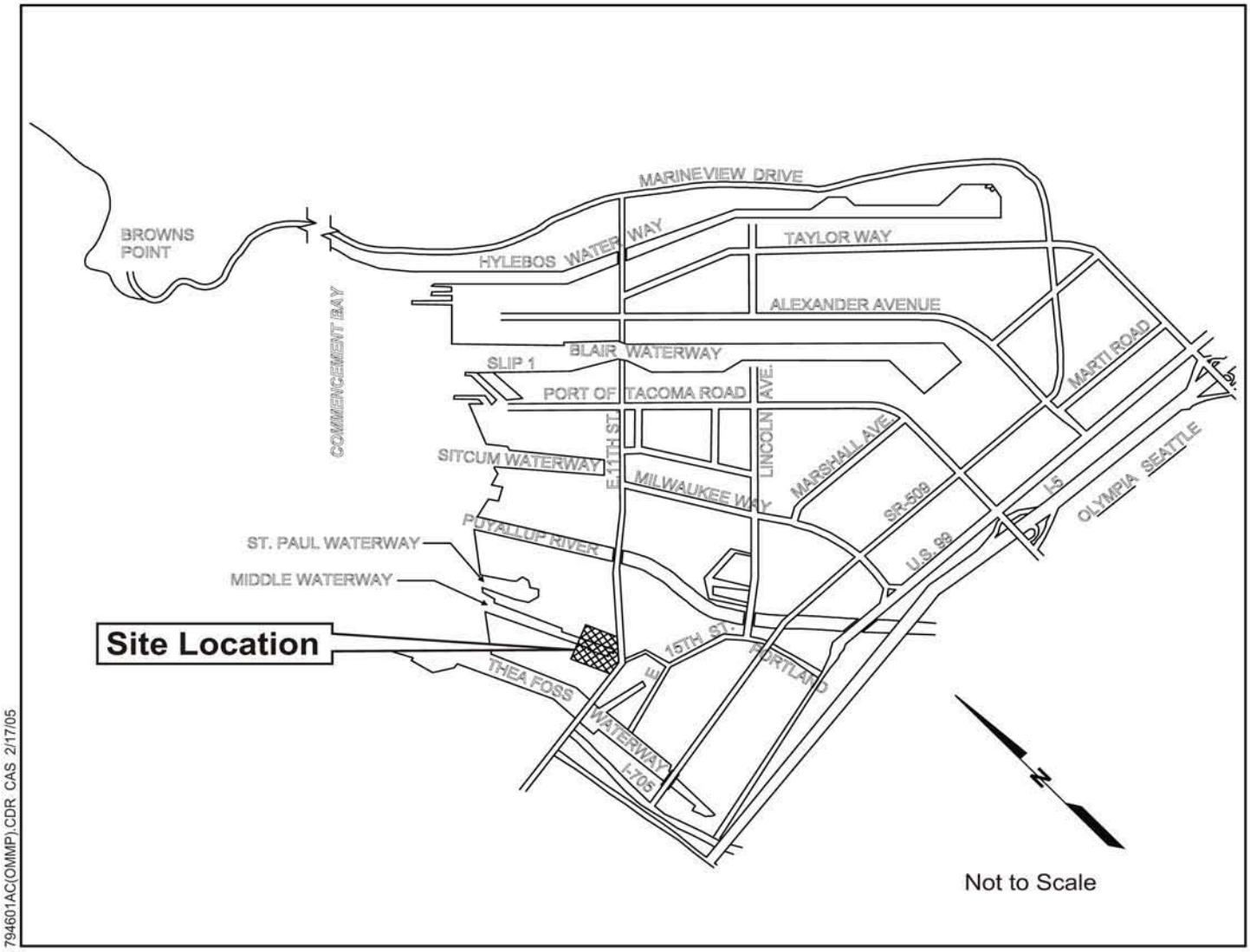


Figure 4-7. St. Paul Waterway (Source: McEntee, D., 2005)

Vicinity Map
Middle Waterway Problem Area C



794601AC(OMMP).CDR CAS 2/17/05

Note: Base map prepared from Microsoft Streets and Trips 2002.

WASHINGTON

HARTCROWSER

7946-01 ***2/05***
Figure 1 ***OMMP***

Figure 4-8. Head of Middle Waterway Vicnity Map (Source: Hart Crowser, 2005b)

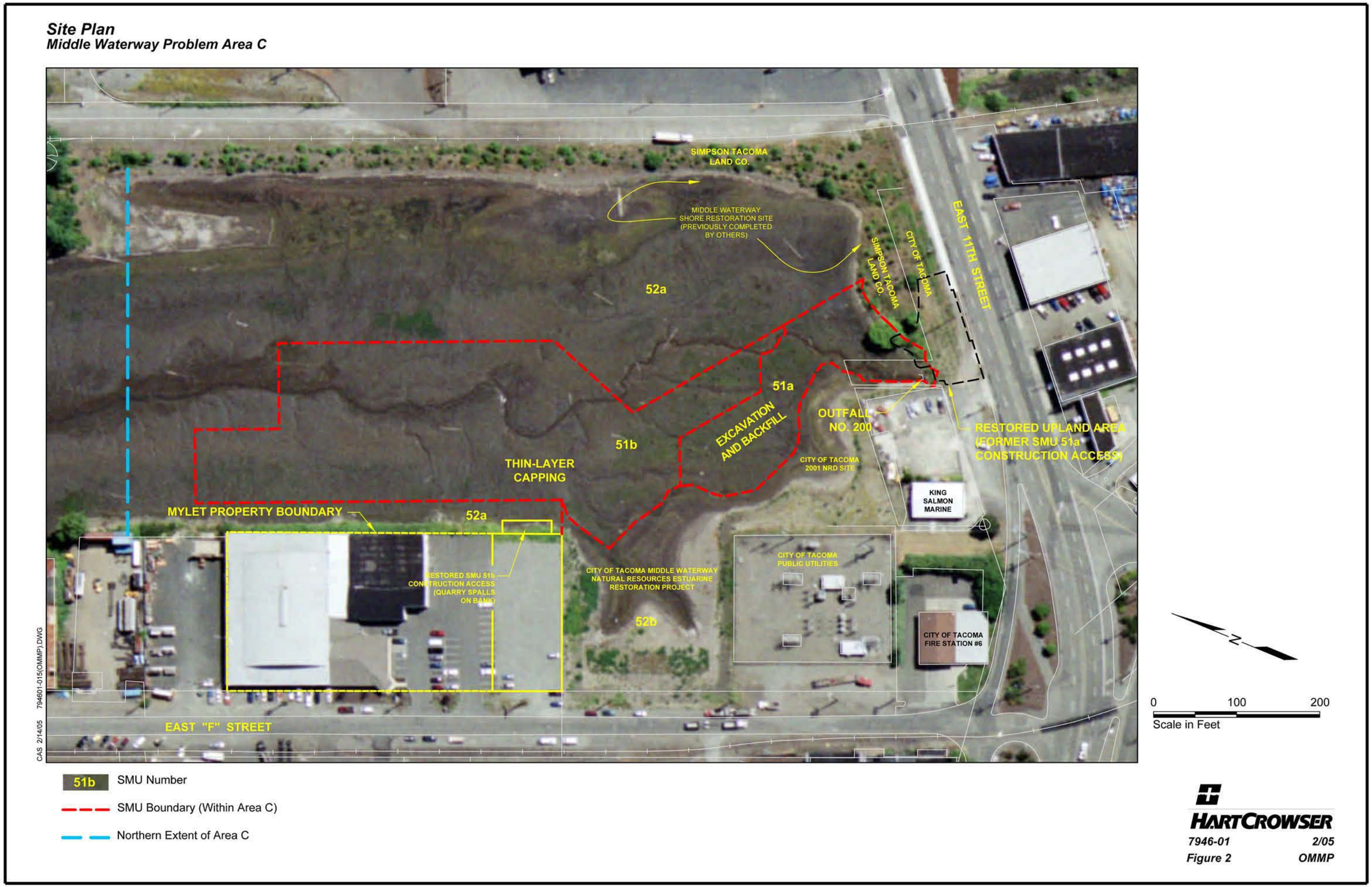


Figure 4-9. Head of Middle Waterway (Hart Crowser, 2005b)

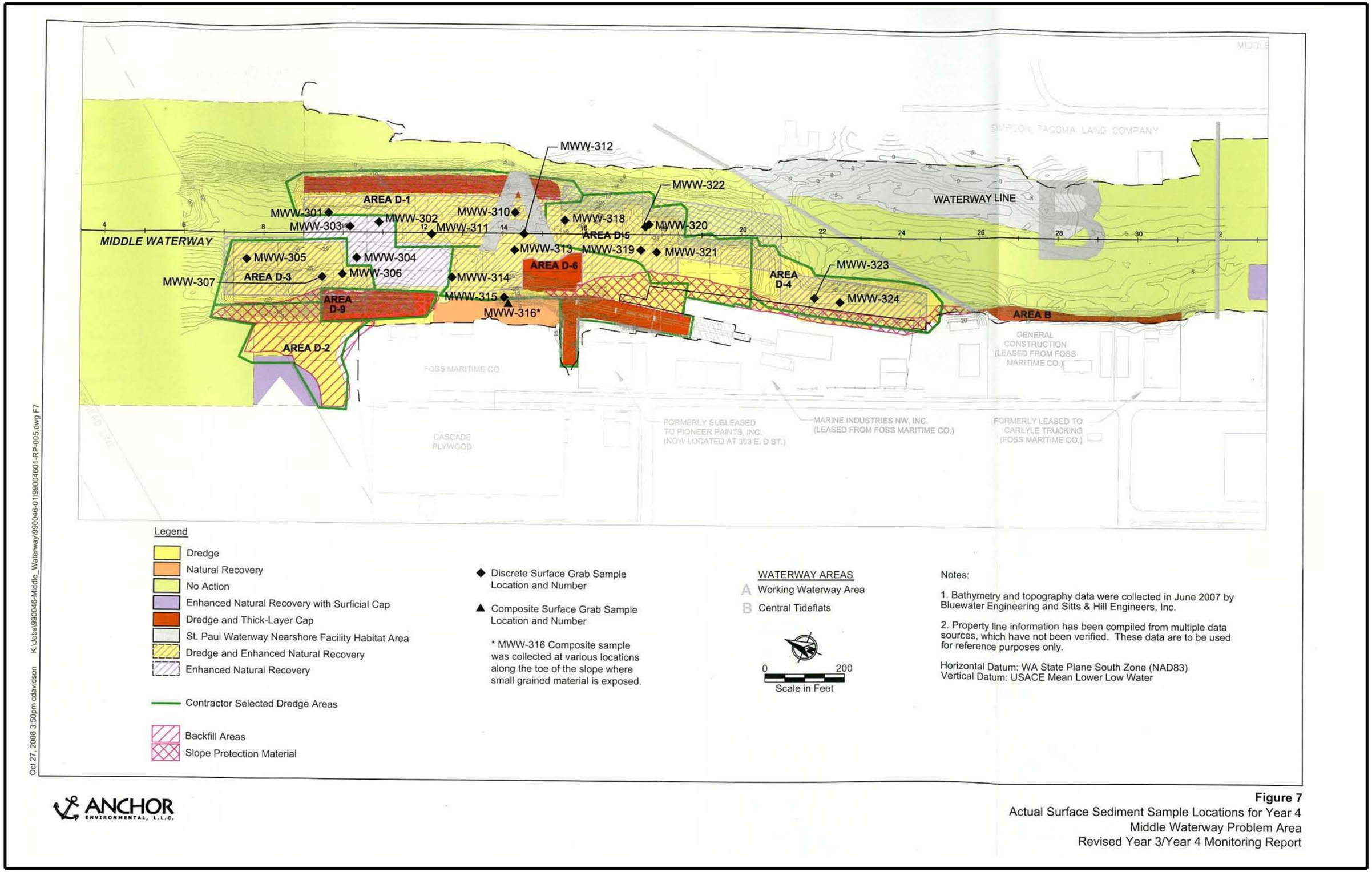


Figure 4-10. Mouth of Middle Waterway (Source: Anchor, 2008)

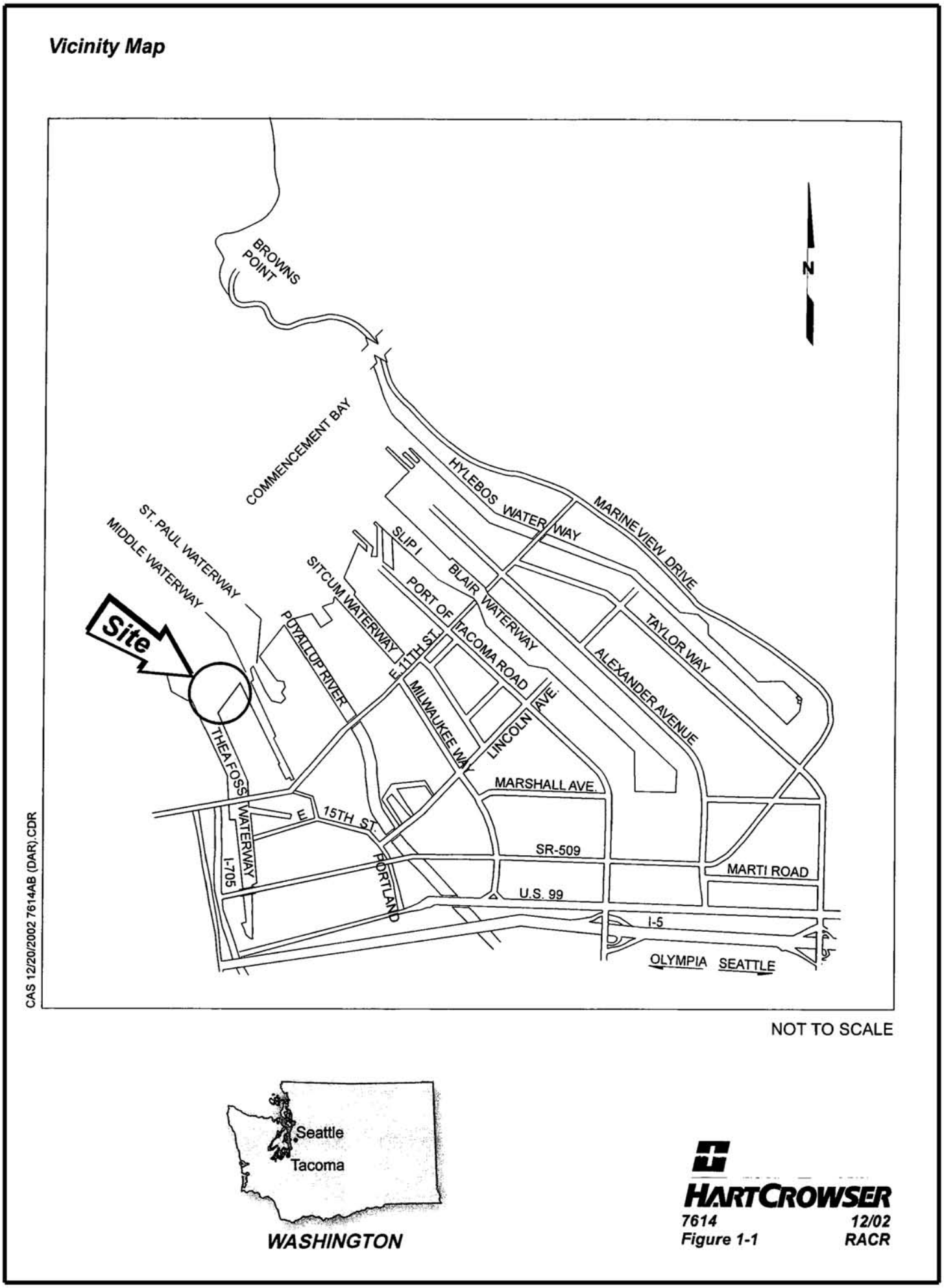


Figure 4-11. Olympic View Resource Area Vicinity Map (Source: Hart Crowser, 2002)

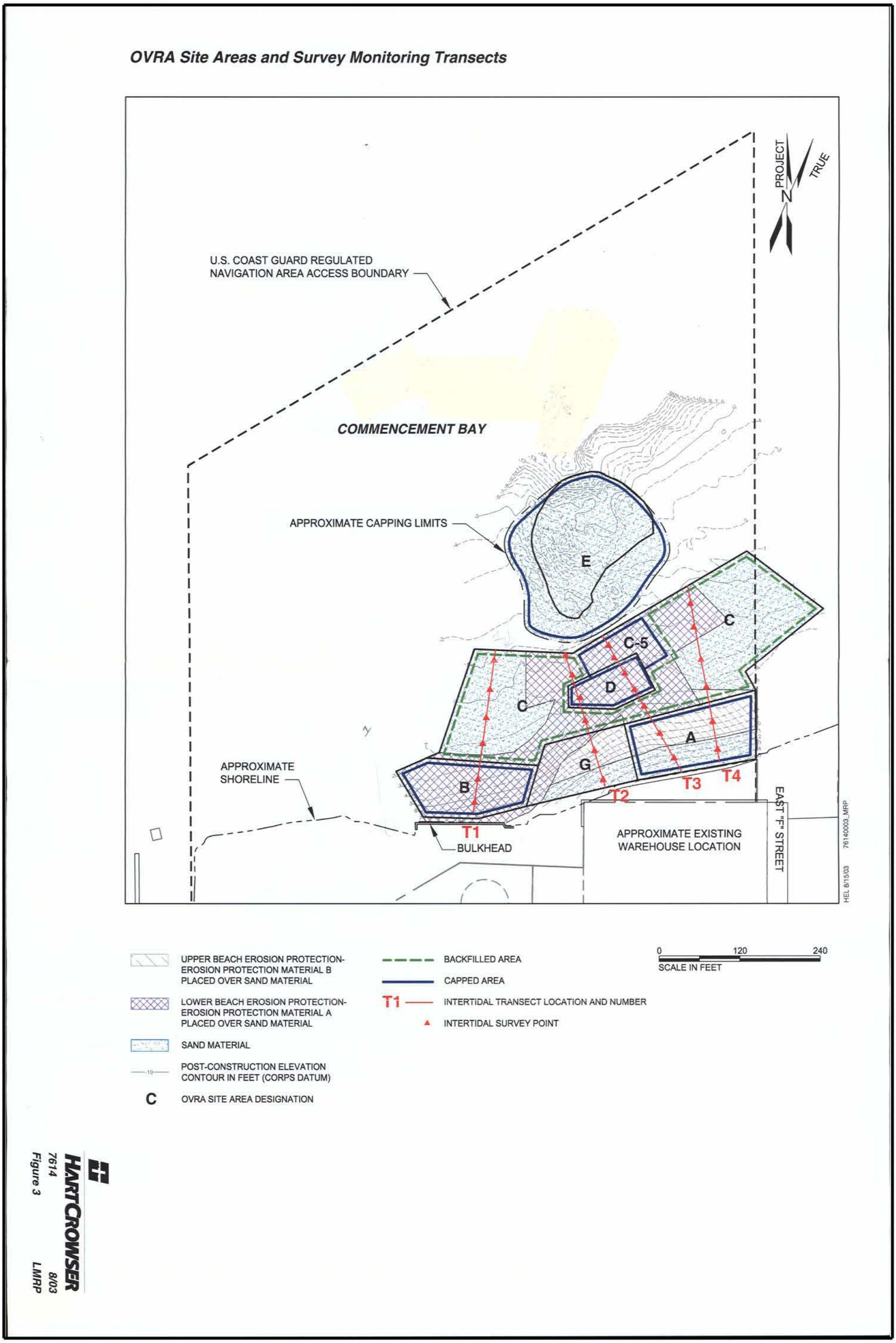


Figure 4-12. Olympic View Resource Area, Site Areas and Survey Monitoring Transects (Source: Hart Crowser, 2003)

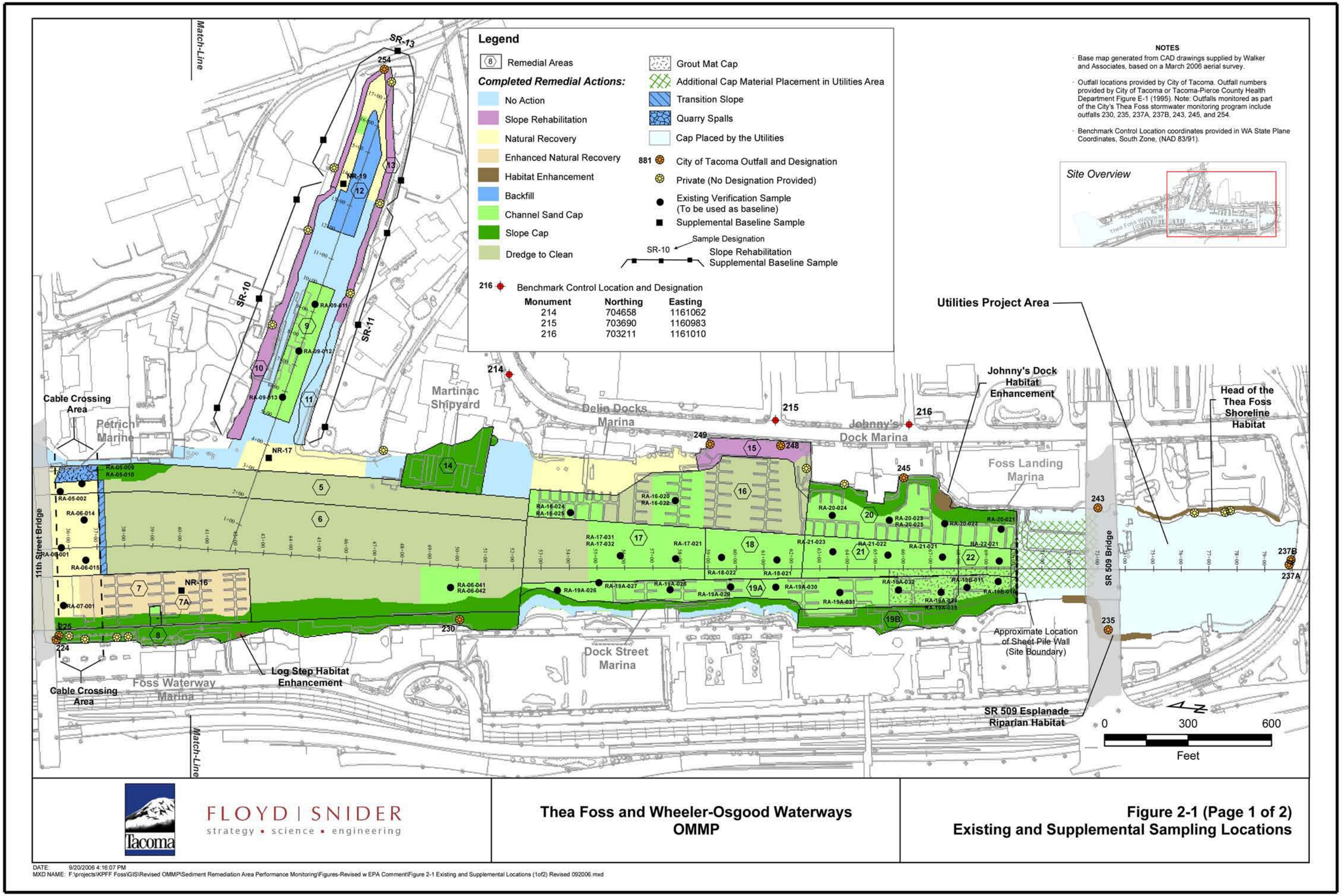


Figure 4-13. Main and Head of Thea Foss Waterway (Source: City of Tacoma, 2006b)

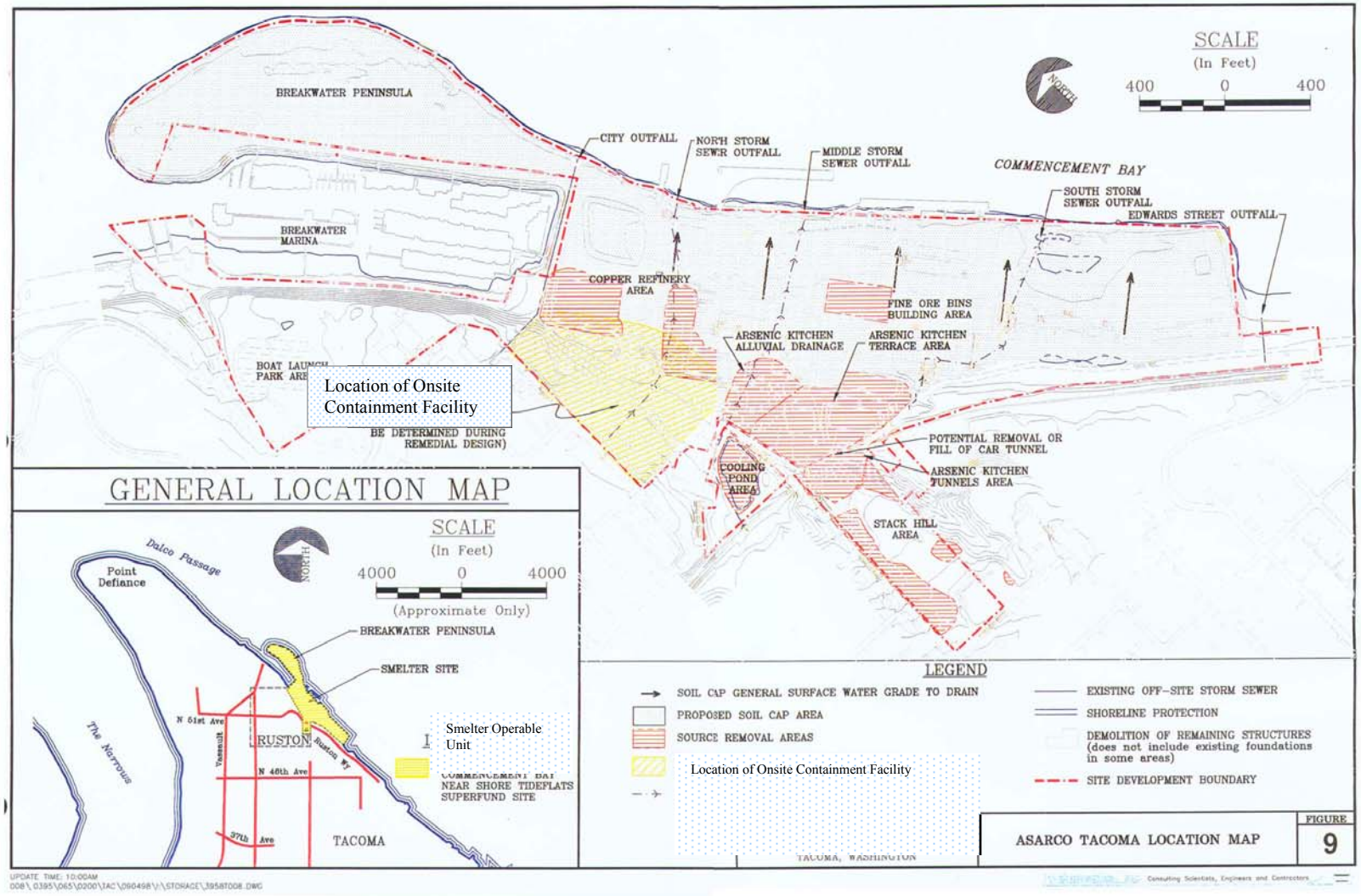


Figure 5-1. Asarco Site Location Map (Source: Point Ruston, 2007a)

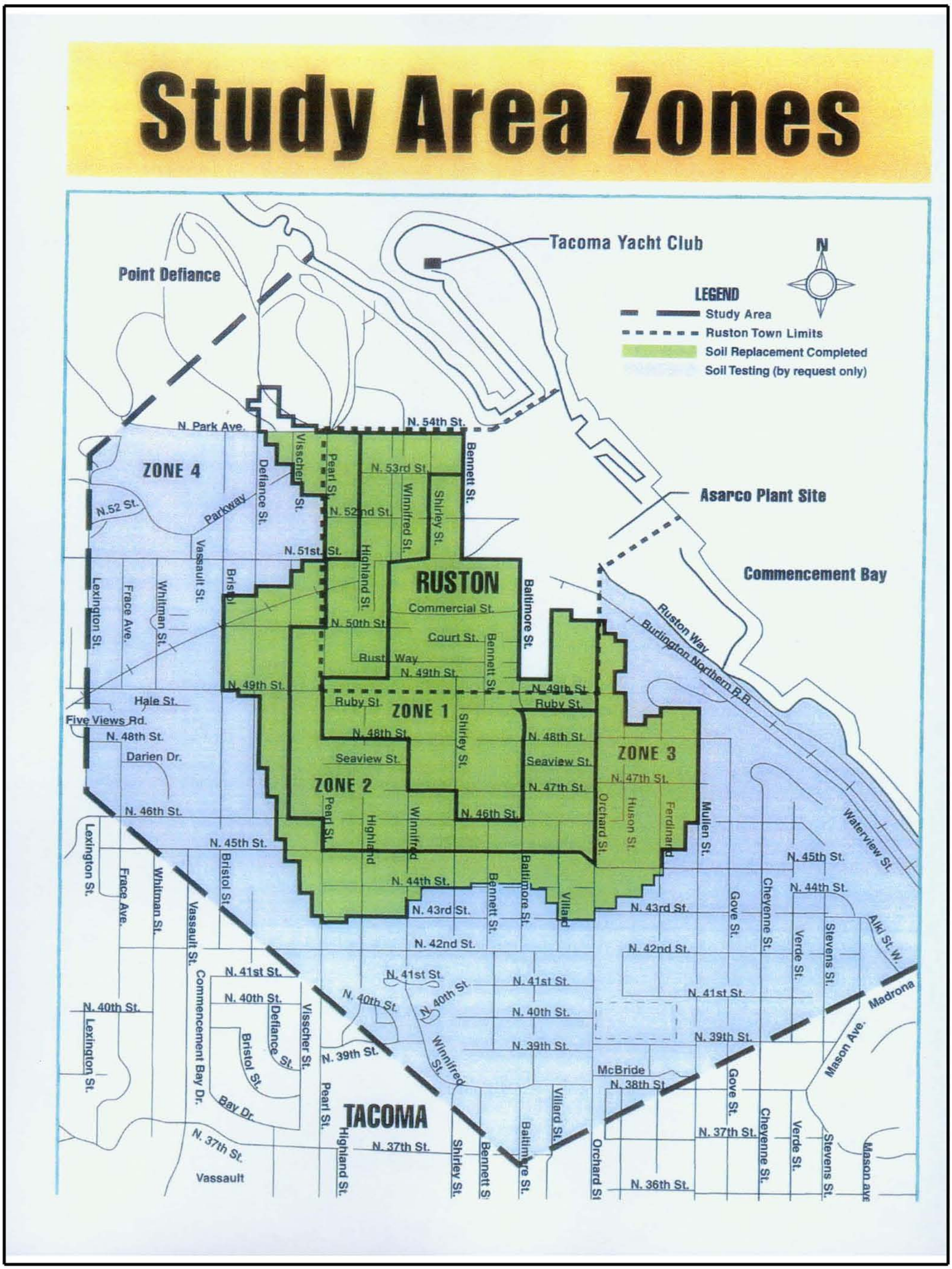


Figure 5-2. Rushton/North Tacoma Study Area (Source: MRC Construction, 2008)

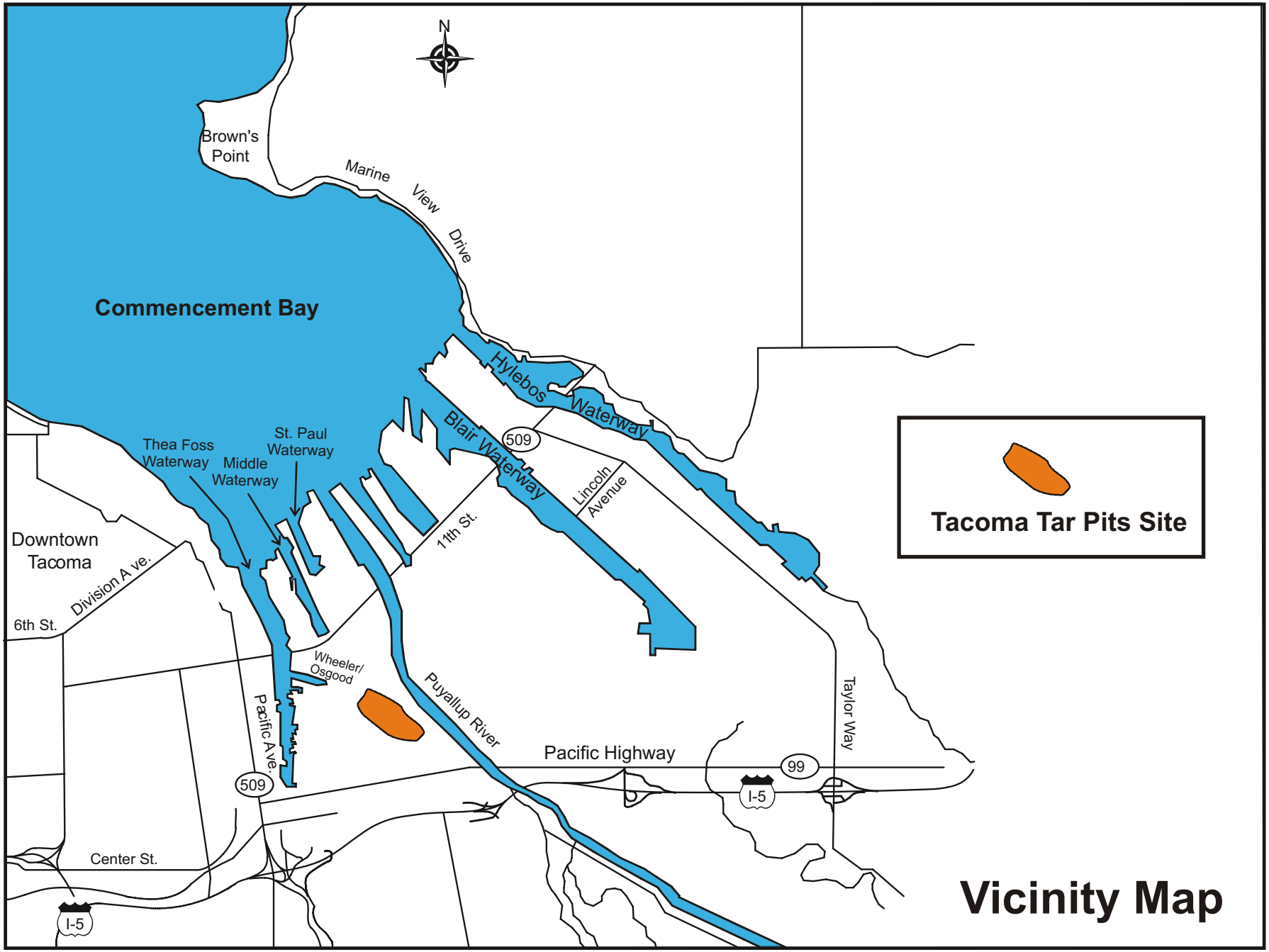


Figure 6-1. Tacoma Tar Pits Site Vicinity Map (Source: Dalton, Olmsted & Fuglevand, 2009d)

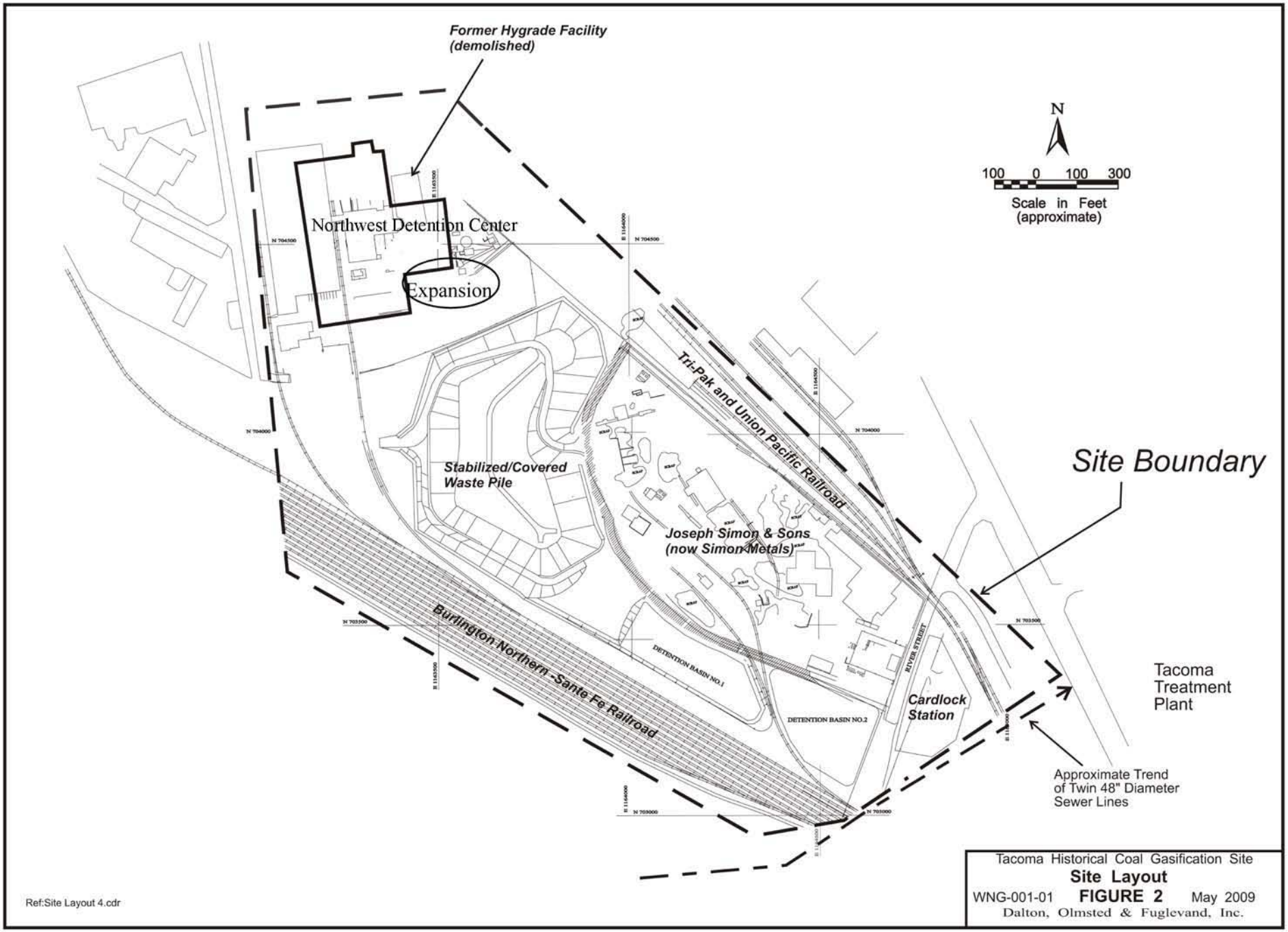


Figure 6-2. Tacoma Tar Pits Site Features (Source: Dalton, Olmsted & Fuglevand, 2009c)

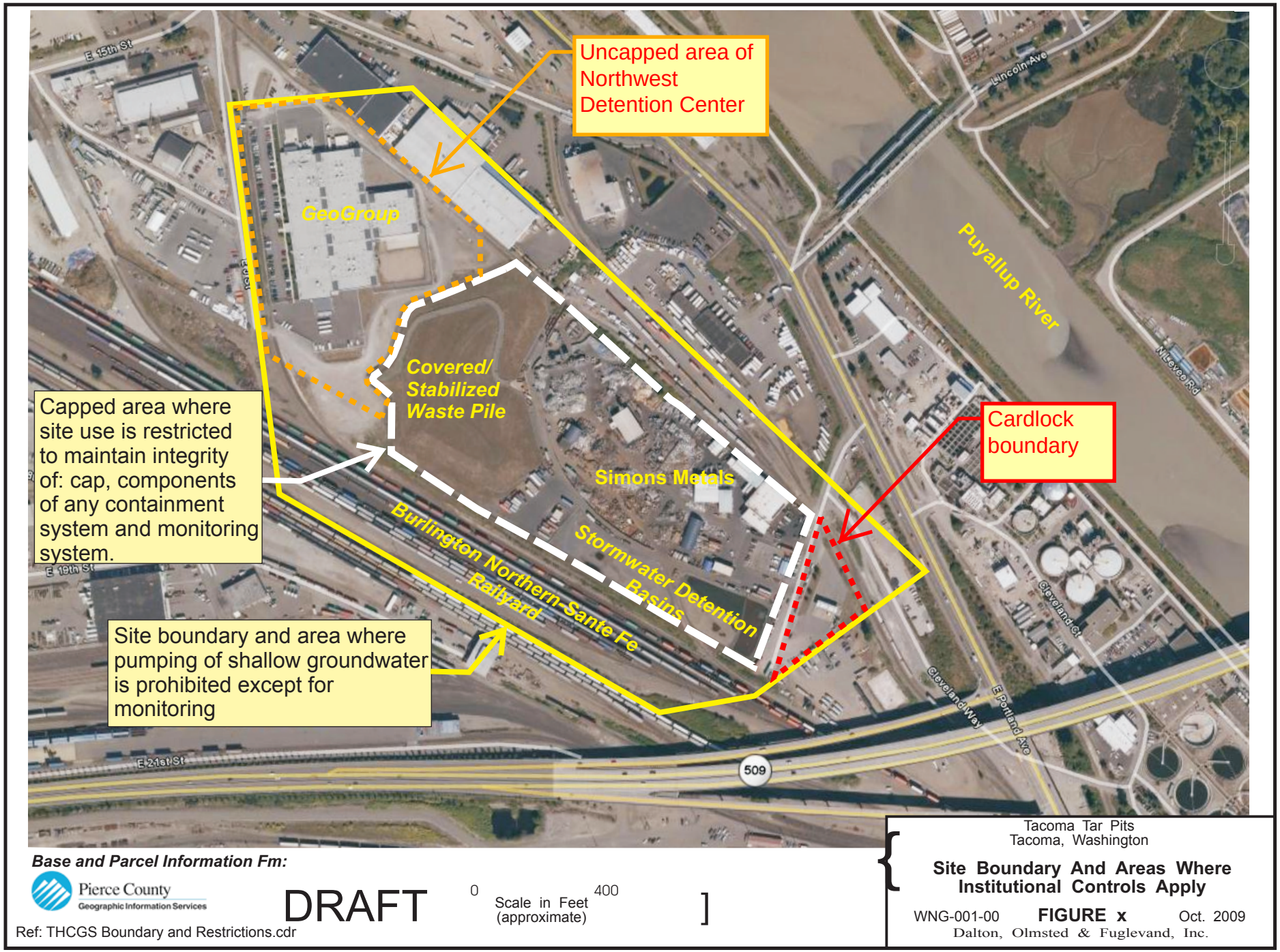


Figure 6-3. Site Boundary and Areas Where Institutional Controls Apply (Source: Dalton, Olmstead & Fuglevand, 2009a)

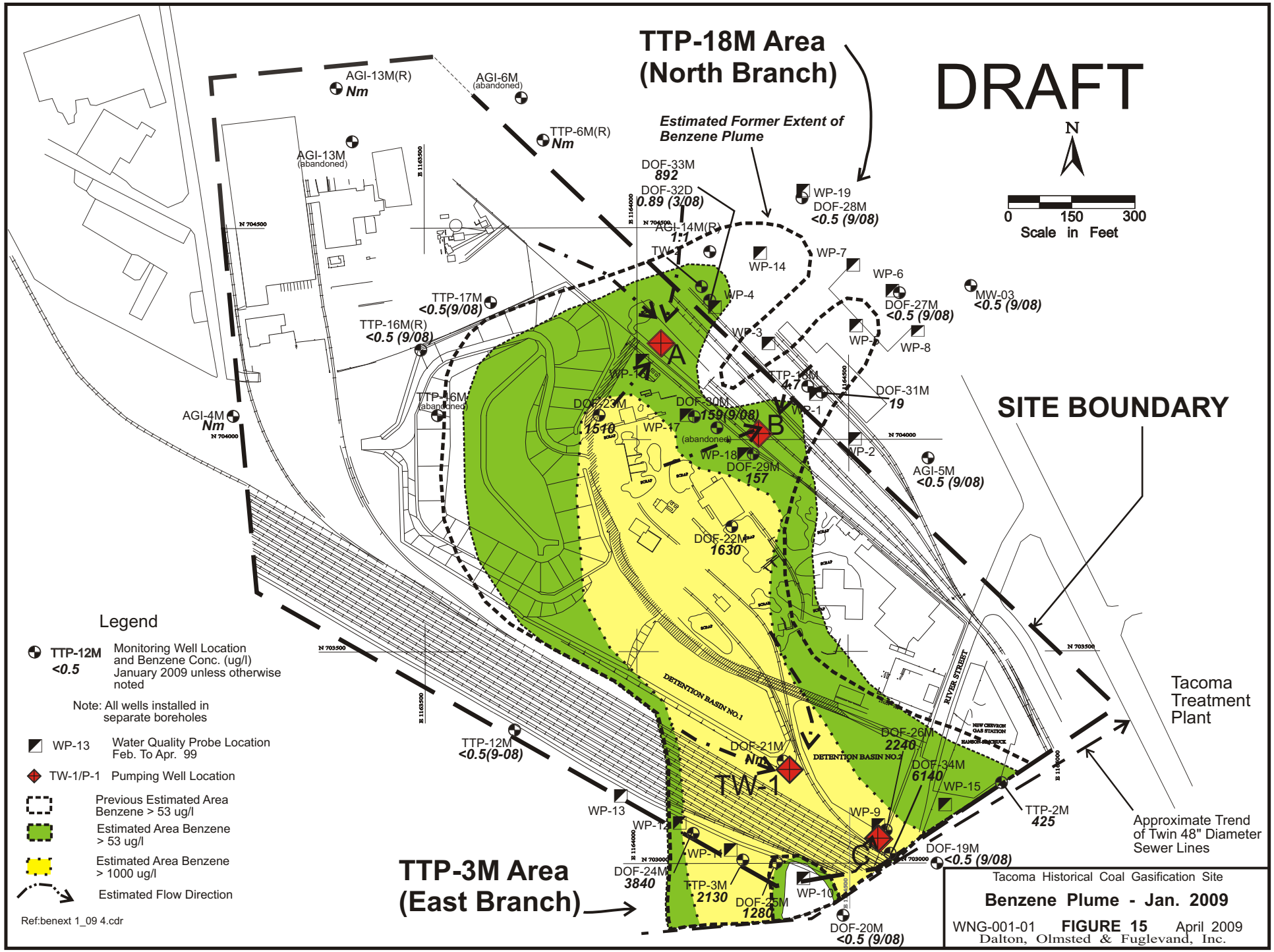


Figure 6-4. Tacoma Tar Pits Benzene Plume, January 2009
(Source: Fig. 15 from Memorandum, Agency Review Draft Groundwater Quality Update Using MAROS, DOF, 2009c)

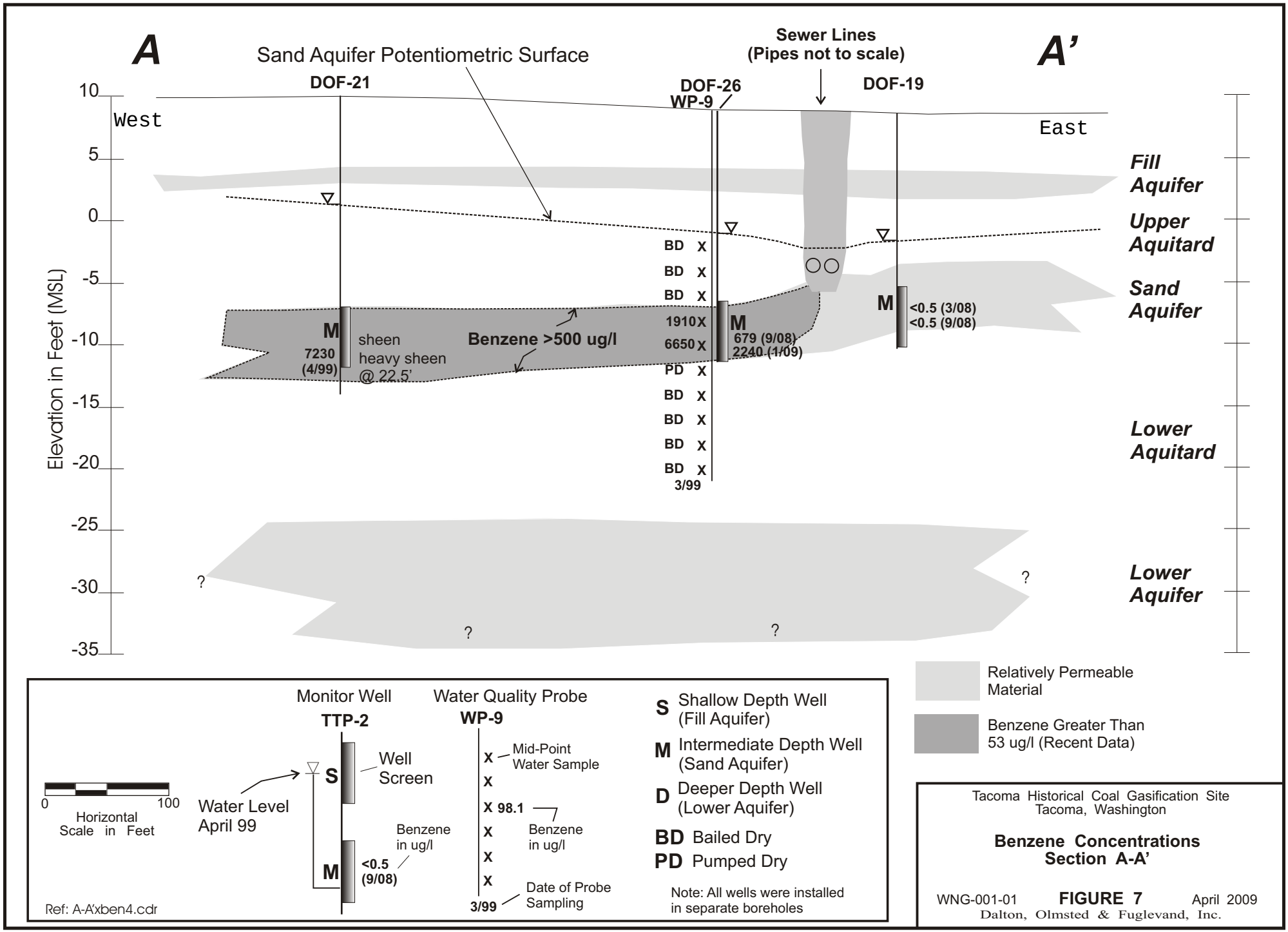


Figure 6-5. Benzene Concentrations in Eastern Branch
(Source: Figure 7 from Memorandum, Agency Review Draft Groundwater Quality Update Using MAROS, DOF, 2009c)

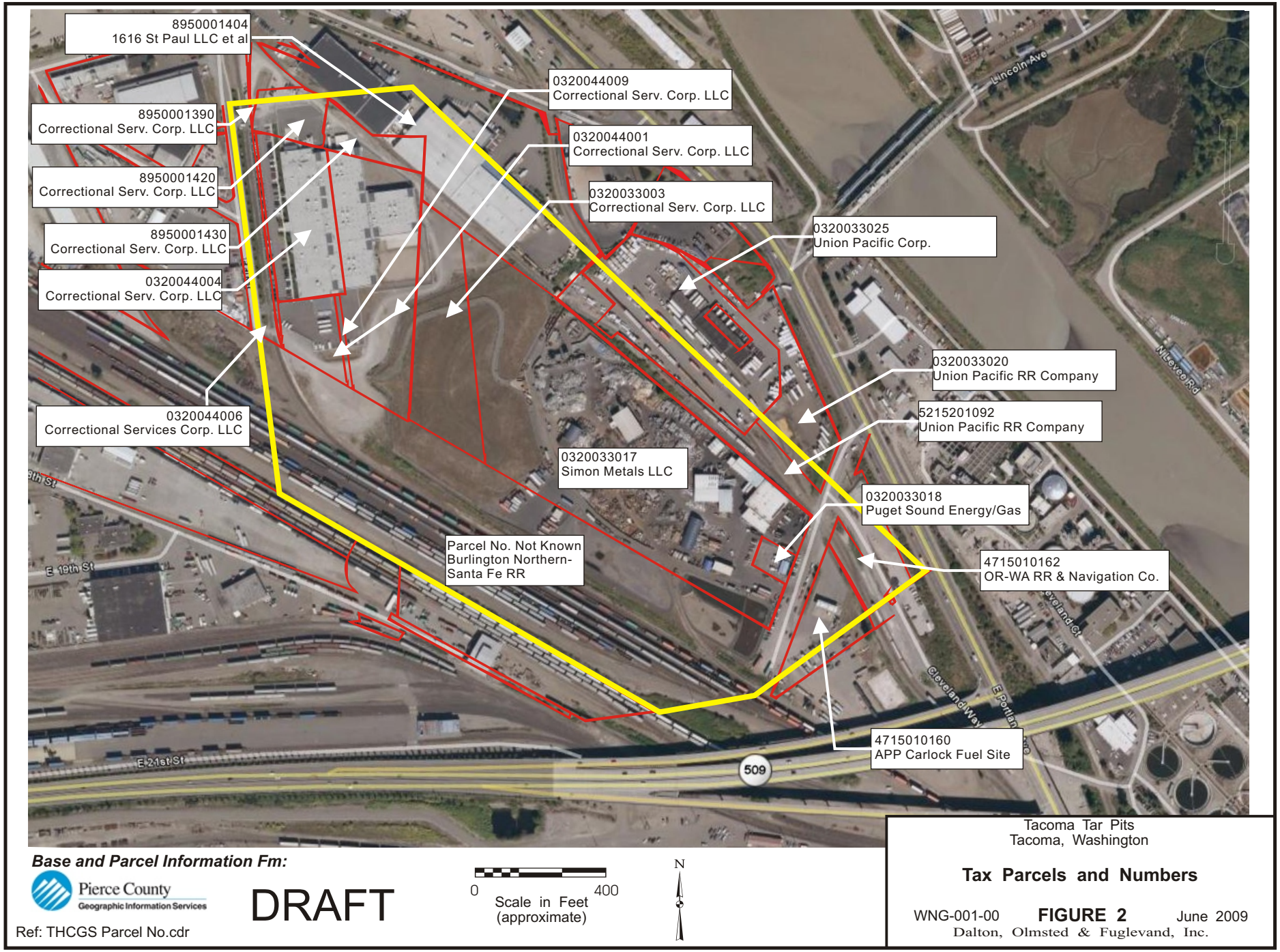


Figure 6-6. Tacoma Tar Pits Tax Parcels and Numbers
(Source: Figure 2 from Memorandum, Institutional Controls THCGS, DOF 2009b.
Note: GeoGroup, Inc., formerly called Correctional Services Corp.)

OU 1 Attachments

OU 1 Attachment 1 - List of Documents Reviewed
OU 1 Attachment 2 - ARARs Review Summary
OU 1 Attachment 3 - Toxicity Review Summary
OU 1 Attachment 4 - Five-Year Review Interview Record
OU 1 Attachment 5 - Advertisement for Notice of Five-Year Review
OU 1 Attachment 6 - Site Photos
OU 1 Attachment 7- Arkema Cap Approval Letter
OU 1 Attachment 8 - Occidental 2005 Amendment to the 1997 AOC
OU 1 Attachment 9 - Tribal Framework Evaluation

OU 1 Attachment 1 - List of Documents Reviewed

List of Documents Reviewed – OU1

Anchor Environmental, L.L.C. (Anchor). 2005a. Final Revised Operations, Monitoring, and Maintenance Plan – Areas A and B. Prepared by Anchor Environmental. February 14, 2005.

Anchor. 2005b. Final Year Zero (Year 0) Monitoring Report. Middle Waterway Problem Area – Areas And B. Commencement Bay Nearshore/Tideflats Superfund Site. Prepared by Anchor Environmental. October 17, 2005.

Anchor. 2005c. Remedial Design Report, Mouth of Hylebos (Segments 3, 4, and 5). Tacoma, Washington. January 2005.

Anchor. 2008. Final Year 3/Year 4 Monitoring Report. Middle Waterway Problem Area – Areas And B. Commencement Bay Nearshore/Tideflats Superfund Site. Prepared by Anchor Environmental. December 2008.

City of Tacoma. 2005. Remedial Action Construction Report-Thea Foss and Wheeler-Osgood Waterways Remediation Project. July 2005.

City of Tacoma. 2006a. Remedial Action Construction Report-Thea Foss and Wheeler-Osgood Waterways Remediation Project. September 2006.

City of Tacoma. 2006b. Operation, Maintenance and Monitoring Plan , -Thea Foss and Wheeler-Osgood Waterways Remediation Project. September 2006.

City of Tacoma. 2007. Year 0 Baseline Monitoring, Annual Operation, Maintenance and Monitoring Plan Report, -Thea Foss and Wheeler-Osgood Waterways Remediation Project. February 28, 2007.

City of Tacoma. 2007. Year 1 Monitoring, Habitat Mitigation Area Monitoring Preliminary Findings Memorandum, -Thea Foss and Wheeler-Osgood Waterways Remediation Project. August 17, 2007.

City of Tacoma. 2008. Year 1 Monitoring, Annual Operation, Maintenance and Monitoring Plan Report, -Thea Foss and Wheeler-Osgood Waterways Remediation Project. March 17, 2008.

City of Tacoma. 2008. Year 2 Monitoring, Annual Sediment and Cap Performance and Early Warning Monitoring Preliminary Findings Memorandum, -Thea Foss and Wheeler-Osgood Waterways Remediation Project. October 2, 2008.

City of Tacoma. 2009. Year 2 Monitoring, Annual Operation, Maintenance and Monitoring Plan Report, -Thea Foss and Wheeler-Osgood Waterways Remediation Project. March 23, 2009.

DOF. 2005. Results of Year 1 Operation, Maintenance and Monitoring Plan Sampling, Head of the Thea Foss Waterway Remediation Project. Prepared for Puget Sound Energy and PacifiCorp Environmental Remediation Company. October 2005.

DOF. 2006. Year 2 Assessment of Utilities' Cap Recontamination, Head of the Thea Foss Waterway Project, Tacoma, Washington. Prepared by Dalton. Olmsted, and Fuglevand, Inc. for PacifiCorp Environmental Remediation Company and Puget Sound Energy. October 2006.

DOF and TtEC (Tetra Tech EC, Inc.). 2005. Assessment of Utilities' Cap Recontamination and Data Summary, Head of Thea Foss Waterway Remediation, Tacoma, Washington. Prepared for PacifiCorp Environmental Remediation Company and Puget Sound Energy. July 2005.

Environmental Protection Agency (EPA). 1989. commencement Bay Nearshore/Tideflats Record of Decision. Prepared by EPA, Region 10, Seattle, Washington. September 1989.

EPA. 1991. Risk Assessment Guidance for Superfund. Volume 1. Human Health Evaluation Manual. Part B, Development of Preliminary Remediation Goals. United States. EPA, Office of Emergency and Remedial Response, Washington, DC. EPA 540-R-92-003.

EPA. 1997. Explanation of Significant Difference- PCB, Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington. July 1997.

EPA. 1999. A Guide for Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents, EPA 540R-98-031. Washington, D.C.: United States Environmental Protection Agency. July 1999.

EPA. 2000a. Explanation of Significant Differences, Commencement Bay Nearshore/Tideflats Superfund Site. EPA, Region 10, Tacoma, Washington. August 3, 2000.

EPA. 2000b. Explanation of Significant Difference- Commencement Bay Nearshore/Tideflats Superfund Site. EPA, Region 10. September 2004.

EPA. 2002. Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites. OSWER Directive 9285.6-08. EPA, Washington, D.C.

EPA. 2007. Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-Based Decision Making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia. August 2007.

Hart Crowser. 1994. Operations, Maintenance, and Monitoring Plan, Sitcum Waterway Remediation Project. June 3, 1994. Prepared by Hart Crowser for the Port of Tacoma, Tacoma, Washington.

Hart Crowser. 2002. Removal Action Completion Report, Olympic View Resource Area, Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington. Prepared by Hart Crowser for the City of Tacoma, Tacoma, Washington.

Hart Crowser. 2003. Final Long-Term Monitoring and Reporting Plan, Olympic View Resource Area, Non-Time-Critical Removal Action, Tacoma, Washington. August 15, 2003. Prepared by Hart Crowser for the City of Tacoma, Washington.

Hart Crowser. 2005a. Remedial Action Construction Report, Middle Waterway Problem Area C, Sediment Management Units 51a and 51b, Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington. Prepared for the DNR, Contract No. AE 099, 7946-01. April 7, 2005.

Hart Crower. 2005b. Operations, Monitoring, and Maintenance Plan, Middle Waterway Problem Area C, Sediment Management Units 51a and 51b, Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma ,Washington. Prepared for the DNF, Contract No. AE 099, 7946-01. April 27, 2005.

Hart Crowser. 2006a. Year 0 (2004) Baseline Monitoring Report, Middle Waterway Problem Area C, Sediment Management Units 51a and 51b, Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington. Prepared for the DNR, Contract No. AE 099, 7946-01. December 11, 2006.

Hart Crowser. 2006b. Year 1 (2005) Monitoring Report, Middle Waterway Problem Area C, Sediment Management Units 51a and 51b, Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington. Prepared for the DNR, contract No. AE 099, 7946-02. December 12, 2006.

Hart Crower. 2007a. Year 2 (2006) Monitoring Report. Middle Waterway Problem Area C. Sediment Management Units 51a and 51b. Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington. Prepared for the DNR. June 20, 2007.

Hart Crower. 2007b. Year 3 (2007) Monitoring Report. Middle Waterway Problem Area C. Sediment Management Units 51a and 51b. Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington. Prepared for the DNR. November 2007.

Hart Crowser. 2009a. Institutional Control Study, Sitcum Waterway Remediation Project. October 2009. Prepared by Hart Crowser for the Port of Tacoma, Tacoma, Washington.

Hart Crower. 2009b. Year 4 (2008) Monitoring Report. Middle Waterway Problem Area C. Sediment Management Units 51a and 51b. Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington. Prepared for the DNR. January 2009.

McEntee, D. 2005. Personal communication on June 6, 2005 from D. McEntee, Simpson, to Karen Keeley, EPA. Institutional Controls, St. Paul Waterway Consent Decree No. C91-5260TC, Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, WA.

TtEC (Tetra Tech EC, Inc.). 2006. Results of Year 2 Operations, Maintenance, and Monitoring Sampling, Head of the Thea Foss Waterway Remediation Project. Tacoma, Washington. November 2006.

TtEC (Tetra Tech EC, Inc.). 2007. Results of Year 3 Operations, Maintenance, and Monitoring Sampling, Head of the Thea Foss Waterway Remediation Project, Tacoma, Washington. August 2007.

TtEC (Tetra Tech EC, Inc.). 2008. Results of Year 4 Operations Maintenance, and Monitoring Sampling, Head of the Thea Foss Waterway Remediation Project, Tacoma, Washington. September 2008.

TtFW (Tetra Tech FW, Inc.); Dalton, Olmsted & Fuglevand, Inc.; and Geoengineers, Inc. 2003. Operations, Maintenance, and Monitoring Plan, Head of the Thea Foss Waterway Remediation Project, Tacoma, Washington. July 2003.

OU 1 Attachment 2 - ARARs Review Summary

Action Specific ARARs				
Sediment Remedial Activities				
Action	Citation	Requirement and Descriptions	Status	Comment
Upland Disposal of RCRA Hazardous Wastes	40 CFR 246	Upland disposal facilities must follow the correct guidelines for source separation of residential, commercial, and institutional solid waste. This includes transportation, storage, and cost.	applicable	No updates listed between 1996-2009.
	40 CFR 264	Standards, requirmements and procedures for owners and operators of hazardous waste treatment, storage, and disposal facilities.	applicable	
	40 CFR 265	Interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities.	applicable	
	40 CFR 268 Subpart D	Defines the Applicability of treatment standards for hazardous waste that are land disposed. Hazardous waste must be at or below specified treatment standards for each hazardous constituent in each listed waste category, and must also meet technology standards.	applicable	
	52 CFR 8712			
State Requirements for Upland Disposal of Solid Waste, Dangerous Waste, and Extremely Hazardous Waste	RCW 70.105 WAC173-303-081	Defines discarded chemical products (including commercial chemical product, and any soil or water that has been contaminated by a commercial chemical product spill) as dangerous waste. Additionally chemical must have generic name listed in the discarded chemical products list to be considered a dangerous waste by Washington state.	applicable	In 2005, there were editorial changes, will not affect protective remedies.
	WAC 173-303-650	Outlines construction and operating requirements for owners and operators of facilities that utilize surface impoundments to treat, store, or dispose of dangerous waste.	applicable	Updated in 2009 to keep state regulations current with federal requirements, the update also included alteration of biological and chemical testing methods. Should not alter affectiveness of remedies in place.
Dredging and Dredged Materials Management, Including Designation of Disposal Sites	Clean Water Act Sect. 404 (40 CFR 125)	A permit must be obtained for dredging actions where there is discharge of dredged or fill material into the navigable waters at specified disposal sites. Lists criteria and standards for the national pollutant discharge elimination system.	applicable	"On June 22, 2009 US Supreme Court rule[d] that EPA cannot issue a NPDES for discharges requiring a section 404 dredge and fill permit from the corps of engineers... Section 404 permits still remain subject to CWA section 401, which requires the state to certify that an activity does not violate state water quality standards... The decision does not override the CWA's discharge standards for toxic pollutants." Downey Brand Publications.

Action Specific ARARs				
Sediment Remedial Activities				
Action	Citation	Requirement and Descriptions	Status	Comment
Requirement of the State Water Quality Certification Process	CWA Sect. 401 (40 CFR 125)	"Actions must not result in a violation of water quality standards or other state policies, requirements, and laws that pertain to the aquatic environment and beneficial use protection" (ROD 1989). Defines the certification process, compliance with applicable requirements, procedures, licensing and suspension.	applicable	No updates.
Requirements of the Washington Department of Fisheries and Department of Wildlife Hydraulics Permit		Includes "design and performance constraints and timing of action" (ROD 1989). Hydraulic Project Approval (HPA).	applicable	"The state Legislature gave the Department of Fish and Wildlife the responsibility of preserving, protecting, and perpetuating all fish and shellfish resources of the state. To assist in achieving that goal, the state Legislature in 1949 passed a state law now known as the "Hydraulic Code" (Chapter 77.55 RCW). A set of agency rules (Chapter 220-110 WAC) has been adopted by the Department of Fish and Wildlife to guide administration of Chapter 77.55 RCW." Under RCW 77.55.06, titled Hazardous substance remedial actions, "procedural requirements of this chapter shall not apply to any person conducting a remedial action at a facility pursuant to a consent decree, order, or agreed order issued pursuant to chapter 70.105D RCW, or to the department of ecology when it conducts a remedial action under chapter 70.105D RCW."
State Requirements for Managing Hazardous Waste Site Cleanups	Requirement of Washington model toxics control act (initiative 97), chapter 2, laws of 1989 (RCW 70.105D.900)	Hazardous waste cleanup must include consideration of human and environmental health. Communities should be notified of releases of hazardous, cleanup remedies, enforcement of standards, and modification of state funding procedures.	applicable	Funding has been modified which will not change effectiveness of remedies in place.

Action Specific ARARs				
Sediment Remedial Activities				
Action	Citation	Requirement and Descriptions	Status	Comment
Requirements for Activities Conducted Within 200 feet of Shorelines of Statewide Significance	Washington Shoreline Management Act (RCW 90.58, WAC 173-14)	Shoreline Management Act provides guidelines for the utilization, protection, restoration, and preservation of the shorelines of Washington state. Each county will create its own Shoreline management plan in accordance with RCW 90.58.	applicable	WAC 173-14 is no longer in existance, previous requirements are now listed uner WAC 173.27. Under WAC 173.27.045 certain developments are not subject to the Shoreline Management Act pursant to RCW 90.58.355, "regarding hazardous substance remedial actions, the procedural requirements of the Shoreline Management Act shall not apply to any person conducting a remedial action at a facility pursuant to a consent decree, order, or agreed order issued pursuant to chapter 70.105D RCW, or to the department of ecology when it conducts a remedial action under chapter 70.105D RCW. The department of ecology shall ensure compliance with the substantive requirements of chapter 90.58 RCW, chapter 173-26 WAC and the local master program through the consent decree, order, or agreed order issued pursuant to chapter 70.105D RCW, or during the department-conducted remedial action, through the procedures developed by the department pursuant to RCW 70.105D.090".
State Requirements for Interference with the Natural Flow of State Waters	RCW 75.20.100	RCW was titled, "Construction projects in state waters: Hydraulic projects or other work — Plans and specifications, Permits, Approval, and Emergencies".	applicable	RCW 75.20.100 was recodified as RCW 77.55.100 pursuant to 2000 c 107 § 129, it was then repealed in 2005 (c 146 § 1006). The material in the original RCW is now covered in RCW 77.55.021, which describes new permit requirements and exceptions for hydraulic projects.
	WAC 220-110	Hydraulic code rules; process of obtaining a HPA, includes protection of fish life.	applicable	The 2000 ESD added the endangered species act (ESA) to the ARARs and further provided mitigation measurements to ensure protection and maintaince of threatened salmon and bull trout species.
Restoration and Enhancement of Fisheries Resources in the Commencement Bay Area	Puyallup Tribe of Indians Settlement Act of 1989 (Public law 101-41, 21 June 1989)		applicable	

Action Specific ARARs				
Sediment Remedial Activities				
Action	Citation	Requirement and Descriptions	Status	Comment
Fishing Rights, Habitat Values, Surface Water, and Groundwater		The original Puyallup Tribe Water Quality Program was difficult to locate but the 1989 ROD states that the resolution action resulted in "adopting Washington water quality standards".	applicable	In 1990, the Coorinated Tribal Water Quality Program (CTWQ) was developed by 27 federally recogonized tribes in washington state.Puyallup triba developed fact sheets concerning water quality standards.Fact Sheet 1 states: "The most extensive change to the Tribal water quality standards is the switch from a class-based designation system for surface waters to a use-based system," should not affect impact existing NPDES permits. Fact sheet 3 states: "Revised criteria for the protection of human health were developed based on EPA guidance taking into account a subsistence-based fish consumption rate, which was determined following EPA's recommended methodology. This rate is approximately 22 times higher than the consumption rate used in the original Tribal criteria." and Fact Sheet No.5 states, "For existing discharges, mixing zones for certain types of chemicals, including cancer-causing chemicals and chemicals that persist and accumulate in the environment, will be phased out by the year to prevent adverse effects or to alleviate unnecessarily restrictive general criteria."

Action Specific ARARs				
Sediment Remedial Activities				
Action	Citation	Requirement and Descriptions	Status	Comment
Protection of Endangered Species in the Puget Sound	Endangered Species Act	The 2000 ESD added the Endangered Species Act (ESA) for remedial actions under the ROD. Both Chinook salmon and bull trout were listed as threatened species within the Puget Sound waters. EPA concluded that the performance of the remedial actions together with all of the mitigative measures that have been required would be unlikely to jeopardize the continued existence of any federally listed or threatened or endangered species or result in the destruction or adverse impacts to critical habitat. Mitigation measures were followed using Section 404 of the Clean Water Act. In 2008 Steelhead Puget Sound DPS (*Oncorhynchus (=Salmo) mykiss*) was added as a threated species to the Washington endangered species list.	applicable	Puget Sound steelhead inhabit streams in the Strait of Juan de Fuca, Puget Sound and Hood Canal river basins in Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive) as well as the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks. This species is primarily composed of winter steelhead stocks, but also includes several small stocks of summer steelhead.Puget Sound steelhead were listed as threatened on May 11, 2007, (72 Federal Register 26722). Between 1992-2002 there was a declining trend in the proportion of selfsustaining populations of this species and increases in the proportion of populations with depressed or unknown status. Declining abundance was particularly evident in southern Puget Sound populations but was also exhibited in northern Puget Sound, Hood Canal and Strait of Juan de Fuca populations.Critical habitat has not been designated for these steelhead.
Source Control Actions				
Discharges to Publicly Owned Treatment Works	40 CFR 403.5	Prohibits certain types of pollutants to be introduced into a POTW also defines local treatment standards and pretreatment standards.	applicable	Minor administrative changes to structure, addition of clause which states that POTWS are allowed to develop BMPs which will be considered local limits, and pretreatment standards for discharged pollutants.
	40 CFR 264.71	Owner/operator, or agent of a facility that receives hazardous waste with a manifest document, must certify, complete, and distribute copies of manifest to appropriate parties.	applicable	Wording and structure was modified but the guidelines remain unchanged except for two changes. (1) the requirement to mail a copy of the manifest (if hazardous waste was imported from a foreign source) to the International Compliance Assurance Division, (2) a facility that receives a hazardous waste from a different state must determine if that state regulates any additional wastes, and whether there is a need to send the original state a copy of the received manifest.(2005)

Action Specific ARARs				
Sediment Remedial Activities				
Action	Citation	Requirement and Descriptions	Status	Comment
	40 CFR 264.72	Defines discrepancy in relation to manifest forms and hazardous wastes received, describes the procedures and methods of documenting a discrepancy and handling the received hazardous waste.	applicable	Amended in 2005. Wording and structure was changed with little affect on meaning. Also a large of addition of what qualifies as a rejected hazardous waste and how to properly process, or ship a rejected hazardous waste (and correctly change or create a new manifest to go along with rejected hazardous waste).
	NPEDS Permits governing direct discharges including storm drain outfall to commencement bay waters (40 CFR 125.122-.124)	NPEDS permit evaluates whether discharge will cause unreasonable degradation to the marine environment. Specific testing, and analysis will be completed and submitted to obtain the proper permit for releasing discharge into marine waters.	applicable	40 CFR 125.122 -125.124 have not been updated or changed since 1980.
Direct Discharges to City of Tacoma Sanitary Sewers	conditions stated in the pertinent pretreatment permits		applicable	
Discharges of Any Pollutant to Waters of the State	Washington water pollution control act RCW 90.48	Defines policy, permits, discharges, and water quality data concerning pollution discharged into state waters.	applicable	Powers, duties and functions of water pollution control commission, director thereof, transferred to department of ecology, this RCW includes oil, sewer, hazardous waste and most discharges.

Chemical Specific ARARs				
Sediment Remedial Activities				
Action	Citation	Requirement and Descriptions	Status	Comment
Limiting Permissible concentrations and Ambient Water Quality Criteria for Protecting Human Health and Aquatic Organisms	40 CFR 125.120 - 125.124	Guidelines for obtaining an NPEDS permit for the discharge into marine water. This permit should provide protection for human and environmental health. NPEDS permit evaluates whether discharge will cause unreasonable degradation to the marine environment. Specific testing, and analysis will be completed and submitted to obtain the proper permit for releasing discharge into marine waters.	applicable	40 CFR 125.120 -125.124 have not been updated or changed since 1980.
	40 CFR 227.22	Assessment of impact ocean dumping would have on other uses of the ocean, including temporary and long range affects.	applicable	No updates/changes found.
	40 CFR 131	Establishes approval, procedures, reviews, and federal/state water quality standards.	applicable	Within 40 CFR 131, 131.36 (d)(14) is concerned with Washington, EPA Region 10 specifically. In 2007water classified as used by fish and shellfish/fish was modified by the removal column C2-6, 14 (maximum and continuous concentration of certain pollutants in saltwater) as applicable criteria.
Groundwater Protection	(for RCRA Facilities) 40 CFR 264	Within 40 CFR 264 (Standards for owners and operators of hazardous waste treatment, storage, and disposal facilities) section 264.92 regulates ground water protection. Owners and operators of hazardous waste facilities must comply with conditions specified in the facility permit (established by Regional Administrator). The owner must ensure that hazardous constituents (defined in 40 CFR 264.93) detected in ground water from a regulated unit do not exceed the concentration limits (listed in 40 CFR 264.94-.96).	applicable	There have been no new updates to 40 CFR 264.92-.96 since the last five year review in 2004.

Chemical Specific ARARs				
Sediment Remedial Activities				
Action	Citation	Requirement and Descriptions	Status	Comment
	40 CFR 265	Under 40 CFR 265 (Interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities) Subpart F (section 265.90-.94)adresses ground water monitoring systems. This monitoring system must be properly placed, maintained, and improved. Sampling and Analysis are regulated under 40 CFR 265.92. The preparation, evaluation and response to the ground water monitoring system is regulated under 40 CFR 265.93. Further 40 CFR 265.94 describes the recordkeeping and reporting of the ground water monitoring system.	applicable	There have been no new updates to 40 CFR 265.91-.92 and .94 since the last five year review in 2004.
Groundwater Used and Drinking Water	40 CFR 141	National primary drinking water regulations including maximum contaminant levels, monitoring, reporting, record keeping, special regulations, treatment technologies, procedures, public notification, and analytical requirements.	applicable	
	40 CFR 143	Controls contaminants in drinking water that generally affect the aesthetic quality of drinking water. This is not federally regulated but is recommended for states to consider in the creation of drinking water standards.	applicable	Amendment in 2007 to table in section b of 143.4, added the references for online edition of Standard Methods for the Examination of Water and Wastewater. Remedies in place still effective.
Contaminant Leaching Trigger Handling ; extraction procedure toxicity test	40 CFR 261.24	Describes the toxicity characteristics of a hazardous waste.	applicable	Typing error amended in 2006, all other changes before 2004.
Surface Waters	Washington Water Quality Standards WAC 173-201	Establishes water quality standards for the surface waters of Washington state in consideration of public health and enjoyment, and also the propagation/protection of aquatic/ marine life.	applicable	Listed as 173-201A. Last update was in 2006 to 173-201A-200 Fresh Water Designates Uses and Criteria. Remedies still protective.
Controlling Discharges to Surface Water and Groundwater	Water pollution control act RCW 90.48	Require use of AKARTs (RCW 90.48.010) to aid in the prevention and control of the pollution of the waters of Washington state.	applicable	No updates since 2004.
	Water recourses act RCW 90.54	Require use of AKARTs.	applicable	

Chemical Specific ARARs				
Sediment Remedial Activities				
Action	Citation	Requirement and Descriptions	Status	Comment
Source Control Activities				
Controlling Discharges to Surface Water and Groundwater	Water pollution control act RCW 90.48	see description in sediment remedial activities in this section (Chemical Specific ARARs).	applicable	
	Water recourses act RCW 90.54	see description in sediment remedial activities in this section (Chemical Specific ARARs).	applicable	
Technology Based Standards	CWA Section 301(b)		applicable	
Discharges into Marine Waters	40 CFR 125.120 - 125.124	see description in sediment remedial activities in this section (Chemical Specific ARARs).	applicable	
	40 CFR 227.22	see description in sediment remedial activities in this section (Chemical Specific ARARs).	applicable	
Protection of Aquatic Life and Human Health	Ambient water quality criteria 40 CFR 131	see description in sediment remedial activities in this section (Chemical Specific ARARs).	applicable	

Location Specific ARARs				
Sediment Remedial Activities				
Action	Citation	Requirement and Descriptions	Status	Comment
Dredged Material and Impacts Assessment	CWA Section 404	Provides regulation for the discharge of dredged or fill material into navigable water of the U.S. including tributaries, interstate wetlands, wetlands that may affect commerce routes, and wetlands that are adjacent to other bodies of water of the U.S.	applicable	"On June 22, 2009 US Supreme Court rule[d] that EPA cannot issue a NPDES for discharges requiring a section 404 dredge and fill permit from the corps of engineers... Section 404 permits still remain subject to CWA section 401, which requires the state to certify that an activity does not violate state water quality standards... The decision does not override the CWA's discharge standards for toxic pollutants." Downey Brand Publications.
	CWA Section 401	For the discharge of dredged or fill materials into navigable waters of the U.S. this section of the CWA defines compliance with applicable water quality requirements, the application process, procedures, license suspension, and monitoring programs.	applicable	No updates.
Protection of Navigable Waterways	Rivers and harbors appropriations act section 10	Exemptions to the construction of bridges, causeways, dams or dikes in any port, roadstead, haven, harbor, canal, navigable river, or other navigable waters of the United States.	applicable	No updates found.
Impact to Fisheries Resources in the Puyallup River Delta	Puyallup Tribe land claim settlement	Indian regulated land included (1) The Blair Waterway property, comprised of approximately 43.4 acres. (2) The Blair Backup property, comprised of approximately 85.2 acres. (3) The Inner Hylebos property, comprised of approximately 72.9 acres. (4) The Upper Hylebos property, comprised of approximately 5.9 acres.	applicable	
Avoidance of Adverse Effects, Potential Harm, and Restore and Preserve Natural and Beneficial uses of Wetlands and Floodplains	Executive Orders 11990	Under this order federal agencies shall avoid adverse impacts (long and short term), and potential harm to wetland habitat and also work to restore and preserve wetland habitat when applicable and plausible.	applicable	Executive order does not seem to have changed.

