STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

In the Matter of Remedial Action by: The Port of Seattle	AGREED ORDER No. DE 8938

TO: Port of Seattle
Attention: Mr. Tay Yoshitani
P.O. Box 1209
Seattle, Washington 98111

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I. INTRODUCTION

The mutual objective of the State of Washington, Department of Ecology (Ecology) and the Port of Seattle (Port) under this Agreed Order (Order) is to provide for remedial action at a facility where there has been a release or threatened release of hazardous substances. This Order requires the Port to implement the Cleanup Action Plan (CAP) (attached hereto as Exhibit A), including the installation of certain remedial actions and the completion of compliance monitoring. The Order also requires the Port to address contamination in the Upland Area of the Terminal 91 Facility (defined below), including any units newly identified during implementation of the CAP. Ecology has determined that these actions are necessary to protect human health and the environment.

II. JURISDICTION

This Agreed Order is issued pursuant to the authority of the Model Toxics Control Act (MTCA), RCW 70.105D.050(1). This Order also satisfies the requirements of WAC 173-303-646 through -64630.

III. PARTIES BOUND

This Agreed Order shall apply to and be binding upon the Parties to this Order, their successors and assigns. The undersigned representative of each Party hereby certifies that he or she is fully authorized to enter into this Order and to execute and legally bind such Party to comply with the Order. The Port agrees to undertake all actions required by the terms and conditions of this Order. No change in ownership or corporate status shall alter the Port's responsibility under this Order. The Port shall provide a copy of this Order to all agents, contractors, and subcontractors retained to perform work required by this Order, and shall ensure that all work undertaken by such agents, contractors, and subcontractors complies with this Order.

IV. DEFINITIONS

Unless otherwise specified herein, the definitions set forth in Chapter 70.105D RCW and Chapter 173-340 WAC shall control the meanings of the terms used in this Order.

1. 1998 Order means Agreed Order No. DE 98HW-N108, entered in 1998 by Ecology, the Port, Burlington Environmental Inc., then a wholly owned subsidiary of Philip Services Corp. ("Philip"), and Pacific Northern Oil Corporation ("PNO") for the purpose of conducting a remedial investigation/feasibility study (RI/FS).

2. 2010 Order means Agreed Order No. DE 7321, entered in 2010 by Ecology and the Port for the purpose of completing the work required by the 1998 Order, with modifications that reflected circumstances that had changed since the 1998 Order.

3. Agreed Order or Order: Refers to this Order and each of the exhibits to the Order. All exhibits are integral and enforceable parts of this Order. The terms "Agreed Order" or "Order" shall include all exhibits to the Order.

4. Dangerous Waste means any solid waste designated under the procedures of WAC 173-303-070 through -100 as dangerous, extremely hazardous, or mixed waste. Dangerous wastes are hazardous substances under RCW 70.105D.020(10).

5. Discrete Unit means an area affected by the release of Hazardous Substances at Terminal 91, within either the Upland or the Tank Farm Affected Area, that requires investigation or remediation separate from and in addition to the CAP.

6. Hazardous Substances has the meaning provided by RCW 70.105D.020(10).

7. Parties: Refers to the State of Washington, Department of Ecology, and the Port of Seattle.

8. Port: Refers to the Port of Seattle.

9. Permit means dangerous waste facility permit WAD000812917, issued to the Port pursuant to 70.105 RCW for this facility. This definition will also apply to any successor permit to permit WAD000812917 for this facility.

10. Site: The Site is referred to as the Port of Seattle, Terminal 91. The Site includes areas where releases of Hazardous Substances originating from the Terminal 91 Facility have come to be located, and is generally located at 2001 West Garfield Street, Seattle, Washington. The Site is defined by the extent of contamination caused by the releases of Hazardous Substances and may include both submerged lands and uplands. The Site, as currently known to exist, is depicted in Exhibit B to this Order. The Site is comprised of three separate and distinct areas: (1) the Tank Farm Affected Area; (2) the Submerged Lands Area; and (3) the Upland Area. The Site constitutes a Facility under RCW 70.105D.020(5).

11. Submerged Lands Area means that part of the Terminal 91 Facility covered by marine waters, generally located on the southern portion of the Terminal 91 Facility and adjacent to Piers 90 and 91, as generally depicted in Exhibit B.

12. Tank Farm Affected Area comprises the Tank Farm Lease Parcel and any areas where Hazardous Substances originating from the Tank Farm Lease Parcel have come to be located. The term "Tank Farm Affected Area" has the same meaning that the term "Site" was given under the 1998 Order. The Tank Farm Affected Area, as believed to be located as of the date of this Order, is depicted generally in Exhibit B.

13. Tank Farm Lease Parcel consists of approximately four acres within Terminal 91 shown in Exhibit B. The Tank Farm Lease Parcel formerly was the site of a tank farm, demolished in 2005, which had for a time operated as a Dangerous Waste facility.

14. Terminal 91 Facility means the real property owned by the Port of Seattle encompassing approximately 216 acres and located at 2001 West Garfield Street, Seattle, Washington, as depicted in Exhibit B. This definition is based on the current definition of "facility" found in WAC 173-303-040 (for purposes of implementing a corrective action).

15. Upland Area means that part of the Terminal 91 Facility other than the Submerged Lands Area and the Tank Farm Affected Area, as generally depicted in Exhibit B.

V. FINDINGS OF FACT

Ecology makes the following findings of fact, without any express or implied admissions of such facts by the Port:

1. The Site is located on the northern side of Elliott Bay generally at 2001 West Garfield Street, Seattle, Washington. The Site is located on Smith Cove and the Smith Cove Waterway on the Elliott Bay waterfront. The Site location is generally depicted in the diagram attached to this Agreed Order as Exhibit B.

2. The Site is listed on the Department of Ecology's Hazardous Sites List as "Seattle Port Terminal 91," under Facility Site ID No. 24768 with a hazard ranking of 1.

3. The Port is the current owner of the entire Terminal 91 Facility which covers approximately 216 acres, of which the Tank Farm Lease Parcel covers approximately four acres.

4. A tank farm was built on the Tank Farm Lease Parcel in or about 1926. The Tank Farm Lease Parcel was operated by various oil companies until December 1941 when the United States Navy took possession of the entire Terminal 91 Facility through condemnation. In about 1972, the Navy declared the Terminal 91 Facility as surplus. The Port began managing the Terminal 91 Facility, and in 1976 the Port acquired the Terminal 91 Facility. The Terminal 91 Facility remains under the Port's management and ownership at the present time. The Port removed all of the tanks and a number of buildings at the Tank Farm Lease Parcel as part of a MTCA independent interim remedial action reported in October 2005.

5. Burlington Environmental Inc. and its predecessors and successors will herein be referred to as "Philip." Philip operated the Tank Farm Lease Parcel from about June 1971, when it began leasing the Tank Farm Lease Parcel from the Port, through September 1995 when its occupancy ended. Philip operated the Tank Farm Lease Parcel as a regulated dangerous waste management facility on or after November 19, 1980, the date which subjects facilities to federal RCRA permitting requirements under 40 C.F.R. § 264, and Chapter 173-303 WAC, Washington's Dangerous Waste Regulations.

6. On November 14, 1980, EPA was notified of dangerous waste management activities on the Terminal 91 Lease Parcel when the Part A form of the RCRA permit application was filed. Pursuant to the November 14, 1980, notification, EPA issued identification number WAD000812917 for this facility. EPA received a Part B portion of the RCRA permit application to obtain a final status permit for a dangerous waste treatment, storage and disposal facility on November 8, 1988. There were numerous revisions to the draft Part B application, but the Final Status Facility Permit was issued July 22, 1992, with an effective date of August 22, 1992. The Port was named as a permittee since the Port owns the property. Active dangerous waste operations ceased at the permitted Tank Farm Lease Parcel in September 1995, and Ecology approved the above-ground closure work in 2003.

7. Hazardous Substances have been released into the environment at this Site. Hazardous Substances have been detected in either soil or groundwater at the Site as detailed in reports generated under the 1998 and 2010 Orders. Those Hazardous Substances detected at the Site included, but are not limited to, total petroleum hydrocarbons, volatile organic compounds, semi-volatile organic compounds, polychlorinated biphenyls, and metals.

8. In 1998, Ecology entered into Agreed Order No. DE 98HW-N108 (the "1998 Order") with the Port, Philip, and PNO.

9. In December 2003, the State of Washington resolved certain claims against Philip relating to the cleanup of the Site in a consent decree filed in United States Bankruptcy Court, *In re Philip Services Corporation*, 310 B.R. 802 (Bankr. S.D. Tex. 2004) (No. 03-37718-H2-11).

10. The Port has performed various remedial actions with respect to various releases at the Terminal 91 Facility pursuant to its registration in Ecology's Voluntary Cleanup Program under the application submitted March 10, 1999. Such remedial actions were performed to address corrective action requirements imposed by the Permit, and have generally been reported to Ecology as part of the cleanup of the Upland Area.

11. On June 29, 2010, Ecology and the Port entered into the 2010 Order, which required the Port to develop a draft cleanup action plan (DCAP) for the Tank Farm Affected Area and address contamination in the Upland Area of the Site.

12. Under the 2010 Order, the Port developed a DCAP. The DCAP and related State Environmental Policy Act (SEPA) determination of non-significance were issued by Ecology for public comment. After the public comment period, Ecology selected the remedy and the cleanup action plan was approved in a letter from Ecology to the Port on December 15, 2010. This cleanup action plan (CAP) is attached as Exhibit A.

VI. ECOLOGY DETERMINATIONS

1. The Port is an "owner or operator" as defined in RCW 70.105D.020(17), of a "facility" as defined in RCW 70.105D.020(5). A Final Status Dangerous Waste Permit was issued July 22, 1992, to Philip as operator and the Port as owner of the property. Under WAC 173-303-64630(3), Ecology is requiring the owner of a facility to fulfill the corrective action responsibilities through this Agreed Order issued pursuant to the Model Toxics Control Act (MTCA).

2. Based upon all factors known to Ecology, a "release" or "threatened release" of "Hazardous Substance(s)" as defined in RCW 70.105D.020(25) and RCW 70.105D.020(10), respectively, has occurred at the Site.

3. Based upon credible evidence, Ecology issued a PLP status letter to the Port dated July 3, 1996, pursuant to RCW 70.105D.040, -.020(16), and WAC 173-340-500. After providing for notice and opportunity for comment, reviewing any comments submitted, and concluding that credible evidence supported a finding of potential liability, Ecology issued a determination that the Port is a PLP under RCW 70.105D.040 and notified the Port of this determination by letter dated August 15, 1996.

4. Pursuant to RCW 70.105D.030(1) and -.050(1), Ecology may require PLPs to investigate or conduct other remedial actions with respect to any release or threatened release of

Hazardous Substances, whenever it believes such action to be in the public interest. Based on the foregoing facts, Ecology believes the remedial actions required by this Order are in the public interest.

5. The remedial actions undertaken by the Port described in Section V.10 and in relation to the development and implementation of the Data Gaps Investigation Work Plan are subsumed under this Order and shall be considered an integral part of the Work to be Performed. The Data Gaps Investigation Work Plan involves activities that are being conducted to collect additional information necessary to proceed with a detailed design for the final cleanup for the Tank Farm Affected Area.

6. Unless otherwise specified, Ecology will use the definitions and requirements for allowable financial assurance mechanisms set forth in the current financial assurance rules covering closure and post-closure in 40 C.F.R. § 264.141–.143, 40 C.F.R. § 264.145, 40 C.F.R. § 264.151, and WAC 173-303-620 will be the definitions and requirements for allowable financial assurance for corrective action under this Order. Ecology will apply these definitions and requirements to this corrective action, except that the words "corrective action" shall be substituted for the words "closure" or "post-closure" in the above listed regulations as needed to produce this result.

7. In the absence of final federal regulations governing financial assurance for corrective action, Ecology's Financial Assurance Officer will use the following resources as guidance in implementing the financial assurance provisions of this Order:

a. The Financial Assurance for Corrective Action Proposed Rule, 51 Fed. Reg. 37853 (Oct. 24, 1986);

b. The financial assurance provisions of Corrective Action for Releases from Solid Waste Management Units Advance Notice of Proposed Rulemaking, 61 Fed. Reg. 19432 (May 1, 1996);

c. The Interim Guidance on Financial Responsibility for Facilities Subject to RCRA Corrective Action (U.S. EPA, Sept. 30, 2003); and/or

d. Any other guidance applicable to financial assurance and corrective action that may be available at the time.

Ecology intends to use the financial assurance provisions of the Corrective Action for Solid Waste Management Units at Hazardous Waste Management Facilities, 55 Fed. Reg. 30798 (July 27, 1990), as secondary guidance. Unless otherwise specified herein, where the language of this Order conflicts with these rules, proposed rules, notices, and guidance documents, the language of this Order will prevail.

VII. WORK TO BE PERFORMED

Based on the foregoing Facts and Determinations, it is hereby ordered that the Port perform or ensure the performance of the following remedial actions and that these actions be conducted in accordance with Chapter 173-340 WAC (MTCA) unless otherwise specifically provided for herein.

A. Work to Be Performed under the CAP

The Port's obligations in relation to the Tank Farm Affected Area are to complete work identified in the approved CAP.

Based on the foregoing Findings of Fact and Ecology Determinations, it is hereby agreed that the Port shall perform the following remedial actions and that these actions be conducted in accordance with Chapter 173-340 WAC and applicable provisions of Chapter 173-303 WAC, unless otherwise specifically provided for herein. All work undertaken pursuant to this Order shall be developed and performed, as appropriate and approved by Ecology, in accordance with the approved Work Plans and all other applicable federal and state regulations. More specifically:

1. **Cleanup Action Plan.** Exhibit A to this Order contains the CAP for the site. Except where specifically provided in this Order, Exhibit A is incorporated by reference

and is an integral and enforceable part of this Order. The Port shall implement the cleanup action described in the CAP in accordance with requirements of WAC 173-303-400 and the items established in 1 through 6 below in this Section (A).

2. **Schedule.** The remedial actions for the Tank Farm Affected Area will be conducted consistent with the Tank Farm Affected Area Project Schedule in Exhibit F to this Order, which shall replace the schedule included in the CAP.

3. **Data Gaps.** If data gaps exist, then either Ecology or the Port may propose additional work to fill the data gaps subject to Section VIII.L of this Order. If parties cannot agree on the need for additional work to fill data gaps, this would trigger the conflict resolution protocol described under Section VIII.J.

4. **Engineering Design.** Consistent with the schedule in Exhibit F, the Port shall prepare the engineering design for the cleanup action described in the CAP in accordance with the requirements of WAC 173-340-400(4). The engineering design shall be completed in the following three stages: (i) design basis memorandum (30% Design), (ii) draft engineering design Report (EDR) (90% Design), and (iii) final EDR (100% Design).

a. **Design Basis Memorandum (30% Design).** The Port shall submit a Design Basis Memorandum (DBM) to Ecology at approximately the 30 percent completion stage of the design process. The intent of the DBM is to utilize the information collected during the Data Gap Investigation Work Plan, Terminal 91 Tank Farm Affected Area, 2011 (approved October 17, 2011) to present the general engineering concepts and criteria used for design of the cleanup action. The DBM will include all components of the selected remedy, including the presumptive remedies specified in the CAP. The DBM will include design concepts and objectives, the rationale for major design decisions, preliminary layout drawings of major design components, and a list of anticipated

construction plans and technical specifications to be included in the Draft EDR. Ecology will review the DBM and provide comments to the Port. Ecology's comments on the DBM will be addressed during preparation of the Draft EDR, and the DBM will not be reissued as a stand-alone document.

b. **Draft Engineering Design Report (90% Design).** In accordance with the Schedule (Exhibit F), the Port shall submit a draft EDR to Ecology in accordance with the requirements of WAC 173-340-400(4) and the CAP. The EDR shall build on the information contained in the DBM and address Ecology's comments on the DBM and shall document the detailed engineering concepts, objectives, and criteria used for design of the cleanup action. Information contained in the EDR will be of sufficient detail to provide for the development and review of construction plans and specifications for all components of the selected remedy, including presumptive remedies specified in the CAP. The EDR will include a detailed implementation plan including an implementation schedule. The implementation schedule will include a critical-path Gantt chart timeline showing anticipated dates and timeframes for all post-EDR deliverables and cleanup action elements.

The EDR may be a single document containing plans for all elements of the cleanup action, or the Port may choose to establish separate EDRs specific to particular elements or groups of elements of the cleanup action. The EDR itself shall contain the information indicated below with an asterisk (*). For other required deliverables/activities below, if the EDR does not contain the deliverable, the EDR shall propose a schedule and due date for submitting, or carrying out, the respective document or action:

1) Construction Plans and Specifications (CPS) consistent with WAC 173-340-400(4)(b).* The CPS document will include design drawings and

specifications sufficient to proceed with construction, and will provide the basis for development of a detailed cost estimate. All permits necessary to complete the cleanup will be identified and included with the CPS*.

2) A Construction Health and Safety Plan.

3) A Construction Quality Assurance (CQA) Plan.*

4) Documentation of the establishment of exposure and other institutional controls consistent with WAC 173-340-440. Consistent with the CAP, a combination of institutional controls and public communications must be implemented.

5) An implementation schedule for all components of the cleanup action.*

6) An Operation and Maintenance Plan (O&M Plan) consistent with WAC 173-340-400(4)(c) for long-term care of the remedy components including the containment wall, asphalt cover, LNAPL recovery system, and other components required to ensure that the remedy remains protective of human health and the environment.

7) A Compliance Monitoring Plan (CMP) consistent with the requirements of WAC 173-340-410 that specifies the types and frequency of monitoring to be performed to document the performance of the cleanup action. The CMP will include a Monitored Natural Attenuation (MNA) Monitoring Plan.

c. **Revised EDR**. Ecology shall review the draft EDR and provide comments. In accordance with the Schedule (Exhibit F), the Port shall submit a revised EDR that addresses Ecology's comments. Ecology will then approve the revised EDR as the final deliverable, approve the revised EDR with changes or conditions, or disapprove the revised EDR and provide additional comments to

the Port. If Ecology disapproves the revised EDR, the Port shall revise the EDR to address Ecology's comments and submit a new revision within forty-five (45) days of receiving Ecology's latest comments. This process shall be repeated, as necessary, until a satisfactory EDR is submitted, or a determination is made under paragraph VIII.J (Resolution of Disputes) below.

5. **Implementation of Cleanup Action.** The Port shall implement the cleanup action in accordance with the approved EDR, any approved plans submitted after the EDR has been approved, and applicable requirements in WAC 173-340-400(6). After completing any construction required by the EDR, the Port will prepare and submit a cleanup Implementation Report (i.e., as-built report) (Implementation Report). The Implementation Report will be prepared in accordance with WAC 173-340-400(6)(b) and will include as-built drawings, documentation developed pursuant to the CQA Plan, and documentation for implementation of institutional controls. The approved EDR may propose whether there will be a single Implementation Report for the entire remedy, or multiple Implementation Reports for selected remedial components. As required by WAC 173-340-400(6)(c), a revised cost estimate will be included in the cleanup Implementation Report with a copy of a revised financial assurance document.

The cleanup Implementation Report (or, Reports, if multiple reports are required for preparation) shall be submitted as "Draft" by the due date(s) established in the approved EDR. Ecology shall review each draft Implementation Report and provide comments. Within forty-five (45) days of receiving Ecology's comments on an Implementation Report, the Port shall submit a revised report as the final deliverable. Ecology will then approve the revised report, approve the revised report with changes or conditions, or disapprove the revised report and provide additional comments to the Port. If Ecology disapproves a revised Implementation Report, the Port shall revise the report

to satisfactorily address Ecology's comments and submit a new revision within thirty (30) days of receiving Ecology's latest comments.

6. **Operation and Maintenance, and Compliance Monitoring.** Following completion of the construction of the cleanup action, the Port will implement the approved O&M Plan and CMP.

7. **Construction Discoveries in the TFAA.** The Port may conduct remedial actions with respect to unanticipated discoveries encountered within the Tank Farm Affected Area in compliance with the Contamination Contingency Plan (Exhibit E).

B. Work to Be Performed in the Submerged Lands Area

To the extent that Hazardous Substances are discovered in the Submerged Lands Area, the Parties agree that it is not practicable at this time to address any such contamination until potential contributing upland sources can be identified and remedied. Additional information would be required to do so; for example, identifying and addressing sources potentially contributing to such contamination, including sources such as stormwater that originated from other industrial properties in the area surrounding the Terminal 91 Facility. The necessity for and the practicability of remediation in the Submerged Lands Area will be reevaluated by the agency as it continues to monitor the site through the review of the quarterly progress reports and future changes to environmental regulations, but no later than 10 years after the effective date of this Order.

C. Work to Be Performed for Releases Not Addressed by CAP

1. **For Known Discrete Units:** For Discrete Units of which the Port is aware as of the effective date of this Order, the Port has the obligations identified below. These known Discrete Units are identified and listed in Exhibit C hereto.

a. For Discrete Units listed in Subpart A of Exhibit C (Discrete Units to Be Addressed During Redevelopment), Ecology has determined that these releases do not pose an immediate threat to human health and the environment.

Accordingly, remedial action for them shall be done in conjunction with the Port's redevelopment of these areas. If the Port has not initiated redevelopment and remedial actions in this area within ten (10) years of the effective date of this Order, the Port shall conduct the remedial actions on a schedule approved by Ecology regardless of the status of the Port's redevelopment. Such work shall be conducted, reported and evaluated as described in Subsection VII.C.1.b.

b. For Discrete Units listed in Subpart B of Exhibit C (Discrete Units to Be Addressed under Work Plans and Schedules), the Port shall:

1) Submit a work plan (or other appropriate documentation needed for completion) to Ecology for addressing the contamination within a time frame agreed to by Ecology. Any such work plan, once approved in writing by Ecology, becomes an integral and enforceable part of this Order. The scope and detail of any such work plan shall be commensurate with the scope and complexity of the appropriate cleanup action necessary, and should be submitted for review and approval by Ecology.

2) Within ninety (90) days of completing the approved remedial action, the Port shall submit a written report describing the actions taken.

3) Ecology shall evaluate such remedial actions to determine whether they meet the substantive requirements of Chapter 173-340 WAC and whether Ecology believes that further remedial action is necessary. Exhibit C shall be updated to reflect Ecology's determination.

2. **For Newly Discovered Discrete Units:**

a. The parties may discover new Discrete Units at the Terminal 91 Facility, which may require a formal amendment of this Order. Section VIII.L requires formal amendment of this Order in the event of "substantial" changes to the work to be performed, with "minor" changes to be documented without formal

amendment. For purposes of releases under subsection VII.C.2, additional work to address them shall be considered "substantial" if the releases are of a kind that would generally be addressed under an agreed order in their own right. Based on previous investigations and site history at the Terminal 91 Facility, non-exclusive examples of minor releases and/or minor changes to remedial actions include:

1) releases subject to the Contamination Contingency Plan;

2) closure, site assessment, and remediation of releases from USTs used for petroleum storage (subject to language in example 5);

3) releases affecting soil but not groundwater;

4) routine disposal of contaminated soil excavated as part of construction activities;

5) releases affecting groundwater in which the only hazardous substances over cleanup levels are petroleum-related and the extent of the contamination plume does not appear to be extensive;

6) removal of accumulated petroleum product from excavation water in cases where construction excavations extend below the water table;

7) installation and operation of product recovery/product monitoring wells or other structures such as product recovery/product monitoring vaults;

8) application of ORC™ or other commonly used remedial products to groundwater to assist in degrading petroleum constituents; and

9) cleaning, decommissioning in place, and/or removal of underground fuel pipelines.

b. For contamination discovered in the context of Port construction activities that is a reportable release under WAC 173-340-300, the Port will follow the

Contamination Contingency Work Plan, attached as Exhibit E hereto. The Contamination Contingency Plan is an integral and enforceable part of this Order.

1) Within ninety (90) days of completing a remedial action under the Contamination Contingency Plan (including any interim remedial actions), the Port shall submit a written report describing the actions taken. In addition, the Port's next quarterly report shall include a revised version of Exhibit C listing the release under Subpart C of Exhibit C (Discrete Units Addressed under the Contamination Contingency Plan).

2) Ecology shall evaluate such remedial actions to determine whether they meet the substantive requirements of Chapter 173-340 WAC and whether Ecology believes that further remedial action is necessary.

3) If a remedial action the Port conducts under the Contamination Contingency Plan is an interim action as defined in WAC 173-340-430, any final cleanup action for that action shall be conducted under the procedures in either subsection VII.C.1.a or VII.C.1.b. Ecology and the Port shall consult to determine which subsection's procedures the cleanup action will proceed under, and shall update Exhibit C to include the newly-discovered Discrete Units in accordance with Section VIII.L, through either the informal or formal process. In the event the Port and Ecology disagree, Ecology shall make the final decision, subject to dispute resolution under Section VIII. J.

c. For newly-discovered releases of hazardous substances and Discrete Units the Port finds outside the context of construction, the Port shall report the Units pursuant to Section VII.G.

d. The Port's obligations to address newly discovered Discrete Units pursuant to Subsection VII.C 2 are subject to relief if the Port demonstrates that

the contamination is the result of a plume for which the Port would not be considered an "owner or operator" pursuant to RCW 70.105D.020(17)(b)(iv) (or similar provision granting relief for the owner of land affected by a migrating plume of Hazardous Substances).

D. General Requirements Applicable to All Work Performed Under This Section

1. **Data Reporting.** The Port shall follow the reporting guidelines in WAC 173-340-840 for all parts of this Order unless otherwise agreed to by both Ecology and the Port in writing. All data generated pursuant to this Order shall be submitted to Ecology-NWRO, including all outlier and duplicate data. In addition, all sampling data generated pursuant to this Order shall be submitted to Ecology-NWRO as copies of the original reported laboratory data sheets, in tabulated data format and in an electronic format approved by Ecology for all referenced environmental media. Laboratory detection limits and practical quantitation limits shall be reported for each constituent concentration detected.

2. **Progress Reports.** The Port shall submit status reports to Ecology-NWRO quarterly on or before January 20, April 20, July 20, and October 20 of each year, and continuing until all of the requirements of this Order are completed to Ecology's satisfaction. The submittal shall address the three-month activity period ending twenty (20) days before the report is due. The Port shall include the following in each status report:

a. All work conducted pursuant to this Agreed Order during the last three month period;

b. Occurrence of any problems, how problems were rectified, deviations from the work plans and an explanation of all deviations;

c. Projected work to occur in the upcoming three months;

d. Summaries of significant findings, changes in personnel, summaries of significant contacts with all federal, state, local community, and public interest groups;

e. Monitoring data collected pursuant to the CMP, not separately reported, (as copies of the original laboratory reporting data sheets, and in tabulated data format) for which quality assurance procedures are completed during the three-month period;

f. Information collected pursuant to the approved O&M Plan necessary to document to continued performance of the cleanup action;

g. Any newly discovered releases at the Terminal 91 Facility, and the Port's proposed classification of such releases (that is, under either Subpart A, B, or C of Exhibit C); and

h. An updated version of Exhibit C to this Order to reflect any newly discovered releases and their classification for remedial action, when the classification is approved by Ecology.

E. Deliverables

Once approved in writing by Ecology, all deliverables the Port submits to Ecology under this Order are incorporated by reference and become enforceable parts of this Order, as if fully set forth herein. During the performance of work under an approved deliverable, field modifications to the submittal may be agreed to orally by the Project Coordinators. In such case, the Port shall submit a description of the field modification to Ecology's Project Coordinator in writing within seven (7) days after the oral agreement, and Ecology's Project Coordinator shall provide written confirmation of the agreed modification. Such field modifications would be subject to VIII.L's terms concerning amendments to the Order.

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F. Remedy for Insufficient Progress

If, at any time after the first exchange of comments on drafts, Ecology determines that insufficient progress is being made in the preparation of any of the deliverables required by this section, Ecology may, after providing written notice and a reasonable opportunity to cure, complete and issue the final deliverable.

G. Reporting Newly Discovered Releases

The Port shall provide notice by email to Ecology of any newly-identified release(s) of hazardous substances at the Terminal 91 Facility as required by WAC 173-340-300 (or any successor provision). The Port shall provide such notice as soon as practical following confirmation of the release, but in no case beyond the 90-day reporting requirement established by WAC 173-340-300. The Port shall also include a report of the newly identified releases in the quarterly progress report as described in Section VII.D.2 of this Order; inclusion in the quarterly report may satisfy the reporting requirement if timely. Newly-identified releases need not be reported if no report would be required under WAC 173-340-300. With the report, the Port shall propose for Ecology's review and approval an appropriate framework for responding to the discovery under this Order, either VII.C.1.a (to be addressed in redevelopment); VII.C.1.b (to be addressed through a release-specific work plan and schedule), or through the VII.C.2.b., the Contamination Contingency Plan (for releases discovered and addressed during construction). Ecology shall respond to the Port's proposed classification within ninety (90) days of receiving the quarterly report, either approving the classification, disapproving it, or requesting further information. Once Ecology has approved the classification, the Parties shall update Exhibit C as necessary to incorporate the newly identified release and approved classification.

VIII. TERMS AND CONDITIONS OF ORDER

A. Public Notice

RCW 70.105D.030(2)(a) and WAC 173-340-600(11)(c) require that, at a minimum, this Order be subject to concurrent public notice. Ecology shall be responsible for providing such

public notice and reserves the right to modify or withdraw any provisions of this Order should public comment disclose facts or considerations which indicate to Ecology that this Order is inadequate or improper in any respect.

B. Remedial Action Costs

The Port shall pay to Ecology costs incurred by Ecology pursuant to this Order and consistent with WAC 173-340-550(2). These costs shall include work performed by Ecology or its contractors for, or on, the Site under Chapter 70.105D RCW, including remedial actions and Order preparation, negotiation, oversight, and administration. These costs shall include work performed both prior to and subsequent to the issuance of this Order. Ecology's costs shall include costs of direct activities and support costs of direct activities as defined in WAC 173-340-550(2). The Port shall pay the required amount within ninety (90) days of receiving from Ecology an itemized statement of 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 statement of work performed will be provided upon request. Itemized statements shall be prepared quarterly. Pursuant to WAC 173-340-550(4), failure to pay Ecology's costs within ninety (90) days of receipt of the itemized statement of costs will result in interest charges at the rate of twelve percent (12%) per annum, compounded monthly.

Pursuant to RCW 70.105D.055, Ecology has authority to recover unreimbursed remedial action costs by filing a lien against real property subject to the remedial actions.

C. Implementation of Remedial Action

If Ecology determines that the Port has failed without good cause to implement the remedial actions, in whole or in part, Ecology may, after notice to the Port, perform any or all remedial actions required by this Order that remain incomplete. If Ecology performs all or portions of such remedial actions because of the Port's failure to comply with its obligations under this Order, the Port shall reimburse Ecology for the costs of doing such work in accordance with Section VIII.B (Remedial Action Costs), provided that the Port is not obligated

under this Section to reimburse Ecology for costs incurred for work inconsistent with or beyond the scope of this Order.

Except where necessary to abate an emergency situation, the Port shall not perform any remedial actions at the Site outside those remedial actions required by this Order, unless Ecology concurs, in writing, with such additional remedial actions. Ecology concurs with remedial actions done in compliance with the Contamination Contingency Plan (Exhibit E) as that Plan is approved by Ecology.

D. Designated Project Coordinators

The project coordinator for Ecology is:

Name:	Galen H. Tritt
Address:	Department of Ecology-BFO 1440 10th Street, Suite 102 Bellingham, WA 98225
Phone:	(360) 715-5200
Email:	gtri461@ecy.wa.gov

The project coordinator for the Port is:

Name:	Susan Roth
Address:	Roth Consulting 3937 SW 109th Street Seattle, WA 98146-1653
Phone:	(206) 617-2176
Email:	susanjroth@comcast.net

Each project coordinator shall be responsible for overseeing the implementation of this Order. Ecology's project coordinator will be Ecology's designated representative for the Site. To the maximum extent possible, communications between Ecology and the Port, and all documents, including reports, approvals, and other correspondence concerning the activities performed pursuant to the terms and conditions of this Order shall be directed through the project coordinators. The project coordinators may designate, in writing, working level staff contacts for all or portions of the implementation of the work to be performed required by this Order.

Any party may change its respective project coordinator. Written notification shall be given to the other party at least ten (10) calendar days prior to the change.

E. Performance

This Order's terms regarding persons performing "work required by this Order" apply only to persons who expressly undertake responsibility for performing such work, and not to Agents/Contractors/Subcontractors of the Port who may take incidental actions subject to the Order as a result of addressing contamination encountered during construction or utility work.

1. The Port shall provide a copy of this Order to all agents, contractors, and subcontractors retained to perform work required by this Order, and shall ensure that all work undertaken by such agents, contractors, and subcontractors complies with this Order.

2. All geologic and hydrogeologic work performed pursuant to this Order shall be under the supervision and direction of a geologist licensed in the State of Washington or under the direct supervision of an engineer registered in the State of Washington, except as otherwise provided for by Chapters 18.220 and 18.43 RCW.

3. All engineering work performed pursuant to this Order shall be under the direct supervision of a professional engineer registered in the State of Washington, except as otherwise provided for by RCW 18.43.130.

4. All construction work performed pursuant to this Order shall be under the direct supervision of a professional engineer or a qualified technician under the direct supervision of a professional engineer. The professional engineer must be registered in the State of Washington, except as otherwise provided for by RCW 18.43.130.

5. Any documents submitted containing geologic, hydrologic or engineering work shall be under the seal of an appropriately licensed professional as required by Chapter 18.220 RCW or RCW 18.43.130.

The Port shall notify Ecology in writing of the identity of any engineering, geology contractor and subcontractor firms and other firms to be used in carrying out the terms of this Order in advance of their involvement at the Site.

F. Access

Ecology or any Ecology authorized representative shall have the full authority to enter and freely move about all property at the Site that the Port either owns, controls, or has access rights to at all reasonable times, consistent with federal law, for the purposes of, *inter alia*: inspecting records, operation logs, and contracts related to the work being performed pursuant to this Order; reviewing the Port's progress in carrying out the terms of this Order; conducting such tests or collecting such samples as Ecology may deem necessary; using a camera, sound recording, or other documentary-type equipment to record work done pursuant to this Order; and verifying the data submitted to Ecology by the Port. The Port shall make all reasonable efforts to secure access rights for those properties within the Site not owned or controlled by the Port where remedial activities or investigations will be performed pursuant to this Order. Ecology or any Ecology authorized representative shall give reasonable notice before entering any Site property owned or controlled by the Port unless an emergency prevents such notice. All persons who access the Site pursuant to this Section shall comply with any applicable Health and Safety Plan(s), and with any applicable federal law, such as that regulating access for homeland security purposes. Ecology employees and their representatives shall not be required to sign any liability release or waiver as a condition of Site property access.

G. Sampling, Data Submittal, and Availability

With respect to the implementation of this Order, the Port shall make the results of all sampling, laboratory reports, and/or test results generated by it or on its behalf available to Ecology. Pursuant to WAC 173-340-840(5), all sampling data shall be submitted to Ecology in both printed and electronic formats in accordance with Section VII (Work to be Performed), Ecology's Toxics Cleanup Program Policy 840 (Data Submittal Requirements), and/or any subsequent procedures specified by Ecology for data submittal.

If requested by Ecology, the Port shall allow split or duplicate samples to be taken by Ecology and/or its authorized representative of any samples collected by the Port pursuant to

implementation of this Order. The Port shall notify Ecology seven (7) days in advance of collecting samples at the Site pursuant to this Order; provided, however, that Ecology may waive this notification requirement and accept samples where they were collected during construction projects or other circumstances where sampling was prudent or necessary but unplanned; and provided further, sampling conducted pursuant to the approved Contamination Contingency Plan (Exhibit E) shall not require separate reporting as a result of this subsection. Ecology shall, upon request, allow split or duplicate samples of any samples collected by Ecology pursuant to the implementation of this Order to be taken by the Port or its authorized representative provided it does not interfere with Ecology's sampling. Without limitation on Ecology's rights under Section VIII.F of this Order, Ecology shall notify the Port prior to any sample collection activity unless an emergency prevents such notice.

In accordance with WAC 173-340-830(2)(a), all hazardous substance analyses shall be conducted by a laboratory accredited under Chapter 173-50 WAC for the specific analyses to be conducted, unless otherwise approved by Ecology.

H. Public Participation

A Public Participation Plan is required for this Site. The approved Public Participation Plan is attached as Exhibit D.

Ecology shall maintain the responsibility for public participation at the Site. However, the Port shall cooperate with Ecology, and shall:

1. If agreed to by Ecology, develop appropriate mailing list, prepare drafts of public notices and fact sheets at important stages of the remedial action, such as the submission of work plans, remedial investigation/feasibility study reports, cleanup action plans, and engineering design reports. As appropriate, Ecology will edit, finalize, and distribute such fact sheets and prepare and distribute public notices of Ecology's presentations and meetings.

2. Notify Ecology's project coordinator prior to the preparation of all press releases and fact sheets, if they concern implementation of this Order, and before any such major

meetings with the interested public and local governments. Likewise, Ecology shall notify the Port prior to the issuance of all press releases and fact sheets, and before major meetings with the interested public and local governments, all to the extent they concern implementation of this Order. For all Port press releases, fact sheets, meetings, and other outreach efforts that concern implementation of this Order that do not receive prior Ecology approval, the Port shall clearly indicate to its audience that the press release, fact sheet, meeting, or other outreach effort was not sponsored or endorsed by Ecology.

3. When requested by Ecology, participate in public presentations on the progress of the remedial action at the Site. Participation may be through attendance at public meetings to assist in answering questions or as a presenter.