Location Specific ARARs				
Sediment Remedial Activities				
Action	Citation	Requirement and Descriptions	Status	Comment
	Executive Order 11988 (40 CFR 6 Appendix A)	Under this order federal agencies are required addresses floodplain management including (but not limited to) avoiding adverse impacts, modification, protection of human health, costs, and associated construction standards. Appendix A requires that no remedial alternatives adversely affect a wetland if another practicable alternative is plausible. If no alternative is available, effects from implementing the alternative must be mitigated.	applicable	Appendix A has been removed and is not included in the most recent (July, 1 2008) Code of Federal Regulations title 40 chapter 1 Part 6.
Source Control Remedial Activities				
Activities Conducted Within 200 Feet Shorelines of Statewide Significance	Washington Shoreline Management Act (RCW 90.58, WAC 173-14)	see description within Action specific ARARs, in the sediment remedial section.	applicable	
State Requirements for Upland Disposal of Solid Waste, Dangerous Waste, and Extremely Hazardous Waste	RCW 70.105 WAC 173-303-081	see description within Action specific ARARs, in the sediment remedial section.	applicable	
	WAC 173-303-650	see description within Action specific ARARs, in the sediment remedial section.	applicable	
Managing Hazardous Waste Site Cleanups	Requirement of Washington model toxics control act (initiative 97), chapter 2, laws of 1989 (RCW 70.105D.900)	Hazardous waste clean up must be conducted in consideration of human and environmental health. Communities must be notified of releases of hazardous, cleanup remedies, enforcement of standards, state funding procedures have been modified.	applicable	Updates in 2008, although funding has been modified should not change effectiveness of remedies in place.
Protection of Endangered Species in the Puget Sound	Endangered Species Act	see description within Action specific ARARs, in the sediment remedial section.	applicable	

Other Factors to be Considered (TBC)				
Sediment Remedial Action				
Action	Citation	Requirement and Descriptions	Status	Comment
Dredged material, disposal site management, disposal site monitoring, and data management	Requirements and guidelines established by PSDDA (1988)		applicable	
Critical Toxicity Values	Including acceptable daily intake levels, carcinogen potency factor, and U.S. Food and Drug Administration action levels for concentrations of mercury and PCBs in edible seafood tissue.	Only PCB were evaluated in the 1989 ROD for risk to human health. The 1997 ESD modified the sediment quality standard for PCB from 150 ppm (dry weight) to 300 ppm (dry weight). This level was found to be protective of human health.	TBC	Although the AET values for total PCBs has not been modified, the Puyallup tribe of Indians may have found a new consumption rate for substinance fishermen. This change could possibly affect the SQS for PCBs as it was originally based on human health risk.

Other Factors to be Considered (TBC)				
Sediment Remedial Action				
Action	Citation	Requirement and Descriptions	Status	Comment
Sanitary Landfills	TPCHD Regulations		applicable	
Land Use	Requirements of the Tacoma shoreline masters program	A Masters Program plan was developed in 1996 that described certain actions (conservation, preservation, and development) to take place in residential, commercial, public, and state land areas that were located along the shorelines of the city of Tacoma.	TBC	In 2003, the Department of Ecology (DOE) issued new guidelines to assist local governments in meeting the State requirement to conduct a comprehensive review and amendment of a Master Program for Shoreline Development. The guidelines outline procedural steps and substantive requirements that must be met. Tacoma's update to its Shoreline Master Program is an extensive overhaul of the program requiring the City to re-evaluate all shoreline policies, designations and regulations and must be based upon scientific and technical information to assure no net loss of shoreline ecological functions while providing for appropriate uses within shoreline areas. The Tacoma Shoreline Master Program includes goals, policies and development regulations for all shoreline areas including Commencement Bay and its waterways, the Narrows, and Wapato Lake. The Planning Commission will be overseeing the update of the program and is expected to make a recommendation to the City Council in late 2008.
Wetlands	EPA wetland action plan (1989),	Includes wetland policy and goal of no net loss.	TBC	

Other Factors to be Considered (TBC)				
Sediment Remedial Action				
Action	Citation	Requirement and Descriptions	Status	Comment
Sediment Quality Standards and Sediment Impact Zones	1989 PSWQA Plan, element P-2	Standards for classifying sediments having adverse effects: "Ecology shall develop and adopt by regulation standards for identifying and designating sediments that have acute or chronic adverse affects on biological resources or pose a significant health risk to humans. The sediment standards will establish the levels of sediment contamination that are acceptable throughout the sound over the long term....if apparent effects threshold values are used as a basis for establishing the standards, the AET values shall be recomputed periodically to incorporate new data.		" In 1987, the authority developed the first Puget Sound Water Quality Management Plan, with updates prepared in 1989, 1991, 1994, and 1996. During this time, the Management Plan evolved along with the issues. Some Plan elements, or actions, were completed, some were revised, and new programs and elements were added. In July 1996, the authorizing legislation for the Puget Sound Water Quality Authority expired, and the state legislature enacted the Puget Sound Water Quality Protection Act (Washington 1999). Under this law, PSWQAT assumed the authority's responsibilities, including review and adoption of the Management Plan." Refer to title 400 WAC.
	element P-3	Dilution Zone Criteria; "… Ecology shall adopt administrative rules specifying criteria for establishment of dilution zones in wastewater discharge permits… Ecology shall develop specific criteria for sediment impact zones that shall include provisions for interim management and closure plans..."	applicable	
Confined disposal, cleanup decisions, and investigations and cleanups of contaminated soil	1989 PSWQA plan, elements S-4	"Ecology will develop standards for reuse or disposal of dredged material that exceeds the sediment quality standards, and that will not be disposed of at unconfined open water disposal sites established by the PSDDA process."	TBC	
	element S-7	Guidelines for sediment clean up decisions: "Ecology shall develop guidelines for deciding whether existing sediments that exceed the sediment quality standards should be capped, excavated, or otherwise treated, or whether no action should be taken."	TBC	
	element S-8	Investigations and cleanup of contaminated sediments.		

Other Factors to be Considered (TBC)				
Sediment Remedial Action				
Action	Citation	Requirement and Descriptions	Status	Comment
Source Control Actions				
Effluent Limits for Toxicants and Particulates	AKART guidelines, and 1989 PSWQA plan element P-6	The Toxicant Effluent Limits in permits shall "control through the use of al known, available, and reasonable methods the sources of toxicants in the waste discharge.	TBC	RCW 90.48.520
	element P-7	Effluent limits in Permits- Particulates: ecology shall provide and review information on particulate contamination in the applicants effluent, and additionally these criteria shall ensure sediment standards will not be violated. The permit shall include control measures, best management practices, numeric limits on toxicity.	TBC	
Criteria for Defining sediment impact zones relative to discharges	1989 PSWQA plan element P-3	Dilution Zone Criteria; "… Ecology shall adopt administrative rules specifying criteria for establishment of dilution zones in wastewater discharge permits… Ecology shall develop specific criteria for sediment impact zones that shall include provisions for interim management and closure plans..."	applicable	

OU 1 Attachment 3 - Toxicity Review Summary

Apparent Effects Threshold (AET) Values Identified in the ROD and Changes to State Regulatory Standards

Contaminant	Standard in ROD (mg/kg dry weight: ppm)	Citation	New Standard
Antimony	150		
Arsenic	57	State Criteria WAC 173-204-520 (2003)	unchanged
Cadmium'	5.10	State Criteria WAC 173-204-520 (2003)	unchanged
Copper'	390	State Criteria WAC 173-204-520 (2003)	unchanged
Lead'	450	State Criteria WAC 173-204-520 (2003)	unchanged
Mercury	0.59	State Criteria WAC 173-204-520 (2003)	0.41
Nickle	-	-	-
140A, B	-	-	-
Silver'	6.1	State Criteria WAC 173-204-520 (2003)	unchanged
Zinc	410	State Criteria WAC 173-204-520 (2003)	unchanged
	(uglkg dry weight; ppb)		
Low Molecular Weight PAH'	5,200	State Criteria WAC 173-204-520 (2003)	unchanged
Naphthalene	2,100	State Criteria WAC 173-204-520 (2003)	unchanged
Acenaphthylene'	1,300	State Criteria WAC 173-204-520 (2003)	unchanged
Acenaphthene	500	State Criteria WAC 173-204-520 (2003)	unchanged
Flourene'	540	State Criteria WAC 173-204-520 (2003)	unchanged
Phenanthrene	1,500	State Criteria WAC 173-204-520 (2003)	unchanged
Anthracene	960	State Criteria WAC 173-204-520 (2003)	unchanged
2-methylnaphthalene'	670	State Criteria WAC 173-204-520 (2003)	unchanged
High Molecular Weight PAH'	17,000	State Criteria WAC 173-204-520 (2003)	unchanged
Fluoranthene[b]	2,500	State Criteria WAC 173-204-520 (2003)	unchanged

Contaminant	Standard in ROD (mg/kg dry weight; ppm)	Citation	New Standard
Pyrene[b]	3,300	Sate Criteria WAC 173-204-520 (2003)	unchanged
Benz (a) anthracene	1,600	State Criteria WAC 173-204-520 (2003)	unchanged
Chrysene	2,800	State Criteria WAC 173-204-520 (2003)	unchanged
Benzofluoranthenes'	3,600	State Criteria WAC 173-204-520 (2003)	unchanged
Benz (a) pyrene'	1,600	State Criteria WAC 173-204-520 (2003)	unchanged
Indeno (1, 2,3-c,d) pyrene	690	State Criteria WAC 173-204-520 (2003)	unchanged
Dibenzo (a,h) anthracene	230	State Criteria WAC 173-204-520 (2003)	unchanged
Benzo (g, h, i) perylene	720	State Criteria WAC 173-204-520 (2003)	unchanged
Chlorinated Organic Compounds			
1,3-dichlorobenzene'	170		not listed
1 ,4-dichlorobenzene'	110		not listed
1,2-dichlorobenzene'	50		not listed
1 ,2,4-trichlorobenzene'	51		not listed
Hexachlorobenzene[b]	22		not listed
Total PCB"	150	ESD 1997	300
Phthalates			
Dimethyl phthalate'	160		not listed
Diethyl phthalate'	200		not listed
Di-n-butyl phthalate'	1,400		not listed
Butyl benzyl phthalate'	900		not listed
Bis(2-ethylhexyl) phthalate	1,300		not listed
Di-n-octyl phthalate	6,200		not listed
Phenols			
Phenol	420	State Criteria WAC 173-204-520 (2003)	unchanged
2-methyl phenol'	63	State Criteria WAC 173-204-520 (2003)	unchanged
4-methylphenol	670	State Criteria WAC 173-204-520 (2003)	unchanged
2,4-dimethylphenol	29	State Criteria WAC 173-204-520 (2003)	unchanged

Contaminant	Standard in ROD (mg/kg dry weight; ppm)	Citation	New Standard
Pentachlorophenol[b,]	360	State Criteria WAC 173-204-520 (2003)	unchanged
Misc			
Benzyl alcohol'	73	State Criteria WAC 173-204-520 (2003)	57
Benzoic acid'	650	State Criteria WAC 173-204-520 (2003)	unchanged
Dibenzofurnan	540	State Criteria WAC 173-204-520 (2003)	unchanged
Hexachlorobutadiene'	11		not listed
N-nitrosocliphenylamine	28		not listed
Volatile Organics			
Tetrachlcroethene	57		not listed
Ethylbenzene	10		not listed
Total xylenes'	40		not listed

Seattle District Listed Bioaccumulative Chemicals
' AET values that would be lowered by the unpromulgated 1998 biological tests

OU 1 Attachment 4 - Five-Year Review Interview Record

Five-Year Review Interview Record

Site:	Commencement Bay, Nearshore / Tideflats	**EPA ID No:**	WAD980726368

Interview Type: ***Telephone*** Visit Other: Mail

Location of Visit:

Date: 6-Aug-09 **Time:** 1400

Interviewer: Emile Pitre **Title:** Chemical Engineer **Organization:** USACE

Individual Contacted

Name: Leslie Ann Rose **Title:** Senior Policy Analyst **Organization:** Citizens for a Healthy Bay

Telephone: 253-383-2429 x-104 **Address:** 917 Pacific Avenue, Suite 100 • Tacoma, WA 98402

Summary of Converstation

1) What is your overall impression of the project?
We have taken the first step towards achieving our remediation goals by removing contaminated sediment. The second step is to recover the aquatic environment (St Paul and Thea Foss Waterways have achieved this goal). For the rest of the Waterways the consent decree does not call it out. Also stated that Dr. Joel Baker is a resource at the Citizens for a Healthy Bay (CHB) that could help with the fish tissue sampling program. He has extensive experience and has worked on this issue while living on the East Coast

2) What affects have site operations (cleanup) had on the surrounding community?
Thea Foss: Cleanup is pivotal in redevelopment of Waterway, University District, and Pacific Ave. Gives the community a sense of pride. Nobody wants the waterway to go back to the way it was. The 1st annual clean/green boating fair was held this year.
At a recent community meeting there were 200 to 300 people outraged because of a museum and other businesses that were slated for development in the land adjacent to the waterway. The community thought it would deny them access to the waterway.
Simpson performed the first remedial action in the area. They openly shared results with the community and the community was pleased.
Sitcum: Port of Tacoma performed the remedial action. Did not openly share information so the community did not know much about the site.
Middle: The community is aware of the habitat restoration essentially surrounding the waterway. Other than that the community is unaware
Hylebos: Most notable to the community at large because of disruptions to the marina community. They had to move boats, some wooden, to the upland and move people out of their boathouses. The marinas were originally in the navigable channel and not permitted, so the private owners had to bring the marina up to code. Homes just above Schnitzer steel had complaints about the dredges working at night and with the construction lights. There is no sense of community ownership. Did notice the recreational crab fishing at the mouth of the waterway has boomed to about 300 pots. The crabs appear to be about two to three times larger than they were 12 years ago.

3) Are you aware of any community concerns regarding the site or it's operation?
If so, please summarize your concerns.
What makes sense to the engineering and science community, such as capping or leaving contamination in-place, is counterintuitive to the community. Capping is not cleanup to the community. There is a sense that the PRPs were allowed to leave contamination in-place as a favor.
The community is concerned about stormwater and source control. In response to the Thea Foss recontamination CHB has a stormwater/source control education program for the community. The Sitcum natural recovery area shows a trend of increasing for constituents such as for zinc. The community feels this area is being recontaminated. The waterway is not being recontaminated because zinc concentrations are below SQOs and is not a constituent for meeting natural recovery standards. Thea Foss is the only problem? This sends a mixed message to the community.

4) Do you feel well informed about the site's activities and progress?
Thea Foss, yes. For the Middle waterway it has been difficult to receive information. CHB has to be proactive and make regular calls.
St. Paul cleanup provided a lot of information in the beginning, but CHB has not received much info lately. For the Sitcum, CHB had to be proactive about getting information. Getting all information from the Head of Hylebos cleanup. Didn't receive much information from the Mouth of Hylebos cleanup. For Occidental, they dropped off the map for a while, but now they are inundated with information. Received no information for the Tacoma Tarpits. Th ecommunity was concerned with the INS building at the site. Last December they initiated construction.
There were no institutional controls in place, the City did not have it in their database, nobody knew about the contamination on-site.

Five-Year Review Interview Record

Site: Commencement Bay, Nearshore / Tideflats	**EPA ID No:** WAD980726368

Summary of Converstation (continued)

5) Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

We are lucky to have the caliber of professionals involved over the years. The community was not recognized as a stakeholder, but they were treated as one. Recommend that at some point post-remediation the site should be under 1 EPA RPM. Also recommend establishing a system to alert EPA when there is a planned disturbance of sediments or soils within operable units. The sites can be entered into the City of Tacoma land-use database to notify EPA when a person applies for a land-use permit within the operable units. Concerned about the mercury contamination in the Middle waterway. Possible sources include: habitat construction performed after the remedial action was complete, MINI may be a source as their BMPs are inconsistent, and midnight dumping. EPA required 4th year monitoring, but CHB would like to see annual monitoring through Year 10, so we have a good baseline. CHB has increased the frequency of the Baykeeper going into Middle waterway to inspect activities that may be contributing to the mercury results.

OU 1 Attachment 5 - Advertisement for Notice of Five-Year Review

EPA *Commencement Bay Nearshore/Tideflats Superfund Site – EPA to Review Past Cleanup*

The U.S. Environmental Protection Agency (EPA) is beginning a "five-year review" of the Commencement Bay Nearshore/Tideflats Superfund site in Tacoma, Washington. This review will look at the cleanup of the different areas listed below.

- Hylebos Waterway, including the Occidental Removal, Outer Hylebos Mitigation Site, Middle Waterway, Thea Foss and Wheeler-Osgood Waterways, Sitcum Waterway, St. Paul Waterway and the Olympic View Resource Area Removal - Karen Keeley, 1-800-424-4372, ext. 2141;
- Asarco Tacoma Smelter (Point Ruston), Ruston/North Tacoma Study Area and Asarco Sediments - Kevin Rochlin, 1-800-424-4372, ext. 2106;
- Tacoma Tar Pits - Tamara Langton, 1-800-424-4372, ext. 2709.

EPA's review will make sure that the cleanups and controls are working and that people and the environment are protected. EPA will collect site information, review monitoring data, review laws, and consult with officials. If you have information you would like us to consider during our review, please contact the project manager associated with that particular project area before April 15, 2009.

The final report will be out by the end of this year.

For more site information, visit
http://yosemite.epa.gov/r10/cleanup.nsf/sites/cbnt

TTY users may call the Federal Relay Service at 800-877-8339 and give the operator Karen Keeley's phone number.

OU 1 Attachment 6 - Site Photos

Mouth of Hylebos photos

Photo 1. Shotcrete Below Pier 25

Photo 2. Shotcrete Below Pier 25

Photo 3. Crushed Rock Armor Below Pier 25

Photo 4. Embankment at Blair Slip 1 During Construction

Photo 5. Slip 1 Piling Installation

Photo 6. Slip 1 Concrete Panel Installation

Photo 7. Embankment at Blair Slip 1 Post-Construction

Photo 8. Vibracore Sampling at Taylor Way

Photo 9. Sheetpile Wall at Taylor Way

Photo 10. Sheetpile Wall Installation at Taylor Way

Head of Hylebos photos

Photo 11. Upland Soil Removal at Arkema

Photo 12. Arkema Bank Cleanup Area

Photo 13. Arkema Shoreline Protection

Photo 14. Arkema Shoreline Protection

Photo 15. ATOFINA Shoreline

Photo 16. Dunlop Bank Cleanup Area

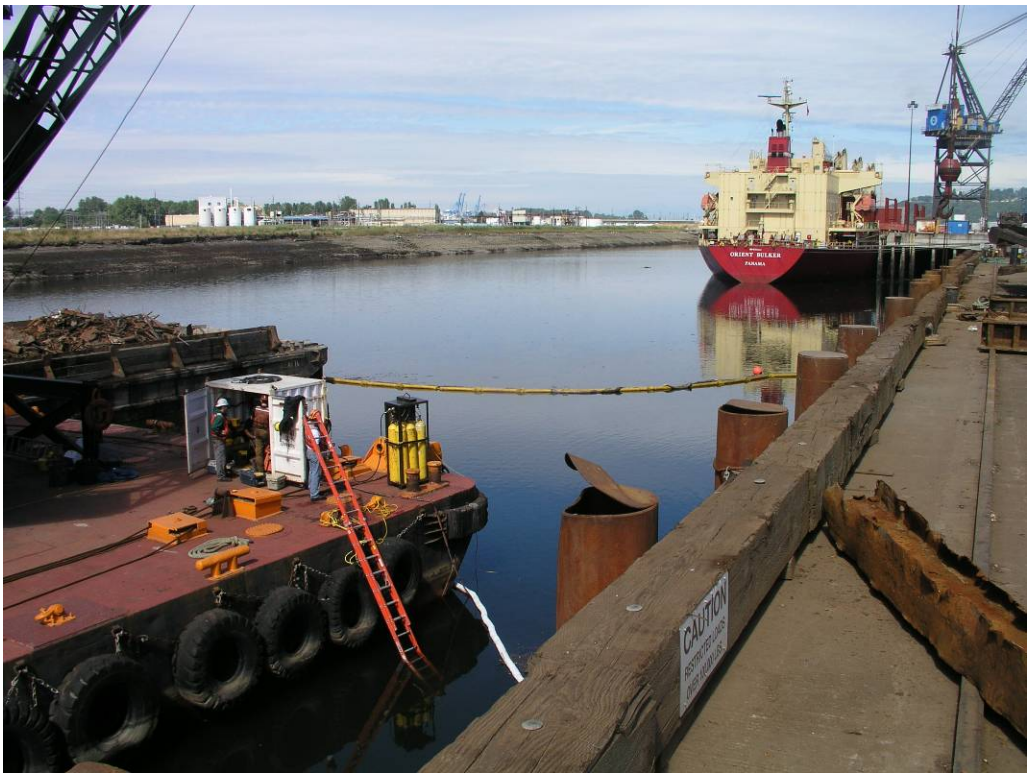


Photo 17. Scrap Steel Removal at Schnitzer Steel

Photo 18. General Metals

Photo 19. Habitat Restoration

Photo 20. Habitat Restoration

Occidental Chemical

Photo 21. Upland Drilling

Photo 22. Upland Groundwater Sampling

Photo 23. Upland Groundwater Sampling

Photo 24. Upland Drilling

Photo 25. Upland Drilling near Shoreline

Photo 26. Subtidal Drilling

Photo 27. Subtidal Drilling

Middle WW Photos

Photo 28. Enhanced Natural Recovery at Low Tide looking West

Photo 29. Enhanced Natural Recovery at Low Tide looking East

Photo 30. Enhanced Natural Recovery

Photo 31. Slope Protection on West Slope

Photo 32. Estuarine Restoration

Photo 33. Outfall No. 200 Channel During Excavation and Backfill

Photo 34. Outfall No. 200 Channel During Post-Backfill

Photo 35. Shore Restoration

Photo 36. Habitat Restoration

Photo 37. Habitat Restoration

Thea Foss photos

Photo 38. Middle Waterway Habitat Area

Photo 39. Middle Waterway Habitat Area

Photo 40. Middle Waterway Habitat Area

Photo 41. Berm at the St. Paul Confined Disposal Facility

Photo 42. Habitat Enhancement

Photo 43. Puyallup River Side Channel Construction

Photo 44. Puyallup River Side Channel

Photo 45. Hylebos Creek Habitat Mitigation

Photo 46. Wheeler-Osgood Backfill

Head of Thea Foss Photos

Photo 47. Head of Thea Foss at Low Tide

Photo 48. Head of Thea Foss West Slope

Photo 49. Twin 96-inch Outfalls Area

Photo 50. Shoreline Habitat Area

Photo 51. Shoreline Habitat Area

Photo 52. Scour Apron Installation

Photo 53. Capping Near West Slope

OU 1 Attachment 7 - Arkema Cap Approval Letter

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

Reply To
Attn Of: ECL-111

December 16, 2005

Frederick Wolf
Regional Remediation Manager
Arkema Chemicals, Inc.
2901 Taylor Way
Tacoma, WA 98421

Charles Ellingson
Pacific Groundwater Group
2377 Eastlake Avenue East
Seattle, WA 98102

Paul Fuglevand
Dalton Olmstead Fuglevand
1827 NE 68th Street, Suite B
Kirkland, WA 98033

Re: EPA Approval of Addendum No. 2 to 2004 Remedial Action (RA) Work Plan
Arkema Southeast Shoreline Subtidal Slope Cap
Design Change Document Dated October 3, 2005
Head of Hylebos RD/RA Consent Decree CO4-5319-RBL

Dear Gentlemen:

EPA has reviewed, with technical assistance from the U.S. Army Corps of Engineers, the document referenced above. As described in the October 3, 2005 submittal letter to EPA, Addendum No. 2 contains three modifications to the Addendum No. 1 cap design (conditionally approved by EPA December 7, 2004). The revised cap has a modified footprint, will be constructed upon a modified dredge cut, and will be installed during the 2005-06 in-water construction season.

The Addendum No. 1 conditional approval letter of December 7, 2004 pointed out that the Subtidal Slope Cap Property Restrictive Covenant was not approved. Likewise, this cap design approval letter does not approve the restrictive covenant, found in Appendix D of the above referenced document. Also, EPA notes that the overall Operation, Maintenance, and Monitoring Plan (OMMP) for the Head of Hylebos Waterway Problem Area, submitted to EPA June 15, 2004, has not been approved, and

some elements of that plan focus upon sediment cap maintenance and monitoring.

As you know, EPA comments provided November 6, 2005 combined with subsequent conversations have served to clarify that the sediment cap needs to be designed, in concert with upland source control measures, to address two related performance criteria. First, sediment quality objectives (SQOs) need to be met. This criterion includes both providing high-quality sediment cover and ensuring that ground water discharging through the cap will not cause recontamination of the sediment matrix material over time within the biologically active zone. Second, the quality of ground water discharging into the upper part of the cap, located within the biologically active zone of the surface sediments, needs to at least meet the level of protection provided by Marine Water Quality Criteria (MWQC). The remedy must meet these performance standards. Attainment of performance standards is a prerequisite for certification of remedial action completion (see paragraph 47. b. of referenced Consent Decree).

Arkema, PGG, DOF, EPA, and the Corps have engaged in some productive conversations regarding how to most effectively and efficiently meet these performance criteria. EPA has also been in conversation with Ecology regarding upland ground water remediation, and has utilized the Corps of Engineers to conduct a cursory review of sediment cap reactive layer materials which might be used to provide passive treatment of discharging ground water. Each of these avenues has led EPA to agree with Arkema that the best course of action is to construct the cap as now designed, and focus upon upland source control measures. EPA's expectation is that Arkema will work rapidly and productively with Ecology to ensure that MTCA soil and ground water cleanup levels are met as soon as practically possible, and thus allow the cap to function effectively.

EPA and Ecology recognize that upland source control has been, and will likely continue to be, a complex endeavor. Based upon current information provided by Arkema and its consultants, continued work to achieve upland source control will be required to meet the MWQC performance criterion. Both the cap and upland areas will be subject to monitoring in order to determine short- and long-term effectiveness at meeting the performance standards. Contingent actions, including but not limited to additional capping, may be required if future monitoring results suggest that upland source control efforts alone will not be sufficient.

Sincerely,

Jonathan Williams

Jonathan Williams
EPA Remedial Project Manager

cc: Mick Easterly, U.S. Corps of Engineers
Emile Pitre, U.S. Corps of Engineers
Dom Reale, Washington Department of Ecology

Russ McMillan, Washington Department of Ecology
Sheila Eckman, EPA ECL
Ted Yackulic, EPA ORC
Tad Cline, PGG
Rob Webb, DOF

OU 1 Attachment 8 - Occidental 2005 amendment to the 1997 AOC

RECEIVED
05 FEB -2 PM 12:11
HEARINGS CLERK
EPA--REGION 10

Amendment
Administrative Order On Consent For Removal Activities Embankment and Area 5106
EPA Docket No. 10-97-0011-CERCLA

Occidental Chemical Corporation ("Occidental"), the United States Environmental Protection Agency ("EPA"), and the Washington Department of Ecology ("Ecology") agree to amend the Administrative Order on Consent for Removal Activities Embankment and Area 5106, EPA Docket No. 10-97-0011-CERCLA ("AOC") pursuant to Paragraph 98 of the AOC as follows.

This amendment reflects agreement amongst EPA, Ecology, and Occidental that A) additional site characterization needs to be conducted, both in upland areas and beneath the Hylebos Waterway, to adequately determine the nature and extent of soil, ground water, surface water, and sediment contamination; B) feasible alternatives to address remaining contamination of all media need to be developed and evaluated; and C) an integrated remedy or set of remedies needs to be selected and designed which will satisfy EPA and Ecology requirements under CERCLA, MTCA, and RCRA. Accordingly, the attached SOW includes the CERCLA remedial process elements of RI/FS, RD, and interim response actions.

1. Pursuant to Paragraph 40 of the AOC, Occidental shall implement the attached Statement of Work ("SOW"). The SOW is attached to this Amendment as Attachment A and and provides for environmental investigation, alternatives analyses, interim response actions to address pH contaminated groundwater, response action selection, and remedial design. All work plans, schedules and other tasks required by the SOW shall be performed pursuant to the terms and conditions of the AOC and subject to approval by EPA and/or Ecology. In addition, all work plans, schedules and other tasks required by the SOW shall be conducted consistent with the Model Toxics Control Act ("MTCA"), Resource Conservation and Recovery Act ("RCRA"), and the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA").

2. EPA and Ecology have entered into a Memorandum of Understanding ("MOU") that provides a framework for coordination and cooperation between the two agencies. The MOU designates the "lead agency" for particular activities that will be performed pursuant to this Amendment, and explains how decision-making responsibilities will be allocated. EPA and Ecology expect that implementation and oversight of this Amendment will be consistent with the MOU. Nothing in this Amendment is intended to provide Occidental or any other third-party with any rights or obligations regarding the MOU.

3. Until the AOC, as amended, is superceded by another legal mechanism (e.g., a consent decree) requiring implementation of recommended alternatives to be developed under the SOW, Occidental shall continue to maintain and operate the Groundwater Treatment System according to the current Corrective Action Plan

and current Corrective Action Monitoring Plan which has been developed under the expired RCRA permit No. WAD00924314. Occidental shall continue to monitor and report hydraulic responses of injection and extraction wells according to the procedures and schedule specified in the Corrective Action Monitoring Plan. Occidental shall continue to redevelop or replace injection and extraction wells with new wells as necessary according to the criteria specified in the Corrective Action Monitoring Plan.

4. The definition of the Site contained in Paragraph 1 of the AOC shall be changed to the following:

> The Site shall mean that portion of segment 5 of the Mouth of the Hylebos Waterway Problem Area and those portions of the upland properties described in the next sentence where Waste Materials have or may come to be located as a result of releases or threatened releases of Waste Materials from operations related to the production, processing, formulation or disposal of chemical materials or products. Accordingly, the Occidental Site shall include, but not be limited to the following: Area 5106; the Occidental Embankment Area; the Pioneer Property located at 605 Alexander Avenue; locations of groundwater contaminant plumes and contaminated sediments on the Port of Tacoma property located at 401 Alexander Avenue to the north of the Pioneer Property; locations of contaminated sediments and groundwater contaminant plumes on the Mariana Properties property located at 709 Alexander Avenue and the Port of Tacoma property located at 721 Alexander Avenue to the south of the Pioneer Property; and other areas of Segment 5 of the Mouth of the Hylebos Waterway Problem Area where releases of Waste Materials from such properties have come to be located and those areas necessary to stage or implement related work. The Occidental Site does not include the release of total petroleum hydrocarbon, BTEX or other constituents of concern from petroleum product storage operations currently or historically located on the 709 Alexander Avenue property or 721 Alexander property which has been identified in shallow groundwater underlying the 709 Alexander Avenue property or the 721 Alexander property and determined to be moving towards the Blair Waterway. Attachment B to this Amendment is a map that generally depicts the Site.

5. Ecology shall be added as a party to the AOC. Ecology shall have the authority to enforce the terms and conditions of the AOC as appropriate as such relate to the work performed pursuant to this Amendment. The terms and condition of the AOC applicable to EPA shall be applicable to Ecology.

6. Consistent with Section XVIII of the AOC ("Stipulated Penalties"), Ecology shall also have the authority to assess and collect stipulated penalties . However, in no event will Occidental be required to pay duplicative stipulated penalties to EPA

and Ecology. Payments of stipulated penalties owed, if any, to the State shall be mailed to the Department of Ecology, Cashiering Section, P.O. Box 5128, Lacey, WA 98509-5128.

7. Consistent with Section XX of the AOC ("Reimbursement of and Oversight Response Costs"), Occidental shall also reimburse the State for all response costs paid or incurred by the State in connection with this Amendment. Occidental shall pay the required amount of such response costs within thirty (30) days of receiving from Ecology an itemized statement of such costs that includes a summary of costs incurred, an identification of involved staff, and the amount of time spent by involved staff members on the project. A general description of the work pertinent to such costs will be provided if requested by Occidental. Ecology will prepare and provide Occidental with itemized statements on a quarterly basis. In addition, within ninety (90) days of the effective date of this Amendment, Occidental shall pay the State $458,259.17 in reimbursement of response costs that the State has incurred in connection with the Occidental Site prior to June 30, 2004. Failure to pay response costs within thirty (30) days of receipt of the itemized statement will result in interest charges in accordance with WAC 173-340-550. All payments owed to the State pursuant to this Amendment will be sent to the Department of Ecology, Cashiering Section, P.O. Box 5128, Lacey, WA 98509-5128.

8. Consistent with Section XVII of the AOC ("Dispute Resolution"), in the event that Occidental objects to notification provided by or action undertaken by Ecology, the Section Supervisor for Hazardous Waste and Toxic Reduction for the Southwest Regional Office shall resolve the initial dispute related to such objection. Any subsequent and timely written appeal of such initial dispute decision shall be resolved by the Program Manager of Ecology's Hazardous Waste and Toxics Reduction Program.

9. The Unilateral Administrative Order (Area 5106), EPA Docket No. CERCLA 10-2002-0066 (the "UAO") is hereby terminated. Remaining additional response actions, required by EPA on March 25, 2003 under authority of the UAO, have been incorporated into the attached Occidental Site SOW. Occidental reserves any defenses it may have to any subsequent action brought by EPA, except for those based upon principles of waiver, res judicata, collateral estoppel, issue preclusion, claims-splitting, or other defenses based upon any contention that the claims raised by EPA in the subsequent proceeding are barred by the termination of the UAO

10. Ecology Enforcement Order DE 95TC-S242, issued to PRI Northwest, Inc. and Occidental Chemical Corporation, effective September 5, 1995, is held in abeyance until a consent decree or administrative order implementing the selected remedies for the Mariana property takes effect.

11. Unless expressly modified by this Amendment, the terms and conditions of the AOC shall apply to all work or other activities required by the Amendment.

12. The AOC as modified by this Amendment contains the entire agreement between EPA, Ecology and Occidental. No statements, promises or inducements made by any party or its representatives that are not contained in this Amendment shall be valid or binding.

Occidental, EPA and Ecology have executed this document to signify their agreement to the foregoing effective as of the date of EPA's execution as set forth below. This agreement may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one the same instrument.

AGREED for Occidental Chemical Corporation

By:_____

Name:_____

Title:_____

Date:_____

AGREED for Washington Department of Ecology

By: K Seiler

Name: K SEILER

Title: SWRO HWTR Section Manager

Date: 1/28/05

AGREED for United States Environmental Protection Agency

By:_____

Name:_____

Title:_____

Date:_____

11. Unless expressly modified by this Amendment, the terms and conditions of the AOC shall apply to all work or other activities required by the Amendment.

12. The AOC as modified by this Amendment contains the entire agreement between EPA, Ecology and Occidental. No statements, promises or inducements made by any party or its representatives that are not contained in this Amendment shall be valid or binding.

Occidental, EPA and Ecology have executed this document to signify their agreement to the foregoing effective as of the date of EPA's execution as set forth below. This agreement may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one the same instrument.

AGREED for Occidental Chemical Corporation

By:_____

Name:_____

Title:_____

Date:_____

AGREED for Washington Department of Ecology

By:_____

Name:_____

Title:_____

Date:_____

AGREED for United States Environmental Protection Agency

By: Sheila M Eckman

Name: Sheila M. Eckman

Title: Unit Manager, Environmental Cleanup Office

Date: 2/1/05

OU 1 Attachment 9 – Tribal Framework Evaluation

Prepared by EPA Region 10
December 13, 2009

Application of the EPA Region 10 August 2007 "Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-Based Decision Making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia" to the Commencement Bay Nearshore/Tideflats Site (Sediments OU 01), Third Five-Year Review

1. Introduction

This document describes EPA's application of the August 2007 "Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-Based Decision Making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia" (EPA 2007) in evaluating the protectiveness of sediment cleanups as part of the Commencement Bay Nearshore/Tideflats (CB/NT) Superfund site third Five-Year Review. This document applies only to the CB/NT Sediments OU.

The Framework was designed to assist EPA Region 10 with developing internal consistency in managing Puget Sound and Strait of Georgia Superfund/RCRA cleanups that involve tribal seafood consumption contaminant exposures. The document focuses on risk assessment and risk based cleanup decisions. The document also concluded "Based on EPA's knowledge of sediment cleanup sites in Puget Sound, the Framework may have limited application for those CERCLA and RCRA sites where the remedy has already been selected…..As part of the five-year review process, Tribes can provide new information to be considered or request that the lead federal agency evaluate particular aspects of a remedy relative to Tribal interests….Such requests would be evaluated on a site-specific basis consistent with EPA's five-year review guidance.....In determining whether a recalculation of site risks or any other detailed analysis is needed as part of the five-year review, EPA would review the basis of the selection of the remedial action and cleanup levels and other relevant information to determine whether further analysis of such updated information is appropriate, and focus our analysis on matters that would help assess the protectiveness of the selected remedy."

2. Application of Framework to the CB/NT Five-Year Review

As part of this third Five-Year Review, EPA identified and evaluated the effects of recent information on seafood consumption rates and exposure durations for Tribal populations as changes in assumptions that were used at the time of remedy selection that could potentially call into question the protectiveness of the remedy where human health exposure to and risk from consumption of seafood contaminated with PCBs above levels of concern. Application of the Framework to the CB/NT five-year review is described below by following the steps of the flowchart included in the 2007 Framework. Each analysis heading corresponds to a particular Framework flowchart item.

2.1. CB/NT Framework flowchart analysis

2.1.1. Box PS-1: Are Puget Sound/Georgia Strait fish and shellfish consumption studies relevant to the Tribe(s)?

The CB/NT Sediments OU is within the usual and accustomed harvesting areas of the Puyallup Tribe. EPA's Framework utilizes fish and shellfish consumption data from studies of the Suquamish and Tulalip Tribes. EPA is not aware of any currently available consumption data for the Puyallup Tribe. EPA believes that seafood consumption data for Puget Sound Tribes with usual and accustomed fish harvesting areas that are not as impacted by environmental contamination as the CB/NT site can reasonably be used as surrogates for Puyallup Tribe seafood consumption.

2.1.2. Box PS-2: Does the site or its environs have high quality physical shellfish habitat to support substantial shellfish harvest in the absence of contamination?

While conditions are improving, a significant percentage of intertidal habitat in the Commencement Bay estuary has been lost due to dredging, filling, and urbanization since the turn of the century. EPA's policy decision in the Framework is to use Tulalip Tribes' seafood consumption rates in areas that currently lack and do not have the potential for extensive high quality intertidal shellfish habitat. The Suquamish Tribe's consumption rates would be applied in areas that currently or may have the potential to have extensive high quality shellfish habitat. **This leads to the selection of Box PS-5: "The Toy et al. study for the Tulalip Tribes may be used as the basis for the Tribal fish and shellfish consumption rate."**

2.1.3. Box PS-9: Select fish and shellfish consumption rates corresponding to information source selected.

The 95th percentile consumer-only Tulalip Tribes' consumption rate for seafood harvested from Puget Sound is 194 grams per day.

2.1.4. Box PS-10: Select a mix of classes of fish and shellfish or representative species to reasonably represent Tribal consumption patterns, while holding constant the total consumption rate.

Appendix A of the Framework discusses how total seafood consumption rates are partitioned into consumption of different seafood classes (e.g., anadromous or salmon, bottom feeding, pelagic, and shellfish). The general formula applied in Appendix A is as follows:

Class consumption rate = total seafood consumption rate X (average class consumption rate)/(sum of averages for each class)

The application of this approach to the Tulalip Tribe data is given as follows:

Table 1: Development of Percentages and Rates of Total Tulalip Tribe Seafood Consumption Associated with Different Seafood Categories			
Seafood Class	**Average Consumption Rate, g/day[1]**	**(average class consumption rate)/(sum of class averages)**	**Class consumption rate = Total consumption rate, 194[2] grams X class percentage**
Anadromous	34.51	49.7%	96.4
Bottom feeding	2.92	4.2%	7.5
Pelagic	2.67	3.9%	8.1
Shellfish	29.32	42.2%	81.9
Sum of averages	69.42		

2.1.5. <u>Box PS-11: Salmon</u>

This section of the Framework discusses whether risks associated with the consumption of salmon should be included or excluded on a contaminant-specific basis. The major sediment contaminant of concern for human health at the CB/NT Site is PCBs. EPA believes that based on studies of PCB contaminant levels in adult salmon throughout Puget Sound (West et al. 2001), that returning adult salmon in the CB/NT do not accumulate a substantial PCB body burden during the time they spend in the CB/NT (see the Human Health Risk Assessment for the Lower Duwamish Superfund Site, Lower Duwamish Workgroup, 2003a). Most of an adult salmon's PCB body burden is acquired during foraging in the open ocean or Puget Sound.

It is possible that PCBs originally found in the CB/NT may have contributed to PCB levels in Puget Sound. Outmigrating juvenile salmon that do not survive to become returning adults contribute their PCB body burden to Puget Sound. Water, vapor and sediment transport may also result in CB/NT PCB loading to Puget Sound. Consequently, some of the PCBs accumulated by salmon in Puget Sound may have originated in the CB/NT. It is unknown what fraction of the mass loading of PCBs to Puget Sound may have originated from the CB/NT. The Puget Sound Ambient Monitoring Program (PSAMP) measured PCB concentrations from salmon collected throughout Puget Sound, including the CB/NT. CB/NT salmon PCB concentrations are generally not greater than those found elsewhere in Puget Sound (West et al. 2001). Based on this information, and for purposes of the CB/NT risk assessment only, EPA is assuming that a significant fraction of PCBs accumulated by salmon during time spent in Puget Sound did not originate from the CB/NT.

In addition to PCBs, the PSAMP evaluated concentrations of a wide range of contaminants in adult salmon throughout Puget Sound (West et al. 2001). Compounds evaluated by the PSAMP program included metals (i.e., copper, arsenic, mercury and lead), Aroclors, pesticides, polycyclic aromatic hydrocarbons, organotin compounds, phthalates, phenols, and ethers (West et al. 2001). PSAMP concluded that adult salmon returning to the Lower Duwamish generally did not have greater

[1] These values were calculated from average g/kg/day consumption rates Table 3 of the Toy et al. 1996 study using an average adult female and male body weight of 81.8 kg.
[2] This value is not published in the Toy et al. (1996) study discussing seafood consumption rates for the Tulalip Tribes, but rather was derived from the Tulalip Tribes seafood consumption data used in the Toy et al. study. 194 g/day is the 95th percentile consumption rate of seafood harvested from Puget Sound. The procedure used to derive this value is given in Appendix B of the general framework.

contaminant concentrations than salmon sampled in other locations in Puget Sound (O'Neill 2005), and EPA believes that conditions in the Commencement Bay area are similar enough that these results are relevant to CB/NT as well. The PSAMP finding for the Lower Duwamish supports EPA's belief that the body burdens of these chemicals in adult salmon harvested in Commencement Bay are not significantly associated with contamination in CB/NT sediments, and that site-related risks posed by salmon consumption are likely small.

2.2. Additional exposure parameters

2.2.1. Exposure duration

Section III F of the Framework discusses other exposure considerations related to Tribal seafood consumption, including exposure duration. The Framework suggests that a lifetime of exposure, represented by a Superfund default value of 70 years, is the appropriate exposure duration to use for lifetime exposure unless site-specific exposure duration data are available. Site-specific exposure data were not available for the CB/NT site. EPA recommends use of an upper bound estimate of exposure duration (EPA 1989) in characterizing exposure and risk. Consequently, for this evaluation, EPA is using an exposure duration of 70 years in the 2009 CB/NT five-year review Framework application.

2.2.2. Body weight

The adult body weight used is based on the tribal data set deemed appropriate for exposure and risk calculation. Since Tulalip data are being suggested as appropriate for the CB/NT Tribal Framework analysis, the average adult Tulalip Tribes body weight of 81.8 kilograms should be used.

3. Summary of Exposure Parameters to be used in the CB/NT Five-Year Review

The daily contaminant intake for each seafood category is derived using the following equation:

[Equation 1] $CDI = (C_i \times IR_i \times FI \times EF \times ED \times CF) / (BW \times AT)$

A description of these parameters and their CB/NT Framework application values are as follows:

CDI = chronic daily intake of contaminant (mg/kg/day)
C_i = contaminant concentration in a representative species for the seafood category under consideration (mg/kg)
IR_i = ingestion rate for seafood category under consideration (g/day), see Table 2
FI = fractional intake of media derived from contaminated source (unitless), 100%
EF = exposure frequency (days/year), 365
ED = exposure duration (years), 70
CF = conversion factor (kg/g), 0.001
BW = body weight (kg), 81.8
AT = averaging time days, 25550

Table 2: IR_i values by seafood category for CB/NT tribal Framework application	
Seafood category	**IR_i (g/day)[3]**
Pelagic fish	8.1
Benthic fish	7.5
Shellfish	81.9

4. Evaluation of the Impacts of Resource Switching on Risks

Resource switching is a source of uncertainty that was not addressed in detail for this review. The seafood consumption rates used for this analysis were the consumption rates of resident species derived in Table 1. EPA determined that use of the total seafood consumption rate was not appropriate for this analysis, as EPA is currently treating contaminant levels in salmon as being largely non-site associated.

5. Summary of the CB/NT Five-Year Review Tribal Seafood Consumption Framework Approaches

Item	**Tribal Seafood Consumption Framework for CB/NT Site**
Study selected as consumption rate data source	Toy et al., 1996, Tulalip Tribe data
Resource switching (i.e., individuals will utilize whatever seafood resources are available to attain a total seafood consumption rate).	Assumed to occur. Consumption rates for seafood categories are held constant regardless of the species in that category that were found in the Lower Duwamish.
Fraction of seafood consumed that is affected by site-specific contamination	Fraction of seafood harvested from Puget Sound
Consumption rate used to assess risks for PCBs and other bioaccumulative contaminants as well as non-bioaccumulative contaminants	97.5 grams per day representing the sum of the following values derived in Table 1 above : 8.1 g/day pelagic species 7.5 g/day bottom feeding species 81.9 g/day shellfish
Body Weight	81.8 kg (based on Tulalip Tribe data)
Exposure Duration	70 years

[3] SEE Table 1 in Section 2.1.4 for source of consumption rates

Summary Evaluation for the CB/NT Five-Year Review showing how the Human Health Risk Estimate would change using adjusted consumption and exposure duration information based on the Framework

	Consumption Rate (grams/day)	**Exposure Duration (years)**	**Adjustment Factor**	**CB/NT 1997 ESD Excess Human Health Cancer Risk Estimate**	**Five-Year Review Evaluation of Human Health Cancer Risk Estimate based on Adjusted Parameters**
Used in CB/NT 1997 ESD	123	30			
Adjusted for Framework	97.5	70			
	79.3%	233.3%	1.8	**1.2E-04**	**2.2E-04**

6. Conclusion

For this five-year review of the CB/NT site, alteration of exposure parameters of CB/NT seafood consumption risks does not result in a significant increase in cancer risk.

References

U.S. EPA. August 2007. Framework for Selecting and Using Tribal Fish and Shellfish Consumption Rates for Risk-Based Decision Making at CERCLA and RCRA Cleanup Sites in Puget Sound and the Strait of Georgia.

Lower Duwamish Workgroup. 2003a. Appendix B, Phase 1 Human Health Risk Assessment.

Lower Duwamish Workgroup. 2003b. Final Phase 1 Remedial Investigation Report.

O'Neill. 2005. Washington State Department of Natural Resources, personal communication.

Toy, K.A., N. Polissar, S.L. Liao, and G.D. Mittelstaedt. 1996. A Fish Consumption Survey of the Tulalip and Squaxin Island Tribes of the Puget Sound Region.

U.S. EPA. 1989. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A) Interim Final.

West, JE, O'Neill SM, Lippert G, Quinnell S. 2001. Toxic contaminants in marine and anadromous fishes from Puget Sound, Washington. Results of the Puget Sound Ambient Monitoring Program fish component 1989-1999. Washington Department of Fish and Wildlife, Olympia, WA.

OU 20, 22 and 19 Attachments

OU 20, 22 and 19 Attachment 1 - List of Documents Reviewed
OU 20, 22 and 19 Attachment 2 - Site Photos

OU 20, 22 and 19 Attachment 1 - List of Documents Reviewed

Asarco Tacoma Smelter:

Anchor. 2006a. Offshore Capping Project Biological Assessment Addendum. February 2006.

Anchor. 2006b. Construction Water Quality Monitoring Plan for Offshore Sediment Capping. September 2006.

Anchor. 2006c. Sediment Capping Project - Fall 2006, Remedial Action Work Plan. October 2006.

Anchor. 2007. Commencement Bay NT - Asarco/Ruston, LLC: Construction Monitoring Report - Offshore Sediment Capping Former Asarco Smelter Site. April 2007.

Asarco. 2006. Site-Wide and PA-Specific Monitoring Report 2002-2005 Vol. 1. May 2006.

Hydrometrics. 2006. Tacoma Upland Remediation Design Grade and Cap Site and Breakwater Peninsula. July 2006.

Hydrometrics. 2007. Commencement Bay NT - Asarco/Ruston, LLC: Point Ruston Remediation Design Grade and Cap Site. May 2007.

Point Ruston. 2006-2009. Monthly Reports, Point Ruston, No. 127 to 159. December 2006 to August 2009.

Point Ruston. 2007a. Remedial Action Comprehensive Plans and Documents Vol. II. January 2007.

Point Ruston. 2007b. Remedial Action, Comprehensive Plans and Documents, Volume II: Construction Health & Safety Plan/Contingency Plan (Final - Revision 2): Operable Unit 02 - Tacoma Smelter Facility & Slag Peninsula; Operable Unit 06 - Sediments/Groundwater. January 2007.

Point Ruston. 2008. Remedial Action, Comprehensive Plans and Documents, Volume II: Construction Health & Safety Plan/Contingency Plan (Final - Revision 4): Operable Unit 02 - Tacoma Smelter Facility & Slag Peninsula; Operable Unit 06 - Sediments/Groundwater. September 2008.

Point Ruston. 2009. Point Ruston General Construction Management Plan; Operable Unit 02 - Tacoma Smelter Facility & Slag Peninsula; Operable Unit 06 - Marine Sediments and Groundwater. January 2009.

Ruston/North Tacoma Study Area

MRC Construction. 2008. Annual Project Completion Report (March 2008-November 2008) Excavation and Removal of Soils Ruston and North Tacoma, Washington. December 2008.

OU 20, 22 and 19 Attachment 2 - Site Photos

Historic Photo of the Asarco Smelter

View of Southern End of Smelter Site Showing Shoreline Armoring and Part of Condo Garage

View of South End of the Smelter Site Showing Condo Garage

View of the Center of the Smelter Site Showing Condo Garage and Docks in the Background

View of the North end of the Smelter Site Showing Stockpiles of Soil From Yard Remediation

The Onsite Containment Facility as Seen from Stack Hill

OU 3 Attachments

OU 3 Attachment 1 - List of Documents Reviewed
OU 3 Attachment 2 - Draft Groundwater Quality Update Using MAROS
OU 3 Attachment 3 - Community-Provided Information Technical Memorandum
OU 3 Attachment 4 - Draft Institutional Controls Report
OU 3 Attachment 5 - Site Inspection Team Roster, Checklist, and Photographs
OU 3 Attachment 6 - Inspection & Maintenance Review Technical Memorandum
OU 3 Attachment 7 - Screening Evaluation of Soils at the Northwest Detention Center
OU 3 Attachment 8 - ARARs Review Summary

OU 3 Attachment 1 - List of Documents Reviewed

LIST OF DOCUMENTS REFERENCED AND REVIEWED
CB/NT OPERABLE UNIT 03 - TACOMA TAR PITS

Sections 3 and 6 Cited References

Alta Geosciences, Inc., 2003. *Groundwater Remediation System, Operation and Maintenance Plan, Tacoma Historical Coal Gasification Site,* February 2003.

Applied Geotechnology, Inc., 1987. *Remedial Investigation, Tacoma Tar Pits, Tacoma, Washington.* Prepared for Washington Natural Gas Company, Joseph Simon & Sons, Inc., Hygrade Food Products Corporation, and Burlington Northern Railroad Company, September 1987.

Bailey, Marcia, PhD, 2009. *Screening Evaluation of Soils at the Northwest Detention Center, Tacoma Tar Pits Superfund Site Memorandum*. Prepared for USEPA. November 22, 2009.

BORDC, 2008a. Email from BORDC (T. Smith) to USEPA (T. Langton), SUBJECT: Request for an Emergency Inspection of the Tacoma Tarpits Operable Unit 23 EPA ID WAD980723795 Hygrade Area, dated December 10, 2008.

Dalton, Olmsted & Fuglevand, Inc. (DOF), 2009a. Figure 6-3, *Site Boundary and Areas Where Institutional Controls Apply*. E-mail from DOF (M. Dalton) to EPA (T. Langton), dated October 2009.

DOF, 2009b. *Draft Institutional Controls THCGS (Tacoma Tar Pits) Memorandum.* Prepared for USEPA. July 6, 2009.

DOF, 2009c. *Agency Review Draft Groundwater Quality Update Using MAROS, Tacoma Coal Gasification Site Memorandum.* Prepared for USEPA. May 16, 2009.

DOF, 2009d. Figure 6-1, *Tacoma Tar Pits Vicinity Map.* E-mail from DOF (M.Dalton) to EPA (T. Langton), dated January 2, 2009.

Ebasco, 1995. *Inspection and Maintenance Manual, Tacoma Historical Coal Gasification Site*. Prepared for Washington Natural Gas Company, August, 1995.

Ecology and Environment (E&E), 2009. *Technical Direction Document Number 09-04-0010, Tacoma Tar Pits Trip Report.* Prepared for USEPA, June 12, 2009.

Ecology, Washington State Department, 2003a. Restrictive Covenant for DVR, LLC, March 27, 2003. [CD]

Ecology, 2003b. Certified mail from Ecology (L. Pearson) to Correctional Services Corporation (B. Paul) regarding the determination that no further remedial action is necessary at the NWDC, dated March 7, 2003.

Envirosphere Company, 1987a. *Feasibility Study of the Tacoma Historical Coal Gasification Site, Final Report*, July 1987.

Envirosphere, 1987b. *Risk Assessment of the Tacoma Historical Coal Gasification Site – Final Report,* July 1987.

EPA, 2003. *Second Five-Year Review Report for Tacoma Tar Pits Operable Unit (Operable Unit 23), Commencement Bay Nearshore/Tideflats Superfund Site, Pierce County, WA*, September 25, 2003.

EPA, 1995. *Explanation of Significant Differences for the Tacoma Tar Pits Operable Unit*, May 9, 1995.

EPA, 1991. *Explanation of Significant Differences for Commencement Bay, Near Shore/Tide Flats OU 23 (Tacoma Tar Pits), Pierce County, WA*, November 1, 1991.

EPA, 1987. *Record of Decision for Commencement Bay, Near Shore/Tide Flats OU 23 (Tacoma Tar Pits), Pierce County, WA*, December 30, 1987.

Puget Sound Energy (PSE), 2007. Industrial Wastewater Permit No. 500043736 for Hazardous Waste Groundwater Remediation Facility. Issued by City of Tacoma Public Works, January 1, 2007.

Other Sections 3 and 6 Supporting Documents

DOF, 2009e. *(Industrial Wastewater Discharge Permit) Quarterly Report for January 1, 2009 to March 31, 2009, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. April 3, 2009.

DOF, 2009f. *(Industrial Wastewater Discharge Permit) Quarterly Report for October 1, 2008 to December 31, 2008, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. January 21, 2009.

DOF, 2009g. *Inspection and Maintenance Report, December 2006 to December 2008, Tacoma Historical Coal Gasification Site, Tacoma, Washington.* Prepared for Puget Sound Energy, January 2008 [sic] (correct date January 2009).

DOF, 2008a. *Water Quality Monitoring Report, March and June 2008 Sampling Events, Tacoma Historical Coal Gasification Site.* November 25, 2008.

DOF, 2008b. *(Industrial Wastewater Discharge Permit) Quarterly Report for July 1, 2008 to September 30, 2008, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. October 14, 2008.

DOF, 2008c. *(Industrial Wastewater Discharge Permit) Quarterly Report for April 1, 2008 to June 30, 2008, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. July 14, 2008.

DOF, 2008d. *(Industrial Wastewater Discharge Permit) Quarterly Report for January 1, 2007 [sic, should be 2008] to March 31, 2008, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. April 14, 2008.

DOF, 2008e. *Water Quality Monitoring Report, September 2007 Sampling Event, Tacoma Historical Coal Gasification Site.* January 21, 2008.

DOF, 2008f. *(Industrial Wastewater Discharge Permit) Quarterly Report for October 1, 2007 to December 31, 2007, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. January 21, 2008.

DOF, 2008g. *Water Quality Monitoring Report, March and July 2007 Sampling Events, Tacoma Historical Coal Gasification Site.* January 4, 2008.

DOF, 2007a. *Water Quality Monitoring Report, October and December 2006 Sampling Events, Tacoma Historical Coal Gasification Site.* December 28, 2007.

DOF, 2007b. *(Industrial Wastewater Discharge Permit) Quarterly Report for July 1, 2007 to September 30, 2007, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. October 12, 2007.

DOF, 2007c. *(Industrial Wastewater Discharge Permit) Quarterly Report for April 1, 2007 to June 30, 2007, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. July 12, 2007.

DOF, 2007d. *(Industrial Wastewater Discharge Permit) Quarterly Report for January 1, 2007 to March 31, 2007, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. April 13, 2007.

DOF, 2007e. *(Industrial Wastewater Discharge Permit) Quarterly Report for October 1, 2006 to December 31, 2006, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. January 11, 2007.

DOF, 2006a. *Water Quality Monitoring Report, March and June 2006 Sampling Events, Tacoma Historical Coal Gasification Site.* December 27, 2006.

DOF, 2006b. *Water Quality Monitoring Report, December 2006 [sic] (correct date 2005) Sampling Event, Tacoma Historical Coal Gasification Site.* December 19, 2006.

DOF, 2006c. *(Industrial Wastewater Discharge Permit) Quarterly Report for July 1, 2006 to September 30, 2006, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. October 13, 2006.

DOF, 2006d. *(Industrial Wastewater Discharge Permit) Quarterly Report for April 1, 2006 to June 30, 2006, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. July 13, 2006.

DOF, 2006e. *(Industrial Wastewater Discharge Permit) Quarterly Report for January 1, 2006 to March 31, 2006, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. April 12, 2006.

DOF, 2006f. *Water Quality Monitoring Report, September 2005 Sampling Event, Tacoma Historical Coal Gasification Site.* February 28, 2006.

DOF, 2006g. *(Industrial Wastewater Discharge Permit) Quarterly Report for October 1, 2005 to December 31, 2005, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. January 13, 2006.

DOF, 2005a. *Inspection and Maintenance Report, November 2004 to November 2005, Tacoma Historical Coal Gasification Site, Tacoma, Washington.* Prepared for Puget Sound Energy, November 2005.

DOF, 2005b. *Water Quality Monitoring Report, March and June 2005 Sampling Events, Tacoma Historical Coal Gasification Site.* November 25, 2005.

DOF, 2005c. *(Industrial Wastewater Discharge Permit) Quarterly Report for July 1, 2005 to September 30, 2005, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. October 10, 2005.

DOF, 2005d. *Inspection and Maintenance Report, November 2003 to November 2004, Tacoma Historical Coal Gasification Site, Tacoma, Washington.* Prepared for Puget Sound Energy, September 2005.

DOF, 2005e. *Water Quality Monitoring Report, September and December 2004 Sampling Events, Tacoma Historical Coal Gasification Site.* September 8, 2005.

DOF, 2005f. *Water Quality Monitoring Report, March and June 2004 Sampling Events, Tacoma Historical Coal Gasification Site.* August 25, 2005.

DOF, 2005g. *(Industrial Wastewater Discharge Permit) Quarterly Report for April 1, 2005 to June 30, 2005, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. July 13, 2005.

DOF, 2005h. *(Industrial Wastewater Discharge Permit) Quarterly Report for January 1, 2005 to March 31, 2005, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. April 12, 2005.

DOF, 2005i. *(Industrial Wastewater Discharge Permit) Quarterly Report for October 1, 2004 to December 31, 2004, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. January 12, 2005.

DOF, 2004a. *Water Quality Monitoring Report, December 2003 Sampling Event, Tacoma Historical Coal Gasification Site.* October 15, 2004.

DOF, 2004b. *(Industrial Wastewater Discharge Permit) Quarterly Report for July 1, 2004 to September 30, 2004, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. October 8, 2004.

DOF, 2004c. *(Industrial Wastewater Discharge Permit) Quarterly Report for April 1, 2004 to June 30, 2004, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. July 8, 2004.

DOF, 2004d. *(Industrial Wastewater Discharge Permit) Quarterly Report for January 1, 2004 to March 31, 2004, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. April 13, 2004.

DOF, 2004e. *(Industrial Wastewater Discharge Permit) Quarterly Report for October 1, 2003 to December 31, 2003, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. January 14, 2004.

DOF, 2003a. *Water Quality Monitoring Report, September 2003 Sampling Event, Tacoma Historical Coal Gasification Site.* December 26, 2003.

DOF, 2003b. *(Industrial Wastewater Discharge Permit) Quarterly Report for July 1, 2003 to September 30, 2003, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. October 1, 2003.

DOF, 2003c. *(Industrial Wastewater Discharge Permit) Quarterly Report for April 1, 2003 to June 30, 2003, Tacoma Historical Coal Gasification Site.* Prepared for City of Tacoma, Environmental Services Wastewater Management. July 1, 2003.

DOF, 2003d. *Inspection and Maintenance Report, November 2002 to November 2003, Tacoma Historical Coal Gasification Site, Tacoma, Washington.* Prepared for Puget Sound Energy, May 2003.

DOF, 2002. *Revised Water Quality Monitoring Program, Tacoma Historical Coal Gasification Site*. January 4, 2002.

DOF, 1999. *Interim Characterization Report THCGS, Technical Memorandum.* Prepared for Puget Sound Energy, June 23, 1999.

DOF, 1995a. *Tacoma Historical Coal Gasification Site, Remedial Action Report,* Prepared for Washington Natural Gas Company, September, 1995.

DOF, 1995b. *Post-Remediation Water Quality Monitoring Plan*, September 1995.

DOF, 1991. *Tacoma Historical Goal Gasification Site Remedial Design, Framework for Remediation.* Prepared for Washington Natural Gas Company, September 23, 1991.

EPA, 2001. *Comprehensive Five-Year Review Guidance.* EPA 540-R-01-007, June 2001.

EPA, 1998. *(First) Five-Year Review for Tacoma Tar Pits NPL Site*. September 27, 1998.

OU 3 Attachment 2 - Draft Groundwater Quality Update Using MAROS

Dalton, Olmsted & Fuglevand, Inc. *Environmental Consultants*

6034 N Star Rd. • Ferndale, Washington 98248
Telephone (360) 380-0862 (FAX 360-380-0862)
Cell (206) 498-6616 e-mail: mdalton@dofnw.com
(Kirkland, WA Office – 425-827-4588)

MEMORANDUM

TO: Tamara Langton - EPA

FROM: Matt Dalton

DATE: Agency Review Draft: May 16, 2009

SUBJECT: Groundwater Quality Update
Using MAROS
Tacoma Coal Gasification Site

REF. NO: WNG-001-01

CC: John Rork - PSE

This technical memorandum presents the results of our groundwater quality update to assist the Environmental Protection Agency (EPA) to complete its periodic five year review of the remedy at the Tacoma Tar Pits, herein referred to as the Tacoma Historical Coal Gasification Site (THCGS). The THCGS is an Operable Unit of the Commencement Bay-Nearshore/Tideflats Superfund Site located within the Tacoma Tideflats industrial area near Commencement Bay. At the request of EPA, Monitoring and Remediation Optimization System (MAROS v. 2.2) software was used to assist in completing the update.

SUMMARY OF FINDINGS

- The THCGS was remediated from 1992 to 1995 and groundwater was monitored quarterly between 1991 to the present. The indicator contaminants of concern outlined in the Record of Decision (ROD) are benzene, certain high molecular weight polycyclic aromatic hydrocarbons (ROD PAHs), polychlorinated biphenyls (PCBs) and lead. Cleanup criteria for the indicator contaminants are based on migration to a surface water receptor (i.e. Puyallup River).

- The point of compliance is the site boundary. Monitoring is being conducted in three aquifers termed the Fill, Sand and Deep Aquifers. The ROD cleanup criteria have been achieved for all the indicator contaminants in the Fill and Deep Aquifers. The ROD cleanup criteria for ROD PAHs, PCBs and lead have also

been achieved in the Sand Aquifer. Benzene exceeds the ROD criterion of 53 ug/l along two portions of the site boundary. The source of benzene is coal tar related material (a Dense Non-Aqueous Phase Liquid or DNAPL) that migrated into the Sand Aquifer. During the site remediation, DNAPL was largely removed from the Fill Aquifer.

- A hydraulic containment system was installed within the Sand Aquifer in 2002 along two portions of the site boundary where benzene exceeds the ROD criterion. The areas where the criterion is exceeded are termed the North Branch and East Branch areas.

- There is no evidence that benzene has ever migrated to the Puyallup River, the primary site receptor. This finding is based on monitoring wells located between the site and the river. Groundwater quality trends indicate that water quality conditions at the site boundary in the North Branch area have substantially improved. This improvement is likely caused by the dissipation of remedial construction impacts and/or by operation of the hydraulic containment system.

- In the East Branch Area the groundwater quality trends are mixed. No concentration trend is evident in the source area, while concentrations in downgradient wells may be increasing or decreasing, depending on well location. Benzene has not migrated beyond the location of buried sewer pipes that are located immediately adjacent to the site boundary. Some of the observed benzene concentration trends may have been caused by remedial construction impacts.

- Overall, the available monitoring data indicate the remedy continues to be protective of the primary receptor; the Puyallup River.

SITE BACKGROUND

The THCGS comprises approximately 52 acres located on a peninsula of land located between the Puyallup River to the northeast and the Thea Foss Waterway to the west (Figure 1). A number of different active facilities are located within the site boundary including Simon Metals within the interior of the site; Tri-Pak (a transloading facility) and Union Pacific Railroad tracks on the north; Burlington Northern-Santa Fe railroad tracks on the south; a Correctional Services Corp. detention facility (former Hygrade facility) on the west; and a card lock station on the east (Figure 2). Also located within the site are a stabilized/covered waste pile and two detention basins that were constructed as part of site remediation.

The site lies over filled tide flats. Near the turn of the last century, imported or dredged fill was placed to provide foundation support for structures associated with a meat packing plant (Hygrade) and various railroad facilities (Figure 2). Construction of the

railroad tracks and meat packing plant was completed prior to construction of a coal gasification plant (manufactured gas plant or MGP) on the northeastern portion of the site (Figure 3).

The MGP operated between 1924 and 1956. Some of the MGP residues (coal ash, coal tar liquor and coal tar solids and semisolids) were deposited on the plant site and in topographically lower areas adjacent to the MGP (DOF and FW 1995). The approximate locations of the lower elevation areas are shown on Figure 3. Demolition of the MGP was completed in 1966. Demolition debris and below grade structures were left in place. The debris and structures were later removed during the site remedial work.

Joseph Simon and Sons (JS&S[i]), a metal recycling company, purchased the site and began construction in 1966. As part of their site development, JS&S placed fill materials in the low areas. The low areas were generally contained by railroad yards on the north and south, the former Hygrade facility on the west, and the MGP/River Street on the east. The fills, originating from a variety of sources, consisted of metal debris, soil, and shredded car interiors (autofluff). During its early operation transformers containing oils with polychlorinated biphenyls (PCBs) were also recycled and PCBs were later detected in site fills.

Analysis of historical air photographs and other information indicates that filling covered and likely spread the coal tar residues over the low areas in a generally westward direction. After the filling was completed, visible evidence of the presence of tar included two "*tar ponds*" located to the west of the former MGP and a "*tar pit*" located to the south of the MGP (Figure 3).

After completion of site investigations, including a Remedial Investigation (RI) and Feasibility Study (FS), a Record of Decision (ROD) was issued for the site in December 1987. The description of the selected remedy in the ROD was as follows:

> *This record of decision addresses source control of on-site contamination through excavation of contaminated soils and stabilization of these contaminated soils in a polymer/cement matrix. The stabilized matrix will be capped to reduce surface water infiltration. Management of migration is addressed by diversion of surface water runoff. On-site shallow groundwater contains detectable concentrations of contaminants. However, because contamination has not been detected off-site and as the remedial action is expected to prevent further contamination, groundwater extraction and treatment is not considered as appropriate at this time. Should monitoring indicate contamination migration, further treatment may be necessary to address shallow groundwater.*

[i] Now known as Simons Metals

In 1991 a Consent Decree (CD) was negotiated between EPA and the potentially responsible parties (PRPs). The CD identified the Washington Natural Gas Co. (WNG) as the performing PRP. WNG later merged with Puget Sound Energy (PSE).

Site remediation occurred between 1992 and 1995 (DOF and FW 1995). For remedial purposes, the site was generally divided into two areas and a number of subareas as illustrated on Figure 4. The areas included the following:

- CAP Area
    - JS&S Operating Area East
    - JS&S Operating Area West
    - Tar Pit Area
    - Fluff Area
    - Ponds Area
- Peripheral Areas.
    - A1 and A2
    - D1 to D4

Most of the remedial work was completed within the CAP area where approximately 185,000 cubic yards of material were excavated, stabilized and placed in the stabilized waste pile (Figure 5). Excavation depths ranged from one to fifteen feet below the existing grade at the time the work was completed. The stabilization process produced a material of low leachability and very low permeability (less than 10E-7 cm/sec). Excavated areas were backfilled with quarry spalls and imported compacted sand and gravel fill.

The bottom of the stabilized waste pile lies above the seasonally high water table and the pile was covered with a geosynthetic/vegetative hybrid cover to minimize the possible infiltration of precipitation. Precipitation runoff from the waste pile flows into detention basin No. 1.

The remaining CAP area is covered with asphalt and concrete (Figure 5) with a permeability less than 10E-7 cm/sec. Precipitation runoff from the metal recycling area is collected in catch basins that flow to detention basin No. 2. After the remedial facilities were constructed in the mid-1990s, JS&S installed an oil/water separator and settling berms to treat stormwater flowing out of detention basin No. 2 as part of their stormwater treatment program mandated by the Washington State Department of Ecology (Ecology).

Stormwater flow from the detention basins flows into the Burlington Northern Ditch (located between the detention basins and BN railroad tracks) and ultimately to the Portland Avenue pump station where it enters the Puyallup River. The outlets of the detention basins are equipped with restricting orifices to limit the combined discharge to less than 1.5 cubic feet per second (cfs).

In the peripheral areas, a number of hot-spots were excavated and backfilled. Excavation depths were three feet or less. Excavated hot-spots are shown on Figure 4.

HYDROGEOLOGY

The site is underlain by a layered sequence of unconsolidated silts and sands (DOF 1999). Geologic sections that illustrate the site geology and water quality conditions are shown on Figures 7 to 11. Section trends are shown on Figure 6.

- The first groundwater zone is termed the Fill Aquifer and is comprised of dredge sand and other fills. The fill aquifer is defined by the water table and the top of the former tidal flat deposits.

- Finer grained tidal flat deposits (Upper Aquitard) define the bottom of the Fill Aquifer and separate the Fill Aquifer from the underlying Sand Aquifer. The Upper Aquitard appears to be absent in the vicinity of TTP-17.

- The Sand Aquifer underlies the Upper Aquitard and consists of fine to coarse sand with variable amounts of silt.

- Underlying the Sand Aquifer is a discontinuous fine grained unit termed the Lower Aquitard.

- Underlying the Lower Aquitard is the Lower Aquifer that is composed of sand layers interbedded with sand/gravel layers and discontinuous layers of silt, clay and silty sand.

Typical non-pumping groundwater flow directions for the Fill and Sand Aquifers are shown on Figures 12 and 13 based on data collected in October 2000. Water level monitoring indicates that tides do not affect groundwater levels in the Fill Aquifer. Groundwater contours (Figure 12) indicate there is a groundwater low in the vicinity of well TTP-17S and shallow groundwater is interpreted to be flowing towards the low in this area. This is the area where the Fill and Sand Aquifers likely are directly connected because the Upper Aquitard appears to be missing. Contours in the southeastern portion of the site indicate that shallow groundwater is flowing in a southeasterly direction.

Water levels in the sand aquifer are potentially influenced by tidal fluctuations. To minimize the effect of tidal changes, water levels are measured on the same day and within as short a time period as practical, typically several hours. Typical non-pumping groundwater contours for the Sand Aquifer are shown on Figure 13. The contours indicate groundwater flows in a northeasterly direction in the Sand Aquifer beneath the western portion of the site. Beneath the eastern portion of the site, groundwater flows in a southeasterly direction.

GROUNDWATER MONITORING AND INTERPETATION

The locations of current monitoring wells associated with the THCGS are shown on Figure 14. The wells are screened in the Fill, Sand and Lower Aquifers. Wells are designated with an "S", "M" or "D" to indicate in which zone the well is screened. The numbers of wells in each aquifer that are currently being monitored on a regular basis are as follows:

- Fill Aquifer – 11 wells
- Sand Aquifer – 26 Wells
- Lower Aquifer – 6 Wells

In addition to the monitoring wells, samples are obtained from one surface water (end of Burlington Northern ditch) and one very deep well (Hygrade Well). The Hygrade Well is screened at a depth of over 500 feet and is a naturally flowing (if left uncapped) artesian well.

The primary objective of water quality monitoring is to provide data to assess compliance with the performance criteria presented in the ROD (EPA 1987). The criteria are summarized below and are applied at the site boundary (Figures 2 and 14). The ROD identifies lead, benzene, PCBs and carcinogenic polycyclic aromatic hydrocarbons (PAHs) as the indicator contaminants of concern.

Surface Water and Ground-Water Performance Criteria

Contaminant of Concern	Surface Water Boundary (ug/l)	Groundwater Boundary (ug/l)
Lead	3.2	50
Benzene	53	53
PCBs	0.2	0.2
PAHs(1)	5-30 (2)	5-30 (2)

(1) benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene
(2) 5 ug/l - individual concentration; 30 ug/l - sum of PAHs

After completion of the RI, monitoring was completed in phases.

- Pre-remediation monitoring was completed between March 1991 and December 1994.
- Post-remediation monitoring began in March 1995 and continues to the present.

In September 2001 (DOF 2001), a water quality "*update*" evaluation was conducted. Available data for each monitoring well were summarized for the period between March 1991 and March 2001. Review of post-remediation data collected after 1994 indicated that the ROD criteria for lead, PCBs, and PAHs were being met at the site boundary in surface water and ground water, and that the benzene criterion was met in surface water and ground water within the fill and deep aquifers. However, benzene exceeded the ROD criterion in the sand aquifer along portions of the site boundary.

Based on review of data collected generally between 1991 and 2001, the monitoring program was revised (DOF 2002). The revised monitoring program emphasizes benzene in the Sand Aquifer. The current monitoring schedule (Table 1) was approved by EPA in January 2002 for implementation during the first quarter of 2002.

The estimated areas where benzene concentrations in the Sand Aquifer exceed the ROD criterion of 53 ug/l are shown on Figure 15 using data collected through January 2009. The initial concentration pattern was established in 1999 based on monitoring well data and the results of groundwater quality sampling (from multiple depths) using a push-probe drilling rig (DOF 1999).

A groundwater hydraulic containment system was installed at the site in early 2002 (Alta and DOF 2003). The purpose of the system is to intercept and treat ground water at the site boundary that contains benzene concentrations above the criterion contained in the ROD. The containment system consists of four extraction wells (see Figure 15). Extraction wells A and B intercept water from the "*North Branch*" of the system and wells C and TW-1 intercept water from the "*East Branch*" of the system. Groundwater from these wells is pumped to a central treatment plant where it is treated by air-stripping. The stripped vapors are collected using vapor-phase carbon. Treated groundwater is discharged to the City of Tacoma sanitary sewer in accordance with the requirements of an Industrial Wastewater Discharge Permit.

The treatment plant began operation in April 2002 by treating contaminated groundwater stored in tanks. In late May, groundwater pumping directly to the plant from the four extraction wells was started. Initial combined flow rates were approximately three gallons per minute (gpm) for wells A and B and one gpm for wells C and TW-1. Shake-down of the pumping and treatment systems was generally completed between June and December 2002. By mid-December 2002, confidence in the treatment plant's automatic operation increased to the point where pumping rates could be increased.

Table 2 summarizes treatment plant operational data between April 2002 and December 2008. Over the past six years, on average, the plant has operated approximately 91% of the time at a flow rate of approximately 10 to 11 gallons per minute (gpm). Influent benzene concentrations from each branch of the containment system are graphically shown on Figure 16.

While the tar ponds and pit were removed during the site remediation, site observations made during the remedial work and the logs of borings indicate that some of the coal tar material deposited and spread over the topographically low areas migrated downward through the upper aquitard into the Sand Aquifer and is the likely source of benzene being contained by the pump and treat system. The hydrogeologic and water quality conditions within each branch of the containment system are very different. These conditions are summarized below.

East Branch - The East Branch lies generally within and downgradient of the former low area that existed south of the MGP (Figure 15). Sections A-A' (Figure 7) and B-B' (Figure 8) trend through this area (Figure 6). The Sand Aquifer is composed of silty fine Sand to fine Sand. Aquifer thicknesses range from approximately five to twelve feet and average approximately eight to twelve feet.

Pump testing at TW-1 (DOF 2000a) indicated a hydraulic conductivity beneath the East Branch area of approximately 6 feet/day. A capture zone analysis (DOF 2000b) indicated a combined pumping rate of 192 cubic feet per day (approximately 1 gpm) from two wells would be sufficient to contain the North Branch Area. Currently, the North Branch wells (TW-1 and C) on Figure 15 are capable of a combined pumping rate of approximately 2 to 3 gpm.

Two buried 48" diameter sewer lines are located adjacent to the east side of the THCGS site boundary. Data reported in the AGI (1987) RI and later Sand Aquifer water level measurements (Figure 13) suggest that leakage of groundwater into the pipes may be occurring. Benzene has generally not been detected in Sand Aquifer monitoring wells DOF-19M and DOF-20M located on the east side of the sewer pipes (Figure 15).

North Branch – The North Branch is generally downgradient of the location of the former tar ponds (Figure 15). Sections C-C' (Figure 9), D-D' (Figure 10) and E-E' (Figure 11) trend through this area (Figure 6). The Sand Aquifer is composed of interbedded silty fine Sand to coarse Sand. Aquifer thicknesses range from approximately four to ten feet and average approximately seven feet.

At DOF-32D (Figure 9) the Sand Aquifer is separated from the Lower Aquifer by the Lower Aquitard. However, near monitor well TTP-18M, the Lower Aquitard appears to be less well defined, although specific capacity data collected during the water quality probe sampling in 1999 indicated a transition to a lower permeability zone at approximately the same depth as in well DOF-32D. Well DOF-31M was installed to monitor water quality below the depth of the well screen in TTP-18M.

Pump testing at TW-2 (DOF 2000a) indicated a hydraulic conductivity beneath the East Branch area of approximately 15 feet/day. A capture zone analysis (DOF 2000b) indicated a combined pumping rate of between 580 and 768 cfd (approximately three to

four gpm) from two wells would be sufficient to contain the North Branch Area. Currently, the North Branch wells (A and B on Figure 15) pump at a combined rate of eight to nine gpm (Well A – 2 to 3 gpm; Well B - 5 to 6 gpm).

The Puyallup River is located downgradient of the North Branch Area and is the potential receptor. Groundwater quality monitoring data from downgradient wells DOF-27M, DOF-28M and MW-3 indicate that benzene has not migrated to the river. The maximum historic extent of benzene migration is shown on Figure 15.

Monitoring data indicate that water quality conditions downgradient of extraction wells A and B have improved. The data indicate that the ROD benzene criterion has been achieved at the site boundary downgradient of pumping well B.