4. Except as provided by the approved Public Participation Plan (Exhibit D), when requested by Ecology, arrange and/or continue information repositories to be located at the following locations:

a. On Ecology's website which is freely accessible to the public.

b. Department of Ecology-NWRO
3190 160th Avenue SE
Bellevue, WA 98008-5452

c. Seattle Public Library
1000 4th Avenue
Seattle, WA 98104

At a minimum, electronic copies of all public notices, fact sheets, and press releases that concern implementation of the Order; remedial action plans and reports, supplemental remedial planning documents, and all other similar documents relating to performance of remedial actions required by this Order shall be promptly placed in these repositories.

I. Retention of Records

During the pendency of this Order, and for ten (10) years from the date of completion of work performed pursuant to this Order, the Port shall preserve all records, reports, documents, and underlying data in its possession relevant to the implementation of this Order. Upon request

of Ecology, the Port shall make all such records available to Ecology and allow access for review within a reasonable time.

J. Resolution of Disputes

1. In the event a dispute arises as to an approval, disapproval, proposed change, or other decision or action by Ecology's project coordinator, or an itemized billing statement under Section VIII.B (Remedial Action Costs), the Parties shall utilize the dispute resolution procedure set forth below.

a. Upon receipt of Ecology's project coordinator's written decision or the itemized billing statement, the Port has fourteen (14) days within which to notify Ecology's project coordinator in writing of its objection to the decision or itemized statement.

b. The Parties' project coordinators shall then confer in an effort to resolve the dispute. If the project coordinators cannot resolve the dispute within fourteen (14) days, Ecology's project coordinator shall issue a written decision.

c. The Port may then request regional management review of the decision. This request shall be submitted in writing to the Hazardous Waste and Toxics Reduction Section Manager, Northwest Region Office, within seven (7) days of receipt of Ecology's project coordinator's written decision.

d. The Section Manager shall conduct a review of the dispute and shall endeavor to issue a written decision regarding the dispute within thirty (30) days of the Port's request for review. The Section Manager's decision shall be Ecology's final decision on the disputed matter.

2. The Parties agree to only utilize the dispute resolution process in good faith and agree to expedite, to the extent possible, the dispute resolution process whenever it is used.

3. Implementation of these dispute resolution procedures shall not provide a basis for delay of any activities required in this Order, unless Ecology agrees in writing to a schedule extension.

K. Extension of Schedule

1. An extension of schedule shall be granted only when a request for an extension is submitted in a timely fashion, generally at least thirty (30) days prior to expiration of the deadline for which the extension is requested, and good cause exists for granting the extension. All extensions shall be requested in writing. The request shall specify:

a. The deadline that is sought to be extended;

b. The length of the extension sought;

c. The reason(s) for the extension; and

d. Any related deadline or schedule that would be affected if the extension were granted.

2. The burden shall be on the Port to demonstrate to the satisfaction of Ecology that the request for such extension has been submitted in a timely fashion and that good cause exists for granting the extension. Good cause may include, but may not be limited to:

a. Circumstances beyond the reasonable control and despite the due diligence of the Port including delays caused by unrelated third parties or Ecology, such as (but not limited to) delays by Ecology in reviewing, approving, or modifying documents submitted by the Port;

b. Acts of God, including fire, flood, blizzard, extreme temperatures, storm, or other unavoidable casualty; or

c. Endangerment as described in Section VIII. M (Endangerment).

However, neither increased costs of performance of the terms of this Order nor changed economic circumstances shall be considered circumstances beyond the reasonable control of the Port.

3. Ecology shall act upon any written request for extension in a timely fashion. Ecology shall give the Port written notification of any extensions granted pursuant to this Order. A requested extension shall not be effective until approved by Ecology. Unless the extension is a substantial change, it shall not be necessary to amend this Order pursuant to Section VIII. L (Amendment of Order) when a schedule extension is granted.

4. An extension shall only be granted for such period of time as Ecology determines is reasonable under the circumstances. Ecology may grant schedule extensions exceeding ninety (90) days only as a result of:

a. Delays in the issuance of a necessary permit which was applied for in a timely manner;

b. Other circumstances deemed exceptional or extraordinary by Ecology; or

c. Endangerment as described in Section VIII.M (Endangerment).

L. Amendment of Order

The project coordinators may orally agree to minor changes to the work to be performed without formally amending this Order. In such a case, the Port shall submit a description of the minor changes to Ecology's project coordinator in writing within seven (7) days after the oral agreement. Minor changes will then be documented in writing by Ecology within seven (7) days after Ecology receives the Port's written description.

Except as provided in Section VIII.N (Reservation of Rights), substantial changes to the work to be performed shall require formal amendment of this Order. This Order may only be formally amended by the written consent of both Ecology and the Port. The Port shall submit a written request for amendment to Ecology for approval. Ecology shall indicate its approval or disapproval in writing and in a timely manner after the written request for amendment is received. If the amendment to this Order represents a substantial change, Ecology will provide public notice and opportunity to comment. Reasons for the disapproval of a proposed amendment to this Order shall be stated in writing. If Ecology does not agree to a proposed

amendment, the disagreement may be addressed through the dispute resolution procedures described in Section VIII.J (Resolution of Disputes).

M. Endangerment

In the event Ecology determines that any activity being performed at the Site is creating or has the potential to create a danger to human health or the environment on or surrounding the Site, Ecology may direct the Port to cease such activities for such period of time as it deems necessary to abate the danger. The Port shall immediately comply with such direction.

In the event the Port determines that any activity being performed at the Site is creating or has the potential to create a danger to human health or the environment, the Port may cease such activities. The Port shall notify Ecology's project coordinator as soon as possible, but no later than twenty-four (24) hours after making such determination or ceasing such activities. Upon Ecology's direction the Port shall provide Ecology with documentation of the basis for the determination or cessation of such activities. If Ecology disagrees with the Port's cessation of activities, it may direct the Port to resume such activities.

If Ecology concurs with or orders a work stoppage pursuant to this Section, the Port's obligations with respect to the ceased activities shall be suspended until Ecology determines the danger is abated, and the time for performance of such activities, as well as the time for any other work dependent upon such activities, shall be extended in accordance with Section VIII.K (Extension of Schedule) for such period of time as Ecology determines is reasonable under the circumstances.

Nothing in this Order shall limit the authority of Ecology, its employees, agents, or contractors to take or require appropriate action in the event of an emergency.

N. Reservation of Rights

This Order is not a settlement under Chapter 70.105D RCW. Ecology's signature on this Order in no way constitutes a covenant not to sue or a compromise of any of Ecology's rights or authority. Ecology will not, however, bring an action against the Port to recover remedial action

costs paid to and received by Ecology under this Order, the 1998 Order, or the 2010 Order. In addition, Ecology will not take additional enforcement actions against the Port regarding remedial actions required by this Order, provided the Port complies with this Order.

Ecology nevertheless reserves its rights under Chapter 70.105D RCW, including the right to require additional or different remedial actions at the Site should it deem such actions necessary to protect human health and the environment, and to issue orders requiring such remedial actions. Ecology also reserves all rights regarding the injury to, destruction of, or loss of natural resources resulting from the release or threatened release of hazardous substances at the Site.

O. Transfer of Interest in Property

No voluntary conveyance or relinquishment of title, easement, leasehold, or other interest in the Tank Farm Affected Area shall be consummated by the Port without provision for continued implementation of all requirements of this Order and implementation of any remedial actions found to be necessary as a result of this Order.

Prior to the Port's transfer of any interest in the Tank Farm Affected Area likely to substantially affect the performance of work under this Order, and during the effective period of this Order, the Port shall provide a copy of this Order to any prospective purchaser, lessee, transferee, assignee, or other successor in said interest; and, at least fourteen (14) days prior to any such transfer, the Port shall notify Ecology of said transfer. For purposes of this provision, only those property interest transfers that involve planned capital improvements (for example, such as excavation or pile driving) shall be considered likely to substantially affect the performance of work under this Order. Upon transfer of any such interest, the Port shall restrict uses and activities to those consistent with this Order and notify all transferees of the restrictions on the use of the property.

P. Compliance with Applicable Laws

1. All actions carried out by the Port pursuant to this Order shall be done in accordance with all applicable federal, state, and local requirements, including requirements to obtain necessary permits, except as provided in RCW 70.105D.090.

2. Pursuant to RCW 70.105D.090(1), the Port is exempt from the procedural requirements of Chapters 70.94, 70.95, 70.105, 77.55, 90.48, and 90.58 RCW and of any laws requiring or authorizing local government permits or approvals. However, the Port shall comply with the substantive requirements of such permits or approvals.

The Port has a continuing obligation to determine whether additional permits or approvals addressed in RCW 70.105D.090(1) would otherwise be required for the remedial action under this Order. In the event either Ecology or the Port determines that additional permits or approvals addressed in RCW 70.105D.090(1) would otherwise be required for the remedial action under this Order, it shall promptly notify the other party of its determination. Ecology shall determine whether Ecology or the Port shall be responsible to contact the appropriate state and/or local agencies. If Ecology so requires, the Port shall promptly consult with the appropriate state and/or local agencies and provide Ecology with written documentation from those agencies of the substantive requirements those agencies believe are applicable to the remedial action. Ecology shall make the final determination on the additional substantive requirements that must be met by the Port and on how the Port must meet those requirements. Ecology shall inform the Port in writing of these requirements. Once established by Ecology, the additional requirements shall be enforceable requirements of this Order. The Port shall not begin or continue the remedial action potentially subject to the additional requirements until Ecology makes its final determination.

3. Pursuant to RCW 70.105D.090(2), in the event Ecology determines that the exemption from complying with the procedural requirements of the laws referenced in RCW 70.105D.090(1) would result in the loss of approval from a federal agency that is

necessary for the State to administer any federal law, the exemption shall not apply and the Port shall comply with both the procedural and substantive requirements of the laws referenced in RCW 70.105D.090(1), including any requirements to obtain permits.

Q. Financial Assurance

1. Financial assurance for corrective action is required by WAC 173-303-64620. Ecology's Financial Assurance Officer shall determine when the Port's actions and submissions meet the requirements of WAC 173-303-64620.

2. The Port must submit the executed or otherwise finalized financial assurance instruments or documents to Ecology's Financial Assurance Officer. In addition, the Port must also submit copies of financial assurance instruments or documents to Ecology's project coordinator.

3. On January 4, 2011, the Port submitted and Ecology later approved a written cost estimate to cover the following activities at the facility: completion of the CAP, which includes Ecology's selection of a final remedy, post-cleanup monitoring at the Site, and completion of remedial actions for Discrete Units identified on Exhibit C. This estimate is subject to annual adjustments for inflation as set forth in subsection 6 below. If the Port is required to submit an additional work plan(s), or to conduct activities related to corrective action not previously part of the original cost estimate, either of which that comprise a substantial change to work required under this Order as described in Section VIII.L, the following process for review and approval of the estimate shall be used: the Port shall submit a revised cost estimate concurrent with the submission of an additional work plan(s). If Ecology rejects the Port's cost estimate as submitted, Ecology shall provide to the Port a revised cost estimate amount that will be the approved cost estimate. Ecology will, if requested by the Port in writing, provide a written explanation of the variance between the Port's proposed cost estimate and Ecology's approved cost estimate. If Ecology does not accept, reject, or revise the Port's cost estimate within sixty (60) days after submittal, the Port's cost estimate will be deemed approved for purposes of this

paragraph. Ecology reserves the right to review and revise the Port's cost estimate after the 60-day review period. If Ecology revises the Port's cost estimate after the 60-day review period, the Port will have thirty (30) days after the revision to provide an updated financial assurance instrument. Within thirty (30) days after Ecology's final approval of the Port's cost estimate amount or the Port's receipt of Ecology's final approval of the Port's cost estimate amount, the Port shall establish and maintain continuous coverage of financial assurance in the amount of the approved cost estimate and submit the applicable financial assurance documentation per paragraph 2, provided, however, that if the Port uses the financial test mechanism, such documentation shall be timely if submitted within one hundred fifty (150) days of the end of the Port's next fiscal year.

4. If the Port believes that the estimated cost of work to complete activities under this Order has diminished below the amount covered by existing financial assurance provided under this Order, the Port may submit a written proposal to Ecology to reduce the amount of the financial assurance provided under this Section so that the amount of the financial assurance is equal to the estimated cost of the remaining work to be performed. The written proposal shall specify, at a minimum, the cost of the remaining work to be performed and the basis upon which such cost was calculated. If Ecology decides to accept such a proposal, Ecology shall notify the Port of its decision in writing. After receiving Ecology's written decision, the Port may reduce the amount of financial assurance only in accordance with and to the extent permitted by such written decision. Within thirty (30) days after receipt of Ecology's written decision, the Port shall submit the applicable financial assurance documentation per paragraph 2. No change to the form or terms of any financial assurance provided under this Section, other than a reduction in amount, is authorized under this paragraph.

5. All cost estimates must be based on the costs to the owner or operator of hiring a third party to complete the work. A third party is neither a parent nor a subsidiary of the Port. On a case-by-case basis, Ecology may also determine that a company which shares a common

higher-tier corporate parent or subsidiary might not qualify as a third party. A cost estimate may not incorporate any salvage value that may be realized with the sale of wastes, facility structures or equipment, land, or other assets associated with the facility. The Port may also not incorporate a zero cost for wastes that might have economic value.

6. The Port shall annually adjust all cost estimates for inflation. Adjustments for inflation shall be calculated in accordance with the procedure outlined in 40 C.F.R. § 264.142(b).

7. Acceptable financial assurance mechanisms are trust funds, surety bonds, letters of credit, insurance, the financial test, and the corporate guarantee. Ecology may allow other financial assurance mechanisms if they are consistent with the laws of the State of Washington and if the Port demonstrates to the satisfaction of Ecology that those mechanisms provide adequate financial assurance.

8. If the Port is using the financial test or corporate guarantee to meet its financial assurance obligation, the annual inflationary adjustment shall occur within one hundred fifty (150) days after the close of the Port's fiscal year. If the Port is using any mechanism other than the financial test or corporate guarantee, this adjustment shall occur each year within thirty (30) days after the anniversary of the effective date of this Order.

9. If the Port seeks to establish financial assurance by using a surety bond for payment or a letter of credit, the Port shall at the same time establish and thereafter maintain a standby trust fund acceptable to Ecology into which funds from the other financial assurance instrument can be deposited, if the financial assurance provider is directed to do so by Ecology, pursuant to the terms of this Order.

10. The Port shall notify Ecology's project coordinator and Financial Assurance Officer by certified mail of the commencement of a voluntary or involuntary bankruptcy proceeding, naming the Port as debtor, within ten (10) days after commencement of the proceeding. A guarantor of a corporate guarantee must make such a notification if it is named as debtor as required under the terms of the corporate guarantee.

a. Once the Port has established financial assurance with an acceptable mechanism, as described above, the Port will be deemed to be without the required financial assurance:

1) In the event of bankruptcy of the trustee or issuing institution; or

2) If the authority of the trustee institution to act as trustee has been suspended or revoked; or

3) If the authority of the institution issuing the surety bond, letter or credit, or insurance policy has been suspended or revoked.

b. In the event of bankruptcy of the trustee or a suspension or revocation of the authority of the trustee institution to act as a trustee, the Port must establish a replacement financial assurance mechanism by any means specified in WAC 173-303-620 or other financial instrument as approved by Ecology within sixty (60) days after such an event.

11. Ecology's Financial Assurance Officer is:

Name:	Kimberly Goetz
Address:	Washington State Department of Ecology P.O. Box 47600 Olympia, WA 98504-7600
Telephone:	(360) 407-6754
FAX:	(360) 407-6715
Email:	kgoe461@ecy.wa.gov

R. Indemnification

The Port agrees to indemnify and save and hold the State of Washington, its employees, and agents harmless from any and all claims or causes of action for death or injuries to persons or for loss or damage to property to the extent arising from or on account of acts or omissions of the Port, its officers, employees, agents, or contractors in entering into and implementing this Order. However, the Port shall not indemnify the State of Washington nor save nor hold its employees and agents harmless from any claims or causes of action to the extent arising out of

the negligent acts or omissions of the State of Washington, or the employees or agents of the State, in entering into or implementing this Order.

S. Land Use Restrictions

The Port shall record a Restrictive Covenant with the office of the King County Auditor within ten (10) days of the completion of the remedial action described in the CAP. The Restrictive Covenant shall restrict future uses of the Facility or portions thereof. The Port shall provide Ecology with a copy of the recorded Restrictive Covenant within thirty (30) days of the recording date.

IX. SATISFACTION OF ORDER

The provisions of this Order shall be deemed satisfied upon the Port's receipt of written notification from Ecology that the Port has completed the remedial activity required by this Order, as amended by any modifications, and that the Port has complied with all other provisions of this Order.

X. TERMINATION OF 2010 AGREED ORDER

This Order supersedes the June 29, 2010, Order and the 2010 Order is terminated upon the effective date of this Order.

XI. ENFORCEMENT

Pursuant to RCW 70.105D.050, this Order may be enforced as follows:

A. The Attorney General may bring an action to enforce this Order in a state or federal court.

B. The Attorney General may seek, by filing an action, if necessary, to recover amounts spent by Ecology for remedial actions and orders related to the Site.

C. In the event the Port refuses, without sufficient cause, to comply with any term of this Order, the Port will be liable for:

1. Up to three (3) times the amount of any costs incurred by the State of Washington as a result of its refusal to comply; and

2. Civil penalties of up to $25,000 per day for each day it refuses to comply.

D. This Order is not appealable to the Washington Pollution Control Hearings Board. This Order may be reviewed only as provided under RCW 70.105D.060.

Effective date of this Order: _____

PORT OF SEATTLE

By _____
Tay Yoshitani
Chief Executive Officer

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

By _____
Dennis Johnson
Section Manager (Acting)
Hazardous Waste and Toxics Reduction
Northwest Regional Office

Exhibit A

Cleanup Action Plan

FINAL
CLEANUP ACTION PLAN
PORT OF SEATTLE TERMINAL 91 SITE
SEATTLE, WASHINGTON

JUNE 2010

APPROVED BY WASHINGTON DEPARTMENT OF ECOLOGY
IN ATTACHED LETTER DATED DECEMBER 15, 2010

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Northwest Regional Office • 3190 160th Avenue SE • Bellevue, Washington 98008-5452 • (425) 649-7000

December 15, 2010

Kathy Bahnick
Port of Seattle Pier 69
PO Box 1209
Seattle, WA 98117

RE: Document approval and public notice of final documents for the Port of Seattle's Terminal 91 Facility: Permit No. WAD980982706

Dear Ms Bahnick:

The Washington State Department of Ecology (Ecology) Hazardous Waste and Toxics Reduction Program completed its review of the Remedial Investigation/Feasibility Study (RI/FS) and public noticed the documents on February 12, 2010. Ecology found the reports to be in compliance with the requirements of the Model Toxics Control Act; Chapter 173-340 WAC.

The public notice and comment period for the RI/FS concluded on March 29, 2010. One comment was received and addressed without change to the draft documents. Accordingly, the RI/FS reports are formally approved and considered final by Ecology.

In addition, the Draft Cleanup Action Plan, based on the findings in the Feasibility Study was public noticed along with the SEPA determination on October 8, 2010 for a 30-day comment period. Similarly, one comment was received by Ecology during this period. The comment was addressed and the Draft Cleanup Action Plan is now approved and considered final by Ecology.

If you have any questions please contact Galen Tritt, the project manager, directly by phone at (360) 715-5232 or email galen.tritt@ecy.wa.gov . Thank you for your continued cooperation through this process.

Sincerely,

Julie Sellick, Section Manager
Hazardous Waste and Toxics Reduction Program

JS:GHT:sa
By certified mail: 7007 0220 0004 6659 0521

cc: Susan Roth, Roth Consulting
Galen Tritt, Ecology-NWRO
Greg Carron, Ecology-CRO
John A. Level, Attorney General's Office
NWRO Central Records: Port of Seattle, T-91 HZW 6.2

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LIST OF ILLUSTRATIONS

LIST OF ACRONYMS AND ABBREVIATIONS

1998 AO	Agreed Order No. DE 98HW-N108
ACM	Asbestos-Containing Materials
AOC	Area of Concern
API	Asian Pacific Islander
Aspect	Aspect Consulting
BD	Bridge Document
BDR1,2,3	Bridge Document Reports 1, 2, 3
BEI	Burlington Environmental, Inc.
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAO	Cleanup Action Objective
CAP	Cleanup Action Plan
Chempro	Chemical Processors, Inc.
Converse	Converse Consultants NW
CPOC	Conditional Point of Compliance
CSM	Conceptual Site Model
CULs	Cleanup Levels
DCA	Dichloroethane
DCE	Dichloroethene
DNAPL	Dense Non-Aqueous Phase Liquid
Ecology	Washington State Department of Ecology
FAMM	Fuel and Marine Marketing
FS	Feasibility Study
Ft	Feet
GWSAP	Groundwater Sampling and Analysis Plan
HQ	Hazard Quotient
IHS	Indicator Hazardous Substance
Lease Parcel	Terminal 91Tank Farm Lease Parcel
LNAPL	Light Non-Aqueous Phase Liquid
MCL	Maximum Contaminant Level
mg/kg	Milligram per Kilogram
µg/kg	Microgram per Kilogram
µg/L	Microgram per Liter
MLLW	Mean Low Low Water
MNA	Monitored Natural Attenuation
MTCA	Model Toxics Control Act
ND	Non-Detect
NPDES	National Pollutant Discharge Elimination System
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PCE	Perchloroethene
PES	PES Environmental, Inc.

PID	Photoionization Detector
PIONEER	PIONEER Technologies
PLP	Potentially Liable Person
PLRD	Passive LNAPL Recovery Device
PNO	Pacific Northern Oil Corporation
POC	Points of Compliance
PVC	Polyvinyl Chloride
Port	The Port of Seattle
PSC	Philip Services Corporation
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RFA	Terminal 91 RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RI/DE	Remedial Investigation/ Data Evaluation
RSSL	Residual Saturation Screening Level
SPOC	Standard Point of Compliance
SVOC	Semi-Volatile Organic Compound
SWMU	Solid Waste Management Unit
TCA	Trichloroethane
TCE	Trichloroethene
TFAA	Tank Farm Affected Area
TPH	Total Petroleum Hydrocarbon
TSCA	Toxic Substances Control Act
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound
WAC	Washington Administrative Code

1.0 INTRODUCTION

1.1 Purpose

This cleanup action plan (CAP) describes the selected cleanup action for the Terminal 91 Tank Farm Site (Site), a portion of the Port of Seattle's (Port's) Terminal 91 Complex in Seattle, Washington (Figure 1). The CAP has been developed in accordance with the Model Toxics Control Act (MTCA) under Chapter 70.105D of the Revised Code of Washington (RCW) and Chapter 173-340 of the Washington Administrative Code (WAC).

The selected cleanup action is based on site-specific data developed pursuant to Agreed Order No. DE 98HW-N108 (1998 AO) between the Port and the Washington Department of Ecology (Ecology). Specifically, the CAP is based on information provided in the Final Draft Feasibility Study Report, Terminal 91 Site, Seattle, Washington (FS Report; PES Environmental, Inc. et al., 2009), the Remedial Investigation Summary Report for the Terminal 91 Tank Farm Site in Seattle, Washington (RI Summary Report; Roth Consulting, 2007), and documents referenced therein. The FS Report and RI Summary Report are on file at the Ecology Northwest Regional Office located at 3190 160th Avenue SE, Bellevue, Washington, 98008-5452.

1.2 Document Organization

The CAP is organized into 10 sections. A brief description of each section is presented below.

- **Section 1 – Introduction.** Section 1 contains an overview of the CAP.
- **Section 2 – Background.** Section 2 provides a summary of the Site description and history, the investigations conducted at the Site, and the cleanup actions previously performed at the Site.
- **Section 3 – Site Conditions.** Section 3 discusses the hydrogeology and groundwater conditions at the Site.
- **Section 4 – Nature and Extent of Contamination.** Section 4 discusses the nature and extent of contamination in Site soil and groundwater.
- **Section 5 – Conceptual Site Model.** Section 5 outlines contaminant sources of, exposure pathways to, and potential receptors of, Site-related contamination.
- **Section 6 – Cleanup Standards.** Section 6 discusses groundwater cleanup levels (CULs), points of compliance (POC), areas exceeding CULs, and also summarizes the regulatory requirements applicable to the cleanup.
- **Section 7 – Approach to Developing Cleanup Action Alternatives.** Section 7 briefly presents the cleanup action objectives (CAOs) for the Site and summarizes the approach used in the FS for developing cleanup action alternatives (CAAs).

- **Section 8 – Description of Selected Cleanup Action Alternatives.** Section 8 provides a description of the selected CAA for the Site, including the presumptive cleanup actions and the selected tank farm CAA, and also summarizes the other five CAAs that were developed and evaluated in the feasibility study for the tank farm portion of the Site.

- **Section 9 – Justification for Selected Cleanup Action Alternative.** Section 9 summarizes how the selected CAA meets the MTCA evaluation criteria and the disproportionate cost analysis.

- **Section 10 – Implementation of the Selected Cleanup Action.** Section 10 outlines the approach for implementing the selected CAA and provides a general implementation schedule.

1.3 Declaration

In accordance with WAC 173-340-360(2)(a), the selected cleanup action meets the threshold requirements, is protective of human health and the environment, complies with applicable state and federal laws, and provides for compliance monitoring. The selected remedy is consistent with the preference of the State of Washington as stated in RCW 70.105D.030(1)(b) for permanent cleanup solutions.

1.4 Applicability

The cleanup standards and the selected cleanup action have been developed as an overall remediation process under Ecology oversight using MTCA authority; they should not be considered as setting precedents for other sites.

1.5 Administrative Record

The documents used to make the decisions discussed in this CAP are part of the administrative record for the Site. The entire administrative record for the Site is available for public review by appointment at Ecology's Northwest Regional Office. To review or obtain copies of the above documents, contact Sally Perkins (Public Disclosure Coordinator) at (425) 649-7190. Information related to the Site, the location of document repositories, and many of the important documents are also available online at the following website: http://www.ecy.wa.gov/programs/tcp/sites/portTerm91/portTerm91_hp.html.

2.0 BACKGROUND

2.1 Site Description

The Site is defined in the 1998 AO as "the Tank Farm Lease Parcel and areas where releases of dangerous constituents originating from the Tank Farm Lease Parcel operations have come to be located." The Tank Farm Lease Parcel (Lease Parcel) is a contiguous parcel, approximately four acres in size, located within the confines of the Port's Terminal 91 Complex. The Terminal 91 Complex is located at 2001 West Garfield Street, Seattle, Washington and encompasses approximately 216 acres, including adjacent submerged and upland areas. The site location map is provided as Figure 1.

Figure 2 is an aerial photograph of the Terminal 91 Facility showing the approximate boundaries of the Site (also known as the Tank Farm Affected Area or TFAA), the Lease Parcel, and other portions of the larger Terminal 91 Complex including the Upland, Short Fill, and Submerged Land portions.

The Lease Parcel is located at the north end of the Site. The primary historical feature of the Lease Parcel is the bulk petroleum storage present from the 1920s through 2005. The aboveground portion of the tank farm, including all of the tanks and containment walls and other aboveground piping and equipment, was demolished and removed in 2005 as part of an interim remedial action. The Lease Parcel consisted of three tank yards and associated buildings and is divided into the following areas (Figure 3):

- **The Black Oil Yard** located at the south end of the Lease Parcel. This yard consisted of three large tanks used to store heavy fuel oils (e.g., Bunker C);
- **The Marine Diesel Oil Yard** located in the center of the tank farm. This yard consisted of 12 main tanks that were used to store a variety of products including diesel, kerosene, and other middle distillates as well as wastewater and waste oil;
- **The Small Yard** was located at the north end of the tank farm and consisted of 10 main tanks and a number of smaller tanks. The small yard was used to store a variety of petroleum products including gasoline and diesel and also wastewater and a variety of other waste materials.
- **The main warehouse** is located just north of the three tank yards. This building still exists at the Site; and
- **Additional areas** including the pipe alley between the Small Yard and the Marine Diesel Oil Yard, the decommissioned oil-water separator west of the Small Yard, and the foam mixing area at the north end of the Lease Parcel.

The Black Oil Yard and the Marine Diesel Oil Yard were surrounded by concrete product-containment walls approximately 15 feet (ft) high. The Small Yard was surrounded by a concrete product-containment wall approximately three ft high. All three tank yards were fully paved with concrete; the Small Yard was paved in 1982 while the paving of the Marine Diesel Oil and Black Oil Yards occurred in 1986. Aboveground and subsurface piping systems were used to transfer product within the tank yards.

2.2 Site History and Development

This section describes the history of the Terminal 91 Complex and its development from the late 1800s through the present day.

2.2.1 History of the Tank Farm Lease Parcel and Related Operations

From the late 1800s through 1920, owners of the Terminal 91 Complex included various railroads, land development companies, and private individuals. The Great Northern Railroad began to develop the area in the early 1900s by filling the area between Magnolia Bluff and Queen Anne Hill. Fill material was added to the area through 1920.

The tank farm at the Lease Parcel was constructed in the 1920s. The Lease Parcel initially may have been used as a gasoline refinery by California Petroleum Company as early as 1925 (Converse Consultants NW [Converse], 1993). The Texas Company appears to have operated the tank farm as a fuel storage facility in the late 1920s and 1930s. The U.S. Navy acquired the entire Terminal 91 Complex in 1942 through condemnation, and operated the tank farm until 1972. During the Navy's possession of the Terminal 91 Complex, the Lease Parcel was used primarily as a fuel and lubricating oil transfer station. The Navy began leasing the Terminal 91 Complex back to the Port in 1972 and deeded it to the Port in 1976.

At about the time the Port leased Terminal 91 back from the Navy, Chemical Processors, Inc. (Chempro), a predecessor of Burlington Environmental, Inc. (BEI) and Philip Services Corporation (PSC), subleased the Lease Parcel from the Port. The main activities conducted by Chempro and its successors were waste oil recovery and wastewater treatment. Beginning in 1980, Chempro applied for and was granted interim status under the Resource Conservation and Recovery Act (RCRA) and began dangerous waste management activities at the Lease Parcel. BEI and the Port (as operator and owner, respectively) were issued a Part B RCRA permit effective August 22, 1992 for the continued operation of a permitted dangerous waste management facility at the Lease Parcel. In September 1995, BEI ceased operations at the Lease Parcel and terminated its lease with the Port; no dangerous waste operations requiring a permit (other than corrective action) have been conducted since then. All regulated waste units at the Lease Parcel have undergone closure.

From approximately 1974 through 1999, Pacific Northern Oil Corporation (PNO) sublet a portion of the Lease Parcel for storage of non-regulated bunker oil and other fuel products. PNO used aboveground and underground piping systems at the Site to transfer bunker oil and fuels within the Lease Parcel and other areas of the Terminal 91 Complex. The Port entered into an agreement with Fuel and Marine Marketing (FAMM), who conducted bunker oil and fuel product storage, blending and marketing operations at the Site until early 2003, when FAMM terminated its lease.

Because the facility would no longer be used as a tank farm, the Port decided to remove the remaining aboveground equipment to reduce risks of hazardous substance releases. In the spring of 2005, the Port initiated product removal, demolition activities, and paving of the Lease Parcel as part of an independent interim remedial action. That interim action was completed in the

summer of 2005. An independent cleanup report documenting the interim action was submitted to Ecology on October 20, 2005 (Roth Consulting, 2005).

2.2.2 History of the Vicinity Surrounding the Tank Farm Lease Parcel

Another tank farm was historically located in the area southwest of the Lease Parcel. This former tank farm was identified as the Old Tank Farm and was called out as Area of Concern (AOC) 11 in the Terminal 91 RCRA Facility Assessment (RFA) (EPA, 1994). Figure 2-4 shows the approximate footprint of the Old Tank Farm (AOC 11). The former tank farm in AOC 11 was reportedly active between 1927 and 1942. Operators included Signal Oil & Gas and Richfield Oil Company. This tank farm was demolished subsequent to the United States Department of the Navy taking possession of the site in December 1942.

Other areas of interest at the Site include Solid Waste Management Unit (SMWU 30), which is the location of a pipeline break that occurred in 1989 near the north end of Pier 91 (Figure 4), and former fuel transfer pipelines that ran in and around the Lease Parcel and out towards Piers 90 and 91.

2.3 Previous Investigations

A number of investigations were performed at the Site between 1985 and 2008 that have characterized the types and distribution of contaminants in soil and groundwater and provide the basis for developing and evaluating the cleanup actions for the Site. These investigations, divided into two general time periods (pre- and post-1998 AO), are summarized in this section.

2.3.1 Pre-1998 Agreed Order Site Investigations

Prior to the 1998 AO, a number of investigations were conducted. These pre-1998 AO investigations provided the basis for the more comprehensive Remedial Investigation (RI) investigation conducted pursuant to the Agreed Order. The primary pre-1998 investigations include:

- **Phase I Hydrogeologic Investigation, 1988:** A Phase I Hydrogeologic Investigation of the Site was completed in 1988 (Sweet-Edwards/EMCON, 1988) to provide a preliminary environmental characterization.
- **Phase II Hydrogeologic Investigation, 1989:** A Phase II Hydrogeologic Investigation of the Site was completed in 1989 (Sweet-Edwards/EMCON, 1989) to meet the requirements of BEI's RCRA 3013 Order.
- **RCRA Facility Investigation, 1992/1993:** BEI performed RCRA Facility Investigation (RFI) fieldwork at the Site between 1992 and 1993 in accordance with the final April 1992 RFI Work Plan (BEI, 1992). The results of these activities were reported in the draft RFI for the Site (BEI, 1995).

The results of these investigations were used as the primary basis for development of the Remedial Investigation/Data Evaluation (RI/DE) Report (PSC et al., 1999).

2.3.2 1998 Agreed Order RI/FS Site Investigations and Evaluations

RI/DE Report. The Agreed Order required the Potentially Liable Person (PLP) group, which included the Port, PSC, and PNO, to prepare the RI/DE Report (PSC et al., 1999). The primary objective of the RI/DE Report was to provide a comprehensive report of investigative work completed to date to assist in preparation of a feasibility study and selection of potential cleanup actions.

Bridge Document Investigations. The Draft RI/DE Report identified several data gaps, and the PLP group concluded that additional work would be necessary prior to evaluating cleanup options for the Site in an FS. This additional data was collected between 2000 and 2004 in a series of "Bridge Document" (BD) investigations. The findings of this work were presented in the BD Report 1 (BDR1; Roth Consulting, 2001), BDR2 (Roth Consulting, 2003), and BDR3 (Aspect Consulting [Aspect], 2004a), soil vapor investigation reports (PSC, 2001 and 2002; PIONEER Technologies [PIONEER], 2004), related work plans (Aspect, 2004b), and a groundwater sampling and analysis plan (PSC, 2003).

The primary tasks performed as part of the BD investigations included the following:

- Identification of potential exposure pathways, analysis of the highest beneficial use of groundwater, determination that a terrestrial ecological exclusion was warranted, development of screening levels for groundwater based on site-specific potential exposure pathways and highest beneficial use of groundwater, and assessment of potential points of compliance for groundwater;
- Assessment of monitoring well locations and the then-current sampling program, and preparation of the *Groundwater Sampling and Analysis Plan* (GWSAP) (PSC, 2003).
- Performance of tidal studies in the shallow and deep aquifers;
- Assessment of potential stratification of contaminants in groundwater by depth-specific groundwater sampling;
- Collection of light nonaqueous phase liquids (LNAPL) samples and LNAPL bail-down testing to assess the composition and potential for recovery of LNAPL from the water table;
- Compilation of bulkhead construction data and a review of underground utilities information to assess the potential for contaminant migration along preferred pathways;
- Revision of the conceptual site model (CSM) for the Site; and
- Performance of several soil vapor investigations in the vicinity of Building M-28, located immediately to the southwest of the Lease Parcel to assess the potential for migration of volatile organic compounds (VOCs) from the subsurface into the building;

Groundwater Seepage Investigation. A groundwater seepage evaluation was performed in 2004 to refine the CSM. The work performed included modeling the Shallow Aquifer along the piers and the Deep Confined Aquifer from upland areas to the downgradient offshore limit of the Deep Confined Aquifer using the U. S. Geological Survey (USGS) groundwater flow model

MODFLOW; evaluation of groundwater discharge to Elliott Bay, and recommendation of compliance monitoring wells and an approach for evaluating groundwater compliance.

Monitored Natural Attenuation Evaluation. An evaluation of monitored natural attenuation (MNA) was conducted in 2005 and 2006 to evaluate the effectiveness of MNA as a remedial technology at the Site. The evaluation was completed by considering data collected along three groundwater flow paths from the former tank farm: Pier 90, Pier 91, and AOC 11. Source, plume, and sentinel wells were used along each flow path. The MNA evaluation showed concentrations of site-related constituents below the screening levels at the sentinel wells, a generally stable or shrinking groundwater plume, and strong indications that biodegradation is occurring along each of the three flow paths evaluated.

Data Gaps Investigation. A series of three data gaps investigations was conducted in 2006 and 2007 to provide the data necessary to conduct the soil-to-groundwater pathway evaluation. The primary focus of the first two phases of the data gaps investigation was to characterize the distribution of total petroleum hydrocarbons (TPH) in the source areas of the site (i.e., Lease Parcel, AOC 11, SMWU 30), to evaluate the distribution of LNAPL, and provide the basis for developing site-specific Residual Saturation Screening Levels (RSSLs). The primary focus of the third phase of the data gaps investigation was to evaluate polychlorinated biphenyl (PCB) concentrations in soil west of the pumphouse area, in the Small Yard, and in the Marine Diesel Oil Yard in order to develop disposal costs for use in soil excavation cleanup alternatives.

Development of RSSLs. An evaluation of RSSLs was conducted in an attempt to estimate the maximum residual soil concentrations at which LNAPL will not accumulate on or in groundwater. The evaluation focused on the Lease Parcel and immediately adjacent areas, using reported spills and releases to target specific hazardous substances for evaluation. Based on the comparison of TPH concentrations in data gaps investigation soil samples, shallow monitoring well LNAPL monitoring results, and RSSLs, the evaluation determined that the many complex and competing factors at the Site do not allow clear or precise conclusions regarding the comparison of TPH concentrations in soil, RSSLs, and presence or absence of LNAPL at the Site as a whole (i.e., including Lease Parcel, AOC 11, and SWMU 30). These factors also do not allow for the development of a Site-wide empirical demonstration that measured soil concentrations either will or will not result in the accumulation of LNAPL on or in groundwater.

LNAPL Monitoring Program. The nature and extent of LNAPLs at the Site has been investigated through measurements conducted generally at least monthly since February 1992 LNAPL accumulations (including a sheen to measurable LNAPL) have been detected in 23 current or former wells within the Site.

As part of the FS work described in the FS Work Plan (PES et al., 2005), CP-PR01 and CP-PR02 were installed in August 2005 for use in a pilot study. The purpose of the pilot study was to evaluate the recoverability of LNAPL at the Lease Parcel. CP-PR01 and CP-PR02 were installed at locations where former wells showed the highest LNAPL recovery rate, near CP-117 and CP-118, respectively. From the time of installation until the early November 2005 monthly LNAPL monitoring event, only sheens were detected in the two pilot study wells. Therefore, the two pilot study wells were incorporated into the monthly LNAPL monitoring program. Wells

CP-PR03 through CP-PR12 were installed in October 2007 as part of the data gaps investigation discussed above.

Groundwater Monitoring Program. Groundwater monitoring has been conducted at the site on an ongoing basis since the 1998 Agreed Order has been in place. Over time, the parameters of the monitoring program (e.g., number of wells, chemicals analyzed, and frequency of monitoring) have changed with the approval of Ecology. Groundwater monitoring is currently being performed at the Site on an annual basis using selected wells. The current groundwater monitoring program consists of: (1) annual monitoring of 8 Shallow Aquifer monitoring wells and 5 Deep Confined Aquifer monitoring wells during the dry season (September/October) and (2) samples are analyzed for TPH as gasoline, diesel, and lube-oil-range hydrocarbons; low-level polycyclic aromatic hydrocarbons (PAHs); selected semi-volatile organic compounds (SVOCs) including carbazole, dibenzofuran, and 1-methylnaphthalene; selected VOCs including 1-4 dichlorobenzene and vinyl chloride; and the metals arsenic and zinc.

2.4 Previous Site Closure and Cleanup Activities

This section summarizes the previous closure activities and other interim cleanup actions conducted at the Site. Many of these historical actions have focused on the former tank farm and the Lease Parcel, but other cleanup actions outside the Lease Parcel but within the Site boundaries are also described.

2.4.1 RCRA Closure Activities

In 1997, PSC performed aboveground closure activities of all RCRA Part B permit related facility equipment, secondary containment, and treatment units, pursuant to a closure plan approved by Ecology (PSC, 1996). Specific activities conducted during the closure included decontamination of the various concrete structures using high-pressure water spraying followed by abrasive blasting, cleaning of Tank 164 (portable tank not shown in FS figures but located immediately northwest of Tank 110) and ancillary equipment (associated piping), and collection of concrete chip samples from tank yards in the vicinity of loading pads and sumps to confirm closure standards were met. These closure activities were documented and closure was certified in a letter PSC submitted to Ecology in 1997 (PSC, 1997). The aboveground closure was approved by Ecology in October 2003 (Ecology, 2003). The rest of the Lease Parcel previously used to store dangerous waste was closed under an interim status closure plan (PSC, 1997).

2.4.2 LNAPL Recovery at SWMU 30

This SMWU is the location of a pipeline break that occurred in 1989, near the north end of Pier 91 (Figure 4). In 1989, oil was observed seeping into the Short Fill Impoundment. After a series of investigations in 1989 and 1990, it was confirmed that the oil was the result of a pipeline failure, and the section of pipeline around the area of contamination was abandoned by PNO (Converse GES, 1990). An interim product extraction system for free product recovery began operation in January 1991 (Converse, 1994). The system operated as a skimming system in recovery well EW-1. During 1991 and 1992, the system removed about 53.5 gallons of liquid hydrocarbons.

Product thickness was observed to increase downgradient with time, and in March 1993 a passive skimming system also was installed in downgradient monitoring well MW-102. By April 1994, the system had recovered about 76.4 gallons of liquid hydrocarbons. Because of the poor recovery rates, the pneumatic recovery system was decommissioned in 1994 and passive LNAPL skimming systems were then installed in three monitoring wells (EW-1, MW-102, and MW-3). By early 2002, the total LNAPL recovered from the three skimmers since their installation in April 1994 was about 23.3 gallons (Aspect, 2002). PNO discontinued the quarterly monitoring and LNAPL recovery program in 2002. The Port is currently monitoring the fluid levels in these wells as part of the annual ground water monitoring program for the Site. The Port also has added wells in this area containing LNAPL to its regular monitoring and LNAPL-removal program.

2.4.3 2005 Tank Farm Demolition Interim Remedial Action

In the spring and early summer of 2005, the Port performed an independent interim remedial action known as the Tank Farm Demolition (Tank Farm Demo). The Tank Farm Demo consisted of the demolition and removal of aboveground fuel storage tanks, fuel stations, pump stations, water and waste piping, steam boiler, structures, and all incidental equipment. At the time the Tank Farm Demo was initiated, the tanks contained various fuel products which were removed for recycling or disposal. Other activities included removal and disposal of asbestos-containing materials (ACM), removal and disposal of petroleum-impacted soil from pipe chases, and purging of three underground fuel transmission lines from the tank farm to the fuel riser station on Pier 90. Once the demolition activities were completed, the Lease Parcel and adjacent, previously unpaved areas were paved. The independent interim remedial action report (Roth Consulting, 2005) documenting these activities was submitted to Ecology.

2.4.4 Seeps Remedial Actions

After demolition of the former tank farm and repaving of the area in 2005, three oily seeps (Seeps 1, 2, and 3) appeared on the pavement surface at three locations in the summer of 2006 with a fourth appearing in 2007 (Figure 5). The sources were identified as oily sand within the double-layered tank bases, which had been left in place as part of the demolition activities. The oily sand was removed and disposed of at a permitted facility, and the locations were backfilled with clean soil and repaved. At Seeps 2 and 4, a utility-type vault was installed to allow for ongoing collection of oil which is recovered and disposed of with LNAPL recovered from LNAPL monitoring wells.

2.4.5 Fuel Pipeline Cleaning Remedial Actions

In June 2007, the Port performed an interim remedial action along the west side of the Lease Parcel at the location of a water line break. In order to access the water line for repair, the Port needed to cut and remove some underground fuel lines at this location (Figure 5). Specific remedial activities included removal and recycling of less than 50 gallons of oil from the pipes, removal of several small sections of pipe, and plugging the remaining cut sections of the pipe that remained in place with grout.

In July, 2008, during excavation activities conducted along the southeast corner of the Lease Parcel as part of the Port's Seattle City Light Duct Bank project, PCS discovered an underground fuel pipeline that had not been decommissioned. The interim remedial action that was performed in September 2008 consisted of removing the oil from the pipeline (Figure 5), cleaning the pipeline, and disposing of the oil and piping at appropriate facilities.

2.4.6 Limited Soil Excavation Remedial Action

During excavation activities outside the southeast corner of the Lease Parcel as part of the Seattle City Light Duct Bank project, soil was encountered with concentrations of TPH exceeding MTCA Method A CULs (Figure 5). The contaminated soil was located to the north of the September 2008 pipeline cleaning remedial action location (see Section 2.4.5) and appears to be unrelated. Approximately 252 tons of soil were stockpiled, sampled, and subsequently disposed of as non-dangerous TPH-contaminated soil.

2.4.7 Tanks Farm LNAPL Recovery Program and Pilot Study

In the fall of 1999, passive LNAPL recovery devices (PLRDs) were installed in eight wells that contained or had previously contained LNAPL. At that time, a monthly product monitoring/recovery program was initiated to monitor the occurrence of LNAPL in these wells and to recover LNAPL. Since that time, five of the wells within the Lease Parcel have been decommissioned (prior to initiation of the Tank Farm Demo) and 13 new LNAPL monitoring/pilot study wells have been installed. About 140 gallons of LNAPL/water mixture have been removed from one or more of the 24 LNAPL monitoring/pilot study wells and two seeps since the first PLRDs were installed in October 1999 through the end of 2009.

3.0 SITE CONDITIONS

3.1 Environmental Setting

The Site is located at the Terminal 91 Complex, which encompasses approximately 216 acres, including adjacent submerged and upland areas (Figures 1 and 2). The Site lies at the south end of the Interbay Region, which is approximately 1.5 miles long and 1,000 to 2,000 ft wide and extends from the Lake Washington Ship Canal on the north to Elliott Bay on the south. The Interbay Region lies within a larger physiographic region, known as the Puget Sound Lowland, which is underlain by thousands of feet of unconsolidated glacial and non-glacial sediments.

Both the upland areas and piers at the Site overlie a portion of the Smith Cove inlet that was initially modified by filling in the early 1900s. Adjacent surface water bodies include Elliott Bay and the Short Fill Impoundment, an isolated water body located just south of the Garfield Street Viaduct. Bulkheads of various types bound the seaward portions of the Site and form the perimeter of the fill-cored piers. The east, center and west slips adjacent to the piers have been maintained to dredged depths of about -35 ft mean low low water (MLLW). An exception to this is the landward ends of the east and west slips, where four intertidal habitat sites are located (two on the northeast corner of the east slip and two on the west margin of the west slip).

No drinking water supply wells are present on or downgradient from the Site. Two deep water-supply wells (screened or perforated at depths of greater than about 250 ft below ground surface [bgs]), neither of which is currently in use, have been identified within approximately a one-half-mile radius of the Lease Parcel. Both wells are within the Terminal 91 Complex owned by the Port. The BDR1 (Roth Consulting, 2001) concluded that groundwater at the Site is non-potable.

3.2 Hydrogeology

Analysis of the geologic and hydrogeologic data collected during investigations at the Site indicates the presence of five primary hydrostratigraphic units beneath the Lease Parcel, which roughly correspond to the five primary stratigraphic units present at the Site. The list below summarizes the five hydrostratigraphic units and their corresponding stratigraphic units.

- **Shallow Aquifer (Shallow Sand Unit).** The Shallow Aquifer is unconfined, and contains an unsaturated zone extending from ground surface to approximately 5 ft bgs. The saturated thickness of the Shallow Aquifer is estimated to be about 10 to 15 ft. The Shallow Aquifer is laterally continuous across the Lease Parcel.
- **Upper Confining Unit (Silty Sand Unit).** The Upper Confining Unit is fully saturated and appears to be laterally continuous across the Lease Parcel. The unit is thickest (approximately 29 ft) along the eastern boundary of the Lease Parcel and thins to between 13 and 15 ft along the western boundary of the Lease Parcel.
- **Intermediate Zone (Gravel Layer within Silty Sand Unit).** This unit is a moderately to poorly sorted, silty sandy Gravel Layer was encountered within the Silty Sand Unit at some boring locations and is referred to as the Intermediate Zone in the cross-sections.

- **Deep Confined Aquifer (Deep Sand Unit).** The Deep Confined Aquifer appears to be laterally continuous across the southern and central portions of the Lease Parcel. It is uncertain if the Deep Confined Aquifer exists beneath the northern portion of the Site. The Deep Confined Aquifer is confined above by the Silty Sand Unit (Upper Confining Unit) and below by the Silty Clayey Sand Unit (Lower Confining Unit).
- **Lower Confining Unit (Silty Clayey Sand Unit).** The Silty Clayey Sand Unit is composed of soft to stiff, olive to gray, fine-grained sediments, primarily silty clay and clayey silt, with lesser amounts of silt and silty, clayey sand. The top of the Silty Clayey Sand Unit is shallowest beneath the eastern portion of the Lease Parcel, where it occurs as shallow as 42 ft bgs, in boring CP-106B. Depth to the top of the unit increases to the south and west, with the top of the unit in excess of 100 ft bgs beneath the middle portions of Piers 90 and 91 (Hart Crowser 1999, 2002).

3.3 Groundwater

3.3.1 Flow Direction and Velocity

Shallow Aquifer. Water level data collected in conjunction with a groundwater seepage evaluation (Aspect, 2004b) and during routine monitoring of monitoring wells at the Site show that the dominant unconfined groundwater flow direction is towards the south beneath the Lease Parcel and to the southwest beneath AOC 11 (Figure 7). Water levels in the wells typically range between 3 and 7 ft below ground surface (Aspect, 2004b) and generally correspond to seasonal variations in precipitation rates, with the highest water levels observed during the wetter winter months. The typical Site horizontal gradient beneath the Lease Parcel is approximately 0.001 ft per foot (Aspect, 2004b).

South of the Lease Parcel, water levels and tidal response data indicate that the relatively impermeable east-west trending, shore-parallel bulkheads and fine-grained Short Fill soil exert significant control over Shallow Aquifer groundwater flow, effectively "channeling" groundwater between the bulkheads within the inner portions of Piers 90 and 91. The shore-parallel bulkhead west of Pier 91 appears to direct shallow groundwater flow to the west southwest of AOC 11. Hence, the Short Fill itself does not appear to be within the flow path of shallow groundwater originating from the Site.

Aspect (2004a) reported that downward vertical gradients between the Shallow Aquifer and Deep Confined Aquifers were noted throughout the Site. Vertical gradients ranged from approximately 0.018 to 0.040 ft/foot, with vertical gradients decreasing to the south. Despite the presence of downward vertical gradients, significant downward movement of Shallow Aquifer groundwater under most of the Site is considered unlikely due to the low measured vertical permeabilities in the upper confining unit. From the southeast corner of the Lease Parcel southward where the upper confining unit appears to be absent, some net movement of Shallow Aquifer groundwater into the Deep Confined Aquifer is likely occurring.

Deep Confined Aquifer. Tidally-averaged groundwater elevation data (Aspect, 2004a) confirm that the groundwater flow direction in the Deep Confined Aquifer beneath and shoreward of the Lease Parcel is towards the south. As in the Shallow Aquifer, water levels in the Deep Confined

Aquifer respond to seasonal variations in precipitation rates, with the highest water levels observed during the wetter winter months. The typical Deep Confined Aquifer horizontal gradient is relatively constant at approximately 0.003 ft/foot beneath the Site, with a flattening of the horizontal gradient beneath and southward of the east-west trending, shore-parallel bulkheads. Unlike in the Shallow Aquifer, most of the existing shore-parallel and pier-perimeter bulkheads do not exert an influence on groundwater flow in the Deep Confined Aquifer due to their shallow depth.

3.3.2 Tidal Influence and Seepage

The shore-parallel bulkheads and the fine-grained Short Fill soil at the Site exert significant control over Shallow Aquifer flow, effectively "channeling" groundwater between the bulkheads within the inner portions of Piers 90 and 91. Shallow groundwater enters the fill in the piers and then discharges to Elliott Bay, apparently from the more seaward portions of the piers, where the pier bulkheads appear to exert less control on groundwater flow. In the case of the Deep Confined Aquifer, the existing shore-parallel and pier-perimeter bulkheads generally do not appear to affect groundwater flow or tidal influence, resulting in discharge to Elliott Bay parallel to the shoreline, either where the Deep Confined Aquifer crops out or through sediments.

Groundwater models of Pier 90 and Pier 91 were used to evaluate groundwater seepage along the pier faces. A flow budget analysis was used to compute the percent of inflow that discharges along the pier faces. Areas of relatively high or low seepage are a factor in determining compliance monitoring strategies for each pier.

The model-predicted percent discharge for the two pier models, plotted along the faces of Piers 90 and 91, is shown in Figure 8. The plots show cumulative discharge along the pier. Higher rates of groundwater discharge occur in segments along the pier where the slope of the cumulative discharge line is steep. For each pier, the east and west faces are plotted separately. More groundwater discharges along the face with the higher cumulative discharge (i.e. the east face of both piers). Residual discharge not accounted for on the cumulative plots discharges through the outer end of the piers.

The discharge analysis for the Deep Confined Aquifer indicates that discharge from the Deep Confined Aquifer is nearly uniformly distributed between the vacated Smith Cove Waterway between Piers 90 and 91 and the slip east of Pier 90. Groundwater in the Deep Confined Aquifer flows toward Elliott Bay from the north and discharges to Elliott Bay in areas where the Upper Confining Unit is missing. The Upper Confining Unit is missing throughout the vacated Smith Cove Waterway and much of the waterway on the east side of Pier 90. However, sediments do not allow groundwater to discharge only at the head of the waterways. Consequently, groundwater seeps offshore, and the groundwater discharge is distributed in different parts of the waterways.

4.0 NATURE AND EXTENT OF CONTAMINATION

4.1 LNAPL

NAPL monitoring at the Site has been ongoing since February 1992. LNAPL has been detected only in the Shallow Aquifer. Dense NAPL (DNAPL) has not been detected in any well, and historical and technical data do not indicate potential for a DNAPL source. Apparent LNAPL thicknesses measured in the monitoring wells varies seasonally, with LNAPL thicknesses generally decreasing during periods of rising water levels. LNAPL accumulations (including a sheen to measurable LNAPL) have been detected in the following current or former 23 wells within the Site:

- **Small Yard:** existing wells CP-PR01, CP-PR11, and CP-PR12, and former wells CP-116 and CP-117;
- **Marine Diesel Oil Yard:** existing wells CP-PR02, CP-PR07, and CP-PR08, and former wells CP-118 and CP-119;
- **Black Oil Yard:** existing wells CP-PR03 and CP-PR04, and former well CP-109;
- **Between the Lease Parcel and AOC 11:** existing wells CP-107, CP-110, UT-MW39-2, and UT-MW39-3;
- **AOC 11:** PNO-MW104[1]; and
- **SWMU 30:** existing wells PNO-EW1, PNO-MW03, PNO-MW06A, PNO-MW102, and PNO-MW103.

Table 1 provides a summary of the historical LNAPL monitoring data and the maximum apparent product thickness measured in 2008. Historically, the apparent LNAPL thicknesses measured in the monitoring wells varied seasonally, with LNAPL thicknesses generally decreasing during periods of rising water levels. Currently, the wells with the thickest accumulations of LNAPL are located in and directly to the west of the Lease Parcel. In 2008, LNAPL accumulations have been detected in the following 11 wells within the Site (see Figure 7):

- **Small Yard:** CP-PR01, CP-PR11, and CP-PR12;
- **Marine Diesel Oil Yard:** CP-PR02 and CP-PR07;
- **Black Oil Yard:** CP-PR03 and CP-PR04;
- **Between the Lease Parcel and AOC 11:** CP-110, UT-MW39-2, and UT-MW39-3;
- **AOC 11:** PNO-MW104; and
- **SWMU 30:** none.

[1] Although well PNO1MW104 is located in the extreme eastern edge of AOC 11, LNAPL observed at this location is likely related to releases from operations in the former pipeline corridor located between AOC 11 and the Lease Parcel.

LNAPL characteristics data have been collected from several of the original LNAPL monitoring wells in the Lease Parcel, the adjacent former pipeline area, and from data gap investigation wells. Recent LNAPL density and viscosity testing data supports the historical understanding that the LNAPL may include a mixture of petroleum products (Aspect, 2004a) with a predominance of diesel-range hydrocarbons (PSC et al., 1999). Test results for the LNAPL sample collected from CP-PR04 indicates that the LNAPL in the Black Oil Yard may be distinct from the LNAPL in other areas of the Site. The LNAPL in CP-PR04 has a viscosity that is similar to a heavier fuel oil, typical of the bulk petroleum product historically stored in the Black Oil Yard.

4.2 Soil

Soil sampling at the Site can be divided into two general time periods: (1) the sampling conducted from 1992 through 1995 that is summarized in the RI/DE Report (PSC et al., 1999) which evaluated a broad range of contaminants including VOCs, SVOCs, TPH, PCBs, and metals; and (2) sampling associated with the data gaps investigations conducted in 2007 and 2008 which focused on TPH and PCBs. In the summary below, information for VOCs, SVOCs, and metals is taken exclusively from the RI/DE Report while the TPH and PCB discussions are based primarily on the data collected in the data gaps investigations.

4.2.1 VOCs

Twenty VOCs were detected in soil samples collected at the Site. The VOC detections included low levels of 12 chlorinated VOCs (perchlorethene [PCE], trichloroethene [TCE], cis-1,2-dichloroethene [cis-1,2-DCE], 1,2-DCE (total), 1,1,1-trichloroethane [TCA], 1,1,1-dichloroethane [1,1,1-DCA], chloroethane, chloroform, methylene chloride, chlorobenzene, Freon 113, and 1,1-dicloropropene) and 8 non-chlorinated VOCs (acetone, benzene, 2-butanone, carbon disulfide, ethylbenzene, 2-hexanone, toluene, and total xylenes). The detections were in samples collected from borings in or near the former Lease Parcel tank yards.

Benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds represent the most widely distributed group of VOCs in Site soil, detected in all but three borings (PSC et al., 1999). The highest concentration of total BTEX (5,000 milligram/kilogram [mg/kg]) was found in a soil boring in the eastern portion of the Small Yard, with concentrations above 10 mg/kg in other borings drilled in the Lease Parcel tank yards. PSC et al. (1999) reported that the distribution of BTEX compounds in soil was consistent with the distribution of LNAPL observed in Site wells. The highest concentrations of benzene were found in a boring just outside the northeast corner of the Small Yard, and the highest concentrations of toluene were found in borings in the Small Yard.

4.2.2 SVOCs

SVOCs were detected in most borings drilled at the Site. The detected SVOCs consisted of:

- PAHs: Naphthalene, 2-methylnaphthalene, acenaphthalene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene;

- Phthalates: di-n-butyl phthalate, butylbenzylphthalate, bis(2-ethylhexyl) phthalate, and di-n-octylphthalate; and

- Other SVOCs: 1,2,4-trichlorobenzene, 4-chloro-3-methylphenol, benzyl alcohol, dibenzofuran, and N-nitrosodiphenylamine.

Total PAH compounds in concentrations greater than 10,000 micrograms/kilogram (µg/kg) and total phthalate concentrations in excess of 40,000 µg/kg were detected in soil samples from each of the three Lease Parcel tank yards.

1,2,4-trichlorobenzene, n-nitrosodiphenylamine, benzyl alcohol, and dibenzofuran were only detected in single borings located in or east of the Small Yard.

4.2.3 TPH

Soil sampling has shown the widespread occurrence of TPH in shallow soil at the Site. Most of the samples have been collected in and near the Lease Parcel, although, samples have also been collected in AOC 11 and SMWU 30.

The highest concentrations of gasoline range TPH (up to 22,000 mg/kg) are contained in smear zone samples from soil borings in the Small Yard, the northern end of the Lease Parcel, and the southern end of AOC 11. The highest concentrations of diesel range TPH (up to 130,000 mg/kg) and motor oil range TPH (up to 41,000 mg/kg) are contained in vadose and smear zone samples from soil borings in the Marine Diesel Oil Yard and the Black Oil Yard. The nature of the TPH impacts in the Black Oil Yard appears to be distinct from the rest of the Site due to the heavier oil bulk products that were stored in this tank farm; total TPH concentrations in this area are entirely from the diesel and motor oil TPH fractions. Total TPH concentrations in the SWMU 30 area also are entirely from the diesel and motor oil TPH fractions. Other areas contain a mixture of gasoline-range and heavier fractions, but all are predominantly diesel and motor oil TPH fractions.

4.2.4 PCBs

PCBs have been detected in shallow soil and in LNAPL within and directly west of the Lease Parcel. Soil sampling results indicate only one soil result above the 50 mg/kg level regulated under the Toxic Substances Control Act (TSCA). That sample was collected prior to 1999 from soil boring HA-03 at 6 ft bgs. The sample contained 85 mg/kg PCBs. The remaining soil PCB concentrations were low compared to the elevated PCB result (85 mg/kg) in historical boring

HA-03. The next highest total PCB concentration was 9.3 mg/kg (DG-104). The remaining total PCB concentrations ranged between non-detect (ND) and 4.2 mg/kg. Locations and results of total PCBs in soil samples are shown on Figure 9, Figure 10, and Table 2.

LNAPL samples were collected from wells with sufficient volumes of LNAPL (PR-07, PR-12, and UT-MW39-3) and analyzed for PCBs. Two of these LNAPL samples (222 mg/kg in PR-12 and 125 mg/kg in UT-MW39-3) were above the 50 mg/kg level regulated under TSCA. Locations and results of total PCBs in LNAPL samples are shown on Figure 9.

4.2.5 Metals

Soil samples were analyzed for 12 metals: arsenic, barium, beryllium, cadmium, chromium, copper, mercury, nickel, lead, selenium, silver, and zinc. Except for selenium, each of these metals was detected in at least one soil sample. The results for all metals but lead were consistent with background concentrations for metals concentrations in the Puget Sound Basin (Ecology, 1994). Arsenic, barium, chromium, copper, nickel, and zinc were detected in every soil sample analyzed. Lead was detected in the majority of the samples analyzed, and beryllium and cadmium were detected in the majority of shallow soil samples analyzed, but not in the deeper soil samples analyzed. Mercury was detected in a minority of the samples analyzed, and silver was only detected in two soil samples. Lead, the only metal detected above the Puget Sound Basin background concentrations, was detected in concentrations ranging from 0.91 to 326 mg/kg. The highest lead concentrations were found in and near the Small Yard.

4.3 Groundwater

The results of the 2007 and 2008 groundwater sampling at the Site are summarized in this section[2]. Groundwater samples were collected from 28 monitoring wells in March 2007, September 2007, and March 2008, and from 29 monitoring wells in September 2008. The results of the 2007 and 2008 groundwater monitoring are summarized in the *Annual Ground Water Report for 2007* (Roth Consulting, 2008) and the *Annual Ground Water Report for 2008* (Roth Consulting, 2009).

4.3.1 Metals

Groundwater samples were analyzed for eight metals (total arsenic, barium, chromium, lead, mercury, selenium, silver, and zinc) in 2007 and 2008. Arsenic was detected in most samples, with the highest concentration (19 micrograms/liter [µg/L]) detected in CP-GP12. Barium was analyzed only in 2008 and was detected in all samples, with the highest concentration (328 µg/L) in CP-GP13. Chromium was detected in 10 to 16 wells in each sampling event, with the highest concentration (13.6 µg/L) in CP-115B. Lead was detected in one well (CP-114) during two events with a maximum concentration of 9.4 µg/L. Mercury was detected (0.0235 µg/L) in only one sample, which was collected from CP-111. Selenium was analyzed only in 2008 and was detected in 7 to 12 wells per sampling event, with the highest concentration (20 µg/L) in

[2] Note that a more extensive data set is used to develop and evaluate CULs in Section 7 of the FS report. The data summarized here are intended to describe the current nature and extent of contamination.

CP-GP03AR. Silver was analyzed only in 2008 and was not detected in any of the wells. Zinc was detected in 3 to 12 wells per event, with the highest concentration (200 µg/L) in CP-103A.

4.3.2 Organic Constituents

TPH Compounds. TPH as gasoline and diesel have been detected in groundwater at the Site, with the highest concentrations and most of the detections in the vicinity of the former Lease Parcel and AOC-11 tank farms and SWMU 30. TPH was not detected in the wells farthest downgradient. Figure 11 shows the concentrations of gasoline-range hydrocarbons in the shallow monitoring wells in 2008, while Figure 12 shows the concentrations of gasoline-range hydrocarbons in the deep monitoring wells in 2007.

Diesel-range hydrocarbons were less widely distributed than gasoline-range hydrocarbons in shallow groundwater and were not detected in 2007 or 2008 in any Deep Confined Aquifer wells[3]. Figure 13 show concentrations of diesel-range hydrocarbons in shallow monitoring wells for 2008.

VOCs. Seventeen VOCs were detected in groundwater samples collected in 2007 and 2008. The VOC detections included three chlorinated VOCs (chlorobenzene, chloroethane, and dichlorodifluoromethane) and 14 non-chlorinated VOCs (acetone, benzene, n-butylbenzene, carbon disulfide, ethylbenzene, hexane, isopropyl benzene, n-propylbenzene, o-xylene, p-isopropyl toluene, sec-butylbenzene, tert-butylbenzene, toluene, and total xylenes). The detections were all relatively low (i.e., less than 20 µg/L) and were distributed in wells located around the former tank farms in the Lease Parcel and AOC-11.

SVOCs. Twenty-two SVOCs were detected in one or more groundwater samples from all wells monitored in 2007 and 2008. The SVOC detections included 15 PAHs (acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, fluorene, indeno(1,2,3-c,d)pyrene, naphthalene, phenanthrene, and pyrene) and 7 other SVOCs (2,4-dimethylphenol, 2-methyl naphthalene, 2-methylphenol, bis(2-ethylhexyl) phthalate, dibenzofuran, diethyl phthalate, and phenol). Low-level PAH detections were widespread but intermittent in groundwater at the Site. One or more of the PAH compounds have been detected in all the wells monitored with the exception of CP-115B. Some of the PAHs such as naphthalene are distributed across the Site; Figure 14 shows naphthalene concentrations in shallow groundwater in 2008. Other PAHs occur at limited and scattered locations. Figures 15 and 16 depict examples of a typical PAH occurrences (chrysene) in shallow and deep Site groundwater. The other seven SVOCs detections were infrequent and localized.

PCBs. Aroclor 1260 was detected in one Shallow Aquifer monitoring well (PNO-MW06A) at a concentration of 0.016 µg/L in March 2008. PCBs were not detected in any other groundwater samples collected at the Site in 2007 or 2008.

[3] Although diesel-range hydrocarbons were not detected in the monitoring wells sampled during the 2007 and 2008 monitoring events, not all wells were monitored. The removal of certain wells from the monitoring program was approved by Ecology. Diesel was detected prior to 2007 in several deep monitoring wells, including wells CP_106B and CP_203B.

5.0 CONCEPTUAL SITE MODEL

This section provides a summary of the CSM for the Site, including identifying and describing the potentially completed and complete exposure pathways.

Figure 17 presents the CSM for the Site that summarizes the sources of contamination, potential routes of exposure, and potential receptors. The CSM is based on the current and future industrial land use, the soil and groundwater sampling results, and the active and potentially active fate and transport mechanisms.

5.1 Contaminant Sources

Tank Farm Lease Parcel. The primary source of contamination at the Site is the Tank Farm and associated operations. A number of documented releases have occurred, including two large releases of petroleum hydrocarbons in 1978 (420,000 gallons of Bunker C) and 1980 (up to 113,000 gallons of oil). In both of these cases, the oil was contained within the tank farm by the concrete dikes and the oil and impacted soil removed to the extent practicable. A number of smaller releases of petroleum products and/or oily water have been documented, ranging in size from several hundred gallons to 20,000 gallons. In all cases, these documented releases were reported to be cleaned up.

No releases were documented at the Lease Parcel prior to 1971, although historical unreported releases are suspected. Periodic releases of oily liquids have reportedly occurred at the Lease Parcel since the 1930s and there are historical photographs and documents indicating that the tank yards were contaminated when Chempro began operations in 1971.

Other Source Areas. There are three other potential sources of contamination located within the Site, but outside the Lease Parcel, which are addressed in the FS:

- **SWMU 30** – This SMWU is the location of a pipeline break that occurred in 1989 near the north end of Pier 91 (Figure 4). An estimated 340 to 1,370 gallons of product were released before the pipeline was repaired. A product recovery system was installed and operated between 1991 and 1994 and recovered a total of 76 gallons. Passive product recovery (i.e., bailing) continued after 1994 with limited amounts of product recovered.
- **AOC 11** – AOC 11 was a former tank farm located west of the Lease Parcel (Figure 4). The former tank farm in AOC 11 was reportedly active between 1927 and 1942 and used to store a variety of petroleum products, including gasoline and oil. The AOC 11 tank farm was reportedly demolished after the United States Department of the Navy took over the site in December, 1942. There are no documented releases from the AOC 11 tank farm.
- **Former Fuel Transfer Pipelines** – Over the history of the site, petroleum and other materials were transferred between ships at Piers 90 and 91, the tank farms, and waste management areas located within the Site, typically via above and belowground pipelines. Figure 6 shows the portions of the site where above or belowground pipeline corridors were (and in some cases still are) located.

5.2 Exposure Pathways and Receptors

The CSM shown in Figure 17 identifies the potentially complete exposure pathways and the potential receptors for the Site for both soil and groundwater.

Soil. Three potentially complete exposure pathways related to soil were identified: (1) direct contact with soil by utility or construction workers; (2) soil to indoor air; and (3) soil to groundwater (which ultimately may impact aquatic receptors). The approach to addressing each of these three pathways is summarized below.

- **Direct Soil Contact.** Direct soil contact by workers (or trespassers) was not retained as a pathway of concern for the Site because soils are currently covered by pavement or buildings. If any future excavation or underground utility work takes place, workers could potentially be exposed to soil, and direct contact with soil would become a pathway of concern. However, institutional controls and standard worker health and safety procedures will be implemented and would provide adequate protection in such instances.

- **Soil to Indoor Air.** This pathway is only potentially applicable at the tank farm, and possibly in areas immediately adjacent to the tank farm. Previous studies (PSC, 2002; PIONEER, 2004) have documented that there are no unacceptable current risks. The only potential future exposures via this pathway would result from future Site development activities. The approach for addressing these potential future exposures will be to implement institutional controls, such as notices on parcel deeds of the potentially impacted properties that require either: (1) use of engineering controls (e.g., vapor barriers, sub-slab venting systems) in Site development plans to mitigate the potential exposure; or (2) conducting a development-specific evaluation of the soil to indoor air pathway (i.e., developing risk-based CULs for the specific-potential exposures related to the proposed development) and implementing remedial actions and/or engineering controls if development specific CULs are exceeded).

- **Soil to Groundwater.** As with the soil to indoor air pathway, the soil to groundwater pathway is only potentially applicable to the tank farm and immediately adjacent areas, generally coinciding with areas where LNAPLs have been observed. The soil to groundwater pathway was evaluated consistent with WAC 173-340-747, which states that concentrations of hazardous substances in soil shall not cause contamination of groundwater at levels that exceed groundwater CULs. This demonstration requires that two criteria be met at the Site:

    - **Soil concentrations shall not cause an exceedance of groundwater CULs.** The potential for soil causing an exceedance of groundwater CULs was evaluated empirically by comparing groundwater concentrations to CULs at the standard point of compliance (SPOC) or conditional POC (CPOC). If groundwater concentrations are below the CULs, then by definition, the concentrations of IHSs in soil are not causing exceedances of groundwater CULs. Conversely, if groundwater concentrations at the POC exceed CULs, then soil to groundwater CULs will be developed for those constituents at that time.

- **Soil concentrations shall not result in the accumulation of LNAPL on or in the groundwater.** The potential for accumulation of LNAPL was evaluated through development of site-specific RSSLs. RSSLs are an estimate of the maximum residual soil concentrations at which LNAPL will not accumulate on or in groundwater and are based on site specific factors such as soil type and contaminant characteristics.

Groundwater. Two potentially complete exposure pathways related to groundwater were identified: (1) groundwater to indoor air; and (2) groundwater to surface water/sediment.

- **Groundwater to Indoor Air.** As noted above, inhalation of indoor air impacted by vapor intrusion from groundwater does not represent an unacceptable risk to workers at the Site under current conditions (PSC 2001, 2002; PIONEER, 2004). However, this remains a potentially-complete exposure pathway for the Site and could be of concern for future commercial land-use scenarios.

- **Groundwater to Surface Water/Sediment.** These pathways are the primary pathways of concern for the Site. Impacted groundwater from the Site could be released to Elliott Bay via the groundwater to surface water pathway and/or groundwater to sediment pathway, potentially resulting in exposure to aquatic receptors (i.e., fish or invertebrates), or to people consuming seafood collected from Elliott Bay.

5.3 Terrestrial Ecological Exclusion

An assessment of Site conditions was performed in order to determine the need for a terrestrial ecological evaluation under WAC 173-340-7490. The Site qualifies for an exclusion from the terrestrial ecological evaluation process, as documented in BDR1 (Roth Consulting, 2001), which was approved by Ecology in a letter dated May 30, 2002 (Ecology, 2002).

6.0 CLEANUP STANDARDS

This section summarizes the development of cleanup standards for the Site per MTCA requirements. Cleanup standards, as explained in WAC 173-340-700 (3), consist of the following:

a) CULs for hazardous substances present at the Site;

b) The location where these CULs must be met (i.e., the POC); and

c) Other regulatory requirements that apply to the Site because of the type of action and/or location of the Site (i.e., applicable state, local, and federal laws).

The approach to developing CULs for the Site consisted of the following steps:

- Selection of IHSs;
- Development of CULs; and
- Selection of the point(s) of compliance.

As described above, most of the potentially applicable soil exposure pathways (e.g., direct contact, soil to indoor air) are either not currently complete or do not currently present a risk. As a result, IHSs were not identified for soil and no risk-based CULs were developed for soil related exposure pathways. Potential future risks associated with these soil-related pathways are addressed through implementation of engineering and institutional controls. The portion of the soil to groundwater pathway related to preventing accumulation of LNAPL in the groundwater is a potentially complete pathway, and the RSSLs developed for the Site were evaluated for use as remediation levels.