MAROS ANALYSIS

MAROS (v. 2.2) was used to further assess trends in the monitoring data. The software uses a sequential analysis approach that includes the following:

- Well by well trend analysis using Mann-Kendall and linear regression statistical procedures; and
- Moment Analysis to assess changes in:
    - Dissolved mass over time (Zeroth Moment)
    - Distance from source to center of mass (First Moment)
    - Change in plume spread over time (Second Moment)

Confidence in the trends is estimated and a description of the trends is given as follows:

- I – Increasing
- PI – Probably increasing
- S – Stable
- PD – Probably decreasing
- D – Decreasing
- NT – No trend

Statistical trend analysis methods are described in Appendix A.2 of the MAROS Users Manual. Decision rules for each statistical method are summarized below. The Moment Analysis methods uses the Mann-Kendall method and analysis decision matrix in assessing changes in dissolved mass etc. over time.

MAROS Mann-Kendall Analysis Decision Matrix

Mann-Kendall Statistic	Confidence in Trend	Concentration Trend
S>0	>95%	Increasing
S>0	90 – 95%	Probably Increasing
S>0	<90%	No Trend
S<0 (or equal to)	<90% and COV>1(or equal to)	No Trend
S<0	<90% and COV<1	Stable
S<0	90 – 95%	Probably Decreasing
S<0	>95%	Decreasing

Notes: S – Mann-Kendall Statistic
COV – Coefficient of Variance

MAROS Linear Regression Analysis Decision Matrix

Confidence in Trend	Ln Slope – Positive	Ln Slope - Negative
<90%	No Trend	COV<1 - Stable
<90%	No Trend	COV>1 – No Trend
90 – 95%	Probably Increasing	Probably Decreasing
>95%	Increasing	Decreasing

Notes: COV Coefficient of Variance

Well by well trend analyses can be analyzed regardless of the configuration and geometry of a contaminant plume. However, the Moment Analysis requires additional information specific to the plume including aquifer properties, flow direction, etc. As shown on Figure 15 and discussed above, two plumes (North and East Branches, respectively), migrating in different directions, are present beneath the site. In addition, the hydrogeologic properties beneath each area are different. For this reason, the MAROS analysis was completed separately for each area.

The primary data input to the MAROS analysis is groundwater quality data. For this analysis, sand aquifer benzene concentrations were used because concentrations of benzene at the site boundary exceed the ROD criterion. As discussed above, monitoring data completed between approximately 1991 and 2002 indicated that the ROD criteria for PCBs, lead and PAHs were achieved in the Fill, Sand and Lower Aquifers, and that the benzene criterion was achieved in the Fill and Lower Aquifers. Based on the earlier data, the groundwater monitoring program was revised and the analysis of PCBs and metals were eliminated and the number and frequency of PAH analyses were reduced. ROD PAHs (low solubility high molecular weight PAHs) have been only intermittently detected near the typical reporting limit of 0.1 ug/l, well below the individual ROD criterion of 5 ug/l.

The MAROS import data set is presented in Attachment 1. Benzene concentration data for twenty-three Sand Aquifer wells collected between March 2002 and January 2009

were used to complete this analysis. This period includes twenty-nine sampling events and was chosen to generally coincide with the start of pumping of the hydraulic containment system. Available data for the period between 1991 and 2002 were used to provide perspective and assist with interpretation of the MAROS results. Time-series plots for selected well locations are presented on Figures 17 to 20.

Wells used in the MAROS analysis are generally divided between "*source*" and "*tail*" positions with respect to the contaminant plume. As defined by MARCOS source areas include zones with NAPLs, contaminated vadose zone soils, and areas where aqueous-phase releases have been introduced to groundwater. Tail areas only contain contaminants in the dissolved phase, but contain no contaminant sources.

North Branch Plume Analysis

Input Data. The North Branch Plume Analysis used the following source and tail wells (Table 3). Well locations are shown on Figures 14 and 15. Wells TTP-16M(R) and TTP-17M(R) were not included in the analysis because these wells are located upgradient of the source area.

Source Wells	Tail Wells	Wells Not Used
DOF-22M	AGI-5M	TTP-16M(R)
DOF-23M	AGI-14M	TTP-17M(R)
	MW-03	
	DOF-18M	
	DOF-27M	
	DOF-28M	
	DOF-29M	
	DOF-30M	
	DOF-31M	
	DOF-33M	

Aquifer properties were based on boring logs, pump testing completed in 2000, water level contouring, and literature values. These values included:

- Sand Aquifer thickness: Average 7 feet
- Hydraulic conductivity: 15 feet/day
- Effective porosity: 0.2
- Hydraulic gradient: 0.0014
- Groundwater flow direction: 45 degrees
- Seepage velocity: 23.9 feet/year

The seepage velocity was estimated using a form of Darcy' Law:

v = Ki/u * 365 days where:

v= Seepage velocity (feet/year)
K= Hydraulic conductivity (feet/day)
i = Hydraulic gradient (feet/foot)
u = Porosity (dimensionless)

The hydraulic gradient represents a pre-pumping average tidal condition (6 to 8 feet MLLW). Monitoring of tidal fluctuation impacts on groundwater levels indicates that flow to the river occurs approximately 60 to 65% of the time. The estimated seepage value was reduced to account for this condition.

The plume characteristics (length, width etc.) were evaluated using the configuration shown on Figure 15. These are listed below:

- Current plume width: 600 feet
- Current plume length: 750 feet
- Maximum (historic) plume length: 950 feet
- Source location: TTP-23M

The receptor was assumed to be the Puyallup River. The distances that were input to MAROS are as follows:

- Distance from source (TTP-23M):
  - Downgradient receptor – 1030 feet
  - Downgradient property line – 350 feet

- Distance from plume tail:
  - Downgradient receptor – 930 feet
  - Downgradient property line – 100

Well Concentration Trends. Summary results for the Mann-Kendall and linear regression analyses are included in Table 3. More detailed results for each statistical method are included in Attachment B. The trend results are shown on Figure 21. Both methods indicated decreasing trends in source area well DOF-23M and either no trend or probably increasing trend in source area well DOF-22M. Most of the tail wells were either stable (MW-03, DOF-27M and DOF-28M), or decreasing/probably decreasing (TTP-18M, DOF-33M, DOF-31M, DOF-29M, AGI-14M). No trend was indicated for AGI-5M and an increasing trend was indicated for DOF-30M.

Moment Analysis. The trends of the Moment Analysis for North Branch wells are summarized below. Additional detail is provided in Table 4.

Moment	Description	Trend
Zeroth Moment	Change in dissolved mass over time	Probably decreasing (Confidence – 94.5%)
First Moment	Distance from Source to Center of Mass	Decreasing (Confidence – 100%
Second Moment (XX)	Change in Location of Center of Mass Over Time	Decreasing (Confidence – 99.1%)
Second Moment (YY)	Change in Location of Center of Mass Over Time	Decreasing (Confidence – 100%)

North Branch Plume - MAROS Summary and Discussion. The overall results of the MAROS analysis are summarized in Table 4 and are listed below.

- Source Stability – Stable
- Tail Stability – Stable
- Recommended Level of (Future) Monitoring Effort – Moderate
- Sampling Duration – Remove treatment system if previously reducing concentration or Preliminary Remediation Goal (PRG met)
- Sampling Frequency – No recommendation
- Sampling Density – Recommend 23 wells

The MAROS analysis indicates that benzene concentration trends in source wells (TTP-22M and TTP-23M) are stable based on monitoring since March 2002. Review of monitoring data in these two wells and tail wells located upgradient of pumping wells A and B since sampling began in the late 1990s indicates that benzene concentrations have shown a general overall decrease (Figure 17). For example, benzene concentrations in well DOF-29M have declined from over 4000 ug/l to 157 ug/l by January 2009. While MAROS suggests that concentration trends in DOF-30M may be increasing overall, since the well was installed, benzene concentrations have declined from over 500 ug/l to 159 ug/l by January 2009.

Benzene concentrations in samples from wells located near the site boundary downgradient of pumping wells A and B have declined. The increases (humps) in the concentration trends evident in the plots for ATI-14M/14M(R) and TTP-18M may have been caused by remedial impacts during site remediation in the mid-1990s. The overall declines evident in the data are likely related to the dissipation of construction impacts and operation of the hydraulic containment system.

Other than a few intermittent detections near the reporting limits, benzene has not been detected in down-gradient wells located between the North Branch site boundary and the Puyallup River. There is no evidence to indicate that benzene from the THCGS has ever reached the river via groundwater flow.

MAROS recommends a sampling well density of 23 wells. This recommendation is based on a rule-of-thumb developed from review of other monitoring well systems. The current system consists of fourteen sand aquifer wells including two upgradient wells. In our opinion, the current system is sufficient for monitoring based on our understanding of the hydrogeologic system and behavior of the contaminant plume developed over the past ten years of monitoring.

Based on the declines in benzene concentrations at the site boundary, PSE is considering developing a plan to further assess the possible cause(s) of the declines. As discussed above, these possibilities include dissipation of construction impacts and/or operation of the hydraulic containment system. Conceptually this plan would include turning off or substantially reducing pumping volumes from wells A and/or B and monitoring changes to groundwater quality. Before such testing would take place, PSE would prepare a testing/monitoring plan and submit this plan to EPA for review and approval.

East Branch Plume Analysis

Input Data. The East Branch Plume Analysis used the following source and tail wells (Table 5). Well locations are shown on Figures 14 and 15.

Source Wells	Tail Wells	Wells Not Used
DOF-26M	TTP-2M	TTP-12M
	TTP-3M	
	DOF-24M	
	DOF-25M	
	DOF-34M	
	DOF-19M	
	DOF-20M	

Aquifer properties were based on boring logs, pump testing completed in 2000, water level contouring, and literature values. These values included:

- Sand Aquifer thickness: Average 10 feet
- Hydraulic conductivity: 6 feet/day
- Effective porosity: 0.2
- Hydraulic gradient: 0.0014
- Groundwater flow direction: 225 degrees
- Seepage velocity: 15.3 feet/year

The seepage velocity was estimated using a form of Darcy' Law:

v = Ki/u * 365 days where:

v= Seepage velocity (feet/year)
K= Hydraulic conductivity (feet/day)
i = Hydraulic gradient (feet/foot)
u = Porosity (dimensionless)

The hydraulic gradient represents a pre-pumping groundwater flow condition.

The plume characteristics (length, width etc.) were evaluated using the configuration shown on Figure 15. These are listed below:

- Current plume width: 800 feet
- Current plume length: 50 feet
- Maximum (historic) plume length: 50 feet
- Source location: TTP-26M

The receptor was assumed to be the Tacoma sewer pipe alignment. The distances imputed to MAROS were as follows:

- Distance from source (TTP-26M):
  - Downgradient receptor – 50 feet
  - Downgradient property line – 50 feet

- Distance from plume tail:
  - Downgradient receptor – 1 foot
  - Downgradient property line – 1 foot

Well Concentration Trends. Summary results for the Mann-Kendall and linear regression analyses are included in Table 5. More detailed results for each statistical method are included in Attachment C. The trend results are shown on Figure 22. The Mann-Kendall results indicated generally increasing trends for benzene concentrations in samples from wells TTP-2M, TTP-3M, DOF-24M and DOF-25M, while a decreasing trend was indicated for samples from well DOF-34M. No trend was indicated for concentrations in source area well DOF-26M and the trends were assessed to be stable in wells TTP-19M and TTP-20M (although benzene has generally not been detected in samples from these latter two wells). The linear regression results are similar, although no trend was indicated for samples from well TTP-3M.

Moment Analysis. The trends of the Moment Analysis for North Branch wells are summarized below. Additional detail is provided in Table 6.

Moment	Description	Trend
Zeroth Moment	Change in dissolved mass over time	Increasing (Confidence – 100%)
First Moment	Distance from Source to Center of Mass	Decreasing (Confidence – 97.3%
Second Moment (XX)	Change in Location of Center of Mass Over Time	Increasing (Confidence – 98.7%)
Second Moment (YY)	Change in Location of Center of Mass Over Time	Increasing (Confidence – 98.5%)

East Branch Plume - MAROS Summary and Discussion. The overall results of the MAROS analysis are summarized in Table 6 and are listed below.

- Source Stability – No Trend
- Tail Stability – No Trend
- Recommended Level of (Future) Monitoring Effort – Extensive
- Sampling Duration – Remove treatment system if previously reducing concentration or Preliminary Remediation Goal (PRG met)
- Sampling Frequency – No recommendation
- Sampling Density – Recommend 7 wells

A portion of the East Branch site boundary is much closer to the source of benzene as compared to the North Branch area. Pumping well C and monitoring wells DOF-26M and DOF-34M are located adjacent to both the former tar pit area and site boundary.

As noted above, no trend was detected for benzene concentrations in well DOF-26M. This is evident in the time series plot of data from DOF-26M shown on Figure 17. A decreasing trend was indicated for well DOF-34M which lies down-gradient of pumping well C and DOF-26M. It appears that benzene concentrations have substantially declined in samples from DOF-34M (Figure 20).

The trends in concentrations from wells TTP-3M, DOF-24M and DOF-25M are similar and appear to be generally increasing (Figure 20). The longest record is for TTP-3M (over 15 years). Two types of trends appear to be present including a longer term trend with relatively shorter term fluctuations superimposed on the longer term trend that are likely seasonal in nature. Pre-remedial concentrations in TTP-3M appear to have been relatively low and then increased to over 2,500 ug/l in the middle 1990s, which may have been caused by the remedial work. In the late 1990s, concentrations declined to below the ROD criterion and then began to show a general increase. The cause of the increase is not known but may be caused by implementation of the remedy that caused construction impacts or longer term changes to the hydrogeologic system.

While MAROS indicates a generally increasing trend (Mann-Kendall) or no trend (linear regression) in benzene concentrations in samples from well TTP-2M, the concentration pattern is more complicated than implied by these statistical analyses. As illustrated by the time-series plot on Figure 20, benzene concentrations have fluctuated with three concentration peaks detected over the past eighteen to nineteen years. Concentration peaks occurred in the mid-1990s, early 2001 and 2006 to present.

To assist in interpreting the concentration trends in wells TTP-2M and TTP-3M, seasonal fluctuations were filtered out by calculating annual averages and plotting the data (Figure 23). Data for each well show three peaks (A, B and C on Figure 23) that appear to correspond. Peaks A and B for both wells occur approximately 6 years apart, with the peak in TTP-2M occurring approximately one year after the peak in TTP-3M.

The C peaks shown on Figure 23 do not correspond as well as those for A and B. The C peak in TTP-2M[ii] occurs approximately three years after that in TTP-3M. However, the concentration trends in both wells appear to be flatter as compared to the earlier peaks which may indicate a similar causal mechanism.

Sufficient monitoring data is not available to assess whether the observed East Branch concentration patterns are associated with factors unrelated to the remediation or were caused by the remedial work. In our opinion, given the massive disturbance that occurred during the site remedial activities between 1992 and 1995, it is highly plausible that the construction activities have had an impact on water quality conditions at the site. If the construction activities have had an impact, it would be expected that concentrations would naturally decline with time.

Available data do indicate that the East Branch contaminant plume is being contained. Benzene has generally not been detected in wells located on the east side of the sewer line alignment.

LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, expressed or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of

[ii] Preliminary data for March 2009 suggest that 2009 benzene concentrations in samples from TTP-2M will be lower than those for 2008.

any changes in environmental standards, practices or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

Dalton, Olmsted & Fuglevand, Inc.

Matthew G. Dalton
Sr. Consulting Hydrogeologist

REFERENCES

AGI (Applied Geotechnology Inc.), 1987, Remedial Investigation, Tacoma Tar Pits, Tacoma, Washington, prepared for Washington Natural Gas Company, Joseph Simon & Sons, Inc., Hygrade Food Products Corporation, and Burlington Northern Railroad Company, September 1987.

Alta and DOF (Alta Geosciences and Dalton, Olmsted & Fuglevand, Inc.), 2003, Construction Completion Report – Groundwater Remediation System, January 2003.

DOF (Dalton, Olmsted & Fuglevand, Inc.), 1999, Technical Memorandum to Lee Marshall, Interim Characterization Report THCGS, June 23, 1999.

DOF, 2000a, Pumping Test Analysis, TW-1 and TW-2 Tests, THCGS, May 5, 2000.

DOF, 2000b, Capture Zone Analyses, THCGS, May 16, 2000.

DOF, 2001, Summary of Water Quality Trends and Proposed Revised Monitoring Program, THCGS, September 10, 2001.

DOF, 2002, Revised Monitoring Program, THCGS, January 4, 2002.

DOF and FW (Dalton, Olmsted & Fuglevand, Inc. and Foster Wheeler Environmental Corp.), 1995, Remedial Action Report, Tacoma Historical Coal Gasification Site, September 1995.

EPA (Environmental Protection Agency), 1987, Record of Decision, Decision Summary and Responsiveness Summary for Final Remedial Action, Commencement Bay-Nearshore/Tideflats, Tacoma Tar Pits Site, Tacoma, Washington, December 1987.

EPA, 1991, Consent Decree for Settlement Between the United States of America and Washington Natural Gas Company, No. C89-155TB (Consolidated with C89-489TB and C90-5373B), Lodged with U.S. District Count, Western District of Washington at Tacoma on October 4, 1991.

List of Tables

Table 1 – Revised Post-Remediation Monitoring Schedule
Table 2 – Summary of Treatment Plant Operational Data
Table 3 – MAROS Plume Analysis Summary – North Branch
Table 4 – MAROS Site Results – North Branch
Table 5 – MAROS Plume Analysis Summary – East Branch
Table 6 – MAROS Site Results – East Branch

List of Figures

Figure 1 – Site Vicinity Map
Figure 2 – Site Layout
Figure 3 – Historic Low Areas
Figure 4 – Site Area Designations and Hot-Spot Locations
Figure 5 – Finished Site Plan
Figure 6 – Geologic Section Trends
Figure 7 – Benzene Concentrations Section A-A’
Figure 8 – Benzene Concentrations Section B-B’
Figure 9 – Benzene Concentrations Section C-C’
Figure 10 – Benzene Concentrations Section D-D’
Figure 11 – Benzene Concentrations Section E-E’
Figure 12 – Groundwater Contours, Fill Unit, October 17, 2000
Figure 13 – Groundwater Contours, Sand Unit, October 17, 2000
Figure 14 – Site Layout
Figure 15 – Benzene Plume – January 2009
Figure 16 – Treatment Plant Influent Concentrations
Figure 17 – Benzene Trends – Interior Site Wells
Figure 18 – Benzene Trends – North Branch Area
Figure 19 – Benzene Trends – Well TTP-17M
Figure 20 – Benzene Trends – East Branch Area
Figure 21 – MAROS – North Branch Benzene Trend Results
Figure 22 – MAROS – East Branch Benzene Trend Results
Figure 23 – Benzene Trends TTP-2M and TTP-3M (Annual Averages)

List of Attachments

Attachment A – MAROS Data Input File
Attachment B – MAROS Results Summary – North Branch Area
Attachment C – MAROS Results Summary – East Branch Area

Table 1 - Revised Post-Remediation Monitoring Schedule (Effective January 2002)

Tacoma Historical Coal
Gasification Site

Well	Water Level	Field Parameters(1)	BTEX	PAHs	PCBs	Dissolved* Lead/Cadmium	Notes
SITE BOUNDARY WELLS							
Fill Aquifer Wells							
TTP-2S(R)	**Q**	**Q**	**Q**	**Q**	(2)	**(2)***	East/southeast portion of site
TTP-3S	**Q**	**A***	**A***	**A***	(2)	**(2)***	East/southeast portion of site; often dry; meets ROD criteria
AGI-4S	**Q**	**(2)***	**(2)***	**(2)***	(2)	**(2)***	Upgradient well; meets ROD criteria
AGI-5S	**Q**	**A***	**A***	**A**	(2)	**(2)***	Meets ROD criteria
TTP-6S(R)	**Q**	**(2)***	**(2)***	**(2)***	(2)	**(2)***	Meets ROD criteria
TTP-12S	**Q**	**A***	**A***	**(2)***	(2)	**(2)***	Meets ROD criteria
AGI-13S	**Q**	**(2)***	**(2)***	**(2)***	(2)	**(2)***	Meets ROD criteria
AGI-14S	**Q**	**A***	**A***	**A***	(2)	**(2)***	Meets ROD criteria
TTP-18S	**Q**	**A**	**A**	**A**	(2)	**(2)***	Meets ROD criteria; often dry
Sand Aquifer Wells							
TTP-2M	**Q**	**Q**	**Q**	**Q**	(2)	**(2)***	East/southeast portion of site; benzene exceeds ROD criteria
TTP-3M	**Q**	**Q**	**Q**	**Q**	(2)	**(2)***	East/southeast portion of site; benzene exceeds ROD criteria
AGI-4M	**Q**	**(2)***	**(2)***	**(2)***	(2)	**(2)***	Upgradient well; meets ROD criteria
AGI-5M	**Q**	**S**	**S**	**A**	(2)	**(2)***	Meets ROD criteria
TTP-6M(R)	**Q**	**(2)***	**(2)***	**(2)***	(2)	**(2)***	Meets ROD criteria
TTP-12M	**Q**	**A***	**A***	**(2)***	(2)	**(2)***	Meets ROD criteria
AGI-13M	**Q**	**(2)***	**(2)***	**(2)***	(2)	**(2)***	Meets ROD criteria
AGI-14M	**Q**	**Q**	**Q**	**S***	(2)	**(2)***	Meets ROD criteria; consistent benzene detections
TTP-18M	**Q**	**Q**	**Q**	**Q**	(2)	**(2)***	Exceeds benzene criteria
DOF-24M	**Q***	**Q***	**Q***	-----	-----	-----	New well since 1997
DOF-25M	**Q***	**Q***	**Q***	-----	-----	-----	New well since 1997
DOF-31M	**Q***	**Q***	**Q***	**S***	-----	-----	New well since 1997
DOF-33M	**Q***	**Q***	**Q***	**S***	-----	-----	New well since 1997
DOF-34M	**Q***	**Q***	**Q***	**S***	-----	-----	Proposed new well
Deep Wells							
AGI-1D	**S***	**S***	**S***	**S***	(2)	**(2)***	East/southeast portion of site; meets ROD criteria
TTP-3D	**S***	**S***	**S***	**S***	(2)	**(2)***	East/southeast portion of site; meets ROD criteria
TTP-4D	**S***	**(2)***	**(2)***	**(2)***	(2)	**(2)***	Meets ROD criteria
TTP-14D	**S***	**A***	**A***	**A***	(2)	**(2)***	Meets ROD criteria
Hygrade	-----	**(3)***	**(3)***	**(3)***	(2)	**(2)***	Very deep well; meets ROD criteria
DOF-32D	**S***	**S***	**S***	-----	(2)	-----	New well since 1997
INTERIOR INFORMATION WELLS							
Fill Aquifer Wells							
TTP-16S(R)	**Q**	**A**	**A**	**A**	(2)	**(2)***	Interior site well; meets ROD criteria
TTP-17S	**Q**	**A***	**A***	**A***	(2)	**(2)***	Interior site well; meets ROD criteria

(RevQTRMONSCH102 4)

Table 1 - Revised Post-Remediation Monitoring Schedule (Effective January 2002)

Tacoma Historical Coal
Gasification Site

Well	Water Level	Field Parameters(1)	BTEX	PAHs	PCBs	Dissolved* Lead/Cadmium	Notes
Sand Aquifer Wells							
TTP-16M(R)	**Q**	**A**	**A**	**A**	(2)	**(2)***	Interior site well; meets ROD criteria
TTP-17M	**Q**	**A***	**A***	**A***	(2)	**(2)***	Interior site well; meets ROD criteria
DOF-21M	**Q***	**-----**	**-----**	**-----**	**-----**	**-----**	New well since 1997
DOF-22M	**Q***	**Q***	**Q***	**S***	**-----**	**-----**	New well since 1997
DOF-23M	**Q***	**Q***	**Q***	**Q***	**-----**	**-----**	New well since 1997
DOF-26M	**Q***	**Q***	**Q***	**S***	**-----**	**-----**	New well since 1997
DOF-29M	**Q***	**Q***	**Q***	**S***	**-----**	**-----**	New well since 1997
DOF-30M	**Q***	**S***	**S***	**S***	**-----**	**-----**	New well since 1997
Deep Wells							
TTP-17D	**Q**	**A***	**A***	**A***	(2)	**(2)***	Interior site well; meets ROD criteria
DOWN-GRADIENT WELLS							
Sand Aquifer Wells							
DOF-19M	**Q**	**S***	**S***	**S***	(2)	**-----**	On east side of sewer lines
DOF-20M	**Q**	**S***	**S***	**S***	(2)	**-----**	On east side of sewer lines
DOF-27M	**Q***	**S***	**S***	**A***	**-----**	**-----**	New well since 1997
DOF-28M	**Q***	**S***	**S***	**A***	**-----**	**-----**	New well since 1997
MW-03	**Q***	**S***	**S***	**A***	**-----**	**-----**	
SURFACE WATER							
SW	**-----**	**S***	**S***	**A***	(2)	**Q(Cd);S*(Pb)**	Surface water

A - Annual Sampling (September)
S - Semiannual Sampling (March and September)
Q - Quarterly Sampling (March, June, September & December)
* - Revision to monitoring program

(1) - Water Level, pH, Conductivitiy, Temperature & Turbidity
(2) - Eliminated from monitoring program
(3) - Sample every other year starting in September 2002
----- - Not part of past or proposed program

(RevQTRMONSCH102 4)

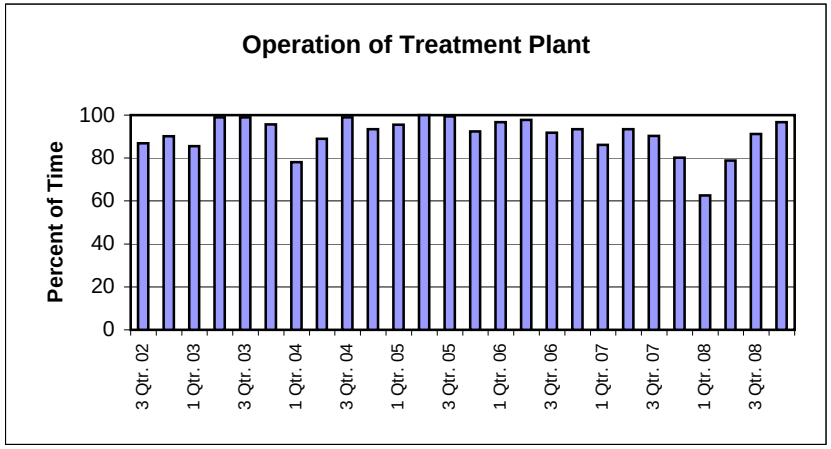
Table 2 - Summary of Treatment Plant Operational Data

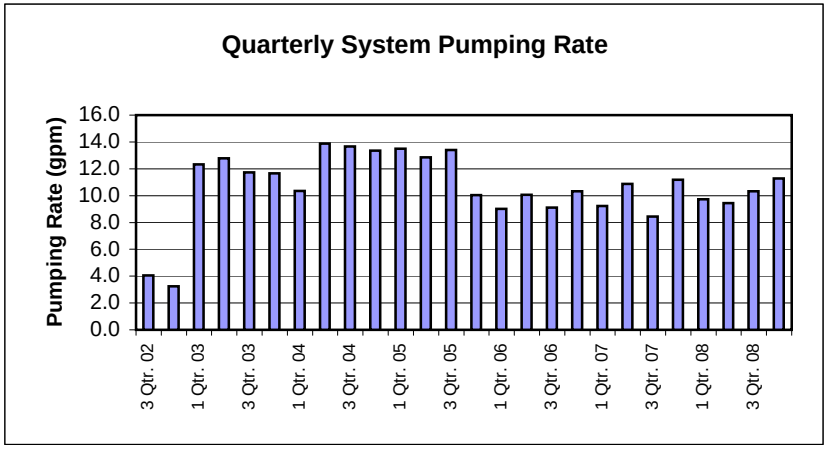
Tacoma Historical Coal Gasification Plant
Tacoma, Washington

Period	End Date	Days in Period	Days Operated	Days Down	% Period Operated	Period Volume (gallons)	Volume Measurement Duration (days)	Pumping Rate Average (gpm)	Average Period Discharge (gpm)	Cummulative Volume (gallons)
April to June 02	6/30/02	----	----	----	----	280660		----		280660
June to September 02	9/27/02	92	80	12	87.0	496498	97	4.1	3.6	777158
October to December 02	12/31/02	92	83	9	90.2	406733	96	3.2	2.9	1183891
January to March 03	3/31/03	90	77	13	85.6	1384909	91	12.3	10.6	2568800
April to June 03	6/30/03	91	90	1	98.9	1657906	91	12.8	12.7	4226706
July to September 03	9/30/03	92	91	1	98.9	1537730	92	11.7	11.6	5764436
October to December 03	12/31/03	91	87	4	95.6	1476804	92	11.7	11.1	7241240
January to March 04	3/31/04	91	71	20	78.0	1058304	91	10.4	8.1	8299544
April to June 04	6/30/04	91	81	10	89.0	1737960	97	13.9	12.4	10037504
July to September 04	9/30/04	92	91	1	98.9	1672697	86	13.7	13.5	11710201
October to December 04	12/31/04	92	86	6	93.5	1654416	92	13.4	12.5	13364617
January to March 05	3/31/05	90	86	4	95.6	1709635	92	13.5	12.9	15074252
April to June 05	6/30/05	90	90	0	100	1667222	90	12.9	12.9	16741474
July to September 05	9/30/05	92	91.5	0.5	99.5	1770676	92	13.4	13.4	18512150
October to December 05	12/31/05	92	85	7	92.4	1185849	89	10.0	9.3	19697999
January to March 06	3/31/06	90	87	3	96.7	1219843	97	9.0	8.7	20917842
April to June 06	6/30/06	91	89	2	97.8	1216018	86	10.1	9.8	22133860
July to September 06	10/5/06	97	89	8	91.8	1168081	89	9.1	8.4	23301941
October to December 06	1/2/07	92	86	6	93.5	1277905	86	10.3	9.6	24579846
January to March 07	3/30/07	87	75	12	86.2	997125	87	9.2	8.0	25576971
April to June 07	6/29/07	91	85	6	93.4	1330455	91	10.9	10.2	26907426
July to September 07	10/4/07	93	84	9	90.3	1019820	93	8.4	7.6	27927246
October to December 07	1/3/08	91	73	18	80.2	1174659	91	11.2	9.0	29101905
January to March 08	3/31/08	91	57	34	62.6	797888	91	9.7	6.1	29899793
April to June 08	7/1/08	90	71	19	78.9	964267	90	9.4	7.4	30864060
July to September 08	9/30/08	91	83	8	91.2	1234550	91	10.3	9.4	32098610
October to December 08	12/31/09	92	89	3	96.7	1444367	92	11.3	10.9	33542977

Table 2 - Summary of Treatment Plant Operational Data

Tacoma Historical Coal Gasification Plant
Tacoma, Washington





MAROS Plume Analysis Summary

Project: THCGS North 2

User Name: M Dalton

Location: Tacoma

State: Washington

Time Period: 3/1/2002 **to** 1/1/2009

Consolidation Period: No Time Consolidation

Consolidation Type: Median

Duplicate Consolidation: Average

ND Values: 1/2 Detection Limit

J Flag Values : Actual Value

Constituent	Well	Source/ Tail	Number of Samples	Number of Detects	Average (mg/L)	Median (mg/L)	All Samples "ND" ?	Mann-Kendall	Linear Regression	Modeling	Empirical
BENZENE											
	DOF-23M	S	27	27	2.2E+00	2.5E+00	No	D	D	N/A	N/A
	DOF-22M	S	28	28	1.5E+00	9.7E-01	No	NT	PI	N/A	N/A
	TTP-18M	T	28	24	1.4E-01	2.8E-02	No	D	D	N/A	N/A
	MW-03	T	14	0	2.5E-04	2.5E-04	Yes	S	S	N/A	N/A
	DOF-33M	T	26	26	9.5E-01	6.6E-01	No	PD	PD	N/A	N/A
	DOF-31M	T	26	23	1.9E-01	6.3E-02	No	D	D	N/A	N/A
	DOF-30M	T	14	14	9.0E-02	6.1E-02	No	I	I	N/A	N/A
	DOF-29M	T	26	26	1.1E+00	1.4E+00	No	D	D	N/A	N/A
	DOF-28M	T	14	0	2.5E-04	2.5E-04	Yes	S	S	N/A	N/A
	DOF-27M	T	14	0	2.5E-04	2.5E-04	Yes	S	S	N/A	N/A
	AGI-5M	T	14	3	7.6E-04	2.5E-04	No	NT	NT	N/A	N/A
	AGI-14M	T	28	18	3.2E-01	6.2E-02	No	D	D	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); Source/Tail (S/T)

The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Site Results

Project: THCGS North 2 **User Name:** M Dalton

Location: Tacoma **State:** Washington

User Defined Site and Data Assumptions:

Hydrogeology and Plume Information:

Groundwater Seepage Velocity: 23.9 ft/yr
Current Plume Length: 750 ft
Current Plume Width 600 ft
Number of Tail Wells: 10
Number of Source Wells: 2

Source Information:

Source Treatment: Pump and Treat

NAPL is observed at this site.

Down-gradient Information:

Distance from Edge of Tail to Nearest:
Down-gradient receptor: 930 ft
Down-gradient property: 100 ft
Distance from Source to Nearest:
Down-gradient receptor: 1030 ft
Down-gradient property: 350 ft

Data Consolidation Assumptions:

Time Period: 3/1/2002 **to** 1/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value

Plume Information Weighting Assumptions:

Consolidation Step 1. Weight Plume Information by Chemical
Summary Weighting: Weighting Applied to All Chemicals Equally
Consolidation Step 2. Weight Well Information by Chemical
Well Weighting: No Weighting of Wells was Applied.
Chemical Weighting: No Weighting of Chemicals was Applied.

Note: These assumptions were made when consolidating the historical montoring data and lumping the Wells and COCs.

1. Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling before reassessment, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Level of Effort	Sampling Duration	Sampling Frequency	Sampling Density
BENZENE	S	S	M	Remove treatment system if previously reducing concentration or PRG met.	No Recommendation	23

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing
Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

Level of Monitoring Effort Indicated by Analysi Moderate

2. Spatial Moment Analysis Results:

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	BENZENE	0.83	-82	94.5%	PD
1st Moment: Distance to Source					
	BENZENE	0.12	-207	100.0%	D
2nd Moment: Sigma XX					
	BENZENE	0.70	-113	99.1%	D
2nd Moment: Sigma YY					
	BENZENE	0.27	-161	100.0%	D

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.20 **Saturated Thickness:** Uniform: 7 ft

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

MAROS Plume Analysis Summary

Project: THCGS East

User Name: M. Dalton

Location: Tacoma

State: Washington

Time Period: 3/1/2002 **to** 1/1/2009

Consolidation Period: No Time Consolidation

Consolidation Type: Median

Duplicate Consolidation: Average

ND Values: 1/2 Detection Limit

J Flag Values : Actual Value

Constituent	Well	Source/ Tail	Number of Samples	Number of Detects	Average (mg/L)	Median (mg/L)	All Samples "ND" ?	Mann-Kendall	Linear Regression	Modeling	Empirical
BENZENE											
	DOF-26M	S	28	28	1.6E+00	1.3E+00	No	NT	NT	N/A	N/A
	TTP-3M	T	28	28	2.0E+00	2.1E+00	No	I	NT	N/A	N/A
	TTP-2M	T	28	14	8.3E-02	1.1E-03	No	I	I	N/A	N/A
	TTP-20M	T	14	1	2.7E-04	2.5E-04	No	S	PD	N/A	N/A
	TTP-19M	T	14	0	2.5E-04	2.5E-04	Yes	S	S	N/A	N/A
	DOF-34M	T	26	26	6.5E+00	6.1E+00	No	D	D	N/A	N/A
	DOF-25M	T	28	27	9.9E-01	9.5E-01	No	I	I	N/A	N/A
	DOF-24M	T	28	28	2.3E+00	2.3E+00	No	I	I	N/A	N/A

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); Source/Tail (S/T)

The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Site Results

Project: THCGS East

User Name: M. Dalton

Location: Tacoma

State: Washington

User Defined Site and Data Assumptions:

Hydrogeology and Plume Information:

Groundwater Seepage Velocity: 15.3 ft/yr

Current Plume Length: 50 ft

Current Plume Width 800 ft

Number of Tail Wells: 7

Number of Source Wells: 1

Source Information:

Source Treatment: Pump and Treat

NAPL is observed at this site.

Down-gradient Information:

Distance from Edge of Tail to Nearest:

Down-gradient receptor: 1 ft

Down-gradient property: 1 ft

Distance from Source to Nearest:

Down-gradient receptor: 50 ft

Down-gradient property: 50 ft

Data Consolidation Assumptions:

Time Period: 3/1/2002 **to** 1/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value

Plume Information Weighting Assumptions:

Consolidation Step 1. Weight Plume Information by Chemical
Summary Weighting: Weighting Applied to All Chemicals Equally
Consolidation Step 2. Weight Well Information by Chemical
Well Weighting: No Weighting of Wells was Applied.
Chemical Weighting: No Weighting of Chemicals was Applied.

Note: These assumptions were made when consolidating the historical montoring data and lumping the Wells and COCs.

1. Compliance Monitoring/Remediation Optimization Results:

Preliminary Monitoring System Optimization Results: Based on site classification, source treatment and Monitoring System Category the following suggestions are made for site Sampling Frequency, Duration of Sampling before reassessment, and Well Density. These criteria take into consideration: Plume Stability, Type of Plume, and Groundwater Velocity.

COC	Tail Stability	Source Stability	Level of Effort	Sampling Duration	Sampling Frequency	Sampling Density
BENZENE	NT	NT	E	Remove treatment system if previously reducing concentration or PRG met.	No Recommendation	7

Note:

Plume Status: (I) Increasing; (PI)Probably Increasing; (S) Stable; (NT) No Trend; (PD) Probably Decreasing; (D) Decreasing

Design Categories: (E) Extensive; (M) Moderate; (L) Limited (N/A) Not Applicable, Insufficient Data Available

Level of Monitoring Effort Indicated by Analysi Extensive

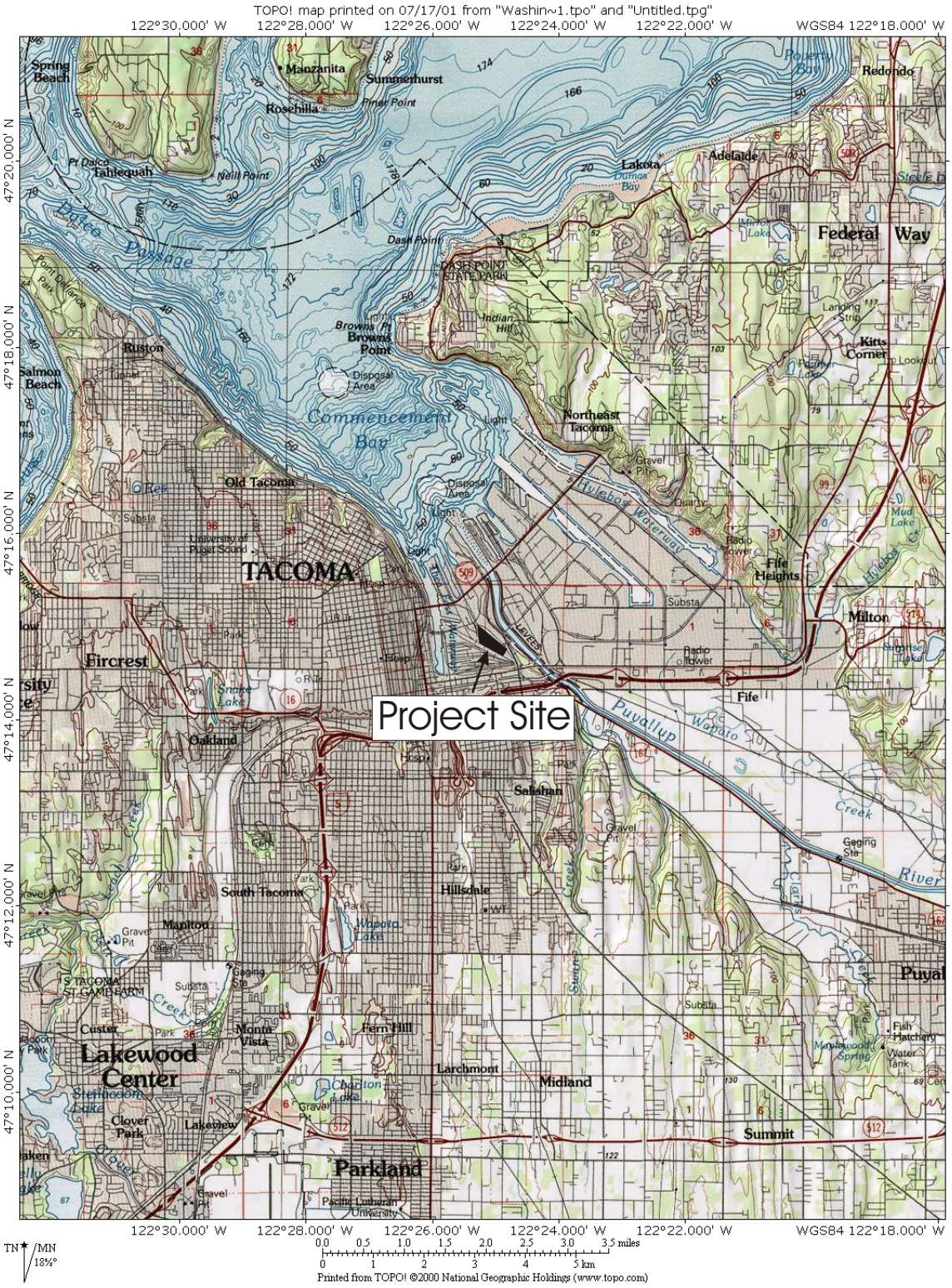
2. Spatial Moment Analysis Results:

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	BENZENE	0.58	174	100.0%	I
1st Moment: Distance to Source					
	BENZENE	0.32	-93	97.3%	D
2nd Moment: Sigma XX					
	BENZENE	0.29	107	98.7%	I
2nd Moment: Sigma YY					
	BENZENE	0.49	105	98.5%	I

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.20 **Saturated Thickness:** Uniform: 10 ft

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

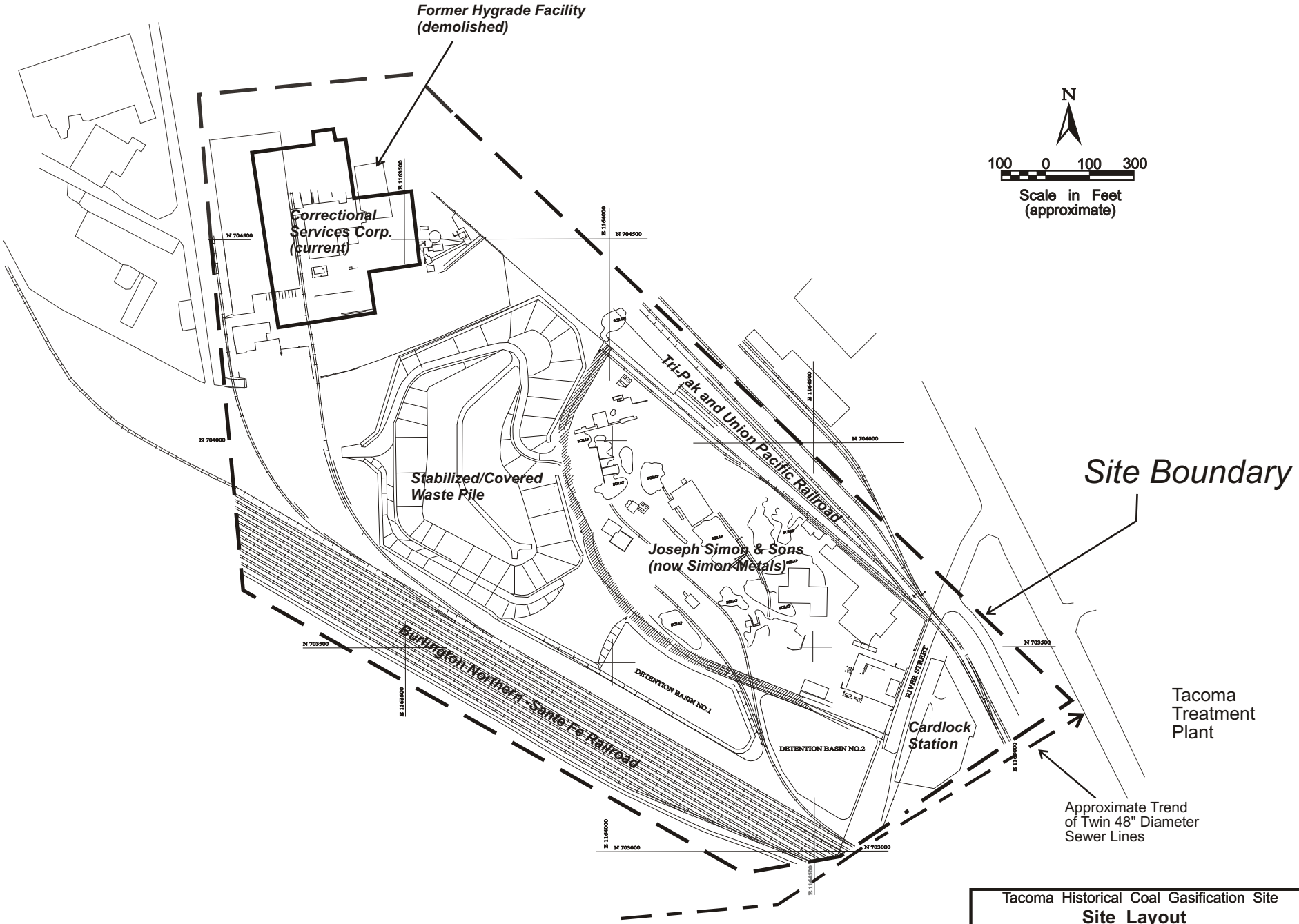


Tacoma Historical Coal Gasification Site
Tacoma, Washington

Site Vicinity Map

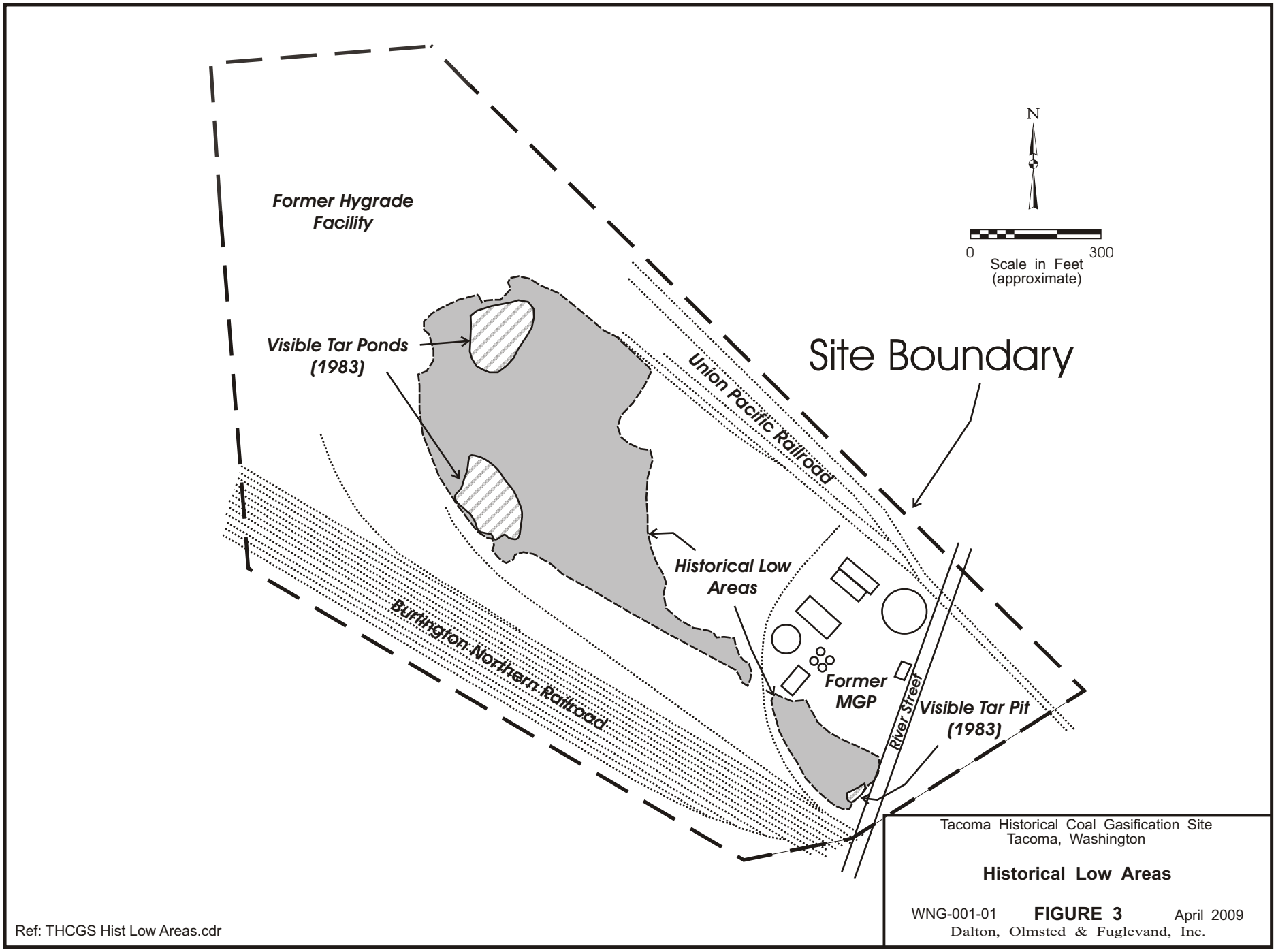
Source: Topo , 2000, National Geographic Holdings, Inc.

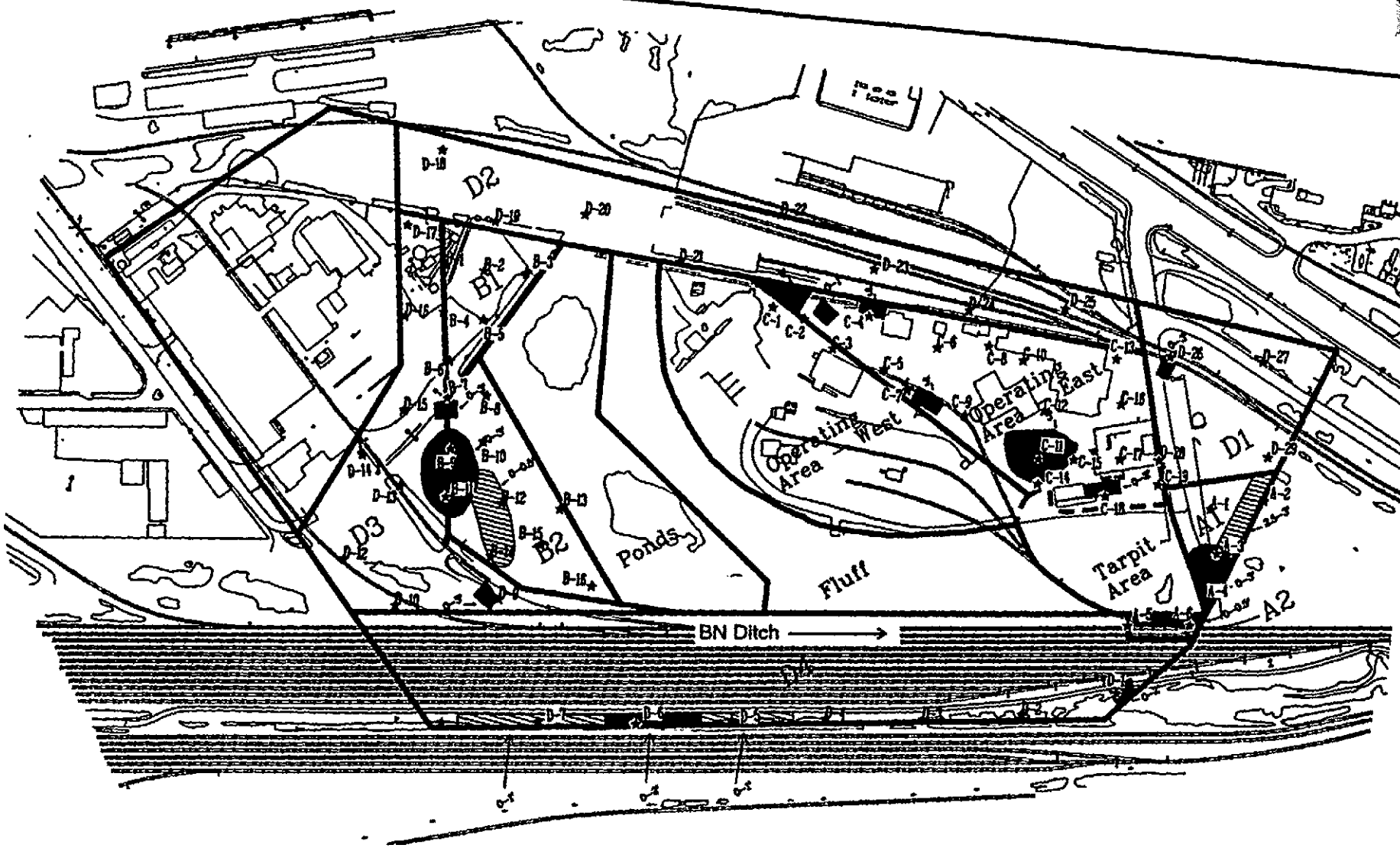
WNG-001-01 **FIGURE 1** July 2001
Dalton, Olmsted & Fuglevand, Inc.



Ref:Site Layout 4.cdr

Tacoma Historical Coal Gasification Site
Site Layout
WNG-001-01 **FIGURE 2** May 2009
Dalton, Olmsted & Fuglevand, Inc.


N
0
300
Scale in Feet
(approximate)
Former Hygrade Facility
Visible Tar Ponds (1983)
Site Boundary
Union Pacific Railroad
Historical Low Areas
Burlington Northern Railroad
Former MGP
River Street
Visible Tar Pit (1983)
Ref: THCGS Hist Low Areas.cdr
Tacoma Historical Coal Gasification Site
Tacoma, Washington
Historical Low Areas
WNG-001-01
FIGURE 3
April 2009
Dalton, Olmsted & Fuglevand, Inc.



Note: Shaded and cross-hatched areas indicate areas of planned hot-spot removals prior to the start of remediation. The actual extent of excavation to remove the planned hot-spots is shown on the Project Record Drawings (Appendix B) and/or described in Appendix C.

ef: parea.cdr

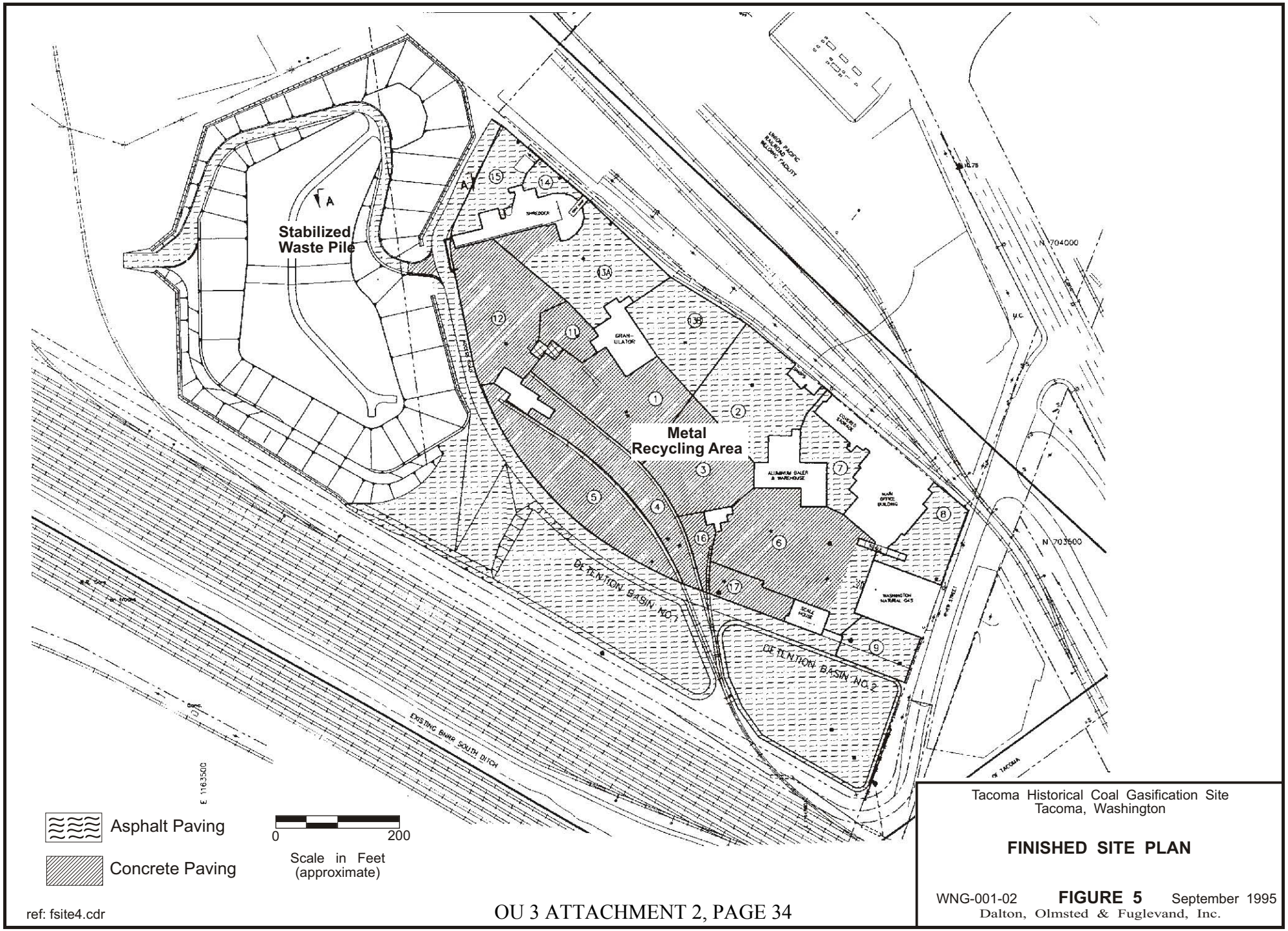
From: Framework for Remediation (DOF 1991)

Tacoma Historical Coal Gasification Site
Tacoma, Washington

SITE AREA DESIGNATIONS AND HOT-SPOT LOCATIONS

WNG-001-02 **FIGURE 4** August 1995

Dalton, Olmsted & F...

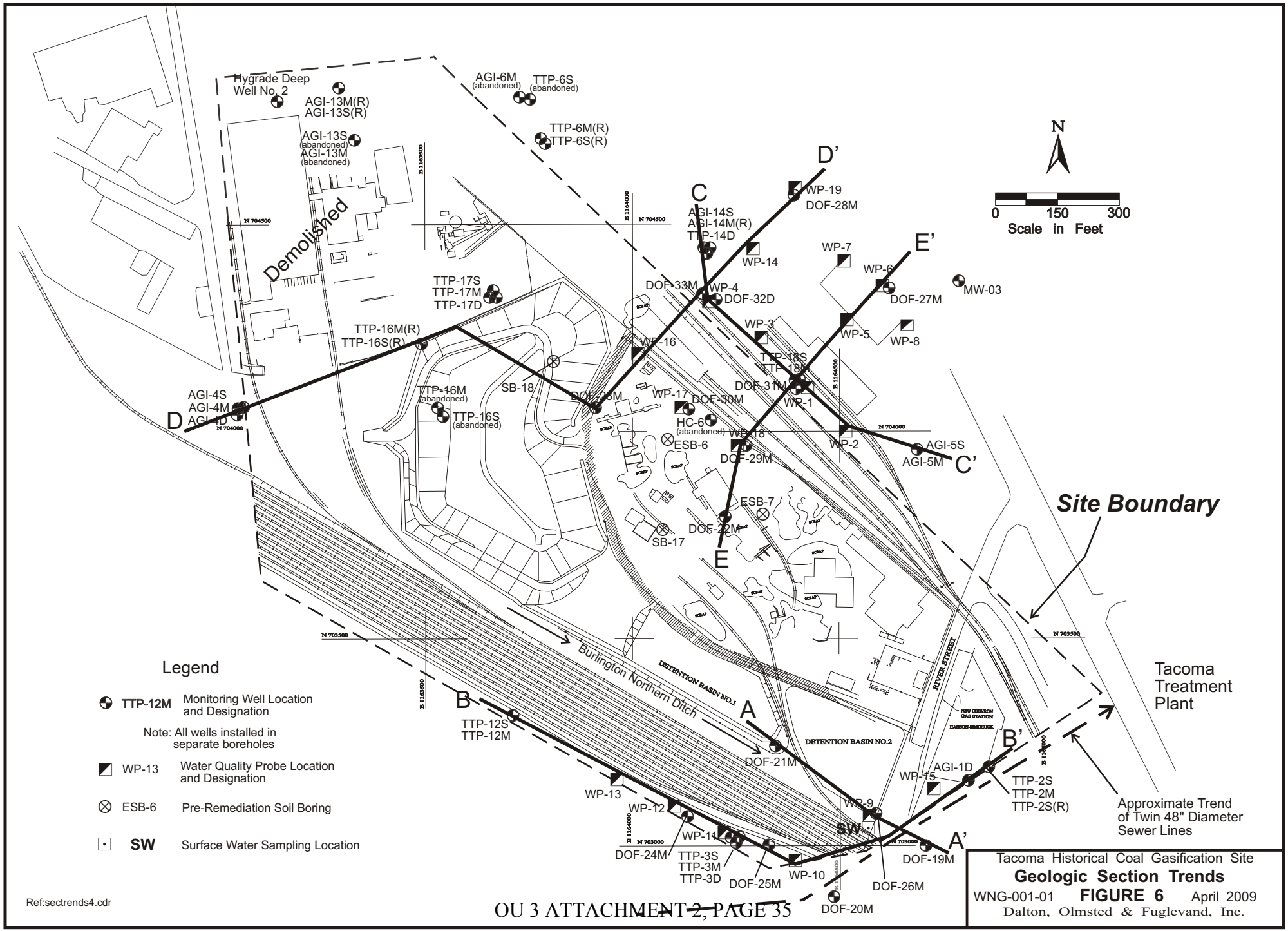


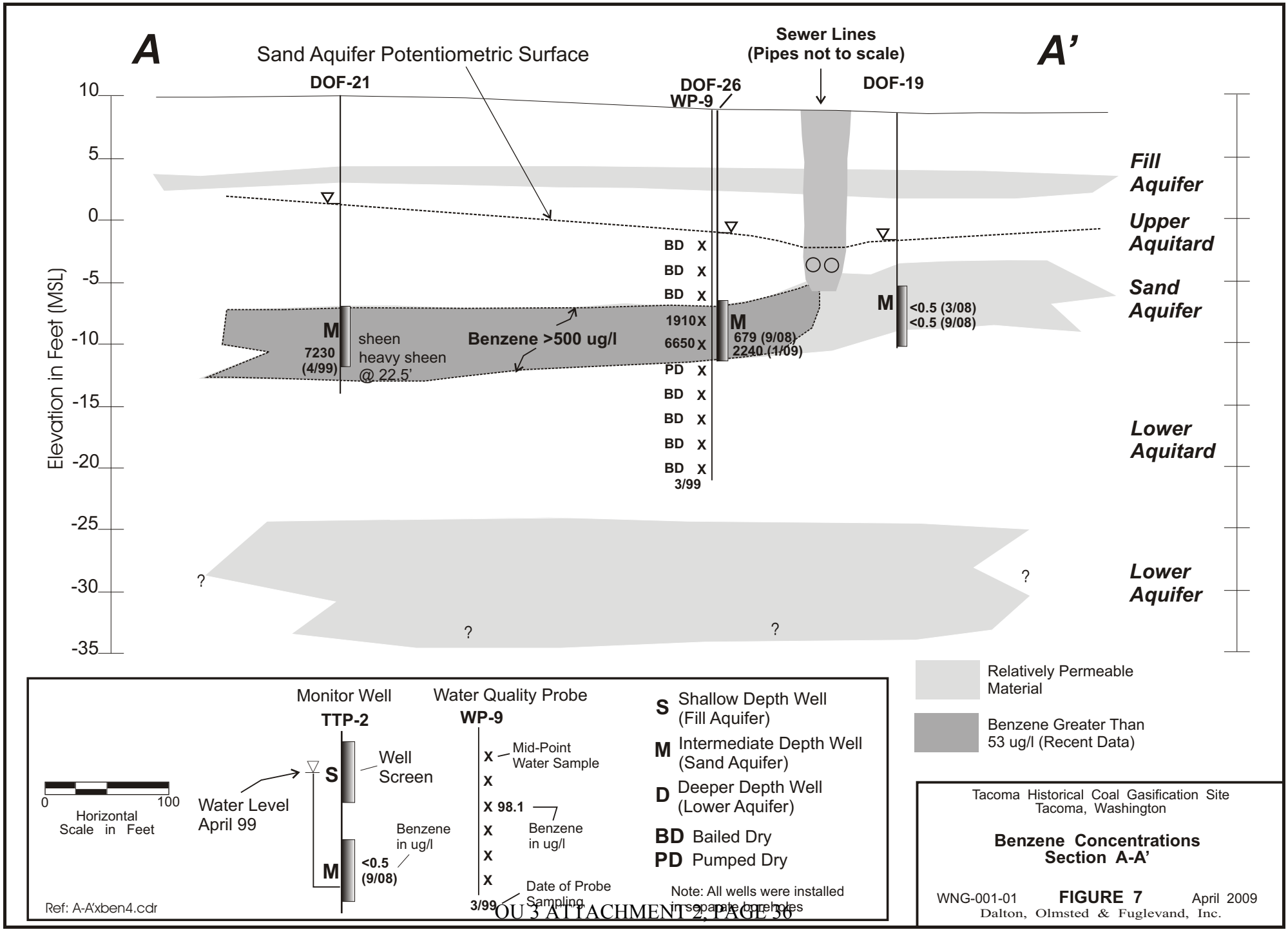
Tacoma Historical Coal Gasification Site
Tacoma, Washington

FINISHED SITE PLAN

WNG-001-02 **FIGURE 5** September 1995
Dalton, Olmsted & Fuglevand, Inc.

ref: fsite4.cdr

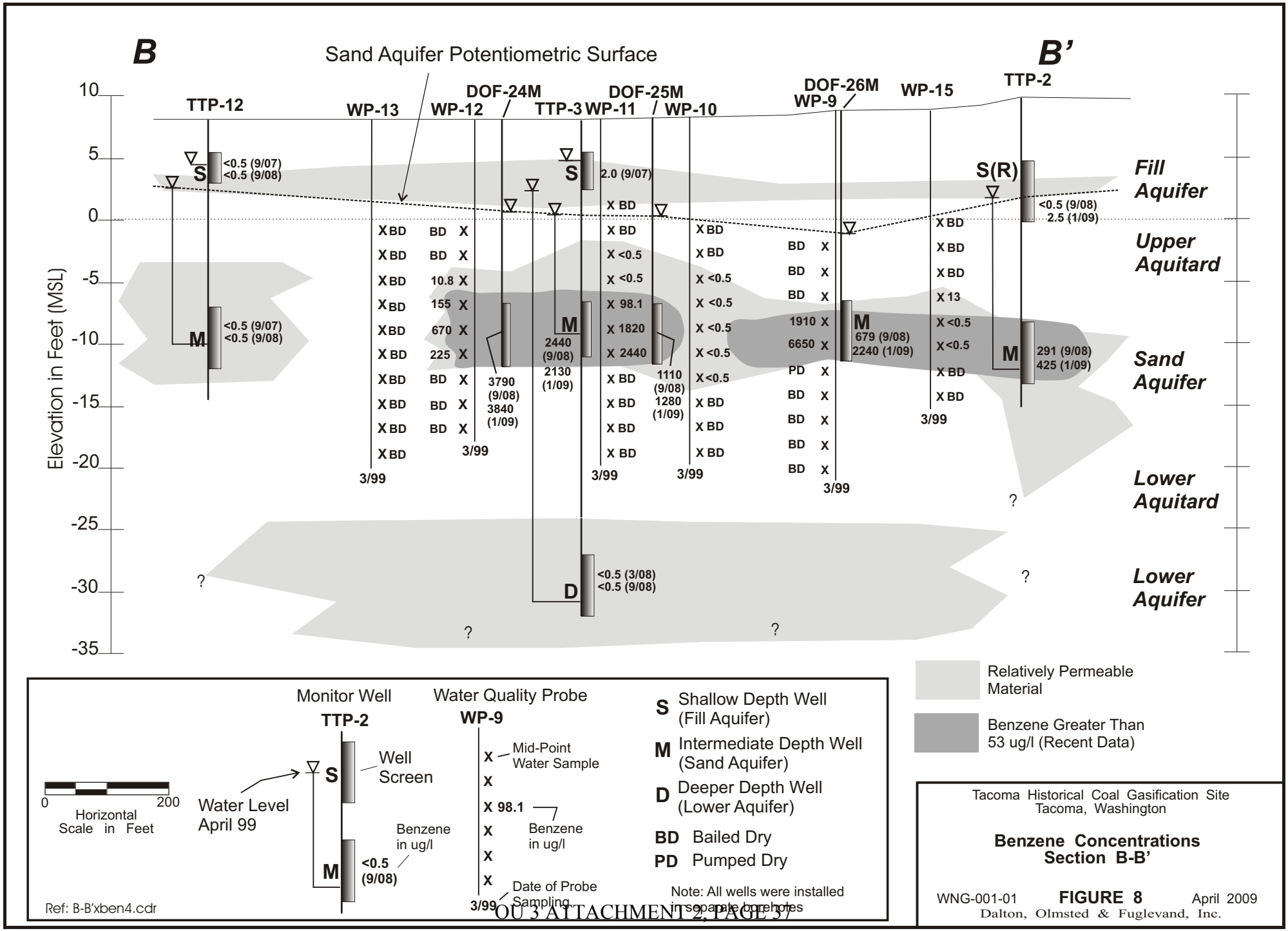

Hygrade Deep Well No. 2
AGI-13M(R)
AGI-13S(R)
AGI-13S (abandoned)
AGI-13M (abandoned)
AGI-6M (abandoned)
TTP-6S (abandoned)
TTP-6M(R)
TTP-6S(R)
Demolished
TTP-17S
TTP-17M
TTP-17D
TTP-16M(R)
TTP-16S(R)
TTP-16M (abandoned)
TTP-16S (abandoned)
SB-18
AGI-4S
AGI-4M
AGI-4D
D
C
AGI-14S
AGI-14M(R)
TTP-14D
D'
WP-19
DOF-28M
WP-14
WP-7
E'
WP-6
DOF-27M
MW-03
DOF-33M
WP-4
DOF-32D
WP-3
WP-5
WP-8
WP-16
TTP-18S
TTP-18M
DOF-31M
WP-1
WP-17
DOF-30M
HC-6 (abandoned)
WP-18
ESB-6
DOF-29M
WP-2
AGI-5S
AGI-5M
C'
ESB-7
DOF-22M
SB-17
E
N
0 150 300
Scale in Feet
Site Boundary
Burlington Northern Ditch
DETENTION BASIN NO.1
DETENTION BASIN NO.2
RIVER STREET
NEW CHEVRON GAS STATION
HANSON-SIMCHUCK
Tacoma Treatment Plant
B
TTP-12S
TTP-12M
A
DOF-21M
B'
AGI-1D
WP-15
TTP-2S
TTP-2M
TTP-2S(R)
WP-13
WP-12
WP-11
WP-9
SW
A'
DOF-24M
TTP-3S
TTP-3M
TTP-3D
DOF-25M
WP-10
DOF-26M
DOF-19M
DOF-20M
Approximate Trend of Twin 48" Diameter Sewer Lines
Legend
TTP-12M Monitoring Well Location and Designation
Note: All wells installed in separate boreholes
WP-13 Water Quality Probe Location and Designation
ESB-6 Pre-Remediation Soil Boring
SW Surface Water Sampling Location
Ref:sectrends4.cdr
Tacoma Historical Coal Gasification Site
Geologic Section Trends
WNG-001-01 FIGURE 6 April 2009
Dalton, Olmsted & Fuglevand, Inc.

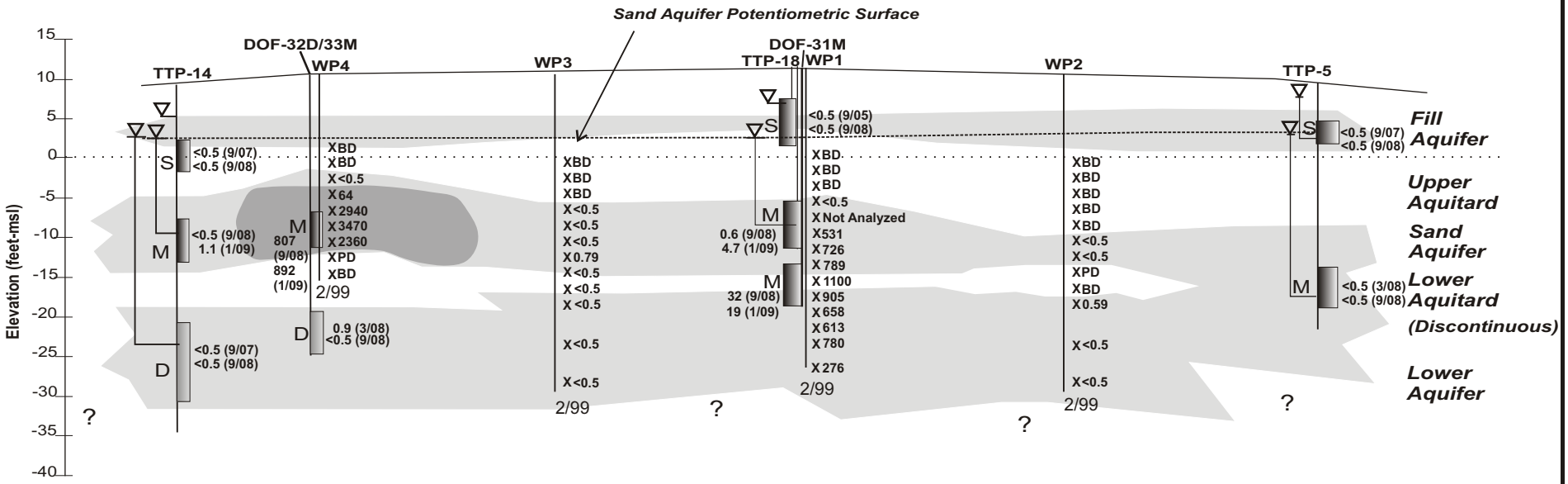


Tacoma Historical Coal Gasification Site
Tacoma, Washington

Benzene Concentrations
Section A-A'

WNG-001-01 **FIGURE 7** April 2009
Dalton, Olmsted & Fuglevand, Inc.


B
B'
Sand Aquifer Potentiometric Surface
Elevation in Feet (MSL)
10
5
0
-5
-10
-15
-20
-25
-30
-35
TTP-12
WP-13
WP-12
DOF-24M
TTP-3
DOF-25M
WP-11
WP-10
DOF-26M
WP-9
WP-15
TTP-2
S
<0.5 (9/07)
<0.5 (9/08)
M
<0.5 (9/07)
<0.5 (9/08)
S
2.0 (9/07)
M
2440 (9/08)
2130 (1/09)
D
<0.5 (3/08)
<0.5 (9/08)
M
679 (9/08)
2240 (1/09)
S(R)
<0.5 (9/08)
2.5 (1/09)
M
291 (9/08)
425 (1/09)
3790 (9/08)
3840 (1/09)
1110 (9/08)
1280 (1/09)
3/99
Fill Aquifer
Upper Aquitard
Sand Aquifer
Lower Aquitard
Lower Aquifer
Relatively Permeable Material
Benzene Greater Than 53 ug/l (Recent Data)
Monitor Well
TTP-2
Water Quality Probe
WP-9
Well Screen
Water Level April 99
Benzene in ug/l
<0.5 (9/08)
Mid-Point Water Sample
X 98.1
Benzene in ug/l
Date of Probe Sampling
0
200
Horizontal Scale in Feet
S Shallow Depth Well (Fill Aquifer)
M Intermediate Depth Well (Sand Aquifer)
D Deeper Depth Well (Lower Aquifer)
BD Bailed Dry
PD Pumped Dry
Note: All wells were installed in separate boreholes
Ref: B-B'xben4.cdr
Tacoma Historical Coal Gasification Site
Tacoma, Washington
Benzene Concentrations
Section B-B'
WNG-001-01
FIGURE 8
April 2009
Dalton, Olmsted & Fuglevand, Inc.