6.1 Selection of Indicator Hazardous Substances

Cleanup levels were developed for constituents in groundwater that could potentially contribute significantly to human health or ecological risks. Under MTCA, these constituents are considered IHSs. IHSs were identified for the Site according to the guidelines provided in WAC 173-340-703, which allows those constituents that do not contribute significantly to the risk associated with a Site to be eliminated from further consideration. Constituents that contributed only a small percentage to the risk were identified and screened from further evaluation based on the following criteria:

- The frequency that a specific constituent occurred in groundwater;
- The geographic distribution of detections for that constituent;
- The magnitude of the concentration for that constituent; and
- The constituent's chemical/physical properties (e.g., persistence in the environment, toxicity to humans or aquatic organisms, and the potential to bioaccumulate).

Initially, the frequency of detection for each constituent was calculated for the entire groundwater data set, which was comprised of sampling rounds from 2000 to 2007. In general, constituents that were never detected, or detected in less than five percent of the samples, were eliminated from further consideration. In some cases, if the detections of infrequently detected constituents were geographically clustered (i.e., adjacent to one another), or were detected at an especially high concentration, they were retained for further evaluation. If the maximum detected value was greater than the 75th percentile plus three times the IQR, then the constituent was retained for further consideration. Constituents that were detected in more than five percent of the samples were automatically retained as IHSs. See *Terminal 91 Tanks Farm Site Feasibility Study Cleanup Levels* (FS CUL Memorandum; PIONEER, 2008) for detailed discussion of this IHS screening process. See Table 7-1 of the FS Report for a complete list of IHSs and the rationale for excluding certain constituents.

Area background groundwater concentrations were based on analytical results from five on-site wells and five upland wells (Figure 18). The analytical results were combined to calculate the area background concentrations for inorganics, based on the decision rule presented in WAC 173-340-709. See *Background Groundwater Evaluation* (PIONEER, 2007) for a detailed discussion. Based on this evaluation, arsenic concentrations found on the Site were determined as area background. Ecology concurred with this conclusion, and arsenic was not considered in the development of CULs.

6.2 Determination of Cleanup Levels

Human health and ecological CULs were developed for the following complete exposure pathways, identified in the CSM: (1) groundwater to indoor air; (2) groundwater to surface water; and (3) groundwater to sediment. CULs were based on the protection of indoor air, surface water, and sediment quality according to MTCA requirements (WAC 173-340-750, WAC 173-340-730, and WAC 173-204, respectively). A detailed description of the derivation of human health and ecological CULs is presented in the FS CUL Memorandum (PIONEER, 2008). Table 3 presents final CULs for shallow groundwater and Table 4 presents final CULs for deep groundwater.

The RSSLs developed for the Site are included as potential remediation levels.

6.2.1 Human Health Cleanup Levels

Groundwater Cleanup Levels Based on Protection of Indoor Air. Groundwater CULs protective of indoor air quality were calculated to address the groundwater to indoor air pathway. MTCA Method C (WAC 173-340-750 (4)) CULs for indoor air were derived and the groundwater CULs were then calculated by dividing the indoor air CULs by groundwater to indoor air attenuation factors developed based on the EPA's Johnson and Ettinger Model. A hazard quotient (HQ) of one was used for calculating noncarcinogenic CULs. The target risk used for calculating carcinogenic CULs was 1×10^{-5}.

Groundwater Cleanup Levels Based on Protection of Surface Water and Sediment. Human health CULs were developed to protect people who may consume seafood from Elliott Bay (including Asian Pacific Islander [API] Fisher) in the vicinity of the Site, in accordance with WAC 173-340-730. Human health CULs were based on surface water CULs, assuming no

dilution from groundwater to surface water. MTCA Method B CULs were derived for surface water based on protection of human health. In addition, modified exposure parameters were used for the API Fisher population, consistent with the MTCA Science Advisory Board recommendations. An HQ of one was used for calculating the noncarcinogenic CULs. The target risk used for calculating carcinogenic CULs was $1x\ 10^{-6}$. Groundwater CULs based on protection of surface water were considered applicable to both Shallow Aquifer and Deep Confined Aquifer groundwater.

6.2.2 Ecological Cleanup Levels

Ecological CULs were based on surface water CULs, assuming no dilution from groundwater to surface water and were developed to protect aquatic organisms that may be exposed to surface water and sediment in Elliott Bay, which may be potentially impacted by groundwater from the Site. These CULs were identified based on:

- Washington State Water Quality Standards (WAC 173-201A);
- Federal Ambient Water Quality Criteria (Section 304 CWA);
- National Toxics Rule (40 CFR 131); and
- Environmental Effects. Where there were no existing standards or criteria for IHSs, groundwater CULs were derived from concentrations that would likely result in no or minimal adverse effects to aquatic organisms (including benthic invertebrates).

6.3 RSSLs

Final RSSLs were developed using Site-specific soil physical property data and LNAPL characteristic data collected in the first data gaps investigation. RSSLs were developed for toluene, gasoline, middle distillate petroleum products (diesel range), and fuel oil. The MTCA four-phase partitioning model spreadsheets were used to develop the revised toluene RSSL, and Ecology and other published industry references were used to develop the revised RSSLs for gasoline, middle distillate petroleum products, and fuel oil. The final RSSL ranges are as follows:

- For fuel oils, the calculated RSSL range was 8,727 to 30,000 mg/kg;
- For middle distillate petroleum products, the calculated RSSL range was 3,879 to 13,333 mg/kg;
- For gasoline, the calculated RSSL range was 1,636 to 5,625 mg/kg; and
- For toluene, the calculated RSSL was 832 mg/kg.

The lower end of the ranges represents product in coarse sand and gravel, while the upper end of the ranges represents product in fine to medium sand.

6.4 Groundwater Point of Compliance

As defined in the MTCA regulations, a POC is the point or points at which CULs must be attained. MTCA defines both an SPOC and a CPOC. The groundwater SPOC, as described in

WAC 173-340-720(8)(b), includes all groundwater within the saturated zone beneath the Site and in any area affected by releases from the Site. A CPOC is used at the Site when it can be demonstrated under WAC 173-340-350 through 173-340-390 that it is not practicable to meet the CULs at the SPOC throughout the Site within a reasonable restoration timeframe.

As discussed below, IHSs are present at concentrations above CULs at a number of SPOC wells, primarily in and adjacent to the source areas in the interior portions of the Site. As a result of these exceedances, CPOC wells are proposed and evaluated. The demonstration of the practicability of achieving CULs at the SPOC (i.e., throughout the Site), and the appropriateness of using a CPOC, were made during the development and evaluation of cleanup alternatives discussed below. The SPOC and CPOC wells for the Site are shown in Figure 18.

6.5 Areas Exceeding Groundwater Cleanup Levels

Groundwater data collected from monitoring wells at the Site were compared to the final FS CULs to determine whether the Site detected groundwater concentrations exceeded final FS CULs at the POC.

6.5.1 Standard Points of Compliance

The SPOC includes all wells located within the Site boundaries. To determine whether groundwater data exceeded the final FS CULs at the Site, the IHS groundwater concentrations in each well were compared to final FS CULs. Locations of SPOC wells are shown in Figure 18. For shallow groundwater, maximum detected IHS concentrations in shallow groundwater exceeded final FS CULs in 15 wells. The locations of these wells are presented in Figure 19. Wells with PAH, diesel, or gasoline concentrations exceeding the final FS CULs were concentrated around the former tank farm, SWMU-30, and AOC-11.

Maximum detected IHS concentrations in deep groundwater exceeded final FS CULs in seven wells. The locations of these wells are presented in Figure 20. The main IHSs exceeding final FS CULs were PAHs, diesel, and gasoline. As with the shallow aquifer, wells with PAH, diesel, or gasoline concentrations exceeding the final FS CULs were clustered around the Lease Parcel.

6.5.2 Conditional Points of Compliance

Because there were exceedances of the final FS CULs at the SPOCs within the Site, compliance at CPOCs was evaluated. Under WAC 173-340-720(8)(c), Ecology may approve use of a CPOC if it can be demonstrated that it is impracticable to meet CULS at the SPOC in a reasonable timeframe; this demonstration is made in Sections 10 and 11 of the FS report. Groundwater final FS CULs must be met at the CPOC, and in areas downgradient of the CPOC.

Four shallow groundwater wells and two deep groundwater wells are proposed CPOC wells (Figure 18). These CPOC wells are the wells closest to potential discharge points on Elliott Bay. There were no IHSs detected in CPOC wells exceeding final FS CULs in shallow or deep wells.

6.6 Areas Exceeding RSSLs

The final RSSLs listed above were compared to the results from the 250 soil samples analyzed during the three phases of the data gaps investigation. For the purposes of this comparison, the fuel oil RSSL is compared to motor oil range TPH concentrations at the Site, and the middle distillate petroleum product RSSL is compared to diesel range TPH concentrations. Figures 21 through 23 highlight soil borings with samples that exceeded the RSSLs for both the individual TPH fractions and for total TPH (i.e., the sum of the gasoline, diesel, and motor oil ranges). The greatest number of samples with TPH concentrations greater than RSSLs is located in and around the Lease Parcel. These samples are largely distributed across the vadose zone and smear zone sample depths, although there are also some exceedances in the saturated zone. The toluene RSSL is exceeded in only two smear zone samples in the Small Yard.

The other areas of the Site (AOC 11 and SMWU-30) have only a few smear zone soil samples with TPH concentrations greater than RSSLs. The data gaps investigation in AOC 11 identified only a single sample in one soil boring that exceeded an individual TPH-range RSSL, in this case the RSSL for gasoline. None of the monitoring wells in AOC 11 had measurable LNAPL in 2008. With respect to SMWU-30, there were two borings each with one sample that exceeded the diesel-range TPH RSSL in the smear zone and one well that had measurable LNAPL in 2008.

6.7 Regulatory Requirements

Cleanup actions must comply with applicable local, state, and federal laws as required by WAC 360(2)(a)(iii); WAC 173-340-710; RCW 70.105D.090. In certain cases, obtaining a permit is required. In other cases, the cleanup action must comply with the substantive requirements of the law but is exempt from the procedural requirements of the law (RCW 70.105D.090; WAC 173-340-710(9)).

6.7.1 Model Toxics Control Act

Ecology's MTCA regulations were the primary regulations used to guide the performance of the FS. Specifically, the FS was conducted following the procedures outlined in WAC 173-340-350. The 1998 AO was issued pursuant to MTCA and the Port's corrective action obligations under the 1998 AO are enforceable conditions of the dangerous waste management permit issued pursuant to Washington Dangerous Waste Regulations.

6.7.2 Washington Dangerous Waste Regulations

Corrective Action Requirements. Activities associated with the former tank farm included the treatment and storage or dangerous wastes, which are regulated under Chapter 70.105 RCW, the Hazardous Waste Management Act of 1976, as amended, and regulations codified in WAC 173-303. Pursuant to these regulations, Ecology issued Permit No. WAD000812917 on August 26, 1992 to the Port, requiring corrective action at the Terminal 91 Complex.

Ecology is requiring that the Port fulfill corrective action responsibilities for the facility, as defined by WAC 173-303-040, using the MTCA regulations as well as the Dangerous Waste Regulations (WAC 173-303 and specifically WAC 173-303-646). The corrective actions taken must meet or exceed all substantive corrective action requirements of the state Hazardous Waste Management Act, and Dangerous Waste Regulations as well as RCRA.

Dangerous Waste Management Requirements. The Dangerous Waste Regulations provide the framework for how to manage the various wastes, debris, and environmental media generated during cleanup actions at the Site. The approach to managing impacted environmental media (e.g., soil, groundwater) and debris (e.g., concrete and steel associated with the former tank farm) that may be generated during cleanup actions is complicated by the range of both dangerous and non-dangerous wastes managed throughout the Lease Parcel, and by the status of the Lease Parcel as a permitted facility. Discussions between the Port and Ecology have lead to the development of two memoranda that provide guidance on this subject:

- *Guidance for Waste Designation Procedures at Terminal 91* (See Appendix B); and
- *Management of the Port of Seattle's T-91 Facility's Tank Farm Site Subsurface Debris* (Appendix B).

6.7.3 Applicable Local, State, and Federal Laws

As noted above, MTCA's threshold requirements listed in WAC 173-340-360(2) include the requirement to "comply with applicable state and federal laws," which are further defined in WAC 173-340-710. The following Federal and Washington State laws and their associated regulations may be applicable to the CAAs developed for the Site:

- **Federal Clean Water Act; (33 U.S.C. §1251 et seq)** contains standards protective of human health and aquatic life. Specific portions of the Clean Water Act applicable to the Site include:
  - Ambient Water Quality Standards (Section 304); and
  - Standards issued under the National Toxics Rule (40 CFR 131).
- **Washington Water Well Construction Regulations (WAC 173-160)** establish state standards for installing, maintaining, and decommissioning groundwater monitoring and recovery wells.
- **Washington Ground Water Quality Standards (WAC 173-201)** establish standards to protect groundwater quality (e.g., maximum contaminant levels [MCLs]) and beneficial uses.
- **Washington State Sediment Management Standards (WAC 1732-204)** establish sediment quality standards protective of aquatic life.

- **Washington Surface Water Quality Standards (WAC 173-201A)** are applicable to surface waters of the state, are protective of aquatic life and other beneficial uses, and could be applicable if an alternative includes discharge of treated water.

- **Washington State NPDES Program Regulations (WAC 173-220)** could be applicable for discharge to surface waters under a National Pollutant Discharge Elimination System (NPDES) permit.

- **Washington Dangerous Waste Regulations (WAC 173-303)** establish procedures and standards related to the definition, management, and disposal of dangerous wastes. The Dangerous Waste Management Permit and related corrective requirements are summarized in Section 8.2.2 above.

- **Washington Clean Air Act Regulations (WAC 173-400)** provide standards and procedures for managing the discharge of contaminants to the atmosphere.

- **Washington Industrial Safety and Health Act Regulations (WAC 296-62)** contain health and safety training requirements for on-site workers. They also contain permissible exposure limits for conducting work at the Site.

7.0 APPROACH TO DEVELOPING CLEANUP ACTION ALTERNATIVES

7.1 Cleanup Action Objectives

Cleanup action objectives form the basis for evaluating potential cleanup technologies and actions for the Site. CAOs are based on an evaluation of the data collected during previous investigations and on the CULs established for the Site. The focus of the CAOs is protection of human health and the environment. The CAOs for soil and groundwater focus on four primary exposure or migration pathways:

- Exposure of future subsurface construction workers to IHSs in soil, particulates, and soil vapors;
- Exposure of future workers and trespassers to IHSs in vapors originating from soil and/or groundwater via indoor air;
- Groundwater discharge to surface water and/or sediment and the subsequent potential for impacts on aquatic life or humans consuming fish; and
- The presence of LNAPL on the groundwater and/or the migration of contaminants from soil that results in the accumulation of LNAPL on groundwater.

The CULs developed for the Site and the CAOs, combined with the current concentrations of IHSs in the soil and groundwater, indicate that there are no current exposures above risk-based criteria on the Site. The first two of the above future exposure pathways (direct contact with soil and vapor migration to indoor air) will be addressed through implementation of engineering and institutional controls.

Because long-term groundwater monitoring has documented that concentrations of IHSs at the CPOC are below risk-based CULs, the third exposure pathway (groundwater discharge to surface water and sediment) does not appear to present a current risk to human health and the environment. Furthermore, the *Monitored Natural Attenuation Evaluation, Final Technical Memorandum* (PES et al., 2006c) documented that naturally occurring attenuation mechanisms have resulted in stable plumes of petroleum-related compounds originating in the tank farm, SMWU 30, and other potential sources; and CULs are likely to continue to be met in the future at the CPOC. As a result, the groundwater to surface water/sediment pathway will be addressed by implementation of an MNA program at the Site.

With the first three pathways being addressed by the presumptive actions described above, the final pathway (LNAPL accumulation on groundwater or the potential migration of LNAPL from soil to groundwater) was the primary focus for the development of the CAA and evaluation process.

7.2 Approach to Developing Cleanup Action Alternatives

As described in Section 7.1, the majority of the potential exposure pathways are addressed using presumptive response actions (i.e., engineering controls, institutional controls, and MNA). The

cleanup actions associated with the presumptive response actions, including the rationale for selecting these actions, are described in Section 8.1.

The remaining parts of the Site not addressed by these presumptive cleanup actions are the Lease Parcel and other contaminant source areas. Section 5.1.1 identified the contaminant sources at the Site, with the Lease Parcel and immediately adjacent areas being by far the most significant source areas. Secondary sources identified within the Site boundaries included SWMU 30, AOC 11, and the former fuel transfer pipelines. Compared to the Lease Parcel, these secondary sources are much smaller in size, contain fewer types of contaminants, and have much less contaminant mass associated with them. Given the relative simplicity of these secondary sources, evaluating a range of alternatives for each was not warranted, and specified cleanup actions were developed for each to effectively eliminate these as potential long-term contaminant sources. These secondary source cleanup actions were included in the presumptive actions described below.

For the Lease Parcel and adjacent areas, addressing the CAOs associated with preventing LNAPL accumulation on groundwater and/or the potential migration of LNAPL from soil to groundwater (i.e., source control) was the primary focus of the CAA development process described in the FS. The combination of the presumptive cleanup actions and one of the CAAs developed for the Lease Parcel constituted the overall cleanup action for the Site.

8.0 DESCRIPTION OF SELECTED CLEANUP ACTION ALTERNATIVE

As noted above, the final CAA for the Site consists of two major components: (1) the presumptive cleanup actions that address areas outside the Lease Parcel and adjacent areas and (2) the CAA for the Lease Parcel.

8.1 Presumptive Cleanup Actions

A series of presumptive cleanup actions were identified to address the following aspects of the Site:

- Preventing exposure via direct contact with contaminated soil and inhalation of vapors by future subsurface workers;
- Preventing exposure of future workers and trespassers via inhalation of indoor air impacted by migration of vapors originating from contaminated soil and groundwater;
- Secondary sources; and
- Groundwater downgradient of the Lease Parcel.

8.1.1 Subsurface Worker Direct Contact and Vapor Inhalation

This pathway addresses potential future exposure of subsurface workers to IHSs in soil and groundwater via the direct contact, vapor inhalation, and particulate inhalation pathways. The cleanup action to address this potential exposure consists of the following institutional controls:

- Notice on the property deed and in operating procedures implemented by the Port notifying personnel of the potential exposure and requirements to implement standard worker health and safety procedures; and
- Requirement that qualified personnel evaluate soil and/or groundwater that may be removed as part of construction activities and manage the material consistent with applicable regulations.

These institutional controls will be included in an environmental covenant developed consistent with Ecology's Model Restrictive (Environmental) Covenant[4].

8.1.2 Indoor Air Pathway

There are no current exposures via the indoor air pathway and potential exposures via this pathway would occur only if future development activities at the Site include construction of a building or other enclosed structure over contaminated soil or groundwater. The approach for

[4] Ecology's Model Restrictive (Environmental) Covenant can be found at: www.ecy.wa.gov/programs/TCP/vcp/vcp_boilerplates/Model%20Covenant%20(Quick%20Fix)%20(2).doc

addressing the potential future exposure of workers or trespassers via the indoor air pathway is to implement land use restrictions that include the following institutional controls:

- Placing a notice in the public land records identifying the potential presence of contaminated soil and/or groundwater;

- Requiring that one of the following approaches be taken to address the potential exposure:

  (1) Include engineering controls (e.g., vapor barriers, sub-slab venting systems) in Site development plans to prevent the potential exposure; or

  (2) Conduct a development-specific evaluation of the soil/groundwater to indoor air pathway (i.e., developing risk-based CULs for the specific potential exposures related to the proposed development).

If concentrations of IHSs exceed the CULs developed under the second option, appropriate supplemental remedial actions will be evaluated and implemented or engineering controls implemented, as appropriate.

8.1.3 Secondary Source Area Actions

The three secondary source areas within the Site are SWMU 30, AOC 11, and the former fuel transfer pipelines. The approach for addressing each of these is described below.

SWMU 30. The presumptive remedy for SMWU 30 includes excavating two areas with evidence of LNAPL to a depth of 9 to 12 ft (see Figure 24), totaling approximately 4,300 square feet (sq ft) and approximately 1,000 cubic yards. The LNAPL and TPH-impacted soil will be stockpiled and profiled for off-site disposal at an approved facility. As part of the excavation, three monitoring wells (PNO-MW-03, PNO-MW-102, and PNO-EW-1) will be decommissioned. Removal of the observed LNAPL source and soil exceeding the RSSLs will greatly reduce the potential for SWMU 30 to cause future exceedances of CULs at the CPOC. The capital costs associated with the proposed SWMU 30 actions are summarized in Table 5 and total $260,000.

AOC 11. Given that none of the monitoring wells in AOC 11 had measurable LNAPL in 2008, that downgradient CPOC well CP_GP14 is below CULs, and the lack of any LNAPL or extensive areas of significant soil contamination that may lead to future LNAPL accumulation, aggressive source removal actions similar to those proposed for SWMU 30 do not appear warranted for AOC 11. The absence of a current LNAPL source is not unexpected given that the AOC 11 tank farm was only operational for 15 years and was demolished over 75 years ago. As a result, the approach for addressing the residual contamination present in AOC 11 will be incorporated into the MNA approach described below.

Former Fuel Transfer Pipelines. A number of subsurface fuel and wastewater transfer pipelines running between the Lease Parcel and Piers 90 and 91 remain in place (Figure 6). Although some of these remaining pipelines have been recently cleaned or otherwise

decommissioned in place and in some cases removed, there may be pipelines that remain in place that have not been cleaned and could contain residual petroleum products. To prevent residual product in the remaining pipelines from becoming a future LNAPL source, the following actions are proposed:

- Prepare an inventory of pipelines known to be remaining in place that have not been properly cleaned and abandoned; and

- Develop and implement a plan to clean and abandon in place the identified pipelines. This plan will include specific procedures for characterizing and managing residual materials in the pipelines, cleaning and decommissioning techniques, and reporting and documentation requirements. Unless a pipeline needs to be physically removed for development reasons, it is assumed that all pipelines will be cleaned and decommissioned in place. This plan also will identify procedures for handling currently unidentified pipelines that may be discovered in the future during maintenance or site development activities.

Although the exact lineal footage of pipelines remaining is unknown, available information suggests that there could be as much as 22,000 ft of pipelines in and around the Lease Parcel and extending to the piers.

8.1.4 Groundwater Downgradient of Lease Parcel

As described in detail in the FS, achieving CULs at the groundwater SPOC is not practicable or technically feasible at the Site. Therefore, consistent with WAC 173-340-720(8)(c), CPOC wells were established for the Site, and monitoring has documented that IHS concentrations in groundwater downgradient of the Lease Parcel are below CULs at the CPOC. The effectiveness of MNA at achieving and maintaining compliance with the CULs was evaluated and documented consistent with Ecology protocols (PES, 2006a). Therefore, groundwater downgradient of the Lease Parcel will be addressed using MNA.

The Port proposes to implement an MNA program consistent with Ecology's MNA guidance document (Ecology, 2005a and 2005b). To monitor both the primary and secondary sources at the Site, wells along the three flowpaths monitored during the MNA evaluation (PES, 2006a) would be included in the program (Figure 25). A well (or wells) upgradient of the Lease Parcel tank farms will be included to confirm the background water quality over time, a well or wells representative of the tank farm source water quality will be included to determine changes in the source area water quality, and wells along the Pier 90, Pier 91, and AOC 11 flowpaths will be included to determine plume water quality and sentinel well water quality. If additional wells are needed to monitor the source area post remediation, or if wells at the site are damaged, the Port will notify Ecology.

8.2 Selected Lease Parcel CAA: Alternative 4 – Containment, Subsurface Structure Removal, and Enhanced LNAPL Recovery

Based on the development and evaluation of the CAAs developed for the Lease Parcel presented in the FS report, Alternative 4 was selected for implementation at the Site. Alternative 4's

primary objective is to prevent migration of LNAPL from the Lease Parcel source area and to prevent future surface product seeps from occurring. This alternative includes: constructing a subsurface slurry wall around the perimeter of the former tank farm; removal of the remaining subsurface structures and tank bases that appear to be the source of the current seeps; removal of highly contaminated soil encountered during the tank bottom removal process; installing an enhanced passive LNAPL recovery system; replacing the existing asphalt paving with new asphalt paving; site drainage improvements; annual asphalt paving inspections and repair; LNAPL monitoring and passive recovery; compliance monitoring; and reporting.

The purpose of the slurry wall will be to prevent migration of LNAPL from the Lease Parcel and to prevent groundwater from flowing through the source area. Removing the existing subsurface structures and highly contaminated soil, along with replacing the asphalt paving, will prevent direct contact with impacted soils, minimize infiltration of precipitation, and effectively eliminate the potential for surface LNAPL seeps to occur. Improvements will be made to existing site drainage infrastructure to prevent stormwater from ponding on the asphalt paving. Figure 26 shows the major features of Alternative 4.

Prior to commencing the slurry wall construction activities described below, all 16 monitoring wells within the footprint of the former tank farm will be decommissioned and the existing asphalt paving will be removed and hauled off site for disposal. In addition to the pavement, all of the remaining subsurface structures, including concrete containment wall footings, steel tank bases, concrete tank bottom "floors," and other structures will be removed (Figure 26). This will require removal of all of the subgrade and fill between the existing asphalt paving and the former tank bottom floor and tank bases (approximately 6,250 cubic yards, or 9,400 tons). The steel tank bases will be decontaminated as necessary and transported off site for recycling as scrap metal.

The slurry wall will be approximately 2 ft wide and 1,550 ft long and will extend to an average depth of approximately 20 ft bgs (Figure 26). The exact alignment of the slurry wall will be evaluated during design and a final alignment proposed in the preliminary design submittal. The wall will be constructed with a slurry mix based on site soil types and compatibility with site groundwater and LNAPL. The depth of the wall was established to be approximately 10 ft below the low water table to prevent migration of LNAPL and minimize contact of groundwater from outside the wall with the most impacted source material.

It is anticipated that once the existing paving and subsurface structures (including tank bases) are removed and the underlying soil exposed, there will likely be one or more areas of surface soil that are visibly and highly contaminated with petroleum (i.e., product-saturated soil). In order to minimize the potential for these soils to act as a source of future seeps, these areas of highly contaminated surface soil will be removed. It was assumed for purposes of the FS that approximately 240 tons of soil (10 areas each measuring 12 ft square and 3 ft deep) will be removed, characterized, and the soil disposed of off site.

The enhanced LNAPL recovery system will be designed to remove the recoverable LNAPL to the extent practicable using passive recovery techniques. Based on the recent LNAPL monitoring data (PES, 2008d), portions of the Lease Parcel most likely to contain recoverable LNAPL are located in the western portion of the former tank farm area and center around wells

PR-07, PR-12, and UT-MW39-3. For purposes of the FS, the enhanced LNAPL recovery system involved a series of 5 trenches located in the target areas listed above (see Figure 26). These trenches would be approximately 50 to 75 ft long, 2 ft wide, and completed approximately 10 ft below the surrounding grade. Each trench would be backfilled with pea gravel, with a section of 6-inch slotted pipe running the length of the trench installed at average low water table elevation. At both ends of the trench, a cleanout well will be installed. These wells would be completed to the bottom of the trench and also connected to the slotted pipe within the trench. As LNAPL collects within the gravel backfill and the slotted piping and cleanout wells, it would be removed either by bailing or pumping depending on the quantity of LNAPL present.

Once the slurry wall and asphalt paving have been installed, ongoing O&M activities associated with Alternative 4 include annual asphalt paving inspections and maintenance, LNAPL recovery and monitoring, compliance groundwater monitoring, and reporting. The enhanced LNAPL recovery system is assumed to be operated and maintained on a monthly basis for three years, bimonthly for an additional two years, and quarterly for five years (10 years total operation period). Recovered LNAPL and water will be disposed of as required. In addition to the operation of the enhanced LNAPL recovery system, O&M activities will also include LNAPL monitoring and passive recovery outside the area of influence of the enhanced LNAPL recovery system.

8.3 Summary of Costs for Selected Cleanup Actions

The total capital costs for implementing the presumptive actions are $930,000 and includes developing and implementing institutional controls; excavating LNAPL source areas at SWMU 30; inventorying, cleaning, and abandoning remaining subsurface pipelines; and developing the MNA plan and installing the required additional monitoring wells. The only estimable long-term O&M cost associated with these actions is the monitoring and reporting that make up the MNA program. The NPV of these monitoring and reporting costs over a 30-year timeframe is $450,000. The total estimated cost for implementing these presumptive cleanup actions is approximately $1,380,000.

The estimated capital costs for Alternative 4 are approximately $2,690,000. Annual O&M costs are estimated to range from approximately $60,000 to $70,000 per year depending on the frequency of LNAPL recovery efforts, and the NPV of the O&M activities for a 30-year time period is approximately $1,190,000. The total estimated present worth costs for Alternative 4 are $3,880,000 (Table 6).

The total estimated cost for implementing the selected cleanup action is $5,260,000.

8.4 Other Lease Parcel CAAs Considered

In addition to the selected CAA described above, five other CAAs were evaluated for the Lease Parcel. These other alternatives are described in detail in the FS Report and summarized briefly below.

8.4.1 Alternative 1 – Existing Asphalt Paving Maintenance and Monitoring

Alternative 1 was the baseline option against which the other alternatives were compared and consists of maintaining the existing asphalt paving in place over the former tank farm, LNAPL monitoring in select wells, and long-term compliance monitoring of groundwater.

8.4.2 Alternative 2 – Containment and Passive LNAPL Recovery

Alternative 2 included constructing a subsurface slurry wall around the perimeter of the former tank farm, replacing the existing asphalt paving with a composite cap (cap) consisting of new asphalt paving and underlying geomembrane, site drainage improvements, annual cap inspections and repair, LNAPL monitoring and passive recovery, compliance monitoring, and reporting. The purpose of the slurry wall was to prevent migration of LNAPL from the Lease Parcel and to prevent groundwater from flowing through the source area. The new composite cap would have prevented direct contact with impacted soils, minimize infiltration of precipitation, and effectively eliminate the potential for surface LNAPL seeps to occur. A majority of the existing subsurface structures/soil would have been left in place. Improvements would have been made to existing site drainage infrastructure to prevent stormwater from ponding on the cap.

8.4.3 Alternative 3 – Active LNAPL Recovery and Subsurface Structure Removal

Alternative 3 is similar to Alternative 2 in that its primary objective was to prevent migration of LNAPL from the Lease Parcel source area and prevent future product seeps from occurring on the asphalt paving, but it achieved those objectives using different approaches. To address LNAPL, Alternative 3 included a vacuum-enhanced LNAPL recovery system while surface seeps were addressed by removing all of the remaining subsurface structures and tank bases that appear to be the source of the current seeps. Alternative 3 also included new asphalt paving to prevent direct contact with impacted soils and prevent infiltration of precipitation.

8.4.4 Alternative 5 - Limited Excavation of LNAPL Areas

The primary component of Alternative 5 was the removal of the LNAPL source areas in and near the Lease Parcel through excavation and disposal of impacted soil in areas where LNAPL has been observed. The excavation would have extended to approximately 3 ft below the low water table, about 10.5 ft bgs after removing the paving, subgrade material, and remaining tank farm concrete. By excavating soils to this depth, the entire “smear zone” and the top of the saturated zone, where most if not all of the LNAPL is expected to be present, would have been removed. The lateral extent of the excavations was based on currently available information regarding the presence of LNAPL in the Lease Parcel and immediately surrounding areas. This approach would have resulted in approximately 12,700 cubic yards, or 19,000 tons, of soil being excavated. Soil would either be direct-loaded into trucks for transportation off site if sufficient data existed to characterize the soil, or stockpiled on site for characterization prior to disposal.

Other components of this alternative included removal of the existing asphalt paving and all remaining above ground and subsurface structures in the former tank farm, backfilling the

excavation area with clean soil, constructing new asphalt paving, and installing new monitoring wells.

8.4.5 Alternative 6 – Excavation of Soils Exceeding RSSLs

Alternative 6 was very similar to Alternative 5 (i.e., source area excavation), except that the boundaries of the excavation were defined by two factors: (1) the areas where LNAPL has been observed as in Alternative 5; and (2) areas where soil contains petroleum hydrocarbons at concentrations exceeding RSSLs. In most cases, the areas exceeding the RSSLs includes all of the areas included in Alternative 5 plus additional soil where LNAPL has not been observed but soil sampling results show TPH concentrations above the RSSLs. For Alternative 6, the excavation of soil to a depth of 10.5 ft would remove approximately 21,500 cubic yards, or 32,300 tons, of soil.

9.0 JUSTIFICATION FOR SELECTED CLEANUP ACTION ALTERNATIVE

Because the final cleanup action for the Site consists of two components – the presumptive cleanup actions and the Lease Parcel Cleanup Action – the analysis of the cleanup actions was performed in two steps. First, the extent to which the presumptive cleanup actions addressed (in part or in full) the MTCA requirements listed above was evaluated. Second, the six cleanup actions for the Lease Parcel were evaluated against those requirements applicable to the Lease Parcel. Finally, the comparative evaluation of the retained remedial alternatives for each evaluation criteria was summarized and a final cleanup action selected for implementation. This detailed evaluation of the CAAs for the Site is provided in Sections 11 and 12 of the FS Report and summarized for the selected CAA below.

9.1 Evaluation of Presumptive Cleanup Actions

The majority of the objectives for the Site are addressed through presumptive actions including engineering and institutional controls, implementation of an MNA program, and controlling LNAPL at the secondary source areas. These actions are described in Section 8.1. The combined presumptive actions address the majority of the MTCA requirements for the Site, as discussed below.

9.1.1 Threshold Requirements

Protectiveness. The presumptive cleanup actions specifically address the primary exposure and migration pathways at the Site and are protective of human health and the environment. Potential future worker exposures via subsurface soil and soil vapors are controlled through engineering and institutional controls. Discharges of groundwater to surface water, which currently meet cleanup levels, will be addressed in the future through implementation of the MNA program. The presumptive cleanup actions for the secondary sources, along with the Lease Parcel Cleanup Actions, only enhance the likelihood that the protectiveness will be maintained and improved in the future.

Compliance with Cleanup Standards. The primary numeric cleanup standards for the Site are the groundwater cleanup levels described in Section 6.2, which address protection of human and aquatic receptors. The other cleanup standard applicable to the Site relates to the prevention of LNAPL from accumulating on the groundwater. Compliance with each of the two standards is discussed below.

The concentration of IHSs in groundwater are currently below cleanup levels at all CPOC wells. Implementation of the MNA program included in the presumptive cleanup actions will document that cleanup levels are met at these wells in the future.

With the exception of the LNAPL observed at SWMU 30, LNAPL (and soils with the potential to result in LNAPL accumulation) is observed primarily in and adjacent to the Lease Parcel. Therefore, the evaluation of whether this cleanup objective is met is addressed mainly by the Lease Parcel CAA. With respect to SWMU 30, the presumptive cleanup action removes the observed LNAPL around well PNO-MW102 and the soil impacted with TPH above RSSLs (Figure 24). By removing the observed LNAPL source and soil exceeding the RSSLs, the

potential for SWMU 30 to cause future exceedances of the LNAPL cleanup standard is eliminated.

Compliance with Regulatory Requirements. All of the presumptive cleanup actions will comply with the applicable legal requirements, including MTCA. Off-site management and disposal of wastes will comply with the applicable solid and dangerous waste regulations.

Compliance Monitoring. The presumptive actions include a comprehensive MNA program that will be developed consistent with Ecology guidelines. Additional compliance monitoring to assess the ongoing performance of the cleanup actions and to monitor compliance with cleanup goals is included in the CAA selected for the Lease Parcel.

9.1.2 Other Requirements

Use of Permanent Solutions. As described in FS, the development of a "permanent" cleanup action for the Site is not feasible because of the severe technical challenges and associated extraordinary costs in attempting such a cleanup. Furthermore, the evaluation process for determining whether a cleanup action uses permanent solutions to maximum extent practicable defined in WAC 173-340-360(3), utilizes a disproportionate cost analysis that is not readily applicable to the use of presumptive actions. That being said, the actions for SWMU 30 and the former fuel transfer pipelines effectively and permanently remove the contaminant sources from these areas and add to the permanence of the overall cleanup action for the Site.

Restoration Time Frame. "Restoration time frame" is defined by MTCA to be the period of time needed to achieve the required cleanup levels at the POC established for the site. For the Site, the POC for groundwater was established at the CPOC wells shown in Figure 18. Groundwater monitoring results indicate that CULs are currently being met at the CPOC. The actions necessary to maintain compliance include implementation of the MNA program included in the presumptive cleanup actions. In addition, implementation of the source control actions included in the presumptive cleanup actions, as well as the Lease Parcel CAA, will help assure that IHS concentrations remain below CULs.

The FS assumes that MNA monitoring would continue for 30 years, although establishing that cleanup standards have been met may take less time, at which point monitoring can be discontinued (i.e., restoration is achieved). A restoration time frame of 20 to 30 years for the Site is considered reasonable based on an evaluation of the factors listed in WAC 173-340-360(4)(b) for determining what is considered a reasonable restoration time frame. Specifically, the Site:

- Poses a low risk to human health and the environment and what risk is present can be readily and effectively controlled through implementation of engineering and institutional controls;

- The current and potential future uses of the Site (i.e., industrial, commercial) are not significantly impacted by the Site contamination and are appropriate uses for the property;

- Existing or potential future water supplies are not affected;
- Monitoring can be effectively implemented throughout the entire site; and
- Natural processes which reduce contaminant concentrations have been documented to occur at the Site.

For these reasons, the presumptive cleanup actions (in conjunction with the Lease Parcel CAA) are considered to provide a reasonable restoration time frame for the Site.

Consider Public Concerns. Ecology has developed a Public Participation Plan (PPP; Ecology, 2010) to promote public understanding and participation in the cleanup process for this Site. As part of the activities outlined in the PPP, Ecology has solicited public comment on the RI, FS, and the 2010 AO by providing for a 45-day public comment period from February 12 through March 29, 2010. Comments received on these documents during the public comment period were considered by Ecology. Ecology responded to the comments, but did not require that the documents be altered by the Port. In its response, Ecology stated that comments from the public will also be considered on this draft CAP once it is available for public notice. This additional public comment period will provide a second opportunity for the public to provide input on the preferred cleanup action alternative. Ecology will continue to involve the public throughout the cleanup process, consistent with the approach presented in the PPP.

9.2 Evaluation of Selected Lease Parcel Cleanup Action Alternative

Alternative 4 was the selected alternative for the Lease Parcel and includes constructing a slurry wall around the perimeter of the former tank farm, removal of all of the remaining subsurface structures and tank bases, removal of highly contaminated surface soil, installation of an enhanced LNAPL recovery system, new asphalt paving, annual paving inspections and repair, LNAPL monitoring and passive recovery outside the enhanced LNAPL recovery system, compliance monitoring, and reporting.

The only CAOs that are not addressed by the presumptive actions relate to the Lease Parcel and include:

- Controlling, to the extent practicable, the migration of IHSs from soil to groundwater in quantities that would result in the accumulation of LNAPL on the groundwater; and
- Controlling, to the extent practicable, the accumulation of LNAPL on the groundwater.

Section 11 and 12 of the FS Report provide a detailed analysis of how Alternative 4 complies with the applicable MTCA evaluation criteria by addressing these two CAOs. This evaluation is summarized below.

9.2.1 Threshold Requirements

Protect human health and the environment. The evaluation of protection of human health and the environment for the Lease Parcel CAAs addressed the control, prevention, or elimination of

product seeps through the asphalt paving placed over the former tank farm. All of the other aspects of complying with this requirement are addressed by the presumptive cleanup actions. Alternative 4 effectively eliminates the potential for product seeps through the asphalt paving by removing all of the remaining subsurface structures, including all of the remaining tank bases, as well as removing highly contaminated surface soil from the former tank farm area and constructing new asphalt paving. The enhanced LNAPL recovery system would further reduce the potential for surface seeps.

Comply with cleanup standards (WAC 173-340-700 through –760). The evaluation of compliance with cleanup standards for the Lease Parcel considered how the CAA prevents LNAPL accumulation on groundwater or migration from soil to groundwater. This evaluation criterion also evaluated the MTCA requirement that nonpermanent cleanup actions treat or remove the LNAPL sources using accepted engineering practices.

Alternative 4 addresses the cleanup standards related to LNAPL by using a combination of the enhanced LNAPL recovery system to remove recoverable LNAPL from the Lease Parcel and adjacent areas and construction of a slurry wall around the former tank farm. Outside the area affected by the enhanced LNAPL recovery system, monitoring and passive recovery activities will be used. By removing the recoverable LNAPL and surrounding the former tank farm area with a slurry wall, Alternative 4 will greatly reduce the potential for migration of LNAPL from the source area.

Alternative 4 relies in part on maintenance of the asphalt paving to minimize infiltration of precipitation and prevent or minimize the migration of LNAPL from soil to groundwater. Because all of the subsurface structures and the highly contaminated surface soil are removed in this alternative, many of the potential soil sources for LNAPL migration to groundwater are removed.

Comply with applicable state and federal laws (WAC 173-340-710). Alternative 4 complies with the applicable legal requirements, including MTCA. Off-site management and disposal of wastes will comply with the applicable solid and dangerous waste regulations.

Provide for compliance monitoring. In addition to the MNA program included in the presumptive cleanup actions, Alternative 4 includes compliance monitoring to assess the ongoing performance of the alternative and to monitor compliance with cleanup goals.

9.2.2 Other Requirements

Use permanent solutions to the maximum extent practicable. The process for determining whether a cleanup action uses permanent solutions to maximum extent practicable is defined in WAC 173-340-360(3). Since none of the alternatives, including the selected alternative, meet the definition of a permanent cleanup action contained in WAC 173-340-200 (a cleanup action where cleanup standards are met without any further cleanup actions being required), the evaluation of this criteria utilized a disproportionate cost analysis that focuses on determining which CAA provides the greatest degree of permanence [WAC 173-340-360(3)(e)(ii)(B)]. The approach for conducting the disproportionate cost analysis is described in Section 9.2.3 below.

Provide for a reasonable restoration time frame. The evaluation of this criterion focused on the time required for Alternative 4 to prevent LNAPL accumulation on groundwater or migration of LNAPL from soil to groundwater in the Lease Parcel. The use of the enhanced LNAPL recovery system in Alternative 4 will remove much of the recoverable LNAPL from the subsurface, and remove it more quickly than the passive techniques of Alternatives 1 and 2 (although potentially not as much or as quickly as the vacuum-enhanced system in Alternative 3). The slurry wall will control migration from the source immediately upon construction. For cost estimating purposes, it was assumed that active LNAPL recovery would continue for 10 years (Table 6), although it is important to note that the majority of the LNAPL recovered in this time would occur in the first several years of operation. At the end of the 10 years, there should be very little residual LNAPL remaining in the area affected by the LNAPL recovery system. Outside the area where active recovery is feasible, monitoring and passive recovery activities will be used and will continue for 30 years.

Preventing or minimizing the migration of LNAPL from soil to groundwater would happen immediately upon implementation of Alternative 4 (e.g., removal of all of the subsurface structures and the highly contaminated surface soil, new asphalt paving) and continue by maintaining the asphalt paving.

Consider public concerns. As noted above, Ecology has developed a PPP for the Site (Ecology, 2010) and solicited public comment on the RI, FS, and the 2010 AO by providing for a 45-day public comment period. Comments received on these documents during the public comment period were considered by Ecology. Ecology responded to the comments, but did not require that the documents be altered by the Port. In its response, Ecology stated that comments from the public will also be considered on this draft CAP once it is available for public notice. This additional public comment period will provide a second opportunity for the public to provide input on the preferred cleanup action alternative. Ecology will continue to involve the public throughout the cleanup process consistent with the approach presented in the PPP.

9.2.3 Disproportionate Cost Analysis

The disproportionate cost evaluation used the criteria described in WAC 173-340-360(3)(f) to determine which Lease Parcel CAA is a permanent solution to the maximum extent practicable. These criteria, and how they were applied to the Lease Parcel CAAs, are:

- **Protectiveness**. This is essentially the same as the primary MTCA requirement described above.

- **Permanence**. This criterion focuses on the degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances. For the evaluation of the Lease Parcel CAAs, this criterion focused on the permanence of addressing the LNAPL on the groundwater and potential sources of LNAPL in soil.

- **Cost**. The overall cost to implement the alternative, including the cost of construction and the NPV of any long-term costs, was used to compare alternatives to each in the cost-benefit analysis.

- **Effectiveness over the long term**. This criterion addresses the degree of certainty that the selected alternative will be successful, the reliability of the alternative during the period of time hazardous substances are expected to remain on-site, the magnitude of residual risk with the alternative in place, and the effectiveness of controls required to manage treatment residues or remaining wastes. For the evaluation of the Lease Parcel CAAs, the differentiating aspect of this criterion was the effectiveness and reliability of the LNAPL control and prevention actions.

- **Management of short-term risks**. This criterion addresses the risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures taken to manage such risks.

- **Technical and administrative implementability**. The ability of an alternative to be implemented including the technical feasibility, availability of necessary off site facilities, administrative and regulatory requirements, access for construction operations and monitoring, and integration with existing facility operations was addressed by this criterion.

- **Consideration of public concerns**. For this evaluation, the potential for a CAA to raise public concerns was addressed.

Alternative 4 provides protection through the construction and maintenance of new asphalt paving and removing all of the remaining subsurface structures and highly contaminated surface soil. It is implementable from both a technical and an administrative standpoint and, although there are some short-term risks associated with its implementation (e.g., heavy construction activities, volatilization of VOCs); these risks can be controlled using standard worker health and safety procedures and engineering controls.

The enhanced LNAPL recovery system will permanently reduce the volume of the recoverable LNAPL at the Lease Parcel. The slurry wall constructed around the former tank farm will significantly and permanently reduce the potential migration of LNAPL from this area. Monitoring and maintenance is required to assure the long-term effectiveness of the paving and LNAPL recovery activities in these areas.

The disproportionate cost analysis was based on comparative evaluation of the Lease Parcel CAAs against the criteria listed above and is summarized in Table 7. The alternatives were ranked from the most to the least permanent solution and then compared based on cost to determine if the benefits provided by a higher cost alternative (as defined by the permanence of the alternative and its ability to meet the CAOs for the Lease Parcel) outweighed the incremental increase in cost of the alternative. The alternative providing the best balance of permanence and cost was selected for implementation along with the presumptive cleanup actions. Based on the analysis detailed in the FS and summarized in Table 7, Alternative 4 provided the best balance of permanence, the ability to meet the CAOs, and cost, and was therefore recommended for implementation.

9.3 Ecology Expectations

WAC 173-340-370 outlines a series of eight expectations that Ecology has regarding selection and implementation of cleanup actions. Selection of the overall cleanup action summarized above for the Site is consistent with these expectations in that it:

- Uses engineering controls (containment) to contain large volumes of materials where treatment is impracticable;
- Minimizes migration of hazardous substances by preventing precipitation and runoff from contacting contaminated soils and waste materials;
- Takes active measures (source control actions) to prevent releases of hazardous substances to surface waters via groundwater discharges; and
- Utilizes natural attenuation appropriately in that:
    - Source control will be conducted to the extent practicable;
    - The contaminants left in place after implementation of the cleanup action do not pose an unacceptable risk to human health and the environment;
    - There is evidence that natural biodegradation is occurring and will continue to occur at a reasonable rate; and
    - Appropriate monitoring requirements are conducted to ensure that natural attenuation processes are taking place and human health and the environment are protected.
    - Does not result in a greater overall threat to human health and the environment compared to other alternatives.

10.0 IMPLEMENTATION OF THE SELECTED CLEANUP ACTION

10.1 Implementation Approach

The final CAA for the Site consists of the presumptive actions described in Section 8.1 and Lease Parcel Alternative 4 as described in Section 8.2. This overall cleanup action will include the general steps outlined below.

- Preparation of this CAP.
- Following final approval of the CAP, initiating cleanup action design.
- Implementation of the presumptive cleanup actions including:
    - Developing and implementing institutional controls;
    - Excavating LNAPL source areas at SWMU 30;
    - Inventorying, cleaning, and abandoning remaining subsurface pipelines; and
    - Developing the MNA monitoring plan, including installing the required additional monitoring wells.
- Implementation of the Lease Parcel cleanup actions including:
    - Removing the existing asphalt paving;
    - Removing and stockpiling existing subgrade and fill, and demolishing the remaining above ground and subsurface structures;
    - Removing highly contaminated surface soil from within the Lease Parcel;
    - Constructing a slurry wall around the former tank farm area;
    - Hauling all demolished and excavated material and decontamination water off site;
    - Designing and installing the enhanced LNAPL recovery trenches;
    - Constructing new asphalt paving with associated stormwater system improvements;
    - Installing new LNAPL monitoring wells; and
    - Initiating the long-term O&M activities including operation of the enhanced LNAPL recovery system, monitoring, asphalt paving inspection and maintenance, passive LNAPL recovery, and reporting.

Following implementation of the preferred cleanup alternative, site development and facility maintenance activities that include subsurface work (e.g., excavation, boring) have the potential to discover additional contamination at the Site. This potential is recognized in the engineering and institutional controls included in the presumptive cleanup actions; these controls will ensure that future subsurface work (e.g., excavation, boring) will utilize appropriate worker health and safety procedures during the subsurface work, and that the appropriate long-term engineering controls (e.g., vapor barriers) are implemented for new developments. Potentially contaminated soil and groundwater removed during these development and maintenance activities will be managed consistent with the specific procedures contained in the Contamination Contingency Plan, which is expected to be part of the new Agreed Order for the entire Terminal 91 Complex.

10.2 Schedule

The remedy design and construction of the cleanup action will be completed in accordance with the schedule below. This schedule anticipates installation of the cleanup action during the 2012 construction season.

Cleanup Action Task	Estimated Completion Date
Finalize 2010 Agreed Order and Permit	July 2010
Public Review of Draft Cleanup Action Plan	October 2010
Finalize Cleanup Action Plan	November 2010
Finalize Cleanup Order	February 2011

The Final Cleanup Order will provide a schedule for the major tasks to be implemented under the Cleanup Order including cleanup action design, bidding and contracting, and cleanup action construction. It is currently anticipated that the design would occur during 2011 and construction during 2012.

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TABLES

Table 1

LNAPL Monitoring Data Summary
Port of SeattleTerminal 91 Cleanup Action Plan
Seattle, Washington

Location	Well	Historical Apparent Thickness Range (feet)	Maximum 2008 Apparent Thickness (feet)	Comments
Lease Parcel, Small Yard	CP-116	0.1 to 0.9	—	No LNAPL recovery since 2001. Well decommissioned in 2004.
	CP-117	0.2 to 1.1	—	Consistent/seasonal recovery until well decommissioned in 2004.
	CP-PR01	0.01 to 0.4	0.09	Pilot test well installed in 2005.
	CP-PR11	Trace to 0.01	0.01	Data gap investigation well installed in 2007.
	CP-PR12	Trace to 1.59	1.59	Data gap investigation well installed in 2007.
Lease Parcel, Marine Diesel Oil Yard	CP-118	0.1 to 1.9	—	Consistent/seasonal recovery until well decommissioned in 2004.
	CP-119	0.1 to 1.6	—	Consistent/seasonal recovery until well decommissioned in 2004.
	CP-PR02	0.01 to 0.3	0.06	Pilot test well installed in 2005.
	CP-PR07	Trace to 0.49	0.49	Data gap investigation well installed in 2007.
	CP-PR08	Trace	Not detected	Data gap investigation well installed in 2007.
Lease Parcel, Black Oil Yard	CP-109	0.2 to 1.2	—	LNAPL thickness decreased to 0.0 to 0.02 ft by 2004. Well decommissioned in 2004.
	CP-PR03	Trace to 0.01	0.01	Data gap investigation well installed in 2007.
	CP-PR04	0.01 to 0.68	0.68	Data gap investigation well installed in 2007.
Between Lease Parcel and AOC 11	CP-107	0.1 to 0.3	Not detected	
	CP-110	0.2 to 0.8	Trace	Periodically contains a PLRD.
	UT-MW39-2	Not detected	0.25 to 0.71	Well monitored between August and December 2008.
	UT-MW39-3	0.1 to 1.6	Trace to 0.99	Periodically contains a PLRD.
AOC 11	PNO-MW104	0.06 to 0.19	0.12	Typical 2008 apparent thickness was 0.01 ft.
SWMU 30	PNO-EW01	0.0 to 1.02	Not monitored	Well under concrete barriers.
	PNO-MW03	0.0 to 1.43	Not detected	Periodically contains a PLRD.
	PNO-MW06A	0.0 to 0.01	Not detected	
	PNO-MW102	0.0 to 0.80	Not detected	
	PNO-MW103	0.0 to 0.08	Not detected	

Notes:

1. Historical LNAPL thickness range is approximate and rounded to the neared 0.1 ft from historical LNAPL monitoring data.
2. PLRD = passive LNAPL recovery device.
3. — = not applicable.

Table 2
Concentrations of PCBs in Soil Samples
Port of Seattle Terminal 91 Cleanup Action Plan
Seattle, Washington

Soil Boring Number	Date Drilled	Sample Depth	Soil Saturation Status	PCBs (mg/kg) Total PCBs
DG-99	9/16/08	2.5	V	ND
		6	Sm	ND
		12	Sat	ND
DG-100	9/16/08	3	V	ND
		6	Sm	**0.42**
		10	Sat	ND
DG-101	9/17/08	3	V	**0.095**
		5.5	Sm	**0.71**
		11	Sat	ND
DG-102	9/16/08	3	V	**0.22**
		6	Sm	**0.63**
		10	Sm/Sat	ND
DG-103	9/16/08	2.5	V	ND
		5	Sm	ND
		13	Sat	ND
DG-104	9/17/08	5.5	Sm	**9.3**
		9	Sat	**0.21**
		13	Sat	**0.14**
DG-105	9/17/08	4	V/Sm	**2.04**
		7	Sm	**0.47**
		11	Sat	ND
DG-106	9/17/08	4	V/Sm	**0.76**
		8	Sm/Sat	ND
		10	Sat	ND
DG-107	9/17/08	3	V	**1.83**
		6	Sm	**0.91**
		11	Sat	ND
DG-108	9/17/08	3	V	**0.54**
		8	Sm/Sat	**0.70**
		10	Sat	ND
DG-109	9/17/08	4	V/Sm	ND
		5	Sm	ND
		10	Sat	ND
DG-110	9/17/08	4	V/Sm	**0.23**
		8	Sm/Sat	**0.345**
		9.5	Sat	ND
		11	Sat	ND
DG-111	9/18/08	3	V	**0.43**
		3 (dup)	V	**1.10**
		7	Sm	**0.557**
DG-112	9/18/08	4	V/Sm	ND
		7	Sm	ND
		7 (dup)	Sm	ND
		10	Sat	ND

Table 2
Concentrations of PCBs in Soil Samples
Port of Seattle Terminal 91 Cleanup Action Plan
Seattle, Washington

Soil Boring Number	Date Drilled	Sample Depth	Soil Saturation Status	PCBs (mg/kg) Total PCBs
DG-113	9/17/08	3	V	ND
		6.5	Sm	**1.58**
		10	Sat	ND
DG-114	9/17/08	5	Sm	**1.6**
		10	Sat	**0.11**
		13	Sat	ND
DG-115	9/18/08	6	Sm	**2.07**
		10	Sat	ND
		12	Sat	ND
		12 (dup)	Sat	ND

Notes:

1. ft bgs = feet below ground surface.
2. Soil saturation status (based on historical water levels):
   v = vadose zone (always above the water table);
   sm = smear zone (seasonally below the water table); and
   sat = saturated zone (always below the water table).
3. PCB analyses performed using EPA Method 8082.

Table 3
Final Cleanup Levels for Shallow[1] Groundwater
Port of Seattle Terminal 91 Cleanup Action Plan
Seattle, WA

CAS Number	Indicator Hazardous Substance	Class	Final Recommended Ecological Cleanup Level for Surface Water (ug/L)	Basis of Final Ecological Cleanup Level	Rationale for Selecting this CUL for Final CUL (if not most protective)	Most Protective Human Health Cleanup Level for Groundwater (ug/L)[2]	Basis of Final Human Health Cleanup Level for Shallow Groundwater	Groundwater PQL[3] (ug/L)	Area Background Concentration for Groundwater[4] (ug/L)	Final FS Shallow Groundwater CUL[5] (ug/L)	Basis for Final FS CUL
7440-38-2	Arsenic	Inorganic	36	State WQS		0.042	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.2	4.71	**4.7**	Background
7440-39-3	Barium	Inorganic	5,700	ECOTOX		55,300	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.5		**5,700**	Ecological
7440-47-3	Chromium	Inorganic	74	AWQC		104,000	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.5	7.31	**74**	Ecological
7439-92-1	Lead	Inorganic	8.10	State WQS	Marine chronic; regulatory threshold	--		1	2.47	**8.1**	Ecological
7439-97-6	Mercury	Inorganic	0.030	State WQS	Marine chronic; regulatory threshold	0.300	AWQC Federal Human Health Consumption of Organisms Only	0.02	0.01	**0.03**	Ecological
7782-49-2	Selenium	Inorganic	71	State WQS	Marine chronic; regulatory threshold	27.6	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.5		**27.6**	Human Health
7440-22-4	Silver	Inorganic	1.90	State WQS		1,100	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**1.9**	Ecological
7440-66-6	Zinc	Inorganic	81	State WQS		5,000	AWQC Federal Organoleptic Effect Criteria	4	38.3	**81**	Ecological
68334-30-5	Diesel	Petroleum				500	Petroleum Related MTCA Method A Table 720-1 Values	250		**500**	Human Health
86290-81-5	Gasoline	Petroleum				800	Petroleum Related MTCA Method A Table 720-1 Values	250		**800**	Human Health
541-73-1	1,3-dichlorobenzene	Semi-Volatile	206	ECOTOX		33.2	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	1		**33.2**	Human Health
90-12-0	1-methylnaphthalene	Semi-Volatile	1,190	ECOTOX		31.6	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**31.6**	Human Health
105-67-9	2,4-dimethylphenol	Semi-Volatile	397	ECOTOX		236	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	1		**236**	Human Health
121-14-2	2,4-dinitrotoluene	Semi-Volatile	307	ECOTOX		3.40	AWQC Federal Human Health Consumption of Organisms Only	1		**3.4**	Human Health
91-57-6	2-methylnaphthalene	Semi-Volatile	373	ECOTOX		421	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**373**	Ecological
95-48-7	2-methylphenol	Semi-Volatile	4,020	ECOTOX		8,770	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	1		**4,020**	Ecological
106-44-5	4-methylphenol	Semi-Volatile	1,830	ECOTOX		891	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	1		**891**	Human Health
83-32-9	Acenaphthene	Semi-Volatile	34	ECOTOX		20	AWQC Federal Organoleptic Effect Criteria	0.01		**20**	Human Health
208-96-8	Acenaphthylene	Semi-Volatile	10.7	SMS		--		0.01		**10.7**	Ecological
120-12-7	Anthracene	Semi-Volatile	2.68	ECOTOX		11,000	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**2.7**	Ecological
56-55-3	Benzo(a)anthracene	Semi-Volatile	0.276	SMS		0.018	AWQC Federal Human Health Consumption of Organisms Only	0.01		**0.02**	Human Health
50-32-8	Benzo(a)pyrene	Semi-Volatile	0.110	ECOTOX		0.013	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.01		**0.01**	Human Health
205-99-2	Benzo(b)fluoranthene	Semi-Volatile	0.187	SMS		0.018	AWQC Federal Human Health Consumption of Organisms Only	0.01		**0.02**	Human Health
UNK-009	Benzo(b,k)fluoranthene	Semi-Volatile	0.187	SMS		0.126	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.01		**0.13**	Human Health
191-24-2	Benzo(g,h,i)perylene	Semi-Volatile	0.012	SMS		--		0.01		**0.01**	Ecological
207-08-9	Benzo(k)fluoranthene	Semi-Volatile	0.187	SMS		0.018	AWQC Federal Human Health Consumption of Organisms Only	0.01		**0.02**	Human Health
65-85-0	Benzoic Acid	Semi-Volatile	2,950	ECOTOX		280,000	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	1		**2,950**	Ecological
86-74-8	Carbazole	Semi-Volatile	299	ECOTOX		0.921	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	1		**1.0**	Human Health
218-01-9	Chrysene	Semi-Volatile	1,560	ECOTOX		0.018	AWQC Federal Human Health Consumption of Organisms Only	0.01		**0.02**	Human Health
53-70-3	Dibenz(a,h)anthracene	Semi-Volatile	0.003	SMS		0.018	AWQC Federal Human Health Consumption of Organisms Only	0.01		**0.01**	PQL
132-64-9	Dibenzofuran	Semi-Volatile	268	ECOTOX		14.70	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**14.7**	Human Health
206-44-0	Fluoranthene	Semi-Volatile	4.10	ECOTOX		38.40	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**4.1**	Ecological
86-73-7	Fluorene	Semi-Volatile	78	ECOTOX		1,470	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**78**	Ecological
67-72-1	Hexachloroethane	Semi-Volatile	NR			2.27	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	1		**2.3**	Human Health
193-39-5	Indeno(1,2,3-cd)pyrene	Semi-Volatile	0.01	SMS		0.018	AWQC Federal Human Health Consumption of Organisms Only	0.01		**0.01**	Ecological
CRESOLS34	Methylphenol, P-, M-	Semi-Volatile	1,250	ECOTOX		--		1		**1,250**	Ecological
91-20-3	Naphthalene	Semi-Volatile	97	ECOTOX		2,110	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**97**	Ecological
85-01-8	Phenanthrene	Semi-Volatile	22	ECOTOX		--		0.01		**22**	Ecological
129-00-0	Pyrene	Semi-Volatile	35	ECOTOX		1,110	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**35**	Ecological
75-34-3	1,1-dichloroethane	Volatile	2,800	ORNL		17,500	Commercial MTCA Method C - 750-1 Inhalation of Indoor Air	0.2		**2,800**	Ecological
95-63-6	1,2,4-trimethylbenzene	Volatile	NR			320	Commercial MTCA Method C - 750-1 Inhalation of Indoor Air	0.2		**320**	Human Health
106-46-7	1,4-dichlorobenzene	Volatile	NR			2.07	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.2		**2.1**	Human Health

Table 3
Final Cleanup Levels for Shallow[1] Groundwater
Port of Seattle Terminal 91 Cleanup Action Plan
Seattle, WA

CAS Number	Indicator Hazardous Substance	Class	Final Recommended Ecological Cleanup Level for Surface Water (ug/L)	Basis of Final Ecological Cleanup Level	Rationale for Selecting this CUL for Final CUL (if not most protective)	Most Protective Human Health Cleanup Level for Groundwater (ug/L)[2]	Basis of Final Human Health Cleanup Level for Shallow Groundwater	Groundwater PQL[3] (ug/L)	Area Background Concentration for Groundwater[4] (ug/L)	Final FS Shallow Groundwater CUL[5] (ug/L)	Basis for Final FS CUL
67-64-1	Acetone	Volatile	NR			311,000	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	1		**311,000**	Human Health
71-43-2	Benzene	Volatile	NR			9.66	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.2		**9.7**	Human Health
104-51-8	Butylbenzene,n-	Volatile	NR			--		0.2			
108-90-7	Chlorobenzene	Volatile	NR			20	AWQC Federal Organoleptic Effect Criteria	0.2		**20**	Human Health
75-00-3	Chloroethane	Volatile	230,000	USGS		381	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.2		**381**	Human Health
156-59-2	Cis-1,2-dichloroethene	Volatile	11,600	USGS		1,360	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**1,360**	Human Health
100-41-4	Ethylbenzene	Volatile	NR			2,100	AWQC Federal Human Health Consumption of Organisms Only	0.2		**2,100**	Human Health
98-82-8	Cumene	Volatile	NR			850	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**850**	Human Health
103-65-1	n-Propylbenzene	Volatile	NR			1,160	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**1,160**	Human Health
135-98-8	Sec-butylbenzene	Volatile	NR			152	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**152**	Human Health
98-06-6	Tert-butylbenzene	Volatile	NR			152	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**152**	Human Health
108-88-3	Toluene	Volatile	NR			8,260	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**8,260**	Human Health
75-01-4	Vinyl Chloride	Volatile	930	RAIS		1.69	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.2		**1.7**	Human Health
1330-20-7	Xylene (total)	Volatile	NR			1,160	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.4		**1,160**	Human Health

Notes:

Final FS CULs = These are the most stringent applicable CULs and are the initial CULs that will be considered in the Feasibility Study (FS). As such, they may be adjusted upward or downward based on area background concentrations, practical quantitation limits, or other information, as appropriate, in the FS.

-- = Toxicity value not available to calculate CUL

API Fisher = Asian Pacific Islander Fisherman

AWQC = Federal Ambient Water Quality Criteria (Section 304 of the Clean Water Act)

CR = Cancer Risk

CUL = Cleanup Level

ECOTOX = U.S. EPA Ecotoxicity Database - available on-line at http://www.epa.gov/ecotox/

HQ = Hazard Quotient

MTCA = Model Toxics Control Act (WAC 173-340)

No BCF = No bioconcentration factor was available to calculate the cleanup level

No Alpha = No groundwater to indoor air volatilization factor was available to calculate the cleanup level

No RfD = No Reference Dose was available to calculate the cleanup level

No SF = No Slope Factor was available to calculate the cleanup level

PQL = Practical Quantitation Limit

NR = No value recommended. Difficulties in the exposure methods of the tests used to derive values resulted in values being highly uncertain.

ORNL = Oak Ridge Nation Laboratory Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects

RAIS = Risk Assessment Information System - available online at http://risk.lsd.ornl.gov/index.shtml

SMS = Sediment Management Standards

USGS 1999 = United States Geological Survey - Selection Procedure and Salient Information for Volatile

WQS = Water Quality Standards

[1] Shallow groundwater wells were screened at a maximum depth of 21 feet below ground surface (bgs)

[2] Based on protection of surface water and protection from vapor intrusion

[3] PQLs were acquired from ARI Laboratories, Inc. *Personal Communication with Susan Dunnihoo, July 22, 2008* .

[4] Based on Terminal 91 Tank Farm Site Background Groundwater Evaluation (PIONEER, 2007)

[5] Based on Terminal 91 Tank Farm Site Feasibility Study Cleanup Levels (PIONEER, 2008)

Table 4
Final Cleanup Levels for Deep[1] Groundwater
Port of Seattle Terminal 91 Cleanup Action Plan
Seattle, WA

CAS Number	Indicator Hazardous Substance	Class	Final Recommended Ecological Cleanup Level for Surface Water (ug/L)	Basis of Final Ecological Cleanup Level for Surface Water	Rationale for Selecting this CUL for Final CUL (if not most protective)	Most Protective Human Health Cleanup Level for Groundwater (ug/L)[2]	Basis of Final Human Health Cleanup Level for Deep Groundwater	Groundwater PQL[3] (ug/L)	Area Background Concentration for Groundwater[4] (ug/L)	Final FS Deep Groundwater CUL[4] (ug/L)	Basis for Final FS CUL
7440-38-2	Arsenic	Inorganic	36	State WQS		0.042	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.2	4.71	**4.7**	Background
7440-39-3	Barium	Inorganic	5,700	ECOTOX		55,300	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.5		**5,700**	Ecological
7440-47-3	Chromium	Inorganic	74	AWQC		104,000	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.5	7.31	**74**	Ecological
7439-92-1	Lead	Inorganic	8.10	State WQS	Marine chronic; regulatory threshold	--		1	2.47	**8.1**	Ecological
7439-97-6	Mercury	Inorganic	0.030	State WQS	Marine chronic; regulatory threshold	0.300	AWQC Federal Human Health Consumption of Organisms Only	0.02	0.01	**0.03**	Ecological
7782-49-2	Selenium	Inorganic	71	State WQS	Marine chronic; regulatory threshold	27.6	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.5		**27.6**	Human Health
7440-22-4	Silver	Inorganic	1.90	State WQS		1,100	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**1.9**	Ecological
7440-66-6	Zinc	Inorganic	81	State WQS		5,000	AWQC Federal Organoleptic Effect Criteria	4	38.3	**81**	Ecological
68334-30-5	Diesel	Petroleum				500	Petroleum Related MTCA Method A Table 720-1 Values	250		**500**	Human Health
86290-81-5	Gasoline	Petroleum				800	Petroleum Related MTCA Method A Table 720-1 Values	250		**800**	Human Health
541-73-1	1,3-dichlorobenzene	Semi-Volatile	206	ECOTOX		33.2	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	1		**33.2**	Human Health
90-12-0	1-methylnaphthalene	Semi-Volatile	1,190	ECOTOX		31.6	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**31.6**	Human Health
105-67-9	2,4-dimethylphenol	Semi-Volatile	397	ECOTOX		236	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	1		**236**	Human Health
121-14-2	2,4-dinitrotoluene	Semi-Volatile	307	ECOTOX		3.40	AWQC Federal Human Health Consumption of Organisms Only	1		**3.4**	Human Health
91-57-6	2-methylnaphthalene	Semi-Volatile	373	ECOTOX		421	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**373**	Ecological
95-48-7	2-methylphenol	Semi-Volatile	4,020	ECOTOX		8,770	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	1		**4,020**	Ecological
106-44-5	4-methylphenol	Semi-Volatile	1,830	ECOTOX		891	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	1		**891**	Human Health
83-32-9	Acenaphthene	Semi-Volatile	34	ECOTOX		20	AWQC Federal Organoleptic Effect Criteria	0.01		**20**	Human Health
208-96-8	Acenaphthylene	Semi-Volatile	10.7	SMS		--		0.01		**10.7**	Ecological
120-12-7	Anthracene	Semi-Volatile	2.68	ECOTOX		11,000	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**2.7**	Ecological
56-55-3	Benzo(a)anthracene	Semi-Volatile	0.276	SMS		0.018	AWQC Federal Human Health Consumption of Organisms Only	0.01		**0.02**	Human Health
50-32-8	Benzo(a)pyrene	Semi-Volatile	0.110	ECOTOX		0.013	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.01		**0.01**	Human Health
205-99-2	Benzo(b)fluoranthene	Semi-Volatile	0.187	SMS		0.018	AWQC Federal Human Health Consumption of Organisms Only	0.01		**0.02**	Human Health
UNK-009	Benzo(b,k)fluoranthene	Semi-Volatile	0.187	SMS		0.126	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.01		**0.13**	Human Health
191-24-2	Benzo(g,h,i)perylene	Semi-Volatile	0.012	SMS		--		0.01		**0.01**	Ecological
207-08-9	Benzo(k)fluoranthene	Semi-Volatile	0.187	SMS		0.018	AWQC Federal Human Health Consumption of Organisms Only	0.01		**0.02**	Human Health
65-85-0	Benzoic Acid	Semi-Volatile	2,950	ECOTOX		280,000	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	1		**2,950**	Ecological
86-74-8	Carbazole	Semi-Volatile	299	ECOTOX		0.921	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	1		**1.0**	Human Health
218-01-9	Chrysene	Semi-Volatile	1,560	ECOTOX		0.018	AWQC Federal Human Health Consumption of Organisms Only	0.01		**0.02**	Human Health
53-70-3	Dibenz(a,h)anthracene	Semi-Volatile	0.003	SMS		0.018	AWQC Federal Human Health Consumption of Organisms Only	0.01		**0.01**	PQL
132-64-9	Dibenzofuran	Semi-Volatile	268	ECOTOX		14.70	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**14.7**	Human Health
206-44-0	Fluoranthene	Semi-Volatile	4.10	ECOTOX		38.40	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**4.1**	Ecological
86-73-7	Fluorene	Semi-Volatile	78	ECOTOX		1,470	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**78**	Ecological
67-72-1	Hexachloroethane	Semi-Volatile	NR			2.27	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	1		**2.3**	Human Health
193-39-5	Indeno(1,2,3-cd)pyrene	Semi-Volatile	0.01	SMS		0.018	AWQC Federal Human Health Consumption of Organisms Only	0.01		**0.01**	Ecological
CRESOLS34	Methylphenol, P-, M-	Semi-Volatile	1,250	ECOTOX		--		1		**1,250**	Ecological
91-20-3	Naphthalene	Semi-Volatile	97	ECOTOX		2,110	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**97**	Ecological
85-01-8	Phenanthrene	Semi-Volatile	22	ECOTOX		--		0.01		**22**	Ecological
129-00-0	Pyrene	Semi-Volatile	35	ECOTOX		1,110	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.01		**35**	Ecological
75-34-3	1,1-dichloroethane	Volatile	2,800	ORNL		23,000	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**2,800**	Ecological
95-63-6	1,2,4-trimethylbenzene	Volatile	NR			643	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**643**	Human Health

Table 4
Final Cleanup Levels for Deep[1] Groundwater
Port of Seattle Terminal 91 Cleanup Action Plan
Seattle, WA

CAS Number	Indicator Hazardous Substance	Class	Final Recommended Ecological Cleanup Level for Surface Water (ug/L)	Basis of Final Ecological Cleanup Level for Surface Water	Rationale for Selecting this CUL for Final CUL (if not most protective)	Most Protective Human Health Cleanup Level for Groundwater (ug/L)[2]	Basis of Final Human Health Cleanup Level for Deep Groundwater	Groundwater PQL[3] (ug/L)	Area Background Concentration for Groundwater[4] (ug/L)	Final FS Deep Groundwater CUL[4] (ug/L)	Basis for Final FS CUL
106-46-7	1,4-dichlorobenzene	Volatile	NR			2.07	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.2		**2.1**	Human Health
67-64-1	Acetone	Volatile	NR			311,000	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	1		**311,000**	Human Health
71-43-2	Benzene	Volatile	NR			9.66	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.2		**9.7**	Human Health
104-51-8	Butylbenzene,n-	Volatile	NR			--		0.2			
108-90-7	Chlorobenzene	Volatile	NR			20	AWQC Federal Organoleptic Effect Criteria	0.2		**20**	Human Health
75-00-3	Chloroethane	Volatile	230,000	USGS		381	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.2		**381**	Human Health
156-59-2	Cis-1,2-dichloroethene	Volatile	11,600	USGS		1,360	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**1,360**	Human Health
100-41-4	Ethylbenzene	Volatile	NR			2,100	AWQC Federal Human Health Consumption of Organisms Only	0.2		**2,100**	Human Health
98-82-8	Cumene	Volatile	NR			850	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**850**	Human Health
103-65-1	n-Propylbenzene	Volatile	NR			1,160	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**1,160**	Human Health
135-98-8	Sec-butylbenzene	Volatile	NR			152	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**152**	Human Health
98-06-6	Tert-butylbenzene	Volatile	NR			152	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**152**	Human Health
108-88-3	Toluene	Volatile	NR			8,260	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.2		**8,260**	Human Health
75-01-4	Vinyl Chloride	Volatile	930	RAIS		1.69	API Fisher MTCA Method B - 730-2 Modified Ingestion of Fish	0.2		**1.7**	Human Health
1330-20-7	Xylene (total)	Volatile	NR			1,160	API Fisher MTCA Method B - 730-1 Modified Ingestion of Fish	0.4		**1,160**	Human Health

Notes:

Final FS CULs = These are the most stringent applicable CULs and are the initial CULs that will be considered in the Feasibility Study (FS). As such, they may be adjusted upward or downward based on area background concentrations, practical quantitation limits, or other information, as appropriate, in the FS.