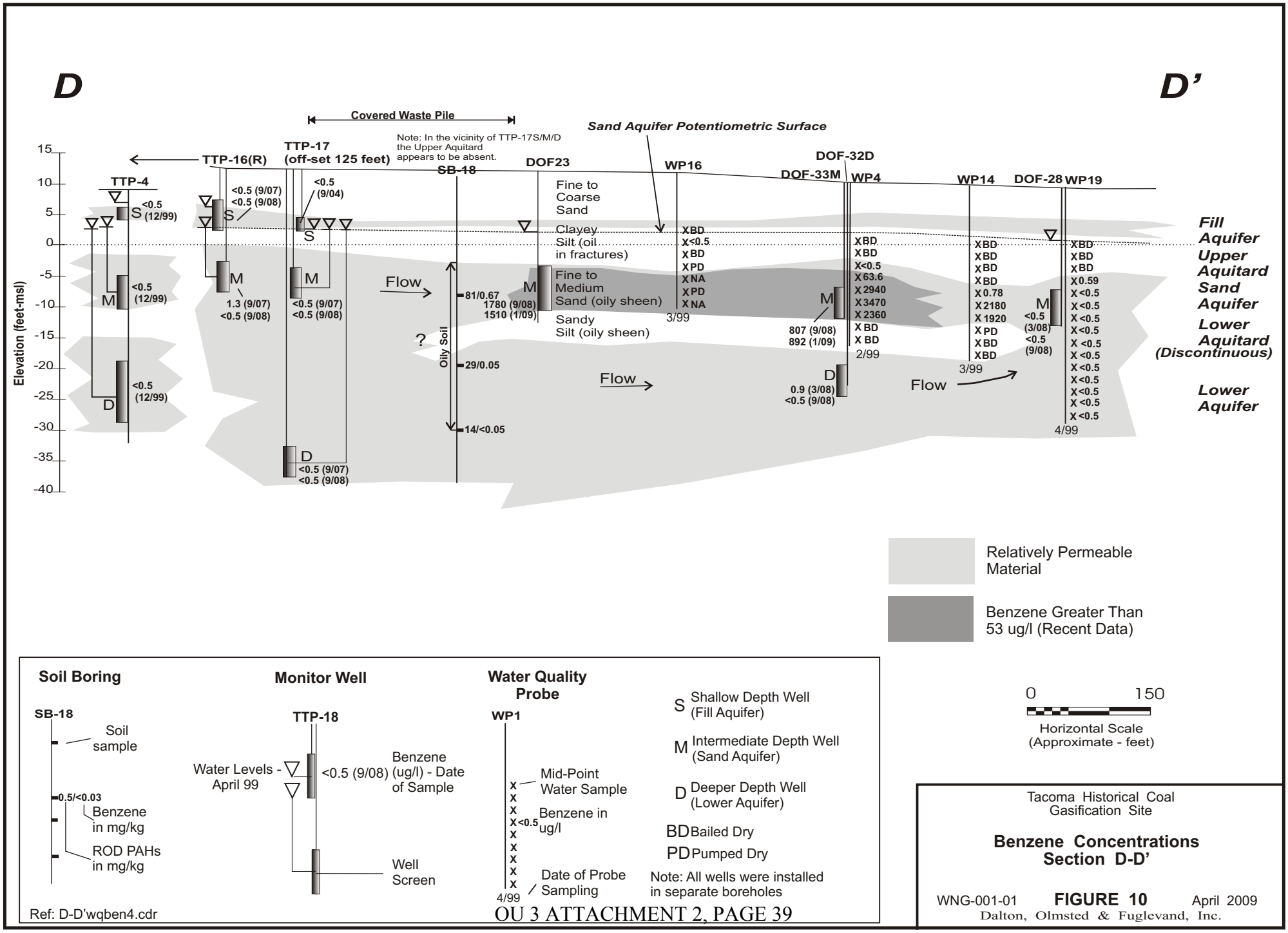


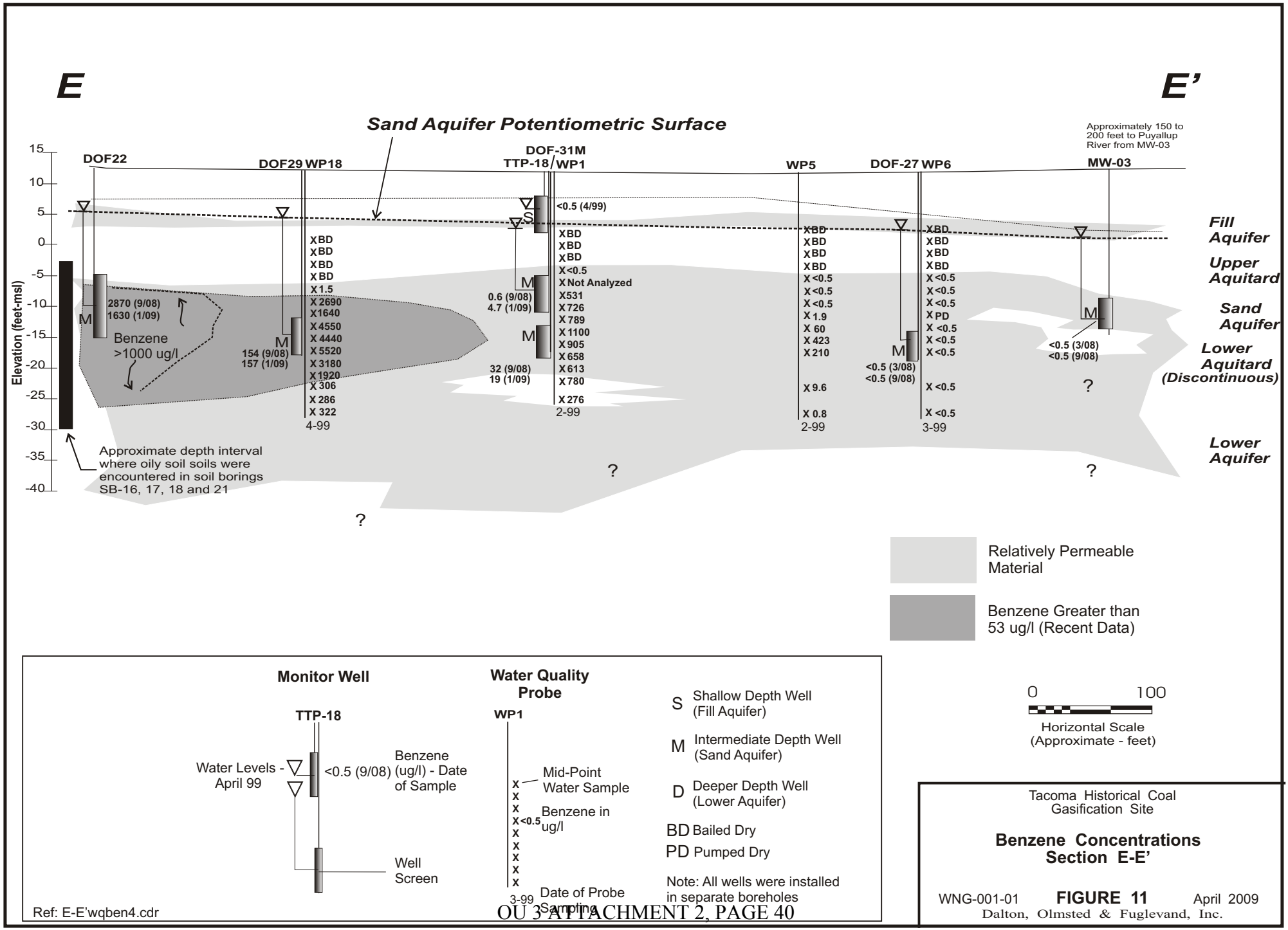
Tacoma Historical Coal Gasification Site

Benzene Concentrations Section C-C'

WNG-001-01 **FIGURE 9** April 2009

Dalton, Olmsted & Fuglevand, Inc.


D
D'
Covered Waste Pile
Sand Aquifer Potentiometric Surface
Note: In the vicinity of TTP-17S/M/D the Upper Aquitard appears to be absent.
Elevation (feet-msl)
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
TTP-4
TTP-16(R)
TTP-17 (off-set 125 feet)
SB-18
DOF23
WP16
DOF-33M
DOF-32D
WP4
WP14
DOF-28
WP19
<0.5 (12/99)
<0.5 (9/07)
<0.5 (9/08)
<0.5 (9/04)
1.3 (9/07)
<0.5 (9/08)
<0.5 (9/07)
<0.5 (9/08)
Flow
81/0.67
1780 (9/08)
1510 (1/09)
29/0.05
14/<0.05
Oily Soil
?
Fine to Coarse Sand
Clayey Silt (oil in fractures)
Fine to Medium Sand (oily sheen)
Sandy Silt (oily sheen)
3/99
807 (9/08)
892 (1/09)
0.9 (3/08)
<0.5 (9/08)
2/99
0.78
2180
1920
3/99
<0.5 (3/08)
<0.5 (9/08)
0.59
4/99
Fill Aquifer
Upper Aquitard
Sand Aquifer
Lower Aquitard (Discontinuous)
Lower Aquifer
Relatively Permeable Material
Benzene Greater Than 53 ug/l (Recent Data)
Soil Boring
SB-18
Soil sample
0.5/<0.03
Benzene in mg/kg
ROD PAHs in mg/kg
Monitor Well
TTP-18
Water Levels - April 99
<0.5 (9/08)
Benzene (ug/l) - Date of Sample
Well Screen
Water Quality Probe
WP1
Mid-Point Water Sample
Benzene in ug/l
Date of Probe Sampling
4/99
S Shallow Depth Well (Fill Aquifer)
M Intermediate Depth Well (Sand Aquifer)
D Deeper Depth Well (Lower Aquifer)
BD Bailed Dry
PD Pumped Dry
Note: All wells were installed in separate boreholes
Ref: D-D'wqben4.cdr
0
150
Horizontal Scale (Approximate - feet)
Tacoma Historical Coal Gasification Site
Benzene Concentrations Section D-D'
WNG-001-01
FIGURE 10
April 2009
Dalton, Olmsted & Fuglevand, Inc.

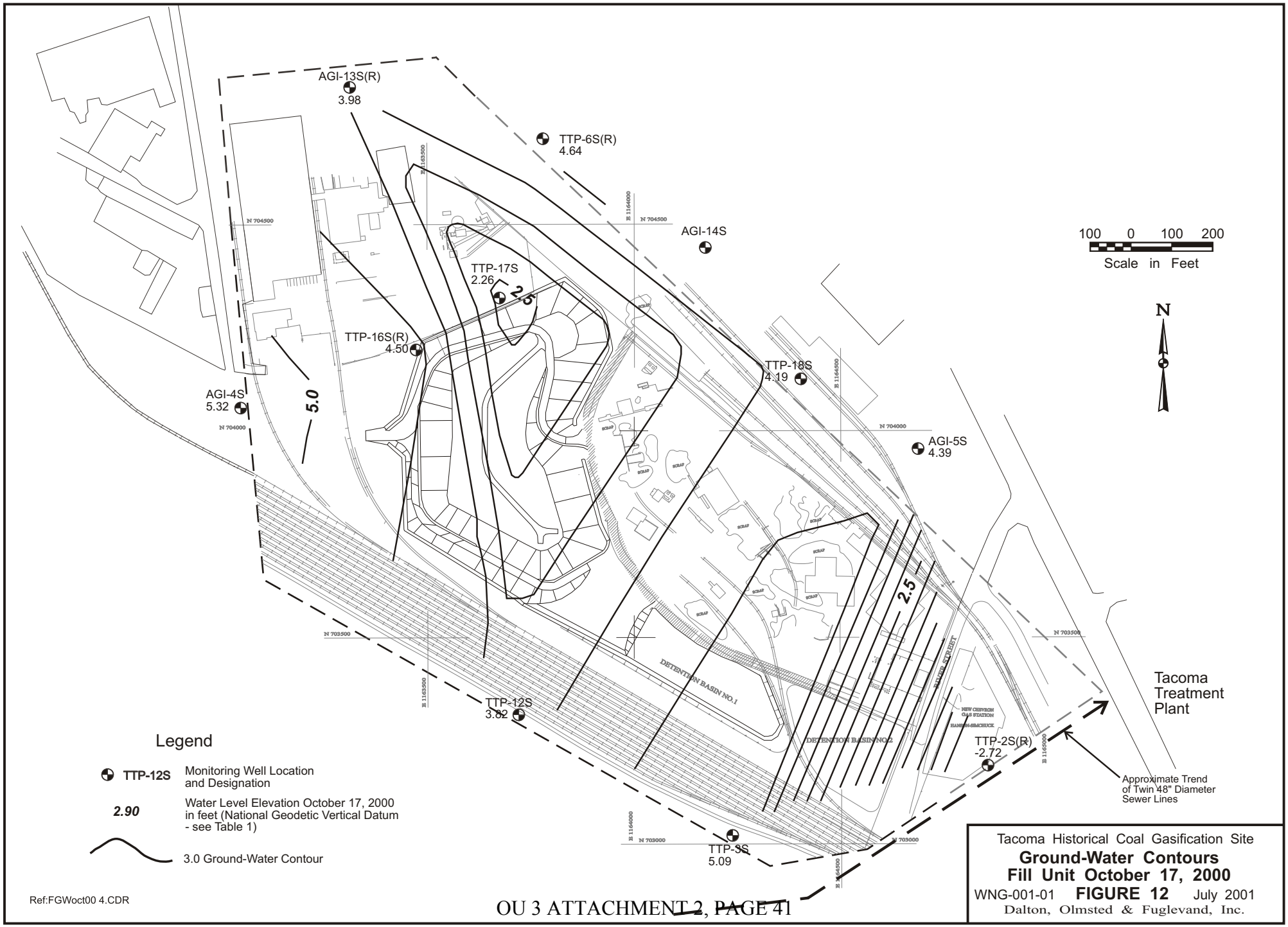


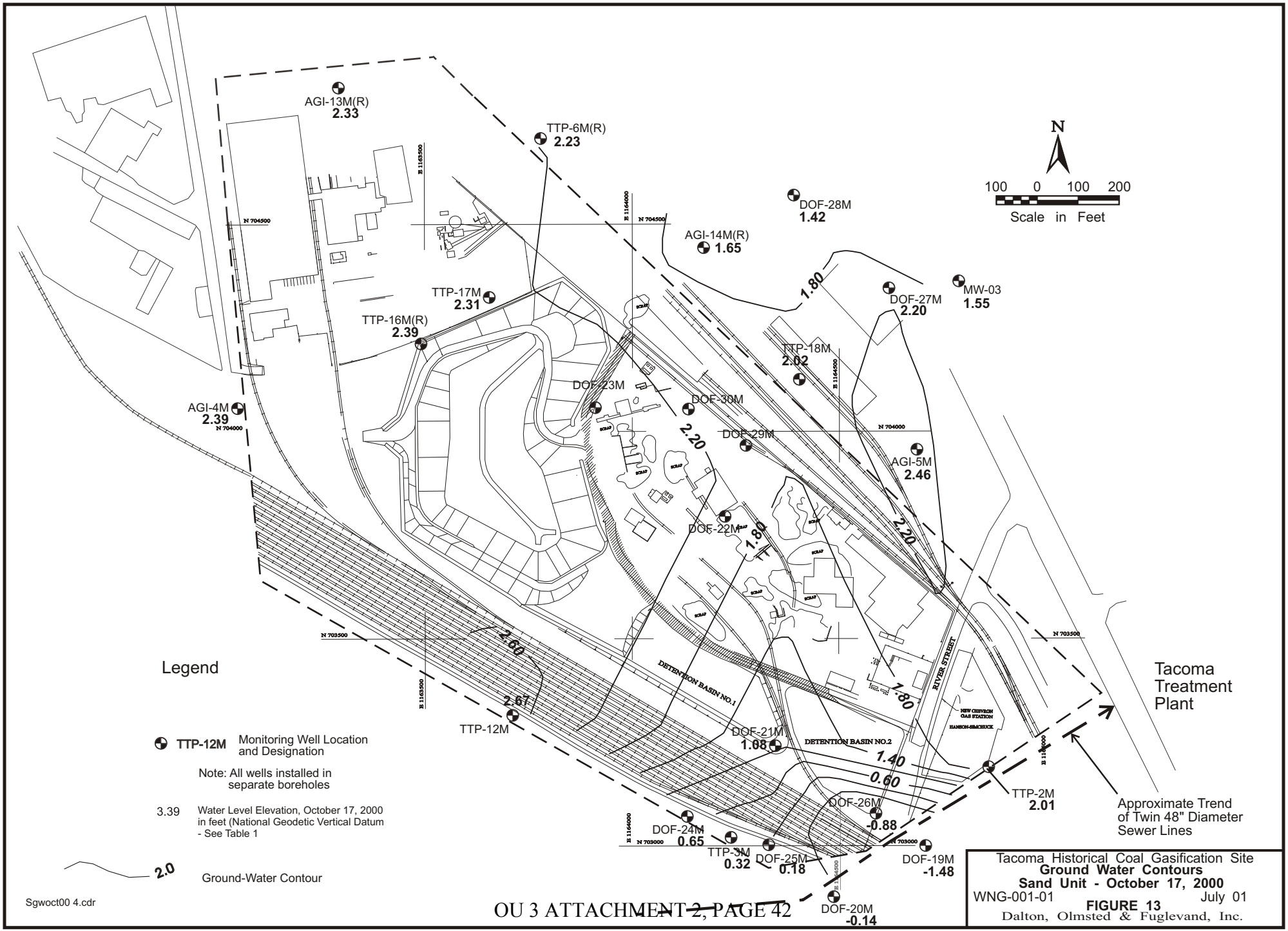
Tacoma Historical Coal Gasification Site

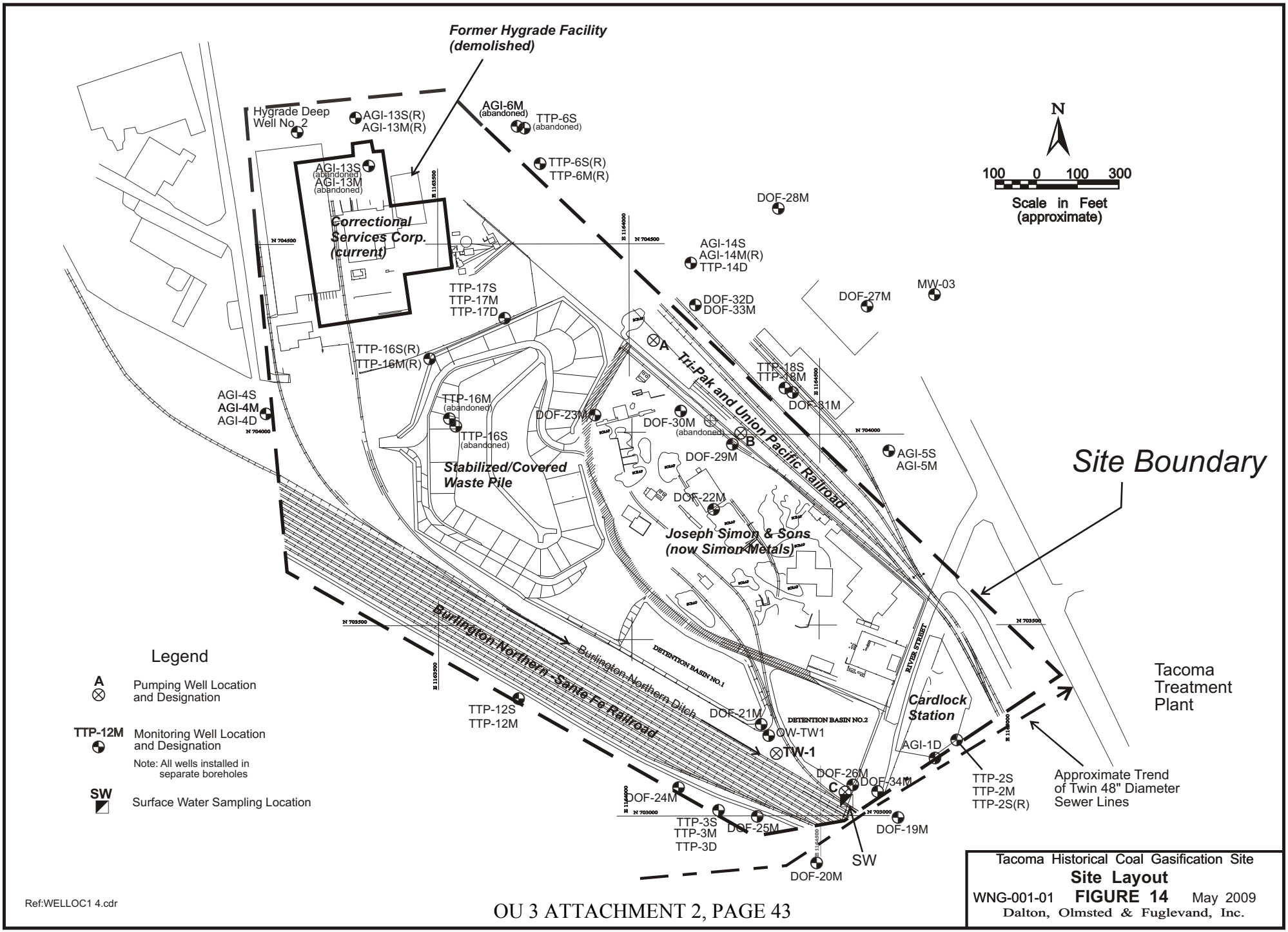
Benzene Concentrations Section E-E'

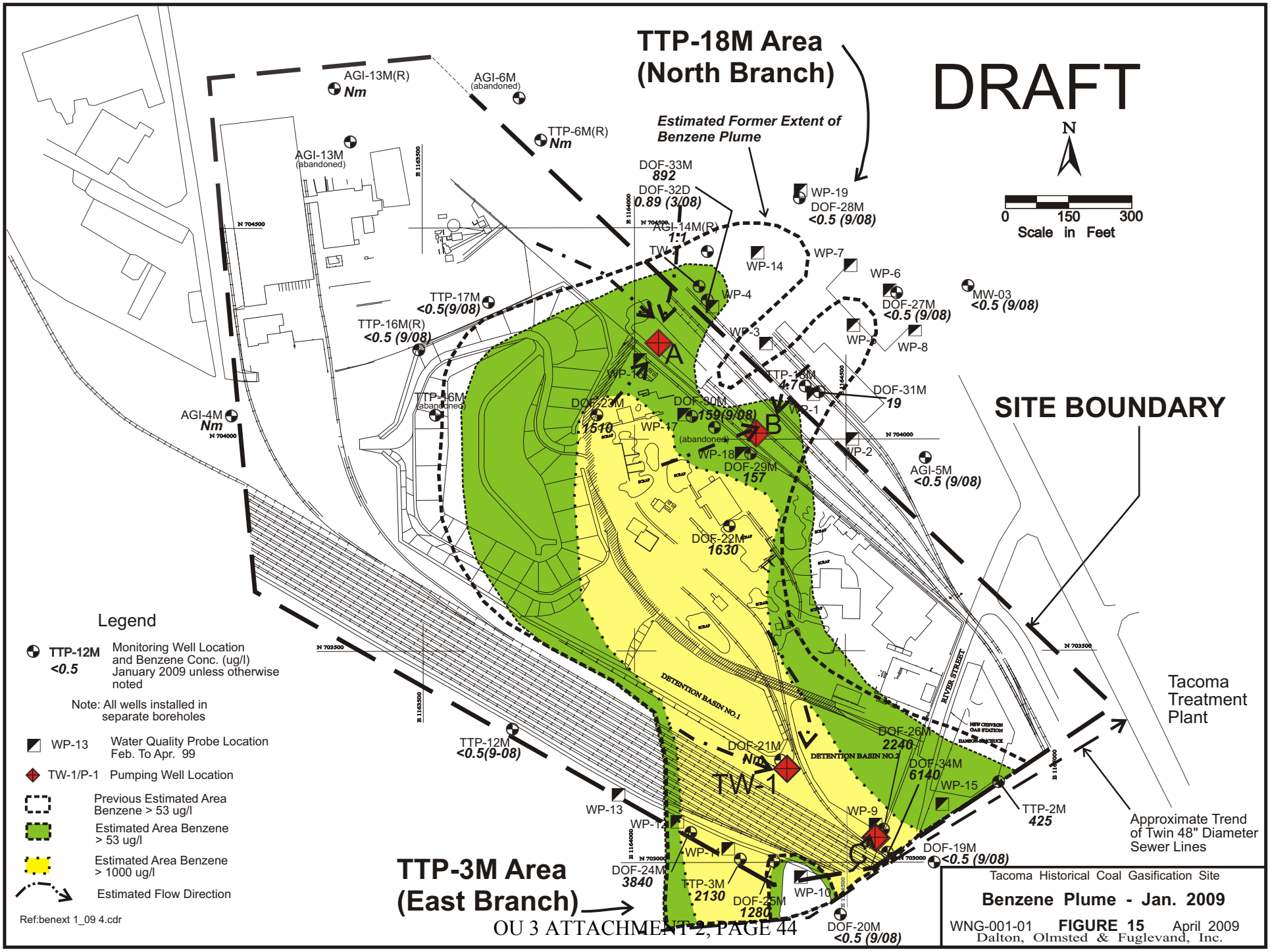
WNG-001-01 **FIGURE 11** April 2009

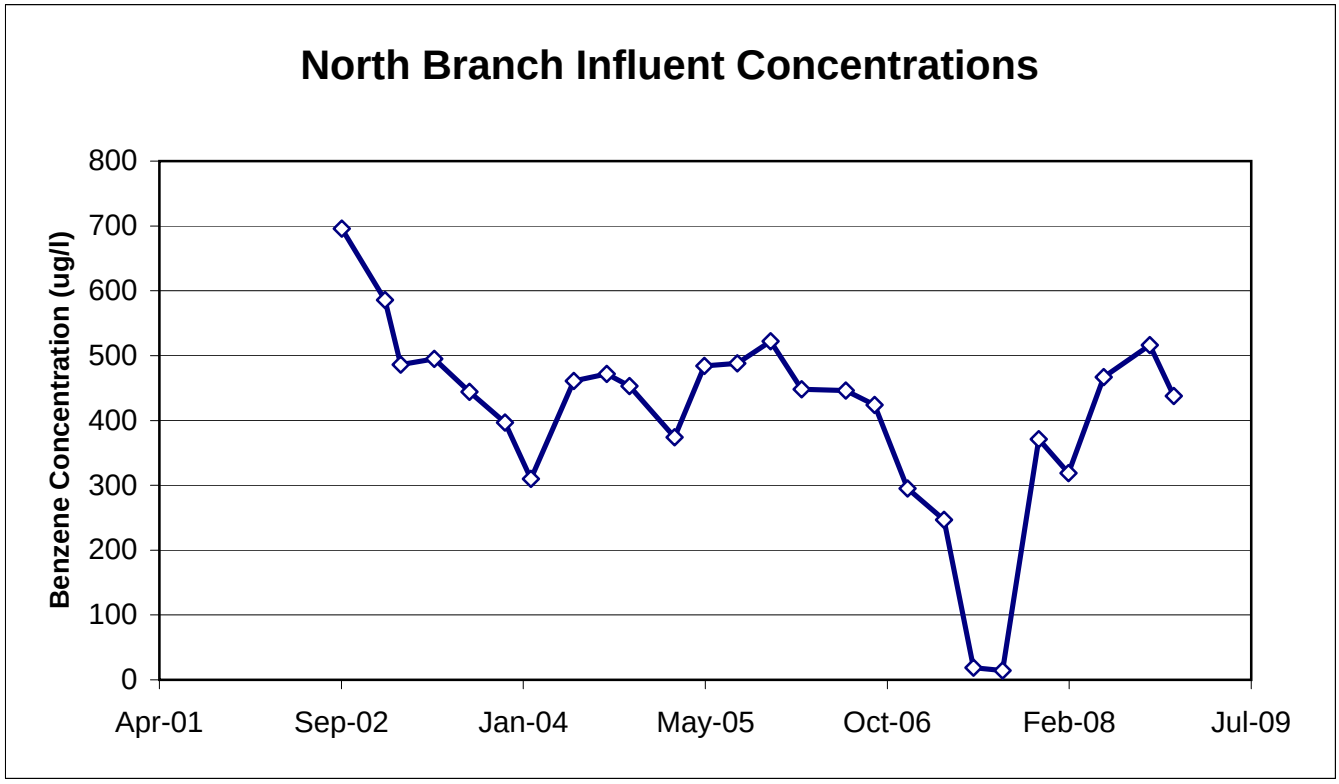
Dalton, Olmsted & Fuglevand, Inc.


AGI-13S(R)
3.98
TTP-6S(R)
4.64
AGI-14S
TTP-17S
2.26
2.5
TTP-16S(R)
4.50
AGI-4S
5.32
5.0
TTP-18S
4.19
AGI-5S
4.39
2.5
TTP-12S
3.82
TTP-3S
5.09
TTP-2S(R)
-2.72
DETENTION BASIN NO.1
DETENTION BASIN NO.2
SALMON STREET
NEW CHEVRON GAS STATION
SCRAP
N 704500
N 704000
N 703500
N 703000
E 1163500
E 1164000
E 1164500
E 1165000
100 0 100 200
Scale in Feet
N
Tacoma Treatment Plant
Approximate Trend of Twin 48" Diameter Sewer Lines
Legend
TTP-12S Monitoring Well Location and Designation
2.90 Water Level Elevation October 17, 2000 in feet (National Geodetic Vertical Datum - see Table 1)
3.0 Ground-Water Contour
Ref:FGWoct00 4.CDR
Tacoma Historical Coal Gasification Site
Ground-Water Contours
Fill Unit October 17, 2000
WNG-001-01 FIGURE 12 July 2001
Dalton, Olmsted & Fuglevand, Inc.


N
100 0 100 200
Scale in Feet
AGI-13M(R)
2.33
TTP-6M(R)
2.23
DOF-28M
1.42
AGI-14M(R)
1.65
MW-03
1.55
DOF-27M
2.20
TTP-17M
2.31
TTP-16M(R)
2.39
TTP-18M
2.02
DOF-23M
DOF-30M
AGI-4M
2.39
DOF-29M
AGI-5M
2.46
DOF-22M
1.80
2.20
2.60
2.67
TTP-12M
DETENTION BASIN NO.1
DETENTION BASIN NO.2
RIVER STREET
NEW CHEVRON GAS STATION
HANSON-SIMCHUCK
DOF-21M
1.08
1.40
0.60
DOF-26M
-0.88
TTP-2M
2.01
DOF-24M
0.65
TTP-3M
0.32
DOF-25M
0.18
DOF-19M
-1.48
DOF-20M
-0.14
Tacoma Treatment Plant
Approximate Trend of Twin 48" Diameter Sewer Lines
Legend
TTP-12M Monitoring Well Location and Designation
Note: All wells installed in separate boreholes
3.39 Water Level Elevation, October 17, 2000 in feet (National Geodetic Vertical Datum - See Table 1
2.0 Ground-Water Contour
Sgwoct00 4.cdr
Tacoma Historical Coal Gasification Site
Ground Water Contours
Sand Unit - October 17, 2000
WNG-001-01
July 01
FIGURE 13
Dalton, Olmsted & Fuglevand, Inc.


Former Hygrade Facility (demolished)
Hygrade Deep Well No. 2
AGI-13S(R)
AGI-13M(R)
AGI-6M (abandoned)
TTP-6S (abandoned)
TTP-6S(R)
TTP-6M(R)
AGI-13S (abandoned)
AGI-13M (abandoned)
Correctional Services Corp. (current)
N
100 0 100 300
Scale in Feet (approximate)
DOF-28M
AGI-14S
AGI-14M(R)
TTP-14D
MW-03
DOF-27M
DOF-32D
DOF-33M
TTP-17S
TTP-17M
TTP-17D
TTP-16S(R)
TTP-16M(R)
A
Tri-Pak and Union Pacific Railroad
TTP-18S
TTP-18M
DOF-31M
AGI-4S
AGI-4M
AGI-4D
TTP-16M (abandoned)
TTP-16S (abandoned)
DOF-23M
DOF-30M (abandoned)
B
DOF-29M
AGI-5S
AGI-5M
Site Boundary
Stabilized/Covered Waste Pile
DOF-22M
Joseph Simon & Sons (now Simon Metals)
Burlington Northern Santa Fe Railroad
Burlington Northern Ditch
DETENTION BASIN NO.1
DETENTION BASIN NO.2
RIVER STREET
Cardlock Station
Tacoma Treatment Plant
TTP-12S
TTP-12M
DOF-21M
QW-TW1
TW-1
AGI-1D
DOF-26M
C
DOF-34M
TTP-2S
TTP-2M
TTP-2S(R)
Approximate Trend of Twin 48" Diameter Sewer Lines
DOF-24M
TTP-3S
TTP-3M
TTP-3D
DOF-25M
DOF-19M
SW
DOF-20M
Legend
A Pumping Well Location and Designation
TTP-12M Monitoring Well Location and Designation
Note: All wells installed in separate boreholes
SW Surface Water Sampling Location
Ref:WELLOC1 4.cdr
Tacoma Historical Coal Gasification Site
Site Layout
WNG-001-01 FIGURE 14 May 2009
Dalton, Olmsted & Fuglevand, Inc.


TTP-18M Area
(North Branch)
DRAFT
N
0 150 300
Scale in Feet
Estimated Former Extent of Benzene Plume
AGI-13M(R)
Nm
AGI-6M
(abandoned)
TTP-6M(R)
Nm
AGI-13M
(abandoned)
DOF-33M
892
DOF-32D
0.89 (3/08)
AGI-14M(R)
1.1
WP-19
DOF-28M
<0.5 (9/08)
WP-14
WP-7
WP-6
DOF-27M
<0.5 (9/08)
MW-03
<0.5 (9/08)
WP-4
WP-3
WP-8
TTP-17M
<0.5(9/08)
TTP-16M(R)
<0.5 (9/08)
TTP-16M
(abandoned)
A
WP-16
DOF-23M
1510
DOF-30M
159(9/08)
WP-17
(abandoned)
B
TTP-18M
47
DOF-31M
19
WP-1
WP-2
AGI-4M
Nm
WP-18
DOF-29M
157
AGI-5M
<0.5 (9/08)
DOF-22M
1630
SITE BOUNDARY
Legend
TTP-12M
<0.5
Monitoring Well Location and Benzene Conc. (ug/l) January 2009 unless otherwise noted
Note: All wells installed in separate boreholes
WP-13
Water Quality Probe Location Feb. To Apr. 99
TW-1/P-1
Pumping Well Location
Previous Estimated Area Benzene > 53 ug/l
Estimated Area Benzene > 53 ug/l
Estimated Area Benzene > 1000 ug/l
Estimated Flow Direction
Ref:benext 1_09 4.cdr
TTP-12M
<0.5(9-08)
DETENTION BASIN NO.1
DETENTION BASIN NO.2
RIVER STREET
NEW CHEVRON GAS STATION
DOF-21M
Nm
TW-1
DOF-26M
2240
DOF-34M
6140
WP-15
TTP-2M
425
WP-13
WP-12
WP-9
C
WP-11
DOF-19M
<0.5 (9/08)
DOF-24M
3840
TTP-3M
2130
DOF-25M
1280
WP-10
DOF-20M
<0.5 (9/08)
TTP-3M Area
(East Branch)
Tacoma Treatment Plant
Approximate Trend of Twin 48" Diameter Sewer Lines
Tacoma Historical Coal Gasification Site
Benzene Plume - Jan. 2009
WNG-001-01 FIGURE 15 April 2009
Dalton, Olmsted & Fuglevand, Inc.



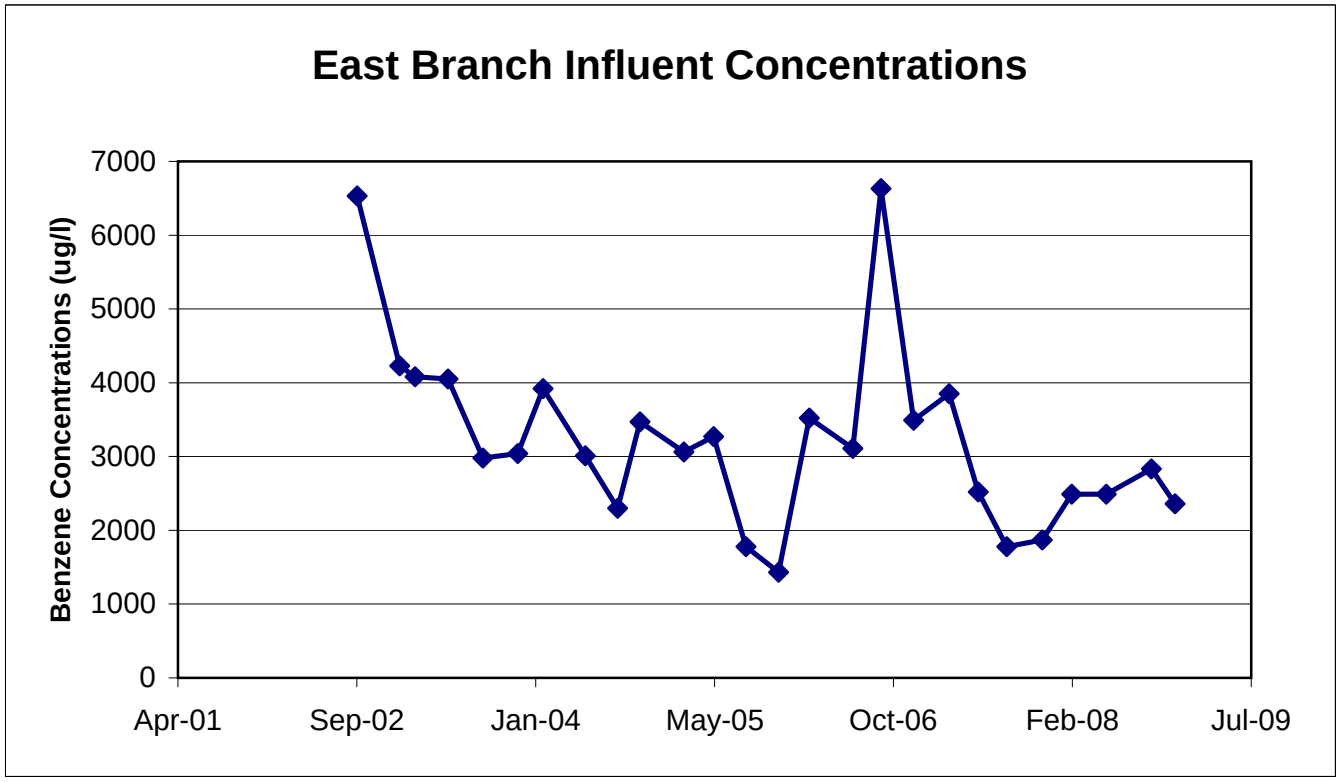
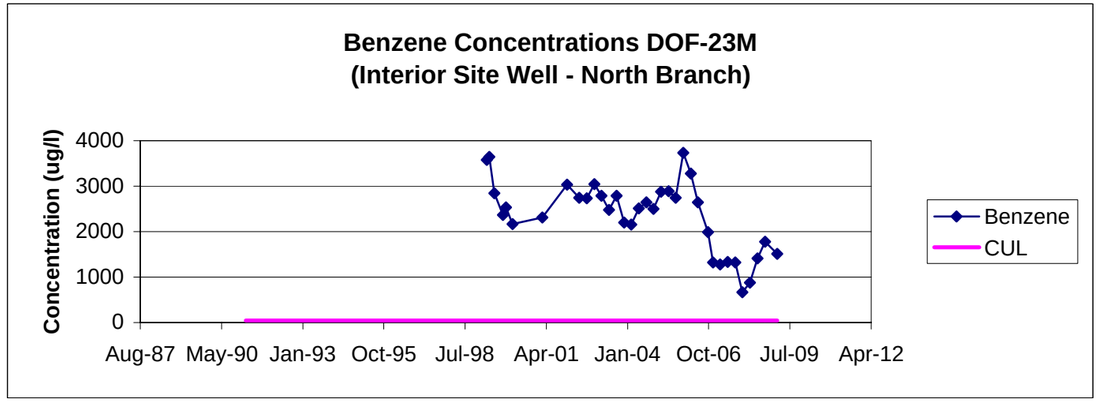
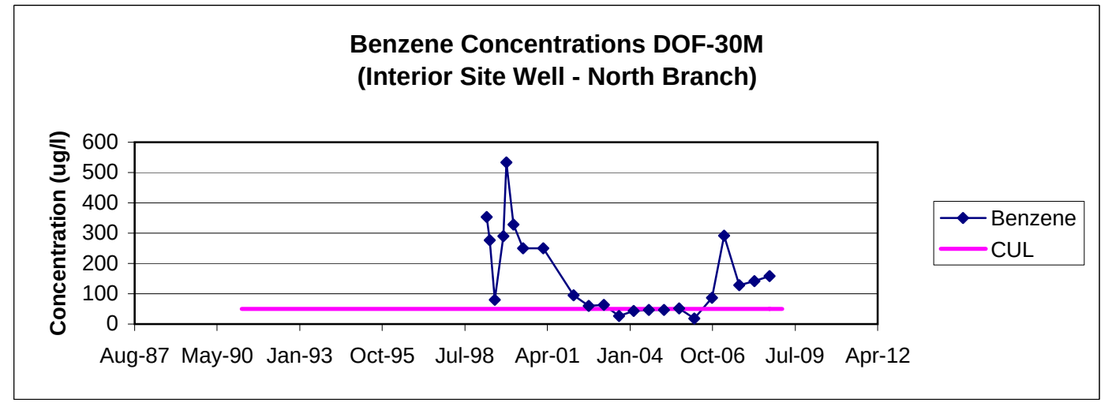
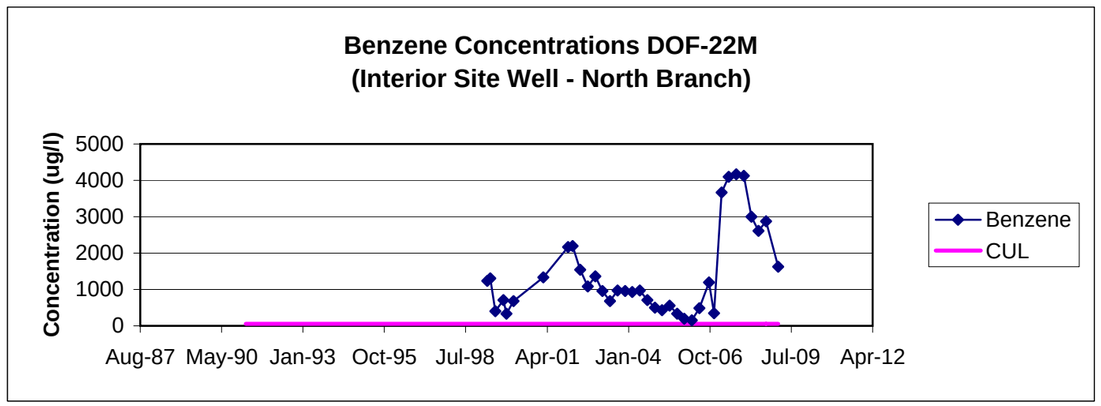
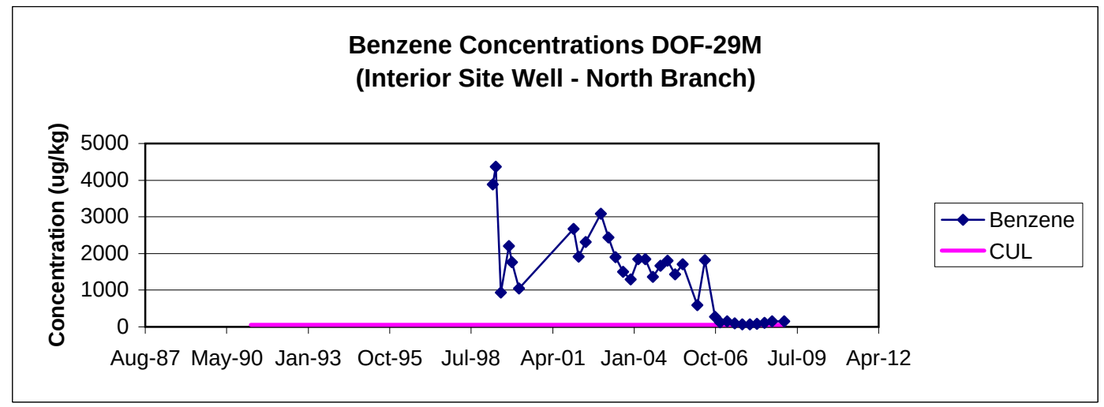


FIGURE 16
Treatment Plant Influent Concentrations









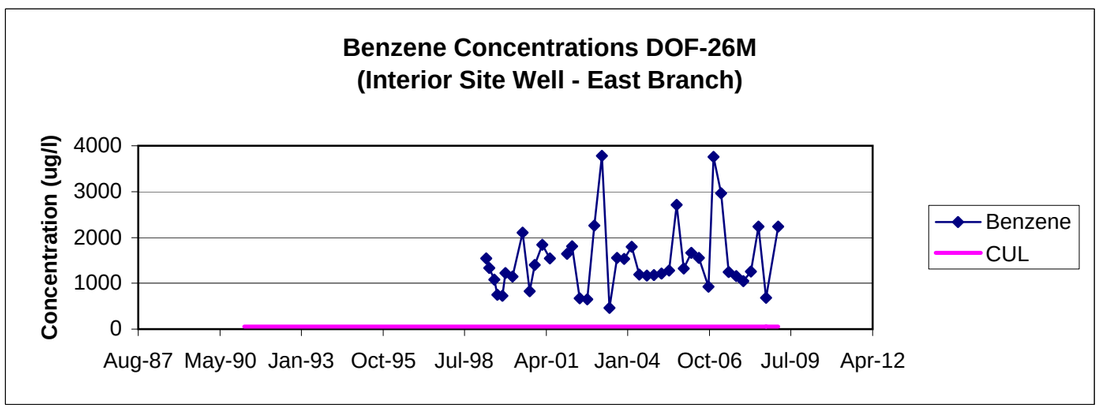
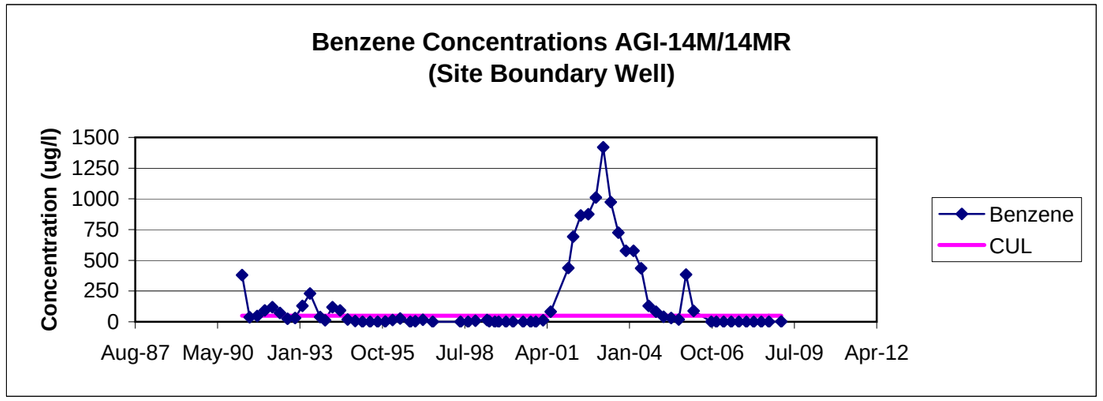
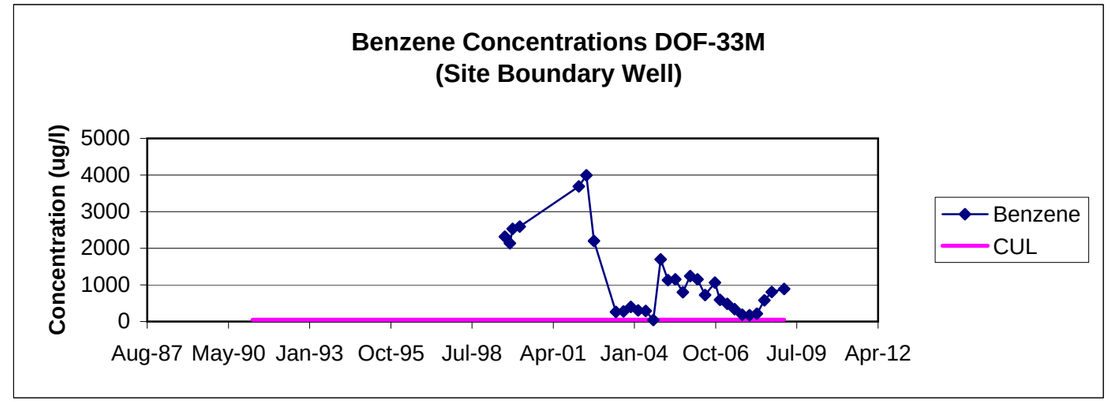
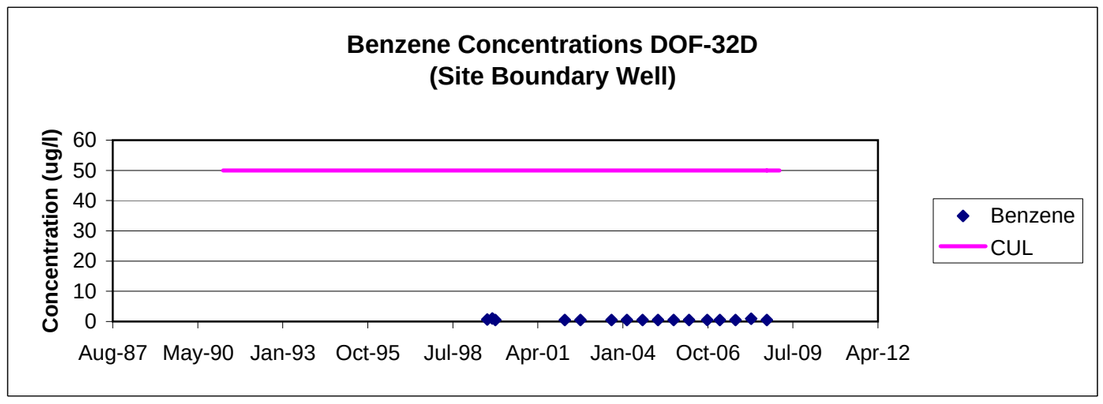
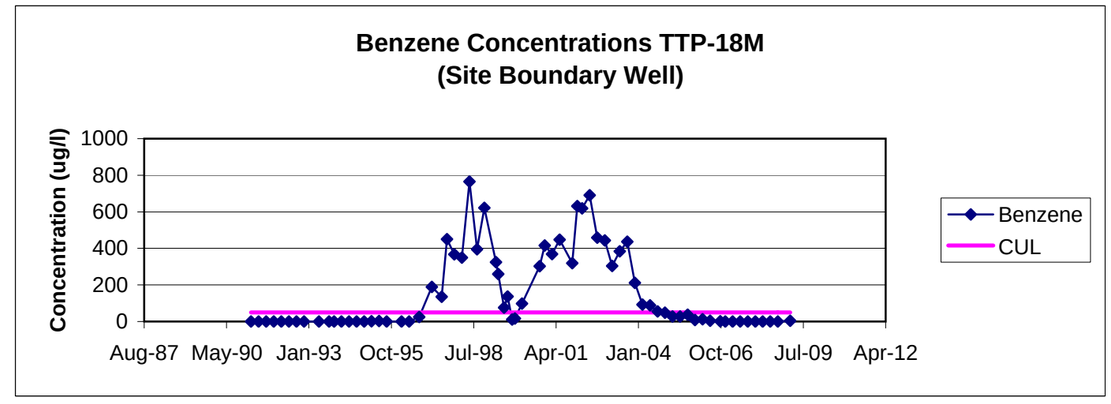


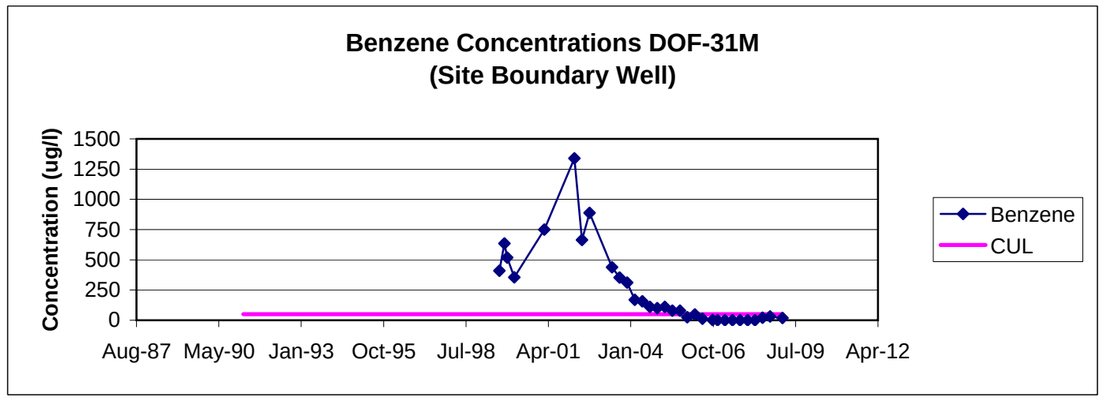
FIGURE 17
Benzene Trends - Interior Site Wells











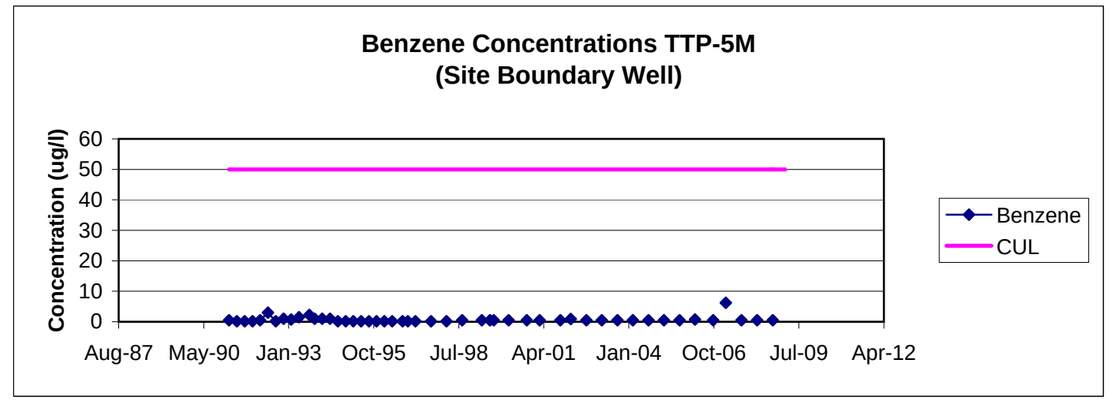


FIGURE 18
Benzene Trends - North Branch Area

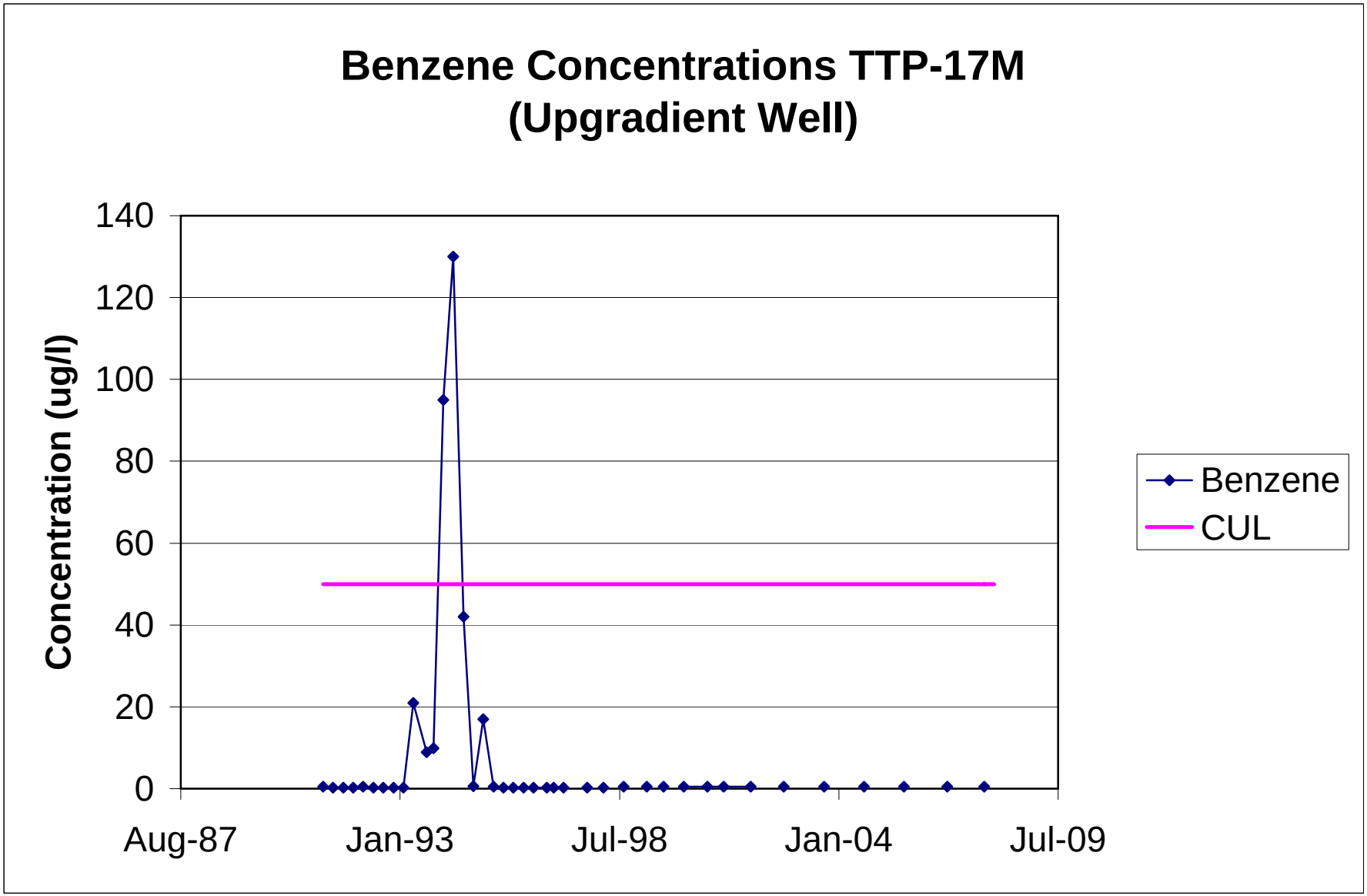
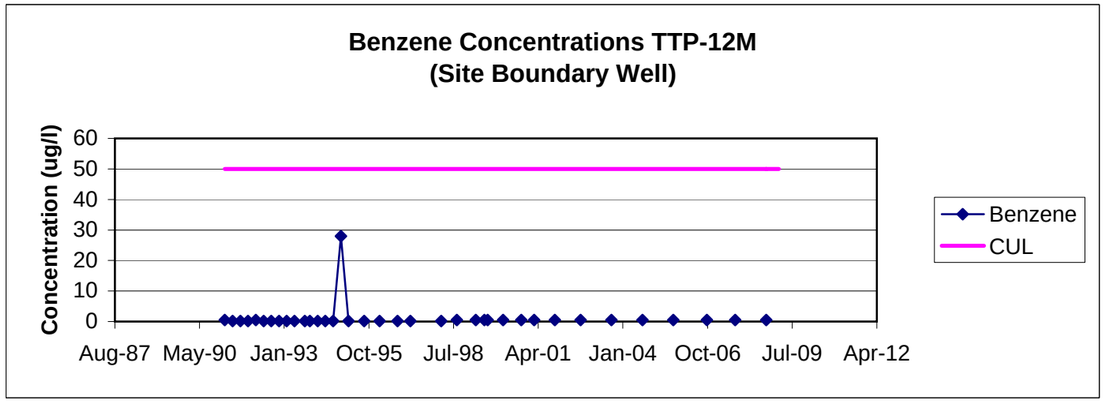
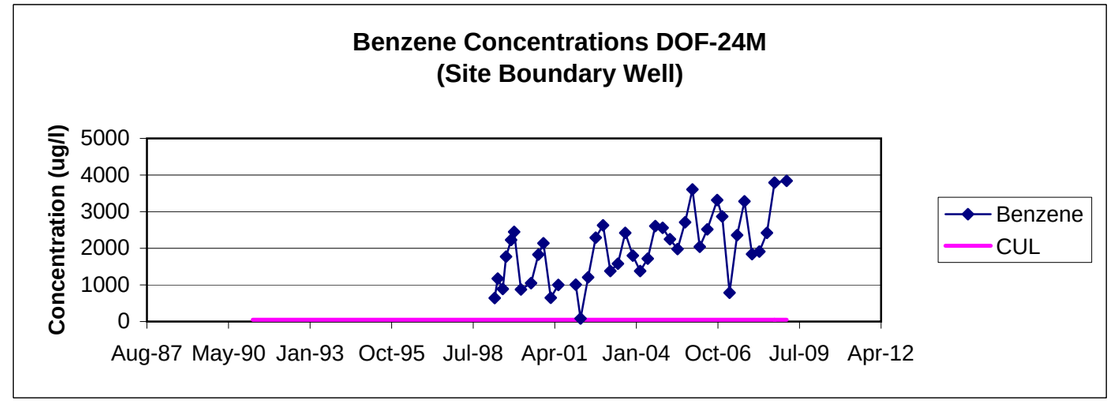
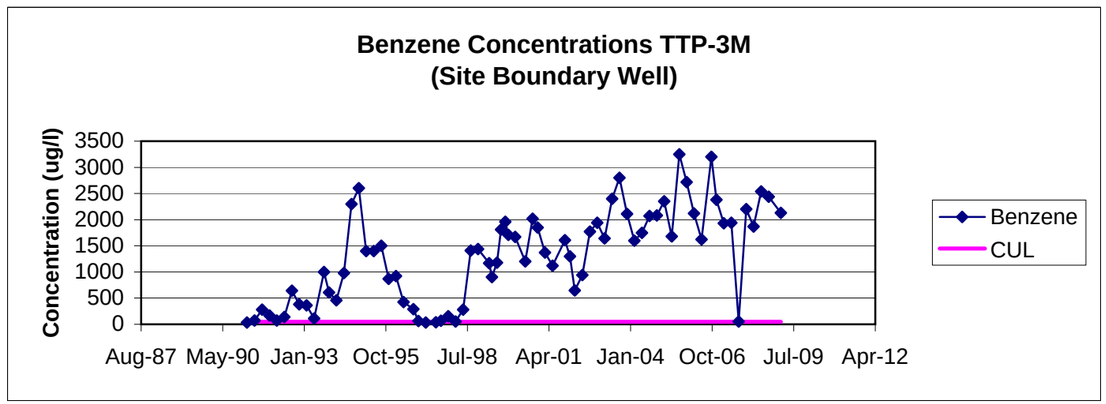
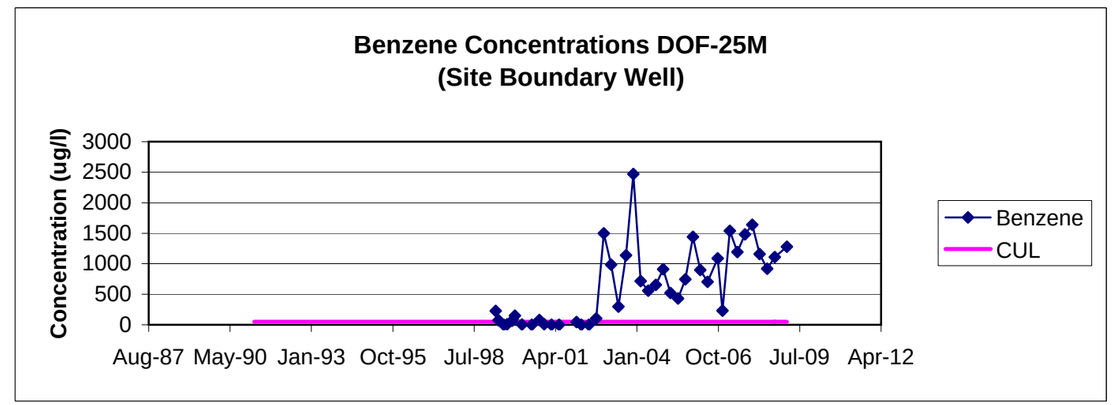


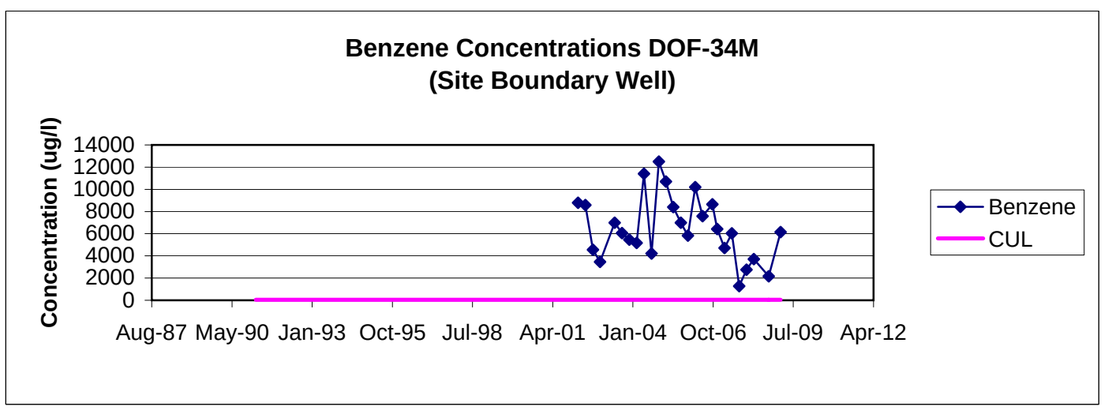
FIGURE 19
Benzene Trends - Well TTP-17M











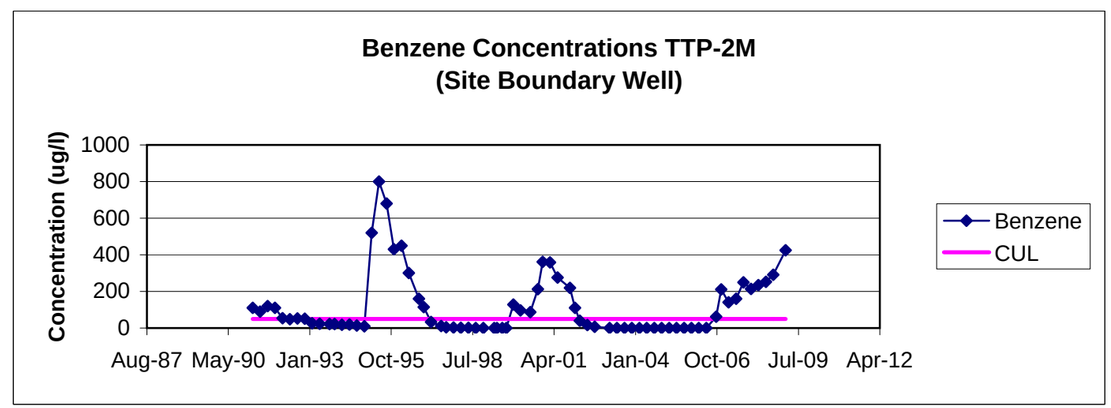
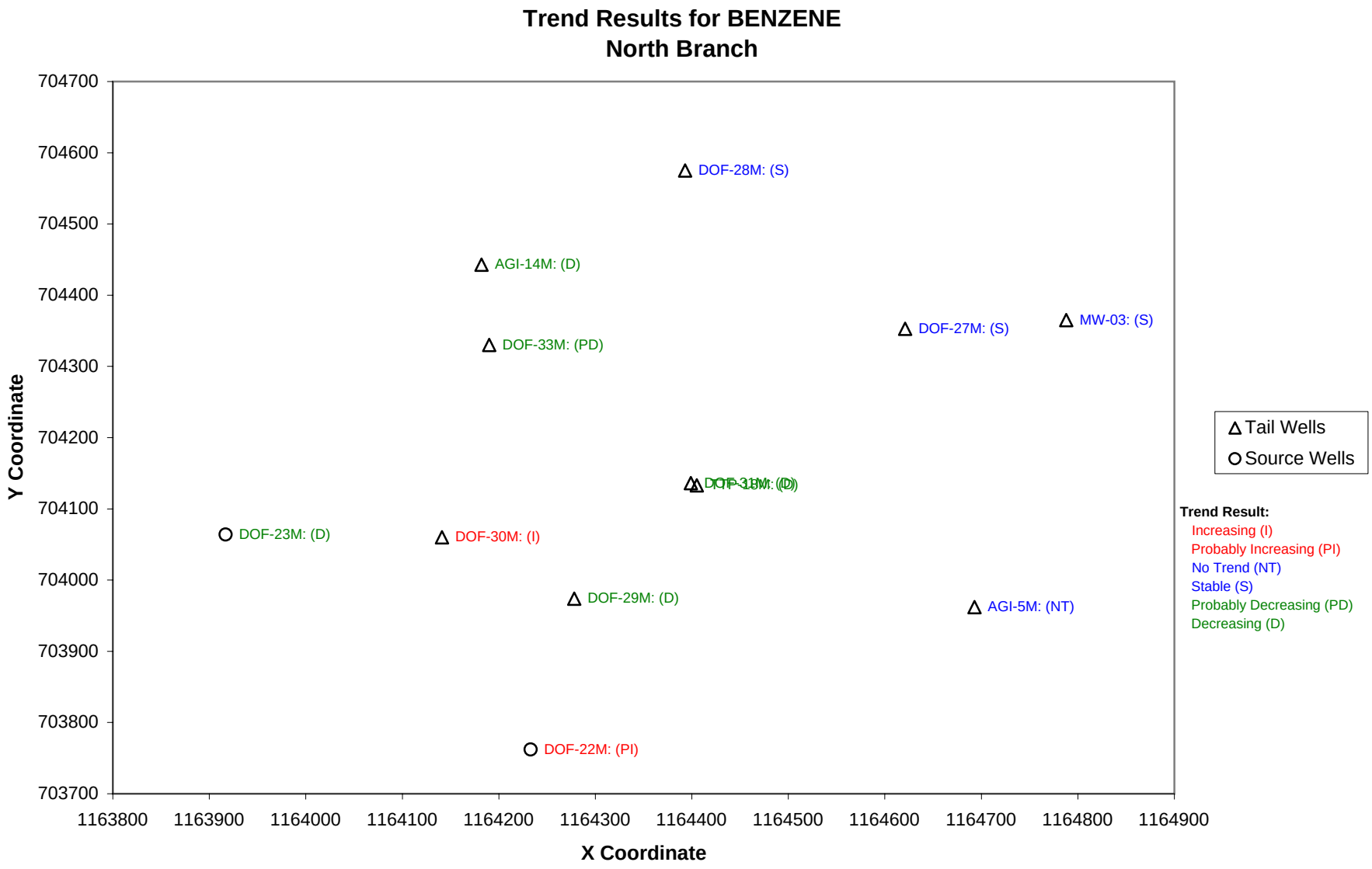


FIGURE 20
Benzene Trends - East Branch Area

Tacoma Historical Coal Gasification Site
Tacoma, WA

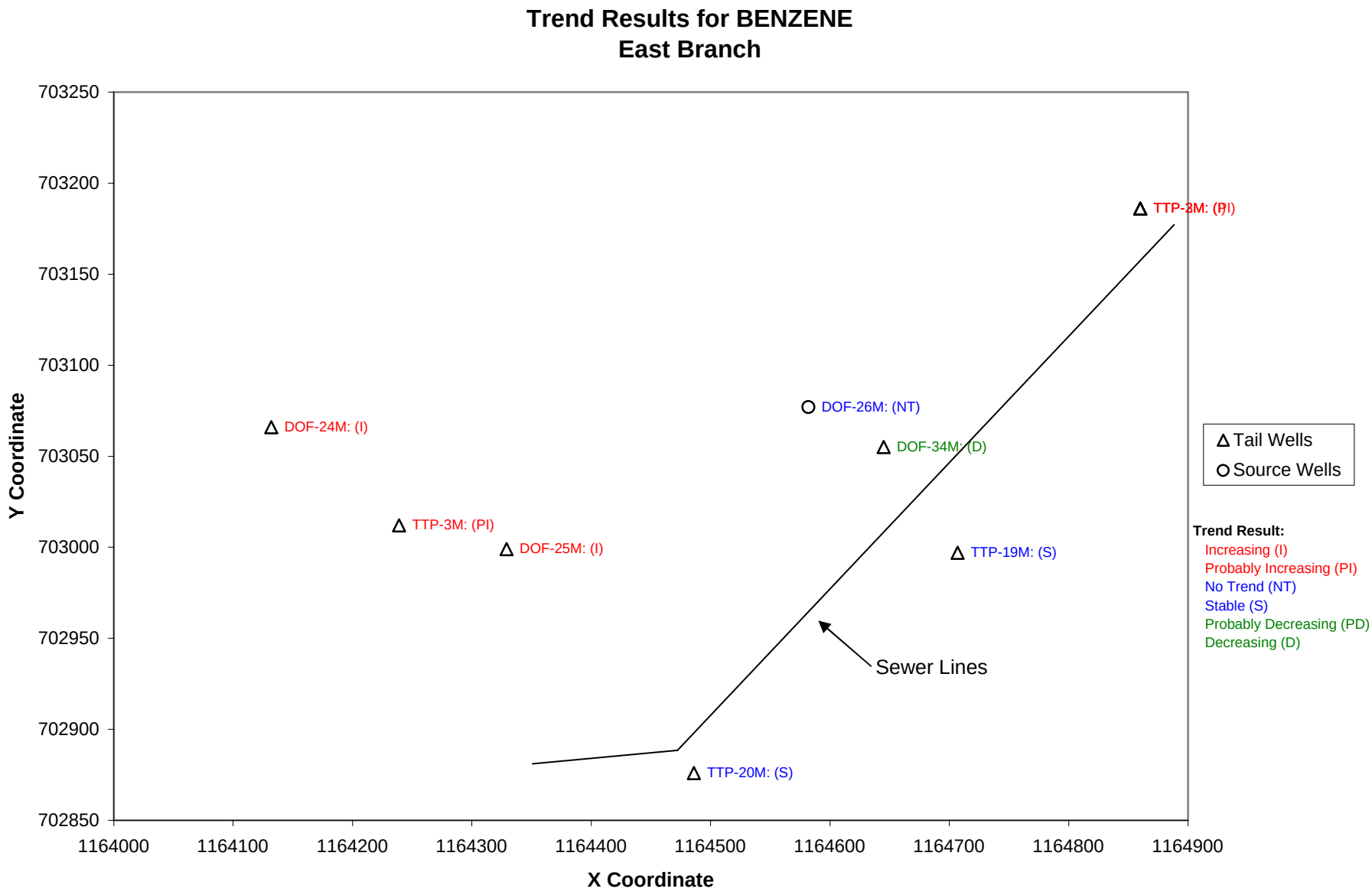


AFCEE Long Term Monitoring Software
Dalton, Olmsted Fuglevand, Inc.

(xlsLOETrendResults North 2-BENZENE)

FIGURE 21
North Branch Benzene Trend Results

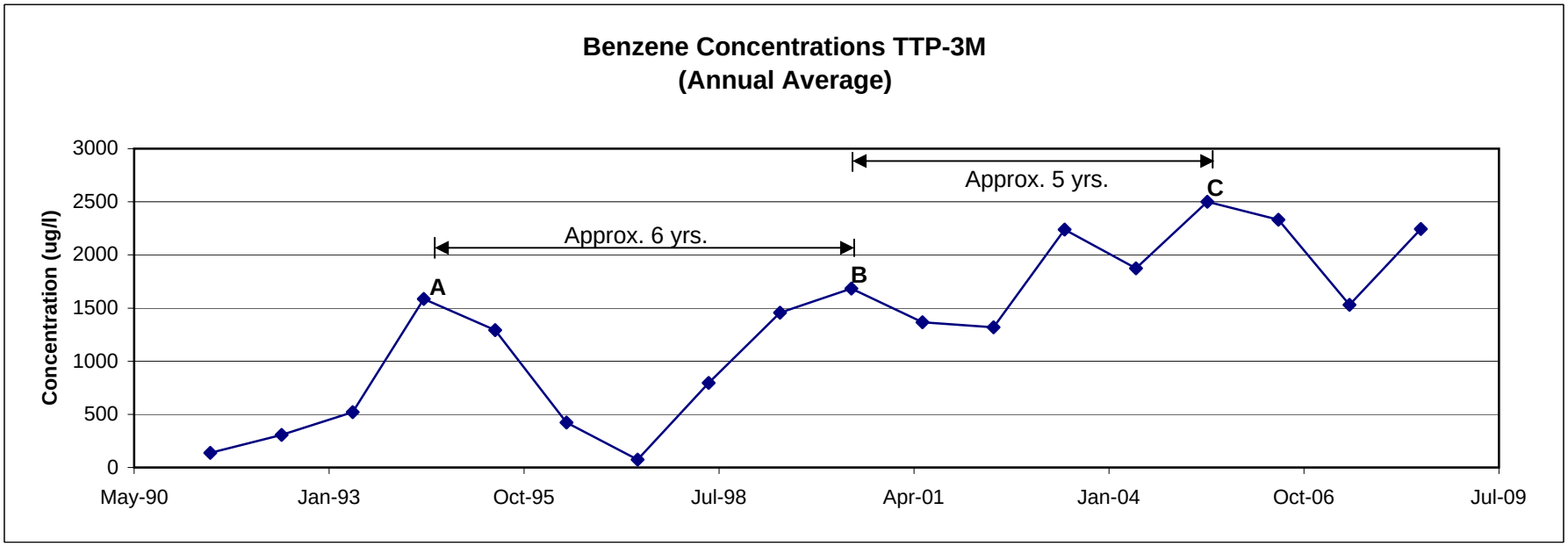
Tacoma Historical Coal Gasification Site
Tacoma,WA



AFCEE Long Term Monitoring Software
Dalton, Olmsted Fuglevand, Inc.