-- = Toxicity value not available to calculate CUL

API Fisher = Asian Pacific Islander Fisherman

AWQC = Federal Ambient Water Quality Criteria (Section 304 of the Clean Water Act)

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ECOTOX = U.S. EPA Ecotoxicity Database - available on-line at http://www.epa.gov/ecotox/

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MTCA = Model Toxics Control Act (WAC 173-340)

No BCF = No bioconcentration factor was available to calculate the cleanup level

No Alpha = No groundwater to indoor air volatilization factor was available to calculate the cleanup level

No RfD = No Reference Dose was available to calculate the cleanup level

No SF = No Slope Factor was available to calculate the cleanup level

PQL = Practical Quantitation Limit

NR = No value recommended. Difficulties in the exposure methods of the tests used to derive values resulted in values being highly uncertain.

ORNL = Oak Ridge Nation Laboratory Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects

RAIS = Risk Assessment Information System - available online at http://risk.lsd.ornl.gov/index.shtml

SMS = Sediment Management Standards

USGS 1999 = United States Geological Survey - Selection Procedure and Salient Information for Volatile

WQS = Water Quality Standards

[a] Deep groundwater wells were screened at a maximum depth of 60 feet below ground surface (bgs)

[c] Based on protection of surface water and protection from vapor intrusion

[e] PQLs were acquired from ARI Laboratories, Inc. *Personal Communication with Susan Dunnihoo, July 22, 2008*.

[d] Based on Terminal 91 Tank Farm Site Background Groundwater Evaluation (PIONEER, 2007)

[b] Based on Terminal 91 Tank Farm Site Feasibility Study Cleanup Levels (PIONEER, 2008)

Table 5
Construction Costs
SMWU-30 - Limited Excavation of LNAPL Source Areas
Port of Seattle Terminal 91 Cleanup Action Plan
Seattle, Washington

Construction Costs										
ITEM	UNIT COST		UNITS	QUANTITY		COST				
	low	high		low	high	low		high		
Construction Costs										
1. Mobilization/demobilization	$ 10,000	$ 15,000	LS	1	1	$	10,000	$	15,000	
2. Excavate clean overburden	$ 5	$ 7	ton	1,000	1,300	$	5,000	$	9,100	
3. Excavate TPH-impacted soil	$ 5	$ 7	ton	1,500	1,900	$	7,500	$	13,300	
4. Water management	$ 15,000	$ 20,000	LS	1	1	$	15,000	$	20,000	
5. Offsite soil disposal										
a) Disposal as solid waste (TPH only)	$ 35	$ 40	ton	1,500	1,900	$	52,500	$	76,000	
6. Backfill excavated area with clean soil										
a) With excavated "clean soil"	$ 10	$ 12	ton	1,000	1,300	$	10,000	$	15,600	
a) With imported clean soil	$ 26	$ 30	ton	1,650	2,100	$	42,900	$	63,000	
7 Replace cap										
a) Remove existing asphalt	$ 0.65	$ 0.75	SF	4,350	5,400	$	2,828	$	4,050	
b) New asphalt paving	$ 2.00	$ 2.25	SF	4,350	5,400	$	8,700	$	12,150	
8. Well decommissioning	$ 400	$ 500	EA	3	3	$	1,200	$	1,500	
					Subtotal	$	155,600	$	229,700	
					Sales Tax on Materials (9%)	$	9,300	$	13,800	
					Engineering and Permitting (10%)	$	15,600	$	23,000	
					Construction Cost Contingency (20%)	$	31,100	$	45,900	
					Total Estimated Capital Costs	**$**	**210,000**	**$**	**310,000**	
					Average Capital Cost	**$**	**260,000**			

Table 6
Construction and Operation and Maintenance Costs
Alternative 4 - Containment, Subsurface Structure Removal, and Enhanced LNAPL Recovery
Port of Seattle Terminal 91 Cleanup Action Plan, Seattle, Washington

Construction Costs

ITEM	UNIT COST low	UNIT COST high	UNITS	QUANTITY low	QUANTITY high	COST low	COST high
Construction Costs							
1. Mobilization/demobilization	$ 70,000	$ 80,000	LS	1	1	$ 70,000	$ 80,000
2. Remove existing asphalt paving	$ 0.65	$ 0.75	SF	135,000	135,000	$ 88,000	$ 101,000
3. Excavate existing sub base	$ 3.00	$ 5.00	ton	9,400	11,750	$ 28,000	$ 59,000
4. Demolish, decontaminate and haul out all existing subsurface structures	$ 520,000	$ 1,100,000	LS	1	1	$ 520,000	$ 1,100,000
5. Excavate highly contaminated soils, incl backfil	$ 31	$ 40	ton	250	500	$ 7,750	$ 20,000
6. Dispose highly contaminated soils							
a) Disposal as solid waste (TPH-only, low level PCB	$ 38	$ 43	ton	150	300	$ 5,700	$ 12,900
b) Disposal as TSCA Waste (PCB >50 ppm)	$ 215	$ 240	ton	50	100	$ 10,750	$ 24,000
c) Contained-out waste (e.g., F001-F005)	$ 58	$ 64	ton	50	100	$ 2,900	$ 6,400
7. Excavate working trench for wall installatior	$ 3	$ 5	ton	3,900	4,900	$ 12,000	$ 25,000
8. Slurry wall installatior	$ 5	$ 10	SF	31,000	31,000	$ 155,000	$ 310,000
9. Stockpile, replace, and compact trench spoils	$ 5	$ 7	ton	3,900	4,900	$ 20,000	$ 34,000
10. Install enhanced LNAPL recovery trenches	$ 65,000	$ 120,000	LS	1	1	$ 65,000	$ 120,000
11. Install new asphalt paving							
a) Stockpile, replace, and compact clean sub base	$ 5	$ 7	ton	9,400	11,800	$ 47,000	$ 83,000
b) Install new asphalt paving	$ 2.00	$ 2.25	SF	135,000	135,000	$ 270,000	$ 304,000
12. Site drainage improvements	$ 25,000	$ 50,000	LS	1	1	$ 25,000	$ 50,000
13. Decommission and replace select monitoring well	$ 5,000	$ 8,000	EA	16	16	$ 80,000	$ 128,000
14. Oversight during construction/construction report	$ 50,000	$ 75,000	LS	1	1	$ 50,000	$ 75,000
					Subtotal	$ 1,407,100	$ 2,457,300
					Sales Tax on Materials (9%)	$ 127,000	$ 221,000
					Engineering and Permitting (10%)	$ 141,000	$ 246,000
					Construction Cost Contingency (20%)	$ 281,000	$ 491,000
					Total Estimated Capital Costs	**$ 1,960,000**	**$ 3,420,000**
					Average Capital Cost	**$ 2,690,000**	

Operation and Maintenance Costs

Activity	**Estimated Annual Cost low**	**Estimated Annual Cost high**	**Baseline O&M Case PW[1] (30 Years)**
1. Annual asphalt paving inspection and maintenance	$ 7,000	$ 13,000	$ 154,000
2. Monthly LNAPL recovery (years 1-2)	$ 25,000	$ 35,000	$ 56,000
3. Bimonthly LNAPL recovery (years 3-5)	$ 15,000	$ 20,000	$ 43,000
4. Quarterly LNAPL recovery (years 5-10)	$ 10,000	$ 15,000	$ 42,000
5. LNAPL monitoring and passive recovery outside expanded recovery systen	$ 6,000	$ 12,000	$ 138,000
6. Compliance groundwater monitoring	$ 15,000	$ 25,000	$ 307,000
7. Annual reporting (inspections, LNAPL recovery and monitoring, groundwater monitoring	$ 20,000	$ 25,000	$ 346,000
	$ 98,000	$ 145,000	
		Subtotal	$ 1,086,000
		O&M Cost Contingency (10 %)	$ 108,600
		Total Estimated O&M Costs	**$ 1,190,000**
TOTAL ESTIMATED PRESENT WORTH COST			**$ 3,880,000**

[1] PW = present worth, calculated assuming a 5% discount rate using the average annual cost and years of operation indicated in the following formula

where A = average annual cost
i = discount rate
n = number of years of operation

All total costs are in 2009 dollars and rounded to nearest $10,000.

FIGURES

U.S.G.S. Topo Map - Seattle North W, WA, 7.5-minute quadrangle.1983

PES Environmental, Inc.
Engineering & Environmental Services

Site Location Map
Port of Seattle Terminal 91
Seattle, Washington

FIGURE
1

948.002.16.001	948-00216001_DCAP_1		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

948-00216001_DCAP_2

For areas shown as Tank Farm Affected Area ("TFAA") that are outside the Tank Farm Lease Parcel, the TFAA includes only soil and ground water below the water table. Soil above the water table (and outside the Tank Farm Lease Parcel) is outside the TFAA.

Note:

N

0 700 feet

The locations of all features are approximate.

Explanation

- Port of Seattle Property Limits
- Tank Farm Lease Parcel
- Tank Farm Affected Area
- Submerged Land

PES Environmental, Inc.
Engineering & Environmental Services

FIGURE 2

Port of Seattle Terminal 91 Facility and Tank Farm Lease Parcel
Port of Seattle Terminal 91
Seattle, Washington

948.002.16.001	948-00216001_DCAP_2		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

Tank 104
Tank 103
Tank 102
Marine Diesel Oil Yard
Tank 101
Tank 100
Tank 99
Tank 98
Tank 92
Tank 97
Tank 96
Tank 95
Tank 94
Tank 90
Black Oil Yard
Tank 91
Tank 93
Pumphouse
Oil/Water Separator
Pipe Alley
Tank 105
Tank 106
Tank 107
Tank 108
Tank 109
Tank 110
Tank 111
Tank 112
Tank 113
Tank 114
Small Yard
Main Warehouse (Building 19)
Foam Mixing Area
Lube Warehouse

Note: Aboveground portions of the tank farm were demolished in 2005; subsurface structures (e.g., tank bottoms, concrete) remain in place except where noted.

Explanation

Lease Parcel Boundary

100 Tank Bottoms Removed During 2005 Demolition Activities

N

0 50

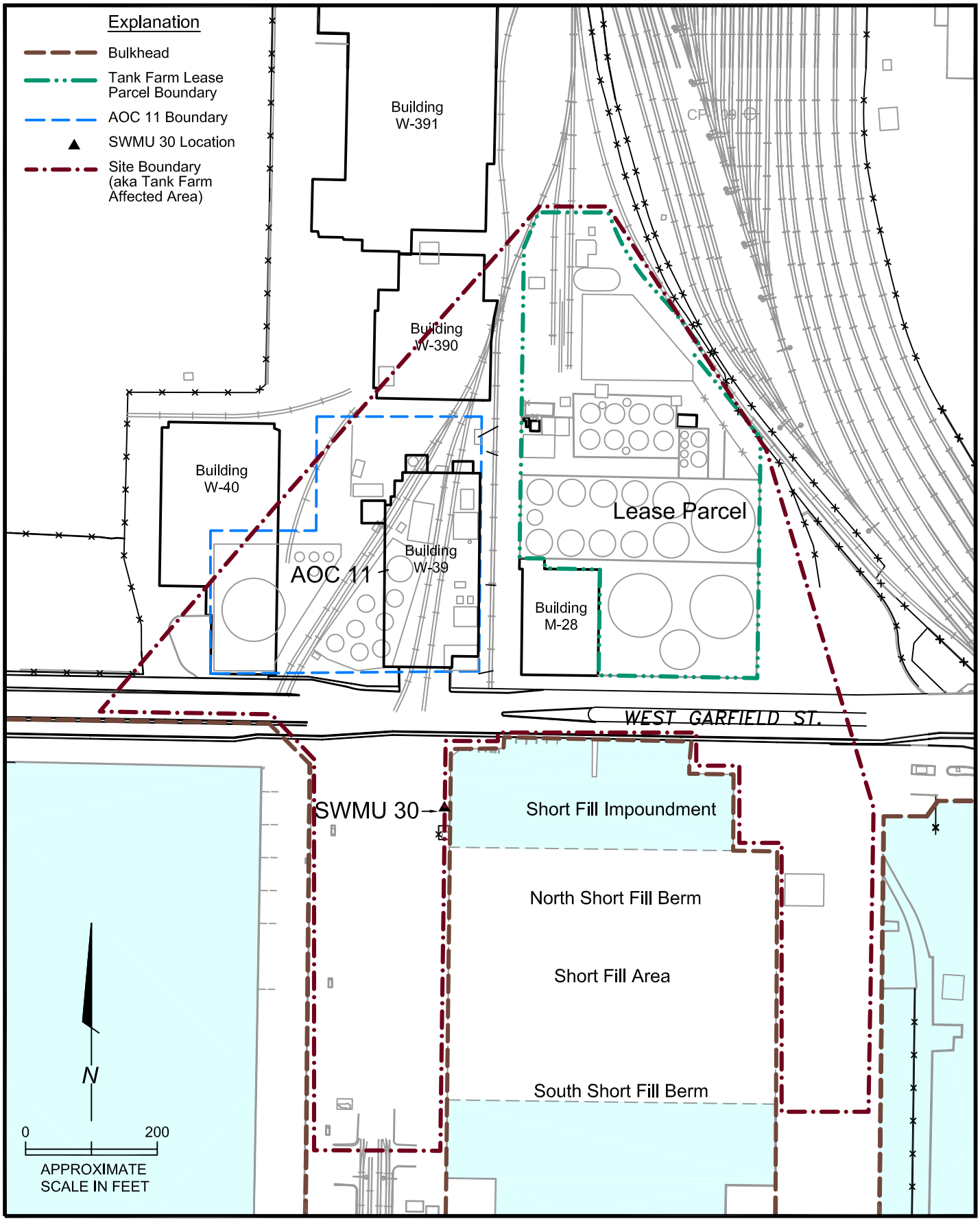
APPROXIMATE SCALE IN FEET

PES Environmental, Inc.
Engineering & Environmental Services

Former Tank Farm Configuration Prior to 2005 Demolition
Port of Seattle Terminal 91
Seattle, Washington

FIGURE 3

948.002.16.001	948-00216001_DCAP_3		3/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

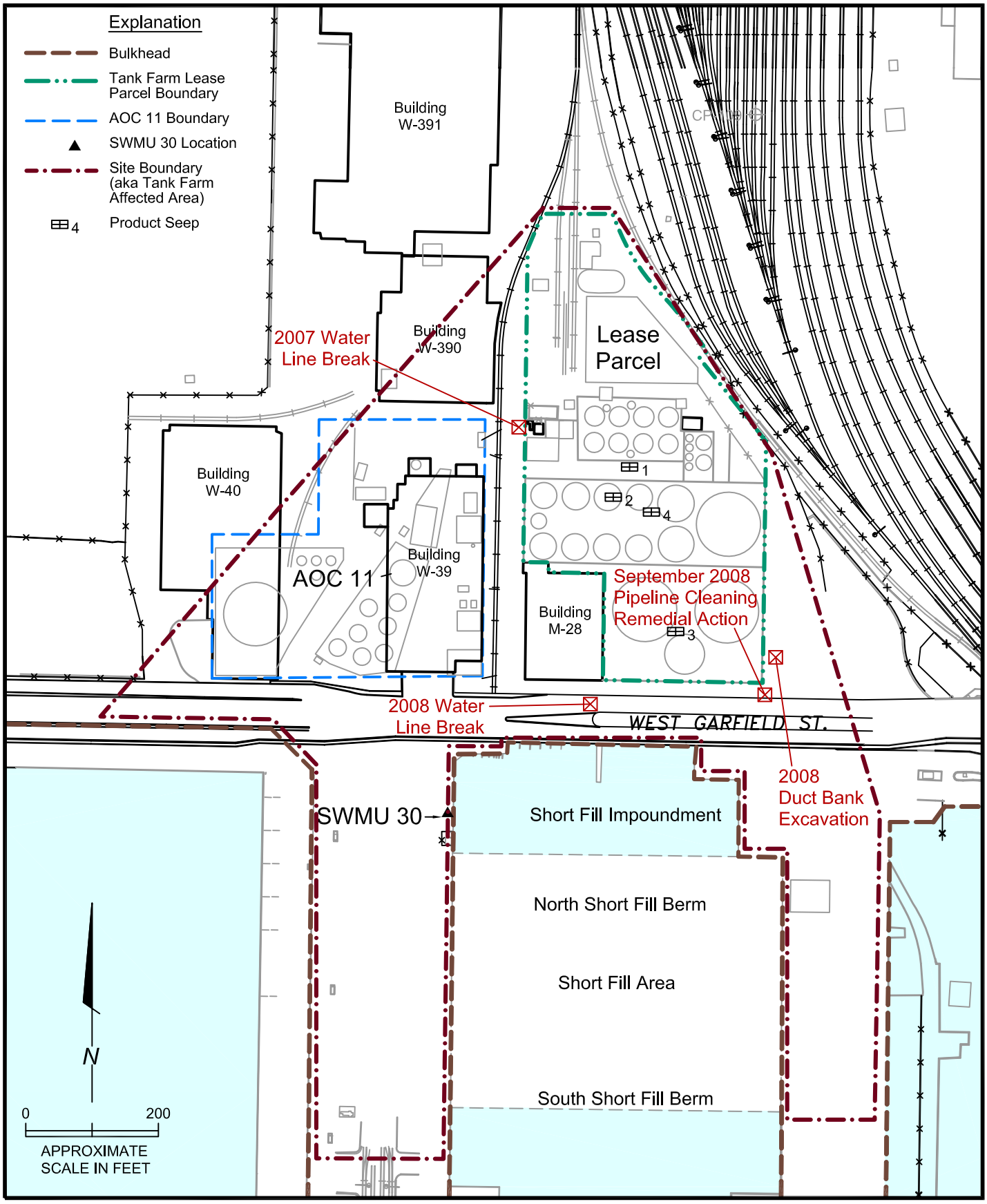


PES Environmental, Inc.
Engineering & Environmental Services

Site Plan
Port of Seattle Terminal 91 Tank Farm Site
Seattle, Washington

FIGURE
4

948.002.16.001	948-00216001_DCAP_4 6		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

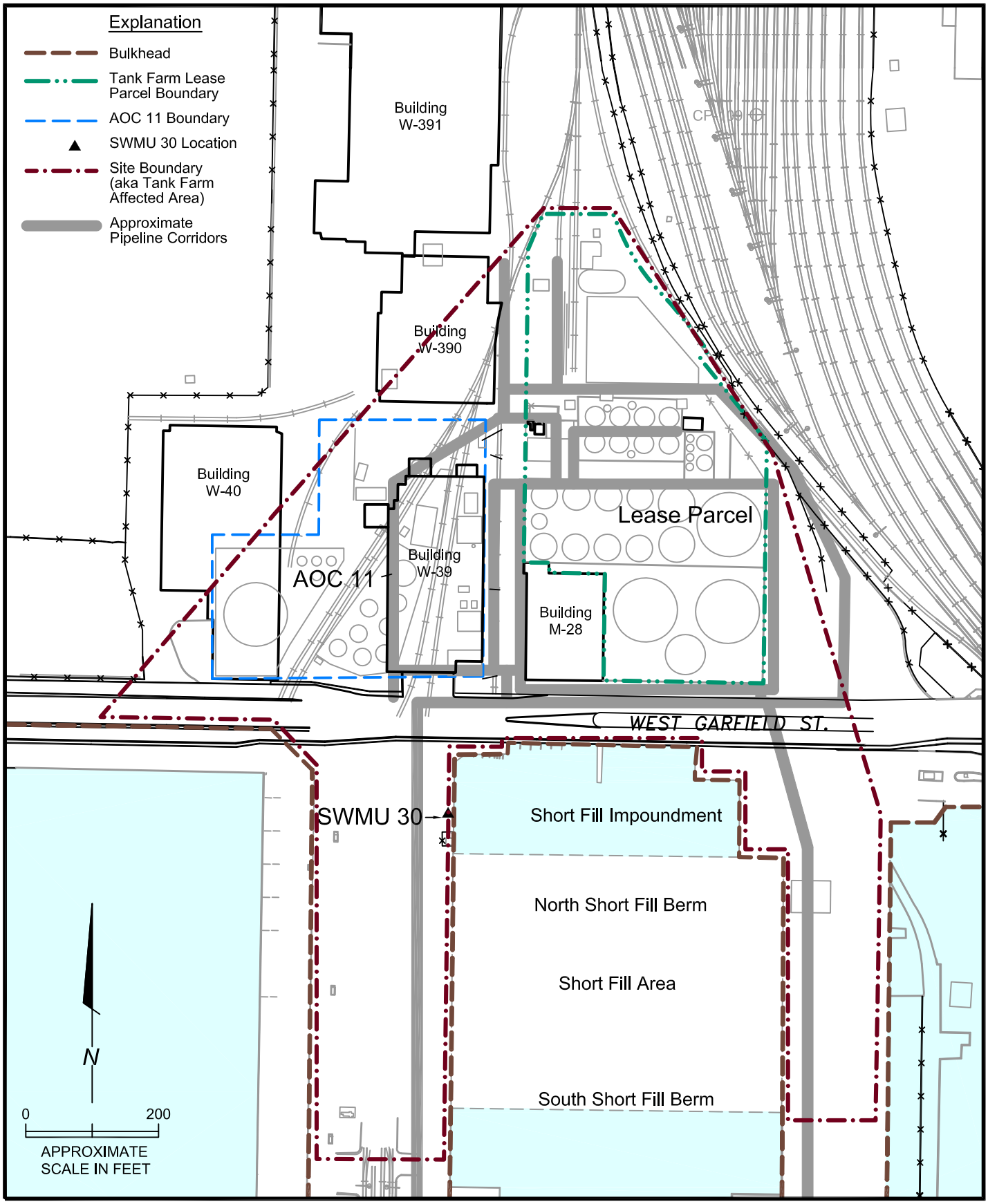


PES Environmental, Inc.
Engineering & Environmental Services

Location of Interim Remedial Actions
Port of Seattle Terminal 91 Tank Farm Site
Seattle, Washington

FIGURE
5

948.002.16.001	948-00216001_DCAP_5		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

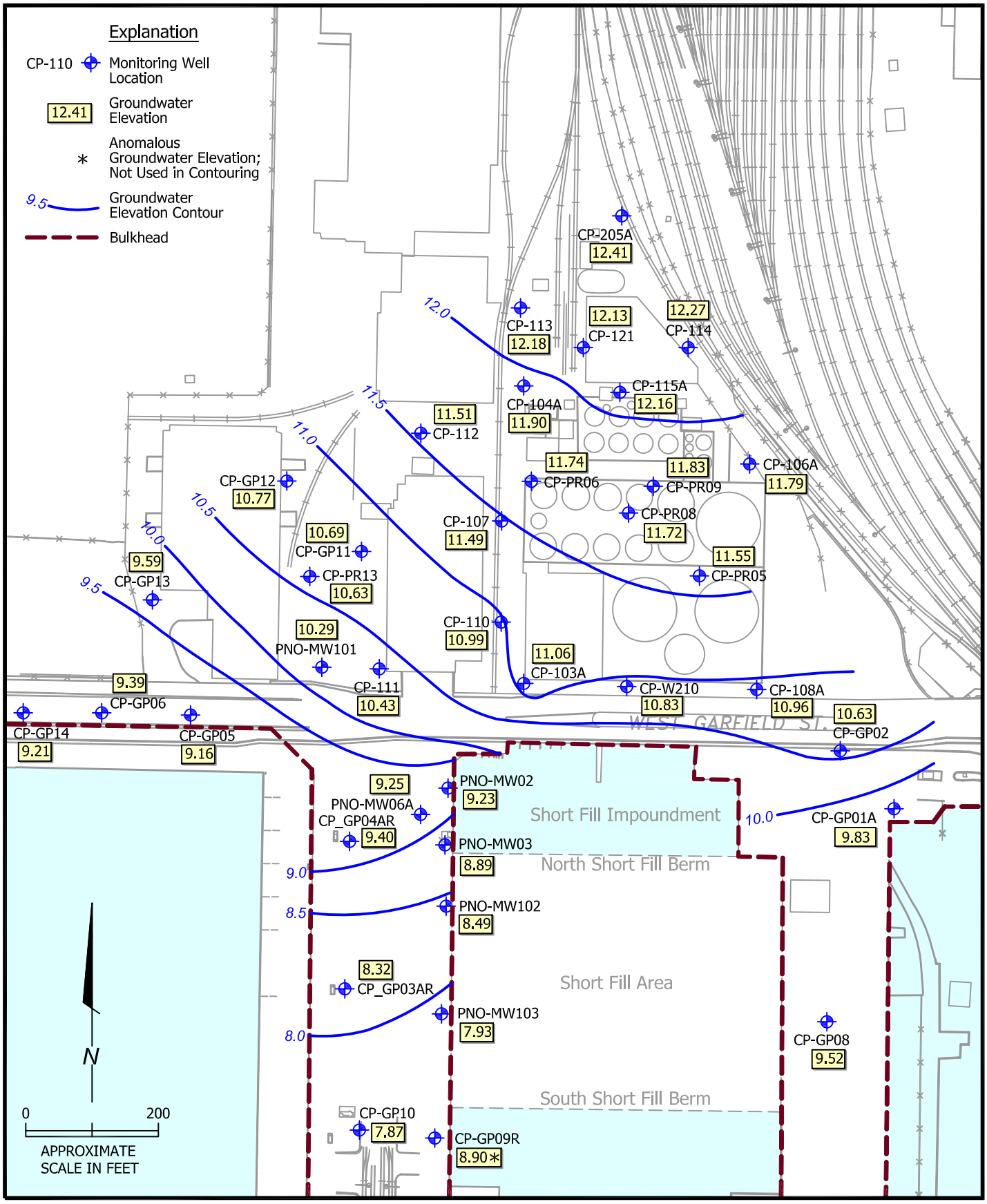


PES Environmental, Inc.
Engineering & Environmental Services

Pipeline Corridors
Port of Seattle Terminal 91
Seattle, Washington

FIGURE
6

948.002.16.001	948-00216001_DCAP_4 6		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE



PES Environmental, Inc.
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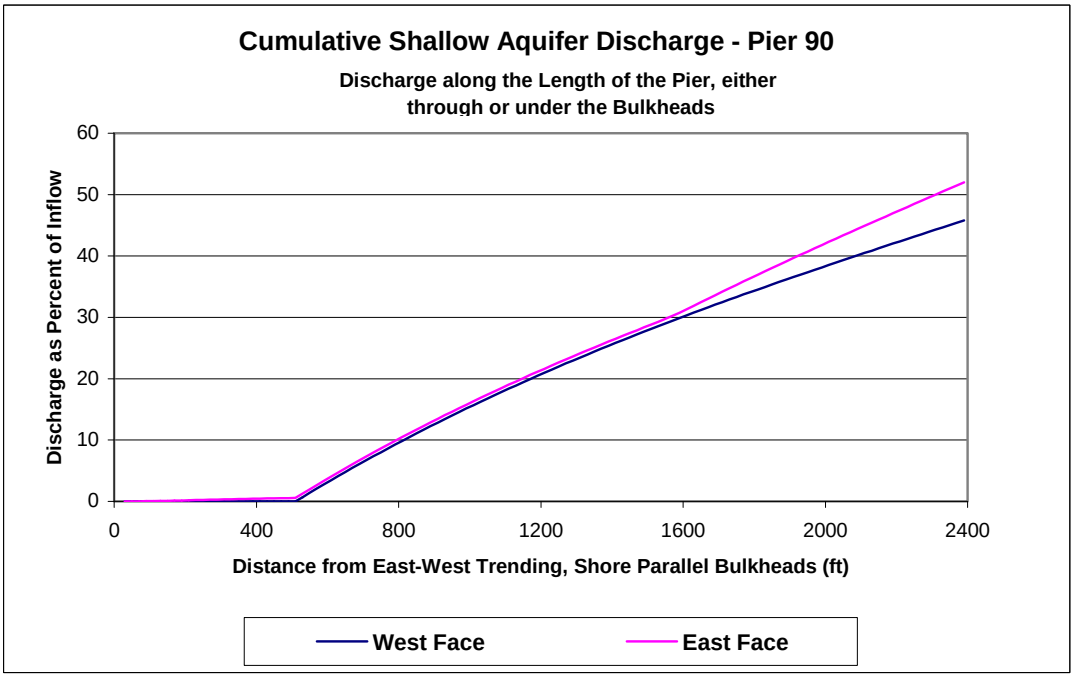
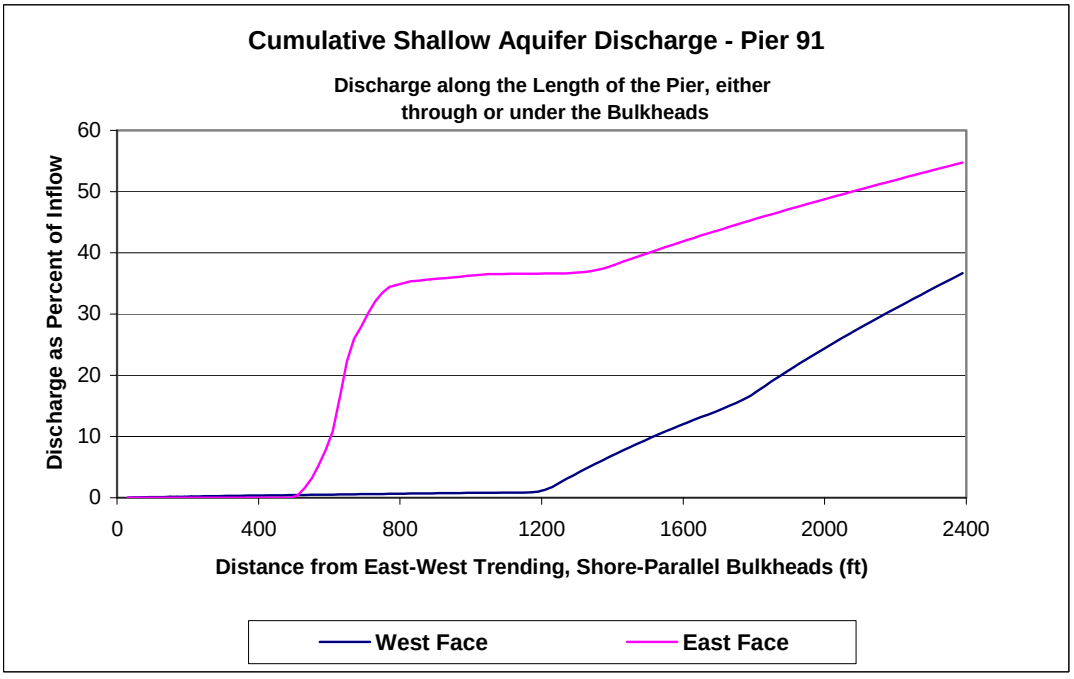
Shallow Aquifer Water Level Elevations - March 10, 2008
Port of Seattle Terminal 91 Tank Farm Site
Seattle, Washington

FIGURE
7

948.002.16.001	948-00216001_DCAP_7		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE





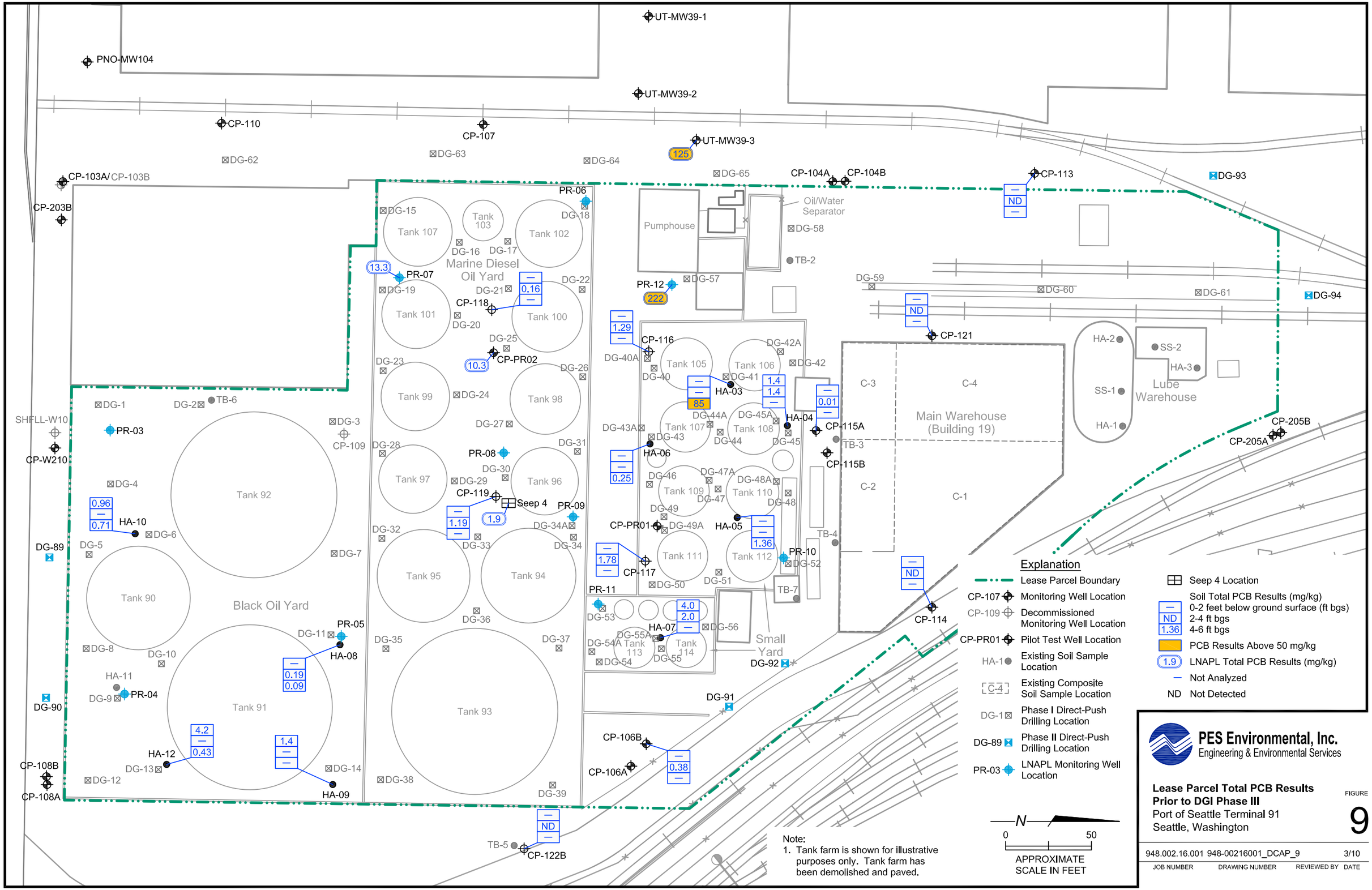
Source - Groundwater Seepage Evaluation Report (Aspect Consulting, 2004)

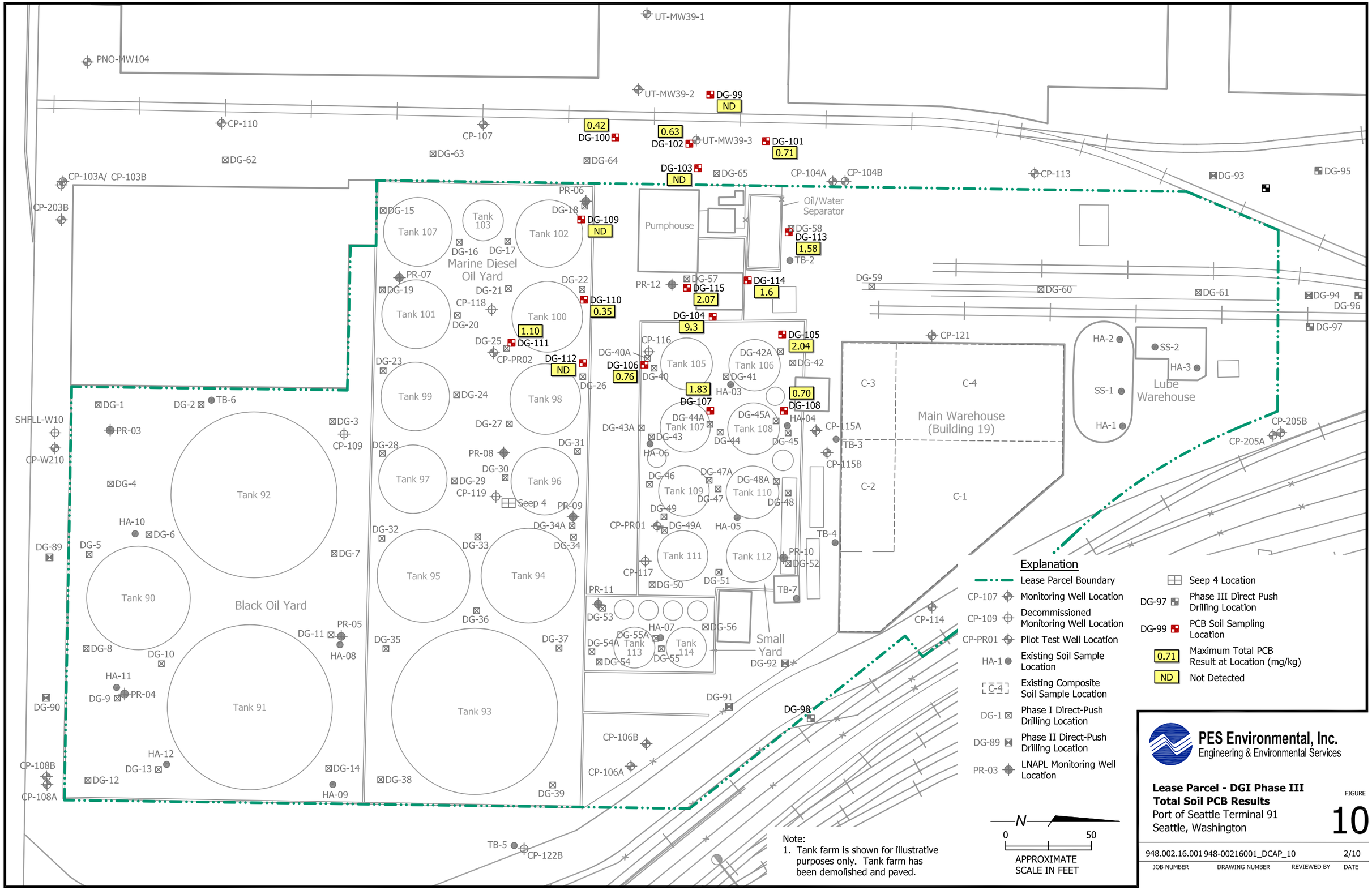
PES Environmental, Inc.
Engineering & Environmental Services

Shallow Aquifer Discharge, Piers 90 and 91
Port of Seattle Terminal 91
Seattle, Washington

FIGURE
8

948.002.16.001	948-00216001_DCAP_8		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE


UT-MW39-1
PNO-MW104
UT-MW39-2
CP-110
CP-107
UT-MW39-3
125
DG-62
DG-63
DG-64
DG-65
CP-104A
CP-104B
CP-113
DG-93
CP-103A/ CP-103B
CP-203B
PR-06
DG-15
Tank 107
Tank 103
Tank 102
DG-18
DG-16
DG-17
Marine Diesel Oil Yard
13.3
PR-07
DG-19
DG-21
0.16
DG-22
CP-118
Tank 101
DG-20
Tank 100
DG-25
10.3
CP-PR02
DG-23
DG-26
Tank 99
DG-24
Tank 98
DG-27
DG-28
Tank 97
PR-08
DG-30
DG-29
Tank 96
CP-119
Seep 4
PR-09
1.9
1.19
DG-32
DG-33
DG-34A
DG-34
Tank 95
Tank 94
DG-36
DG-35
DG-37
Pumphouse
Oil/Water Separator
DG-58
TB-2
PR-12
222
DG-57
DG-59
DG-60
DG-61
DG-94
ND
CP-121
1.29
CP-116
DG-40A
DG-40
Tank 105
Tank 106
DG-42A
DG-42
DG-41
HA-03
1.4
1.4
85
0.01
DG-44A
DG-45A
HA-04
CP-115A
DG-43A
DG-43
Tank 107
Tank 108
DG-44
DG-45
TB-3
HA-06
CP-115B
0.25
DG-46
DG-47A
DG-48A
Tank 109
DG-47
Tank 110
DG-48
DG-49
CP-PR01
DG-49A
HA-05
1.36
TB-4
1.78
CP-117
PR-10
DG-52
Tank 111
Tank 112
DG-51
DG-50
PR-11
TB-7
DG-53
4.0
2.0
HA-07
DG-56
DG-55A
DG-54A
Tank 113
Tank 114
DG-55
DG-54
Small Yard
DG-92
DG-91
CP-106B
CP-106A
0.38
ND
CP-114
C-3
C-4
C-2
C-1
Main Warehouse (Building 19)
HA-2
SS-2
HA-3
Lube Warehouse
SS-1
HA-1
CP-205B
CP-205A
DG-1
DG-2
TB-6
SHELL-W10
PR-03
CP-W210
DG-3
CP-109
DG-4
0.96
0.71
HA-10
DG-6
DG-89
DG-5
DG-7
Tank 92
Tank 90
Black Oil Yard
DG-8
DG-10
PR-05
DG-11
HA-08
0.19
0.09
HA-11
DG-9
PR-04
DG-90
Tank 91
Tank 93
4.2
0.43
HA-12
DG-13
1.4
DG-14
HA-09
DG-12
DG-38
DG-39
CP-108B
CP-108A
TB-5
ND
CP-122B
Explanation
Lease Parcel Boundary
CP-107 Monitoring Well Location
CP-109 Decommissioned Monitoring Well Location
CP-PR01 Pilot Test Well Location
HA-1 Existing Soil Sample Location
C-4 Existing Composite Soil Sample Location
DG-1 Phase I Direct-Push Drilling Location
DG-89 Phase II Direct-Push Drilling Location
PR-03 LNAPL Monitoring Well Location
Seep 4 Location
Soil Total PCB Results (mg/kg)
— 0-2 feet below ground surface (ft bgs)
ND 2-4 ft bgs
1.36 4-6 ft bgs
PCB Results Above 50 mg/kg
1.9 LNAPL Total PCB Results (mg/kg)
— Not Analyzed
ND Not Detected
Note:
1. Tank farm is shown for illustrative purposes only. Tank farm has been demolished and paved.
N
0
50
APPROXIMATE SCALE IN FEET
PES Environmental, Inc.
Engineering & Environmental Services
Lease Parcel Total PCB Results Prior to DGI Phase III
Port of Seattle Terminal 91
Seattle, Washington
FIGURE
9
948.002.16.001 948-00216001_DCAP_9 3/10
JOB NUMBER DRAWING NUMBER REVIEWED BY DATE



Explanation

- Lease Parcel Boundary
- CP-107 Monitoring Well Location
- CP-109 Decommissioned Monitoring Well Location
- CP-PR01 Pilot Test Well Location
- HA-1 Existing Soil Sample Location
- C-4 Existing Composite Soil Sample Location
- DG-1 Phase I Direct-Push Drilling Location
- DG-89 Phase II Direct-Push Drilling Location
- PR-03 LNAPL Monitoring Well Location
- Seep 4 Location
- DG-97 Phase III Direct Push Drilling Location
- DG-99 PCB Soil Sampling Location
- 0.71 Maximum Total PCB Result at Location (mg/kg)
- ND Not Detected

N

0 50

APPROXIMATE SCALE IN FEET

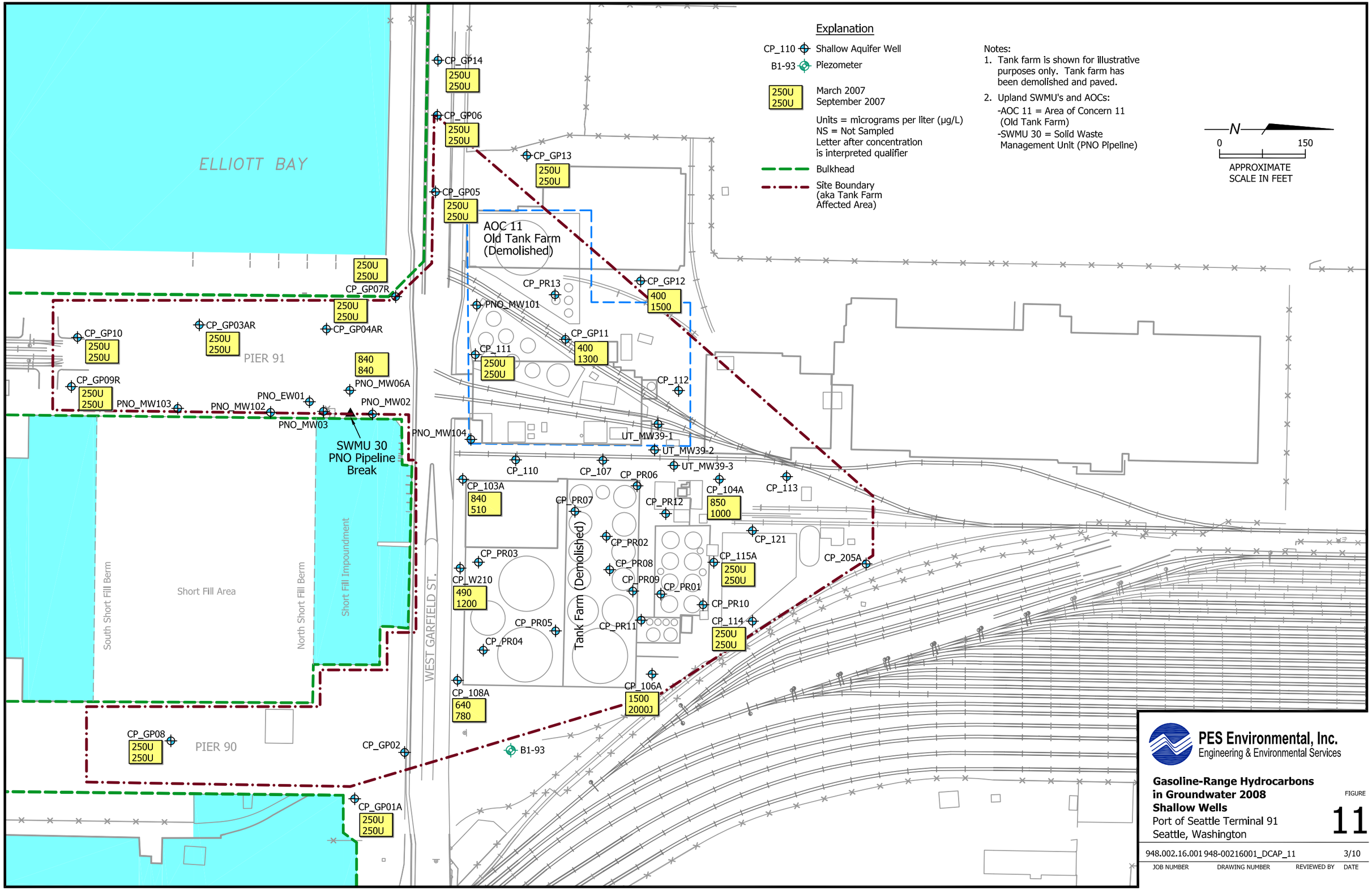
Note:
1. Tank farm is shown for illustrative purposes only. Tank farm has been demolished and paved.

PES Environmental, Inc.
Engineering & Environmental Services

Lease Parcel - DGI Phase III
Total Soil PCB Results
Port of Seattle Terminal 91
Seattle, Washington

FIGURE
10

948.002.16.001	948-00216001_DCAP_10		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

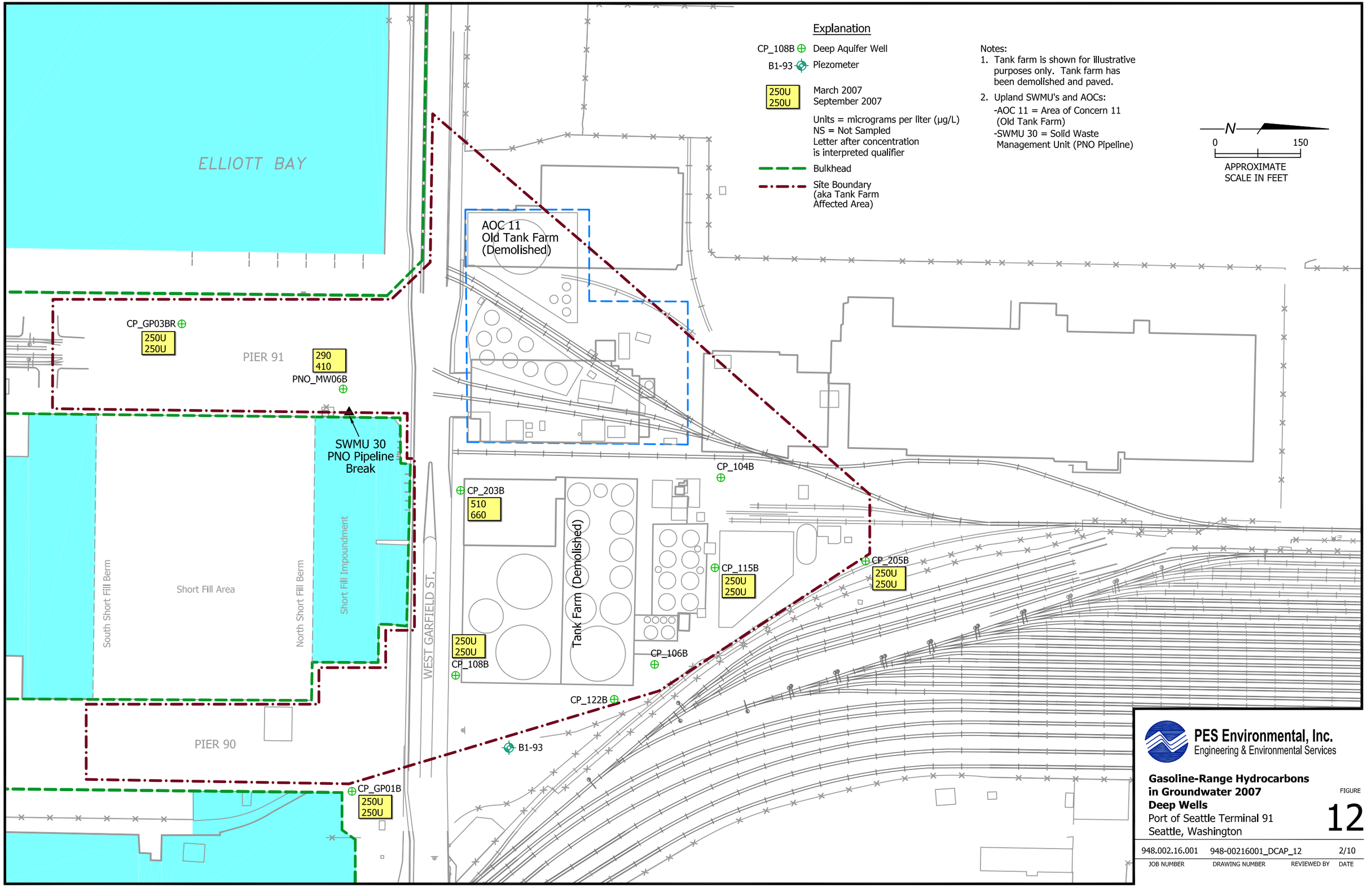


PES Environmental, Inc.
Engineering & Environmental Services

Gasoline-Range Hydrocarbons in Groundwater 2008
Shallow Wells
Port of Seattle Terminal 91
Seattle, Washington

FIGURE 11

JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE
948.002.16.001	948-00216001_DCAP_11		3/10

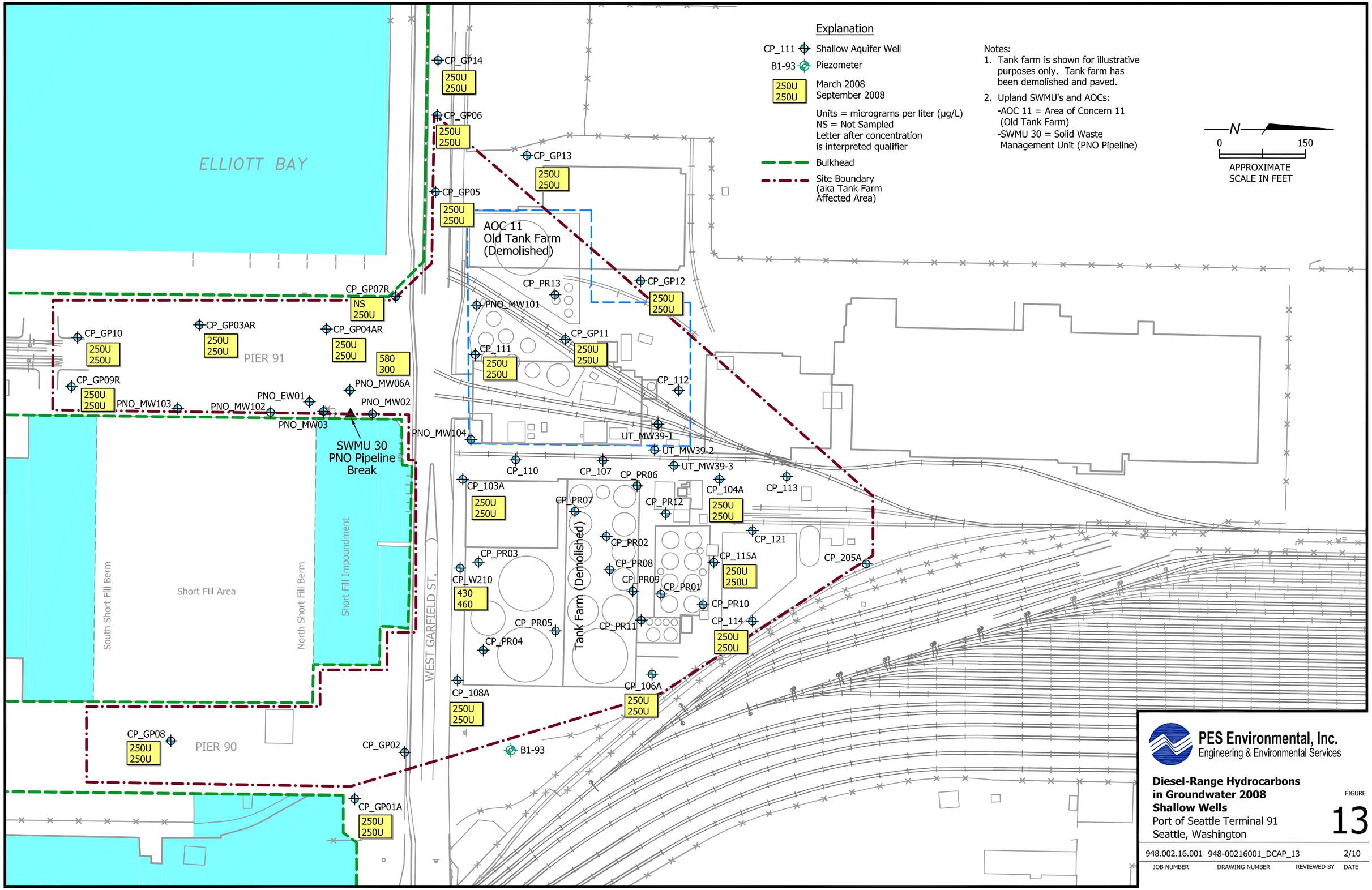


PES Environmental, Inc.
Engineering & Environmental Services

Gasoline-Range Hydrocarbons in Groundwater 2007
Deep Wells
Port of Seattle Terminal 91
Seattle, Washington

FIGURE
12

948.002.16.001	948-00216001_DCAP_12		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

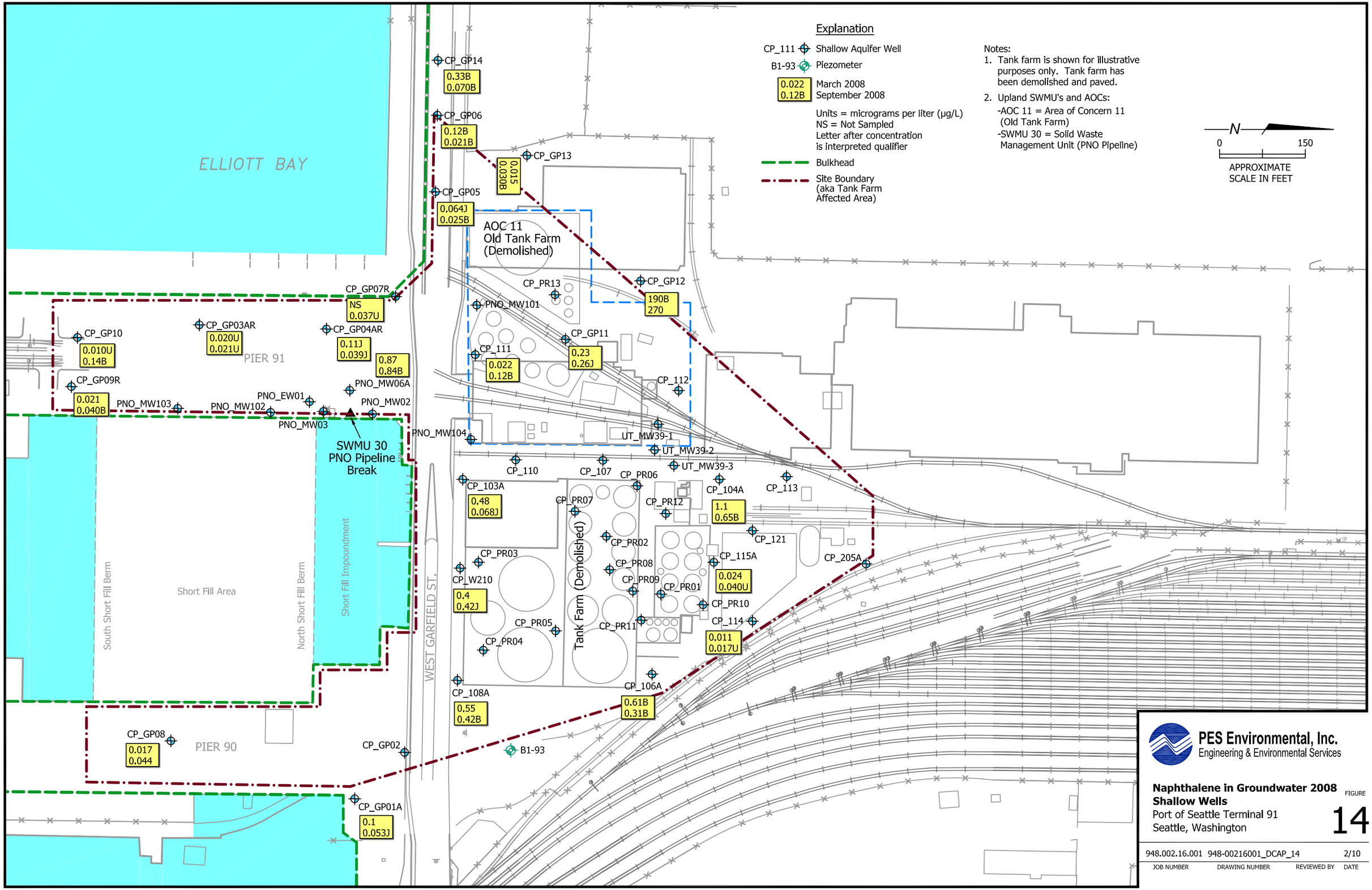


PES Environmental, Inc.
Engineering & Environmental Services

Diesel-Range Hydrocarbons in Groundwater 2008 Shallow Wells
Port of Seattle Terminal 91
Seattle, Washington

FIGURE
13

948.002.16.001	948-00216001_DCAP_13		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

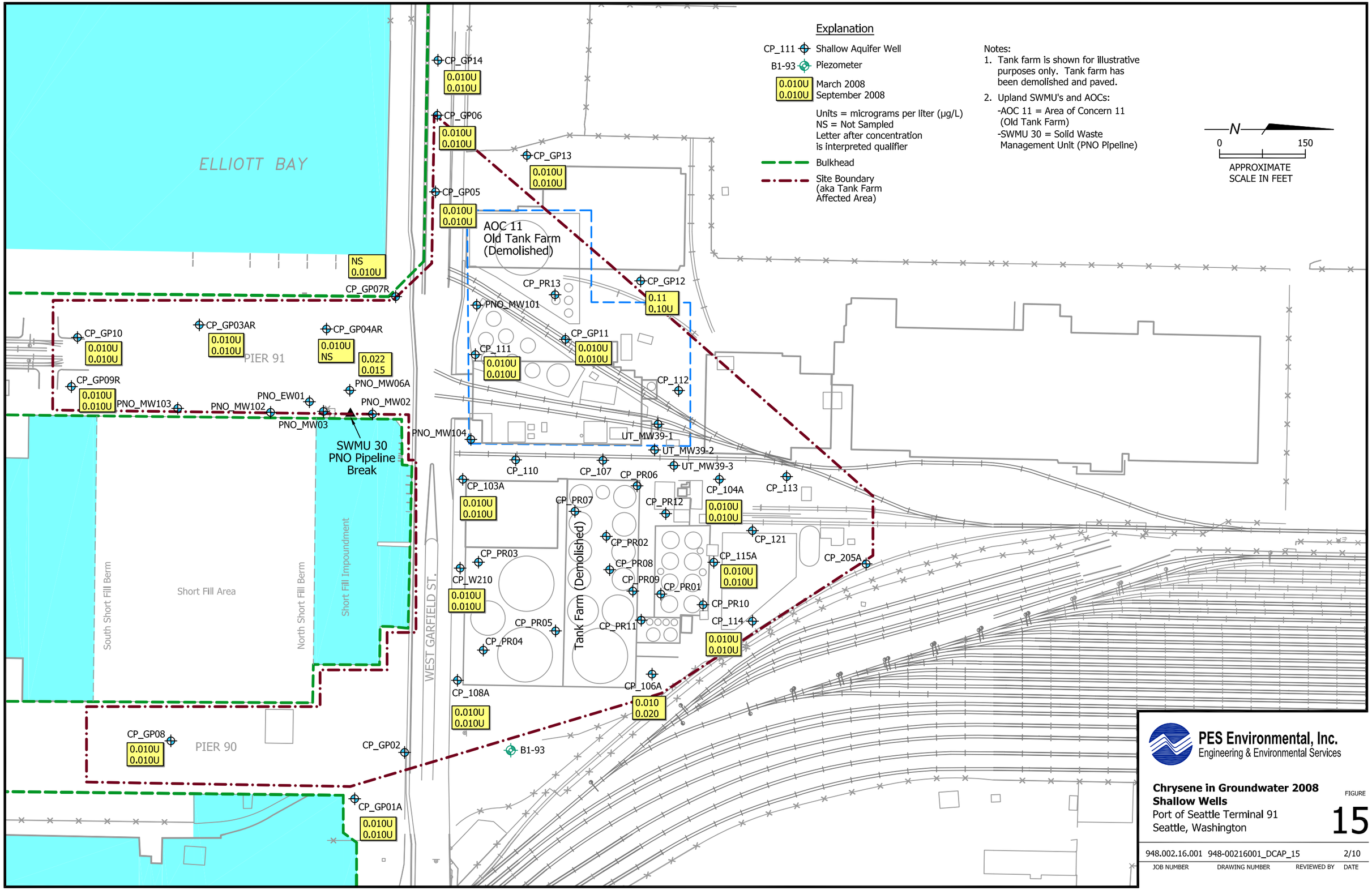


PES Environmental, Inc.
Engineering & Environmental Services

Naphthalene in Groundwater 2008
Shallow Wells
Port of Seattle Terminal 91
Seattle, Washington

FIGURE 14

948.002.16.001	948-00216001_DCAP_14		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE



PES Environmental, Inc.
Engineering & Environmental Services

Chrysene in Groundwater 2008
Shallow Wells
Port of Seattle Terminal 91
Seattle, Washington

FIGURE
15

948.002.16.001	948-00216001_DCAP_15		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

ELLIOTT BAY

PIER 91

PIER 90

Short Fill Area

South Short Fill Berm

North Short Fill Berm

Short Fill Impoundment

WEST GARFIELD ST.

Tank Farm (Demolished)

AOC 11
Old Tank Farm
(Demolished)

SWMU 30
PNO Pipeline
Break

CP_GP03BR
0.010U
0.010U

PNO_MW06B
0.010U
0.010U

CP_203B
0.010U
0.010U

CP_104B

CP_115B
0.010U
0.010U

CP_205B
0.010U
0.010U

CP_106B

CP_108B
0.010U
0.010U

CP_122B

B1-93

CP_GP01B
0.010U
0.035

Explanation

CP_108B — Deep Aquifer Well

B1-93 — Piezometer

0.010U
0.010U — March 2008
September 2008

Units = micrograms per liter (µg/L)
NS = Not Sampled
Letter after concentration
is interpreted qualifier

Bulkhead

Site Boundary
(aka Tank Farm
Affected Area)

Notes:

1. Tank farm is shown for illustrative purposes only. Tank farm has been demolished and paved.
2. Upland SWMU's and AOCs:
   -AOC 11 = Area of Concern 11 (Old Tank Farm)
   -SWMU 30 = Solid Waste Management Unit (PNO Pipeline)

N

0 150

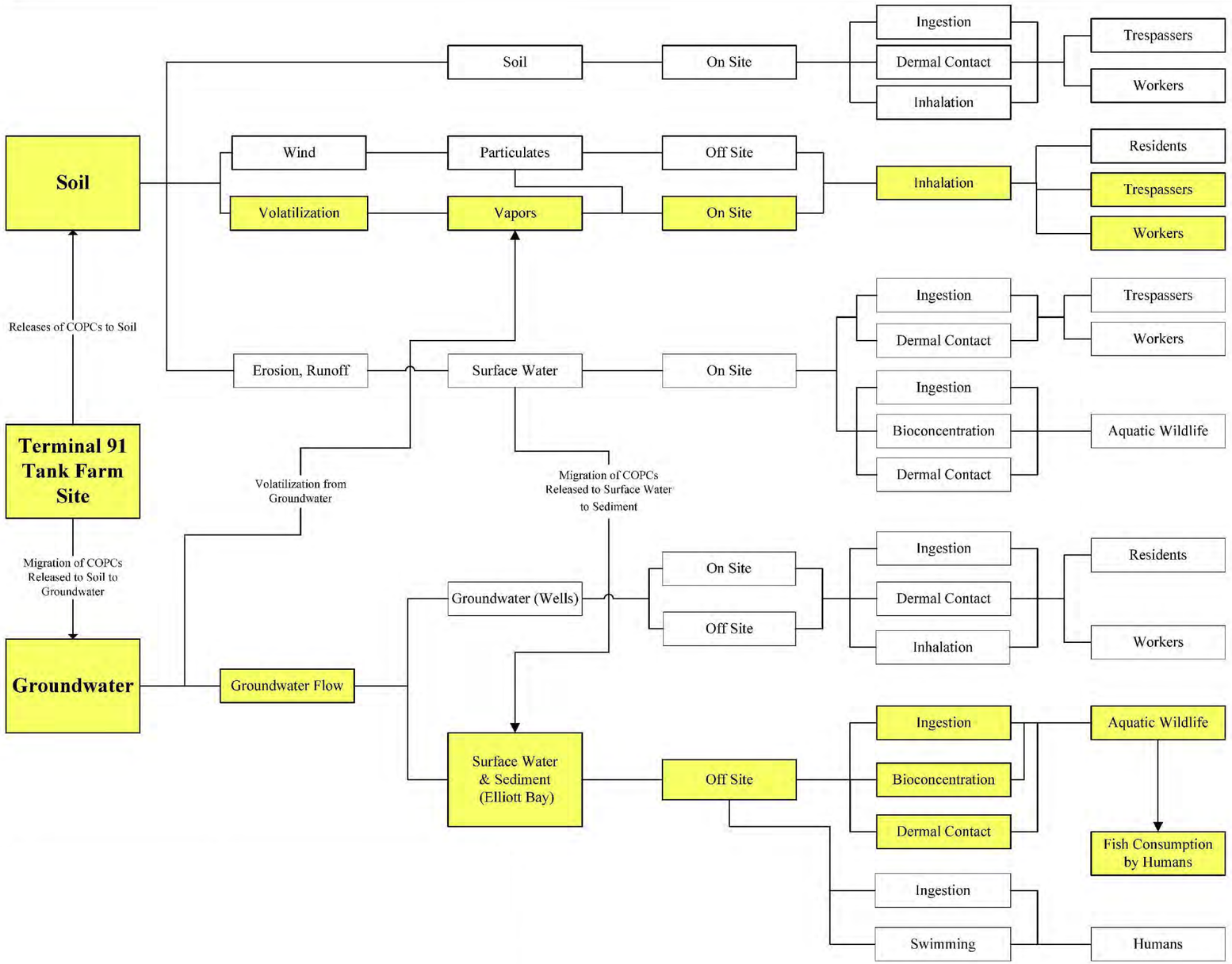
APPROXIMATE
SCALE IN FEET

PES Environmental, Inc.
Engineering & Environmental Services

Chrysene in Groundwater 2008
Deep Wells
Port of Seattle Terminal 91
Seattle, Washington

FIGURE
16

948.002.16.001	948-00216001_DCAP_16		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE



Primary and Secondary Sources	Transport Mechanism	Exposure Medium	Exposure Point	Exposure Route	Potential Receptor	Complete Pathway?	Rationale
Soil		Soil	On Site	Ingestion, Dermal Contact, Inhalation	Trespassers	No	The site is almost completely paved or is covered by buildings. As an institutional control, the Port of Seattle will not demolish the pavement. Occasional workers (such as trench utility workers) with the potential to encounter impacted soil in trenches will be notified prior to those activities.
					Workers	No	
	Wind	Particulates	Off Site	Inhalation	Residents	No	Inhalation of particulates is not a complete exposure pathway for off-site or on-site receptors because the site is almost completely paved or is covered by buildings. Inhalation of indoor air impacted by vapor intrusion from soil and/or vapor intrusion from groundwater is a potentially-complete exposure pathway for on-site current/future trespassers and for on-site current/future workers.
	Volatilization	Vapors	On Site		Trespassers	**Yes**	
					Workers	**Yes**	
	Erosion, Runoff	Surface Water	On Site	Ingestion, Dermal Contact	Trespassers	No	The site is almost completely paved or is covered by buildings, which minimizes erosion of soils. Storm water is either discharged to the sanitary sewer or collected in catch basins and discharged via storm drains, which further limits erosion from the site. The only surface water impoundment near the site is the short fill impoundment. The Port of Seattle plans to fill or cover the impoundment. As an institutional control, the Port of Seattle will not demolish the pavement.
					Workers	No	
				Ingestion, Bioconcentration, Dermal Contact	Aquatic Wildlife	No	
Groundwater	Groundwater Flow	Groundwater (Wells)	On Site, Off Site	Ingestion, Dermal Contact, Inhalation	Residents	No	Groundwater flows directly into Elliott Bay. There are no residents on or downgradient of the site. As an institutional control, the Port of Seattle will institute restrictive covenants to make this site permanently unavailable for drinking water use.
					Workers	No	No drinking water source is available on site. As an institutional control, the Port of Seattle will institute restrictive covenants to make this site permanently unavailable for drinking water use. Workers with the potential to encounter groundwater in trenches will be notified prior to those activities.
		Surface Water & Sediment (Elliott Bay)	Off Site	Ingestion, Bioconcentration, Dermal Contact	Aquatic Wildlife	**Yes**	Impacted groundwater/surface water may reach Elliott Bay and be taken up by aquatic wildlife in surface water and/or sediment.
					Fish Consumption by Humans	**Yes**	Impacted groundwater/surface water may reach Elliott Bay and be taken up by aquatic wildlife in surface water and/or sediment which are then consumed by humans.
				Ingestion, Swimming	Humans	No	Elliott Bay is too saline to use as a drinking water supply. Due to the industrial nature of the site vicinity, recreational uses such as swimming are unlikely.

Source - "Conceptual Site Model, Terminal 91 Tank Farm Site," Pioneer Technologies Corporation

PES Environmental, Inc.
Engineering & Environmental Services

Conceptual Site Model
Port of Seattle Terminal 91 Tank Farm Site
Seattle, Washington

PLATE
17

948.002.06.008 (JOB NUMBER) 948-00216001_DCAP_17 (DRAWING NUMBER) REVIEWED BY 2/10 (DATE)

Legend

- Shallow Standard Point of Compliance Well
- Shallow Standard and Conditional Point of Compliance Well
- Deep Standard Point of Compliance Well
- Deep Standard and Conditional Point of Compliance Well
- Background Well Locations
- SWMU 30 Location
- AOC 11 Boundary
- Upland Monitoring Well Used in Background Evaluation

Notes:

Model Toxic Control Act (MTCA)

Standard Point of Compliance as defined in MTCA WAC 173-340-720(8)(b)

Conditional Point of Compliance as defined in MTCA WAC 173-340-720(8)(c)

Shallow wells are screened at a maximum depth of 21 feet below ground surface.

Deep wells are screened at a maximum depth of 60 feet below ground surface.

Solid Waste Managment Unit (SWMU)

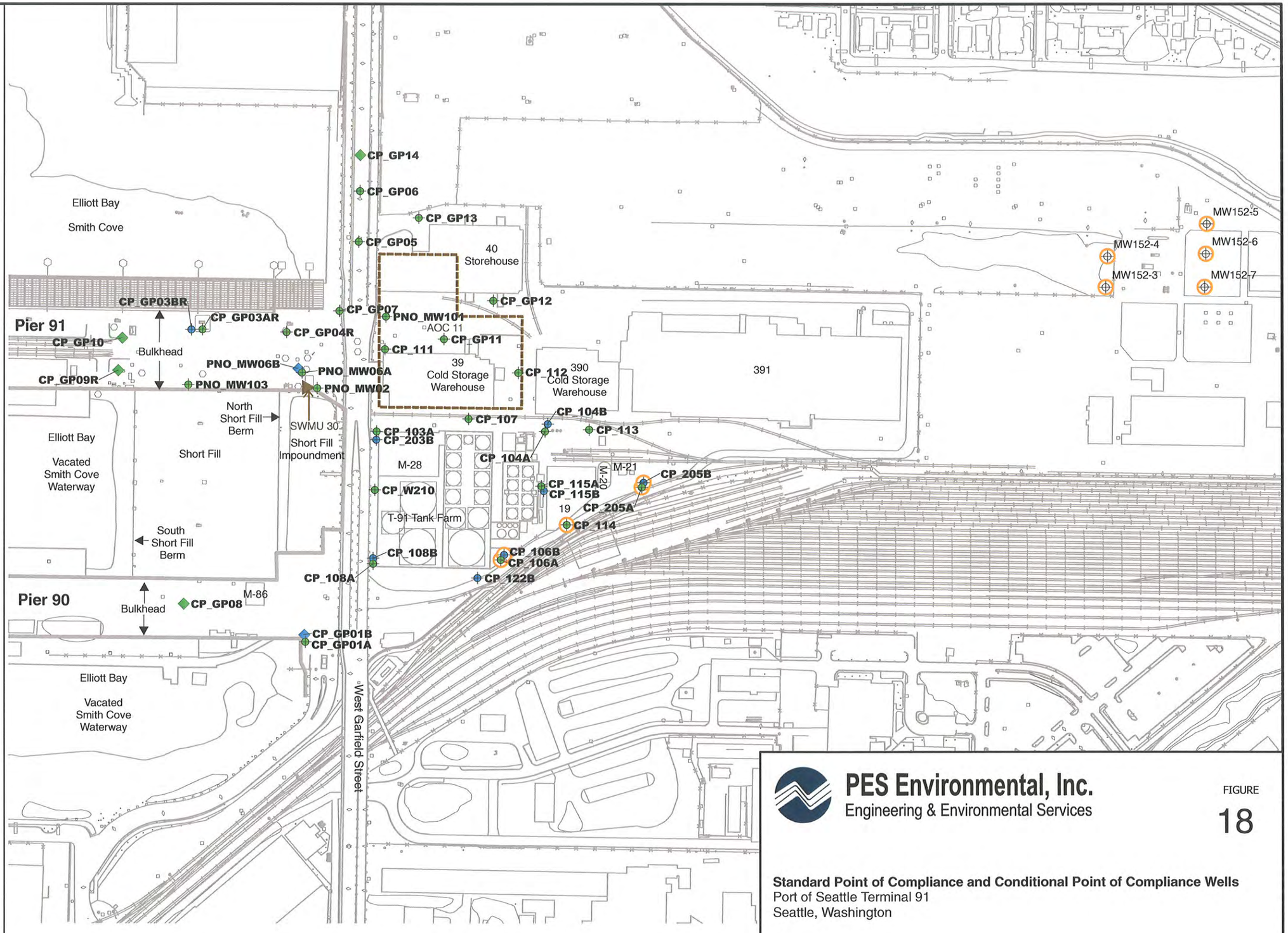
Area of Concern (AOC)

The tank farm is shown for illustrative purposes only. The above-ground portions of the tank farm were demolished and paved in 2005.