(xlsLOETrendResults East-BENZENE)

FIGURE 22
East Branch Benzene Trend Results



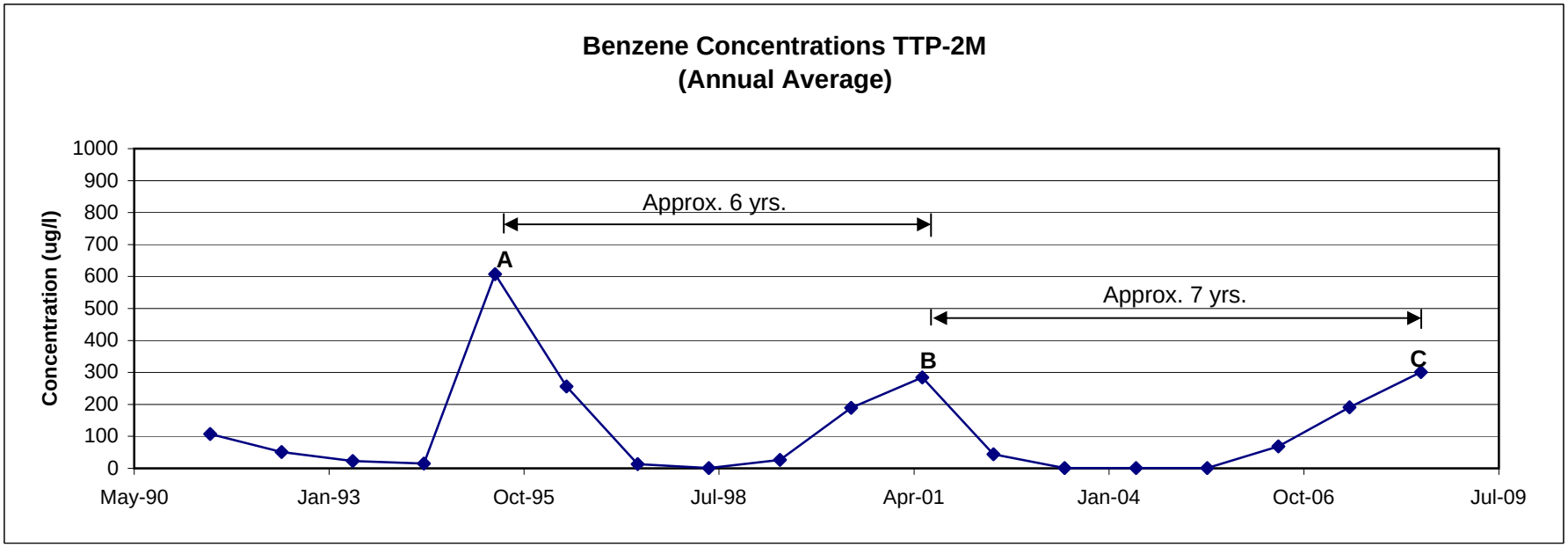


FIGURE 23
Benzene Trends TTP-2M and TTP-3M

ATTACHMENT A
MAROS DATA IMPORT FILE

Excel Import Template

WellName	XCoord	YCoord	Constituent	SampleDate	Result	Units	DetLim	Flags
TTP-2M	1164860	703186	BENZENE	3/1/2008	0.234	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	6/1/2008	0.253	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	9/1/2008	0.291	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	1/1/2009	0.425	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	3/1/2007	0.141	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	7/1/2007	0.16	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	9/1/2007	0.25	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	12/1/2007	0.214	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	3/1/2006		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	6/1/2006		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	10/1/2006	0.0621	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	12/1/2006	0.211	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	3/1/2005		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	6/1/2005		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	9/1/2005		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	12/1/2005		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	3/1/2004		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	6/1/2004		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	9/1/2004		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	12/1/2004		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	3/1/2003		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	6/1/2003		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	9/1/2003		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	12/1/2003		mg/l	0.0005	ND
TTP-2M	1164860	703186	BENZENE	3/1/2002	0.0404	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	6/1/2002	0.017	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	9/1/2002	0.0074	mg/l	0.0005	
TTP-2M	1164860	703186	BENZENE	12/1/2002	0.0019	mg/l	0.0005	
TTP-3M	1164860	703186	BENZENE	3/1/2008	1.87	mg/l	0.0005	
TTP-3M	1164860	703186	BENZENE	6/1/2008	2.54	mg/l	0.0005	
TTP-3M	1164860	703186	BENZENE	9/1/2008	2.44	mg/l	0.0005	
TTP-3M	1164860	703186	BENZENE	1/1/2009	2.13	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	3/1/2007	1.93	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	7/1/2007	1.94	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	9/1/2007	0.053	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	12/1/2007	2.2	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	3/1/2006	2.12	mg/l	0.0005	

Excel Import Template

TTP-3M	1164239	703012	BENZENE	6/1/2006	1.62	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	10/1/2006	3.2	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	12/1/2006	2.38	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	3/1/2005	2.35	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	6/1/2005	1.68	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	9/1/2005	3.25	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	12/1/2005	2.72	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	3/1/2004	1.6	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	6/1/2004	1.75	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	9/1/2004	2.07	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	12/1/2004	2.08	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	3/1/2003	1.64	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	6/1/2003	2.4	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	9/1/2003	2.8	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	12/1/2003	2.11	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	3/1/2002	0.648	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	6/1/2002	0.94	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	9/1/2002	1.77	mg/l	0.0005	
TTP-3M	1164239	703012	BENZENE	12/1/2002	1.94	mg/l	0.0005	
AGI-5M	1164693	703962	BENZENE	3/1/2008		mg/l	0.0005	ND
AGI-5M	1164693	703962	BENZENE	9/1/2008		mg/l	0.0005	ND
AGI-5M	1164693	703962	BENZENE	3/1/2007	0.0062	mg/l	0.0005	
AGI-5M	1164693	703962	BENZENE	9/1/2007		mg/l	0.0005	ND
AGI-5M	1164693	703962	BENZENE	3/1/2006	0.00074	mg/l	0.0005	
AGI-5M	1164693	703962	BENZENE	10/1/2006		mg/l	0.0005	ND
AGI-5M	1164693	703962	BENZENE	3/1/2005		mg/l	0.0005	ND
AGI-5M	1164693	703962	BENZENE	9/1/2005		mg/l	0.0005	ND
AGI-5M	1164693	703962	BENZENE	3/1/2004		mg/l	0.0005	ND
AGI-5M	1164693	703962	BENZENE	9/1/2004		mg/l	0.0005	ND
AGI-5M	1164693	703962	BENZENE	3/1/2003		mg/l	0.0005	ND
AGI-5M	1164693	703962	BENZENE	9/1/2003		mg/l	0.0005	ND
AGI-5M	1164693	703962	BENZENE	3/1/2002	0.00092	mg/l	0.0005	
AGI-5M	1164693	703962	BENZENE	9/1/2002		mg/l	0.0005	ND
TTP-12M	1163715	703308	BENZENE	9/1/2008		mg/l	0.0005	ND
TTP-12M	1163715	703308	BENZENE	9/1/2007		mg/l	0.0005	ND
TTP-12M	1163715	703308	BENZENE	9/1/2006		mg/l	0.0005	ND
TTP-12M	1163715	703308	BENZENE	9/1/2005		mg/l	0.0005	ND
TTP-12M	1163715	703308	BENZENE	9/1/2004		mg/l	0.0005	ND

Excel Import Template

TTP-12M	1163715	703308	BENZENE	9/1/2003		mg/l	0.0005	ND
TTP-12M	1163715	703308	BENZENE	9/1/2002		mg/l	0.0005	ND
AGI-14M	1164182	704443	BENZENE	3/1/2008		mg/l	0.0005	ND
AGI-14M	1164182	704443	BENZENE	6/1/2008		mg/l	0.0005	ND
AGI-14M	1164182	704443	BENZENE	9/1/2008		mg/l	0.0005	ND
AGI-14M	1164182	704443	BENZENE	1/1/2009	0.0011	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	3/1/2007		mg/l	0.0005	ND
AGI-14M	1164182	704443	BENZENE	7/1/2007		mg/l	0.0005	ND
AGI-14M	1164182	704443	BENZENE	9/1/2007		mg/l	0.0005	ND
AGI-14M	1164182	704443	BENZENE	12/1/2007		mg/l	0.0005	ND
AGI-14M	1164182	704443	BENZENE	3/1/2006	0.088	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	6/1/2006		mg/l	0.0005	ND
AGI-14M	1164182	704443	BENZENE	10/1/2006		mg/l	0.0005	ND
AGI-14M	1164182	704443	BENZENE	12/1/2006		mg/l	0.0005	ND
AGI-14M	1164182	704443	BENZENE	3/1/2005	0.0412	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	6/1/2005	0.0307	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	9/1/2005	0.018	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	12/1/2005	0.384	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	3/1/2004	0.577	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	6/1/2004	0.436	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	9/1/2004	0.13	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	12/1/2004	0.0826	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	3/1/2003	1.42	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	6/1/2003	0.974	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	9/1/2003	0.725	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	12/1/2003	0.577	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	3/1/2002	0.692	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	6/1/2002	0.865	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	9/1/2002	0.875	mg/l	0.0005	
AGI-14M	1164182	704443	BENZENE	12/1/2002	1.01	mg/l	0.0005	
TTP-16M	1163496	704216	BENZENE	9/1/2008		mg/l	0.0005	ND
TTP-16M	1163496	704216	BENZENE	9/1/2007	0.0013	mg/l	0.0005	
TTP-16M	1163496	704216	BENZENE	9/1/2006		mg/l	0.0005	ND
TTP-16M	1163496	704216	BENZENE	9/1/2005		mg/l	0.0005	ND
TTP-16M	1163496	704216	BENZENE	9/1/2004		mg/l	0.0005	ND
TTP-16M	1163496	704216	BENZENE	9/1/2003		mg/l	0.0005	ND
TTP-16M	1163496	704216	BENZENE	9/1/2002		mg/l	0.0005	ND
TTP-17M	1163662	704327	BENZENE	9/1/2008		mg/l	0.0005	ND

Excel Import Template

TTP-17M	1163662	704327	BENZENE	9/1/2007		mg/l	0.0005	ND
TTP-17M	1163662	704327	BENZENE	9/1/2006		mg/l	0.0005	ND
TTP-17M	1163662	704327	BENZENE	9/1/2005		mg/l	0.0005	ND
TTP-17M	1163662	704327	BENZENE	9/1/2004		mg/l	0.0005	ND
TTP-17M	1163662	704327	BENZENE	9/1/2003		mg/l	0.0005	ND
TTP-17M	1163662	704327	BENZENE	9/1/2002		mg/l	0.0005	ND
TTP-18M	1164405	704133	BENZENE	3/1/2008		mg/l	0.0005	ND
TTP-18M	1164405	704133	BENZENE	6/1/2008	0.0006	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	9/1/2008	0.00058	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	1/1/2009	0.0047	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	3/1/2007	0.00068	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	7/1/2007		mg/l	0.0005	ND
TTP-18M	1164405	704133	BENZENE	9/1/2007		mg/l	0.0005	ND
TTP-18M	1164405	704133	BENZENE	12/1/2007		mg/l	0.0005	ND
TTP-18M	1164405	704133	BENZENE	3/1/2006	0.013	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	6/1/2006	0.0042	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	10/1/2006	0.00097	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	12/1/2006	0.00057	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	3/1/2005	0.0279	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	6/1/2005	0.028	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	9/1/2005	0.0375	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	12/1/2005	0.0086	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	3/1/2004	0.093	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	6/1/2004	0.089	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	9/1/2004	0.0549	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	12/1/2004	0.0487	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	3/1/2003	0.304	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	6/1/2003	0.384	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	9/1/2003	0.436	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	12/1/2003	0.212	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	3/1/2002	0.619	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	6/1/2002	0.69	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	9/1/2002	0.458	mg/l	0.0005	
TTP-18M	1164405	704133	BENZENE	12/1/2002	0.444	mg/l	0.0005	
TTP-19M	1164707	702997	BENZENE	3/1/2008		mg/l	0.0005	ND
TTP-19M	1164707	702997	BENZENE	9/1/2008		mg/l	0.0005	ND
TTP-19M	1164707	702997	BENZENE	3/1/2007		mg/l	0.0005	ND
TTP-19M	1164707	702997	BENZENE	9/1/2007		mg/l	0.0005	ND

Excel Import Template

TTP-19M	1164707	702997	BENZENE	3/1/2006		mg/l	0.0005	ND
TTP-19M	1164707	702997	BENZENE	10/1/2006		mg/l	0.0005	ND
TTP-19M	1164707	702997	BENZENE	3/1/2005		mg/l	0.0005	ND
TTP-19M	1164707	702997	BENZENE	9/1/2005		mg/l	0.0005	ND
TTP-19M	1164707	702997	BENZENE	3/1/2004		mg/l	0.0005	ND
TTP-19M	1164707	702997	BENZENE	9/1/2004		mg/l	0.0005	ND
TTP-19M	1164707	702997	BENZENE	3/1/2003		mg/l	0.0005	ND
TTP-19M	1164707	702997	BENZENE	9/1/2003		mg/l	0.0005	ND
TTP-19M	1164707	702997	BENZENE	3/1/2002		mg/l	0.0005	ND
TTP-19M	1164707	702997	BENZENE	9/1/2002		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	3/1/2008		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	9/1/2008		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	3/1/2007		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	9/1/2007		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	3/1/2006		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	10/1/2006		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	3/1/2005		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	9/1/2005		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	3/1/2004		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	9/1/2004		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	3/1/2003		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	9/1/2003		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	3/1/2002		mg/l	0.0005	ND
TTP-20M	1164486	702876	BENZENE	9/1/2002	0.00052	mg/l	0.0005	
MW-03	1164788	704365	BENZENE	3/1/2008		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	9/1/2008		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	3/1/2007		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	9/1/2007		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	3/1/2006		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	10/1/2006		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	3/1/2005		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	9/1/2005		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	3/1/2004		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	9/1/2004		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	3/1/2003		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	9/1/2003		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	3/1/2002		mg/l	0.0005	ND
MW-03	1164788	704365	BENZENE	9/1/2002		mg/l	0.0005	ND

Excel Import Template

DOF-22M	1164233	703762	BENZENE	3/1/2008	3	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	6/1/2008	2.61	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	9/1/2008	2.87	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	1/1/2009	1.63	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	3/1/2007	3.67	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	7/1/2007	4.1	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	9/1/2007	4.16	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	12/1/2007	4.12	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	3/1/2006	0.146	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	6/1/2006	0.492	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	10/1/2006	1.19	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	12/1/2006	0.342	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	3/1/2005	0.434	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	6/1/2005	0.552	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	9/1/2005	0.336	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	12/1/2005	0.199	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	3/1/2004	0.925	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	6/1/2004	0.975	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	9/1/2004	0.707	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	12/1/2004	0.498	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	3/1/2003	0.959	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	6/1/2003	0.68	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	9/1/2003	0.972	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	12/1/2003	0.963	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	3/1/2002	2.2	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	6/1/2002	1.54	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	9/1/2002	1.08	mg/l	0.0005	
DOF-22M	1164233	703762	BENZENE	12/1/2002	1.36	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	3/1/2008	0.878	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	6/1/2008	1.41	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	9/1/2008	1.78	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	1/1/2009	1.51	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	3/1/2007	1.28	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	7/1/2007	1.33	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	9/1/2007	1.32	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	12/1/2007	0.665	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	3/1/2006	3.28	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	6/1/2006	2.64	mg/l	0.0005	

Excel Import Template

DOF-23M	1163917	704064	BENZENE	10/1/2006	1.99	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	12/1/2006	1.32	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	3/1/2005	2.88	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	6/1/2005	2.89	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	9/1/2005	2.75	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	12/1/2005	3.73	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	3/1/2004	2.16	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	6/1/2004	2.51	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	9/1/2004	2.65	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	12/1/2004	2.5	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	3/1/2003	2.79	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	6/1/2003	2.48	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	9/1/2003	2.79	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	12/1/2003	2.2	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	6/1/2002	2.74	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	9/1/2002	2.73	mg/l	0.0005	
DOF-23M	1163917	704064	BENZENE	12/1/2002	3.05	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	3/1/2008	1.91	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	6/1/2008	2.42	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	9/1/2008	3.79	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	1/1/2009	3.84	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	3/1/2007	0.788	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	7/1/2007	2.36	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	9/1/2007	3.28	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	12/1/2007	1.84	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	3/1/2006	2.04	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	6/1/2006	2.52	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	10/1/2006	3.32	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	12/1/2006	2.87	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	3/1/2005	2.25	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	6/1/2005	1.98	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	9/1/2005	2.71	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	12/1/2005	3.61	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	3/1/2004	1.38	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	6/1/2004	1.72	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	9/1/2004	2.61	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	12/1/2004	2.56	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	3/1/2003	1.38	mg/l	0.0005	

Excel Import Template

DOF-24M	1164132	703066	BENZENE	6/1/2003	1.58	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	9/1/2003	2.42	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	12/1/2003	1.8	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	3/1/2002	0.0834	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	6/1/2002	1.21	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	9/1/2002	2.29	mg/l	0.0005	
DOF-24M	1164132	703066	BENZENE	12/1/2002	2.63	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	3/1/2008	1.16	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	6/1/2008	0.919	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	9/1/2008	1.11	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	1/1/2009	1.28	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	3/1/2007	1.54	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	7/1/2007	1.19	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	9/1/2007	1.48	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	12/1/2007	1.64	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	3/1/2006	0.897	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	6/1/2006	0.704	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	10/1/2006	1.09	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	12/1/2006	2.33	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	3/1/2005	0.521	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	6/1/2005	0.429	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	9/1/2005	0.743	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	12/1/2005	1.44	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	3/1/2004	0.715	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	6/1/2004	0.558	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	9/1/2004	0.655	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	12/1/2004	0.909	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	3/1/2003	0.986	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	6/1/2003	0.297	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	9/1/2003	1.14	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	12/1/2003	2.47	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	3/1/2002	0.00087	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	6/1/2002		mg/l	0.0005	ND
DOF-25M	1164329	702999	BENZENE	9/1/2002	0.103	mg/l	0.0005	
DOF-25M	1164329	702999	BENZENE	12/1/2002	1.5	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	3/1/2008	1.26	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	6/1/2008	2.24	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	9/1/2008	0.679	mg/l	0.0005	

Excel Import Template

DOF-26M	1164582	703077	BENZENE	1/1/2009	2.24	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	3/1/2007	2.96	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	7/1/2007	1.24	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	9/1/2007	1.16	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	12/1/2007	1.05	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	3/1/2006	1.66	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	6/1/2006	1.55	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	10/1/2006	0.93	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	12/1/2006	3.76	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	3/1/2005	1.21	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	6/1/2005	1.28	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	9/1/2005	1.32	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	12/1/2005	1.32	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	3/1/2004	1.8	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	6/1/2004	1.19	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	9/1/2004	1.17	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	12/1/2004	1.18	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	3/1/2003	3.78	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	6/1/2003	0.458	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	9/1/2003	1.55	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	12/1/2003	1.53	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	3/1/2002	1.81	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	6/1/2002	0.673	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	9/1/2002	0.646	mg/l	0.0005	
DOF-26M	1164582	703077	BENZENE	12/1/2002	2.26	mg/l	0.0005	
DOF-27M	1164621	704353	BENZENE	3/1/2008		mg/l	0.0005	ND
DOF-27M	1164621	704353	BENZENE	9/1/2008		mg/l	0.0005	ND
DOF-27M	1164621	704353	BENZENE	3/1/2007		mg/l	0.0005	ND
DOF-27M	1164621	704353	BENZENE	9/1/2007		mg/l	0.0005	ND
DOF-27M	1164621	704353	BENZENE	3/1/2006		mg/l	0.0005	ND
DOF-27M	1164621	704353	BENZENE	10/1/2006		mg/l	0.0005	ND
DOF-27M	1164621	704353	BENZENE	3/1/2005		mg/l	0.0005	ND
DOF-27M	1164621	704353	BENZENE	9/1/2005		mg/l	0.0005	ND
DOF-27M	1164621	704353	BENZENE	3/1/2004		mg/l	0.0005	ND
DOF-27M	1164621	704353	BENZENE	9/1/2004		mg/l	0.0005	ND
DOF-27M	1164621	704353	BENZENE	3/1/2003		mg/l	0.0005	ND
DOF-27M	1164621	704353	BENZENE	9/1/2003		mg/l	0.0005	ND
DOF-27M	1164621	704353	BENZENE	3/1/2002		mg/l	0.0005	ND

Excel Import Template

DOF-27M	1164621	704353	BENZENE	9/1/2002		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	3/1/2008		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	9/1/2008		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	3/1/2007		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	9/1/2007		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	3/1/2006		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	10/1/2006		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	3/1/2005		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	9/1/2005		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	3/1/2004		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	9/1/2004		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	3/1/2003		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	9/1/2003		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	3/1/2002		mg/l	0.0005	ND
DOF-28M	1164393	704575	BENZENE	9/1/2002		mg/l	0.0005	ND
DOF-29M	1164278	703974	BENZENE	3/1/2008	0.084	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	6/1/2008	0.115	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	9/1/2008	0.154	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	1/1/2009	0.157	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	3/1/2007	0.156	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	7/1/2007	0.092	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	9/1/2007	0.076	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	12/1/2007	0.071	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	3/1/2006	0.591	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	6/1/2006	1.82	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	10/1/2006	0.278	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	12/1/2006	0.126	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	3/1/2005	1.81	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	6/1/2005	1.43	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	9/1/2005	1.71	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	12/1/2005		mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	3/1/2004	1.84	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	6/1/2004	1.85	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	9/1/2004	1.36	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	12/1/2004	1.67	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	3/1/2003	2.44	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	6/1/2003	1.9	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	9/1/2003	1.5	mg/l	0.0005	

Excel Import Template

DOF-29M	1164278	703974	BENZENE	12/1/2003	1.3	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	3/1/2002	1.92	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	6/1/2002	2.31	mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	9/1/2002		mg/l	0.0005	
DOF-29M	1164278	703974	BENZENE	12/1/2002	3.08	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	3/1/2008	0.141	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	9/1/2008	0.159	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	3/1/2007	0.292	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	9/1/2007	0.129	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	3/1/2006	0.0188	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	10/1/2006	0.0868	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	3/1/2005	0.0468	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	9/1/2005	0.0523	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	3/1/2004	0.0426	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	9/1/2004	0.0467	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	3/1/2003	0.0636	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	9/1/2003	0.0266	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	3/1/2002	0.0953	mg/l	0.0005	
DOF-30M	1164141	704060	BENZENE	9/1/2002	0.0594	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	3/1/2008		mg/l	0.0005	ND
DOF-31M	1164399	704136	BENZENE	6/1/2008	0.021	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	9/1/2008	0.032	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	1/1/2009	0.019	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	3/1/2007		mg/l	0.0005	ND
DOF-31M	1164399	704136	BENZENE	7/1/2007		mg/l	0.0005	ND
DOF-31M	1164399	704136	BENZENE	9/1/2007	0.00063	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	12/1/2007	0.00108	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	3/1/2006	0.0482	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	6/1/2006	0.0134	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	10/1/2006	0.0013	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	12/1/2006	0.00054	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	3/1/2005	0.111	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	6/1/2005	0.0791	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	9/1/2005	0.0785	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	12/1/2005	0.0254	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	3/1/2004	0.17	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	6/1/2004	0.156	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	9/1/2004	0.11	mg/l	0.0005	

Excel Import Template

DOF-31M	1164399	704136	BENZENE	12/1/2004	0.0998	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	3/1/2003		mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	6/1/2003	0.438	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	9/1/2003	0.353	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	12/1/2003	0.311	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	3/1/2002	1.34	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	6/1/2002	0.664	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	9/1/2002	0.888	mg/l	0.0005	
DOF-31M	1164399	704136	BENZENE	12/1/2002		mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	3/1/2008	0.215	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	6/1/2008	0.578	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	9/1/2008	0.807	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	1/1/2009	0.892	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	3/1/2007	0.482	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	7/1/2007	0.337	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	9/1/2007	0.186	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	12/1/2007	0.17	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	3/1/2006	1.15	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	6/1/2006	0.721	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	10/1/2006	1.06	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	12/1/2006	0.592	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	3/1/2005	1.13	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	6/1/2005	1.15	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	9/1/2005	0.797	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	12/1/2005	1.24	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	3/1/2004	0.306	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	6/1/2004	0.29	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	9/1/2004	0.0442	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	12/1/2004	1.7	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	3/1/2003		mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	6/1/2003	0.261	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	9/1/2003	0.273	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	12/1/2003	0.403	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	3/1/2002	3.69	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	6/1/2002	3.99	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	9/1/2002	2.2	mg/l	0.0005	
DOF-33M	1164190	704330	BENZENE	12/1/2002		mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	3/1/2008	3.7	mg/l	0.0005	

Excel Import Template

DOF-34M	1164645	703055	BENZENE	9/1/2008	2.17	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	1/1/2009	6.14	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	3/1/2007	4.71	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	7/1/2007	6.04	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	9/1/2007	1.27	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	12/1/2007	2.75	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	3/1/2006	10.2	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	6/1/2006	7.57	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	10/1/2006	8.65	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	12/1/2006	6.42	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	3/1/2005	10.7	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	6/1/2005	8.4	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	9/1/2005	6.98	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	12/1/2005	5.83	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	3/1/2004	5.16	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	6/1/2004	11.4	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	9/1/2004	4.22	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	12/1/2004	12.5	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	3/1/2003		mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	6/1/2003	6.98	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	9/1/2003	6.05	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	12/1/2003	5.47	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	3/1/2002	8.78	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	6/1/2002	8.59	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	9/1/2002	4.56	mg/l	0.0005	
DOF-34M	1164645	703055	BENZENE	12/1/2002	3.46	mg/l	0.0005	

ATTACHMENT B

MAROS RESULTS SUMMARIES
NORTH BRANCH

MAROS Mann-Kendall Statistics Summary

Project: THCGS North 2 **User Name:** M Dalton

Location: Tacoma **State:** Washington

Time Period: 3/1/2002 to 1/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
BENZENE								
DOF-23M	S	27	27	0.35	-143	99.9%	No	D
DOF-22M	S	28	28	0.84	24	67.4%	No	NT
TTP-18M	T	28	24	1.49	-314	100.0%	No	D
MW-03	T	14	0	0.00	0	47.8%	Yes	S
DOF-33M	T	26	26	1.05	-68	93.0%	No	PD
DOF-31M	T	26	23	1.69	-248	100.0%	No	D
DOF-30M	T	14	14	0.80	33	96.0%	No	I
DOF-29M	T	26	26	0.80	-217	100.0%	No	D
DOF-28M	T	14	0	0.00	0	47.8%	Yes	S
DOF-27M	T	14	0	0.00	0	47.8%	Yes	S
AGI-5M	T	14	3	2.09	-2	52.2%	No	NT
AGI-14M	T	28	18	1.31	-266	100.0%	No	D

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)- Due to insufficient Data (< 4 sampling events); Source/Tail (S/T)

The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Linear Regression Statistics Summary

Project: THCGS North 2 **User Name:** M Dalton

Location: Tacoma **State:** Washington

Time Period: 3/1/2002 to 1/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Average Conc (mg/L)	Median Conc (mg/L)	Standard Deviation	All Samples "ND" ?	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
BENZENE									
DOF-23M	S	2.2E+00	2.5E+00	7.8E-01	No	-4.1E-04	0.35	100.0%	D
DOF-22M	S	1.5E+00	9.7E-01	1.3E+00	No	3.6E-04	0.84	93.8%	PI
TTP-16M	T	1.4E-01	2.8E-02	2.1E-01	No	-3.5E-03	1.49	100.0%	D
MW-03	T	2.5E-04	2.5E-04	1.1E-19	Yes	0.0E+00	0.00	100.0%	S
DOF-33M	T	9.5E-01	6.6E-01	9.9E-01	No	-4.0E-04	1.05	92.4%	PD
DOF-31M	T	1.9E-01	6.3E-02	3.2E-01	No	-3.0E-03	1.69	100.0%	D
DOF-30M	T	9.0E-02	6.1E-02	7.2E-02	No	4.8E-04	0.80	96.6%	I
DOF-29M	T	1.1E+00	1.4E+00	9.2E-01	No	-1.6E-03	0.80	100.0%	D
DOF-28M	T	2.5E-04	2.5E-04	1.1E-19	Yes	0.0E+00	0.00	100.0%	S
DOF-27M	T	2.5E-04	2.5E-04	1.1E-19	Yes	0.0E+00	0.00	100.0%	S
AGI-5M	T	7.6E-04	2.5E-04	1.6E-03	No	1.0E-04	2.09	61.5%	NT
AGI-14M	T	3.2E-01	6.2E-02	4.2E-01	No	-4.3E-03	1.31	100.0%	D

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); COV = Coefficient of Variation

MAROS Spatial Moment Analysis Summary

Project: THCGS North 2
Location: Tacoma

User Name: M Dalton
State: Washington

	0th Moment	1st Moment (Center of Mass)			2nd Moment (Spread)		
Effective Date	Estimated Mass (Kg)	Xc (ft)	Yc (ft)	Source Distance (ft)	Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
BENZENE							
3/1/2002	2.7E+00	1,164,283	704,093	367	6,377	17,442	11
6/1/2002	1.5E+01	1,164,163	704,099	248	4,411	12,116	7
9/1/2002	4.2E+00	1,164,161	704,137	254	10,353	16,676	11
12/1/2002	0.0E+00						5
3/1/2003	3.3E+00	1,164,172	704,095	257	11,197	16,340	10
6/1/2003	6.7E+00	1,164,160	704,070	243	3,955	14,212	7
9/1/2003	2.3E+00	1,164,171	704,097	256	12,901	20,225	12
12/1/2003	6.3E+00	1,164,158	704,070	241	3,679	13,973	7
3/1/2004	2.3E+00	1,164,166	704,086	250	11,559	19,928	12
6/1/2004	6.6E+00	1,164,153	704,057	236	2,924	13,279	7
9/1/2004	1.6E+00	1,164,170	704,038	254	11,889	15,404	12
12/1/2004	8.1E+00	1,164,150	704,086	234	2,814	10,001	7
3/1/2005	2.3E+00	1,164,159	704,096	244	10,749	16,582	12
6/1/2005	7.2E+00	1,164,148	704,075	231	2,443	9,997	7
9/1/2005	2.0E+00	1,164,160	704,085	244	11,075	15,680	12
12/1/2005	2.8E+00	1,164,156	704,150	254	1,677	14,035	6
3/1/2006	1.6E+00	1,164,146	704,138	240	10,574	17,283	12
6/1/2006	6.2E+00	1,164,143	704,058	226	1,450	8,766	7
10/1/2006	1.9E+00	1,164,128	704,046	212	6,977	12,289	12
12/1/2006	1.8E+00	1,164,137	704,061	220	785	9,143	7
3/1/2007	2.9E+00	1,164,143	704,007	233	9,986	9,675	12
7/1/2007	2.2E+00	1,164,139	704,013	228	547	9,584	7
9/1/2007	1.9E+00	1,164,126	704,004	217	5,826	8,623	12
12/1/2007	1.5E+00	1,164,142	704,004	233	797	9,252	7
3/1/2008	1.7E+00	1,164,128	704,007	218	6,219	9,213	12
6/1/2008	2.5E+00	1,164,145	704,034	230	1,491	10,166	7
9/1/2008	2.7E+00	1,164,136	704,039	220	7,030	11,603	12
1/1/2009	2.9E+00	1,164,145	704,050	229	1,773	10,387	7

Project: THCGS North 2 **User Name:** M Dalton

Location: Tacoma **State:** Washington

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	BENZENE	0.83	-82	94.5%	PD
1st Moment: Distance to Source					
	BENZENE	0.12	-207	100.0%	D
2nd Moment: Sigma XX					
	BENZENE	0.70	-113	99.1%	D
2nd Moment: Sigma YY					
	BENZENE	0.27	-161	100.0%	D

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.20 Saturated Thickness: Uniform: 7 ft

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

Note: The Sigma XX and Sigma YY components are estimated using the given field coordinate system and then rotated to align with the estimated groundwater flow direction. Moments are not calculated for sample events with less than 6 wells.

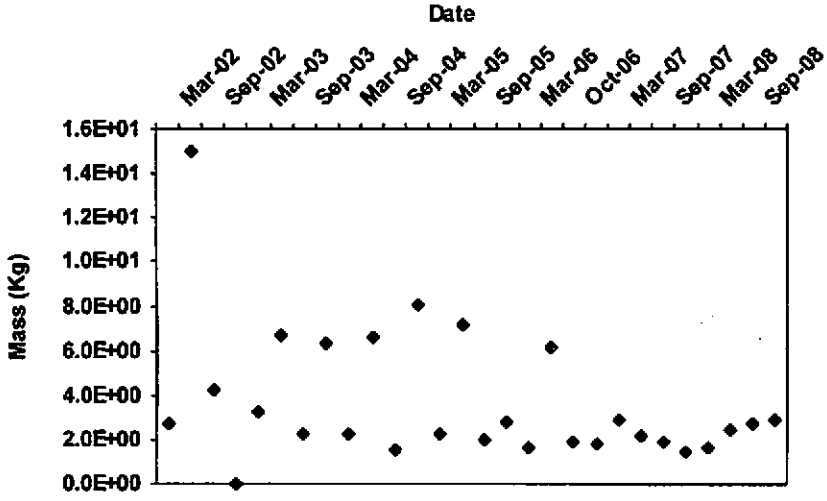
MAROS Zeroth Moment Analysis

Project: THCGS North 2 **User Name:** M Dalton

Location: Tacoma **State:** Washington

COC: BENZENE

Change in Dissolved Mass Over Time



Porosity: 0.20

Saturated Thickness:

Uniform: 7 ft

Mann Kendall S Statistic:

-82

Confidence in Trend:

94.5%

Coefficient of Variation:

0.83

Zeroth Moment Trend:

PD

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
3/1/2002	BENZENE	2.7E+00	11
6/1/2002	BENZENE	1.5E+01	7
9/1/2002	BENZENE	4.2E+00	11
12/1/2002	BENZENE	0.0E+00	5
3/1/2003	BENZENE	3.3E+00	10
6/1/2003	BENZENE	6.7E+00	7
9/1/2003	BENZENE	2.3E+00	12
12/1/2003	BENZENE	6.3E+00	7
3/1/2004	BENZENE	2.3E+00	12
6/1/2004	BENZENE	6.6E+00	7
9/1/2004	BENZENE	1.6E+00	12
12/1/2004	BENZENE	8.1E+00	7
3/1/2005	BENZENE	2.3E+00	12
6/1/2005	BENZENE	7.2E+00	7
9/1/2005	BENZENE	2.0E+00	12
12/1/2005	BENZENE	2.8E+00	6
3/1/2006	BENZENE	1.6E+00	12
6/1/2006	BENZENE	6.2E+00	7
10/1/2006	BENZENE	1.9E+00	12
12/1/2006	BENZENE	1.8E+00	7
3/1/2007	BENZENE	2.9E+00	12
7/1/2007	BENZENE	2.2E+00	7

MAROS Zeroth Moment Analysis

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
9/1/2007	BENZENE	1.9E+00	12
12/1/2007	BENZENE	1.5E+00	7
3/1/2008	BENZENE	1.7E+00	12
6/1/2008	BENZENE	2.5E+00	7
9/1/2008	BENZENE	2.7E+00	12
1/1/2009	BENZENE	2.9E+00	7

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect. Moments are not calculated for sample events with less than 6 wells.

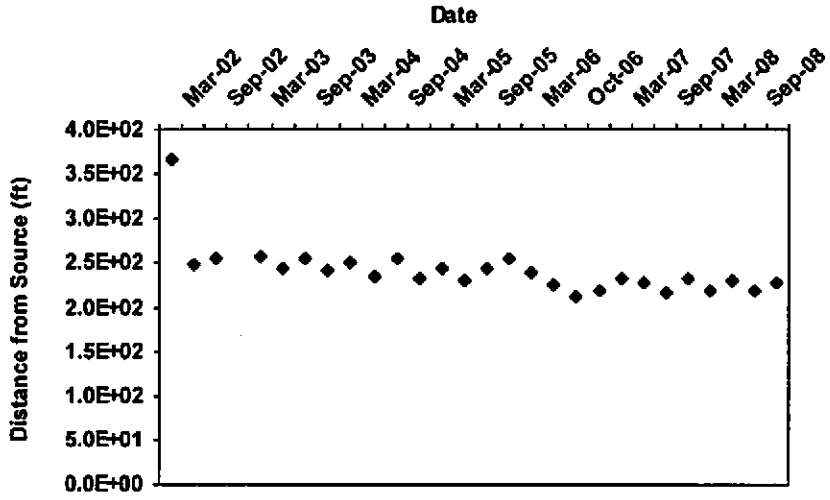
MAROS First Moment Analysis

Project: THCGS North 2 **User Name:** M Dalton

Location: Tacoma **State:** Washington

COC: BENZENE

Distance from Source to Center of Mass



Mann Kendall S Statistic: -207

Confidence in Trend: 100.0%

Coefficient of Variation: 0.12

First Moment Trend: D

Data Table:

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source (ft)	Number of Wells
3/1/2002	BENZENE	1,164,283	704,093	367	11
6/1/2002	BENZENE	1,164,163	704,099	248	7
9/1/2002	BENZENE	1,164,161	704,137	254	11
12/1/2002	BENZENE				5
3/1/2003	BENZENE	1,164,172	704,095	257	10
6/1/2003	BENZENE	1,164,160	704,070	243	7
9/1/2003	BENZENE	1,164,171	704,097	256	12
12/1/2003	BENZENE	1,164,158	704,070	241	7
3/1/2004	BENZENE	1,164,166	704,086	250	12
6/1/2004	BENZENE	1,164,153	704,057	236	7
9/1/2004	BENZENE	1,164,170	704,038	254	12
12/1/2004	BENZENE	1,164,150	704,086	234	7
3/1/2005	BENZENE	1,164,159	704,096	244	12
6/1/2005	BENZENE	1,164,148	704,075	231	7
9/1/2005	BENZENE	1,164,160	704,085	244	12
12/1/2005	BENZENE	1,164,156	704,150	254	6
3/1/2006	BENZENE	1,164,146	704,138	240	12
6/1/2006	BENZENE	1,164,143	704,058	226	7
10/1/2006	BENZENE	1,164,128	704,046	212	12
12/1/2006	BENZENE	1,164,137	704,061	220	7
3/1/2007	BENZENE	1,164,143	704,007	233	12
7/1/2007	BENZENE	1,164,139	704,013	228	7
9/1/2007	BENZENE	1,164,126	704,004	217	12

MAROS First Moment Analysis

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source (ft)	Number of Wells
12/1/2007	BENZENE	1,164,142	704,004	233	7
3/1/2008	BENZENE	1,164,128	704,007	218	12
6/1/2008	BENZENE	1,164,145	704,034	230	7
9/1/2008	BENZENE	1,164,136	704,039	220	12
1/1/2009	BENZENE	1,164,145	704,050	229	7

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

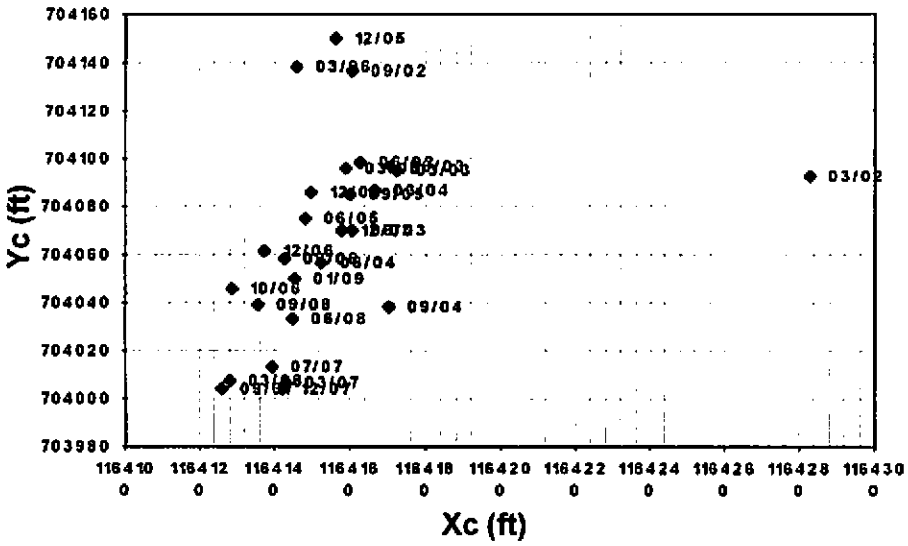
MAROS First Moment Analysis

Project: THCGS North 2 **User Name:** M Dalton

Location: Tacoma **State:** Washington

COC: BENZENE

Change in Location of Center of Mass Over Time



Groundwater Flow Direction:

Source Coordinate:

X: 1,163,917

Y: 704,064

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source (ft)	Number of Wells
3/1/2002	BENZENE	1,164,283	704,093	367	11
6/1/2002	BENZENE	1,164,163	704,099	248	7
9/1/2002	BENZENE	1,164,161	704,137	254	11
12/1/2002	BENZENE				5
3/1/2003	BENZENE	1,164,172	704,095	257	10
6/1/2003	BENZENE	1,164,160	704,070	243	7
9/1/2003	BENZENE	1,164,171	704,097	256	12
12/1/2003	BENZENE	1,164,158	704,070	241	7
3/1/2004	BENZENE	1,164,166	704,086	250	12
6/1/2004	BENZENE	1,164,153	704,057	236	7
9/1/2004	BENZENE	1,164,170	704,038	254	12
12/1/2004	BENZENE	1,164,150	704,086	234	7
3/1/2005	BENZENE	1,164,159	704,096	244	12
6/1/2005	BENZENE	1,164,148	704,075	231	7
9/1/2005	BENZENE	1,164,160	704,085	244	12
12/1/2005	BENZENE	1,164,156	704,150	254	6
3/1/2006	BENZENE	1,164,146	704,138	240	12
6/1/2006	BENZENE	1,164,143	704,058	226	7
10/1/2006	BENZENE	1,164,128	704,046	212	12
12/1/2006	BENZENE	1,164,137	704,061	220	7
3/1/2007	BENZENE	1,164,143	704,007	233	12
7/1/2007	BENZENE	1,164,139	704,013	228	7
9/1/2007	BENZENE	1,164,126	704,004	217	12
12/1/2007	BENZENE	1,164,142	704,004	233	7
3/1/2008	BENZENE	1,164,128	704,007	218	12

MAROS First Moment Analysis

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source (ft)	Number of Wells
6/1/2008	BENZENE	1,164,145	704,034	230	7
9/1/2008	BENZENE	1,164,136	704,039	220	12
1/1/2009	BENZENE	1,164,145	704,050	229	7

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

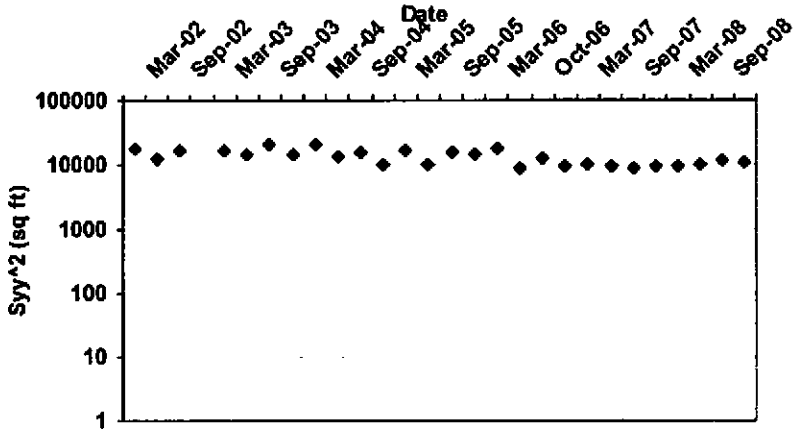
MAROS Second Moment Analysis

Project: THCGS North 2 **User Name:** M Dalton

Location: Tacoma **State:** Washington

COC: BENZENE

Change in Plume Spread Over Time

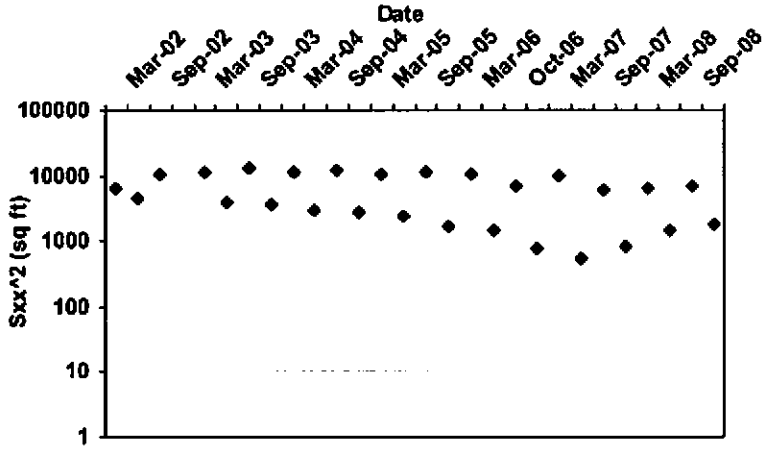


Mann Kendall S Statistic: -161

Confidence in Trend: 100.0%

Coefficient of Variation: 0.27

Second Moment Trend: D



Mann Kendall S Statistic: -113

Confidence in Trend: 99.1%

Coefficient of Variation: 0.70

Second Moment Trend: D

Data Table:

Effective Date	Constituent	Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
3/1/2002	BENZENE	6,377	17,442	11
6/1/2002	BENZENE	4,411	12,116	7
9/1/2002	BENZENE	10,353	16,676	11
12/1/2002	BENZENE			5
3/1/2003	BENZENE	11,197	16,340	10
6/1/2003	BENZENE	3,955	14,212	7
9/1/2003	BENZENE	12,901	20,225	12
12/1/2003	BENZENE	3,679	13,973	7
3/1/2004	BENZENE	11,559	19,928	12
6/1/2004	BENZENE	2,924	13,279	7
9/1/2004	BENZENE	11,889	15,404	12
12/1/2004	BENZENE	2,814	10,001	7

MAROS Second Moment Analysis

Effective Date	Constituent	Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
3/1/2005	BENZENE	10,749	16,582	12
6/1/2005	BENZENE	2,443	9,997	7
9/1/2005	BENZENE	11,075	15,680	12
12/1/2005	BENZENE	1,677	14,035	6
3/1/2006	BENZENE	10,574	17,283	12
6/1/2006	BENZENE	1,450	8,766	7
10/1/2006	BENZENE	8,977	12,289	12
12/1/2006	BENZENE	785	9,143	7
3/1/2007	BENZENE	9,986	9,675	12
7/1/2007	BENZENE	547	9,584	7
9/1/2007	BENZENE	5,826	8,623	12
12/1/2007	BENZENE	797	9,252	7
3/1/2008	BENZENE	6,219	9,213	12
6/1/2008	BENZENE	1,491	10,166	7
9/1/2008	BENZENE	7,030	11,603	12
1/1/2009	BENZENE	1,773	10,387	7

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events)

The Sigma XX and Sigma YY components are estimated using the given field coordinate system and then rotated to align with the estimated groundwater flow direction. Moments are not calculated for sample events with less than 6 wells.

ATTACHMENT C

MAROS RESULTS SUMMARIES
EAST BRANCH

MAROS Mann-Kendall Statistics Summary

Project: THCGS - East
User Name: M Dalton
Location: Tacoma
State: Washington

Time Period: 3/1/2002 to 1/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Number of Samples	Number of Detects	Coefficient of Variation	Mann-Kendall Statistic	Confidence in Trend	All Samples "ND" ?	Concentration Trend
BENZENE								
DOF-26M	S	28	28	0.53	9	58.2%	No	NT
TTP-3M	T	28	28	0.34	87	95.5%	No	I
TTP-2M	T	28	14	1.47	155	99.9%	No	I
TTP-20M	T	14	1	0.27	-11	70.5%	No	S
TTP-19M	T	14	0	0.00	0	47.8%	Yes	S
DOF-34M	T	26	26	0.44	-80	95.9%	No	D
DOF-25M	T	28	27	0.61	144	99.8%	No	I
DOF-24M	T	28	28	0.39	144	99.8%	No	I

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events); Source/Tail (S/T)

The Number of Samples and Number of Detects shown above are post-consolidation values.

MAROS Linear Regression Statistics Summary

Project: THCGS - East
User Name: M Dalton
Location: Tacoma
State: Washington

Time Period: 3/1/2002 to 1/1/2009
Consolidation Period: No Time Consolidation
Consolidation Type: Median
Duplicate Consolidation: Average
ND Values: 1/2 Detection Limit
J Flag Values : Actual Value

Well	Source/ Tail	Average Conc (mg/L)	Median Conc (mg/L)	Standard Deviation	All Samples "ND" ?	Ln Slope	Coefficient of Variation	Confidence in Trend	Concentration Trend
BENZENE									
DOF-26M	S	1.6E+00	1.3E+00	8.3E-01	No	8.5E-05	0.53	74.4%	NT
TTP-3M	T	2.0E+00	2.1E+00	6.8E-01	No	2.2E-05	0.34	54.5%	NT
TTP-2M	T	8.3E-02	1.1E-03	1.2E-01	No	2.6E-03	1.47	100.0%	I
TTP-20M	T	2.7E-04	2.5E-04	7.2E-05	No	-9.7E-05	0.27	90.9%	PD
TTP-19M	T	2.5E-04	2.5E-04	1.1E-19	Yes	0.0E+00	0.00	100.0%	S
DOF-34M	T	6.5E+00	6.1E+00	2.9E+00	No	-2.7E-04	0.44	97.2%	D
DOF-25M	T	9.9E-01	9.5E-01	6.1E-01	No	1.5E-03	0.61	99.9%	I
DOF-24M	T	2.3E+00	2.3E+00	8.8E-01	No	4.4E-04	0.39	99.4%	I

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); COV = Coefficient of Variation

MAROS Spatial Moment Analysis Summary

Project: THCGS - East
Location: Tacoma

User Name: M Dalton
State: Washington

	0th Moment	1st Moment (Center of Mass)			2nd Moment (Spread)		
Effective Date	Estimated Mass (Kg)	Xc (ft)	Yc (ft)	Source Distance (ft)	Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
BENZENE							
3/1/2002	7.1E-01	1,164,599	703,090	21	12,005	1,365	8
6/1/2002	5.8E-01	1,164,555	703,098	34	11,578	563	6
9/1/2002	1.1E+00	1,164,440	703,063	142	17,052	1,537	8
12/1/2002	3.1E+00	1,164,404	703,053	180	10,314	463	6
3/1/2003	2.0E+00	1,164,362	703,046	222	4,298	633	7
6/1/2003	1.0E+00	1,164,408	703,050	176	11,918	424	6
9/1/2003	2.0E+00	1,164,369	703,045	215	8,107	708	8
12/1/2003	2.9E+00	1,164,400	703,048	184	9,553	245	6
3/1/2004	1.5E+00	1,164,379	703,046	206	9,161	810	8
6/1/2004	1.8E+00	1,164,416	703,050	168	11,047	354	6
9/1/2004	1.6E+00	1,164,372	703,046	213	8,477	751	8
12/1/2004	2.3E+00	1,164 409	703,049	175	10,602	316	6
3/1/2005	1.5E+00	1,164,380	703,046	204	10,420	840	8
6/1/2005	1.7E+00	1,164,412	703,051	172	10,874	380	6
9/1/2005	1.8E+00	1,164,371	703,046	213	8,950	756	8
12/1/2005	2.8E+00	1,164,392	703,049	192	9,447	287	6
3/1/2006	1.9E+00	1,164,377	703,046	208	9,322	772	8
6/1/2006	2.2E+00	1,164,408	703,050	178	10,155	336	6
10/1/2006	2.8E+00	1,164,433	703,065	149	17,507	1,345	8
12/1/2006	6.4E+00	1,164,455	703,068	127	14,442	959	6
3/1/2007	3.1E+00	1,164,458	703,069	124	18,254	1,445	8
7/1/2007	3.6E+00	1,164,460	703,070	123	15,213	1,000	6
9/1/2007	3.4E+00	1,164,448	703,073	134	13,470	1,244	8
12/1/2007	3.3E+00	1,164,452	703,069	130	14,919	1,008	6
3/1/2008	3.1E+00	1,164,457	703,072	125	17,295	1,385	8
6/1/2008	0.0E+00						5
9/1/2008	3.1E+00	1,164,446	703,072	136	16,077	1,362	8
1/1/2009	5.7E+00	1,164,469	703,075	113	14,769	1,034	6

Project: THCGS - East
Location: Tacoma

User Name: M Dalton
State: Washington

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	BENZENE	0.58	174	100.0%	I
1st Moment: Distance to Source					
	BENZENE	0.32	-93	97.3%	D
2nd Moment: Sigma XX					
	BENZENE	0.29	107	98.7%	I
2nd Moment: Sigma YY					
	BENZENE	0.49	105	98.5%	I

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.20 Saturated Thickness: Uniform: 10 ft

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

Note: The Sigma XX and Sigma YY components are estimated using the given field coordinate system and then rotated to align with the estimated groundwater flow direction. Moments are not calculated for sample events with less than 6 wells.

MAROS Zeroth Moment Analysis

Project: THCGS East

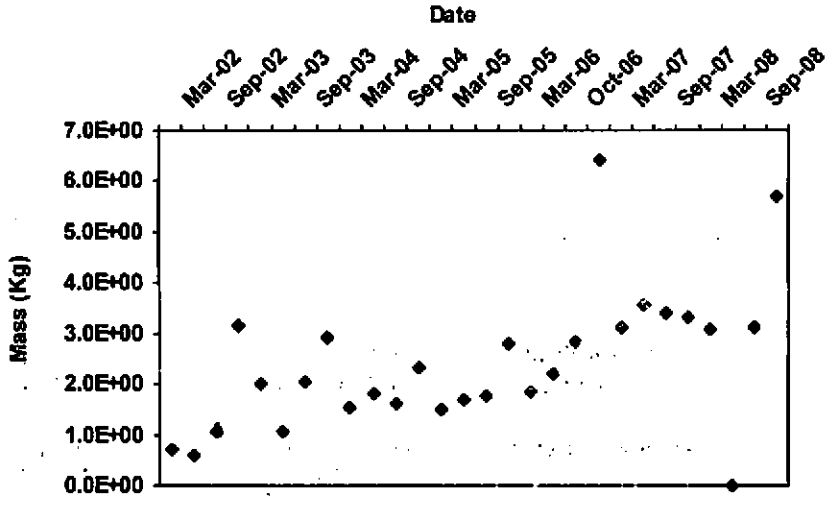
User Name: M Dalton

Location: Tacoma

State: Washington

COC: BENZENE

Change in Dissolved Mass Over Time



Porosity: 0.20

Saturated Thickness:

Uniform: 10 ft

Mann Kendall S Statistic:

174

Confidence in Trend:

100.0%

Coefficient of Variation:

0.58

Zeroth Moment Trend:

1

Data Table:

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
3/1/2002	BENZENE	7.1E-01	8
6/1/2002	BENZENE	5.8E-01	6
9/1/2002	BENZENE	1.1E+00	8
12/1/2002	BENZENE	3.1E+00	6
3/1/2003	BENZENE	2.0E+00	7
6/1/2003	BENZENE	1.0E+00	6
9/1/2003	BENZENE	2.0E+00	8
12/1/2003	BENZENE	2.9E+00	6
3/1/2004	BENZENE	1.5E+00	8
6/1/2004	BENZENE	1.8E+00	6
9/1/2004	BENZENE	1.6E+00	8
12/1/2004	BENZENE	2.3E+00	6
3/1/2005	BENZENE	1.5E+00	8
6/1/2005	BENZENE	1.7E+00	6
9/1/2005	BENZENE	1.8E+00	8
12/1/2005	BENZENE	2.8E+00	6
3/1/2006	BENZENE	1.9E+00	8
6/1/2006	BENZENE	2.2E+00	6
10/1/2006	BENZENE	2.8E+00	8
12/1/2006	BENZENE	6.4E+00	6
3/1/2007	BENZENE	3.1E+00	8
7/1/2007	BENZENE	3.6E+00	6

MAROS Zeroth Moment Analysis

Effective Date	Constituent	Estimated Mass (Kg)	Number of Wells
9/1/2007	BENZENE	3.4E+00	8
12/1/2007	BENZENE	3.3E+00	6
3/1/2008	BENZENE	3.1E+00	8
6/1/2008	BENZENE	0.0E+00	5
9/1/2008	BENZENE	3.1E+00	8
1/1/2009	BENZENE	5.7E+00	6

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events); ND = Non-detect. Moments are not calculated for sample events with less than 6 wells.

MAROS First Moment Analysis

Project: THCGS - East

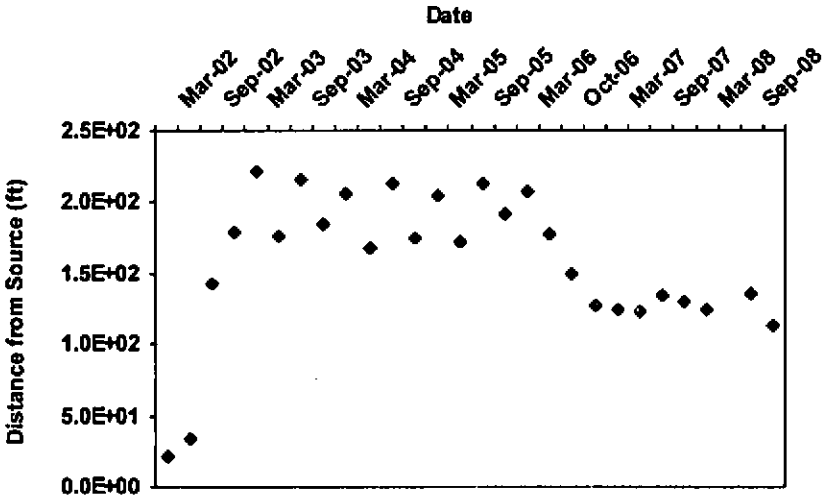
User Name: M Dalton

Location: Tacoma

State: Washington

COC: BENZENE

Distance from Source to Center of Mass



Mann Kendall S Statistic: -93

Confidence in Trend: 97.3%

Coefficient of Variation: 0.32

First Moment Trend: D

Data Table:

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source (ft)	Number of Wells
3/1/2002	BENZENE	1,164,599	703,090	21	8
6/1/2002	BENZENE	1,164,555	703,098	34	6
9/1/2002	BENZENE	1,164,440	703,063	142	8
12/1/2002	BENZENE	1,164,404	703,053	180	6
3/1/2003	BENZENE	1,164,362	703,046	222	7
6/1/2003	BENZENE	1,164,408	703,050	176	6
9/1/2003	BENZENE	1,164,369	703,045	215	8
12/1/2003	BENZENE	1,164,400	703,048	184	6
3/1/2004	BENZENE	1,164,379	703,046	206	8
6/1/2004	BENZENE	1,164,416	703,050	168	6
9/1/2004	BENZENE	1,164,372	703,046	213	8
12/1/2004	BENZENE	1,164,409	703,049	175	6
3/1/2005	BENZENE	1,164,380	703,046	204	8
6/1/2005	BENZENE	1,164,412	703,051	172	6
9/1/2005	BENZENE	1,164,371	703,046	213	8
12/1/2005	BENZENE	1,164,392	703,049	192	6
3/1/2006	BENZENE	1,164,377	703,046	208	8
6/1/2006	BENZENE	1,164,406	703,050	178	6
10/1/2006	BENZENE	1,164,433	703,065	149	8
12/1/2006	BENZENE	1,164,455	703,068	127	6
3/1/2007	BENZENE	1,164,458	703,069	124	8
7/1/2007	BENZENE	1,164,460	703,070	123	6
9/1/2007	BENZENE	1,164,448	703,073	134	8

MAROS First Moment Analysis

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source (ft)	Number of Wells
12/1/2007	BENZENE	1,164,452	703,069	130	6
3/1/2008	BENZENE	1,164,457	703,072	125	8
6/1/2008	BENZENE				5
9/1/2008	BENZENE	1,164,446	703,072	136	8
1/1/2009	BENZENE	1,164,469	703,075	113	6

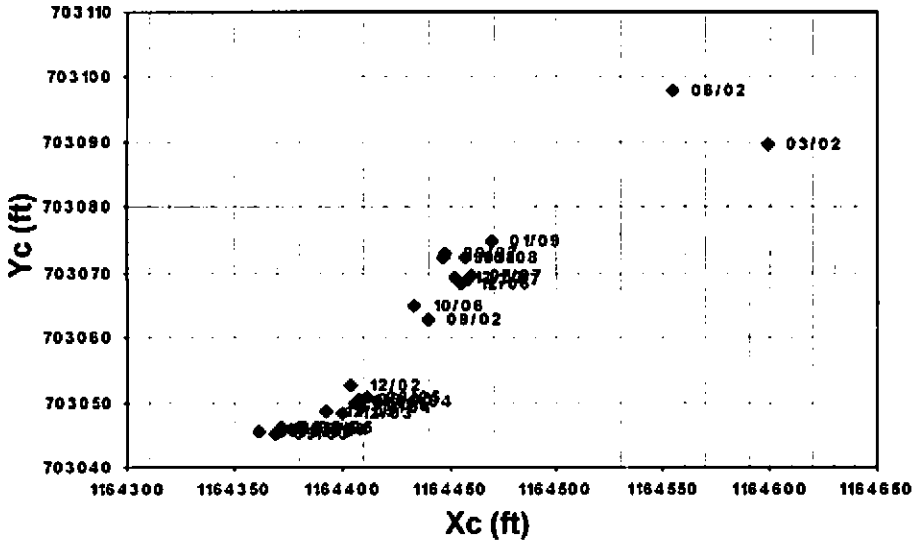
Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

MAROS First Moment Analysis

Project: THCGS East
User Name: M Dalton
Location: Tacoma
State: Washington

COC: BENZENE

Change in Location of Center of Mass Over Time



Groundwater Flow Direction:

Source Coordinate:

X: 1,164,582
Y: 703,077

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source (ft)	Number of Wells
3/1/2002	BENZENE	1,164,599	703,090	21	8
6/1/2002	BENZENE	1,164,555	703,098	34	6
9/1/2002	BENZENE	1,164,440	703,063	142	8
12/1/2002	BENZENE	1,164,404	703,053	180	6
3/1/2003	BENZENE	1,164,362	703,046	222	7
6/1/2003	BENZENE	1,164,408	703,050	176	6
9/1/2003	BENZENE	1,164,369	703,045	215	8
12/1/2003	BENZENE	1,164,400	703,048	184	6
3/1/2004	BENZENE	1,164,379	703,046	206	8
6/1/2004	BENZENE	1,164,416	703,050	168	6
9/1/2004	BENZENE	1,164,372	703,046	213	8
12/1/2004	BENZENE	1,164,409	703,049	175	6
3/1/2005	BENZENE	1,164,360	703,046	204	8
6/1/2005	BENZENE	1,164,412	703,051	172	6
9/1/2005	BENZENE	1,164,371	703,046	213	8
12/1/2005	BENZENE	1,164,392	703,049	192	6
3/1/2006	BENZENE	1,164,377	703,046	208	8
6/1/2006	BENZENE	1,164,406	703,050	178	6
10/1/2006	BENZENE	1,164,433	703,065	149	8
12/1/2006	BENZENE	1,164,455	703,068	127	6
3/1/2007	BENZENE	1,164,458	703,069	124	8
7/1/2007	BENZENE	1,164,460	703,070	123	6
9/1/2007	BENZENE	1,164,448	703,073	134	8
12/1/2007	BENZENE	1,164,452	703,069	130	6
3/1/2008	BENZENE	1,164,457	703,072	125	8

MAROS First Moment Analysis

Effective Date	Constituent	Xc (ft)	Yc (ft)	Distance from Source (ft)	Number of Wells
6/1/2008	BENZENE				5
9/1/2008	BENZENE	1,164,446	703,072	136	8
1/1/2009	BENZENE	1,164,469	703,075	113	6

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events). Moments are not calculated for sample events with less than 6 wells.

MAROS Second Moment Analysis

Project: THCGS East

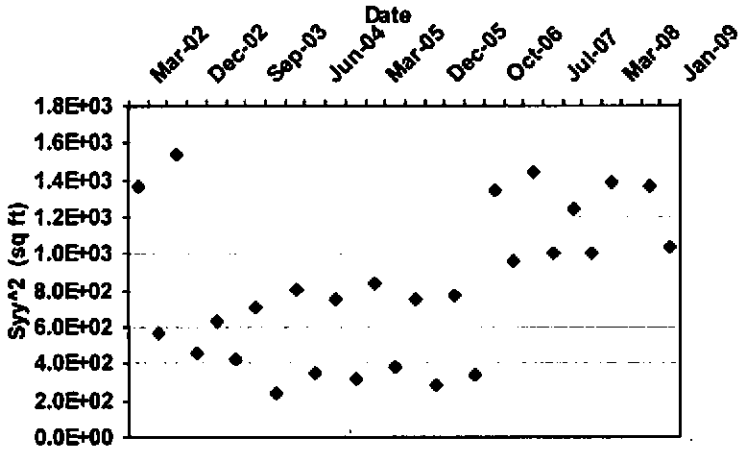
User Name: M Dalton

Location: Tacoma

State: Washington

COC: BENZENE

Change in Plume Spread Over Time

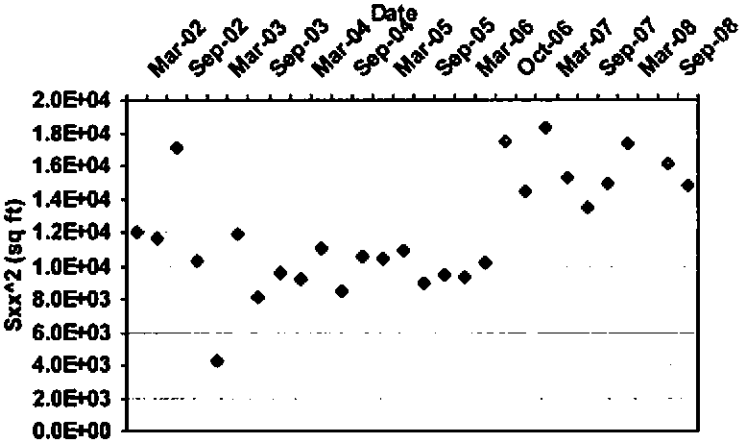


Mann Kendall S Statistic: 105

Confidence in Trend: 98.5%

Coefficient of Variation: 0.49

Second Moment Trend: I



Mann Kendall S Statistic: 107

Confidence in Trend: 98.7%

Coefficient of Variation: 0.29

Second Moment Trend: I

Data Table:

Effective Date	Constituent	Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
3/1/2002	BENZENE	12,005	1,365	8
6/1/2002	BENZENE	11,578	563	6
9/1/2002	BENZENE	17,052	1,537	8
12/1/2002	BENZENE	10,314	463	6
3/1/2003	BENZENE	4,298	633	7
6/1/2003	BENZENE	11,918	424	6
9/1/2003	BENZENE	8,107	708	8
12/1/2003	BENZENE	9,553	245	6
3/1/2004	BENZENE	9,161	810	8
6/1/2004	BENZENE	11,047	354	6
9/1/2004	BENZENE	8,477	751	8
12/1/2004	BENZENE	10,602	316	6

MAROS Second Moment Analysis

Effective Date	Constituent	Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
3/1/2005	BENZENE	10,420	840	8
6/1/2005	BENZENE	10,874	380	6
9/1/2005	BENZENE	8,950	756	8
12/1/2005	BENZENE	9,447	287	6
3/1/2006	BENZENE	9,322	772	8
6/1/2006	BENZENE	10,155	336	6
10/1/2006	BENZENE	17,507	1,345	8
12/1/2006	BENZENE	14,442	959	6
3/1/2007	BENZENE	16,254	1,445	8
7/1/2007	BENZENE	15,213	1,000	6
9/1/2007	BENZENE	13,470	1,244	8
12/1/2007	BENZENE	14,919	1,006	6
3/1/2008	BENZENE	17,295	1,385	8
6/1/2008	BENZENE			5
9/1/2008	BENZENE	16,077	1,362	8
1/1/2009	BENZENE	14,769	1,034	6

Note: Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A) - Due to insufficient Data (< 4 sampling events)

The Sigma XX and Sigma YY components are estimated using the given field coordinate system and then rotated to align with the estimated groundwater flow direction. Moments are not calculated for sample events with less than 6 wells.

MAROS Spatial Moment Analysis Summary

Project: THCGS East
Location: Tacoma

User Name: M Dalton
State: Washington

	0th Moment	1st Moment (Center of Mass)			2nd Moment (Spread)		
Effective Date	Estimated Mass (Kg)	Xc (ft)	Yc (ft)	Source Distance (ft)	Sigma XX (sq ft)	Sigma YY (sq ft)	Number of Wells
BENZENE							
3/1/2002	7.1E-01	1,164,599	703,090	21	12,005	1,365	8
6/1/2002	5.8E-01	1,164,555	703,098	34	11,578	563	6
9/1/2002	1.1E+00	1,164,440	703,063	142	17,052	1,537	8
12/1/2002	3.1E+00	1,164,404	703,053	180	10,314	463	6
3/1/2003	2.0E+00	1,164,362	703,046	222	4,298	633	7
6/1/2003	1.0E+00	1,164,408	703,050	176	11,918	424	6
9/1/2003	2.0E+00	1,164,369	703,045	215	8,107	708	8
12/1/2003	2.9E+00	1,164,400	703,048	184	9,552	245	6
3/1/2004	1.5E+00	1,164,379	703,046	206	9,161	810	8
6/1/2004	1.8E+00	1,164,416	703,050	168	11,047	354	6
9/1/2004	1.6E+00	1,164,372	703,046	213	8,477	751	8
12/1/2004	2.3E+00	1,164,409	703,049	175	10,602	316	6
3/1/2005	1.5E+00	1,164,380	703,046	204	10,420	840	8
6/1/2005	1.7E+00	1,164,412	703,051	172	10,874	360	6
9/1/2005	1.8E+00	1,164,371	703,046	213	8,950	756	8
12/1/2005	2.8E+00	1,164,392	703,049	192	9,447	287	6
3/1/2006	1.9E+00	1,164,377	703,046	208	9,322	772	8
6/1/2006	2.2E+00	1,164,406	703,050	178	10,155	336	6
10/1/2006	2.8E+00	1,164,433	703,065	149	17,507	1,345	8
12/1/2006	6.4E+00	1,164,455	703,068	127	14,442	959	6
3/1/2007	3.1E+00	1,164,458	703,069	124	18,254	1,445	8
7/1/2007	3.6E+00	1,164,460	703,070	123	15,213	1,000	6
9/1/2007	3.4E+00	1,164,448	703,073	134	13,470	1,244	8
12/1/2007	3.3E+00	1,164,452	703,069	130	14,919	1,006	6
3/1/2008	3.1E+00	1,164,457	703,072	125	17,295	1,385	8
6/1/2008	0.0E+00						5
9/1/2008	3.1E+00	1,164,446	703,072	136	16,077	1,362	8
1/1/2009	5.7E+00	1,164,469	703,075	113	14,769	1,034	6

Project: THCGS East

Location: Tacoma

User Name: M Dalton

State: Washington

Moment Type	Constituent	Coefficient of Variation	Mann-Kendall S Statistic	Confidence in Trend	Moment Trend
Zeroth Moment: Mass					
	BENZENE	0.58	174	100.0%	I
1st Moment: Distance to Source					
	BENZENE	0.32	-93	97.3%	D
2nd Moment: Sigma XX					
	BENZENE	0.29	107	98.7%	I
2nd Moment: Sigma YY					
	BENZENE	0.49	105	98.5%	I

Note: The following assumptions were applied for the calculation of the Zeroth Moment:

Porosity: 0.20 **Saturated Thickness:** Uniform 10 ft

Mann-Kendall Trend test performed on all sample events for each constituent. Increasing (I); Probably Increasing (PI); Stable (S); Probably Decreasing (PD); Decreasing (D); No Trend (NT); Not Applicable (N/A)-Due to insufficient Data (< 4 sampling events).

Note: The Sigma XX and Sigma YY components are estimated using the given field coordinate system and then rotated to align with the estimated groundwater flow direction. Moments are not calculated for sample events with less than 6 wells.

OU 3 Attachment 3 -
Community-Provided Information Technical Memorandum

US Army Corps of Engineers®
Seattle District

MEMORANDUM FOR RECORD

SUBJECT: Community-Provided Information Technical Memorandum, Tacoma Tar Pits (OU 03), Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington, Third Five-Year Review

PREPARED BY: Tamara Langton, USEPA Region 10 Remedial Project Manager for Tacoma Tar Pits OU 03, and Jefferey Powers, Hydrogeologist, Seattle District, U.S. Army Corps of Engineers

Date: 16 Dec 2009

Purpose

The purpose of this memorandum is to document review of community-provided information on the Tacoma Tar Pits site (site) as part of the Commencement Bay/Nearshore Tideflats (CB/NT) Superfund Site's 2009 Five-Year Review. Concerns or complaints not directly related to environmental issues at the Tacoma Tar Pits site are not addressed.

Focus of Community Information

Nearly all of the information provided by the community regarding the site was related to the initial construction and expansion of the Northwest Detention Center (NWDC) and concerns with potential risks to detainees and on site workers from contact with contaminated soil and groundwater. Concerns received about this expansion were from two citizen groups, the Bill of Rights Defense Committee (BORDC) – Tacoma and Citizens for a Healthy Bay (CHB), and from two local citizens.

In preparation for this memorandum, multiple emails were reviewed from the BORDC, CHB, City of Tacoma, Washington State Department of Ecology (Ecology), EPA Region 10, Dalton, Olmsted & Fuglevand, Inc. (DOF), Lydig Construction (Lydig), Landau Associates, Inc., and The GEO Group, Inc. A number of technical documents were also reviewed and are listed under *References, Community-Provided Information and Other Support Documents* at the end of this memorandum.

SUBJECT: Community-Provided Information Technical Memorandum, Tacoma Tar Pits (OU 03), Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington, Third Five-Year Review, continued

The Northwest Detention Center

The NWDC is located on the former Hygrade meat packing plant property in the northwest portion of the Tacoma Tar Pits site, and is used to temporarily detain individuals who are awaiting determination of their immigration status. The property is comprised of seven tax parcels that cover approximately 14.25 acres. This property was included as part of the Tacoma Tar Pits Superfund site because of suspected contamination emanating from the former Tacoma Historical Coal Gasification Plant operations and the metals recycling facility located south and downgradient of the NWDC. Groundwater was found to be contaminated and subsequently monitored; however, little soil contamination was found. Except for a small section at the southeast corner, the vast majority of this property, including soils beneath the current NWDC facility, did not require excavation or capping under the Superfund remedy.

After demolition of the Hygrade buildings and prior to construction of the initial detention facility, soils contaminated with total petroleum hydrocarbons (TPH) and carcinogenic polyaromatic hydrocarbons (cPAHs) unrelated to the Superfund cleanup were discovered in three areas of the former Hygrade property. In 2002, the property owner entered into Ecology's Voluntary Cleanup Program (VCP) to address this soil contamination. Impacted soil and debris were excavated from the three areas, backfilled with clean materials, and capped. Cleanup of the three areas was completed in early January 2003. Ecology issued an opinion letter on March 3, 2003 stating the cleanup actions met state cleanup requirements and that no further cleanup actions were needed prior to redeveloping the property as long as the property owner entered into and complied with a Restrictive Covenant (Ecology 2003a and 2003b). On March 27, 2003, the property owner recorded the Restrictive Covenant which prohibited uses of the cleaned and capped VCP areas and property groundwater. Groundwater investigation and remediation was not required by the VCP; however, groundwater use on this property is restricted and groundwater continues to be monitored as part of the Superfund remedy. See below section (Violation of Land-Use Restrictions) for more information on land-use restrictions at the site.

Construction of the initial NWDC facility was completed in late 2003. The Department of Homeland Security, Immigration and Customs Enforcement (ICE) currently lease the NWDC from the property owner. When first constructed, the NWDC was designed to hold approximately 500 - 1,000 detainees. In 2008, preparations began for expansion of the facility to include a new wing to house an additional 553 detainees. Expansion construction was completed in summer 2009.

Request for Emergency Inspection and Other Community Concerns

On December 10, 2008 EPA received a request from the BORDC to conduct an emergency inspection of the NWDC expansion area. The BORDC contended that expansion grading, excavating, auguring and soils compression activities breached the VCP surface cap allowing contaminated subsurface groundwater and highly contaminated soils to be exposed in violation

of Ecology's Restrictive Covenant. The request included photos where BORDC had observed areas of contamination due to expansion activities.

On December 11, EPA received an inquiry from CHB regarding the BORDC concerns along with an e-mail forwarded from a local citizen complaining of odor and "ooze" at the site. This citizen also contended that there was no "bottom" to the engineered waste pile to the south of the NWDC facility allowing site (soil) contaminants to readily come in contact with groundwater.

In early September 2009, Ecology forwarded to EPA a complaint received from a local citizen concerned that the expansion activities violated the aforementioned Restrictive Covenant and allowed contaminants to seep into the facility buildings "causing an unbearable hazard."

Coordinated Inspections and Investigations

In response to citizen concerns received on December 10 and 11, the City of Tacoma, Ecology and EPA immediately launched a coordinated inspection of the NWDC expansion area. Since then a number of additional inspections were conducted by or on behalf of EPA, Ecology, the City of Tacoma, and the Washington State Department of Labor and Industry as expansion efforts continued through spring 2009. As part of soil excavations, the Tacoma-Pierce County Health Department (TPCHD) required the NWDC property owner to stockpile and sample excavated soils prior to their removal to the Pierce County Land Recovery, Inc., (LRI) landfill located in Graham, Washington. EPA and Ecology obtained copies of the sampling results from the property owner as they became available to ensure that on site construction workers, and NWDC staff and detainees, were safe from exposure to any contaminated materials that may have been found. In addition, EPA conducted limited soil and surface water sampling in April 2009 (E&E 2009).

In addition to inspections and analyses related to the NWDC expansion, the City of Tacoma continues its extensive surface and storm-water monitoring and compliance program of the entire tideflats area which includes the Tacoma Tar Pits site. EPA also continues to monitor groundwater downgradient of the NWDC facility.

Results of Inspections and Investigations

The community concerns over the initial construction and expansion of the NWDC and potential risks to detainees and onsite workers from contact with contaminated soil and groundwater were not substantiated. This conclusion is based on a review of available documents, inspections and investigations conducted at the site from December through April, 2009, and from ongoing surface and groundwater water monitoring conducted by EPA and the City of Tacoma.

Observed Areas of Contamination

Concerns over odor and "ooze" at the site were not observed or substantiated. In addition, several of the photos submitted with the December 10 and 11 notices were not on the Tacoma

SUBJECT: Community-Provided Information Technical Memorandum, Tacoma Tar Pits (OU 03), Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington, Third Five-Year Review, continued

Tar Pits site. Ecology and City of Tacoma inspectors, however, located each area and worked with the applicable property owner to address suspected contamination where warranted. Additional offsite photos submitted in January 2009 were also investigated.

Bottom of the Waste Pile

Concerns with the "bottom-less" engineered waste pile south and downgradient of the NWDC facility were also not substantiated as the "feet" of the engineered and stabilized waste pile are well above the water table. The contaminated material under the original waste pile area was excavated to the top of the underlying clay layer and was backfilled with clean materials. The clean backfill was placed well above the seasonally high water table, and stabilized wastes were placed on top of the clean material. Materials were stabilized using either a pug mill or a custom-designed and built batch mix plant. The primary stabilizing agent was Portland cement, although tarry materials were stabilized with a combination of cement and the proprietary ingredient "P-27" manufactured by the Silicate Technology Company. The end result of either stabilization process was a roller compactable material which was placed and compacted within the waste pile on top of the clean fill. Plates were installed on top of the pile to monitor settlement. Little settlement was observed.

The goal during development of the engineered waste pile design was to stabilize the waste materials so that if they did contact water, they would not leach above the 1987 Record of Decision (ROD) surface and groundwater performance criteria. The design testing program was extensive (many mix designs and leaching tests were conducted) and confirmed by testing completed during remedial actions (many field coupons were collected and tested). To date, there is no evidence that the capped and stabilized engineered waste pile materials are having any impact on groundwater.

Impacts on Superfund Remedy

In regards to impacts on the Superfund remedy, the initial construction and subsequent expansion of the NWDC facility did not impact the Superfund remedy. This conclusion is based on a review of site documents and construction plans, as well as observations and interviews conducted during recent expansion activities. The facility's construction footprint did not breach the capped engineered waste pile south of the facility or any other capped portion of the site pursuant to the Superfund remedy. In addition, construction efforts did not impact the groundwater monitoring system or groundwater. Groundwater from the NWDC property is currently below ROD cleanup criteria and in the case of benzene is non-detect according to data from downgradient monitoring wells located between the NWDC facility and the capped engineered waste pile to the south and east.

SUBJECT: Community-Provided Information Technical Memorandum, Tacoma Tar Pits (OU 03), Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington, Third Five-Year Review, continued

Excavation Risks

As mentioned earlier in this memorandum, the TPCHD required the NWDC property owner to stockpile and sample excavated soils prior to their removal to the LRI landfill. The samples and analytical results were reviewed by Ecology and EPA.

All but two of the stockpiled soil samples were either non-detect or below accepted cleanup levels. Two soil samples taken on February 3, 2009 from the new wing elevator shaft excavation showed exceedances of certain polycyclic aromatic hydrocarbons, or PAHs (Test America 2009). The TPCHD approved of the disposal to LRI; however, Ecology and EPA wanted to determine if the sample materials were derived from coal tar (a Superfund contaminant) or from petroleum. Ecology submitted the sample results to their laboratory in Manchester, Washington for further analysis. Based on this analysis, a chemist at the Ecology laboratory stated that the PAHs observed in the sample results were due to petroleum contamination, either pyrogenic or petrogenic in origin, and were not associated with coal-derived material (Ecology 2009a). Since these samples did not originate from the Superfund-contaminated area of the site or pose any adverse risks to detainees or on site workers, excavation activities were allowed to continue.

In regards to risks during excavation, evaluation of sampling data indicated that adverse effects on construction workers, detainees and NWDC staff and detainees from exposure to soils and groundwater during excavation are not anticipated (Bailey 2009).

Vapor Intrusion Risks

The construction and expansion of the NWDC did add a potential new exposure pathway for detainees and workers within the detention facility buildings via vapor intrusion from subsurface contamination. As such, a screening evaluation was conducted by an EPA risk assessor during this Five-Year Review using soil sampling data taken from expansion excavations.

Of the sixteen individual PAHs that EPA currently evaluates for human health, only seven of these are considered volatile for purposes of vapor intrusion, and of those, only naphthalene, a contaminant of concern during excavations, has inhalation toxicity values (cancer and noncancer) in EPA's Regional Screening Levels tables. Mercury (elemental), which is also volatile, was also found in excavation soil samples. Benzene, the primary focus of the groundwater monitoring program, was not detected in excavation soils. Therefore, the screening evaluation for vapor intrusion at the NWDC was limited to naphthalene and elemental mercury in subsurface soil.

Results of this screening evaluation found that unacceptable risks to detainees and onsite workers from exposure to estimated indoor air concentrations from vapor intrusion is not likely. No additional review is necessary unless new information suggests otherwise (Bailey 2009).

SUBJECT: Community-Provided Information Technical Memorandum, Tacoma Tar Pits (OU 03), Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington, Third Five-Year Review, continued

Utility Trench Area Risks

In addition to soil sampling conducted on behalf of the NWDC property owner, EPA's contractor, Ecology and Environment (E&E), conducted limited soil and surface water sampling in April 2009 due to observance of "tar-like chips" during excavation of the utility trench area on the far eastern boundary of the NWDC property. Results of the two "obsidian-like" soil samples showed exceedances of ROD cleanup levels for Aroclor 1260 (a PCB) and for benzo (a)pyrene (a PAH). E&E concluded that these exceedances do not likely pose a risk to detainees or on site workers since the samples are not representative of actual exposure to soil because of their solid nature, i.e., those risks due to direct contact with the solid material would be less than with typical soil in the utility trench area (E&E 2009). The same EPA risk assessor who conducted the screening evaluation of the potential vapor intrusion pathway discussed above, reviewed E&E's sampling data and analyses. Although the EPA risk assessor generally agreed with E&E's conclusion, she observed that there remains a question as to what actual, representative soil samples from this utility trench area might contain (Bailey 2009).

Although there is still a question about the soils in the utility trench area, a reasonable assumption can be made that they do not pose a direct exposure risk to detainees or on site workers since 1) soils excavated from the utility trench area were apparently combined and sampled by the PRP's remedial contractor along with other excavation soils prior to off site disposal, and 2) according to the property owner, the trench was backfilled with clean materials and hydro seeded or capped with 3 to 4 inches of 5/8" crushed rock for a perimeter road. Therefore, based on current information, it is not recommended that additional soil sampling in the utility trench area be obtained at this time.

Other Community Concerns

The community also voiced other concerns regarding the NWDC expansion including the validity of sampling data, the state of Washington's State Environmental Protection Act (SEPA) addendum, the violation of land-use restrictions on the NWDC property, and the breaching of clean "caps." These are addressed below only as far as they relate to environmental concerns at the Tacoma Tar Pits site.

Reliability and Availability of Sampling Data

BORDC expressed concern about the reliability of the sampling data from expansion excavation activities, stating that "the Department of Ecology is relying on limited sample results from the very people in violation of the Restrictive Covenant" (BORDC 2009a). The samples taken prior to and during excavation activities were done by reputable environmental contractors according to customary protocols, and were analyzed by reliable laboratories. These entities hold no stake in the outcome of the results and there is no reason to suspect the results would not be valid.

SUBJECT: Community-Provided Information Technical Memorandum, Tacoma Tar Pits (OU 03), Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington, Third Five-Year Review, continued

BORDC also stated that the most critical items pertaining to groundwater testing and storm water discharge were done outside of the review process and citizen oversight, and specifically asked where the results of quarterly sampling conducted by the City of Tacoma were located (BORDC 2009a). Quarterly surface water and groundwater sampling is conducted by Puget Sound Energy's remedial contractor pursuant to the Superfund remedy, and sampling results are reviewed and made publicly available in the EPA Tacoma Tar Pits site file located at the EPA Region 10 Seattle office. BORDC would need to contact the City of Tacoma for sampling results related to their storm water monitoring and compliance program.

SEPA Appeal

The BORDC submitted an appeal to the City of Tacoma regarding the City's SEPA Determination of No significance for the NWDC expansion (BORDC 2008b). Upon reviewing the appeal's supporting documentation, two environmental issues were noted. The first issue concerned regional geologic and flooding hazards and the second environmental issue concerned the "cumulative effects" of the degraded media associated with the detention center expansion. Since the SEPA application does not address the handling of pre-existing or potentially pre-existing subsurface contamination associated with the site, this issue is not directly applicable to the Tacoma Tar Pits site or the greater CB N/T Superfund Site. Also, while the natural hazards mentioned may be well founded, these are irrelevant to the Tacoma Tar Pits site or the CB/NT Superfund Site.

Violation of Land Use Restrictions

The concern over violation of land-use restrictions and the breaching of clean soil caps allowing contaminated materials to be released may be partly based on confusion over two, separate legal documents that restrict uses of the NWDC property.

In 1991, EPA entered into a Consent Decree (CD) with then property owner, Hygrade Food Products, which included certain land-use restrictions (United States District Court 1991). The CD, specifically under *Conveyance of Site/Institutional Controls, Paragraph 21*, requires notice be given to potential purchasers or lessees of the [then Hygrade, now Geo Group] property within the capped portions of the Site that a) hazardous substances remain under the cap at the Site, and b) use of the property must never be allowed to disturb the integrity of the cap or any other component of the containment system or the function of the Site's groundwater monitoring system. As stated earlier in this memorandum, only a small section of the southeast corner of the NWDC property required excavation of contaminated soils and clean capping under the Superfund remedy. Groundwater was not remediated on the NWDC property, but groundwater downgradient from the NWDC property continues to be monitored. The cap mentioned in the CD, therefore, only applies to the Superfund-capped portion of the NWDC property which was not breached by the NWDC expansion efforts. The groundwater monitoring system was also not impacted during expansion as evidenced by recent groundwater monitoring results.

SUBJECT: Community-Provided Information Technical Memorandum, Tacoma Tar Pits (OU 03), Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington, Third Five-Year Review, continued

As discussed earlier, Ecology entered into a Restrictive Covenant on tax parcels associated with the current NWDC facility with then property owner DVR, LLC (subsequently transferred to the Correctional Services Corporation, or CSC, and now owned by The GEO Group, Inc.). The Restrictive Covenant (Ecology 2003) was required because the 2002-2003 VCP soil cleanup actions resulted in residual concentrations of TPH that exceed the Model Toxics Control Act (MTCA) Method A residential Cleanup Levels for groundwater (Landau Associates 2003). This Restrictive Covenant contains a prohibition on the taking or use of groundwater from the shallow aquifer on the NWDC property for purposes other than monitoring or remediation. The Restrictive Covenant for the NWDC property also prohibits activities on the property that may interfere with the integrity of the three VCP cleanup areas that may result in the release or exposure of hazardous substances (i.e., groundwater) that remains on the property as part of the cleanup. Section 6 of the Restrictive Covenant directs the land owner to notify and obtain approval from Ecology prior to any use of the property that is inconsistent with the terms of the Restrictive Covenant.

The three VCP cleanup areas, SP-1, SP-8, and SP-11 were addressed in 2002-2003 as described in the Northwest Detention Facility Cleanup Report (Landau Associates 2003). Area SP-1 is outside the NWDC expansion construction footnote; Area SP-8 is within close proximity to – but outside of – the expansion construction footprint. A small portion of Area SP-11 appears to overlap with the expansion construction footprint per figures provided in the aforementioned Cleanup Report. These three areas were excavated until sampling indicated cleanup levels had been attained in-situ. This corresponded to an excavation depth of about 10 to 11 feet for the SP-11 area. SP-11 was subsequently backfilled with 2-3 feet of crushed concrete surfacing material followed by about 6-7 feet of imported clean sand and gravel, followed by 1-2 feet of concrete surfacing material to grade.

As it appears that a small portion of SP-11 was breached during auguring and excavation of the new detainee wing, the property owner was to have notified Ecology beforehand. Failure to do so violated Section 6 of the Restrictive Covenant (Ecology 2008). Upon discovering this, Ecology notified the property owner, The GEO Group, Inc., of the violation. In response, the GEO Group submitted an application to enter the VCP in response to expansion activities (Ecology 2009c).

Breaching of VCP Areas

The concern over violation of land-use restrictions and the breaching of clean soil caps allowing contaminated materials to be released may also be based on confusion over the location and depth of bore hole testing, auguring and foundation excavation activities.

On December 16, 2008, BORDC requested EPA to take a look at bore hole tests taken by Landau Associates in 2003 as part the VCP cleanup and the SEPA application for the initial NWDC construction (USEPA 2008). BORDC expressed concern that the results of those tests, especially those for VCP cleanup area SP-8 where they claimed that expansion auguring

activities were happening, showed high levels of PAHs. Related to this, in a later e-mail to Ecology, BORDC claimed that "testing at 8 to 12 feet would be from the clean fill and this showed contamination" (BORDC 2009a).

Landau Associates did conduct confirmation soil sampling from the three areas cleaned up under the 2002 – 2203 VCP. Results presented in their 2003 Cleanup Report indicate that eight of the 65 soil samples exceeded the MTCA Method B cleanup level for benzo(a)pyrene (137 ug/kg). Five of these samples were beneath the railroad right-of-way in the SP-1 remediation area, and three of these five samples were off the NWDC property. Excluding the three off property soil samples, the two remaining exceedances met MTCA requirements that less than 10 percent of samples should be above the cleanup level. Groundwater was not sampled as part of the VCP cleanup. Results from EPA groundwater monitoring in 2002 were non-detect for benzene, toluene, ethylbenzene, xylene (BTEX), and PAHs. Anthracene was detected at 0.01 ug/L which is well below the MTCA Method B cleanup level for groundwater (4,800 ug/L).

Bore hole testing was conducted by GeoTech in August 2008 in which shallow groundwater samples were collected at the south end of the NWDC site before expansion auguring and excavation activities commenced. None of these bore holes were within the VCP areas. Results of sample analyses indicated no Volatile Organic Compound (VOC) or polychlorinated biphenyl (PCB) contamination, and only minimal detections of the PAHs anthracene and phenanthrene at one well (GeoTech 2008). Although one elevated lead result was reported, this was later found to be caused by a mistakenly unfiltered sample (Landau Associates 2008).

Review of sampling data from stockpiles of soil that were brought up by augurs during expansion efforts found some moderate exceedances of the MTCA Method A residential cleanup level for PAHs, but these PAH levels were below the MTCA industrial worker scenario (Ecology 2009b).

Based on a review of available technical documents and expansion construction plans, on site observations, and interviews with Lydig construction and GEO Group, Inc. personnel, none of the bore hole testing took place in any of the VCP areas, and none of the auguring and foundation excavation activities took place in the SP-1 or SP-8 VCP areas. Pile auguring and foundation excavation activities for the new detainee wing appear to have been limited to a small section of the SP-11 VCP area. BORDC assertions that construction activity "involves auguring down 50 to 100 feet" for stone piles for the building foundation and the auguring work has "displaced much of the subsurface contamination and brought up highly toxic soils to the surface" cannot be substantiated (BORDC 2008a). The construction contractor (Lydig) indicated that pile auguring did not exceed 8 feet; the piles to 40 feet were driven by vibratory coring machine below the augured depth without extraction of soil (Ecology 2009b).

SUBJECT: Community-Provided Information Technical Memorandum, Tacoma Tar Pits (OU 03), Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington, Third Five-Year Review, continued

Summary and Conclusion

The community concerns over the initial construction and expansion of the NWDC and potential risks to detainees and on site workers from contact with contaminated soil and groundwater were not substantiated based on a review of available documents, inspections and investigations conducted at the site from December through April, 2009, and from ongoing surface and groundwater water monitoring conducted by EPA and the City of Tacoma.

The engineered cap covering the stabilized waste pile in the central portion of the Tacoma Tar Pits site has not been breached, and the NWDC expansion-related construction activities have stayed clear of the Superfund capped areas and groundwater monitoring system.

The GEO Group's failure to notify Ecology prior to expansion excavation activities was a violation of the Ecology Restrictive Covenant; however, the environmental impacts and human health risks associated with this violation have not been realized.

SUBJECT: Community-Provided Information Technical Memorandum, Tacoma Tar Pits (OU 03), Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington, Third Five-Year Review, continued

References, Community-Provided Information and Other Supporting Documents

Bailey, Marcia, PhD, 2009. *Screening Evaluation of Soils at the Northwest Detention Center, Tacoma Tar Pits Superfund Site Memorandum..* Prepared for USEPA. November 22, 2009.

Bill of Rights Defense Committee (BORDC), 2009a. E-mail from BORDC (T. Smith) to Ecology (J. Mercuri), SUBJECT: UPDATE: Northwest Detention Center, Tacoma, Washington, dated February 5, 2009.

BORDC, 2009b. E-mail from BORDC (T. Smith) to Ecology (S. Toteff), *Violation of Protective Environmental Covenant to GEO Group, Inc. and CSC LLC of Tacoma at the Northwest Detention Center (NWDC) – Tacoma,* dated January 6, 2009.

BORDC, 2008a. Email from BORDC (T. Smith) to USEPA (T. Langton), SUBJECT: Request for an Emergency Inspection of the Tacoma Tarpits Operable Unit 23 EPA ID WAD980723795 Hygrade Area, dated December 10, 2008.

BORDC, 2008b. Appeal to Determination of Non-Significance SEPA (Environmental Issues), September 2008.

BORDC, 2004-2008c. PowerPoint presentations addressing past immigration and detention practices and the Northwest Detention Center, 2004 & 2008. [CD]

Citizens for a Healthy Bay (CHB), 2008. E-mail from CHB (L. Rose) to EPA (J. Odell) forwarding December 7, 2008 complaint from citizen, dated December 11, 2009.

City of Tacoma, 2008a. E-mail from City of Tacoma (M. Rhubright) to City of Tacoma (M. Kennedy) regarding inspections at Northwest Detention Center on December 10, 2008 due to citizen complaint, dated December 11, 2008.

City of Tacoma, 2008b. *Addendum to Existing Environmental Document (State Environmental Policy Act Addendum),* November 14, 2008. [CD]

City of Tacoma. *Environmental Policy Element - City of Tacoma Comprehensive Plan,* Last amended December 12, 2007. [CD]

City of Tacoma, 2000. *Determination of Environmental Nonsignificance Memorandum*, signed by S. Schultz, SEPA Officer, October 5, 2000. [CD]

Dalton, Olmsted & Fuglevand, Inc. (DOF), 2008a. THCGS – INS facility construction site visit memorandum. Prepared for Puget Sound Energy. December 14, 2008.

DOF, 2008b. E-mail from DOF (M. Dalton (DOF) to EPA (T. Langton) regarding the bottom of the engineered waste pile, dated December 9, 2009.

Ecology and Environment (E&E), 2009. *Technical Direction Document Number 09-04-0010, Tacoma Tar Pits Trip Report.* Prepared for USEPA, June 12, 2009.

Ecology, Washington State Department,, 2009a. E-mail from Ecology chemist (B. Carrell) to Ecology project manager (T. Middleton) regarding the February 2, 2009 high PAH soil sample, dated March 18, 2009.

SUBJECT: Community-Provided Information Technical Memorandum, Tacoma Tar Pits (OU 03), Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington, Third Five-Year Review, continued

Ecology, 2009b. E-mail from Ecology (J. Mercuri) to BORDC (T. Smith) regarding concerns at Northwest Detention Center, dated January 28, 2009.

Ecology & Geo Group, Inc., 2009c. Department of Ecology Voluntary Cleanup Program Agreement between Ecology and The Geo Group, Inc. January 22, 2009.

Ecology, 2008. E-mail from Ecology (J. Mercuri) to C. Beckett regarding oil on storm water pond and contamination concerns from INS Correctional Services, dated December 31, 2008.

Ecology, 2003a. Restrictive Covenant for DVR, LLC, March 27, 2003. [CD]

Ecology, 2003b. Certified mail from Ecology (L. Pearson) to Correctional Services Corporation (B. Paul) regarding the determination that no further remedial action is necessary at the NWDC, dated March 7, 2003.

Ethnic America Network, 2007. Various PowerPoint presentations concerning NWDC, 2007. [CD]

Environmental Services Network (ESN), 2008. Analytical Data Report for The GEO Group Project in Tacoma, Washington. Prepared for GeoTech Consultants. June 23, 2008.

Federal Emergency Management Agency (FEMA), 2008. 100-Year Flood Map (November 27, 2008). [CD]

GeoTech Consultants, 2008a. *Groundwater Sampling and Analysis* Letter Report. Proposed Expansion of Northwest Detention Center. Prepared for The GEO Group, Inc. August 21, 2008.

GeoTech Consultants, Inc, 2008b. *Addendum to GeoTechnical Engineering Study*, Proposed Expansion of Northwest Detention Center. Prepared for The GEO Group, Inc., July 1, 2008.

Huckell/Weinman Associates, 2000. *Expanded Environmental Checklist for INS Detention Facility*, [including Appendix A – Environmental Investigation] (April 21, 2000). [CD]

Immigration and Naturalization Service, 2001. *Final Report, Environmental Impact Statement for the Tacoma/Seattle Area Detention Center, Pierce County, WA,* June 2001. [CD]

Landau Associates, 2008. Memorandum from Landau Associates (J. Wynkoop and K.Hooper) to Lydig Construction (H. Hansen), *Environmental Services Northwest Detention Center* (re-evaluation of lead found in GeoTech groundwater sample, October 20, 2008.

Landau Associates, 2003. *Cleanup Report Correctional Services Corporation Northwest Detention Facility, Tacoma, Washington.* Prepared for Correctional Services Corporation, January 23, 2003.

Landau Associates, 2002a. *Final Cleanup Action Plan for the Northwest Detention Center, Tacoma, Landau Associates*, November 15, 2002.

Landau Associates, 2002b. *Draft Cleanup Action Plan Correctional Services Corporation INS Tacoma Facility, Tacoma, Washington.* Prepared for Correctional Services Corporation, September 30, 2002.

SUBJECT: Community-Provided Information Technical Memorandum, Tacoma Tar Pits (OU 03), Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington, Third Five-Year Review, continued

MACTEC, 2008. Transmittal Memo, S*tate Environmental Policy Act – Environmental Checklist Addendum. Proposed Expansion of Northwest Detention Center.* Prepared for The GEO Group, Inc. October 21, 2008.

Office of Technology Assessment on Superfund Implementation, 1988. Are We Cleaning Up? 10 Superfund Case Studies, A Special Report of Office of Technology Assessment on Superfund Implementation, June 1988. [CD]

Seattle University, 2008. *Voices from Detention: A Report on Human Rights Violations at the Northwest Detention Center in Tacoma, Washington.* Seattle University School of Law International Human Rights Clinic in collaboration with One America. July 2008.

Tacoma News Tribune, 2008. Chlorine Scare on Tacoma's Tideflats, March 10 2008 (date of electronic file). [CD]

Test America, 2009. Analytical Report for Job Number 580-12662-1 NW Detention Center. Prepared for Landau & Associates, Inc. February 6, 2009.

United States District Court, 1991. Partial Consent Decree for De Minimis Settlement Between the United States of America and City of Tacoma, Hygrade Food Products Corporation, Larry J.

Hansen and John D. Simchuck, filed under United States District Court Western

District of Washington at Tacoma under Civil Action No. C90-5373. May 13, 1991.

United States Environmental Protection Agency (USEPA), 2008. E-mail from EPA (T. Langton) to the City of Tacoma (S. Schultz, P. Rambow and M. Rhubright) and Ecology (J.Mercuri and M. Coleman) regarding a phone conversation with BORDC (T. Smith) on auguring and foundation excavation activities, dated December 16, 2009.

United States Geological Survey (USGS), 2002. Mount Rainier – Learning to Live with Volcanic Risk, Fact Sheet 034-02, US Geological Survey, 2002. [CD]

OU 3 Attachment 4- Draft Institutional Controls Report

Dalton, Olmsted & Fuglevand, Inc. *Environmental Consultants*

6034 N Star Rd. • Ferndale, Washington 98248
Telephone (360) 380-0862 (FAX 360-380-0862)
Cell (206) 498-6616 e-mail: mdalton@dofnw.com
(Kirkland, WA Office – 425-827-4588)

MEMORANDUM

TO: Tamara Langton - EPA

FROM: Matt Dalton

DATE: Draft: July 6, 2009

SUBJECT: Institutional Controls
THCGS (Tacoma Tar Pits)

REF. NO: WNG-001-00

CC: John Rork - PSE

This memorandum summarizes the results of an assessment of institutional controls (ICs) associated with properties located within the Tacoma Historical Coal Gasification or THCGS (aka Tacoma Tar Pits) site boundary (Figures 1 and 2). The THCGS is an operable unit within the Commencement Bay/Near Shore Tideflats (CB/NT) Superfund site. This assessment was completed by Dalton, Olmsted & Fuglevand, Inc. (DOF) for Puget Sound Energy (PSE) at the request of Tamara Langton, Site Manager for the Environmental Protection Agency (EPA), as part of EPA's current 5-year review of the CB/NT site.

The THCGS is comprised of a number of properties owned by different entities. While PSE is the performing responsible party, PSE only owns a small parcel, along River Street, that is used as a natural gas regulator station. The THCGS site boundary and parcel tax numbers are shown on Figure 2 and summarized in Table 1.

The majority of the property located within the THCGS site boundary is currently owned by the following entities:

- Simon Metals LLC
- Correctional Services Corp. (CSC of Tacoma)
- Burlington Northern/Santa Fe Railroad

Smaller parcels are owned by:

- Puget Sound Energy
- Aper I or Rain City Real Estate Holdings (APP Card Lock Station)
- Union Pacific Railroad
- 1616 St. Paul LLC

APPROACH AND DATA SOURCES

The THCGS site boundary was identified from the Remedial Action Report (DOF and FW 1995). Tax parcel numbers and current recorded ownership of properties within the THCGS boundary were identified from the Pierce County Assessors Office web page (www.appraisers.com/consumer/tax_ass/washington.html).

Chicago Title Insurance Company (Chicago Title) was contracted to complete an initial survey of target property records. Based on this review, ICs were identified for property owned by CSC of Tacoma and Aper I (cardlock station). Based on this preliminary review, Chicago Title was contacted to complete additional research (to issue a Plat Certificate) for a number of parcels including those owned by Simon Metals LLC, Puget Sound Energy, Union Pacific Railroad (UPRR) and Burlington Northern-Santa Fe Railroad (BNSF).

ICs were identified by review of Partial Consent Decrees and Consent Decrees referenced in the property records. The available information is summarized below. Selected documents are included in Attachments A to F. Electronic copies of the selected documents and other compiled documents are included on CD in Attachment G.

INSTITUTIONAL CONTROLS

ICs for the THCGS are summarized in the following documents[i]:

- Partial Consent Decree for De Minimis Settlement Between the United States of America and City of Tacoma, Hygrade Food Products Corporation, Larry J. Hansen and John D. Simchuck, filed under United States District Court Western District of Washington at Tacoma under Civil Action No. C90-5373.

- Consent Decree for Settlement Between the United States of America and Joseph Simon & Sons, Inc., filed under United States District Court Western District of

[i] We assume there were De Minimis settlements between the United States of America and Burlington Northern and Union Pacific Railroads, and that these documents contain similar institutional control requirements as those in the cited documents. However, copies of the settlement documents were not identified in the title searches.

Washington at Tacoma under Civil Action No. C89-155B, Consolidated with C89-489TB & C90-5373B.

- Consent Decree for Settlement Between the United States of America and Washington Natural Gas Company, filed under United States District Court Western District of Washington at Tacoma under Civil Action No. C89-155TB, Consolidated with C89-489TB & C90-5373B.

The ICs include the following:

(1) The restrictions and obligations set forth in the Partial Consent Decree and Consent Decrees run with the land and are binding upon any and all persons who acquire any interest in any property included in the Site.

(2) The Decrees were to be recorded with the Pierce County's Auditor's office and a copy was to be provided to the City of Tacoma Planning Department.

(3) Any deed, title, or other instrument of conveyance regarding the Site shall contain a notice that the Site is the subject of the Partial Consent Decree or Consent Decree, as appropriate.

(4) Said notice shall notify any potential purchasers or lessors of property contained within the Site that there are restrictions upon the use of shallow groundwater beneath the Property, including a prohibition against pumping of groundwater in shallow aquifers for purposes other than monitoring; and

(5) With regard to property contained within the capped portions of the Site:
   a. hazardous substances remain under the cap at the Site; and
   b. post-remedial action and use is restricted such that use of such property must never be allowed to disturb the integrity of the cap, of any component of any containment system, or the function of the Site's monitoring system, unless the Regional Administrator for EPA, Region 10, finds that the disturbance:
      (i) is necessary to the proposed use of such property and will not increase the potential hazard to human health or the environment; or
      (ii) is necessary to reduce a threat to human health or the environment.

SUMMARY OF FINDINGS

- The THCGS is comprised of sixteen tax parcels owned by at least seven entities. Ownership of the River Street right-of-way is unclear.

- Institutional controls (ICs) are outlined in Consent Decrees between the responsible parties and the U.S. Government. The ICs pertain to restricting the use of groundwater (all properties) and maintaining the integrity of a cap that covers contaminated material (all or portions of some properties). Recording of the Consent Decrees was the responsibility of the signatories of each Decree.

- Our research indicates that's ICs were recorded with Pierce County for properties currently owned by Puget Sound Energy, Simon Metals LLS, Apes I (Rain City Real Estate Holdings), and Correctional Services Corp. (CSC of Tacoma).

- The filing status of the ICs with respect to property owned by Union Pacific Railroad (UPRR), Burlington Northern-Santa Fe Railroad (BNSF) and 1616 St. Paul LLC is unclear. A portion of the capped area is on property owned by BNSF. PSE recommends that EPA contact these landowners directly to assess the status of the ICs for these properties.

- In addition to recording the Consent Decrees with Pierce County, copies of the Decrees were to be submitted to the City of Tacoma Planning Department (Tacoma Planning). The Decrees were likely submitted to Tacoma Planning (by at least Puget Sound Energy), however we have not been able to locate a record of their submittal and do not know the process Tacoma Planning would have used to record the ICs. Tacoma's GIS system maps do not show the THCGS.

PROPERTY STATUS SUMMARIES

Joseph Simon & Sons (now Simon Metals LLC)

- **Address**: 2202 E. River St., Tacoma, Washington 98421
- **Parcel No**.: 0320033017
- **Status**: Property in capped area. The ICs appeared to have been recorded (Nos. 8811180328, 9106060099, 9112190201, 9204160208) based on Exhibit B to the Recent Deed of Trust – May 8, 2008 (Attachment A[ii]). Recorded documents and dates:
    - Administrative Order - November 18, 1988
    - Partial Consent Decree (C89-155B and C90-5373) – June 6, 1991

[ii] Exhibit B to Chicago Title Insurance Co. Plat Certificate only identified the memorandum of notice associated with the Administrative Order (1988).

- Consent Decree (C89-155B and C90-5373B) – December 19, 1991
- Consent Decree (C89-155B, C89-489TB and C90-5373B) – April 16, 1992.

Washington Natural Gas Company (now Puget Sound Energy)

- **Address**: 2200 E. River St., Tacoma, Washington 98421
- **Parcel No**.: 0320033018
- **Status**: ICs recorded (Nos. 8811180199, 9112190202, 9202210301) based on Exhibit B to Chicago Title Insurance Co. Plat Certificate – June 3, 2009 (Attachment B). Recorded documents and dates:
  - Administrative Order - November 18, 1988
  - Consent Decree (C89-155B, C89-489TB and C90-5373B) – December 19, 1991
  - Consent Decree (C89-155TB, C89-489TB and C90-5373B) – February 21, 1992.

Apes I, LLC (APP Card Lock formerly owned by Hanson and Simchuck. Current ownership is listed as Rain City Real Estate Holdings by the City)

- **Address**: 2115 E. River St., Tacoma, Washington 98421
- **Parcel No**.: 4715010160
- **Status**: ICs recorded (Nos. 9106060099, 9106100294, 9112190201, 9204160208) based on Exhibit B to Statutory Warranty Deed (Attachment D). Recorded documents and dates:
  - Partial Consent Decree (C89-155B, C89-489TB and C90-5373) – Date not indicated.

CSC of Tacoma (NW Detention Center)

- **Address**: 1623 E. J St., Tacoma, Washington 98421
- **Parcel No**.: 0320033003, 0320044004, 8950001390, 8950001420, 8950001430, 0320044001 and 0320044006.
- **Status**: Portion of property in capped area. ICs described in Statutory Warranty Deed between DVR, LLC (Grantor) and CSC of Tacoma (Attachment C). Parcel 0320044006 is noted as being owned by the City of Tacoma in the Pierce County records but is now owned by CSC of Tacoma. Recorded documents and dates:
  - Partial Consent Decree (C90-5373) – Date not indicated

1616 St. Paul LLC

- **Address**: 1616 St. Paul Ave., Tacoma, WA
- **Parcel No**.: 8950001404
  - **Status**: ICs not identified in preliminary survey by Chicago Title (Attachment F). Additional research is required.

Union Pacific Railroad

- **Address**: 2018 Portland Ave., Tacoma,WA 98421
- **Parcel Nos**.: 4715010162 (OR WA RR & Navigation Co.), 0320033025, 0320033020, 5215201092
- **Status**: ICs appear not to have been recorded based on Plat Certificate – Schedule B by Chicago Title Insurance Co. (Attachment E). Additional research required.

Burlington Northern/Santa Fe Railroad

- **Address**: 2304 to 2306 E. E St., Tacoma,WA 98421
- **Parcel Nos**.: Not shown in Pierce Co. Assessor or City of Tacoma records
- **Status**: Portion of property in capped area. Status of recording of ICs unknown. Additional research required.

CLOSING

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, expressed or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

REFERENCES

DOF (Dalton, Olmsted & Fuglevand, Inc.) and FW (Foster Wheeler Environmental Corporation), 1995, Remedial Action Report, Tacoma Historical Coal Gasification Site, September 1995.

Attachments

Table 1 – Tax Parcel Numbers and Ownership
Figure 1 – Vicinity Map
Figure 2 – Tax Parcels and Numbers

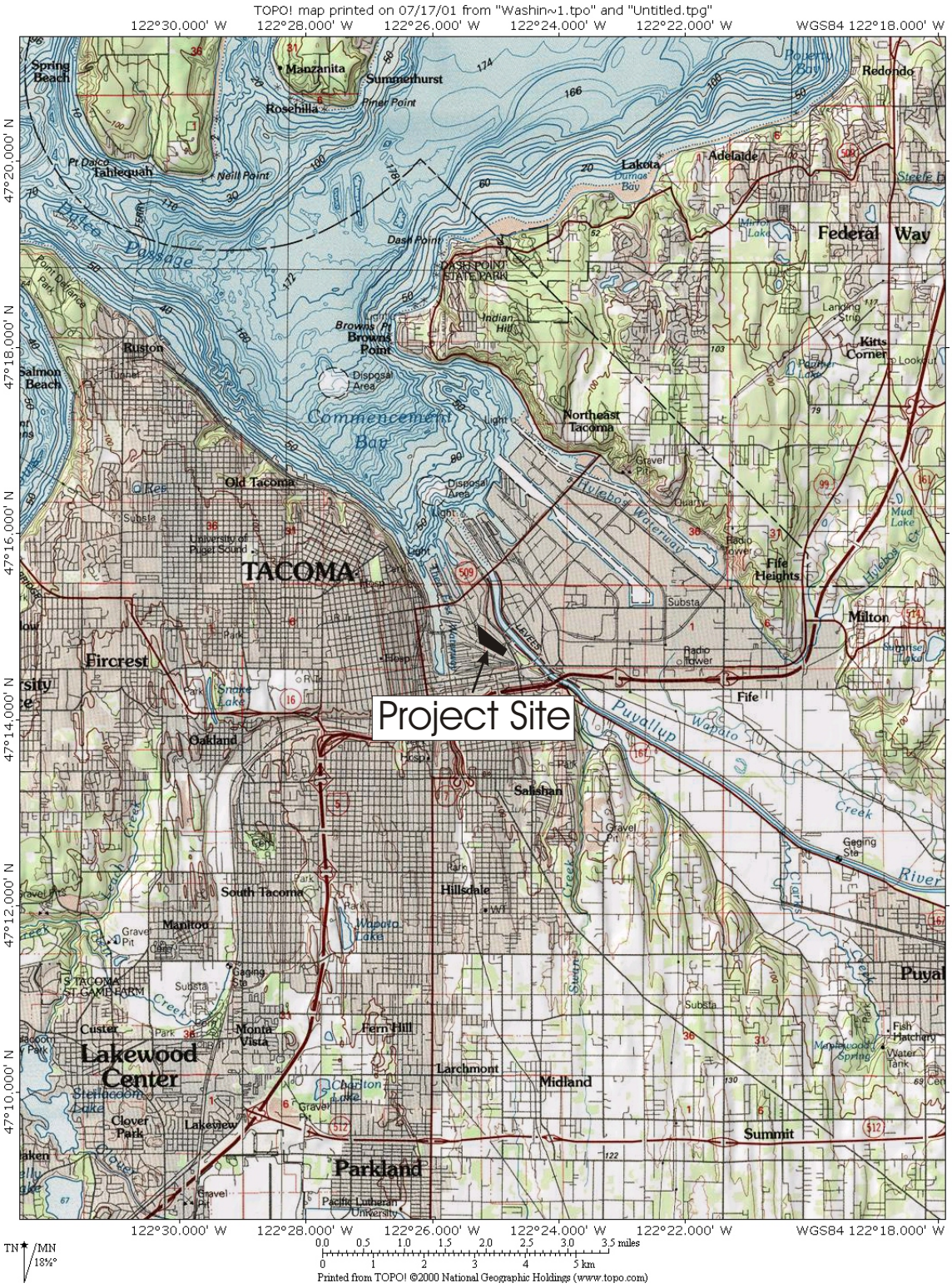
Attachment A – Selected Documents – Simon Metals LLC
Attachment B – Selected Documents – Puget Sound Energy
Attachment C – Selected Documents – CSC of Tacoma
Attachment D – Selected Documents – Aples I LCC (Cardlock Sta)
Attachment E – Selected Documents – Union Pacific Railroad
Attachment F – Selected Documents – 1616 St. Paul LLC
Attachment G – Other Documents on CD

TABLE 1 - Tax Parcel Numbers and Ownership

Tacoma Historical Coal Gasification Site,
Tacoma, Washington

Parcel Owner	Tax Parcel Number(s)	IC Recording Numbers	Date	Comment
Simon Metals (1) (formerly Joseph Simon and Sons)	0320033017	8811180328 9106060099 9112190201 9204160208	11/18/1988 6/6/1991 12/19/1991 4/16/1992	Adm. Order Partial Consent Decree Consent Decree Consent Decree
Puget Sound Energy (formerly Washington Natural Gas)	0320033018	8811180199 9112190201 9202210301	11/18/1988 12/19/1991 2/21/1992	Adm. Order Consent Decree Consent Decree
Apes I, LLC (APP Cardlock - owner is Rain City Real Estate Holdings formerly Hanson-Simchuck prop.)	4715010160	9106060099 9106100294 9112190201 9204160208	Unknown	Partial Consent Decree (assumed recorded in 1991)
Correctional Services Corporation LLC (CSC of Tacoma) (former Hygrade Property)	0320033003 0320044004 8950001390 8950001420 8950001430 0320044001 0320044006(2)	Unknown (Based on Statutory Warranty Deed - 3-28-03)	Unknown	Partial Consent Decree
1616 St. Paul LLC	895001404	Unknown	Unknown	IC's not identifed in Chicago Title preliminary survey
Union Pacific Railroad (UPRR)	4715010162 0320033025 0320033020 5215201092	Unknown	----	Chicago Title not identify ICs in Plat Certificate
Burlington Northern-Santa Fe Railroad (BNSF)	Not indicated on Pierce Co. Assessors Map	Unknown	----	----

Notes: (1) - Based on Exhibit B to Deed of Trust - May 2, 2008
(2) Parcel transferred from City of Tacoma to DVR LLC by Quitclaim Deed on March 26, 2003. Transferred from DVR LLC to CSC of Tacoma by Quitclaim Deed March 28, 2003. City of Tacoma was party to Partial Consent Decree that outlined institutional controls. It is unknown whether ICs were formerly recorded for this parcel.
ICs - Institutional Controls

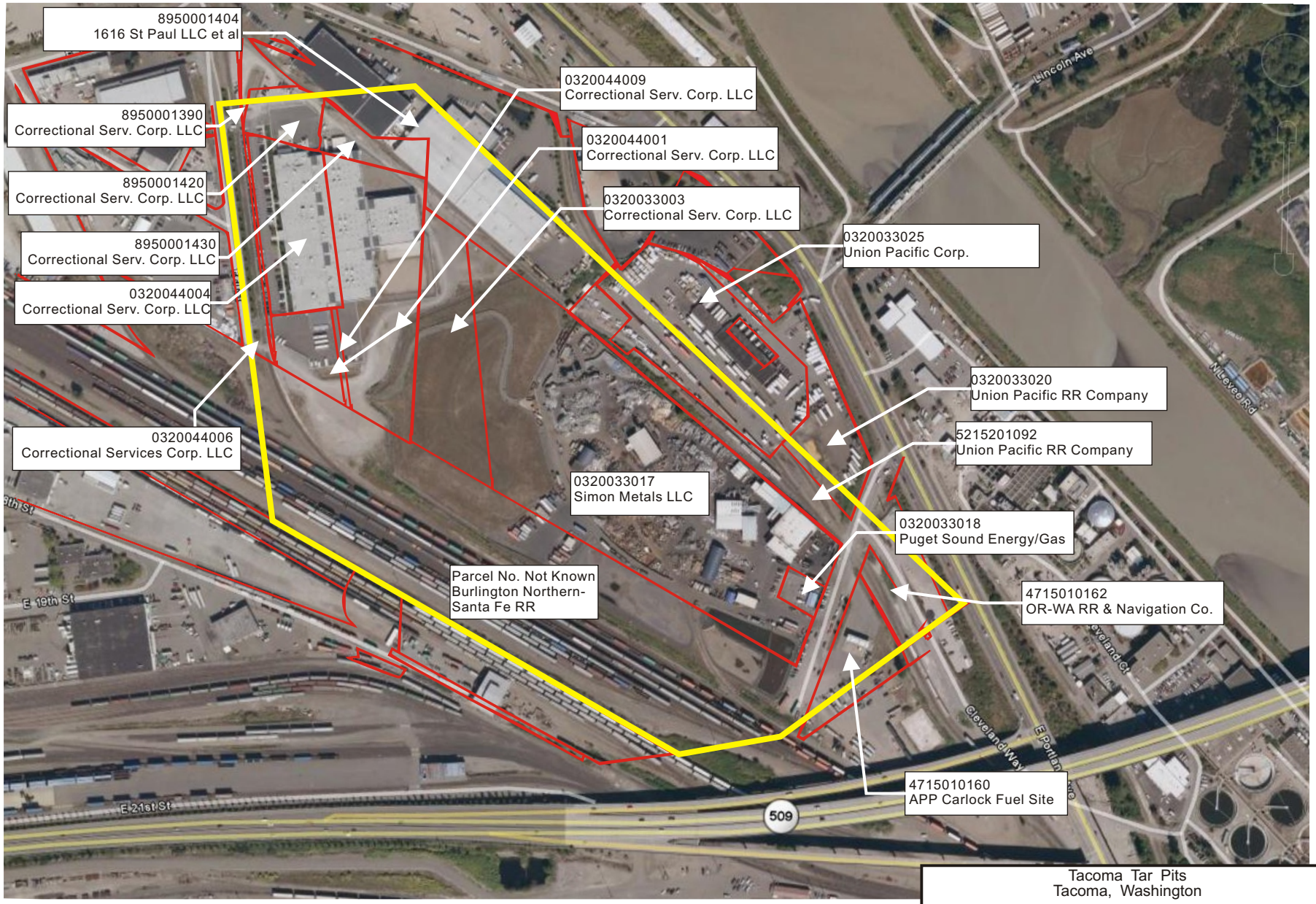


Tacoma Historical Coal Gasification Site
Tacoma, Washington

Site Vicinity Map

Source: Topo , 2000, National Geographic Holdings, Inc.

WNG-001-01 **FIGURE 1** July 2001
Dalton, Olmsted & Fuglevand, Inc.



Base and Parcel Information Fm:

Pierce County
Geographic Information Services

Ref: THCGS Parcel No.cdr

DRAFT

0 400
Scale in Feet
(approximate)

N

Tacoma Tar Pits
Tacoma, Washington

Tax Parcels and Numbers

WNG-001-00 **FIGURE 2** June 2009
Dalton, Olmsted & Fuglevand, Inc.

ATTACHMENT A
Simon Metals LLC

CHICAGO TITLE INSURANCE COMPANY

4717 SOUTH 19TH, STE 201, TACOMA, WA 98405

Order No.: 004350373 **PROPERTY ADDRESS:** WASHINGTON
Your No.: SIMON METALS

DALTON, OLMSTED & FUGLEVAND, INC.
10827 NE 68TH STREET, SUITE B
KIRKLAND, WASHINGTON 98033

ATTN: NANCY CASE O'BOURKE

Enclosed are your materials on the above transaction. If you have any questions regarding these materials, please contact us.

Thank you for this opportunity to serve you.

UNIT 4

ROB HAINEY	COMMERCIAL TITLE MANAGER	
	EMAIL:	ROB.HAINEY@CTT.COM
	PHONE:	(253) 671-6623
DAVID COLEMAN	SENIOR TITLE EXAMINER/TITLE OFFICER	
	EMAIL:	DAVID.COLEMAN@CTT.COM
	PHONE:	253-671-6646

FAX NUMBER (253) 671-6614

TITLET7/RDA/0999

CHICAGO TITLE INSURANCE COMPANY

4717 South 19th Street, Suite 201 Tacoma, WA 98405
(253) 474-2377

ORIGINAL INVOICE: 06/09/09
INVOICE AS OF: 06/09/09
ORDER NUMBER: 4350373
ESCROW NUMBER:
CUSTOMER NUMBER: 0073329 -000
DEPARTMENT NUMBER: 00753

ATTN: NANCY CASE O'BOURKE
DALTON, OLMSTED & FUGLEVAND, INC.
10827 NE 68TH STREET, SUITE B
KIRKLAND, WASHINGTON 98033

POLICY(S) APPLIED FOR: PLAT CERTIFICATE $ 350.00

YOUR REFERENCE: SIMON METALS

CODE	DESCRIPTION	AMOUNT
CER	PLAT CERTIFICATE	350.00
PTT	PIERCE TITLE SALES TAX	32.55
	BALANCE DUE:	$382.55

PLEASE ENCLOSE A COPY OF THIS INVOICE WITH YOUR REMITTANCE

INVOICE3-6-22-95/RLK

CHICAGO TITLE INSURANCE COMPANY
4717 SOUTH 19TH, STE 201, TACOMA, WA 98405

PLAT CERTIFICATE

Order No.: 4350373

Certificate for Filing Proposed Plat:

In the matter of the plat submitted for our approval, this Company has examined the records of the County Auditor and County Clerk of PIERCE County, Washington, and the records of the Clerk of the United States Courts holding terms in said County, and from such examination hereby certifies that the title to the following described land situate in said PIERCE County, to-wit:

SEE SCHEDULE A (NEXT PAGE)

VESTED IN:

SIMON METALS, LLC, A WASHINGTON LIMITED LIABILITY COMPANY

EXCEPTIONS:

SEE SCHEDULE B ATTACHED

CHARGE: $350.00
TAX: $ 32.55

Records examined to JUNE 2, 2009 at 8:30 AM

By

DAVID W. COLEMAN
Title Officer/Commercial Examiner
(253)671-6646

PLATCRTA/RDA/0999

CHICAGO TITLE INSURANCE COMPANY

PLAT CERTIFICATE

SCHEDULE A

(Continued) Order No.: 4350373

LEGAL DESCRIPTION

THAT PORTION OF GOVERNMENT LOTS 3 AND 4, SECTION 03, TOWNSHIP 40 NORTH, RANGE 3 EAST OF THE W.M. DESCRIBED AS FOLLOWS:

BEGINNING AT THE INTERSECTION OF THE NORTHERLY LINE OF THE RIGHT OF WAY OF THE NORTHERN PACIFIC RAILWAY COMPANY WITH THE WESTERLY LINE OF RIVER STREET AS DEDICATED BY THE NORTHWESTERN IMPROVEMENT COMPANY AND THE NORTHERN PACIFIC RAILWAY COMPANY ON DECEMBER 06, 1901; THENCE ON SAID WESTERLY LINE OF RIVER STREET NORTH 19°20'45" EAST 387.6 FEET TO A LINE PARALLEL WITH AND 340 FEET SOUTHWESTERLY FROM THE CENTER LINE OF CLEVELAND WAY IN THE INDIAN ADDITION TO THE CITY OF TACOMA, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 7 OF PLATS, PAGE 30; THENCE ALONG AN EXTENSION OF SAID PARALLEL LINE (BEING THE SOUTHWESTERLY LINE OF THAT CERTAIN TRACT CONVEYED TO THE OREGON AND WASHINGTON RAILROAD COMPANY BY DEED RECORDED DECEMBER 23, 1903 AND RECORDING NUMBER 279927, RECORDS OF PIERCE COUNTY, WASHINGTON, NORTH 50°22'15" WEST 1,369.4 FEET TO THE SOUTHWESTERLY CORNER OF SAID TRACT; THENCE ALONG THE EASTERLY LINE OF TRACT CONVEYED TO THE CARSTONS PACKING COMPANY, BY DEED RECORDED MAY 21, 1907 UNDER RECORDING NUMBER 239984, RECORDS OF PIERCE COUNTY, WASHINGTON; SOUTH 08°45'30" EAST 805.82 FEET TO SAID NORTHERLY LINE OF RIGHT OF WAY OF THE NORTHERN PACIFIC RAILWAY COMPANY; THENCE ON SAID LINE OF RIGHT OF WAY SOUTH 61°09'10" EAST 917.4 FEET TO THE PLACE OF THE BEGINNING.

EXCEPT THE FOLLOWING DESCRIBED PROPERTY:

COMMENCING AT THE INTERSECTION OF THE NORTHERLY LINE OF THE RIGHT OF WAY OF THE NORTHERN PACIFIC COMPANY WITH THE WESTERLY LINE OF RIVER STREET AS DEDICATED BY THE NORTHWESTERN IMPROVEMENT COMPANY AND THE NORTHERN PACIFIC RAILWAY COMPANY ON DECEMBER 06, 1901; THENCE ON SAID WESTERLY LINE OF RIVER STREET NORTH 19°20'45" EAST 100.09 FEET TO THE TRUE POINT OF BEGINNING; THENCE NORTH 70°39'15" WEST 123.7 FEET; THENCE NORTH 19°20'45" EAST 94 FEET; THENCE SOUTH 70°39'15" EAST 123.7 FEET; THENCE SOUTH 19°20'45" WEST 94 FEET TO THE POINT OF BEGINNING.

SITUATE IN THE CITY OF TACOMA, COUNTY OF PIERCE, STATE OF WASHINGTON.

CHICAGO TITLE INSURANCE COMPANY

PLAT CERTIFICATE

SCHEDULE B

Order No.: 4350373

This certificate does not insure against loss or damage by reason of the following exceptions:

GENERAL EXCEPTIONS:

A. Defects, liens, encumbrances, adverse claims or other matters, if any, created, first appearing in the public records or attaching subsequent to the effective date hereof but prior to the date the proposed insured acquires for value of record the estate or interest or mortgage thereon covered by this Commitment.

B. Rights or claims of parties in possession not shown by the public records.

C. Encroachments, overlaps, boundary line disputes, and any other matters which would be disclosed by an accurate survey and inspection of the premises.

D. Easements or claims of easements not shown by the public records.

E. Any lien, or right to lien, for contributions to employee benefit funds, or for state workers' compensation, or for services, labor, or material heretofore or hereafter furnished, all as imposed by law, and not shown by the public records.

F. Liens under the Workmen's Compensation Act not shown by the public records.

G. Any service, installation, connection, maintenance or construction charges for sewer, water, electricity or garbage removal.

H. General taxes not now payable; matters relating to special assessments and special levies, if any, preceding or in the same becoming a lien.

I. Reservations or exceptions in patents or in Acts authorizing the issuance thereof; Indian tribal codes or regulations, Indian treaty or aboriginal rights, including easements or equitable servitudes.

J. Water rights, claims, or title to water.

K. THIS REPORT IS ISSUED AND ACCEPTED UPON THE UNDERSTANDING THAT THE LIABILITY OF THE COMPANY SHALL NOT EXCEED ONE THOUSAND DOLLARS($1000.00).

PLAT CERTIFICATE

SCHEDULE B

(Continued) Order No.: 4350373

EXCEPTIONS

A 1. GENERAL TAXES: FIRST HALF DELINQUENT MAY 1, SECOND HALF DELINQUENT NOVEMBER 1:

YEAR:	2009
AMOUNT BILLED:	$ 73,393.48
AMOUNT PAID:	$ 36,696.74
AMOUNT DUE:	$ 36,696.74
TAX ACCOUNT NUMBER:	03-20-03-3-017
LEVY CODE:	005
ASSESSED VALUE-LAND:	$ 3,935,200.00
ASSESSED VALUE-IMPROVEMENTS:	$ 2,380,000.00

B 2. DEED OF TRUST AND ASSIGNMENT OF RENTS AND/OR LEASES, AND THE TERMS AND CONDITIONS THEREOF:

GRANTOR:	SIMON METALS, LLC, A WASHINGTON LIMITED LIABILITY COMPANY
TRUSTEE:	TRANSNATION TITLE INSURANCE COMPANY
BENEFICIARY:	U.S. BANK NATIONAL ASSOCIATION, A NATIONAL BANKING ASSOCIATION
AMOUNT:	$ 17,000,000.00
DATED:	MAY 5, 2008
RECORDED:	OCTOBER 10, 2008
RECORDING NUMBER:	200810100152

THE AMOUNT NOW SECURED BY SAID DEED OF TRUST AND THE TERMS UPON WHICH THE SAME CAN BE DISCHARGED OR ASSUMED SHOULD BE ASCERTAINED FROM THE HOLDER OF THE INDEBTEDNESS SECURED.

C SAID DEED OF TRUST IS A RE-RECORDING OF DEED OF TRUST RECORDED UNDER RECORDING NUMBER 200805060709.

D MODIFICATION OF DEED OF TRUST AND THE TERMS AND CONDITIONS THEREOF:

DATED:	MAY 8, 2009
RECORDED:	MAY 29, 2009
RECORDING NUMBER:	200905291109

E 3. DEED OF TRUST AND ASSIGNMENT OF RENTS AND/OR LEASES, AND THE TERMS AND CONDITIONS THEREOF:

GRANTOR:	SIMON METALS, LLC, A WASHINGTON LIMITED LIABILITY COMPANY
TRUSTEE:	TRANSNATION TITLE INSURANCE COMPANY

BENEFICIARY:	GRAMOR INVESTMENTS, INC., A CORPORATION INCORPORATED UNDER THE LAWS OF THE PROVINCE OF ALBERTA CANADA
AMOUNT:	$ 8,000,000.00
DATED:	MAY 5, 2005
RECORDED:	MAY 6, 2008
RECORDING NUMBER:	200805060710

THE AMOUNT NOW SECURED BY SAID DEED OF TRUST AND THE TERMS UPON WHICH THE SAME CAN BE DISCHARGED OR ASSUMED SHOULD BE ASCERTAINED FROM THE HOLDER OF THE INDEBTEDNESS SECURED.

F SUBORDINATION AGREEMENT AND THE TERMS AND CONDITIONS THEREOF:

RECORDED:	MAY 6, 2008
RECORDING NUMBER:	200805060711

SAID AGREEMENT RELATES TO THE LIEN PRIORITY OF THE ABOVE DEED OF TRUST AND THE DEED OF TRUST RECORDED UNDER RECORDING NUMBER 200805060709 (WHICH WAS RE-RECORDED UNDER RECORDING NUMBER 200810100152).

G 4. LEASE, AND THE TERMS AND CONDITIONS THEREOF:

LESSOR:	RAINIERBANK LEASING, INC.
LESSEE:	JOSEPH SIMON & SONS, INC., PHILIP SIMON, NORMAN SIMON AND HERBERT SIMON, EACH INDIVIDUALLY, JOINTLY & SEVERALLY
FOR A TERM OF:	UNKNOWN
FROM:	NOVEMBER 20, 1981
RECORDED:	DECEMBER 04, 1981
RECORDING NUMBER:	8112040187

H 5. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:

GRANTEE:	CITY OF TACOMA
PURPOSE:	THE RIGHT AND PRIVILEGE TO INSTALL POLES, ANCHORS, EQUIPMENT, DISTRIBUTION AND GUY WIRES TOGETHER WITH THE RIGHT TO TRIM AND KEEP TRIMMED ALL DANGER TREES, LOCATED UPON THE TRACT OF LAND FIRST ABOVE DESCRIBED AND WITH THE PRIVILEGE ALSO TO ENTER UPON SAID LAND FROM TIME TO TIME, WITH REASONABLE CARE, TO CHANGE, REPAIR, RENEW OR REMOVE SAID POLES, ANCHORS, DISTRIBUTION, GUY WIRES AND EQUIPMENT
AREA AFFECTED:	A PORTION OF SAID PREMISES
RECORDED:	APRIL 21, 1971

PLAT CERTIFICATE

SCHEDULE B

(Continued)

Order No.: 4350373

RECORDING NUMBER: 2388020

I 6. RIGHTS OF ANY GOVERNMENTAL AGENCY TO FILE A LIEN OR LIENS AGAINST THE HEREIN DESCRIBED PROPERTY IN CONNECTION WITH ENVIRONMENTAL PROTECTION OR HAZARDOUS WASTE AS DISCLOSED BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY LIST OF POTENTIALLY HAZARDOUS WASTE SITES AND PROCEEDINGS IN PIERCE COUNTY SUPERIOR COURT CAUSE NUMBER 82-2-01348-5.

J 7. MEMORANDUM OF NOTICE, INCLUDING THE TERMS AND PROVISIONS THEREOF:

RECORDED: NOVEMBER 18, 1988
RECORDING NUMBER: 8811180328

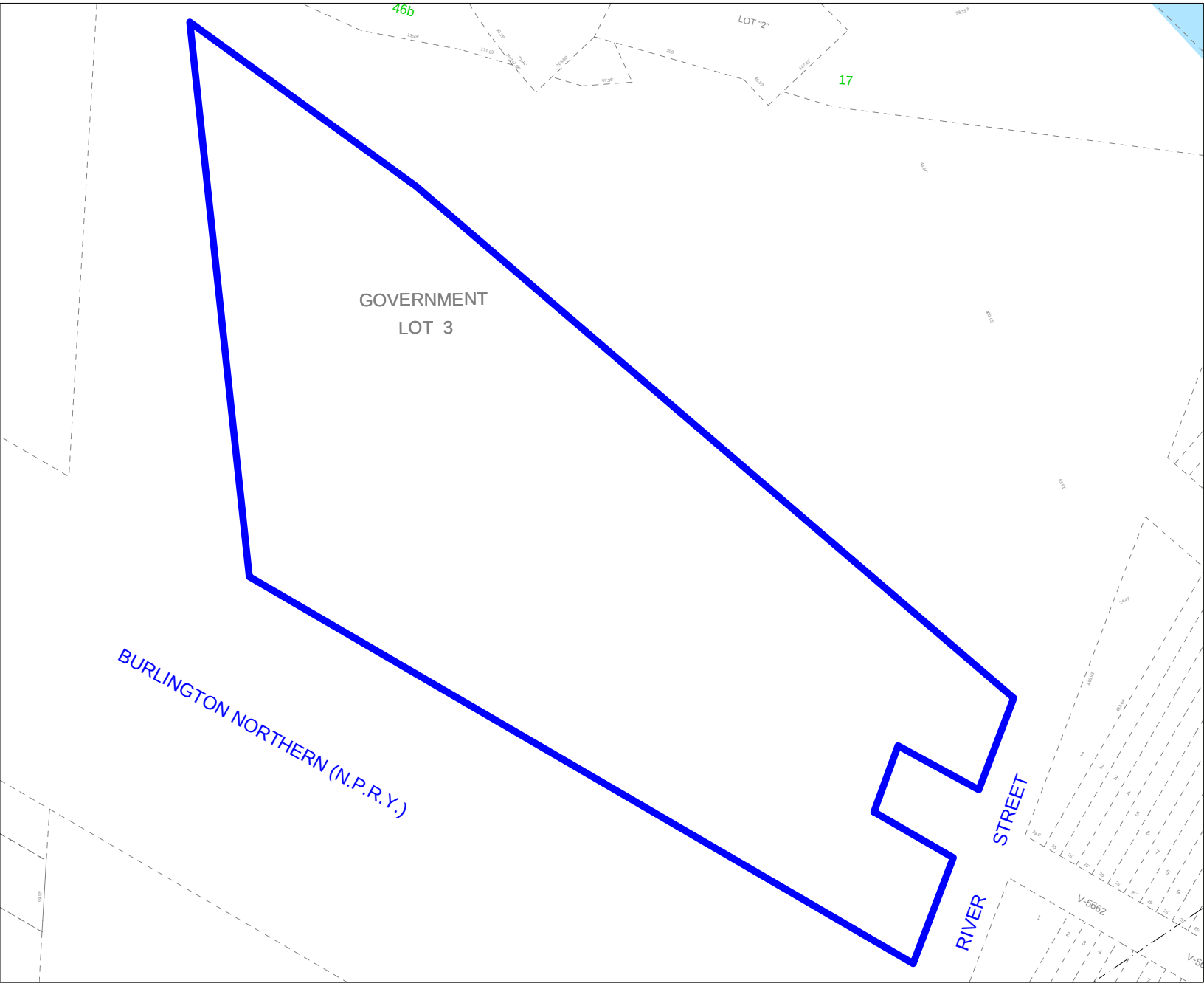
K 8. THE LEGAL DESCRIPTION IN THIS CERTIFICATE IS BASED ON INFORMATION PROVIDED WITH THE APPLICATION AND THE PUBLIC RECORDS. ALL PARTIES MUST NOTIFY THE TITLE INSURANCE COMPANY IF THE DESCRIPTION DOES NOT CONFORM TO THEIR EXPECTATIONS.

L DWCdwc

ORDERED BY: DALTON, OLMSTED & FUGLEVAND, INC.

END OF SCHEDULE B

Chicago Title Order No. 4350373



SCALE 1 : 2,290

200 0 200 400 600

FEET

N

Chicago Title Order No. 4350373

SCALE 1 : 2,290

200 0 200 400 600

FEET

N

2m

200805060709 37 PGS
05/06/2008 1:01pm $163.00
PIERCE COUNTY, WASHINGTON

200810100152 37 PGS
10/10/2008 11:10am $79.00
PIERCE COUNTY, WASHINGTON

After Recording Mail To:

U.S. Bank National Association
10800 NE 8th Street, 10th Floor
Bellevue, Washingon 98004
Attention: Nickolas J. Kokkonis

Auditor's Note:
This document or a portion of
is a photocopy, not certified,
not original signatures.

(2)

DEED OF TRUST, ASSIGNMENT OF RENTS AND LEASES AND SECURITY AGREEMENT

(Fixture Filing)

RE-RECORD

Coversheet Recording Information:

GRANTOR:	SIMON METALS, LLC, a Washington limited liability company
GRANTEE (Beneficiary):	U.S. BANK NATIONAL ASSOCIATION, a national banking association, in its capacity as administrative agent for Lenders under the Credit Agreement of even date herewith
GRANTEE (Trustee):	TRANSNATION TITLE INSURANCE COMPANY
LEGAL DESCRIPTION:	PTN GOVT LOTS 3 & 4 IN NW SW 3-20-3E The complete legal description is on Exhibit A.

ASSESSOR'S PROPERTY TAX PARCEL ACCOUNT NUMBER: 0320033017

LANDAMERICA COMMERCIAL SERVICES

11208627

DEED OF TRUST
12187-2336/LEGAL14220242.3
5/2/08

79-
143 2m

EXHIBIT B
to Deed of Trust

Permitted Exceptions

1. NOTICE OF TAP OR CONNECTION CHARGES WHICH HAVE BEEN OR WILL BE DUE IN CONNECTION WITH DEVELOPMENT OR RE-DEVELOPMENT OF THE LAND AS DISCLOSED BY RECORDED INSTRUMENT. INQUIRIES REGARDING THE SPECIFIC AMOUNT OF THE CHARGES SHOULD BE MADE TO THE CITY/COUNTY/AGENCY.

   CITY/COUNTY/AGENCY: CITY OF TACOMA
   RECORDING NO.: 2864651

   AS AMENDED AND/OR MODIFIED BY INSTRUMENTS RECORDED UNDER RECORDING NO.'S 2881434 AND 8012010130.

2. UNRECORDED LEASEHOLDS, IF ANY; RIGHTS OF VENDORS AND HOLDERS OF SECURITY INTERESTS ON PERSONAL PROPERTY INSTALLED UPON THE LAND; AND RIGHTS OF TENANTS TO REMOVE TRADE FIXTURES AT THE EXPIRATION OF THE TERM.

3. RESERVATIONS CONTAINED IN PATENT RECORDED IN VOLUME 78 OF DEEDS AT PAGE 296, UNDER RECORDING NO. 57614, AS FOLLOWS:

   "SUBJECT TO THE RIGHT OF THE PROPRIETOR OF A VEIN OR LODE TO EXTRACT AND REMOVE HIS ORE THEREFROM, SHOULD THE SAME BE FOUND TO PENETRATE OR INTERSECT THE PREMISES HEREBY GRANTED"

4. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:

   GRANTEE: TACOMA RAILWAY AND POWER COMPANY
   PURPOSE: RIGHT OF WAY FOR POLE AND WIRE LINE
   AREA AFFECTED: A PORTION OF GOV'T. LOTS 3 AND 4
   RECORDED: DECEMBER 1, 1900
   RECORDING NO.: 133410

   NOTE: THE DESCRIPTION CONTAINED THEREIN IS NOT SUFFICIENT TO DETERMINE ITS EXACT LOCATION WITHIN THE PROPERTY HEREIN DESCRIBED

5. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:

   GRANTEE: CITY OF TACOMA
   PURPOSE: INSTALL POLES, ANCHORS, EQUIPMENT, DISTRIBUTION AND GUY WIRES
   AREA AFFECTED: PARALLEL WITH THE SOUTHWESTERLY LINE OF SAID PREMISES
   RECORDED: APRIL 21, 1971
   RECORDING NO.: 2388020

6. MATTERS SET FORTH BY SURVEY:

   RECORDED: NOVEMBER __, 1976
   RECORDING NO.: 1694
   DISCLOSES: RIGHT TO PLAT FUTURE STREETS

7. MEMORANDUM OF NOTICE AND THE TERMS AND CONDITIONS THEREOF:

   RECORDED: NOVEMBER 18, 1988
   RECORDING NO.: 8811180328
   REGARDING: ADMINISTRATIVE ORDER FOR ENVIRONMENTAL REMEDIATION

8. PARTIAL CONSENT DECREE FOR SETTLEMENT AND THE TERMS AND CONDITIONS THEREOF:

CIVIL ACTION NO.:	C89-155B AND C90-5373
RECORDED:	JUNE 6, 1991
RECORDING NO.:	9106060099
REGARDING:	ENVIRONMENTAL REMEDIATION

9. CONSENT DECREE FOR SETTLEMENT AND THE TERMS AND CONDITIONS THEREOF:

CIVIL ACTION NO.:	C89-155B AND C90-5373B
RECORDED:	DECEMBER 19, 1991
RECORDING NO.:	9112190201
REGARDING:	ENVIRONMENTAL REMEDIATION

10. CONSENT DECREE FOR SETTLEMENT AND THE TERMS AND CONDITIONS THEREOF:

CIVIL ACTION NO.:	C89-155B, C89-489TB AND C90-5373B
RECORDED:	APRIL 16, 1992
RECORDING NO.:	9204160208
REGARDING:	ENVIRONMENTAL REMEDIATION

11. MATTERS SET FORTH BY SURVEY:

RECORDED:	SEPTEMBER 8, 2000
RECORDING NO.:	200009085003
DISCLOSES:	RIGHT TO PLAT FUTURE STREETS

12. THE EFFECT ON THE TITLE AND THE DESCRIPTION OF THE LAND DUE TO THE LOCATION OF "NORTHERN PACIFIC RAILWAY RIGHT OF WAY " CONTAINED IN THE LEGAL DESCRIPTION IN SCHEDULE A.

13. AN EXCLUSION OF ALL RIGHTS, FEE SIMPLE AND OTHERWISE, AS TO THAT PORTION OF THE LAND INSURED EXCEPTED FOR A RAILROAD RIGHT OF WAY.

14. ANY RESTRICTIONS ON THE USE OF THE LAND RESULTING FROM THE RIGHTS OF THE PUBLIC OR RIPARIAN OWNERS TO USE ANY PORTION WHICH IS NOW, OR HAS BEEN, COVERED BY WATER.

ATTACHMENT B
Puget Sound Energy
(Formerly Washington Natural Gas)

CHICAGO TITLE INSURANCE COMPANY

4717 SOUTH 19TH, STE 201, TACOMA, WA 98405

Order No.: 004350375 **PROPERTY ADDRESS:** WASHINGTON
Your No.: PUGET SOUND ENERGY

DALTON, OLMSTED & FUGLEVAND, INC.
10827 NE 68TH STREET, SUITE B
KIRKLAND, WASHINGTON 98033

ATTN: NANCY CASE O'BOURKE

Enclosed are your materials on the above transaction. If you have any questions regarding these materials, please contact us.

Thank you for this opportunity to serve you.

UNIT 4

ROB HAINEY	COMMERCIAL TITLE MANAGER	
	EMAIL:	ROB.HAINEY@CTT.COM
	PHONE:	(253) 671-6623
DAVID COLEMAN	SENIOR TITLE EXAMINER/TITLE OFFICER	
	EMAIL:	DAVID.COLEMAN@CTT.COM
	PHONE:	253-671-6646

FAX NUMBER (253) 671-6614

TITLET7/RDA/0999

CHICAGO TITLE INSURANCE COMPANY
4717 SOUTH 19TH, STE 201, TACOMA, WA 98405

PLAT CERTIFICATE

Order No.: 4350375

Certificate for Filing Proposed Plat:

In the matter of the plat submitted for our approval, this Company has examined the records of the County Auditor and County Clerk of PIERCE County, Washington, and the records of the Clerk of the United States Courts holding terms in said County, and from such examination hereby certifies that the title to the following described land situate in said PIERCE County, to-wit:

SEE SCHEDULE A (NEXT PAGE)

VESTED IN:

PUGET SOUND ENERGY, INC., A WASHINGTON CORPORATION, WHICH ACQUIRED TITLE AS WASHINGTON GAS AND ELECTRIC COMPANY

EXCEPTIONS:

SEE SCHEDULE B ATTACHED

CHARGE: $350.00
TAX: $ 32.55

Records examined to JUNE 3, 2009 at 8:30 AM

By

DAVID W. COLEMAN
Title Officer/Commercial Examiner
(253)671-6646

PLATCRTA/RDA/0999

CHICAGO TITLE INSURANCE COMPANY

PLAT CERTIFICATE

SCHEDULE A

(Continued) Order No.: 4350375

LEGAL DESCRIPTION

COMMENCING AT THE INTERSECTION OF THE NORTHERLY LINE OF THE RIGHT OF WAY OF THE NORTHERN PACIFIC COMPANY WITH THE WESTERLY LINE OF RIVER STREET AS DEDICATED BY THE NORTHWESTERN IMPROVEMENT COMPANY AND THE NORTHERN PACIFIC RAILWAY COMPANY ON DECEMBER 06, 1901; THENCE ON SAID WESTERLY LINE OF RIVER STREET NORTH 19°20'45" EAST 100.09 FEET TO THE TRUE POINT OF BEGINNING; THENCE NORTH 70°39'15" WEST 123.7 FEET; THENCE NORTH 19°20'45" EAST 94 FEET; THENCE SOUTH 70°39'15" EAST 123.7 FEET; THENCE SOUTH 19°20'45" WEST 94 FEET TO THE POINT OF BEGINNING.

SITUATE IN THE CITY OF TACOMA, COUNTY OF PIERCE, STATE OF WASHINGTON.

PLATCRTL/RDA/0999

CHICAGO TITLE INSURANCE COMPANY

PLAT CERTIFICATE

SCHEDULE B

Order No.: 4350375

This certificate does not insure against loss or damage by reason of the following exceptions:

GENERAL EXCEPTIONS:

A. Defects, liens, encumbrances, adverse claims or other matters, if any, created, first appearing in the public records or attaching subsequent to the effective date hereof but prior to the date the proposed insured acquires for value of record the estate or interest or mortgage thereon covered by this Commitment.

B. Rights or claims of parties in possession not shown by the public records.

C. Encroachments, overlaps, boundary line disputes, and any other matters which would be disclosed by an accurate survey and inspection of the premises.

D. Easements or claims of easements not shown by the public records.

E. Any lien, or right to lien, for contributions to employee benefit funds, or for state workers' compensation, or for services, labor, or material heretofore or hereafter furnished, all as imposed by law, and not shown by the public records.

F. Liens under the Workmen's Compensation Act not shown by the public records.

G. Any service, installation, connection, maintenance or construction charges for sewer, water, electricity or garbage removal.

H. General taxes not now payable; matters relating to special assessments and special levies, if any, preceding or in the same becoming a lien.

I. Reservations or exceptions in patents or in Acts authorizing the issuance thereof; Indian tribal codes or regulations, Indian treaty or aboriginal rights, including easements or equitable servitudes.

J. Water rights, claims, or title to water.

K. THIS REPORT IS ISSUED AND ACCEPTED UPON THE UNDERSTANDING THAT THE LIABILITY OF THE COMPANY SHALL NOT EXCEED ONE THOUSAND DOLLARS($1000.00).

PLAT CERTIFICATE

SCHEDULE B

(Continued) Order No.: 4350375

EXCEPTIONS

A 1. THE TAXES SHOWN BELOW, AS BILLED AND PAID, REFLECT AN EXEMPTION ALLOWED PURSUANT TO RCW 84.36. ANY CHANGES WITH RESPECT TO THE TAXPAYER MAY RESULT IN CURTAILMENT OF THE EXEMPTION AND AN ADJUSTMENT OF THE AMOUNT OF TAXES DUE. NO INSURANCE IS GIVEN AGAINST ANY ADDITIONAL TAXES LEVIED AGAINST SAID PREMISES CAUSED BY THE CURTAILMENT OF SAID EXEMPTION:

YEAR:	2009
AMOUNT BILLED:	$ 6.39
AMOUNT PAID:	$ 6.39
EXEMPTION:	PUBLIC UTILITY - POWER
TAX ACCOUNT NUMBER:	03-20-03-3-018
LEVY CODE:	005
ASSESSED VALUE-LAND:	$ 99,000.00
ASSESSED VALUE-IMPROVEMENTS:	$ 42,700.00

B 2. GENERAL TAXES ON OPERATING REAL PROPERTY OF THE TAXPAYER:

TAXPAYER:	PUGET SOUND ENERGY
AMOUNT BILLED:	$ 121.06
AMOUNT PAID:	$ 60.53
AMOUNT DUE:	$ 60.53
TAX ACCOUNT NUMBER:	000-4700-005
LEVY CODE:	005

C 3. GENERAL TAXES ON OPERATING PERSONAL PROPERTY OF THE TAXPAYER:

TAXPAYER:	PUGET SOUND ENERGY
AMOUNT BILLED:	$ 4,527.23
AMOUNT PAID:	$ 2,263.61
AMOUNT DUE:	$ 2,263.62
TAX ACCOUNT NUMBER:	002-4700-005
LEVY CODE:	005

D 4. RIGHTS OF ANY GOVERNMENTAL AGENCY TO FILE A LIEN OR LIENS AGAINST THE HEREIN DESCRIBED PROPERTY IN CONNECTION WITH ENVIRONMENTAL PROTECTION OR HAZARDOUS WASTE AS DISCLOSED BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY LIST OF POTENTIALLY HAZARDOUS WASTE SITES AND PROCEEDINGS IN PIERCE COUNTY SUPERIOR COURT CAUSE NUMBER 82-2-01348-5.

E 5. RECORD NOTICE OF EPA ADMINISTRATIVE ORDER, INCLUDING THE TERMS AND PROVISIONS THEREOF:

RECORDED:	NOVEMBER 18, 1988
RECORDING NUMBER:	8811180199

PLAT CERTIFICATE

SCHEDULE B

(Continued)

Order No.: 4350375

F 6. CONSENT DECREE FOR SETTLEMENT, INCLUDING THE TERMS AND PROVISIONS THEREOF:

RECORDED: DECEMBER 19, 1991
RECORDING NUMBER: 9112190201

G 7. RECORD NOTICE OF CONSENT DECREE, INCLUDING THE TERMS AND PROVISIONS THEREOF:

RECORDED: FEBRUARY 21, 1992
RECORDING NUMBER: 9202210301

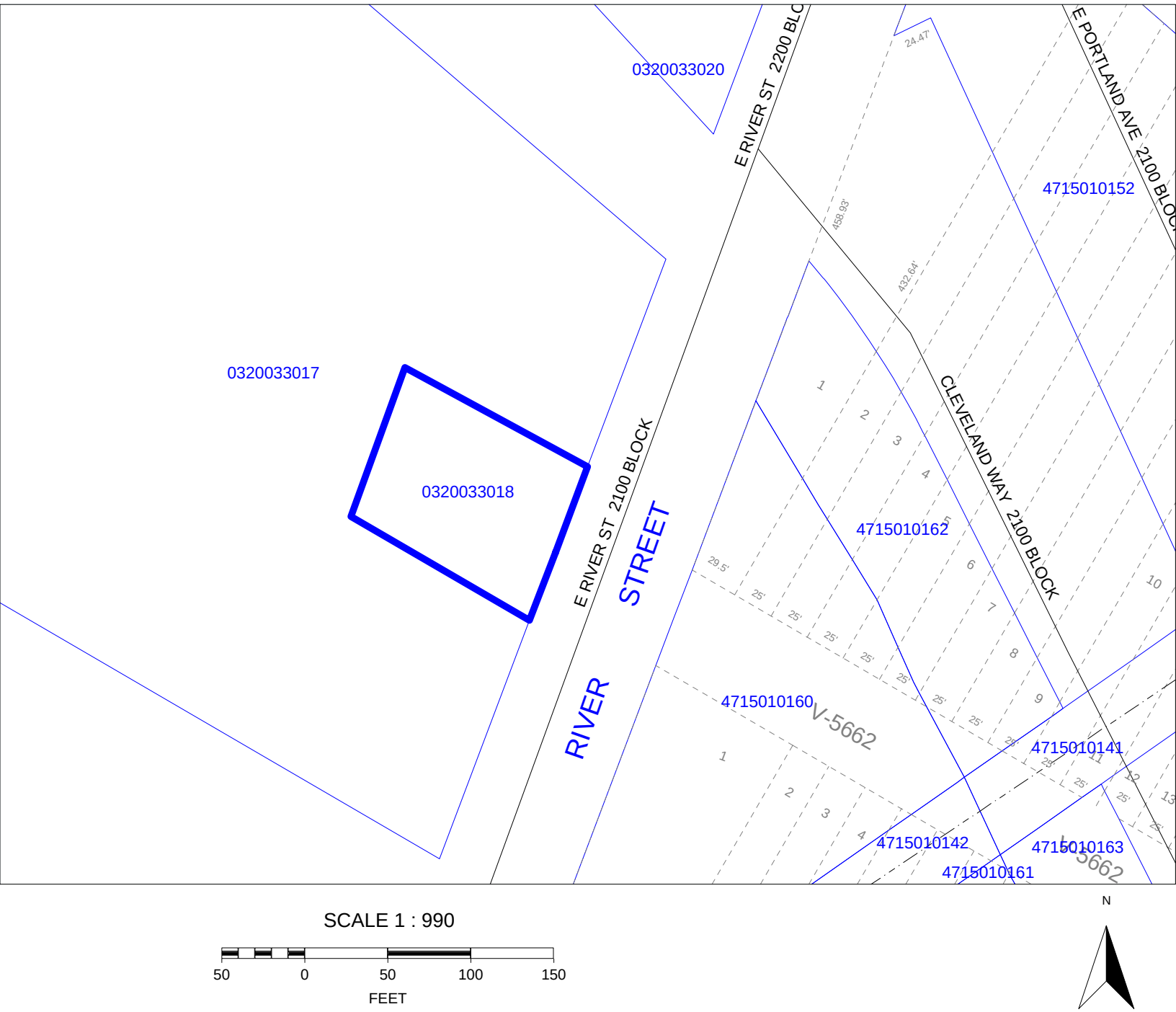
H 8. THE LEGAL DESCRIPTION IN THIS CERTIFICATE IS BASED ON INFORMATION PROVIDED WITH THE APPLICATION AND THE PUBLIC RECORDS. ALL PARTIES MUST NOTIFY THE TITLE INSURANCE COMPANY IF THE DESCRIPTION DOES NOT CONFORM TO THEIR EXPECTATIONS.

I DWCdwc

ORDERED BY: DALTON, OLMSTED & FUGLEVAND, INC.

END OF SCHEDULE B

Chicago Title Order No. 4350375

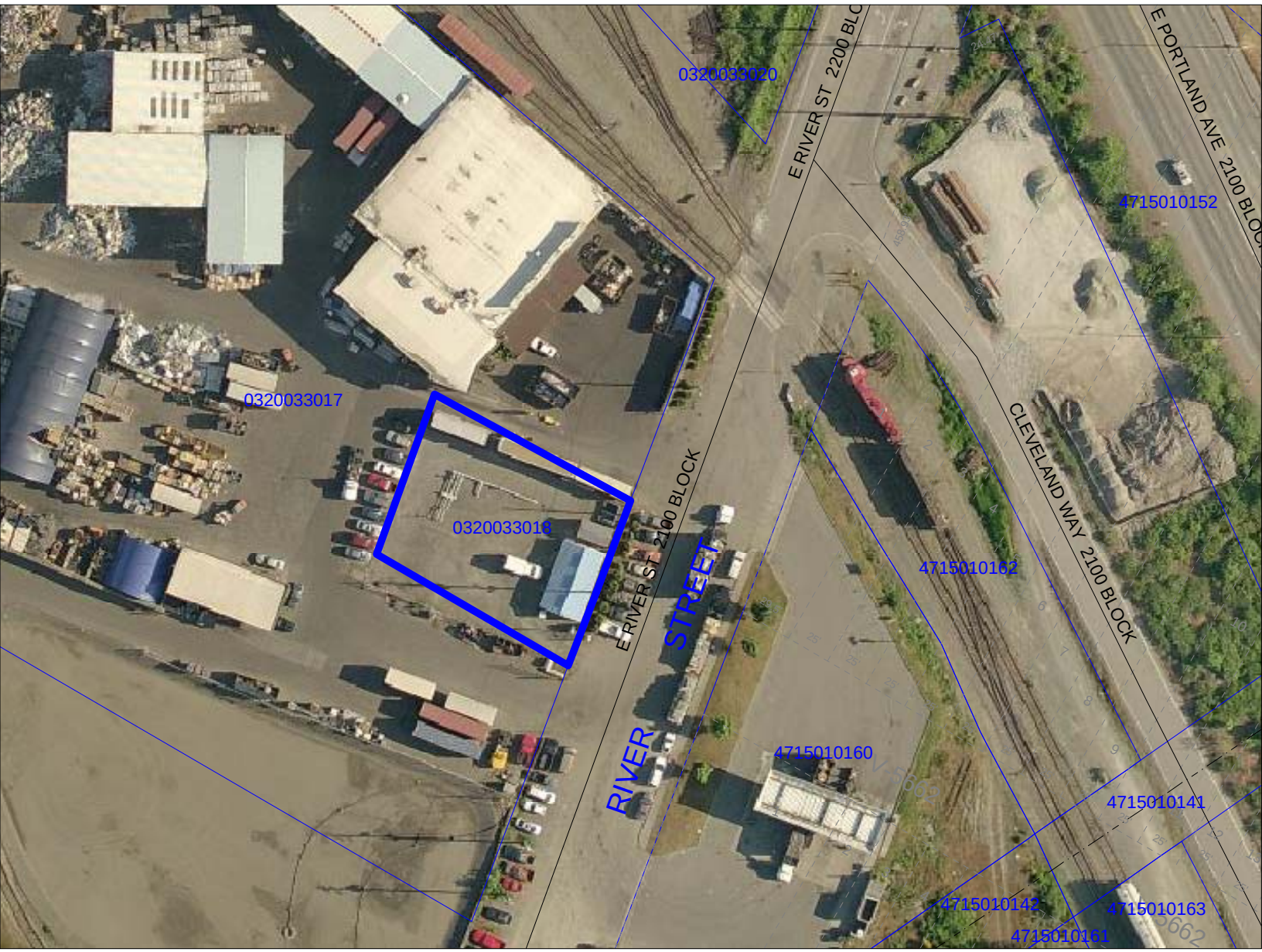


SCALE 1 : 990

50 0 50 100 150

FEET

Chicago Title Order No. 4350375



SCALE 1 : 990

50 0 50 100 150

FEET

N

8811180199 VOL 517 PAGE 1781

RECORD NOTICE

Washington Natural Gas Company is the owner of the following described real property:

> That portion of Government Lots 3 and 4, Section 3, Township 20 North, Range 3 East of the W.M., described as follows:
>
> Commencing at the intersection of the northerly line of the right-of-way of the Northern Pacific Company with the westerly line of River Street as dedicated by the Northwestern Improvement Company and the Northern Pacific Railway Company on December 6, 1901; thence on said westerly line of River Street north 19°20'45" east 160.9 feet to the true point of beginning; thence north 70°39'15" west 123.7 feet; thence north 19°20'45" east 94 feet; thence south 70°39'15" east 123.7 feet; thence south 19°20'45" west 94 feet to the point of beginning.
>
> Situate in Pierce County, Washington.

The attached Administrative Order, EPA Docket No. 1088-09-35-106, issued by the United States Environmental Protection Agency places restrictions and obligations on the above described real property.

WASHINGTON NATURAL GAS COMPANY

by Timothy J. Hogan

its VICE PRESIDENT · LEGAL

NOV 18 1988 All:38

STATE OF WASHINGTON)
)ss.
COUNTY OF KING)

On this 18th day of November, 1988, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn personally appeared Timothy J. Hogan, to me known to be the Vice President, Legal, of Washington Natural Gas Company, the corporation that executed the foregoing instrument and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that he is authorized to execute the said instrument and that the seal affixed is the corporate seal of said corporation.

WITNESS my hand and official seal hereto affixed the day and year in this certificate above written.

C. Mauccia

Notary Public in and for the State of Washington, residing at Seattle
My Appointment expires 11-22-90

24

8811180199

9202210301

PLEASE RETURN TO:
WASHINGTON NATURAL GAS CO.
ATTENTION: LEGAL DEPT.
SEATTLE, WA 98111

BK 0748 PG 2884

RECORD NOTICE

Washington Natural Gas Company is the owner of the following described real property:

That portion of Government Lots 3 and 4, Section 3, Township 20 North, Range 3 East of the W.M., described as follows:

Commencing at the intersection of the northerly line of the right-of-way of the Northern Pacific Company with the westerly line of River Street as dedicated by the Northwestern Improvement Company and the Northern Pacific Railway Company on December 6, 1901; thence on said westerly line of River Street north 19°20'45" east 160.9 feet to the true point of beginning; thence north 70°39'15" west 123.7 feet; thence north 19°20'45" east 94 feet; thence south 70°39'15" east 123.7 feet; thence south 19°20'45" west 94 feet to the point of beginning.

Situate in Pierce County, Washington.

The attached Consent Decree for Settlement between the United States of America and Washington Natural Gas Company, entered in the United States District Court, Western District of Washington, at Tacoma, Cause No. C89-155TB, places restrictions and obligations on the above described property, which are referenced in Paragraph 22(a) of said Consent Decree.

WASHINGTON NATURAL GAS COMPANY

BY: T J Hogan

ITS: Vice President-Legal & Corporate Secretary

STATE OF WASHINGTON)
)ss.
COUNTY OF KING)

On this 21st day of February, 1992, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn personally appeared Timothy J. Hogan, to me known to be the Vice President, Legal and Corporate Secretary, of Washington Natural Gas Company, the corporation that executed the foregoing instrument and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that he is authorized to execute the said instrument and that the seal affixed is the corporate seal of said corporation.

WITNESS my and and official seal hereto affixed the day and year in this certificate above written.

Notary Public in and for the State of Washington, residing at Federal Way
My commission expires 10-9-94

9202210301

D.P.

ATTACHMENT C
Correctional Services Corp. (CSC of Tacoma)

200303281584 7 PGS
03-28-2003 04:43pm $25.00
PIERCE COUNTY, WASHINGTON

Return Address:
Graham & Dunn PC
1420 Fifth Avenue, 33rd Foor
Seattle, WA 98101

First American Title Insurance Company

DOCUMENT TITLE(S) (for transactions contained therein):
1. Statutory Warranty Deed
2.
3.
4.

F.A.T. - P805772 -T2
MAR 28 2003

Reference Number(s) of Documents assigned or released:
(on page__of document(s))

Grantor(s)
1. DVR, L.L.C.
2.
3.
4.

Additional Names on page of document.

Grantee(s)
1. CSC of Tacoma, LLC
2.
3.
4.

Additional Names on page of document.

Legal Description (abbreviated i.e. lot, block, plat or section, township, range)
Prt. Govt. Lot 3 & 7, Sect. 3 & 4, Township 20 Range 3;
Prt. Blocks 46 & 47B Map of Tacoma Tidelands;
Prt. Blocks 48 & 49 Map of Tacoma Tidelands;
Prt. Govt. Lot 10 Sec. 4 Twnship 20 Range 3

Additional legal is on page 7 of document.

Assessor's Property Tax Parcel/Account Number
0320033003, 0320044004, 8950001390, 8950001420, 8950001430, 0320041015, 8950001440, 8950001490, 0320044001(as to a portion)

The Auditor/Recorder will rely on information provided on the form. The staff will not read the document to verfiy the accuracy or completeness of the indexing information provided herein.

1124788 4 PGS
03-28-2003 04:29pm EDRURY
EXCISE COLLECTED:$70,310.00
PAT MCCARTHY, AUDITOR
PIERCE COUNTY, WASHINGTON

AFF.FEE:$0.00

RECORDED AT THE REQUEST OF
AND AFTER RECORDING RETURN TO:

GRAHAM & DUNN PC
1420 Fifth Avenue, 33rd Floor
Seattle, Washington 98101
Attn: Janene A. Collins

STATUTORY WARRANTY DEED

The Grantor, DVR, LLC, a Washington limited liability company, for and in consideration of TEN DOLLARS ($10.00) and other valuable consideration, including Grantor's initial leg of a Section 1031 tax deferred exchange, in hand paid, conveys and warrants to CSC of Tacoma, LLC, a Delaware limited liability company, the property situated in the County of Pierce, State of Washington and described on Exhibit A, attached hereto and incorporated herein by this reference (the "Property") which is subject to the following:

Pursuant to that certain Partial Consent Decree for De Minimis Settlement Between the United States of America and City of Tacoma, Hygrade Food Products Corporation, Larry J. Hansen and John D. Simchuck, filed under United States District Court Western District of Washington at Tacoma under Civil Action No. C90-5373 (the "Partial Consent Decree") notice is hereby given to Grantee and any potential purchasers or lessees of the Property or other property contained within the "Tacoma Tar Pits Site", as defined in the Partial Consent Decree, (the "Site"), that:

(1) The Site, including the Property, is the subject of the Partial Consent Decree;

(2) There are restrictions upon the use of groundwater beneath the Property and other property in the Site, including a prohibition against pumping of groundwater in shallow aquifers for purposes other than monitoring; and

(3) With regard to property contained within the capped portions of the Site, which includes the Property:

(a) hazardous substances remain under the cap at the Site; and

m20063-417436.doc

(b) post-remedial action and use is restricted such that use of such property must never be allowed to disturb the integrity of the cap, of any other component of any containment system, or the function of the Site's monitoring system, unless the Regional Administrator for EPA, Region 10, finds that the disturbance:

(i) is necessary to the proposed use of such property and will not increase the potential hazard to human health or the environment; or

(ii) is necessary to reduce a threat to human health or the environment.

The Property is also subject to City of Tacoma, Department of Public Works charges or assessment fees in accordance with Statute, City Charter or by instrument recorded November 1, 1978 under Auditor's file no. 2864651; Continuing Special Assessment for Downtown Business Improvement Area (BIA") established by ordinance no. 24058, dated April 5, 1988; Other terms and conditions of Consent Decree for Settlement recorded December 19, 1991 under Auditor's file no. 9112190201; Easement recorded July 25, 1901 under Auditor's file no. 140234; Easement recorded May 21, 1907 under Auditor's file nos. 239984 and 239985; Easement recorded October 31, 1912 under Auditor's file no. 370219; Easement recorded April 12, 1945 under Auditor's file no. 1367811; Easement recorded May 15, 1953 under Auditor's file no. 1653056; Easement recorded December 15, 1953 under Auditor's file no. 167008; Restrictive Covenant by Grantor in favor of State of Washington, Department of Ecology as Grantee, dated March 26, 2003 recorded under Auditor's file no. 200303270878; Deed by Grantor in favor of the City of Tacoma as grantee, dated March 26, 2003, recorded under Auditor's file no. 200303271338; Survey by David Evans and Associates, Inc. dated March 19, 2003, Job No. CSER0000.0001 discloses the following:

(1) portions of chain link fence outside of property lines over the east and south property lines;
(2) asphalt drive from easterly adjoiner crosses onto said property; and
(3) 4 inch concrete trench drains cross east and south boundaries.

This Conveyance is being made directly by Grantor to Grantee at the request of and under the exclusive control of Tax Deferred Exchange Services, Inc., a Washington corporation, who is acting as Qualified Intermediary in this transaction

Grantor reserves all water rights associated with the Property, howsoever acquired, which are excluded from this conveyance.

DVR, LLC

By: Douglas S. Rhine
Its: Member

By: Virginia J. Rhine
Its: Member

STATE OF WASHINGTON)
) ss.
COUNTY OF KING)

I certify that I know or have satisfactory evidence that Douglas S. Rhine and Virginia J. Rhine are the persons who appeared before me, and said persons acknowledged that they signed this instrument, on oath stated that they were authorized to execute the instrument and acknowledged it as the members of DVR, LLC, a Washington limited liability company, to be the act and deed of said company, for the uses and purpose therein mentioned.

Given under my hand and official seal this 28 day of March, 2003

(Signature)

Laurel Barton
(type or print name)

NOTARY PUBLIC in and for the State of Washington
Residing at Seattle.
My appointment expires 12-18-05.

m20063-417436.doc

EXHIBIT A

Legal Description

PARCEL A:

ALL THOSE PORTIONS OF GOVERNMENT LOT 3 IN SECTION 3 AND GOVERNMENT LOT 7, SECTION 4, TOWNSHIP 20 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN AND BLOCKS 46, 46B, 47, AND 47B OF MAP OF TACOMA TIDELANDS, ACCORDING TO PLAT FILED FOR RECORD SEPTEMBER 14,1895 IN THE OFFICE OF THE PIERCE COUNTY AUDITOR BOUNDED AND DESCRIBED AS FOLLOWS:

COMMENCING AT THE MEANDER CORNER BETWEEN SECTIONS 3 AND 4, TOWNSHIP 20 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN, ON THE SOUTH BANK OF THE CHANNEL OF THE PUYALLUP RIVER, THE SAID MEANDER CORNER BEING THE COMMON CORNER OF GOVERNMENT LOT 3, IN SAID SECTION 3 AND GOVERNMENT LOT 7 IN SAID SECTION 4 AND TIDELANDS BLOCKS 46 AND 47; THENCE ALONG THE LINE BETWEEN SAID TIDELAND BLOCKS 46 AND 47; NORTH 02°0'40" EAST 106.27 FEET TO THE TRUE POINT OF BEGINNING; THENCE WITH COURSES BASED ON THE SAME MERIDIAN AS USED ON MAP OF TACOMA TIDELANDS NORTH 69°17'00" WEST 48.23 FEET; THENCE NORTH 71°22'44" WEST 336.15 FEET; THENCE NORTH 50°21'50" WEST 102.42 FEET: THENCE NORTH 42°6'15" WEST 129.44 FEET; THENCE NORTH 65°2'13" WEST 30.87 FEET; THENCE SOUTH ALONG THE WEST BOUNDARY OF TIDELAND BLOCK 47, 277.16 FEET TO THE SOUTHWEST CORNER OF SAID BLOCK; THENCE SOUTH 77°0"7" EAST 5.10 FEET; THENCE SOUTH 8°45'30" EAST 444.776 FEET; THENCE NORTH 81°14'30" EAST 14 FEET, MORE OR LESS, TO A POINT 8 FEET DISTANT EASTERLY MEASURED AT RIGHT ANGLES FROM THE CENTER OF THE PACIFIC MEAT COMPANY'S SPUR TRACK NO.2 AS THE SAME EXISTED ON MAY 23, 1901; THENCE FOLLOWING A LINE PARALLEL WITH AN 8 FEET DISTANT EASTERLY FROM THE CENTER LINE OF THE ST. PAUL AND TACOMA LUMBER COMPANY'S SPUR TRACK AS THE SAME EXISTED ON JANUARY 16, 1907, SOUTH 8°45'30" EAST 138.94 FEET; THENCE ON A CURVE TO THE LEFT HAVING A RADIUS OF 707.30.FEET PARALLEL WITH AND 8 FEET DISTANT EASTERLY FROM THE CENTER LINE OF ST. PAUL AND TACOMA LUMBER COMPANY'S SPUR TRACK AS THE SAME EXISTED ON JANUARY 16, 1907, A DISTANCE OF 112.35 FEET, MORE OR LESS, TO A POINT ON THE NORTHERLY LINE OF THE RIGHT OF WAY OF THE MAIN LINE OF THE NORTHERN PACIFIC RAILWAY COMPANY, SAID NORTHERLY LINE OF RIGHT OF WAY BEING PARALLEL WITH AND DISTANT 200 FEET NORTHERLY FROM, WHEN MEASURED AT RIGHT ANGLES TO THE CENTER LINE OF THE MAIN TRACK OF SAID RAILWAY COMPANY AS NOW LOCATED AND OPERATED; THENCE SOUTH 61°9'20" EAST ALONG SAID NORTH LINE OF RIGHT OF WAY 463.6 FEET TO THE SECTION LINE BETWEEN SAID SECTIONS 3 AND 4; THENCE

CONTINUING SOUTH 61°9'20" EAST ALONG SAID NORTH LINE OF SAID RIGHT OF WAY 394.76 FEET; THENCE NORTH 8°45'30" WEST 1,029.84 FEET TO THE NORTHERN

BOUNDARY OF A TRACT IN TIDELAND BLOCK 46 SOLD AND CONVEYED BY THE STATE OF WASHINGTON TO THE NORTHERN PACIFIC RAILWAY COMPANY BY DEED DATED AUGUST 31, 1901; THENCE NORTH 68°26'7" WEST ALONG THE NORTH BOUNDARY LINE OF SAID TRACT, 147.54 FEET; THENCE NORTH 69°17'00" WEST 21.95 FEET TO THE WEST LINE OF BLOCK 46 AND THE TRUE POINT OF BEGINNING, IN TACOMA, PIERCE COUNTY, WASHINGTON.

EXCEPTING, HOWEVER, THAT PORTION OF TIDELAND BLOCK 47 EXCEPTED BY THE NORTHWESTERN IMPROVEMENT COMPANY IN ITS DEED TO THOMAS CARSTENS DATED JANUARY 16, 1907 DESCRIBED AS FOLLOWS:

ALL THAT PART OF SAID LANDS LYING WEST OF A LINE DRAWN PARALLEL WITH AND DISTANT 15 FEET EASTERLY FROM THE CENTER LINE OF THAT CERTAIN TRACK KNOWN AS PACIFIC MEAT COMPANY'S SPUR TRACK NO.2, AS THE SAME IS NOW LOCATED AND CONSTRUCTED OVER AND ACROSS OR ADJACENT TO THE PREMISES.

ALSO EXCEPTING A STRIP OF LAND EXCEPTED BY THE NORTHERN PACIFIC RAILWAY COMPANY IN ITS DEED TO THOMAS CARSTENS DATED JANUARY 16, 1907, BEING A STRIP OF LAND 16 FEET IN WIDTH, BEING 8 FEET WIDE ON EACH SIDE OF THE CENTER LINE OF THAT CERTAIN TRACK KNOWN AS PACIFIC MEAT COMPANY'S SPUR TRACK NO.1, AS THE SAME IS NOW CONSTRUCTED AND OPERATED ON, OVER AND ACROSS THE PREMISES; AND EXCEPTING A CERTAIN TRACT OF LAND CONDEMNED BY THE OREGON AND WASHINGTON RAILROAD COMPANY, A CORPORATION, CONDEMNATION SUIT NO.1539 IN THE CIRCUIT COURT OF THE UNITED STATES, WESTERN DISTRICT OF WASHINGTON, SOUTHERN DIVISION IN DECREE RECORDED SEPTEMBER 25,1909 IN BOOK 343 OF DEEDS AT PAGE 204 AND MORE FULLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE SECTION LINE BETWEEN SECTIONS 3 AND 4, TOWNSHIP 20 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN, SAID POINT BEING A DISTANCE OF 2,508.14 FEET, MORE OR LESS, NORTHERLY MEASURED ALONG SAID SECTION LINE FROM THE SECTION CORNER COMMON TO SECTIONS 3, 4, 9 AND 10, TOWNSHIP 20 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN; THENCE NORTH 50°23'50" WEST A DISTANCE OF 330 FEET, MORE OR LESS, TO A POINT ON THE SOUTHERLY LINE OF LAND IN BLOCK 47, FORMERLY OWNED BY THE ST. PAUL AND TACOMA LUMBER COMPANY; THENCE SOUTH 71°22'44" EAST FOLLOWING ALONG THE LINE BETWEEN LAND OWNED BY CARSTENS PACKING COMPANY AND LAND FORMERLY OWNED BY THE ST. PAUL AND TACOMA LUMBER COMPANY, A DISTANCE OF 225.2 FEET, MORE OR LESS, TO AN ANGLE POINT OF SAID LAND BETWEEN LAND OWNED BY THE CARSTENS PACKING COMPANY AND LAND FORMERLY OWNED BY THE ST. PAUL AND TACOMA LAND COMPANY; THENCE SOUTH 69°17'00" EAST ALONG A LINE BETWEEN LAND OWNED BY CARSTENS PACKING COMPANY AND LAND FORMERLY OWNED BY THE ST. PAUL AND TACOMA LUMBER COMPANY, A DISTANCE OF 48.23 FEET, MORE OR LESS, TO THE INTERSECTION OF THE SECTION LINE BETWEEN SECTIONS 3 AND 4, TOWNSHIP 20 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN AND THE LINE BETWEEN LAND OWNED BY THE CARSTENS PACKING

COMPANY AND LAND FORMERLY OWNED BY ST. PAUL AND TACOMA LUMBER COMPANY, CONTINUING SOUTH 69°17'00" EAST ALONG THE SAME SAID PROPERTY LINE A DISTANCE OF 21.95 FEET, MORE OR LESS, TO AN ANGLE POINT; THENCE SOUTH 68°26'7" EAST FOLLOWING ALONG THE SOUTHERLY BOUNDARY OF LAND FORMERLY OWNED BY THE ST. PAUL AND TACOMA LUMBER COMPANY, A DISTANCE OF 147.54 FEET, MORE OR LESS, TO A POINT ON THE LINE BETWEEN LAND OWNED BY THE CARSTENS PACKING COMPANY AND LAND OWNED BY NORTHERN PACIFIC RAILWAY COMPANY; THENCE SOUTH 8°41'20" EAST ALONG THE LINE BETWEEN LAND OWNED BY THE CARSTENS PACKING COMPANY AND LAND OWNED BY THE NORTHERN PACIFIC RAILWAY COMPANY, A DISTANCE OF 224.04 FEET, MORE OR LESS, TO A POINT ON SAME SAID PROPERTY LINE; THENCE NORTH 50°23'50" WEST, A DISTANCE OF 254.1 FEET, MORE OR LESS, TO THE POINT OF BEGINNING.

ALSO EXCEPTING THE TRACT CONVEYED TO OREGON-WASHINGTON RAILROAD AND NAVIGATION COMPANY, AN OREGON CORPORATION BY DEED DATED DECEMBER 14, 1911 AND RECORDED UNDER AUDITOR'S NO.363356 DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT THAT IS NORTH 277.16 FEET FROM THE SOUTHWEST CORNER OF BLOCK 47 OF MAP OF TACOMA TIDELANDS; THENCE SOUTH 65°02'13" EAST A DISTANCE OF 30.87 FEET; THENCE SOUTH 42°06'15" EAST A DISTANCE OF 28.041 FEET; THENCE IN A NORTHWESTERLY DIRECTION A DISTANCE OF 50 FEET, MORE OR LESS, TO A POINT ON THE WESTERLY LINE OF THE CARSTEN PROPERTY; THENCE NORTH A DISTANCE OF 16.608 FEET TO THE POINT OF BEGINNING.

ALSO KNOWN AS PARCEL A OF RECORD OF SURVEY, RECORDED SEPTEMBER 8, 2000, UNDER RECORDING NO.200009085003, IN PIERCE COUNTY, WASHINGTON.

PARCEL B:

THOSE PORTIONS OF BLOCKS 48 AND 49 OF MAP OF TACOMA TIDELANDS, ACCORDING TO PLAT FILED FOR RECORD SEPTEMBER 14, 1985 IN THE OFFICE OF THE PIERCE COUNTY AUDITOR AND OF GOVERNMENT LOT 10 IN SECTION 4, TOWNSHIP 20 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN LYING EASTERLY OF A LINE PARALLEL WITH AND DISTANT 30 FEET EASTERLY MEASURED AT RIGHT ANGLES FROM THE CENTER LINE OF THE SPUR TRACK KNOWN AS THE ST. PAUL AND TACOMA LUMBER COMPANY'S SPUR, AS CONSTRUCTED AND OPERATED ACROSS SAID PREMISES ON FEBRUARY 15, 1928 AND SOUTHERLY OF A LINE RUNNING NORTH 65°02'13" WEST FROM A POINT ON THE EAST LINE OF SAID BLOCK 48, 71.21 FEET NORTH FROM THE SOUTHEAST CORNER OF SAID BLOCK, IN TACOMA, PIERCE COUNTY, WASHINGTON.,

ALSO KNOWN AS PARCEL B OF RECORD OF SURVEY, RECORDED SEPTEMBER 8, 2000, UNDER RECORDING NO.200009085003, IN PIERCE COUNTY, WASHINGTON.

(2)

200303281585 8 PGS
03-28-2003 04:43pm $26.00
PIERCE COUNTY, WASHINGTON

Return Address:
Graham & Dunn PC
1420 Fifth Avenue, 33rd Floor
Seattle, WA 98101

First American Title Insurance Company

DOCUMENT TITLE(S) (for transactions contained therein): 1. QuitClaim Deed 2. 3. 4.	P805772-T2 F.A.T. MAR 28 2003
Reference Number(s) of Documents assigned or released: (on page__of document(s))	
Grantor(s) 1. DVR, L.L.C. 2. 3. 4. Additional Names on page of document.	
Grantee(s) 1. CSC of Tacoma, LLC 2. 3. 4. Additional Names on page of document.	
Legal Description (abbreviated i.e. lot, block, plat or section, township, range) Prtn Blocks 47-49B Map of Tacoma Tidelands; Prtn Govt Lot 7 Sec. 4 Twnship 20 Rg. 3 Additional legal is on page 7 of document.	
Assessor's Property Tax Parcel/Account Number 0320044006 and 0320044001(as to a portion)	
The Auditor/Recorder will rely on information provided on the form. The staff will not read the document to verfiy the accuracy or completeness of the indexing information provided herein.	

1124764 3 PGS
03-28-2003 04:39pm EDRURY
EXCISE COLLECTED:$2,225.00 AFF.FEE:$0.00
PAT MCCARTHY, AUDITOR
PIERCE COUNTY, WASHINGTON

26

RECORDED AT THE REQUEST OF
AND AFTER RECORDING RETURN TO:

GRAHAM & DUNN PC
1420 Fifth Avenue, 33rd Floor
Seattle, Washington 98101
Attn: Janene A. Collins

QUITCLAIM DEED

DVR, LLC, a Washington limited liability company, hereinafter called "Grantor", for and in consideration of TEN and NO/100 DOLLARS ($10.00) and other good and valuable consideration, including Grantor's initial leg of a Section 1031 tax deferred exchange, in hand paid, conveys and quitclaims, without any covenants of warranty whatsoever and without recourse to the Grantor, its successors and assigns, to CSC of Tacoma LLC, a Delaware limited liability company, herein after called "Grantee", all of its right, title and interest, if any, certain real estate, subject however, to all existing interests, including but not limited to all reservations, right-of-ways and easements of record or otherwise, situated in the County of Pierce, State of Washington, hereinafter called "Property", together with all after acquired title of grantor therein, more particularly described as set forth on Exhibit A.

Grantee has been allowed to make an inspection of the Property and has knowledge as to the past use of the Property. Based upon this inspection and knowledge, Grantee is aware of the condition of the Property and **GRANTEE ACKNOWLEDGES THAT GRANTEE IS PURCHASING THE PROPERTY ON AN "AS-IS WITH ALL FAULTS" BASIS WITH ANY AND ALL PATENT AND LATENT DEFECTS, INCLUDING THOSE RELATING TO THE ENVIRONMENTAL CONDITION OF THE PROPERTY, AND THAT GRANTEE IS NOT RELYING ON ANY REPRESENTATION OR WARRANTIES, EXPRESS OR IMPLIED, OF ANY KIND WHATSOEVER FROM GRANTOR AS TO ANY MATTERS CONCERNING THE PROPERTY,** including the physical condition of the Property and any defects thereof, the presence of any hazardous substances, wastes or contaminants in, on or under the Property, the conditions or existence of the above ground or underground structures or improvements in, on or under the Property, the conditions of title to the Property, and the leases, easements or other agreements affecting the Property. Grantee is aware of the risk that hazardous substances and contaminants may be present on the Property, and indemnifies, holds harmless and hereby waives, releases and discharges forever Grantor from any and all present or future claims or demands, and any and all damages, loss, injury, liability, claims or cots, including fines, penalties and judgments,

m20063-417439.doc

and attorney's fees, arising from or in any way relating to the condition of the Property or alleged presence, use, storage, generation, manufacture or contaminants in, on or under the Property. Losses shall include without limitation (a) the cost of any investigation, removal, remedial or other response action that is required by any Environmental Law, that is required by judicial order or by order of or agreement with any governmental authority, or that is necessary or otherwise is reasonable under the circumstances, (b) capital expenditures necessary to cause the Grantor's remaining property or the operations or business of the Grantor on its remaining property to be in compliance with the requirements of any Environmental Law, (c) losses for injury or death of any person, and (d) losses arising under any Environmental Law enacted after the transfer. The rights of Grantor under this section shall be in addition to and not in lieu of any other rights or remedies to which it may be entitled under this document or otherwise. This indemnity specifically includes the obligation of Grantee to remove, close, remediate, reimburse or take other action requested or required by any governmental agency concerning any hazardous substances or contaminants on the Property. Notwithstanding the foregoing, for losses incurred due to the events that occur pre-closing, Grantee's obligation to indemnify and hold harmless Grantor as set forth in this paragraph shall apply only to the extent such losses are caused by, contributed to, or aggravated by the presence on and use of the Property by Grantee or Grantee's Assignor, Correctional Services Corporation ("CSC"), or violation of any Environmental Law by Grantee or CSC.

The term "Environmental Law" means any federal, state or local statute, regulation, code rule, ordinance, order, judgment, decree, injunction or common law pertaining in any way to the protection of human health or the environment, including without limitation, the Resource, Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation and Liability Act, the Toxic Substance Control Act, and any similar or comparable state or local law.

The term "Hazardous Substance" means any hazardous, toxic, radioactive or infectious substance, material or waste as defined or regulated under any Environmental Law, and includes without limitation petroleum oil and any of its fractions.

Grantee acknowledges that Grantor's property for sale, may be subject to reversion upon abandonment of use for Railroad purposes and that the Quitclaim deed is for the purpose of releasing the Grantor's interest in said subject Property.

By acceptance of this deed, Grantee acknowledges that a material consideration for this conveyance, without which it would not be made, is the agreement by the Grantee for itself and for its successors and assigns, that the Grantor, its predecessors, successors, and assigns shall be in no manner responsible to the Grantee, any subsequent owner, purchaser, or any person interested therein for any and all claims, demands, damages, causes of action including

loss of access, or suits regarding the quiet and peaceable possession of such Property, title thereto, or condition thereof.

This Conveyance is being made directly by Grantor to Grantee at the request of and under the exclusive control of Tax Deferred Exchange Services, Inc., a Washington corporation, who is acting as Qualified Intermediary in this transaction.

[Signatures on following pages]

IN WITNESS WHEREOF, the said Grantor caused this instrument to be signed by its authorized representative, ~~attested by its Assistant Secretary and its corporate seal to be affixed hereto~~ on the 28th day of March, 2003

DVR, LLC

By: Douglas S. Rhine
Its: Member

By: Virginia J. Rhine, Member

ACCEPTED:

CSC OF TACOMA, LLC

By: Correctional Services Corporation,
Its Sole Member

By: _____
James F. Slattery
President and Chief Executive Officer

4

Quit Claim Deed

STATE OF WASHINGTON)
) ss.
COUNTY OF PIERCE)

On this 28th day of March, 2003, before me, the undersigned, a Notary Public in and for the State of Washington, duly commissioned and sworn, personally appeared Douglas S. Rhine and Virginia J. Rhine, to me known to be the Members, of DVR, LLC, a Washington limited liability company, the company that executed the foregoing instrument, and acknowledged the said instrument to be the free and voluntary act and deed of said company, for the uses and purposes therein mentioned, and on oath stated that they are authorized to execute said instrument for said company.

Given under my hand and official seal this 28th day of March, 2003

RENEE M. RICHARDSON
COMMISSION EXPIRES
NOTARY
PUBLIC
9-26-04
STATE OF WASHINGTON

(Signature)

Renee M. Richardson
(type of print name)

NOTARY PUBLIC in and for the State of Washington
Residing at Gig Harbor.
My appointment expires 09/25/04.

5

m20063-417439.doc

EXHIBIT A

Legal Description

PARCEL A:

THOSE PORTIONS OF BLOCKS 47, 48, 49, 49A, AND 49B OF MAP OF TACOMA TIDELANDS, ACCORDING TO PLAT FILED FOR RECORD SEPTEMBER 14, 1895 IN THE OFFICE OF THE PIERCE COUNTY AUDITOR AND OF GOVERNMENT LOT 7 IN SECTION 4, TOWNSHIP 20 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN LYING NORTH OF THE NORTHERLY LINE OF THE RIGHT OF WAY OF THE MAIN LINE OF THE NORTHERN PACIFIC RAILWAY COMPANY, SAID NORTHERLY LINE OF RIGHT OF WAY BEING PARALLEL WITH AND DISTANT 200 FEET NORTHEASTERLY FROM, WHEN MEASURED AT RIGHT ANGLES TO THE CENTERLINE OF THE MAIN TRACK OF SAID RAILWAY AS NOW LOCATED AND OPERATED, EAST OF J STREET; AND SOUTHWESTERLY OF A LINE BEGINNING AT A POINT ON THE EAST LINE J STREET, WHICH IS NORTH 65°02'13" WEST FROM A POINT ON THE EAST LINE OF SAID BLOCK 48, WHICH POINT IS 71.21 FEET NORTH FROM THE SOUTHEAST CORNER OF SAID BLOCK 48; THENCE SOUTH 65°02'13" EAST TO A POINT WHICH IS 18.73 FEET ON SAID BEARING FROM THE EAST LINE OF SAID BLOCK 48; THENCE SOUTH 08°46'20" EAST 294.98 FEET TO THE SOUTHERLY LINE OF SAID BLOCK 47; THENCE ALONG SAID SOUTHERLY LINE NORTH 77°00'07" WEST 5.94 FEET TO THE NORTHERLY EXTENSION OF A LINE PARALLEL WITH AND 8 FEET EASTERLY OF THE CENTERLINE OF THE PACIFIC MEAT COMPANY SPUR NO.2 AS SHOWN IN SURVEY RECORDED IN VOLUME 17 OF SURVEYS AT PAGE 94, RECORDS OF PIERCE COUNTY, WASHINGTON; THENCE ALONG SAID NORTHERLY EXTENSION AND SAID PARALLEL LINE SOUTH 08°33'50" EAST 415.07 FEET TO THE BEGINNING OF A TANGENT CURVE TO THE RIGHT HAVING A RADIUS OF 411.31 FEET;

THENCE SOUTHEASTERLY AND SOUTHERLY 70.29 FEET ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 09°47'30" TO A POINT OF REVERSE CURVE TO THE LEFT HAVING A RADIUS OF 564.96 FEET (THE RADIUS CENTER OF SAID REVERSE CURVE BEARS SOUTH 88°46'20" EAST); THENCE SOUTHERLY AND SOUTHEASTERLY 98.60 FEET ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 10°00'00" TO A POINT OF COMPOUND CURVE TO THE LEFT HAVING A RADIUS OF 707.30 FEET (THE RADIUS CENTER OF SAID COMPOUND CURVE BEARS NORTH 81°13'40" EAST); THENCE ON A CURVE TO THE LEFT HAVING A RADIUS OF 707.30 FEET PARALLEL WITH AND 8 FEET DISTANT EASTERLY FROM THE CENTER LINE OF ST. PAUL AND TACOMA LUMBER COMPANY'S SPUR TRACK AS THE SAME EXISTED ON JANUARY 16, 1907 TO A POINT ON THE NORTHERLY LINE OF THE ABOVE DESCRIBED RIGHT OF WAY OF THE MAIN LINE OF THE NORTHERN PACIFIC RAILWAY COMPANY, AND THE TERMINUS OF SAID DESCRIBED LINE.

EXCEPTING THEREFROM THAT PORTION CONVEYED TO THE CITY OF TACOMA BY DEED RECORDED UNDER AUDITOR'S FILE NO. 200303271338, RECORDS OF PIERCE COUNTY, WASHINGTON.

PARCEL B:

THAT PORTION OF GOVERNMENT LOT 7, SECTION 4, TOWNSHIP 20 NORTH, RANGE 3 EAST OF WILLAMETTE MERIDIAN BEING DESCRIBED AS FOLLOWS:

BEGINNING AT THE SOUTHWEST CORNER OF PARCEL A OF THAT CERTAIN RECORD OF SURVEY FILED SEPTEMBER 8, 2000 UNDER AUDITOR'S NO.200009085003, RECORDS OF PIERCE COUNTY, WASHINGTON; THENCE SOUTH 61°08'57" EAST ALONG THE SOUTHERLY LINE OF SAID PARCEL A 235.19 FEET TO THE WEST LINE OF A SIXTEEN (16) FOOT STRIP RESERVED IN DEED RECORDED UNDER AUDITOR'S FILE NO.239984, DEPICTED AND REFERENCED AS ITEM 17A IN SAID RECORD OF SURVEY, AND THE TRUE POINT OF BEGINNING; THENCE NORTH 09°53'08" WEST ALONG SAID WEST LINE A DISTANCE OF 290.11 FEET TO THE NORTHWEST CORNER OF SAID 16 FOOT STRIP; THENCE NORTH 81°13'40" EAST ALONG THE NORTH LINE OF SAID 16 FOOT STRIP A DISTANCE OF 16.00 FEET TO THE NORTHEAST CORNER OF SAID 16 FOOT STRIP; THENCE SOUTH 09°53'08" EAST ALONG THE EAST LINE OF SAID 16 FOOT STRIP A DISTANCE OF 302.63 FEET TO THE NORTH LINE OF THE 400 FOOT WIDE CHARTER RIGHT OF WAY OF BURLINGTON NORTHERN RAILROAD; THENCE ALONG SAID NORTH LINE NORTH 61°08'57" WEST A DISTANCE OF 20.51 FEET TO THE TRUE POINT OF BEGINNING.

EXCEPTING THEREFROM THAT PORTION CONVEYED TO THE CITY OF TACOMA BY DEED RECORDED UNDER AUDITOR'S FILE NO. 200303270878, RECORDS OF PIERCE COUNTY, WASHINGTON.

200303271338 4 PGS
03-27-2003 04:25pm $22.00
PIERCE COUNTY, WASHINGTON

When Recorded, Return To:

City of Tacoma Asset Management
Division
General Services Department
747 Market Street, Room 737
Tacoma WA 98402-3701

DOCUMENT TITLE	QUIT CLAIM DEED	P805772 -T2 F.A.T. MAR 27 2003
Grantor	DVR LLC	
Grantee	CITY OF TACOMA	
Legal Description -SEE EXHIBIT A FOR FULL LEGAL DESCRIPTION Northeast Quarter of Section 4, Township 20 North, Range 3 East, W. M.		
Reference Number	DEED NO. 6881	
Assessor's Parcel Number	032004-400-6	

Page 1 of 4

22
24.00

1124506 2 PGS
03-27-2003 03:58pm EACLARK1
EXCISE COLLECTED:$0.00
PAT MCCARTHY, AUDITOR
PIERCE COUNTY, WASHINGTON

AFF.FEE:$2.00

03-002CK/DEED NO. 6881

QUIT CLAIM DEED

The **GRANTOR, DVR LLC**, for good and valuable consideration, conveys and quit claims to **CITY OF TACOMA, GRANTEE**, a municipal corporation, all its rights, title, and interest in the following described real property, situate in the County of Pierce, State of Washington, for street purposes:

SEE ATTACHED EXHIBIT A

ASSESSOR'S PROPERTY TAX PARCEL NUMBER: 032004-400-6

Grantor acknowledges and accepts that the City of Tacoma shall not be responsible for improving the street and, furthermore, the Grantee shall improve the street at time of development of the parcel.

Dated this 26th day of March, 2003

_____ its Member

03-002CK/DEED NO. 6881

STATE OF WASHINGTON)
) SS
COUNTY OF Pierce)

I, Joel D. Simmonds, a Notary Public in and for the said State, do hereby certify that on this 26th day of March, 2003, personally appeared before me Douglas S. Rhine to me known to be the Member of the LLC ~~of the corporation~~ that executed the within and foregoing instrument, and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that he/she was authorized to execute said instrument, and that the seal affixed is the corporate seal of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year in this certificate first above written.

JOEL D. SIMMONDS
COMMISSION EXPIRES
NOTARY
PUBLIC
5-10-06
STATE OF WASHINGTON

Notary Public in and for the State of Washington
Residing at Olympia in ~~said County~~ Thurston County
My Commission expires 5-10-06

ACCEPTED:

Department Director

Description Approved:

Chief Surveyor

APPROVED as to Form and Legality:

Assistant City Attorney

Page 3 of 4

EXHIBIT A

Those portions of Blocks 48, 49, 49A, and 49B of Map of Tacoma Tidelands, according to Plat filed for record September 14, 1895, in the office of the Pierce County Auditor, and of Government Lot 7 in Section 4, Township 20 North, Range 3 East, W. M. lying as follows:

North of the northerly line of the right of way of the main line of the Northern Pacific Railway Company, said northerly line of right of way being parallel with and distant 200 feet northeasterly from, when measured at right angles to the centerline of the main track of said Railway as now located and operated;

East of the east right of way line of East "J" Street;

Southerly of a line beginning at a point on the east right of way line of East "J" Street, which is North 65°02'13" West from a point on the east line of said Block 48, which point is 71.21 feet north from the southeast corner of said Block 48; thence South 65°02'13" East to a point, herein referred to as Point "A", which is 50.48 feet, more or less, on said bearing from the east line of said Block 48;

And West of the west line of a 19-foot railroad easement recorded under Pierce County Auditor's File Number 200106200797, said west line being 9.50 feet west of the centerline of the Burlington Northern Santa Fe Spur Track (a/k/a St. Paul and Tacoma Lumber Company's Spur Track) as surveyed January 26, 2000, by David Evans and Associates, Inc., said centerline is described as follows:

> Beginning at the aforementioned Point "A", being a point on said centerline and the beginning of a non-tangent curve to the left having a radius of 637.27 feet; thence southeasterly 65.55 feet, more or less, along said curve through a central angle of 05°53'58" (the radius center of said curve bears North 87°07'38" East); thence South 08°46'20" East along said centerline, a distance of 817.73 feet to the beginning of a curve to the left having a radius of 715.30 feet; thence southeasterly along said curve, a distance of 108.25 feet, more or less, through a central angle of 08°40'40" to the northerly line of said right of way of the main line of the Northern Pacific Railway Company and the TERMINUS of this centerline description, said Terminus bears North 61°08'57" West, a distance of 11.48 feet, more or less, from the southeast corner of Parcel "A" of deed recorded under Auditor's File Number 200106200797, (also being the southwest corner of Parcel "A" of survey recorded under Auditor's File Number 200009085003), records of Pierce County, Washington.

The west line of said 19-foot railroad easement is to be extended so as to intersect and terminate at the north line of this dedication and to be shortened so as to intersect and terminate at the south line of this dedication.

ATTACHMENT D
Aples I LLC
(Cardlock Station)

200605220594.001

200605220594 5 PGS
05/22/2006 11:01am $36.00
PIERCE COUNTY, WASHINGTON

AFTER RECORDING MAIL TO:

Apes I, LLC
5709 - 134th St. Ct. E.
Puyallup, WA 98373

STATUTORY WARRANTY DEED

Tax Account No.: 4715010142, 4715010160; 4715010161

THE GRANTOR(S) **LARRY J. HANSEN AND LINDA K. HANSEN, husband and wife, as to Parcels 1 and 2 and HANSEN PROPERTIES PARTNERSHIP, as to Parcel 3**
for and in consideration of TEN DOLLARS ($10.00) and other good and valuable considerations in hand paid, conveys, and warrants to **APES I, LLC, a Washington limited liability company** the following described real estate, situated in the County of Pierce, State of Washington:

Abbreviated Legal: LOTS 1-6, BLK 7146 AND LOTS 1 - 35, BLK 7246, INDIAN ADD

SEE PAGES 3 AND 4, EXHIBIT 'A', ATTACHED HERETO AND MADE A PART HEREOF BY REFERENCE FOR COMPLETE LEGAL DESCRIPTION.

SEE EXHIBIT 'B' ATTACHED HERETO AND MADE A PART HEREOF BY REFERENCE FOR EXCEPTIONS TO TITLE.

Dated: 5/19/06

LARRY J. HANSEN

LINDA K. HANSEN

HANSEN PROPERTIES PARTNERSHIP

By: LARRY J. HANSEN
Its Authorized Signatory

05/22/2006 10:26am ECCOMITO 4126229 3 PGS
EXCISE COLLECTED:$17,853.48 PRO FEE:$0.00
PGT RECORDING AUDITOR COUNTY FEE:$0.00
PIERCE COUNTY, WA STATE FEE:$5.00

36

STATE OF WASHINGTON }
} ss.
COUNTY OF PIERCE }

On this day before me personally appeared LARRY J. HANSEN AND LINDA K. HANSEN to me known to be the individual(s) described in and who executed the within and foregoing instrument, and acknowledged that THEY signed the same as THEIR free and voluntary act and deed, for the uses and purposes therein mentioned.

GIVEN under my hand and official seal this 19th day of May, 2006.

Cynthia L. Foley
Print/Type Name: Cynthia L. Foley
Notary Public in and for the State of Washington,
Residing at University Place
My appointment expires: 9-20-07

CYNTHIA L. FOLEY NOTARY PUBLIC 9-20-07 STATE OF WASHINGTON

STATE OF WASHINGTON
SS:
COUNTY OF PIERCE

I certify that I know or have satisfactory evidence that LARRY J. HANSEN is the person who appeared before me, and said person acknowledged that (he/she) signed this instrument, on oath stated that (he/she) is authorized to execute the instrument and acknowledged it as the AUTHORIZED SIGNATORY of HANSEN PROPERTIES PARTNERSHIP to be the free and voluntary act of such party for the uses and purposes mentioned in the instrument.

GIVEN under my hand and official seal this 19th day of May, 2006.

Cynthia L. Foley
Print/Type Name: Cynthia L. Foley
Notary Public in and for the State of Washington,
Residing at University Place
My appointment expires: 9-20-07

CYNTHIA L. FOLEY NOTARY PUBLIC 9-20-07 STATE OF WASHINGTON

200605220584.003

EXHIBIT 'A'
LEGAL DESCRIPTION

PARCEL NO. 1:

A PARCEL OF LAND SITUATE IN SECTION 3, TOWNSHIP 20 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN, CITY OF TACOMA, COUNTY OF PIERCE, STATE OF WASHINGTON, BEING A PORTION OF LOTS 1 THROUGH 6, BOTH INCLUSIVE, OF BLOCK 7146, LOTS 1 THROUGH 5, BOTH INCLUSIVE, OF BLOCK 7246 AND VACATED SOUTH 22ND STREET, ALL LOCATED IN INDIAN ADDITION TO THE CITY OF TACOMA, BOUNDED AND DESCRIBED AS FOLLOWS;

BEGINNING AT A POINT ON THE WESTERLY LINE OF SAID LOT 1 OF BLOCK 7146 WHICH BEARS SOUTH 20°41'53" WEST, 355.91 FEET FROM THE MOST NORTHERLY CORNER OF SAID LOT 1;
THENCE ALONG THE WESTERLY LINE OF SAID LOT 1 OF BLOCK 7146 AND EXTENDING ACROSS SAID VACATED SOUTH 22ND STREET AND ALONG THE WESTERLY LINE OF SAID LOT 1 OF BLOCK 7246, SOUTH 20°41'53" WEST, 458.49 FEET TO A POINT ON THE NORTHWESTERLY LINE OF A PARCEL OF LAND CONVEYED BY THE UNION PACIFIC RAILROAD COMPANY TO THE CITY OF TACOMA BY QUIT CLAIM DEED DATED OCTOBER 1, 1951, UPRR CO. L.S. D.A. 2054;
THENCE ALONG SAID NORTHWESTERLY LINE NORTH 54°58'43" EAST, 345.85 FEET;
THENCE NORTH 26°52'58" WEST, 202.01 FEET TO THE BEGINNING OF A CURVE CONCAVE SOUTHWESTERLY HAVING A RADIUS OF 438.34 FEET;
THENCE NORTHWESTERLY ALONG SAID CURVE, THROUGH A CENTRAL ANGLE OF 07°38'37", 58.46 FEET TO THE POINT OF BEGINNING;

EXCEPT THAT PORTION THEREOF CONDEMNED BY PIERCE COUNTY SUPERIOR CAUSE NO. 94-2-04499-6;

PARCEL NO. 2:

A PARCEL OF LAND SITUATE IN SECTION 3, TOWNSHIP 20 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN, CITY OF TACOMA, COUNTY OF PIERCE, STATE OF WASHINGTON, BEING A PORTION OF LOTS 1 THROUGH 36, BOTH INCLUSIVE, OF BLOCK 7246 IN INDIAN ADDITION TO THE CITY OF TACOMA, SAID PARCEL BEING BOUNDED AND DESCRIBED AS FOLLOWS;

COMMENCING AT THE MOST NORTHERLY CORNER OF LOT 1 OF BLOCK 7146 IN SAID INDIAN ADDITION;
THENCE ALONG THE NORTHEASTERLY LINE OF SAID BLOCK 7146, SOUTH 49°01'17" EAST, 524.59 FEET TO THE MOST EASTERLY CORNER OF A PARCEL OF LAND CONVEYED BY THE UNION PACIFIC RAILROAD COMPANY TO THE CITY OF TACOMA BY QUIT CLAIM DEED DATED OCTOBER 1, 1951, UPRR CO. L.S. D.A. 2054;
THENCE ALONG THE SOUTHEASTERLY LINE OF SAID DEEDED PARCEL SOUTH 54°58'43" WEST, 481.18 FEET TO THE TRUE POINT OF BEGINNING;
THENCE CONTINUING ALONG SAID SOUTHEASTERLY LINE SOUTH 54°58'43" WEST, 370.12 FEET TO THE SOUTHWESTERLY LINE OF SAID BLOCK 7248;
THENCE ALONG SAID SOUTHWESTERLY LINE SOUTH 59°48'17" EAST, 640.00 FEET;
THENCE SOUTH 79°37'04" EAST, 218.30 FEET;
THENCE NORTH 43°13'34" WEST, 491.22 FEET TO THE BEGINNING OF A CURVE CONCAVE NORTHEASTERLY HAVING A RADIUS OF 372.48 FEET;
THENCE NORTHWESTERLY ALONG SAID CURVE, THROUGH A CENTRAL ANGLE OF 18°20'36", 106.25 FEET;
THENCE NORTH 26°52'58" WEST, 144.61 FEET TO THE TRUE POINT OF BEGINNING;

EXCEPT THAT PORTION THEREOF CONDEMNED BY PIERCE COUNTY SUPERIOR CAUSE NO. 94-2-04499-6;

200605220594.004

PARCEL NO. 3:

A STRIP OF LAND 50 FEET WIDE SITUATED IN AND BEING ALL OF THOSE PARTS OF BLOCKS 7146 AND 7246, INDIAN ADDITION TO THE CITY OF TACOMA, PIERCE COUNTY, WASHINGTON, AND VACATED SOUTH 22ND STREET, THAT LIES BETWEEN LINES THAT ARE PARALLEL WITH AND 25 FEET DISTANT, MEASURED AT RIGHT ANGLES, ON EACH SIDE OF THE HEREINAFTER DESCRIBED CENTERLINE OF THE INTERCEPTOR SEWER LINE OF THE CITY OF TACOMA, AND EXTENDING SOUTHWESTERLY FROM THE NORTHEASTERLY LINE OF SAID BLOCK 7146 TO THE SOUTHWESTERLY AND NORTHWESTERLY LINES OF SAID BLOCK 7246;

SAID CENTER LINE OF INTERCEPTOR SEWER LINE HEREINBEFORE REFERRED TO OVER AND ACROSS SAID BLOCKS AND OTHER PROPERTY BEING DESCRIBED AS FOLLOWS;

BEGINNING AT A POINT IN THE CENTER LINE OF CLEVELAND WAY IN SAID CITY THAT IS 5 FEET DISTANT SOUTHEASTERLY, MEASURED AT RIGHT ANGLES, FROM THE NORTHWESTERLY LINE OF LOT 23 IN BLOCK 7145, SAID INDIAN ADDITION, PRODUCED SOUTHWESTERLY;
THENCE SOUTHWESTERLY ALONG A STRAIGHT LINE WHICH FORMS AN ANGLE OF 76° FROM NORTHWEST TO SOUTHWEST WITH SAID CENTER LINE OF CLEVELAND WAY, A DISTANCE OF 855.49 FEET;
THENCE SOUTHWESTERLY ALONG A STRAIGHT LINE WHICH FORMS AN ANGLE OF 05°19'03" FROM SOUTH TO WEST WITH THE LAST DESCRIBED STRAIGHT LINE PRODUCED SOUTHWESTERLY, A DISTANCE OF 230 FEET;

SITUATE IN THE **COUNTY OF PIERCE**, STATE OF WASHINGTON.

EXHIBIT 'B'
EXCEPTIONS TO TITLE

1. NOTICE OF TAP OR CONNECTION CHARGES WHICH HAVE BEEN OR WILL BE DUE IN CONNECTION WITH DEVELOPMENT OR RE-DEVELOPMENT OF THE LAND AS DISCLOSED BY RECORDED INSTRUMENT. INQUIRIES REGARDING THE SPECIFIC AMOUNT OF THE CHARGES SHOULD BE MADE TO THE CITY/COUNTY/AGENCY.

   CITY/COUNTY/AGENCY: CITY OF TACOMA
   RECORDING NO.: 2864651

   AS AMENDED AND/OR MODIFIED BY INSTRUMENTS RECORDED UNDER RECORDING NO.'S 2881434 AND 8012010130.

2. UNRECORDED LEASEHOLDS, IF ANY; RIGHTS OF VENDORS AND HOLDERS OF SECURITY INTERESTS ON PERSONAL PROPERTY INSTALLED UPON THE LAND; AND RIGHTS OF TENANTS TO REMOVE TRADE FIXTURES AT THE EXPIRATION OF THE TERM. RESERVATIONS CONTAINED IN INSTRUMENT RECORDED UNDER RECORDING NO. 8106300307.

3. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:

   GRANTEE: WASHINGTON NATURAL GAS COMPANY
   PURPOSE: PIPE LINE OR PIPE LINES
   AREA AFFECTED: A PORTION OF SAID PREMISES
   RECORDED: JUNE 22, 1992
   RECORDING NO.: 9206220549

4. COVENANTS, CONDITIONS, EASEMENTS AND RESTRICTIONS AMONG OTHER THINGS IMPOSED BY JUDGMENT IN PIERCE COUNTY SUPERIOR COURT CAUSE NO. 94-2-04499-6.

5. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:

   GRANTEE: CITY OF TACOMA
   PURPOSE: SEWERS
   AREA AFFECTED: A PORTION OF SAID PREMISES
   RECORDED: DECEMBER 8, 1998
   RECORDING NO.: 9812080052

6. OCCUPANCY PERMIT AND THE TERMS AND CONDITIONS THEREOF:

   RECORDED: JULY 13, 2005
   RECORDING NO.: 200507131280

7. TERMS AND CONDITIONS CONTAINED IN UNITED STATES DISTRICT COURT CAUSE NOS. C89-155B, C89-489TB AND C90-5373. IN CONNECTION THEREWITH THE COMPANY NOTES INSTRUMENTS RECORDED UNDER RECORDING NOS. 9106060099, 9106100294, 9112190201 AND 9204160208.

ATTACHMENT E
Union Pacific Railroad
(UPRR)

CHICAGO TITLE INSURANCE COMPANY

4717 SOUTH 19TH, STE 201, TACOMA, WA 98405

Order No.: 004350376 **PROPERTY ADDRESS:** WASHINGTON
Your No.: UNION PACIIFIC RR

DALTON, OLMSTED & FUGLEVAND, INC.
10827 NE 68TH STREET, SUITE B
KIRKLAND, WASHINGTON 98033

ATTN: NANCY CASE O'BOURKE

Enclosed are your materials on the above transaction. If you have any questions regarding these materials, please contact us.

Thank you for this opportunity to serve you.

UNIT 4

ROB HAINEY	COMMERCIAL TITLE MANAGER	
	EMAIL:	ROB.HAINEY@CTT.COM
	PHONE:	(253) 671-6623
DAVID COLEMAN	SENIOR TITLE EXAMINER/TITLE OFFICER	
	EMAIL:	DAVID.COLEMAN@CTT.COM
	PHONE:	253-671-6646

FAX NUMBER (253) 671-6614

TITLET7/RDA/0999

CHICAGO TITLE INSURANCE COMPANY
4717 SOUTH 19TH, STE 201, TACOMA, WA 98405

PLAT CERTIFICATE

Order No.: 4350376

Certificate for Filing Proposed Plat:

In the matter of the plat submitted for our approval, this Company has examined the records of the County Auditor and County Clerk of PIERCE County, Washington, and the records of the Clerk of the United States Courts holding terms in said County, and from such examination hereby certifies that the title to the following described land situate in said PIERCE County, to-wit:

SEE SCHEDULE A (NEXT PAGE)

VESTED IN:

UNION PACIFIC RAILROAD COMPANY, A DELAWARE CORPORATION

EXCEPTIONS:

SEE SCHEDULE B ATTACHED

CHARGE: $350.00
TAX: $ 32.55

Records examined to JUNE 2, 2009 at 8:30 AM

By

DAVID W. COLEMAN
Title Officer/Commercial Examiner
(253)671-6646

PLATCRTA/RDA/0999

PLAT CERTIFICATE

SCHEDULE A

(Continued) Order No.: 4350376

LEGAL DESCRIPTION

A PARCEL OF LAND IN AND BEING ALL THAT PART OF LOT 3, TACOMA TIDE LANDS, PIERCE COUNTY, WASHINGTON, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT IN THE CENTERLINE OF CANAL STREET, 80 FEET WIDE, THAT IS SOUTH 46°48'30" EAST, A DISTANCE OF 181 FEET, MORE OR LESS, FROM THE INTERSECTION OF THE CENTERLINE OF ST. PAUL AVENUE, 80 FEET WIDE, AND SAID CANAL STREET CENTERLINE;
THENCE SOUTH 46°48'30" WEST A DISTANCE OF 216 FEET, MORE OR LESS, TO THE TRUE POINT OF BEGINNING;
THENCE NORTH 80°00' WEST A DISTANCE OF 152 FEET, MORE OR LESS;
THENCE SOUTH 46°00' WEST A DISTANCE OF 173 FEET, MORE OR LESS;
THENCE SOUTH 46°00' EAST A DISTANCE OF 140 FEET, MORE OR LESS;
THENCE SOUTH 46°00' WEST A DISTANCE OF 90 FEET, MORE OR LESS;
THENCE SOUTH 49°30' EAST A DISTANCE OF 70 FEET, MORE OR LESS;
THENCE NORTH 48°45' EAST A DISTANCE OF 30 FEET, MORE OR LESS;
THENCE SOUTH 48°45' EAST A DISTANCE OF 510 FEET, MORE OR LESS;
THENCE NORTH 46°30' EAST A DISTANCE OF 165 FEET, MORE OR LESS;
THENCE NORTH 6°30' EAST A DISTANCE OF 146 FEET, MORE OR LESS;
THENCE NORTH 44°30' WEST A DISTANCE OF 500 FEET, MORE OR LESS, TO THE TRUE POINT OF BEGINNING OF THIS DESCRIPTION.

EXCEPT A STRIP OF LAND 21 FEET IN WIDTH, BEING 17 FEET NORTHEASTERLY AND 4 FEET SOUTHWESTERLY, MEASURED AT RIGHT ANGLES FROM THE CENTERLINE OF RAILROAD OWNED LEAD TRACK NO. 11 AS NOW CONSTRUCTED AND OPERATED, BETWEEN RAILROAD SURVEY STATION 20+20 AND RAILROAD SURVEY STATION 27+40.

SITUATE IN THE CITY OF TACOMA, COUNTY OF PIERCE, STATE OF WASHINGTON.

CHICAGO TITLE INSURANCE COMPANY

PLAT CERTIFICATE

SCHEDULE B

Order No.: 4350376

This certificate does not insure against loss or damage by reason of the following exceptions:

GENERAL EXCEPTIONS:

A. Defects, liens, encumbrances, adverse claims or other matters, if any, created, first appearing in the public records or attaching subsequent to the effective date hereof but prior to the date the proposed insured acquires for value of record the estate or interest or mortgage thereon covered by this Commitment.

B. Rights or claims of parties in possession not shown by the public records.

C. Encroachments, overlaps, boundary line disputes, and any other matters which would be disclosed by an accurate survey and inspection of the premises.

D. Easements or claims of easements not shown by the public records.

E. Any lien, or right to lien, for contributions to employee benefit funds, or for state workers' compensation, or for services, labor, or material heretofore or hereafter furnished, all as imposed by law, and not shown by the public records.

F. Liens under the Workmen's Compensation Act not shown by the public records.

G. Any service, installation, connection, maintenance or construction charges for sewer, water, electricity or garbage removal.

H. General taxes not now payable; matters relating to special assessments and special levies, if any, preceding or in the same becoming a lien.

I. Reservations or exceptions in patents or in Acts authorizing the issuance thereof; Indian tribal codes or regulations, Indian treaty or aboriginal rights, including easements or equitable servitudes.

J. Water rights, claims, or title to water.

K. THIS REPORT IS ISSUED AND ACCEPTED UPON THE UNDERSTANDING THAT THE LIABILITY OF THE COMPANY SHALL NOT EXCEED ONE THOUSAND DOLLARS($1000.00).

PLAT CERTIFICATE

SCHEDULE B

(Continued) Order No.: 4350376

EXCEPTIONS

A 1. THE TAXES SHOWN BELOW, AS BILLED AND PAID, REFLECT AN EXEMPTION ALLOWED PURSUANT TO RCW 84.36. ANY CHANGES WITH RESPECT TO THE TAXPAYER MAY RESULT IN CURTAILMENT OF THE EXEMPTION AND AN ADJUSTMENT OF THE AMOUNT OF TAXES DUE. NO INSURANCE IS GIVEN AGAINST ANY ADDITIONAL TAXES LEVIED AGAINST SAID PREMISES CAUSED BY THE CURTAILMENT OF SAID EXEMPTION:

YEAR:	2009
AMOUNT BILLED:	$ 6.60
AMOUNT PAID:	$ 6.60
EXEMPTION:	PUBLIC UTILITY - TRANSPORTATION
TAX ACCOUNT NUMBER:	03-20-03-3-025
LEVY CODE:	005
ASSESSED VALUE-LAND:	$ 849,100.00
ASSESSED VALUE-IMPROVEMENTS:	$ 82,000.00

K 2. GENERAL TAXES: FIRST HALF DELINQUENT MAY 1, SECOND HALF DELINQUENT NOVEMBER 1:

YEAR:	2009
AMOUNT BILLED:	$ 5,992.14
AMOUNT PAID:	$ 2,996.07
AMOUNT DUE:	$ 2,996.07
TAX ACCOUNT NUMBER:	521520-109-2
LEVY CODE:	005
ASSESSED VALUE-LAND:	$ 84,100.00
ASSESSED VALUE-IMPROVEMENTS:	$ 431,000.00

B 3. VIADUCT AGREEMENT, INCLUDING THE TERMS AND PROVISIONS THEREOF:

RECORDED:	JUNE 1, 1937
RECORDING NUMBER:	1217125

C 4. RAILROAD RIGHT OF WAY, INCLUDING THE TERMS AND PROVISIONS THEREOF:

RECORDED:	SEPTEMBER 4, 1937
RECORDING NUMBER:	1220940

D 5. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:

GRANTEE:	CITY OF TACOMA
PURPOSE:	SEWERS
AREA AFFECTED:	A PORTION OF SAID PREMISES
RECORDED:	FEBRUARY 2, 1949
RECORDING NUMBER:	1507137

PLAT CERTIFICATE

SCHEDULE B

(Continued)

Order No.: 4350376

E 6. UNRECORDED AGREEMENT, AND THE TERMS AND CONDITIONS THEREOF, AS DISCLOSED BY QUIT CLAIM DEED RECORDED DECEMBER 30, 1980 UNDER RECORDING NUMBER 8012300167.

F 7. UNRECORDED LEASE IN FAVOR OF CARSTENS HOLDING COMPANY, AND THE TERMS AND CONDITIONS THEREOF, DATED JANUARY 9, 1956, AS DISCLOSED BY DEED RECORDED JANUARY 16, 1966 UNDER RECORDING NUMBER 2131799.

G 8. UNION PACIFIC RAILROAD LEASE NO. 143971, AND THE TERMS AND CONDITIONS THEREOF, AS DISCLOSED BY THE PIERCE COUNTY TAX ROLLS AND THE PIERCE COUNTY ASSESSOR'S MAP.

J 9. RAILROAD RIGHT OF WAY, AS DISCLOSED BY THE PIERCE COUNTY ASSESSOR'S MAP.

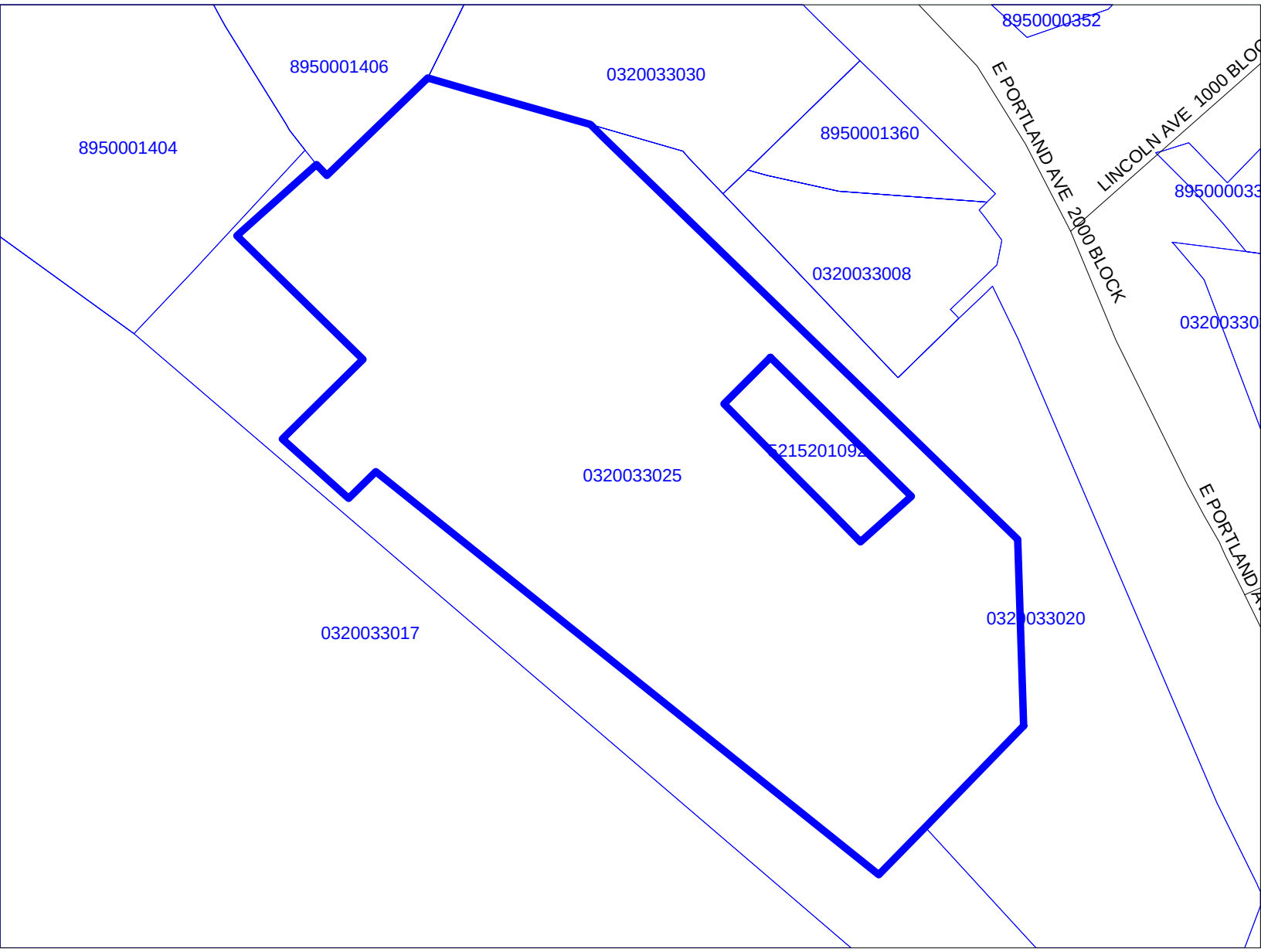
H 10. THE LEGAL DESCRIPTION IN THIS CERTIFICATE IS BASED ON INFORMATION PROVIDED WITH THE APPLICATION AND THE PUBLIC RECORDS. ALL PARTIES MUST NOTIFY THE TITLE INSURANCE COMPANY IF THE DESCRIPTION DOES NOT CONFORM TO THEIR EXPECTATIONS.

I DWCdwc

ORDERED BY: DALTON, OLMSTED & FUGLEVAND, INC.

END OF SCHEDULE B

Chicago Title Order No. 4350376



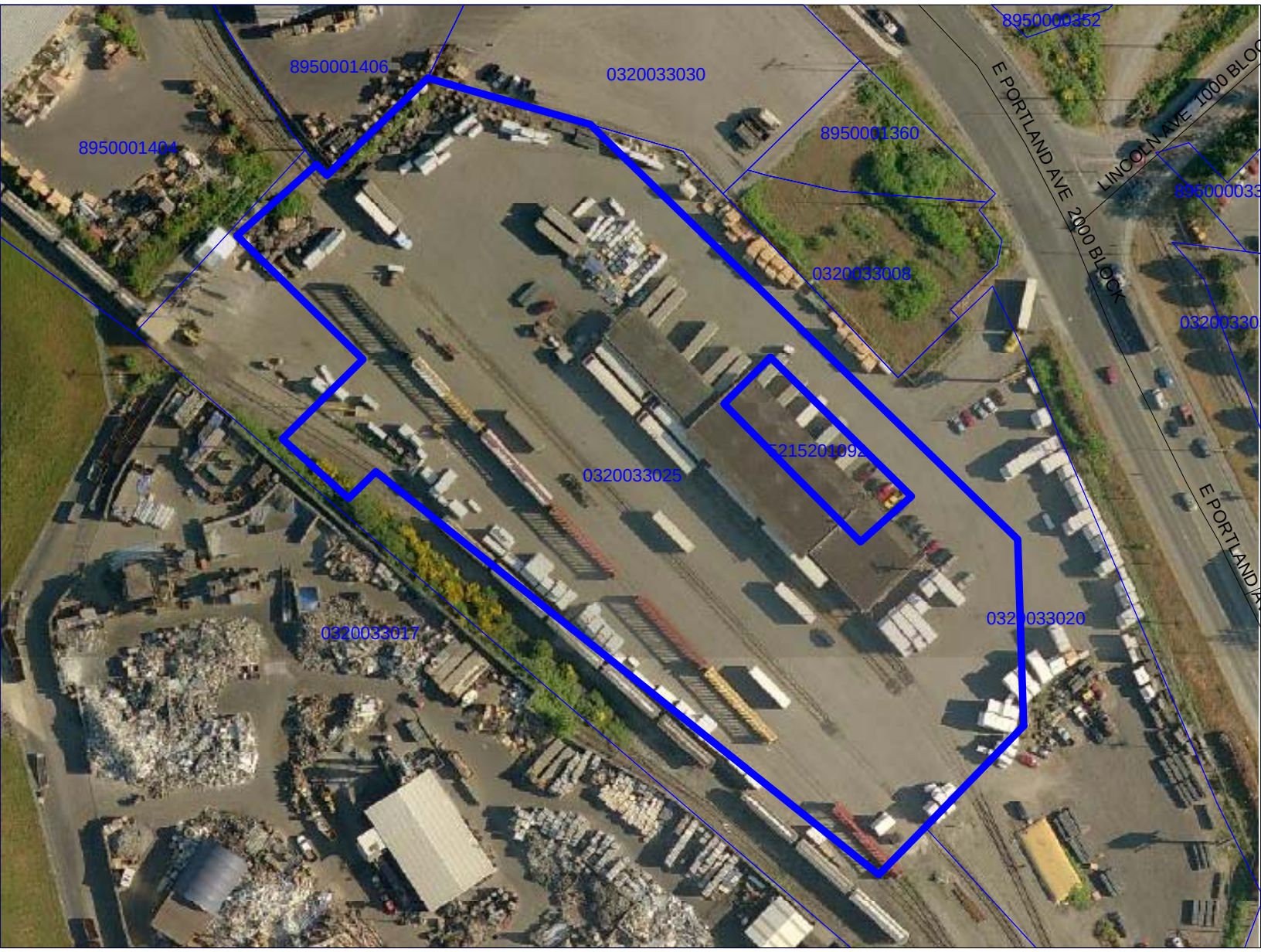
SCALE 1 : 1,412

100 0 100 200 300

FEET

N

Chicago Title Order No. 4350376



SCALE 1 : 1,412

100 0 100 200 300

FEET

N

ATTACHMENT F
1616 St. Paul LLC

200505180735 5 PGS
05-18-2005 01:50pm $23.00
PIERCE COUNTY, WASHINGTON

Name & Return Address:

16116 ST Paul LLC
1124 112TH ST E
Tacoma WA 98445

Please print legibly or type information.

Document Title(s)	GCD
Grantor(s)	DVR LLC
___ **Additional Names on Page** ____ **of Document**	
Grantee(s)	16116 ST Paul LLC
___ **Additional Names on Page** ____ **of Document**	
Legal Description (Abbreviated: i.e., lot, block & subdivision name or number OR section/township/range and quarter/quarter section)	04-20-03
Complete Legal Description on Page 2 **of Document**	
Auditor's Reference Number(s)	
Assessor's Property Tax Parcel/Account Number(s)	895000-140-4 895000-138-2

The Auditor/Recorder will rely on the information provided on this cover sheet. The Staff will not read the document to verify the accuracy or completeness of the indexing information provided herein.

I am requesting an emergency nonstandard recording for an additional fee as provided in RCW 36.18.010. I understand that the recording processing requirements may cover up or otherwise obscure some part of the text of the original document.

_____

Signature of Requesting Party (Required for non-standard recordings only)

Gpcovst.doc rev 4/02

4083445 4 PGS

05-18-2005 01:41pm ERJOHNSO
EXCISE COLLECTED:$0.00 AFF.FEE:$2.00
PAT MCCARTHY, AUDITOR
PIERCE COUNTY, WASHINGTON

QUIT CLAIM DEED

GRANTOR(S):	DVR, L.L.C., a Washington limited liability company
GRANTEES(S):	1616 ST. PAUL, LLC, a Washington limited liability company
ABBREVIATED LEGAL:	WEST ½ SECTION 3, TOWNSHIP 20 NORTH, RANGE 3, E.W.M.
FULL LEGAL ON PAGE:	ATTACHED EXHIBIT
TAX PARCEL NO.:	8950001404 and 8950001382

THE GRANTORS, DVR, L.L.C., for and in consideration of Ten Dollars ($10.00) and other good and valuable consideration, in hand paid, convey and quitclaim to 1616 ST. PAUL, LLC, a Washington limited liability company, the following described real estate situated in Pierce County, State of Washington:

FULL LEGAL DESCRIPTION ON ATTACHED EXHIBIT

DATED this 3rd day of January, 2005.

GRANTORS:

Douglas S. Rhine
Member, DVR, L.L.C.

Virginia J. Rhine
Member, DVR, L.L.C.

STATE OF WASHINGTON)
) ss:
COUNTY OF PIERCE)

On this day personally appeared before me Douglas S. Rhine and Virginia J. Rhine, to me known to be the individuals described in and who executed the within and foregoing instrument, and acknowledged that they signed the same as their free and voluntary act and deed, for the uses and purposes therein mentioned.

Witness my hand and official seal hereto affixed the day and year first above written.

DEANNA M. PETERS NOTARY PUBLIC 11-01-05 STATE OF WASHINGTON

Deanna M Peters
Notary Public in and for the State of Washington
Residing at: Puyallup
My Commission Expires: 11-1-05

4083445 4 PGS

05-18-2005 01:41pm ERJOHNSO
EXCISE COLLECTED:$0.00
PAT MCCARTHY, AUDITOR
PIERCE COUNTY, WASHINGTON
AFF.FEE:$2.00

LEGAL DESCRIPTION EXHIBIT

PARCEL A:
A PARCEL OF LAND BEING A PORTION OF GOVERNMENT LOTS 2 AND 3 OF SECTION 3 AND OF GOVERNMENT LOT 8 OF SECTION 4, TOWNSHIP 20 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN, IN PIERCE COUNTY, WASHINGTON, INCLUDING PORTIONS OF BLOCK 46, 46A, 46B, 47 AND 47A, TACOMA TIDE LANDS, SHOWN ON THE REPLAT OF A PORTION THEREOF, ENTITLED "1925 REPLAT 6", FILED FOR RECORD IN THE OFFICE OF THE PIERCE COUNTY AUDITOR, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE EAST LINE OF SAID SECTION 4 FROM WHICH POINT THE SOUTHEAST CORNER OF SAID SECTION 4, LIES SOUTH 02°00'40" WEST, 2508.14 FEET;
THENCE NORTH 50°23'50" WEST, 330.01 FEET, SAID POINT BEING ON THE SOUTHERLY LINE OF SAID BLOCK 47;
THENCE ALONG SAID SOUTHERLY LINE, NORTH 71°22'44" WEST, A DISTANCE OF 110.95 FEET;
THENCE NORTH 50°23'50" WEST 102.42 FEET;
THENCE NORTH 42°06'15" WEST, 129.44 FEET;
THENCE SOUTH 71°25'11" EAST A DISTANCE OF 177.80 FEET;
THENCE NORTH 49°04'23" WEST ALONG THE SOUTHEAST LINE OF THAT CERTAIN PARCEL OF LAND 1965 IN BOOK 1374, PAGES 73, 74 AND 75, RECORDED JULY 15, 1977 UNDER AUDITOR'S NO. 2750211, 159.07 FEET;
THENCE NORTH 49°31'46" WEST, ALONG ANOTHER SOUTHEAST LINE OF SAID DEEDED PARCEL OF LAND, 152.91 FEET;
THENCE NORTH 50°57'10" EAST ALONG THE NORTHWEST LINE OF A PARCEL OF LAND FILED UNDER AUDITOR'S NO. 2103192, 38.14 FEET TO THE SOUTHERLY RIGHT OF WAY MARGIN OF ST. PAUL AVENUE;
THENCE SOUTH 68°54'50" EAST ALONG SAID SOUTHERLY RIGHT OF WAY MARGIN, 603.46 FEET;
THENCE SOUTH 68°55'12" EAST ALONG SAID SOUTHERLY RIGHT OF WAY MARGIN, 407.81 FEET TO THE WESTERLY MARGIN OF THE OREGON-WASHINGTON RAILROAD AND NAVIGATION CO. RIGHT OF WAY RECORDED UNDER AUDITOR'S NO. 8206090237;
THENCE CONTINUING ALONG SAID WESTERLY RIGHT OF WAY MARGIN ALONG A CURVE TO THE RIGHT, THE CENTER OF WHICH BEARS SOUTH 73°10'12" WEST HAVING A RADIUS OF 444.28 FEET CONTAINING A CENTRAL ANGLE OF 09°40'28" AN ARC DISTANCE OF 75.02 FEET;
THENCE CONTINUING ALONG SAID WESTERLY RIGHT OF WAY MARGIN, SOUTH 07°09'20" EAST, 89.80 FEET;
THENCE CONTINUING ALONG SAID WESTERLY RIGHT OF WAY MARGIN ALONG A CURVE TO THE LEFT, THE CENTER OF WHICH BEARS NORTH 82°50'40" EAST AND HAVING A RADIUS OF 474.28 FEET, CONTAINING A CENTRAL ANGLE OF 31°15'00" AN ARC DISTANCE OF 258.68 FEET;
THENCE CONTINUING ALONG SAID WESTERLY RIGHT OF WAY MARGIN SOUTH 38°24'20" EAST 20.15 FEET;

200505180735.004

LEGAL DESCRIPTION EXHIBIT

THENCE CONTINUING ALONG SAID WESTERLY RIGHT OF WAY MARGIN, ALONG A CURVE TO THE LEFT, THE CENTER OF WHICH BEARS NORTH 51°35'40" EAST HAVING A RADIUS OF 777.68 FEET, CONTAINING A CENTRAL ANGLE OF 02°18'11" AN ARC DISTANCE OF 31.26 FEET;
THENCE SOUTH 43°12'00" WEST 171.23 FEET, TO A POINT ON THE SOUTHWESTERLY LINE OF THAT CERTAIN PARCEL OF LAND HERETOFORE CONVEYED BY NORTHWESTERN IMPROVEMENT COMPANY TO OREGON-WASHINGTON RAILROAD COMPANY BY WARRANTY DEED DATED NOVEMBER 18, 1907, RECORDED NOVEMBER 23, 1908 IN BOOK 337, PAGE 146;
THENCE ALONG SAID SOUTHWESTERLY LINE OF SAID DEEDED PARCEL, NORTH 50°22'15" WEST A DISTANCE OF 291.92 FEET TO THE MOST SOUTHERLY CORNER OF THAT CERTAIN PARCEL OF LAND RECORDED IN DEED RECORDED IN BOOK 343 OF DEEDS AT PAGE 204;
THENCE CONTINUING ON THE SAME BEARING A DISTANCE OF 255 FEET, MORE OR LESS, TO THE POINT OF BEGINNING.

EXCEPT THE RAILROAD TRACKAGE AND APPURTENANCES THEREON, LOCATED UPON, ALONG AND ACROSS SAID LAND, AS EXCEPTED BY OREGON-WASHINGTON RAILROAD AND NAVIGATION COMPANY IN DEED RECORDED UNDER AUDITOR'S NO. 2750210.

PARCEL B:
A PORTION OF BLOCK 47 AND 47A OF THE PLAT OF TACOMA TIDELANDS, SHOWN ON THE REPLAT OF A PORTION THEREOF, ENTITLED "1925 REPLAT 6" FILED FOR RECORD IN THE OFFICE OF THE PIERCE COUNTY AUDITOR AND A PORTION OF GOVERNMENT LOT 8, IN THE NORTHEAST QUARTER OF SECTION 4, TOWNSHIP 20 NORTH, RANGE 3 EAST OF THE WILLAMETTE MERIDIAN, IN PIERCE COUNTY, WASHINGTON, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHWEST CORNER OF A PARCEL OF LAND AS CONVEYED BY DEED RECORDED UNDER AUDITOR'S NO. 2103192, SAID POINT BEING ON THE SOUTHERLY RIGHT OF WAY LINE OF ST. PAUL AVENUE, SHOWN ON A RECORD OF SURVEY AS PARCEL "C" FILED FOR RECORD JUNE 21, 1984 UNDER AUDITOR'S NO. 8406210335;
THENCE SOUTH 50°57'10" WEST, 38.14 FEET ALONG THE NORTHWEST LINE OF SAID PARCEL "C", TO INTERSECT THE NORTHERLY LINE OF A PARCEL OF LAND AS CONVEYED BY QUIT CLAIM DEED RECORDED UNDER AUDITOR'S NO. 8306280339 RECORDED IN BOOK 141 OF DEEDS AT PAGES 82-84 AND ALSO AUDITOR'S NO. 2750211, RECORDED ON JULY 15, 1977;
THENCE SOUTH 49°31'46" EAST, 152.91 FEET ALONG THE SOUTHERLY LINE OF SAID DEEDED PARCEL OF LAND;
THENCE CONTINUING SOUTH 49°04'23" EAST, 123.31 FEET, TO A POINT 15.00 FEET NORTHERLY, AND MEASURED AT RIGHT ANGLES, FROM THE CENTERLINE OF TRACK NO. ICC-20 OF THE OREGON-WASHINGTON RAILROAD & NAVIGATION COMPANY, AS NOW CONSTRUCTED AND OPERATED, AND THE POINT OF BEGINNING;
THENCE CONTINUING SOUTH 49°04'23" EAST, 35.76 FEET ALONG THE SOUTHEAST LINE

200505180735.005

LEGAL DESCRIPTION EXHIBIT

OF PARCEL "C" OF SAID RECORD OF SURVEY DRAWING AUDITOR'S NO. 8406210335 AND DEED RECORDED UNDER AUDITOR'S NO. 2750211;
THENCE NORTH 71°25'11" WEST, 177.80 FEET;
THENCE SOUTH 42°06'15" EAST, 28.04 FEET TO THE SOUTHEASTERLY CORNER OF A TRACT OF LAND CONVEYED TO OREGON-WASHINGTON RAILROAD & NAVIGATION COMPANY, AN OREGON CORPORATION, BY DEED DATED DECEMBER 14, 1911 AND RECORDED UNDER AUDITOR'S NO. 363356;
THENCE NORTH 69°47'30" WEST, 49.86 FEET ALONG THE SOUTH LINE OF SAID DEED UNDER AUDITOR'S NO. 363356 TO THE WESTERLY LINE OF THE CARSTEN PROPERTY CONVEYED BY DEED DATED JANUARY 16, 1907, UNDER AUDITOR'S NO. 239985 BEING THE WEST LINE OF SAID BLOCK 47 OF SAID PLAT OF TACOMA TIDELANDS;
THENCE NORTH 00°00'00" EAST, 16.61 FEET ALONG THE WEST LINE OF SAID BLOCK 47 AND WEST LINE OF SAID DEED NO. 363356 TO THE NORTHWEST CORNER OF SAID TRACT OF LAND DEEDED TO OREGON-WASHINGTON RAILROAD & NAVIGATION COMPANY, SAID POINT BEING NORTH 277.16 FEET FROM THE SOUTHWEST CORNER OF SAID BLOCK 47 OF TACOMA TIDELANDS;
THENCE ON THE EXTENSION OF THE NORTHERLY LINE OF SAID OREGON-WASHINGTON RAILROAD & NAVIGATION COMPANY PROPERTY, NORTH 65°02'13" WEST, 18.73 FEET TO INTERSECT A LINE THAT IS PARALLEL WITH AND 30.00 FEET EASTERLY OF THE CENTERLINE OF THE SPUR TRACK KNOWN AS THE ST. PAUL AND TACOMA LUMBER COMPANY SPUR LINE;
THENCE NORTH 08°46'20" WEST, 67.88 FEET ALONG SAID PARALLEL LINE TO INTERSECT THE SOUTHERLY LINE OF THAT CERTAIN PARCEL OF LAND CONVEYED BY QUIT CLAIM DEED RECORDED IN BOOK 141 OF DEEDS AT PAGES 82-84 UNDER AUDITOR'S NO. 8306280339, SAID LINE BEING PARALLEL WITH AND 15.00 FEET NORTHERLY OF THE CENTERLINE OF TRACT NO. ICC-27;
THENCE SOUTH 48°11'00" EAST, 40.87 FEET ALONG SAID PARALLEL LINE TO A CURVE TO THE LEFT, HAVING A RADIUS POINT WHICH BEARS NORTH 41°49'00" EAST, 444.28 FEET;
THENCE SOUTHEASTERLY ALONG THE ARC OF SAID CURVE TO THE LEFT AND CONCENTRIC WITH THE CENTERLINE OF SAID TRACT NO. ICC-27 THROUGH A CENTRAL ANGLE OF 23°02'00" AN ARC DISTANCE OF 178.60 FEET TO A LINE THAT IS TANGENT TO SAID CURVE TO THE LEFT;
THENCE SOUTH 71°13'00" EAST 13.96 FEET ALONG SAID TANGENT LINE TO THE NORTHERLY LINE OF THAT CERTAIN PARCEL OF LAND RECORDED UNDER AUDITOR'S NO. 8306280339 AND THE POINT OF BEGINNING.

SITUATE IN THE CITY OF TACOMA, COUNTY OF PIERCE, STATE OF WASHINGTON.

Site Inspection Team Roster

Tacoma Tar Pits, Commencement Bay Nearshore/Tide Flats Superfund Site
Third Five-Year Review
Site Inspection – June 3, 2009

Name	Title	Affiliation
Tamara Langton	Remedial Project Manager	USEPA, Region 10
Mark Stifelman	Risk Assessor	USEPA, Region 10
Bernie Zavala	Hydrogeologist	USEPA, Region 10
Richard Mednick	Site Attorney	USEPA, Region 10
Jefferey Powers	Hydrogeologist	US Army Corps of Engineers, Seattle District
John Rork	Project Manager	Puget Sound Energy
Matthew Dalton	Hydrogeologist	Dalton, Olmsted & Fuglevand, Inc.
David Cooper	Engineer	Dalton, Olmsted & Fuglevand, Inc.
Vida Piera	Permit Manager	City of Tacoma Public Works Department
John Sunich	Source Control Representative	City of Tacoma Public Works Department
Mark Burley	Environmental Contact	Simons Metals

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Tacoma Tar Pits Operable Unit (OU 23) Commencement Bay Nearshore/Tideflats Superfund Site	**Date of inspection:** June 3, 2009
Location and Region: Tacoma, Pierce County, Washington EPA Region 10	**EPA ID:** WAD980723795
Agency, office, or company leading the five-year review: EPA Region 10, with assistance by US Army Corps of Engineers, Seattle District	**Weather/temperature:** Sunny and warm/80-85°F

Remedy Includes: (Check all that apply)

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

Attachments: ☒ Inspection team roster attached ☒ Photographs attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** John Rork (Name) PSE Project Manager (Title) 6/3/09 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached Informally interviewed during site inspection; comments incorporated into checklist responses

2. **O&M staff** Matt Dalton (Name) Dalton, Olmsted & Fuglevand (PSE Contractor) (Title) 6/3/09 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached Informally interviewed during site inspection; comments incorporated into checklist responses

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency City of Tacoma Public Works Department
Contact Vida S. Piera Permit Manager for Site's waste water discharge permit
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
Informally interviewed during site inspection; also interviewed by phone on 6/23/09. Ms. Piera had the following concerns regarding PSE, their contractor DOF, and the groundwater treatment system. These issues will be further discussed after review of Ms. Piera's site inspection write-up.
1) Accidental Spill Prevention Plan requires updating
2) Legal authority documentation for DOF to act on behalf of PSE
3) A non-mechanical type flow meter should be used to measure discharge of treatment water to POTW
4) Approved treatment plant design requires use of sequestering agent, which is not currently being used

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

Mark Burley, Simons Metals, on-site interview during site inspection; comments incorporated into checklist responses

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

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

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ☐ Readily available — ☐ Up to date — ☐ N/A
   Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — ☐ N/A
   Remarks Spill Plan and MSDS sheets on site and readily available. Copies of HASP are kept at PSE and DOF offices.

3. **O&M and OSHA Training Records** — ☐ Readily available — ☐ Up to date — ☐ N/A
   Remarks Not believed to be on site during inspection.

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☒ Effluent discharge — ☒ Readily available — ☒ Up to date — ☐ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks_____

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ☒ N/A
   Remarks Gas generation is not a concern for this landfill due to nature of waste

6. **Settlement Monument Records** — ☐ Readily available — ☒ Up to date — ☐ N/A
   Remarks: As anticipated and based on several settlement surveys early on after waste stabilization, settlement is not an issue and hasn't been conducted for approximately 10 years according to Mr. Dalton.

7. **Groundwater Monitoring Records** — ☐ Readily available — ☐ Up to date — ☐ N/A
   Remarks: Not kept onsite. These records are maintained at the offices of PSE and their remedial contractor, DOF. These records have been reviewed and are up to date.

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

9. **Discharge Compliance Records**
   - ☐ Air — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks: As with the groundwater monitoring records, these records (for both post-GAC air sampling and treated groundwater effluent) are kept off site at PSE and DOF offices.

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

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other Dalton, Olmsted & Fuglevand (DOF) is contractor for Puget Sound Energy (PSE) PRP.

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ G Breakdown attached
Date Date To tal cost
From_____ To_____ _____ G Breakdown attached
Date Date To tal cost
From_____ To_____ _____ G Breakdown attached
Date Date To tal cost
From_____ To_____ _____ G Breakdown attached
Date Date To tal cost
From_____ To_____ _____ G Breakdown attached
Date Date To tal cost

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

Describe costs and reasons: Mr. Dalton, with PRP remedial contractor, indicated O&M costs over past five years have not been unusually high or unanticipated.

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

A. Fencing

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

Remarks Fencing viewed was in good condition; not all fencing was viewed.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks Mr. Burley of Simons Metals indicated generally only rare trespass occurrences on their property which does not appear to effect CERCLA site remedy in any way.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

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

Type of monitoring (*e.g.*, self-reporting, drive by) Periodic on-the-ground inspection
Frequency Quarterly at a minimum (plus extreme weather events)
Responsible party/agency DOF, the PRP remedial contractor
Contact Matthew Dalton Hydrogeologist, DOF
Name Title Date Phone no.

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☒ N/A
Other problems or suggestions: ☐ Report attached

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

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☐ No vandalism evident
Remarks Rare trespass related to Simon Metals business; however no impact to CERCLA site.

2. **Land use changes on site** ☐ N/A
Remarks NW Detention Center expansion on Correctional Services Corporation property on NW portion of Site, footprint is close to but not impacting the waste pile.

3. **Land use changes off site** ☒ N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks Minor asphalt failure on access road leading up to waste pile cover (See Site Inspection Photo 8). Otherwise roads generally in good condition.

B. Other Site Conditions

Remarks _____

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
Areal extent_____ Depth_____
Remarks_____

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident
Lengths_____ W idths_____ Depths_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks_____

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
Areal extent_____ Depth_____
Remarks_____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☐ No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks Mr. Dalton reports annual mowing of vegetative cover and related occasional scuffing of vegetative cap in mounded areas where mower bottoms out; however grass grows back quickly and no erosion has occurred.

6. **Alternative Cover (armored rock, concrete, etc.)** ☒ N/A
Remarks_____

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
Areal extent_____ Height_____
Remarks_____

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches ☒ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☒ N/A or okay
Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☒ N/A or okay
Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☒ N/A or okay
Remarks_____

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

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Typ e_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ☐ Applicable ☒ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____

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

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____

F. Cover Drainage Layer ☒ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks Outlet pipes not visible. Drainage system subject to annual site inspection by PSE. No problems evident.

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

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

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks 2 Asphalt-lined basins. Minor siltation in Detention Basin 1 (basin which collects runoff from waste pile) but does not appear to affect performance. See Photos 13 and 14. The basin is periodically swept clean.

2. **Erosion** Areal extent_____ Depth_____
   ☒ Erosion not evident
   Remarks_____

3. **Outlet Works** ☒ Functioning ☐ N/A
   Remarks Outlet pipe of DB 1 checked and appears in good condition. DB 2 outlet not checked.

4. **Dam** ☐ Functioning ☒ N/A
   Remarks_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
Remarks_____

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

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident
Areal extent_____ Depth_____
Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent_____ Type blackberry bushes predominant
Remarks Some vegetation observed in drainage channel draining waste pile (Photo 7) and BNSF ditch (Photo 15). This vegetation is periodically removed but reportedly never has prevented flow.

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks_____

4. **Discharge Structure** ☒ Functioning ☐ N/A
Remarks Channels draining waste pile discharge by pipe directly into Detention Basin 1.

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks_____

2. **Performance Monitoring** Type of monitoring_____
☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching
Head differential_____
Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A	
A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A	
1.	**Pumps, Wellhead Plumbing, and Electrical** ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks None of above visually inspected but reportedly all are in good working order.
2.	**Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☒ Good condition ☐ Needs Maintenance Remarks
3.	**Spare Parts and Equipment** ☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided Remarks Routine/common spare parts on site locked in secured area.
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☐ N/A	
1.	**Collection Structures, Pumps, and Electrical** ☒ Good condition ☐ Needs Maintenance Remarks 2 surface water detention basins are the collection structures and are in good condition. Minor sedimentation in DB 1. Minor surficial cracking of asphalt in DB 1 is patched with polymer as needed. No pumps or electrical; they drain by gravity.
2.	**Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☒ Good condition ☐ Needs Maintenance Remarks
3.	**Spare Parts and Equipment** ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided Remarks N/A

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☒ Air stripping (aqueous) ☒ Carbon adsorbers (air)
☐ Filters_____
☒ Additive (*e.g.*, chelation agent, flocculent) Sodium hypochlorite disinfecting agent to control biofouling (approx. 50 gallons every 3 weeks)
☐ Others_____
☒ Good condition ☐ Needs Maintenance
☐ Sampling ports properly marked and functional Not checked
☐ Sampling/maintenance log displayed and up to date Not checked
☐ Equipment properly identified Not checked
☒ Quantity of groundwater treated annually 4.4 million gallons (Dec 2007-Dec 2008)
☐ Quantity of surface water treated annually Unknown
Remarks Two pressure gages along treatment train appeared not to be working but reportedly this didn't affect system performance

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☒ Good condition ☐ Needs Maintenance
Remarks_____

3. **Tanks, Vaults, Storage Vessels**
☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs Maintenance
Remarks_____

4. **Discharge Structure and Appurtenances**
☐ N/A ☒ Good condition ☐ Needs Maintenance
Remarks Discharge pipeline from plant is buried but has leak detection and no problems evident.

5. **Treatment Building(s)**
☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair
☒ Chemicals and equipment properly stored
Remarks Treatment plant is not fully enclosed: covered by roof and surrounded by locked chain-link fence. Supplies, equipment and documentation stored in locked metal con-ex trailer.

6. **Monitoring Wells** (pump and treatment remedy)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks Not all wells viewed; however the ones located and viewed appeared in good condition.

D. Monitoring Data

1. Monitoring Data
☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring data suggests:
☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining (North Branch)

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☒ N/A
Remarks_____

X. OTHER REMEDIES

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

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Waste pile cap and cover remedy intended to encapsulate treated soils and minimize precipitation infiltration. This remedy appears to be functioning effectively, and as designed.
Groundwater extraction and treatment remedy intended to capture contaminated groundwater, and contain and reduce benzene plumes. This remedy appears to be functioning effectively and as designed although East Branch plume lateral extent does not appear to be declining.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
O&M procedures appear adequate at this time and deficiencies are generally corrected promptly to ensure long-term protectiveness of the remedies.

C. Early Indicators of Potential Remedy Problems
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. None.
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Minimal. Only noted opportunity for optimization would be enhanced East Branch groundwater contaminant extraction which would reduce benzene concentrations within this area quicker.

Site Inspection Photographs

Tacoma Tar Pits, Commencement Bay Nearshore/Tide Flats Superfund Site
Third Five-Year Review
Site Inspection – June 3, 2009

Photo 1. Simons Metals Property; facing NNW. Asphalt surface cap in foreground.

Photo 2. Surface completion of monitoring well DOF-30M in good condition.

Photo 3. Well DOF-29M kept clear of recycling debris; facing N.

Photo 4. Covered Waste Pile with covered box culvert and asphalt surface cap in foreground; facing SW.

Photo 5. Debris on metal grate covering box culvert; facing N.

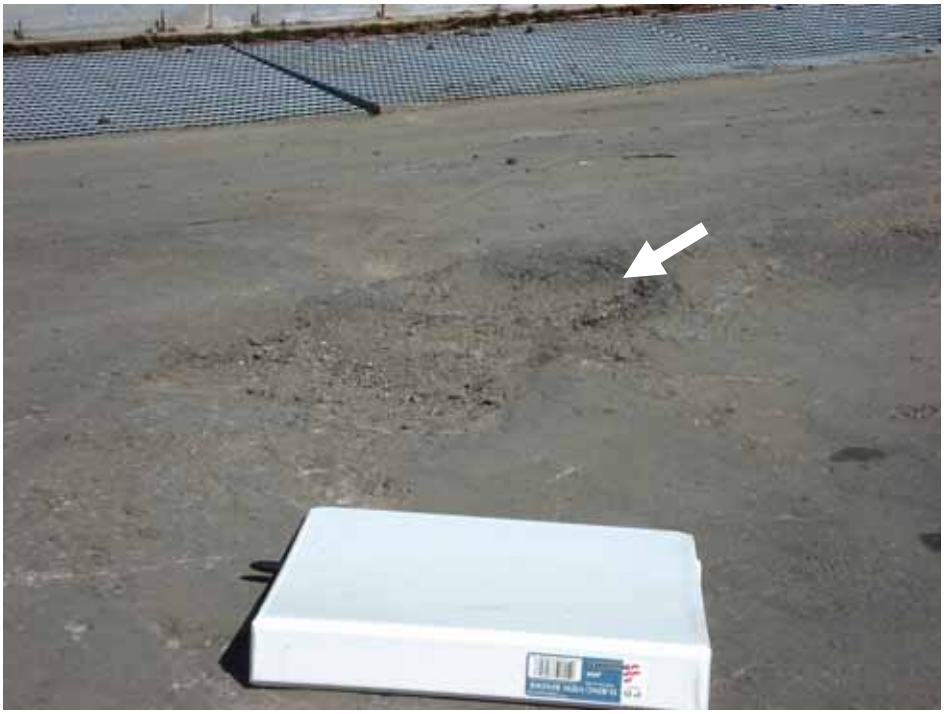


Photo 6. Gouge in asphalt on Simons Metals (1-inch ring binder in foreground for scale).

Photo 7. Vegetation growing in armored drainage channel between Waste Pile and access road.

Photo 8. Small failure in asphalt of access road.

Photo 9. Top of Waste Pile; facing S. Access road to left and Tacoma Dome in distance on right.

Photo 10. NW Detention Center Expansion from top of Waste Pile; facing NW. Vaults for TTP-17 wells denoted.

Photo 11. Waste Pile with downtown Tacoma in background and BNSF rail lines to left; facing W.

Photo 12. Groundwater treatment plant; facing W.

Photo 13. Detention Basin 1; facing ESE. Minor sedimentation present.

Photo 14. Detention Basin 1; facing NW. Note outlet to BNSF ditch in left foreground.

Photo 15. BNSF drainage ditch; facing NW.

Photo 16. Detention basin 2; facing E.

Photo 17. Vault for Extraction Well C with DOF-26M in foreground; facing SSW.

OU 3 Attachment 5- Site Inspection Team Roster, Checklist, and Photographs

Site Inspection Team Roster

Tacoma Tar Pits, Commencement Bay Nearshore/Tide Flats Superfund Site
Third Five-Year Review
Site Inspection – June 3, 2009

Name	Title	Affiliation
Tamara Langton	Remedial Project Manager	USEPA, Region 10
Mark Stifelman	Risk Assessor	USEPA, Region 10
Bernie Zavala	Hydrogeologist	USEPA, Region 10
Richard Mednick	Site Attorney	USEPA, Region 10
Jefferey Powers	Hydrogeologist	US Army Corps of Engineers, Seattle District
John Rork	Project Manager	Puget Sound Energy
Matthew Dalton	Hydrogeologist	Dalton, Olmsted & Fuglevand, Inc.
David Cooper	Engineer	Dalton, Olmsted & Fuglevand, Inc.
Vida Piera	Permit Manager	City of Tacoma Public Works Department
John Sunich	Source Control Representative	City of Tacoma Public Works Department
Mark Burley	Environmental Contact	Simons Metals

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Tacoma Tar Pits Operable Unit (OU 23) Commencement Bay Nearshore/Tideflats Superfund Site	**Date of inspection:** June 3, 2009
Location and Region: Tacoma, Pierce County, Washington EPA Region 10	**EPA ID:** WAD980723795
Agency, office, or company leading the five-year review: EPA Region 10, with assistance by US Army Corps of Engineers, Seattle District	**Weather/temperature:** Sunny and warm/80-85°F

Remedy Includes: (Check all that apply)

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

Attachments: ☒ Inspection team roster attached ☒ Photographs attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** John Rork (Name) PSE Project Manager (Title) 6/3/09 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached Informally interviewed during site inspection; comments incorporated into checklist responses

2. **O&M staff** Matt Dalton (Name) Dalton, Olmsted & Fuglevand (PSE Contractor) (Title) 6/3/09 (Date)
   Interviewed ☒ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached Informally interviewed during site inspection; comments incorporated into checklist responses

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency City of Tacoma Public Works Department
Contact Vida S. Piera Permit Manager for Site's waste water discharge permit
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
Informally interviewed during site inspection; also interviewed by phone on 6/23/09. Ms. Piera had the following concerns regarding PSE, their contractor DOF, and the groundwater treatment system. These issues will be further discussed after review of Ms. Piera's site inspection write-up.
1) Accidental Spill Prevention Plan requires updating
2) Legal authority documentation for DOF to act on behalf of PSE
3) A non-mechanical type flow meter should be used to measure discharge of treatment water to POTW
4) Approved treatment plant design requires use of sequestering agent, which is not currently being used

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

Mark Burley, Simons Metals, on-site interview during site inspection; comments incorporated into checklist responses

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

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

Remarks_____

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date ☐ N/A
Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☐ N/A
Remarks Spill Plan and MSDS sheets on site and readily available. Copies of HASP are kept at PSE and DOF offices.

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☐ N/A
Remarks Not believed to be on site during inspection.

4. **Permits and Service Agreements**

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

Remarks_____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks Gas generation is not a concern for this landfill due to nature of waste

6. **Settlement Monument Records** ☐ Readily available ☒ Up to date ☐ N/A
Remarks: As anticipated and based on several settlement surveys early on after waste stabilization, settlement is not an issue and hasn't been conducted for approximately 10 years according to Mr. Dalton.

7. **Groundwater Monitoring Records** ☐ Readily available ☐ Up to date ☐ N/A
Remarks: Not kept onsite. These records are maintained at the offices of PSE and their remedial contractor, DOF. These records have been reviewed and are up to date.

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

9. **Discharge Compliance Records**

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

Remarks: As with the groundwater monitoring records, these records (for both post-GAC air sampling and treated groundwater effluent) are kept off site at PSE and DOF offices.

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

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ☒ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other Dalton, Olmsted & Fuglevand (DOF) is contractor for Puget Sound Energy (PSE) PRP.

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ G Breakdown attached
Date Date Total cost
From_____ To_____ _____ G Breakdown attached
Date Date Total cost
From_____ To_____ _____ G Breakdown attached
Date Date Total cost
From_____ To_____ _____ G Breakdown attached
Date Date Total cost
From_____ To_____ _____ G Breakdown attached
Date Date Total cost

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

Describe costs and reasons: Mr. Dalton, with PRP remedial contractor, indicated O&M costs over past five years have not been unusually high or unanticipated.

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

A. Fencing

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

Remarks Fencing viewed was in good condition; not all fencing was viewed.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks Mr. Burley of Simons Metals indicated generally only rare trespass occurrences on their property which does not appear to effect CERCLA site remedy in any way.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

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

Type of monitoring (*e.g.*, self-reporting, drive by) Periodic on-the-ground inspection
Frequency Quarterly at a minimum (plus extreme weather events)
Responsible party/agency DOF, the PRP remedial contractor
Contact Matthew Dalton Hydrogeologist, DOF
Name Title Date Phone no.

Reporting is up-to-date ☒ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☒ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☒ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☒ N/A
Other problems or suggestions: ☐ Report attached

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

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☐ No vandalism evident
Remarks Rare trespass related to Simon Metals business; however no impact to CERCLA site.

2. **Land use changes on site** ☐ N/A
Remarks NW Detention Center expansion on Correctional Services Corporation property on NW portion of Site, footprint is close to but not impacting the waste pile.

3. **Land use changes off site** ☒ N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A
Remarks Minor asphalt failure on access road leading up to waste pile cover (See Site Inspection Photo 8). Otherwise roads generally in good condition.

B. Other Site Conditions

Remarks _____

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
Areal extent_____ Depth_____
Remarks_____

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident
Lengths_____ Widths_____ Depths_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks_____

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
Areal extent_____ Depth_____
Remarks_____

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☐ No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks Mr. Dalton reports annual mowing of vegetative cover and related occasional scuffing of vegetative cap in mounded areas where mower bottoms out; however grass grows back quickly and no erosion has occurred.

6. **Alternative Cover (armored rock, concrete, etc.)** ☒ N/A
Remarks_____

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
Areal extent_____ Height_____
Remarks_____

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches ☒ Applicable ☐ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☒ N/A or okay
Remarks_____

2. **Bench Breached** ☐ Location shown on site map ☒ N/A or okay
Remarks_____

3. **Bench Overtopped** ☐ Location shown on site map ☒ N/A or okay
Remarks_____

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

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable ☒ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

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

1. **Gas Treatment Facilities**
☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs Maintenance
Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
☐ Good condition ☐ Needs Maintenance
Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
☐ Good condition ☐ Needs Maintenance ☐ N/A
Remarks_____

F. Cover Drainage Layer ☒ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
Remarks Outlet pipes not visible. Drainage system subject to annual site inspection by PSE. No problems evident.

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

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

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
☐ Siltation not evident
Remarks 2 Asphalt-lined basins. Minor siltation in Detention Basin 1 (basin which collects runoff from waste pile) but does not appear to affect performance. See Photos 13 and 14. The basin is periodically swept clean.

2. **Erosion** Areal extent_____ Depth_____
☒ Erosion not evident
Remarks_____

3. **Outlet Works** ☒ Functioning ☐ N/A
Remarks Outlet pipe of DB 1 checked and appears in good condition. DB 2 outlet not checked.

4. **Dam** ☐ Functioning ☒ N/A
Remarks_____

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks_____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
Remarks_____

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

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident
Areal extent_____ Depth_____
Remarks_____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent_____ Type blackberry bushes predominant
Remarks Some vegetation observed in drainage channel draining waste pile (Photo 7) and BNSF ditch (Photo 15). This vegetation is periodically removed but reportedly never has prevented flow.

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks_____

4. **Discharge Structure** ☒ Functioning ☐ N/A
Remarks Channels draining waste pile discharge by pipe directly into Detention Basin 1.

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks_____

2. **Performance Monitoring** Type of monitoring_____
☐ Performance not monitored
Frequency_____ ☐ Evidence of breaching
Head differential_____
Remarks_____

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

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

1. **Pumps, Wellhead Plumbing, and Electrical**
☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks None of above visually inspected but reportedly all are in good working order.

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks_____

3. **Spare Parts and Equipment**
☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks Routine/common spare parts on site locked in secured area.

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

1. **Collection Structures, Pumps, and Electrical**
☒ Good condition ☐ Needs Maintenance
Remarks 2 surface water detention basins are the collection structures and are in good condition. Minor sedimentation in DB 1. Minor surficial cracking of asphalt in DB 1 is patched with polymer as needed. No pumps or electrical; they drain by gravity.

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance
Remarks_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks N/A

C. Treatment System ☐ Applicable ☐ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☒ Air stripping (aqueous) ☒ Carbon adsorbers (air)
☐ Filters_____
☒ Additive (*e.g.*, chelation agent, flocculent) Sodium hypochlorite disinfecting agent to control biofouling (approx. 50 gallons every 3 weeks)
☐ Others_____
☒ Good condition ☐ Needs Maintenance
☐ Sampling ports properly marked and functional Not checked
☐ Sampling/maintenance log displayed and up to date Not checked
☐ Equipment properly identified Not checked
☒ Quantity of groundwater treated annually 4.4 million gallons (Dec 2007-Dec 2008)
☐ Quantity of surface water treated annually Unknown
Remarks Two pressure gages along treatment train appeared not to be working but reportedly this didn't affect system performance

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☒ Good condition ☐ Needs Maintenance
Remarks_____

3. **Tanks, Vaults, Storage Vessels**
☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs Maintenance
Remarks_____

4. **Discharge Structure and Appurtenances**
☐ N/A ☒ Good condition ☐ Needs Maintenance
Remarks Discharge pipeline from plant is buried but has leak detection and no problems evident.

5. **Treatment Building(s)**
☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair
☒ Chemicals and equipment properly stored
Remarks Treatment plant is not fully enclosed: covered by roof and surrounded by locked chain-link fence. Supplies, equipment and documentation stored in locked metal con-ex trailer.

6. **Monitoring Wells** (pump and treatment remedy)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks Not all wells viewed; however the ones located and viewed appeared in good condition.

D. Monitoring Data

1. Monitoring Data
☒ Is routinely submitted on time ☒ Is of acceptable quality

2. Monitoring data suggests:
☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining (North Branch)

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☒ N/A
Remarks_____

X. OTHER REMEDIES

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

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Waste pile cap and cover remedy intended to encapsulate treated soils and minimize precipitation infiltration. This remedy appears to be functioning effectively, and as designed.
Groundwater extraction and treatment remedy intended to capture contaminated groundwater, and contain and reduce benzene plumes. This remedy appears to be functioning effectively and as designed although East Branch plume lateral extent does not appear to be declining.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
O&M procedures appear adequate at this time and deficiencies are generally corrected promptly to ensure long-term protectiveness of the remedies.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. None.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Minimal. Only noted opportunity for optimization would be enhanced East Branch groundwater contaminant extraction which would reduce benzene concentrations within this area quicker.

Site Inspection Photographs

Tacoma Tar Pits, Commencement Bay Nearshore/Tide Flats Superfund Site
Third Five-Year Review
Site Inspection – June 3, 2009

Photo 1. Simons Metals Property; facing NNW. Asphalt surface cap in foreground.

Photo 2. Surface completion of monitoring well DOF-30M in good condition.

Photo 3. Well DOF-29M kept clear of recycling debris; facing N.

Photo 4. Covered Waste Pile with covered box culvert and asphalt surface cap in foreground; facing SW.

Photo 5. Debris on metal grate covering box culvert; facing N.

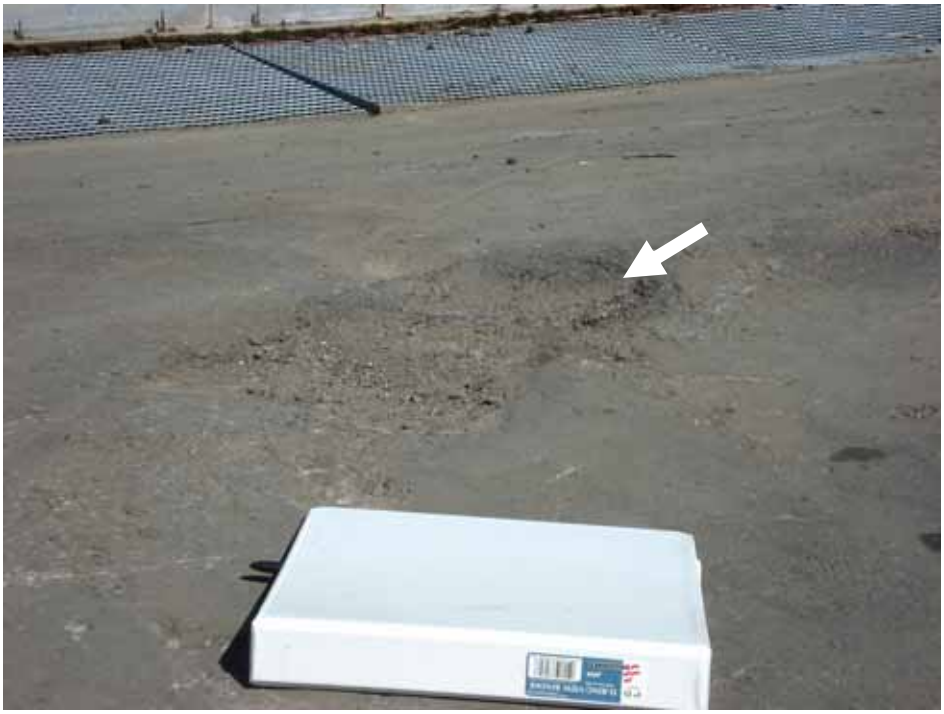


Photo 6. Gouge in asphalt on Simons Metals (1-inch ring binder in foreground for scale).

Photo 7. Vegetation growing in armored drainage channel between Waste Pile and access road.

Photo 8. Small failure in asphalt of access road.

Photo 9. Top of Waste Pile; facing S. Access road to left and Tacoma Dome in distance on right.

Photo 10. NW Detention Center Expansion from top of Waste Pile; facing NW. Vaults for TTP-17 wells denoted.

Photo 11. Waste Pile with downtown Tacoma in background and BNSF rail lines to left; facing W.

Photo 12. Groundwater treatment plant; facing W.

Photo 13. Detention Basin 1; facing ESE. Minor sedimentation present.

Photo 14. Detention Basin 1; facing NW. Note outlet to BNSF ditch in left foreground.

Photo 15. BNSF drainage ditch; facing NW.

Photo 16. Detention basin 2; facing E.

Photo 17. Vault for Extraction Well C with DOF-26M in foreground; facing SSW.

OU 3 Attachment 6 - Inspection & Maintenance Review Technical Memorandum

MEMORANDUM FOR RECORD

SUBJECT: Inspection & Maintenance Review Technical Memorandum, Tacoma Tar Pits (OU 23), Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington, Third Five-Year Review

PREPARED BY: Jefferey Powers, Hydrogeologist, Seattle District, U.S. Army Corps of Engineers

PREPARED FOR: Tamara Langton, USEPA Region 10 Remedial Project Manager for Tacoma Tar Pits OU 23

Date: 27 October 2009

Introduction and Purpose

According to the annual reporting, the need for inspection and maintenance of the capping-related remedies is largely directed towards identifying and repairing damage caused by severe weather. The most common "severe weather" comes from rainfall events. Rainfall is most abundant during late fall to early spring. Site Inspections are performed by Dalton, Olmsted & Fuglevand personnel for Puget Sound Energy. Information related to the capping-remedies inspection and maintenance was reviewed as part of this evaluation.

The site groundwater extraction and treatment system began full-time operation in September 2002 and by December 2002, after further "shake-down" of the system, began automatic operation and with increased flow rates. The system consists of two separate branches feeding a common treatment plant. The North Branch consists of extraction wells A and B and associated pumps and conveyance piping, and the East Branch includes extraction wells C and TW-1. Extracted groundwater is treated in a central treatment plant by air stripping and subsequent vapor-phase carbon absorption. No liquid-phase carbon treatment is necessary. Most common routine inspection and maintenance items include stripper tray cleaning and check on condition of vapor-phase carbon. Inspection and maintenance data of the extraction and treatment system, as reported in the quarterly Water Quality Monitoring Reports, were reviewed as part of this evaluation.

Data Reviewed

The following lists all components which are subject to routine inspection and maintenance:

Capping-related remedies:

- Waste Pile Cover (stabilized wastes within the waste pile covered by geosynthetic fabrics, compacted soil and a vegetative layer)
- Additional Covered Waste (stabilized wastes within the former construction water treatment area located between the stabilized waste pile and Detention Basin No. 1, covered with low-permeability asphalt).
- Concrete and Asphalt Covers (paving) in the Joseph Simon & Sons (JS&S) operating area
- Waste Pile Storm Drainage Facilities (box culverts, lined ditch, and Detention Basin No 1).
- JS&S Operating Area Storm Drainage Facilities (catch basins and Detention Basin No. 2.
- Burlington Northern Ditch (that drains both detention basins)
- Signage and Fencing

Groundwater-related remedy:

- Pump and Treat System (extraction wells, pipe lines, treatment plant components including effluent concentrations to POTW; as documented in quarterly discharge monitoring reports)

Observations and Corresponding Maintenance

<u>2003</u>

Dates of capping-related site inspections in 2003 were: July 24 (in conjunction with the second Five-Year Review Site Inspection), September 23, October 8, and December 9. Groundwater monitoring, which included inspection and sampling of the treatment system, occurred September 22-26 (3rd Quarter) and December 16-18 (4th Quarter) (the 1st and 2nd Quarter results, which preceded the last Five-Year Review, were not reviewed). All components of the remedy remained operational and functional, and appeared in good condition, with the following exceptions. These observed deficiencies were addressed on the dates noted:

Capping-Related Remedy:

- Some brush present in rocked drainage channels on pile – Removed in September Minor sediment in box culverts into and out of detention basins – Not impeding flow and not significant enough to remove
- Minor rutting and scraping of vegetative layer due to mowing activities – Not significant enough to repair
- Vegetation growth in Burlington Northern Ditch – Removed in September
- Several "holes" had developed along the sides of the asphalt-paved access road on the waste pile cover – Repaired in October
- Several asphalt gouges formed in asphalt cover due to storage container feet sinking into sun-heated asphalt – Repaired in October

- As routine preventative maintenance, Detention Basin No. 2 manholes and oil/water separator cleaned out

Pump and Treat Remedy:

- System shut down for plant stripper tray cleaning/general maintenance – July 18
- East Branch well TW-1 shut off for cleaning due to bio-fouling – Cleaned September 4-5
- Well C shut down due to bio-fouling – Cleaned October 27-28
- System shut down due to software problem – December 2-3
- System shut down due to leak sensor malfunction – December 7-9

System effluent is routinely analyzed for VOCs and SVOCs. The East Branch of the groundwater extraction system was temporarily shut down September 10-15 due to an effluent sample reporting error. What was first believed to be an effluent discharge criteria exceedance (of Total Toxic Organics) was later determined to be from an influent duplicate sample. Once the error was identified and discussed with City of Tacoma, the system was turned back on. During 2003 the plant operated 95% of the time.

<u>2004</u>

Dates of site inspections in 2004 were: June 14, October 27, and December 9. Groundwater monitoring, including inspection and sampling of the treatment system occurred March 24-26 (1st Quarter), June 16-17 (2nd Quarter), September 24-30 (3rd Quarter), December 17-21 (4th Quarter). All components of the remedy remained operational and functional, and appeared in good condition, with the following exceptions. These observed deficiencies were addressed on the dates noted:

Capping-Related Remedy:

- Some brush present in rocked drainage channels on pile – Removed in October/November
- Minor sediment in box culverts into and out of detention basins – Not restricting flow and not significant enough to remove
- Minor rutting and scraping of vegetative layer due to mowing activities – More widespread than previous year but still not significant enough to repair, found not to adversely affect soil cover
- An asphalt curb along the north side of Detention Basin No. 1 was found to be damaged – No repair reported
- Minor surface cracks in asphalt lining of detention basins – Filled with elastomeric emulsion crack filler in June
- Minor asphalt gouging, concrete cracking and raveling along joints was observed on JS&S facility – Found not to be significant enough to require repair
- Vegetation growth in Burlington Northern Ditch – Not restricting or impeding flow therefore left in place

- As routine preventative maintenance, Detention Basin No. 2 manholes and oil/water separator cleaned out during summer, Detention Basin No. 1 manhole cleaned in December

Pump and Treat Remedy:

- The P&T system was shut down due to freeze damage – January 3-15
- The system was shut down due to a faulty transfer pump and leak sensor in vault LDV-5 – January 27-28
- System shut down due to a programming fault in the PLC – January 1-February 2
- Shut down to replace vapor-phase carbon – February 5, November 4
- Shut down to install a sump pump in east railroad vault – February 23-24
- Well A shut down due to pump failure. Pump was replaced – February 4-12
- System shut down due to pump flow problems in north branch. Pump controller reprogrammed – February 14-15
- System shut down due to programming fault in PLC – February 21-23
- System shut down to raise three transfer pumps and to treat wells TW-1 and C with acid for biofouling – April 8-9
- System shut down for elevated vacuum pressure – April 19
- System shut down due to electronic fault in PLC – April 5-7
- System shut down due to electronic fault in PLC and plugged gate valve which caused equalization tank to overflow – April 10-16
- System shut down to replace discharge bag filter to prevent high water level in air stripper – September 16, October 2-4
- System shut down to replace a cracked fitting near the vacuum break for the holding tank – September 20
- System shut down to clean/replace fouled air stripper – October 5-6
- Blower motor failure due to loose wire – October 25-27

The average system flow rate during 2004 was approximately 11.6 gpm, and ranged from a low of 8 to a high of 13 gpm. The system was operational about 90% of the time. All discharge criteria were reportedly met during all quarters in 2004.

<u>2005</u>

Dates of site inspections in 2005 were: June 15, August 31, September 21, October 5, and November 16. Dates of groundwater sampling, which included inspection of the Pump and Treatment system, were March 23-25 (1st Quarter), June 23-27 (2nd Quarter), August 31-September 2 (3rd Quarter), and December 20-21 (4th Quarter). All components of the remedy remained operational and functional, and appeared in good condition, with the following exceptions. These observed deficiencies were addressed on the dates noted:

Capping-Related Remedy:

- Some brush present in rocked drainage channels on pile – Removed in September, October, November
- Minor sediment in box culverts into and out of detention basins – Not restricting flow and not significant enough to remove
- Minor rutting and scraping of vegetative layer due to mowing activities – Not significant enough to repair
- JS&S was observed to be parking some equipment in Detention Basin No. 1 – JS&S contacted and issue was promptly resolved, implying equipment was moved
- The damaged asphalt curb along the north side of Detention Basin No. 1 reported in 2004 has since been repaired
- Minor surface cracks in asphalt lining of detention basins – Filled with elastomeric emulsion crack filler in June
- Vegetation growth in Burlington Northern Ditch – Not restricting or impeding flow therefore left in place
- As routine preventative maintenance, Detention Basin No. 2 manholes and oil/water separator cleaned out during summer

Pump and Treat Remedy:

- System shut down due to air stripper backup and repair – January 8-12
- System shut down to replace vapor-phase carbon and units housing carbon – July 7
- System shut down to replace vapor-phase carbon – October 28-November 4

The average system flow rate during 2005 was approximately 12 gpm. Overall, the Pump & Treat system operated approximately 97% of the time. All discharge criteria were reportedly met during this period.

<u>2006</u>

The reviewer did not have access to the Inspection and Maintenance Report of the capping-related remedies for 2006; therefore no review of that information was conducted. Groundwater sampling and related Pump and Treat inspection and maintenance activities occurred on March 14-17 (1st Quarter), June 21-22 (2nd Quarter), October 15-20 (3rd Quarter), and December 19-28 (4th Quarter). All components of the groundwater extraction and treatment remedy remained operational and functional, and appeared in good condition, with the following exceptions and related corrections.

Pump and Treat Remedy:

- System was shut down for 3 days during 1st Quarter and 2 days during 2nd Quarter (exact dates not given) due to routine-type maintenance or repairs (details not provided). System was shut down for a total of 8 days during 3rd Quarter and 6 days during 4th Quarter (dates not given) due to routine maintenance or repairs (details not provided).

During 2006, the Pump & Treat system operated approximately 95% of the time, with an average flow rate of 9.5 gpm. This rate was notably lower than for the last two years. All discharge criteria were reportedly met during this period.

2007

Dates of site inspections in 2007 were: October 3 and November 1. The dates of groundwater monitoring occurred on March 29-April 3 (1st Quarter), July 5-13 (2nd Quarter), September 20-27 (3rd Quarter), and presumably December for the 4th Quarter (reviewer did not have 4th Quarter monitoring report). All components of the remedy remained operational and functional, and appeared in good condition, with the following exceptions. These observed deficiencies were addressed on the dates noted:

Capping-Related Remedy:

- Some brush present in rocked drainage channels on pile –
- Minor sediment in box culverts and drainage ways into and out of detention basins – Not restricting flow and not significant enough to remove
- Minor rutting and scraping of vegetative layer due to mowing activities – Not significant enough to repair
- Minor surface cracks in asphalt lining of both detention basins – No additional repairs noted
- Vegetation growth in Burlington Northern Ditch – Not restricting or impeding flow therefore left in place
- Minor asphalt gouging, concrete cracking and raveling along joints was observed on JS&S facility – Found not to be significant enough to require repair
- As routine preventative maintenance, both detention basins are reportedly periodically cleaned

Pump and Treat Remedy:

- System was shut down for a total of 12 days during the 1st Quarter due to "cold weather shutdowns or repairs." The specific dates and nature of maintenance or repairs were not provided in the reporting. System was shut down for 6 days during 2nd Quarter (exact dates not given) due to routine-type maintenance or repairs.
- The system was shut down for 9 days during the 3rd Quarter for unspecified routine maintenance or repairs.

Based on the first three quarters of data, the treatment system operated for 90% of the time, with an average flow of 8.5 gpm. There were no reported exceedances of discharge criteria to the POTW.

2008

Dates of site inspections in 2008 were: October 1, October 30, and December 30. The reviewer had access to the first two rounds of quarterly monitoring and related treatment system

inspection and maintenance reporting, which occurred March 26-31 and June 26-30. All components of the remedy remained operational and functional, and appeared in good condition. Because the capping-related remedial action inspection and maintenance reporting for 2008 was combined with that of 2007, please refer to the bulleted list under 2007 paragraph, above, for deficiencies and corrective actions for this period.

For the groundwater Pump and Treat remedy:

- During the 1st Quarter the system was shut down for a total of 34 days due to "cold weather" related shut downs or repairs. Despite the excessive cumulative shut down time, no details were reported regarding the nature of the maintenance or repairs. The system was operational 63% of the time during this period, with an average flow of 6-7 gpm.
- During the 2nd Quarter the system was shut down a total of 20 days. Again, no details were provided as to exactly when and for what reason. During this period the plant operated 78% of the time, and the average flow was about 6-7 gpm.

Analysis and Conclusions

The most serious threat to the integrity of the capping-related remedy during the period reviewed was the "holes" found in the asphalt-paved access road to the stabilized material cover. In 2003 several "holes" were observed along the sides of this roadway, where the edge of the road meets the adjacent ecology blocks on the road periphery, on the covered waste pile. These holes were the ones identified during the first Five-Year Review (described there as "a small pavement failure", Sections 8 & 9 (Issues and Recommendations). The Five-Year Review recommended repair "before the rainy season begins (e.g., November 2003)." Repairs were made by the end of October.

The groundwater extraction and treatment system has reduced benzene concentrations from maximums of approximately 700 ug/l to 319-467 ug/l in the North Branch, and from approximately 6,500 ug/l to about 2,500 ug/l in the East Branch, although in both branches the concentrations have fluctuated more or less around their current concentrations since late 2003. The system appeared to operate with maximum flow and minimal downtime or operational issues in 2005. Since that time until about mid-2008 average flow had declined from about 12 to 6 or 7 gpm, and system operational time had decreased from about 97% to 63-78% for the 1st and 2nd Quarters of 2008. Data from the last two quarters in 2008 indicate operational time and flow rates are back up to 91-97% and 10-11 gpm, respectively. More detail on the nature of the system shut downs should be provided in the water quality monitoring reports as was done up to and including 2005. The system is less than seven years old and should still be performing at a high level of effectiveness.

Based on this review it appears DOF is proactive in identifying potential issues with the capping-related remedy, and the groundwater treatment remedy at least up until the end of 2005 based on their periodic site inspections and in correcting issues before they are allowed to have serious adverse impact to the remedies. Based on system O&M data presented in the MAROS

groundwater evaluation (DOF 2009), the system appears to have been functioning well and at a high efficiency level since March 2006.

Documents Reviewed

Dalton, Olmsted & Fulglevand, Inc. (DOF), 2003. *Inspection and Maintenance Report, November 2002 to November 2003, Tacoma Historical Coal Gasification Site, Tacoma, Washington.* Prepared for Puget Sound Energy, May 2003.

DOF, 2003a. *Water Quality Monitoring Report, September 2003 Sampling Event, Tacoma Historical Coal Gasification Site.* December 26, 2003.

DOF, 2004. *Water Quality Monitoring Report, December 2003 Sampling Event, Tacoma Historical Coal Gasification Site.* October 15, 2004.

DOF, 2005a. *Inspection and Maintenance Report, November 2003 to November 2004, Tacoma Historical Coal Gasification Site, Tacoma, Washington.* Prepared for Puget Sound Energy, September 2005.

DOF, 2005b. *Inspection and Maintenance Report, November 2004 to November 2005, Tacoma Historical Coal Gasification Site, Tacoma, Washington.* Prepared for Puget Sound Energy, November 2005.

DOF, 2005c. *Water Quality Monitoring Report, March and June 2004 Sampling Events, Tacoma Historical Coal Gasification Site.* August 25, 2005.

DOF, 2005d. *Water Quality Monitoring Report, September and December 2004 Sampling Events, Tacoma Historical Coal Gasification Site.* September 8, 2005.

DOF, 2005e. *Water Quality Monitoring Report, March and June 2005 Sampling Events, Tacoma Historical Coal Gasification Site.* November 25, 2005.

DOF, 2006a. *Water Quality Monitoring Report, September 2005 Sampling Event, Tacoma Historical Coal Gasification Site.* February 28, 2006.

DOF, 2006b. *Water Quality Monitoring Report, December 2006 [sic] (correct date 2005) Sampling Event, Tacoma Historical Coal Gasification Site.* December 19, 2006.

DOF, 2006c. *Water Quality Monitoring Report, March and June 2006 Sampling Events, Tacoma Historical Coal Gasification Site.* December 27, 2006.

DOF, 2007. *Water Quality Monitoring Report, October and December 2006 Sampling Events, Tacoma Historical Coal Gasification Site.* December 28, 2007.

DOF, 2008a. *Inspection and Maintenance Report, December 2006 to December 2008, Tacoma Historical Coal Gasification Site, Tacoma, Washington.* Prepared for Puget Sound Energy, January 2008 [sic] (correct date January 2009).

DOF, 2008b. *Water Quality Monitoring Report, March and July 2007 Sampling Events, Tacoma Historical Coal Gasification Site.* January 4, 2008.

DOF, 2008c. *Water Quality Monitoring Report, September 2007 Sampling Event, Tacoma Historical Coal Gasification Site.* January 21, 2008.

DOF, 2008d. *Water Quality Monitoring Report, March and June 2008 Sampling Events, Tacoma Historical Coal Gasification Site.* November 25, 2008.

DOF, 2009. *Agency Review Draft Groundwater Quality Update Using MAROS, Tacoma Coal Gasification Site.* May 16, 2009.

OU 3 Attachment 7-Screening Evaluation of Soils at theNorthwest Detention Center

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101-3140

November 22, 2009

Reply To: OEA-095

MEMORANDUM

SUBJECT: Screening evaluation of soils at the Northwest Detention Center, Tacoma Tar Pits Superfund Site

FROM: Marcia Bailey, Toxicologist
Office of Environmental Assessment

TO: Tamara Langton, Remedial Project Manager
Office of Environmental Cleanup (ECL-113)

At your request, I reviewed soil sampling and building foundation information that you provided me for the Northwest Detention Center, with regard to potential vapor intrusion in the buildings. My evaluation necessarily included a number of assumptions and uncertainties. I attempted to make these conservative, as this is essentially a screening exercise to determine whether this exposure pathway deserves further review for protection of human health. Therefore, this is not an attempt to present risks based on a reasonable maximum exposure scenario, but rather to come closer to a worst-case scenario, although the degree to which this is accomplished is flawed by the lack of specific knowledge of what, if any, soil contamination actually underlies individual buildings[1]. I also did a minor evaluation of the potential for risks due to direct contact with contaminated soils, the potential for which would seem to be limited to the utility trench area. The results of my evaluations are summarized below. Copies of the vapor intrusion modeling efforts are attached, as are tables summarizing the results.

Vapor Intrusion

Of the 16 individual polycyclic aromatic hydrocarbons (PAHs) that EPA currently evaluates for human health, only seven are considered volatile for purposes of vapor intrusion, and of those, only naphthalene has inhalation toxicity values (cancer and noncancer) in EPA's Regional Screening Levels tables. Mercury (elemental), which is

[1] The confirmation soil samples obtained from the area now under the original detention center footprint, as reported in "Cleanup 'Report, Correctional Services Corporation Northwest Detention Facility," dated January 28, 2003, by Landau Associates, were analyzed only for a single indicator chemical, benzo(a)pyrene, which is not useful for vapor intrusion assessment.

Printed on Recycled Paper

volatile, is also a contaminant of concern at the site. Therefore, my evaluation for vapor intrusion at this site was limited to naphthalene and mercury.

As ground water under the detention center apparently is not contaminated, and because no soil vapor measurements are available, I used the available site soil sampling data and EPA's soil to indoor air model (based on the work of Johnson & Ettinger) to estimate indoor air concentrations in a building volume that approximates the first floor dorms area of the detention center (which happens to be similar in volume to the new administration building). The dimensions of the first floor dorms as well as the air exchange rate were provided to EPA in a specifications document from MacDonald-Miller. I used only the first floor dorms designated as Area C3 in the MacDonald-Miller document, rather than the entire first floor, to try to estimate a relatively small (1116 square feet), distinct area that potentially could be affected by subsurface vapor intrusion. I used the highest concentration of naphthalene in all of the sampling data I was given for the entire site, which was 1600 ug/kg, from sampling at the west excavation area for the new administration building. That sample result is from the January 14, 2009 "Test America Report." The next highest soil naphthalene concentration reported in the documents I received was 1210 ug/kg, from excavation samples in the area of the new wing. Other site soil samples for naphthalene were reported at 1180 ug/kg or less. The highest mercury value was 327 ug/kg, from overburden samples in the east excavation area for the new wing of the detention center. The second highest mercury concentration was 120 ug/kg from the same area. Other samples were 61 ug/kg, in the west excavation soils for the new administration building, or lower.

Use of the size of the first floor dorms and the highest site naphthalene and mercury concentrations should conservatively represent vapor intrusion risks in any of the buildings at the site. I used the specific air exchange rate for the first floor dorms area of the main detention center, provided in the MacDonald-Miller document of 3.6 times per hour. According to an e-mail dated October 21, 2009 from attorney Joan Mell, representing The GEO Group, Inc., to EPA Region 10 attorney Richard Mednick, the air exchange rate in the new administration building is similar to that of the main detention center. I also used a default commercial air exchange rate of 1 per hour, as a comparison to evaluate the sensitivity of this variable.

I used the standard worker exposure scenario of 25 years, 250 days per year and a detainee scenario which assumed an exposure duration of 5 years, 365 days per year, which I understand to be a high, but not unreasonable, estimate, for this facility.

I modeled two subsurface conditions. Both assumed that the subsurface resembles sand, which may or may not be conservative, depending upon whether considerable amounts of gravel are present, especially near the surface (given that more gravel generally results in a higher potential for vapor intrusion). Nevertheless, sand appears to be the best classification available, for purposes of using the J-E model for estimating partitioning from soil to indoor air at this site. The "Addendum to Geotechnical Engineering Study" dated July 1, 2008, prepared by Geotech Consultants, Inc., observes that the "ground surface is underlain by fill consisting of gravelly sand and

gravelly, silty sand (possible asphalt cuttings)." Beneath the fill, i.e., below 9 to 3 feet below grade, the soil contains more silt. The variable in the two conditions that I employed is the depth to the bottom of soil contamination. In one model run, I assumed that soil contamination ends at the water table, at a depth of 8 feet below ground surface (based on soil borings from information you provided to me, which also provided descriptions of soil conditions used to inform my modeling inputs). This causes the model to behave in the finite mode, meaning that there is an assumed or known vertical end to the contamination. This may be reasonable for this site since groundwater under the detention center area does not appear to be contaminated. In the other model run, I assumed that we do not know the vertical extent of the soil contamination, causing the model to behave in the infinite mode, conservatively assuming that there is no end to the soil contamination. It is reasonable to run the model using this assumption since groundwater samples showing no contamination were not necessarily obtained at the water table, but at deeper depths. This also provides a form of sensitivity analysis to indicate how important it may be – in terms of predicting indoor air concentrations due to vapor intrusion – to ascertain the actual depth to the bottom of soil contamination.

I did not use information from the disciplinary "segregation building," which is smaller (3038 ft^2 area) than the dorms area in the detention center, because the information provided by Joan Mell in an e-mail dated October 21, 2009, indicates that exposure is only a day or two. I have no information indicating that the subsurface in this area is more contaminated than other areas.

I gave no "credit" for the vapor barrier installed under the original detention center (and do not know if something similar was installed under the new wing or the new administration building), because vapor barriers – as opposed to vapor intrusion barriers – are manufactured to deter water moisture from entering the building, as opposed to organic solvent vapors. The construction standard for vapor intrusion barriers is higher, and they are less likely to be punctured by foundation materials than are vapor barriers. Nevertheless, giving no credit for vapor barriers should be considered a conservative assumption for this exercise, as some proportion of organic vapors may be prevented from entering the indoor air due to the vapor barrier.

The exposure, building, and subsurface assumptions are shown in Table 1. Excess individual lifetime cancer estimates and noncancer hazard quotients (estimated using EPA Superfund toxicity values and exposure assumptions) are shown in Table 2. Air cleanup levels for Ecology's MTCA Methods B and C from Ecology's CLARC database also are provided.

<u>Conclusions regarding vapor intrusion potential</u>

As shown in Table 2, the estimated excess individual lifetime cancer risks and hazards due to exposure to estimated indoor air concentrations of naphthalene and elemental mercury from vapor intrusion into indoor air are all lower than 1E-5 and a hazard quotient of 1.0, assuming that the air exchange rate is as reported (i.e., 3.6 per hour) for the facility. Using a default commercial air exchange rate of 1.0 per hour

results in a modest exceedance of the standard hazard quotient of 1.0 for several exposure scenarios. MTCA Methods B and C air cleanup levels are exceeded under several exposure scenarios for both naphthalene and mercury. No Method C cleanup levels are exceeded using the site-specific air exchange rate of 3.6 times per hour. The assumption of the bottom of the soil contamination existing at a finite depth (8 feet) or an infinite depth only marginally impacted the predicted indoor air concentrations.

As maximum soil concentrations were used in this exercise, it is likely that indoor air concentrations were overestimated, provided that the air exchange rate of 3.6 per hour is not a significant exaggeration of the actual rate. Only additional sampling, such as of vapor underneath the slabs in the site buildings, and/or indoor air sampling in the buildings, would provide more information regarding the likelihood of vapor intrusion from soil contamination to be occurring. A nonconservative uncertainty is the inability to estimate hazards associated with exposure to volatile PAHs other than naphthalene that have no EPA-recognized toxicity values. If any become available, we can revisit this assessment.

<u>Direct contact with soil</u>

I did not see evidence of the potential for direct contact with contaminated soil in the documents provided to me, with the possible exception of the utility trench area, where samples of an "obsidian-like material" showed an exceedance of the ROD cleanup value concentration for Aroclor 1260. This information is provided in the "Technical Direction Document Number 09-04-0010, Tacoma Tar Pits Trip Report" by Ecology and Environment, Inc., dated June 12, 2009.

Aroclor 1260 was reported at a maximum measured concentration of 1400 ug/kg, while the cleanup concentration provided in the ROD is 1,000 ug/kg. The risk associated with the measured concentration of 1400 ug/kg, using standard Superfund soil exposure assumptions, is 6.4E-6 for residential exposure and 1.9E-6 for industrial exposure.

The ROD concentration of 1,000 ug/kg for benzo(a)pyrene was exceeded by a benzo(a)pyrene equivalence concentration (representing the relative toxicity of the total of seven carcinogenic PAHs measured in the samples) of 3,501 ug/kg. This results in an estimated risk of 2.3E-4 for standard residential exposure and 1.7E-5 for standard industrial exposure.

Additional information is provided in Table 3, including MTCA cleanup levels and calculated risks associated with concentrations that exceed ROD values. Calculation of benzo(a)pyrene equivalents is provided in Table 4.

The Ecology and Environment, Inc. report cited above states that the samples obtained and analyzed are not representative of actual exposure to soil because of their solid nature, i.e., that risks due to contact with the solid material would be less than with typical soil in the area.. While I do not disagree with that, the observation begs the

question as to what actual, representative soil samples from this utility trench area might contain. We do not know, based on this sampling and analysis exercise. Only additional sampling would address this issue. Professional judgment and site use information regarding the likelihood for direct contact exposure to the soil should inform decisions regarding the need for additional sampling.

Thank you for the opportunity to provide my evaluation of potential risks and hazards associated with workers and detainees at the Northwest Detention Center. Please contact me at (206) 553-0684 with any questions regarding my observations and opinions.

Attachments

Table 1. Northwest Detention Center Exposure, Subsurface and Building Inputs to J-E Vapor Intrusion Model for Soil to Indoor Air

Exposure Inputs

Receptor	*Averaging time for carcinogens, yrs*	*Averaging time for noncarcinogens, yrs*	*Exposure duration, yrs*	*Exposure frequency, d/yr*
Worker	70	25	25	250
Detainee	70	5	5	365

Subsurface Inputs

Ave. soil temperature, C	*Depth below grade to bottom of enclosed space floor, cm*	*Depth below grade to top of contamination, cm*	*Depth below grade to bottom of contamination, cm*	*Thickness of top soil stratum, cm*
12	20	20	243.8 (finite model) or 0 (infinite model)	20

Soil type	*Soil dry bulk density, g/cm3*	*Soil total porosity, unitless*	*Soil water-filled porosity, cm3/cm3*	*soil organic carbon fraction, unitless*
Sand	1.66	0.375	0.053	0.002

Building inputs

Enclosed space floor thickness, cm	*Soil-bldg. Pressure differential, g/cm-s2*	*Enclosed space floor length, cm*	*Enclosed space foor width, cm*	*Enclosed space floor height, cm*	*Floor-wall seam crack width, cm*	*Indoor air exchange rate, 1/hour*	*Ave. vapor flow rate into bldg., L/min*
20	40	1018	1018	284	0.1	3.6 (site-specific reported) or 0 (commercial default)	calculated by model

Table 2. Estimated Excess Individual Lifetime Cancer Risks and Noncancer Hazard Quotients for Vapor Intrusion at Detention Center Buildings

Chemical	Highest concentration in soil, ug/kg	Receptor	Air Exchange Rate, per hour	Model type	Calculated indoor air conc., ug/m3	Estimated Cancer risk	Estimated noncancer H.Q.	MTCA Method B* air cleanup level, ug/m3	MTCA Method C * air cleanup level, ug/m3
Naphthalene	1600	Worker	3.6	Infinite	0.85	7.10E-06	0.19	1.40	3.00
		Worker	3.6	Finite	0.69	5.70E-06	0.16	1.40	3.00
		Worker	1	Infinite	3.55	2.90E-05	0.81	1.40	3.00
		Worker	1	Finite	2.72	2.30E-05	0.62	1.40	3.00
		Detainee	3.6	Infinite	0.85	1.40E-06	0.19	1.40	3.00
		Detainee	3.6	Finite	0.81	1.30E-06	0.18	1.40	3.00
		Detainee	1	Infinite	3.55	8.60E-06	1.20	1.40	3.00
		Detainee	1	Finite	3.30	8.00E-06	1.10	1.40	3.00
Mercury, elemental	327	Worker	3.6	Infinite	0.25	N/A	0.56	0.14	0.30
		Worker	3.6	Finite	0.16	N/A	0.37	0.14	0.30
		Worker	1	Infinite	0.89	N/A	2.03	0.14	0.30
		Worker	1	Finite	0.58	N/A	1.33	0.14	0.30
		Detainee	3.6	Infinite	0.25	N/A	0.56	0.14	0.30
		Detainee	3.6	Finite	0.22	N/A	0.49	0.14	0.30
		Detainee	1	Infinite	1.03	N/A	3.43	0.14	0.30
		Detainee	1	Finite	0.87	N/A	2.90	0.14	0.30

* Ecology does not recognize a cancer inhalation potency for naphthalene; EPA uses a value from CalEPA.
The Method B value is based on unrestricted land use under MTCA.
The Method C value is based on industrial land use under MTCA.
Exceedances of MTCA air cleanup levels are highlighted in blue.

Table 3. Utility Trench "Obsidian-like" Soil Sample Evaluation

Chemical	Conc in sample 9040202, ug/kg	ROD cleanup level, ug/kg	Risk associated w/ROD level residential exposure	Risk associated w/ ROD exceedance residential exposure	Risk associated w/ROD level industrial exposure	Risk associated w/ ROD exceedance industrial exposure	EPA RSL residential 1E-6 risk, ug/kg	EPA RSL residential 1E-4 risk, ug/kg	EPA RSL industrial 1E-6 risk, ug/kg	EPA RSL industrial 1E-4 risk, ug/kg	MTCA A unrestricted, ug/kg	MTCA A industrial, ug/kg	MTCA B ug/kg	MTCA C ug/kg
Aroclor 1254	880	1,000	4.5E-06	n/a	1.4E-06	n/a	220	22,000	740	74,000	n/a	n/a	n/a	n/a
Aroclor 1260	1,400	1,000	4.5E-06	6.4E-06	1.4E-06	1.9E-06	220	22,000	740	74,000	n/a	n/a	n/a	n/a
Total PCBs	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1,000	10,000	500	66,000
Benzo(a)pyrene equivalents*	3,501	1,000	6.7E-05	2.3E-04	4.8E-06	1.7E-05	15	1500	210	210,000	100	2,000	140	18,000

*includes chrysene, benzo(a)pyrene, benzo(a)anthracene), benzo(b)fluorene, benzo(k)fluorene, dibezo(a,h)anthracene and indeno(1,2,3-cd) pyrene, adjusted for potency relative to benzo(a)pyrene

Notes: .
1) Benzo(a)pyrene TEQs for the sample results in Table 2 of Ecology and Environment, Inc., report to EPA, Document Number 09-04-0010, dated June 12, 2009, did not include chrysene. The values here include chrysene.
2) Table 2 of the report indicates that there is a ROD PAH cleanup value of 5,000 ug/kg for six cPAHs, but a ROD cleanup level for benzo(a)pyrene of 1,000 ug/kg. If this is accurately represented,
I recommend the ROD be amended to include a cPAH cleanup level based on benzo(a)pyrene equivalents using relative potency factors. The various cPAHs cannot be toxicologically summed without using relative potency factors.

Table 4. Calculation of benzo(a)pyrene TEQs

	relative potency factor	sample # 9040201 ug/kg	sample # 9040201 TEQ	sample # 9040202 ug/kg	sample # 9040202 TEQ
benzo(a)anthracene	0.1	670	67	260	26
benzo(a)pyrene	1	680	680	3000	3000
benzo(b)fluoranthene	0.1	920	92	210	21
benzo(k)fluoranthene	0.01	270	2.7	260	2.6
chrysene	0.001	710	0.71	260	0.26
dibenzo(a,h)anthracene	1	100	100	410	410
indeno(1,2,3-cd)pyrene	0.1	310	31	410	41
Total TEQ			973		3,501

OU 3 Attachment 8 - ARARs Review Summary

ARARs Review Summary, Tacoma Tar Pits OU3

Media	Source/ARAR Citation	Requirement Synopsis	Status	Current ARAR Evaluation
Soil	*[Federal]* Resource Conservation and Recovery Act (RCRA) 42 USC 6901, Subtitle C: Part B permit	The use of certain treatment systems, in particular waste incinerators, requires the preparation of a Part B permit application. Information on the site such as geotechnical and hydrological conditions must be included along with intended uses of the site.	Not applicable	Incineration was included within two remedial alternatives; however, it was not part of the final selected remedy for the site; therefore is not applicable.
Soil	*[Federal]* RCRA 42 USC 6901, Subtitle C, 40 CFR 264, Subpart G	Post-closure care must be provided for at least thirty years and includes monitoring, reporting, and maintenance of waste containment systems. Covers and similar structures must not be disturbed unless special conditions arise. A local land use authority must be notified of the presence of remaining contamination and the locations of waste facilities. Also, the previous use of the site and restrictions on the future use of the site must be recorded in the property deed.	Relevant and appropriate	Still relevant and appropriate. No changes which affect site or remedy. Monitoring, reporting, and maintenance of waste-pile cover continues.
Soil	*[Federal]* RCRA 42 USC 6901, Subtitle C, 40 CFR 264, Subpart N	Provisions pertaining to the capping, monitoring, closure, and post-closure care of the site. A final cover must be placed which minimizes the migration of liquids through the landfill, requires minimal maintenance, promotes drainage, and minimizes degradation of the surface, accommodates settling and subsidence without the loss of effectiveness, and has permeability less than the underlying materials. The cap must be inspected and maintained, and groundwater monitoring conducted.	Relevant and appropriate	Still relevant and appropriate. No changes which affect site or remedy. Monitoring, reporting, and maintenance of waste-pile cover continues.
Soil	*[Federal]* Department of Transportation (DOT) 49 CFR Parts 171 to 173	Transport, packaging, labeling, placarding, and manifesting of hazardous waste shipments. These regulations apply to the off-site shipment of contaminated soils and perhaps spent activated carbon. Waste materials must be identified, loaded in non-leaking containers, labeled and placarded as appropriate for the contents, and manifested to verify that the shipments reach their intended destination.	Applicable	Currently only potentially applicable to transport off site of spent carbon (if determined to be a hazardous waste) from groundwater treatment plant vapor treatment train.

Media	Source/ARAR Citation	Requirement Synopsis	Status	Current ARAR Evaluation
Soil	*[Federal]* Toxic Substances Control Act (TSCA) 15 USC 2601, 40 CFR 761.60-.79	Records, reporting, storage, handling, incineration, and landfilling of PCB-containing wastes. These regulations apply to disposal or incineration of excavated PCB-contaminated materials. PCB materials which are disposed of prior to February 17, 1978, are considered to be in service and do not require excavation for disposal. Incineration of excavated PCB-containing materials must destroy 99.9999 percent of the PCBs. The incinerator must be approved and be operated under specific conditions. Materials containing less than 50 ppm PCBs may be disposed in a sanitary landfill.	Applicable	Applies to PCB-contaminated soils. Incineration, covered under 761.70, was included within two remedial alternatives; however, it was not part of the final selected remedy for the site; therefore is not applicable. Title additions to TSCA subsequent to the 1987 ROD covering radon and lead-based paint not applicable to site or remedy.
Surface water	*[Federal]* Clean Water Act (CWA) 33 USC 1251	National Pollution Discharge Elimination System (NPDES, 40 CFR 122). These regulations govern point source discharges into navigable waterways such as the Puyallup River. Limits on the concentrations of contaminants which may be discharged are determined on a case-by-case basis.	Applicable	Updates/changes to 40 CFR 122 since the 1987 ROD do not affect site or remedy. Treated groundwater is discharged to City of Tacoma POTW under their NPDES permit; continues to apply to untreated surface water discharging from site retention basins into BNSF drainage ditch.
Surface water	*[Federal]* Federal Water Quality Criteria	Water quality criteria are established placing limits on the concentration of compounds in fresh and marine waters. These criteria may apply to discharges into off-site surface water. The action levels include water quality criteria for on site and boundary surface waters.	Applicable	ROD-selected indicator chemicals in surface water are: benzo(a)pyrene, PCBs, benzene, and lead. 1987 ROD clean up level for lead in surface water at site boundary was 3.2 ug/l, and was based on chronic freshwater ambient water quality criteria (CFAWQC) and the detection limit at that time. Current CFAWQC is 2.5 ug/l since detection limit has been reduced. Similarly, on site surface water clean up level has reduced from 172 to 65 ug/l. Surface water lead concentration last monitored in March 2008 with result of 1.7 ug/l in BNSF ditch; therefore these changes do not appear to affect remedy.
Ground-water	*[Federal]* RCRA 42 USC 6901, Subtitle C, 40 CFR 264, Subpart F	Pertains to groundwater monitoring, hazardous constituents, concentration limits, points of compliance, and corrective action. A program of groundwater monitoring must be implemented to detect the presence of contaminants at the point of compliance, which is usually at site boundaries. If concentrations of particular compounds are detected above designated limits more extensive monitoring is necessary and corrective actions may be required.	Relevant and appropriate	RCRA, 42 USC 6901, Subtitle C was amended in 1984, 1992, and 1996; however, the substantive requirements that apply to the groundwater remedy at the Tacoma Tar Pits site (40 CFR 264) remain unchanged since the time the 1987 ROD was signed and has no impact on the protectiveness of the groundwater remedy. ROD-selected indicator chemicals in groundwater are: benzo(a)pyrene, PCBs, benzene, and lead. ARAR Is still relevant and appropriate since benzene in groundwater is above clean up levels at site boundary.

Media	Source/ARAR Citation	Requirement Synopsis	Status	Current ARAR Evaluation
Ground-water	*[Federal]* Safe Drinking Water Act (SDWA) 42 USC 300, 40 CFR 141	Maximum contaminant levels (MCLs) must be attained for sources of drinking water. The MCL for lead was included in the action levels. Drinking water regulations are relevant and appropriate to the lower aquifers at the site.	Relevant and appropriate	ROD-selected indicator chemicals in groundwater are: benzo(a)pyrene, PCBs, benzene, and lead. Of the 1987 ROD indicator chemicals, lead was the only one for which the groundwater clean up goal/maximum allowable contaminant concentration was based solely on its Maximum Contaminant Level (MCL, 40 CFR 141). At the time of the ROD the MCL for lead was 50 ug/l; however, in 1992 this value was lowered to 15 ug/l, where it currently remains. These chemicals are at acceptable levels in the lower aquifers at the site, even considering the lowered action level for lead. The last time groundwater was tested for lead was in 2001, where the maximum concentration within the fill/sand aquifers was 14.4 ug/l, and within the lower aquifers was 1.5 ug/l. The ROD requires clean up criteria be achieved for these chemicals in the upper aquifers at the site. ARAR, including new action level for lead, is still relevant and appropriate; however, groundwater from all aquifers at/downgradient of the site is not used for drinking purposes.
Air	*[Federal]* RCRA 42 USC 6901, Subtitle C, Section 3003, 40 CFR 264, Subpart O	Provisions pertaining to the testing, performance standards, operation, monitoring, and closure of incinerators, including mobile incinerators. Wastes to be burned must be chemically analyzed; trial burns must be performed; the incinerators must be operated to achieve a destruction and removal efficiency (DRE) of 99.99 percent for Principal Organic Hazardous Constituents (POHCs); air emissions must be monitored, hydrogen chloride must be controlled to the less stringent of 99 percent removal or 1.8 kg per hour, and particulate emissions must not exceed 180 mg per dry standard cubic meter, and upon closure all wastes and waste residues must be removed. A Part B permit application must be submitted and approved prior to the use of an incinerator, except for test burns.	Not applicable	Incineration was included within two remedial alternatives; however, it was not part of the final selected remedy for the site; therefore is not applicable.

Media	Source/ARAR Citation	Requirement Synopsis	Status	Current ARAR Evaluation
Soil	*[State]* Washington Administrative Code (WAC) 17-303-081 to 103	Designation of Dangerous Waste (DW) and Extremely Hazardous Waste (EHW). The state definition of a hazardous waste incorporates EPA designation of hazardous waste which is based on the compound being specifically listed as such or on the waste exhibiting the properties of reactivity, ignitability, corrosivity, or Extraction Procedure (EP) toxicity. Ecology distinguishes hazardous waste as Extremely Hazardous Waste (EHW) or Dangerous Waste (DW). The distinction is based on the properties of persistence, concentration, carcinogenicity, mutagenicity, teratogenicity, concentration of certain compounds, and toxicity. Residues, contaminated soils, water, or other debris from the clean up of spills of compounds listed on the "moderately dangerous chemical products list" (WAC 173-303-9903) in excess of 400 pounds are designated as DW. If the spilled compounds are listed on the "acutely dangerous chemical products list" (WAC 173-303-9903), soils, residues, water, or other debris in excess of 220 pounds are considered EHW. Materials containing greater than 1 percent PAH are considered EHW when the total quantity exceeds 220 pounds. However, wastes which were not designated as hazardous waste at the time of disposal are not considered DW or EHW.	Relevant and appropriate	At the time of the ROD, EPA and Ecology had determined that the EHW classification, while not applicable because on site disposal pre-dated hazardous waste classification, was relevant and appropriate.

Media	Source/ARAR Citation	Requirement Synopsis	Status	Current ARAR Evaluation
Surface water	*[State]* WAC 173-201	Water Quality Standards for Surface Waters of the State of Washington. Surface water bodies are classified according to the water quality and uses of the water. The surface waters near the site are classified as follows: *Class B (good) – Puyallup River, Inner Commencement Bay* *Class C (fair) – Commencement Bay – City Waterway* Criteria are established for fecal coliform bacteria, dissolved oxygen, total dissolved gas, temperature, pH, and turbidity. In addition, concentrations of contaminants must be below levels which may adversely affect human health, the environment, or uses of the water body. The criteria and classifications of the State Water Quality Standards do not apply within a dilution zone defined by Ecology. Within the dilution zone, fish and shellfish must not be killed or aesthetic values diminished.	Applicable	Update to 173-201A-240. Fresh Water Designated Uses and Criteria/Toxic Substances. PCB cleanup level for surface water at site boundary and groundwater in sand and fill aquifers stated in ROD is 0.2 ug/l and was based on the chronic freshwater ambient water quality criterion and detection limit at that time. Since then the State's freshwater Water Quality Standards criterion for PCBs in surface water have been reduced to 0.014 ug/l. No PCBs were detected in RI and have been discontinued since at least 1999, although detection limits have decreased since the RI. Remedy still protective.
Surface water	*[State]* WAC 173-216	NPDES Permits administered by the State. Discharges of water to off-site navigable waterways may require an NPDES permit. The concentration limits of contaminant discharges are determined on a case-by-case basis.	Applicable	PSE holds Industrial Wastewater Discharge Permit No. 500043736 authorizing discharge of treated groundwater to Tacoma sanitary sewer. ARAR still applies.
Surface water, Ground-water	*[State]* RCW 90.48, 90.52, and 90.54	Water Pollution Control and Discharge Standards. Waters of the State of Washington, which include surface water and groundwater, are to be protected to maximize their beneficial use. Materials and substances which might enter these waters must receive prior treatment with known, available, and reasonable methods.	Applicable	Powers, duties and functions of water pollution control commission, director thereof, transferred to Department of Ecology. RCW 90.48 includes oil, sewer, hazardous waste and most discharges. Does not affect site or remedy. Additional obligations related to oil entering State waters, fees and credits; does not affect site or remedy.
Surface water, Ground-water	*[State]* State Water Code (RCW 90.03) and Water Rights (RCW 90.14)	These laws specify the conditions for extracting surface water or groundwater for nondomestic uses. Water extraction must be consistent with beneficial uses of the resources and must not be wasteful. Groundwater extraction wells, which may be used to control the migration of contamination, must comply with the substantive requirements necessary to obtain a water rights permit. Water rights laws may pertain if groundwater is extracted for treatment.	Applicable	No water code changes that affect site or remedy. No water rights changes since ROD

Media	Source/ARAR Citation	Requirement Synopsis	Status	Current ARAR Evaluation
Ground-water	*[State]* WAC 173-303-645	Groundwater protection requirements for waste management facilities are generally comparable to Federal regulations. The point of compliance, the determination of dangerous constituents which are monitored, and the compliance concentrations, however, are determined by Ecology on a case-by-case basis.	Applicable	Grammatical changes to WAC in 2009 do not affect site or remedy; no other changes which affect site or remedy.
Ground-water	*[State]* WAC 173-154	Upper Aquifers and Upper Aquifer zones must be protected to the extent practicable to avoid depletions, excessive water level declines, or reductions in water quality in order to preserve the water for domestic, stockwater, and similar uses, and preserve spring and stream flow.	Applicable	These WAC rules have not been updated since the last FYR; site remains in compliance.
Ground-water	*[State]* RCW 13.104 and WAC 173-160	Minimum standards exist for resource protection and water well construction, construction reports, and examination and licensing well construction contractors and equipment operators. These standards apply if monitoring or extraction wells are installed.	Applicable	Monitoring/extraction wells in upper aquifer zones have been installed in accordance with WAC 173-360; minor ARAR changes do not affect site or remedy.
Ground-water	*[State]* WAC 173-240	Submission of plans and reports. Ecology must review plans for wastewater treatment facilities.	Applicable	No changes since ROD.
Air	*[State]* WAC 173-303-670	Incinerators must comply with the emission standards determined by the State air pollution control authority, in this case, the Puget Sound Air Pollution Control Authority.	Not applicable	Incineration was included within two remedial alternatives; however, it was not part of the final selected remedy for the site; therefore is not applicable.
Air	*[State]* WAC 173-400-040(5)	Contaminant air emissions from any sources must not be detrimental to the health, safety, or welfare of any person and must not damage any property or business. Emissions from incinerators must satisfy this requirement.	Applicable	Rule updated in 2005 to conform to recent Federal changes with respect to new source review. Does not affect site or remedy.
Air	*[State]* WAC 173-400 and 173-403	New Source Review for hazardous waste incinerators. Emissions of toxic air contaminants from new sources undergo a review process in which the contaminants are identified, the best available control technology (BACT) is determined, estimates are made of the maximum ambient air concentration (MAAC), and an acceptable ambient level (AAL) established. Based on these findings, a new source may be approved or disapproved.	Not applicable	Incineration was included within two remedial alternatives; however, it was not part of the final selected remedy for the site; therefore is not applicable.

Media	Source/ARAR Citation	Requirement Synopsis	Status	Current ARAR Evaluation
Air	*[State]* WAC 173-303-670	The State regulations regarding incinerators are comparable to Federal regulations. In addition, regulations of the local air pollution control authority pertain. In the Tacoma area, the Puget Sound Air Pollution Control Authority (PSAPCA) has jurisdiction. According to PSAPCA regulations, particulate emissions are limited to 0.01 grains per standard dry cubic feet of air (gr/sdcf) compared to 0.08 required under Federal regulations. Also, BACT must be used. Because Tacoma is a containment area for particulate matter, emissions must be less than 50 pounds per hour. Exceedence of this level requires the "purchase" of emission offsets at 1.1 times the emission rate.	Not applicable	Incineration was included within two remedial alternatives; however, it was not part of the final selected remedy for the site; therefore is not applicable.
TBC or Other since ROD was issued				
Soil, Surface water, Ground-water	Washington Model Toxics Control Act (RCW 70.105D.900)	The Washington State Model Toxics Control Act (MTCA) was promulgated in 1989 under Washington Administrative Code (WAC) 173-340, two years after the Tacoma Tar Pits ROD was signed. It states that hazardous waste clean up must be conducted in consideration of human and environmental health. Communities must be notified of releases of hazardous, clean up remedies, enforcement of standards, state funding procedures have been modified.	To Be Considered	This rule established that the appropriate clean up level for sites undergoing remedial action are the clean up levels in effect at the time the final clean up action was selected (WAC 173-340-702(12)(a-c)). Since the ROD identified the final clean up action and clean up levels prior to the promulgation of MTCA, the original MTCA is not an ARAR. Likewise, MTCA as amended in February 2001 and October 2007 is not an ARAR.
Soil	WAC 16-752, Washington Noxious Weeds Laws	Washington State has enacted laws to control the introduction and spread of designated, non-native noxious weeds.	To Be Considered	Spotted Knapweed has been observed atop the engineered waste pile cover since the last FYR. Spotted Knapweed is on the Washington State Class B Noxious Weed List, and is designated for control in the Tacoma area. This requirement, however, was not deemed an ARAR or a To Be Considered (TBC) requirement at the Tacoma Tar Pits site as it does not cause the soil remedy component to be less protective against potential exposure to hazardous substances for humans or avian receptors. Should a vegetation management plan be developed for the site, control of Spotted Knapweed should be a component of that plan as it is less than optimum habitat for birds.

Note:
ARARs summary based on discussion of ARARs in Record of Decision (EPA, 1987), Appendix III. ARARs were not further discussed in the two ESDs.