N

0 100 200 400 Feet

Map Reference: PIONEER Technologies Corporation, August 2008.



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Engineering & Environmental Services

FIGURE
18

Standard Point of Compliance and Conditional Point of Compliance Wells
Port of Seattle Terminal 91
Seattle, Washington

JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE
948.002.16.001	948-00216001_DCAP_18		2/10

Legend

- Shallow SPOC Well With At Least One Exceedance of Final FS CUL
- Shallow Well Without Exceedances of Final FS CULs
- SWMU 30 Location
- AOC 11 Boundary

Notes:

Feasibility Study (FS)

Cleanup Level (CUL)

See Table 7-3 for a list of Final FS CULs.

Model Toxic Control Act (MTCA)

Standard Point of Compliance (SPOC) as defined in MTCA WAC 173-340-720(8)(b)

Shallow wells are screened at a maximum depth of 21 feet below ground surface.

Solid Waste Managment Unit (SWMU)

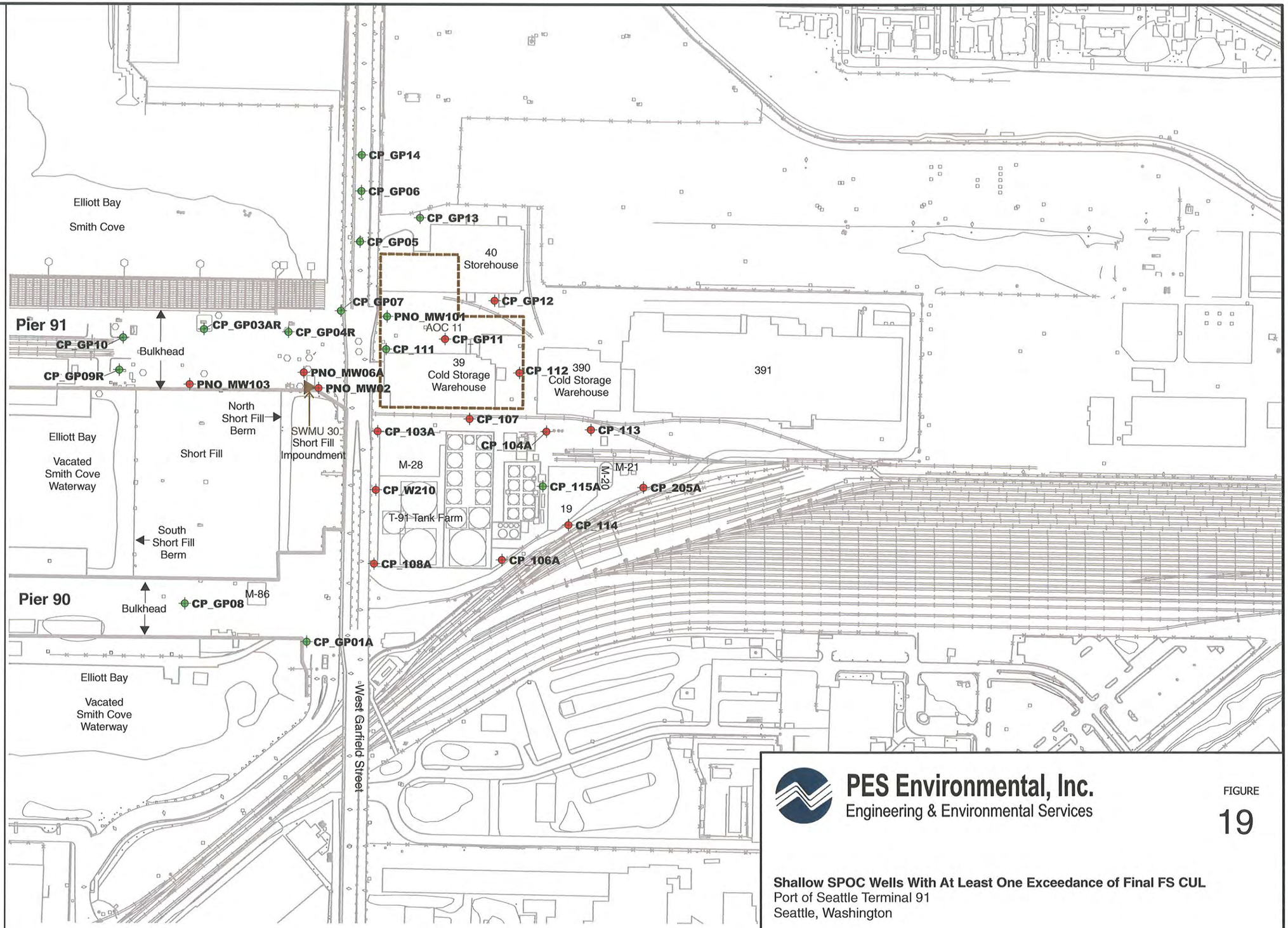
Area of Concern (AOC)

The tank farm is shown for illustrative purposes only. The above-ground portions of the tank farm were demolished and paved in 2005.

N

0 125 250 500 Feet

Map Reference: PIONEER Technologies Corporation, August 2008.



PES Environmental, Inc.
Engineering & Environmental Services

FIGURE
19

Shallow SPOC Wells With At Least One Exceedance of Final FS CUL
Port of Seattle Terminal 91
Seattle, Washington

948.002.16.001	948-00216001_DCAP_19		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

Legend

- Deep SPOC Well With At Least One Exceedance of Final FS CUL
- Deep Well Without Exceedances of Final FS CULs
- Background Well Locations
- SWMU 30 Location
- AOC 11 Boundary

Notes:

Feasibility Study (FS)

Cleanup Level (CUL)

See Table 7-4 for a list of Final FS CULs.

Model Toxic Control Act (MTCA)

Standard Point of Compliance (SPOC) as defined in MTCA WAC 173-340-720(8)(b)

Deep wells are screened at a maximum depth of 60 feet below ground surface.

Solid Waste Managment Unit (SWMU)

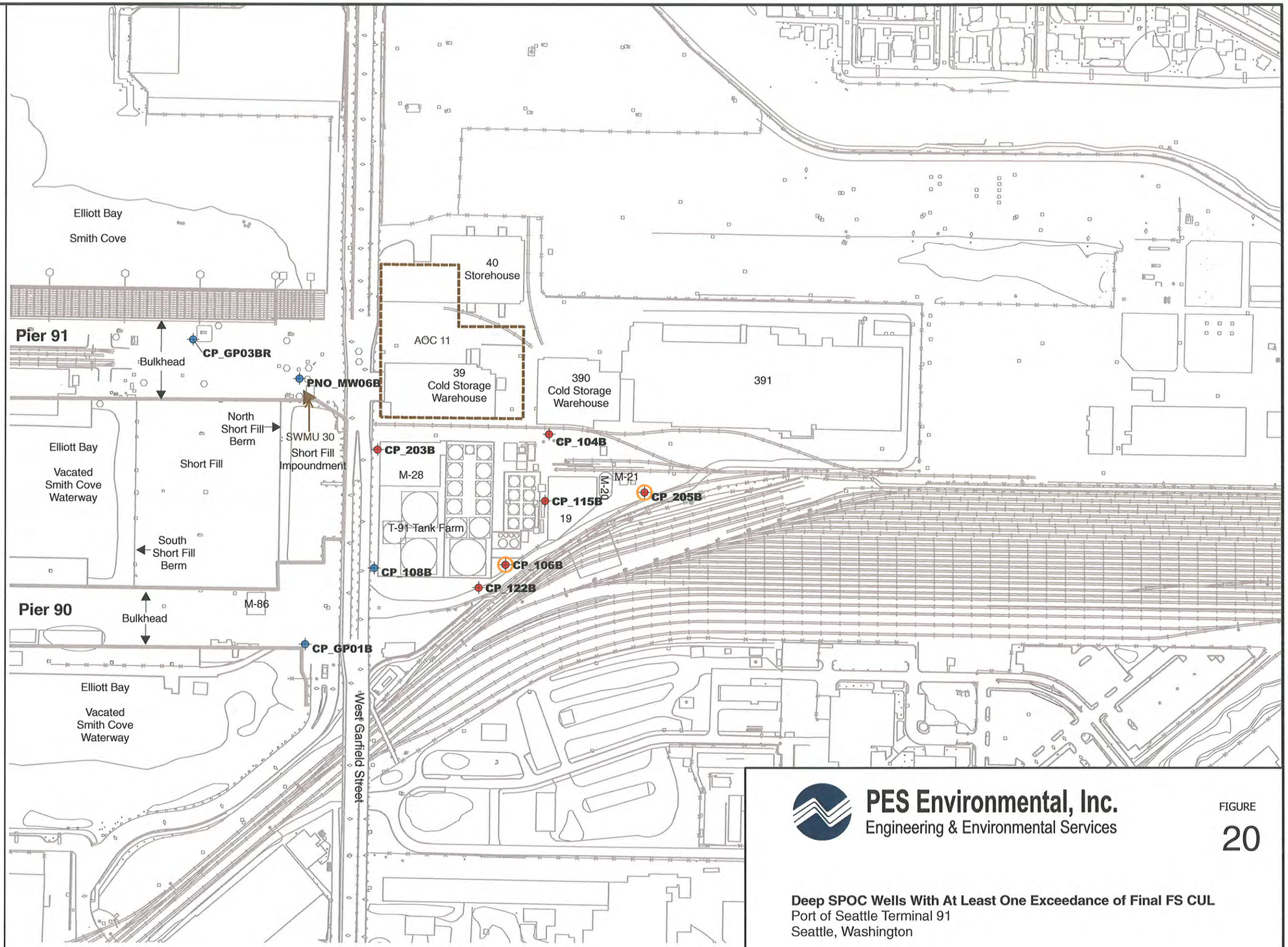
Area of Concern (AOC)

The tank farm is shown for illustrative purposes only. The above-ground portions of the tank farm were demolished and paved in 2005.

N

0 125 250 500 Feet

Map Reference: PIONEER Technologies Corporation, August 2008.

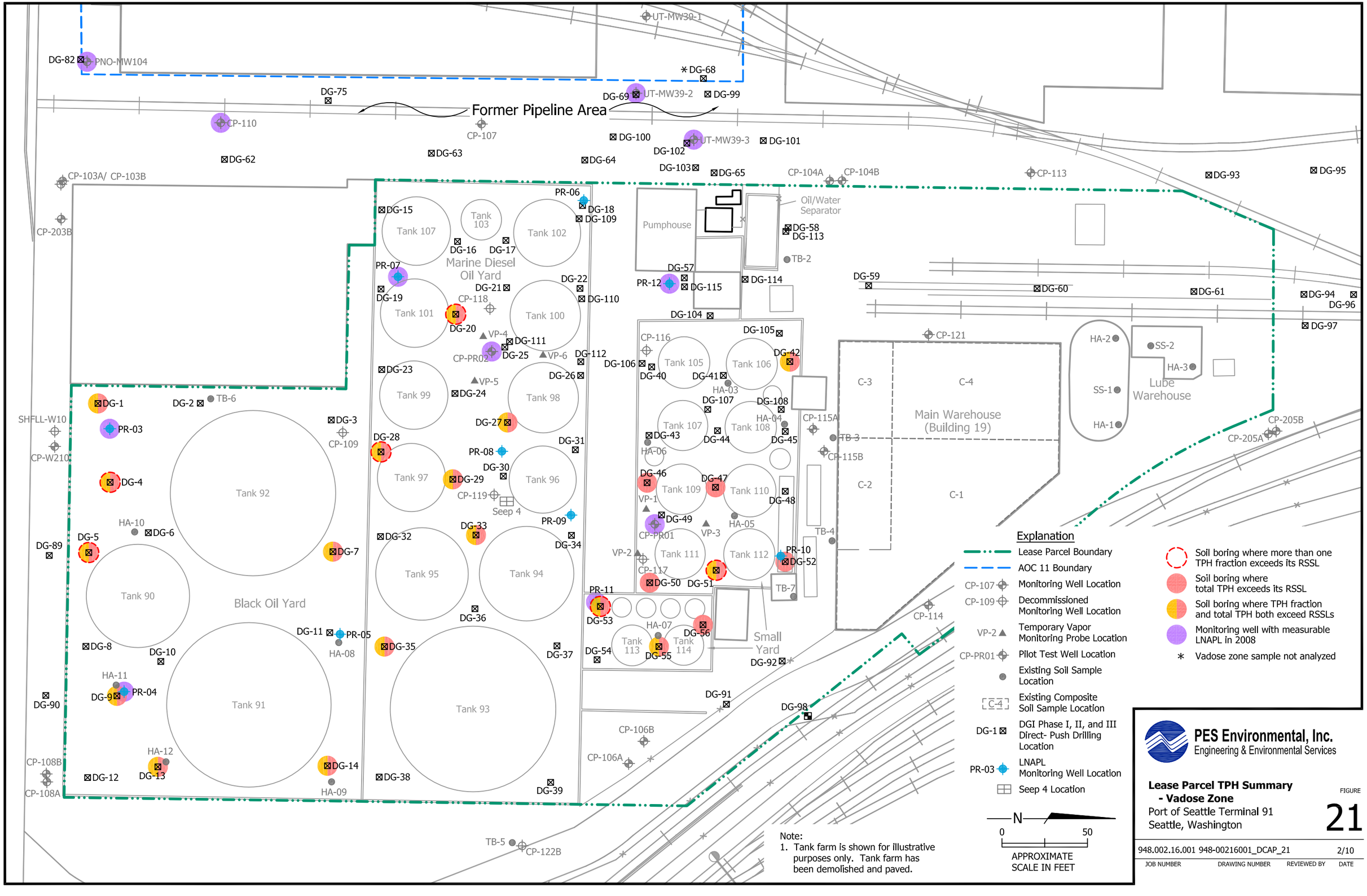


PES Environmental, Inc.
Engineering & Environmental Services

FIGURE
20

Deep SPOC Wells With At Least One Exceedance of Final FS CUL
Port of Seattle Terminal 91
Seattle, Washington

948.002.16.001	948-00216001_DCAP_20		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

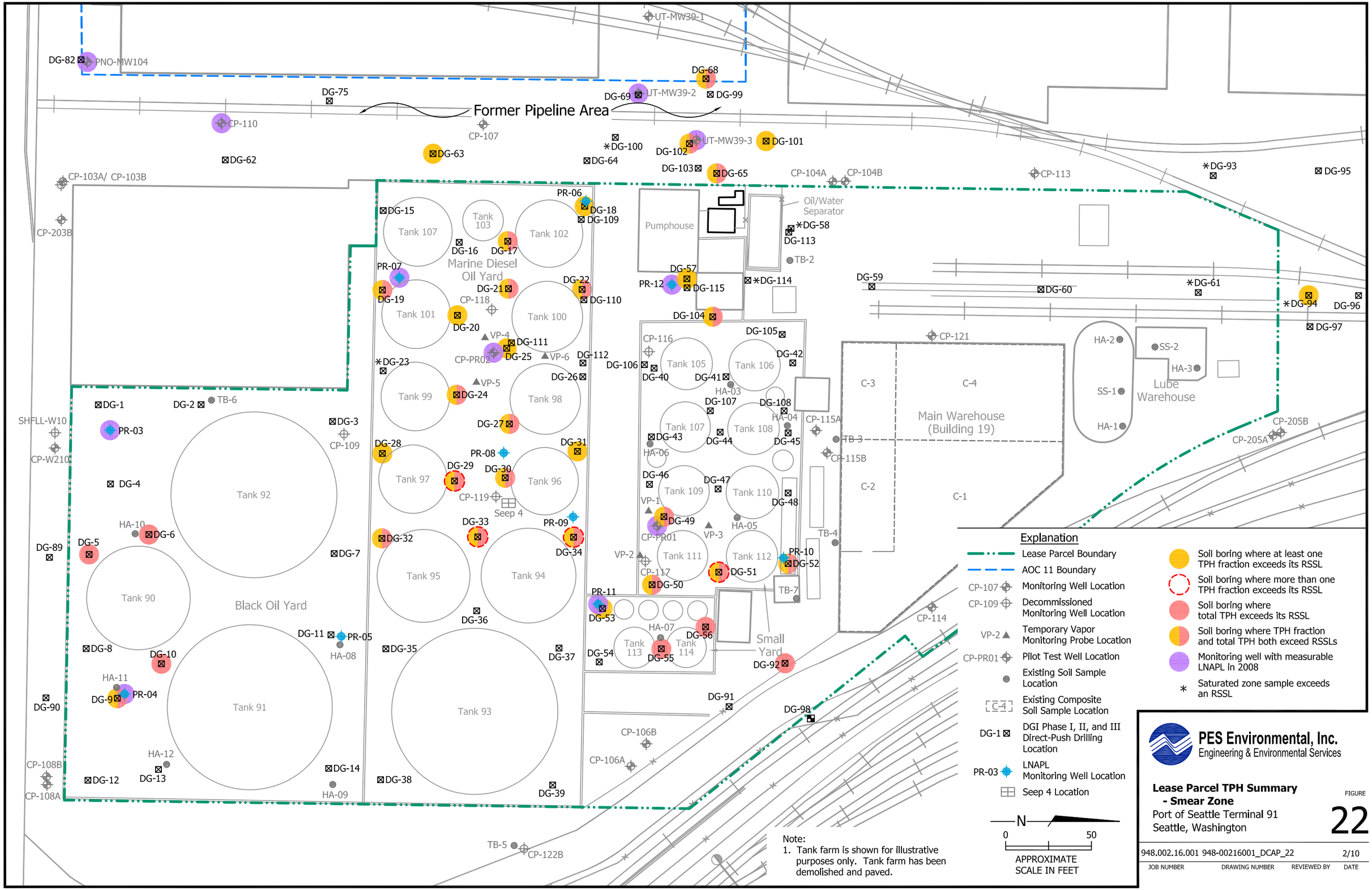


PES Environmental, Inc.
Engineering & Environmental Services

Lease Parcel TPH Summary - Vadose Zone
Port of Seattle Terminal 91
Seattle, Washington

FIGURE
21

JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE
948.002.16.001	948-00216001_DCAP_21		2/10



Explanation

- Lease Parcel Boundary
- AOC 11 Boundary
- CP-107 Monitoring Well Location
- CP-109 Decommissioned Monitoring Well Location
- VP-2 Temporary Vapor Monitoring Probe Location
- CP-PR01 Pilot Test Well Location
- Existing Soil Sample Location
- C-4 Existing Composite Soil Sample Location
- DG-1 DGI Phase I, II, and III Direct-Push Drilling Location
- PR-03 LNAPL Monitoring Well Location
- Seep 4 Location

- Soil boring where at least one TPH fraction exceeds its RSSL
- Soil boring where more than one TPH fraction exceeds its RSSL
- Soil boring where total TPH exceeds its RSSL
- Soil boring where TPH fraction and total TPH both exceed RSSLs
- Monitoring well with measurable LNAPL in 2008
- * Saturated zone sample exceeds an RSSL

N

0 50

APPROXIMATE SCALE IN FEET

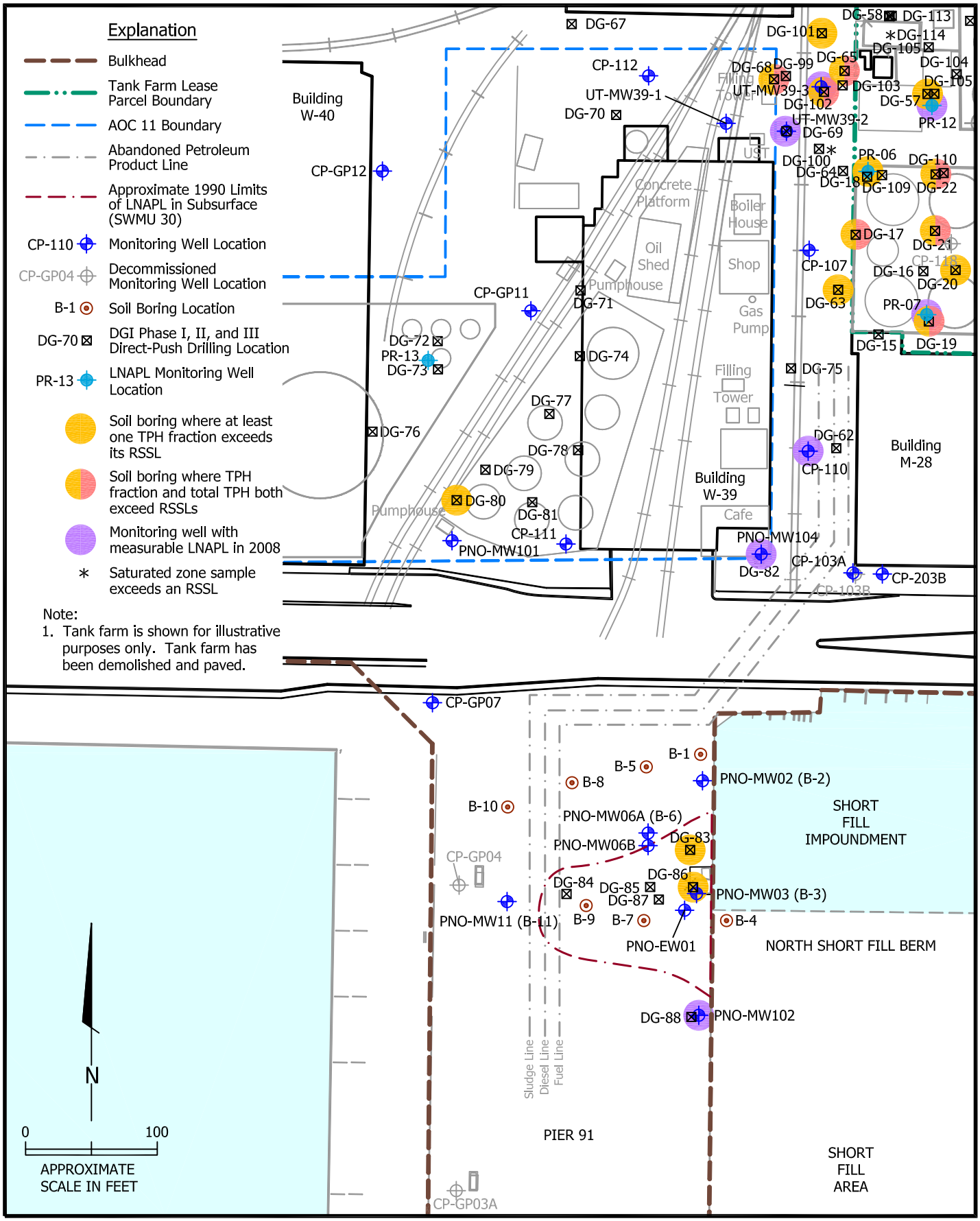
Note:
1. Tank farm is shown for illustrative purposes only. Tank farm has been demolished and paved.

PES Environmental, Inc.
Engineering & Environmental Services

Lease Parcel TPH Summary - Smear Zone
Port of Seattle Terminal 91
Seattle, Washington

FIGURE 22

948.002.16.001	948-00216001_DCAP_22		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

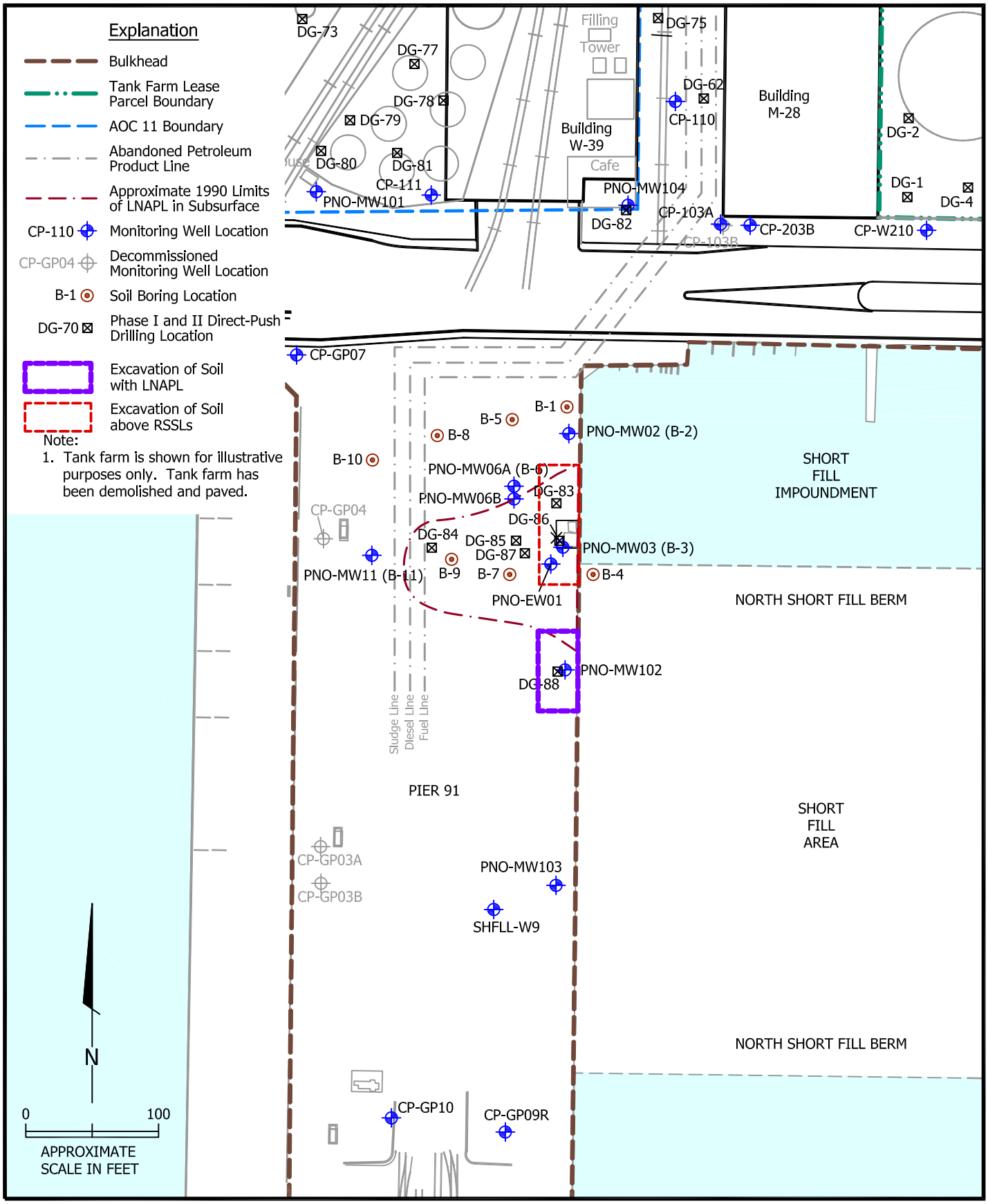


PES Environmental, Inc.
Engineering & Environmental Services

AOC 11 and SWMU 30 TPH Summary - Smear Zone
Port of Seattle Terminal 91
Seattle, Washington

FIGURE
23

948.002.16.001	948-00216001_DCAP_23		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

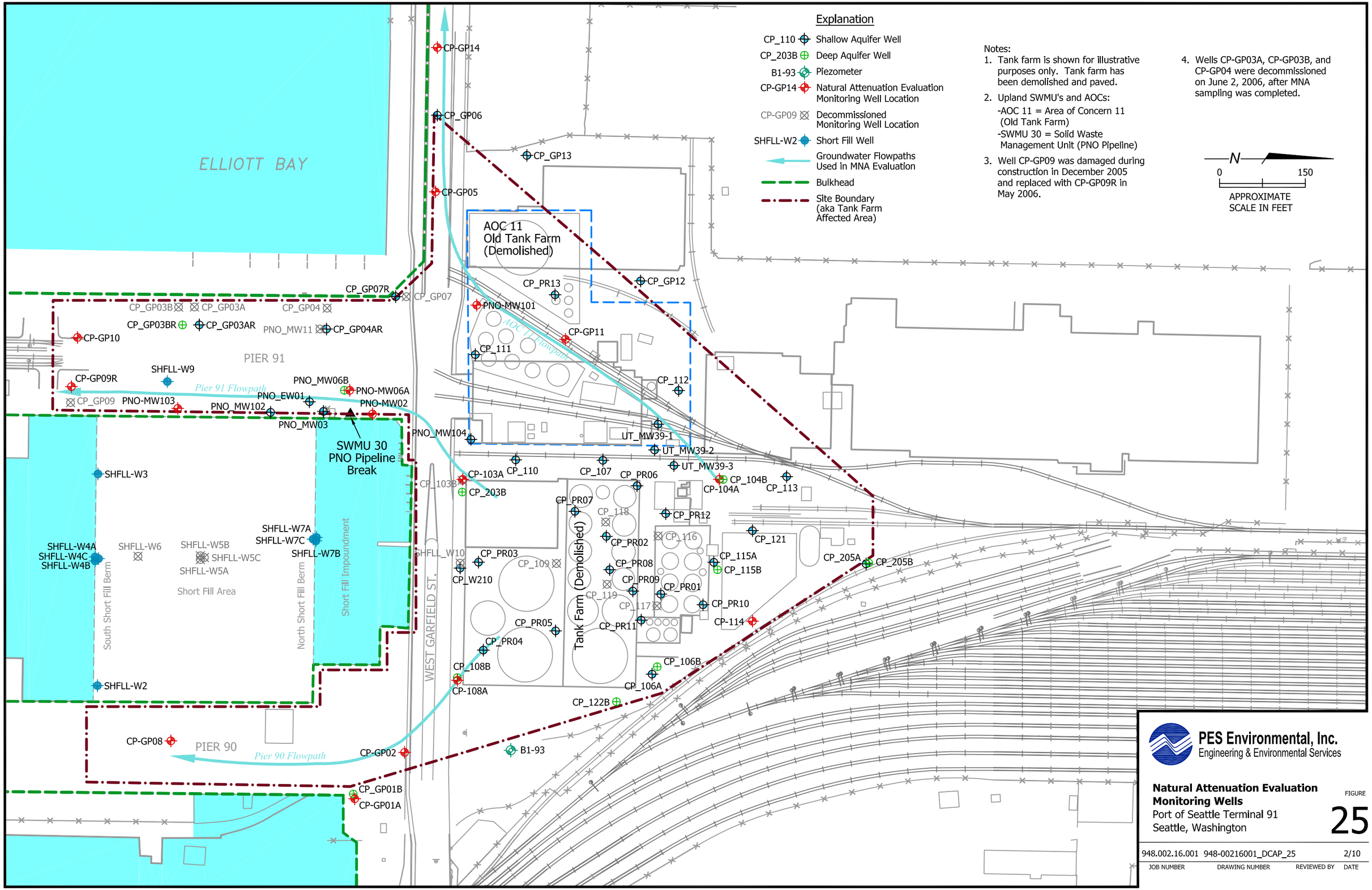


PES Environmental, Inc.
Engineering & Environmental Services

SWMU 30 - Limited Excavation
Port of Seattle Terminal 91
Seattle, Washington

FIGURE
24

948.002.16.001	948-00216001_DCAP_24		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE



PES Environmental, Inc.
Engineering & Environmental Services

Natural Attenuation Evaluation Monitoring Wells
Port of Seattle Terminal 91
Seattle, Washington

FIGURE 25

948.002.16.001	948-00216001_DCAP_25		2/10
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

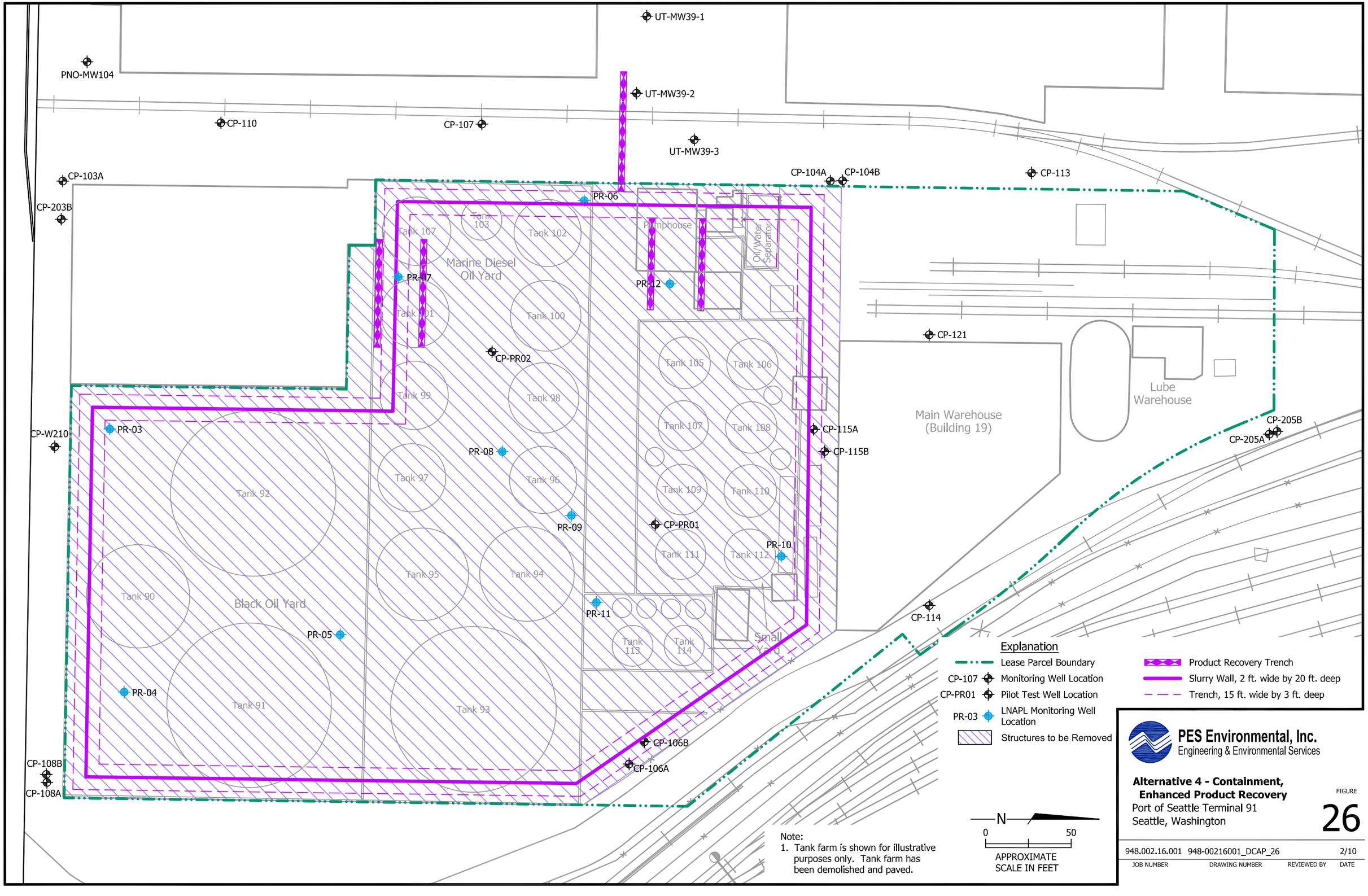

UT-MW39-1
PNO-MW104
UT-MW39-2
CP-110
CP-107
UT-MW39-3
CP-103A
CP-203B
CP-104A
CP-104B
CP-113
PR-06
Tank 103
Tank 102
Tank 107
Pumphouse
Oil/Water Separator
Marine Diesel Oil Yard
PR-07
PR-12
Tank 101
Tank 100
CP-121
CP-PR02
Tank 105
Tank 106
Tank 99
Tank 98
Lube Warehouse
Main Warehouse (Building 19)
CP-W210
PR-03
Tank 107
Tank 108
CP-115A
CP-205B
CP-205A
PR-08
CP-115B
Tank 97
Tank 96
Tank 92
Tank 109
Tank 110
PR-09
CP-PR01
PR-10
Tank 111
Tank 112
Tank 95
Tank 94
Tank 90
Black Oil Yard
PR-11
CP-114
PR-05
Tank 113
Tank 114
Small Yard
PR-04
Tank 91
Tank 93
CP-106B
CP-106A
CP-108B
CP-108A
Explanation
Lease Parcel Boundary
CP-107 Monitoring Well Location
CP-PR01 Pilot Test Well Location
PR-03 LNAPL Monitoring Well Location
Structures to be Removed
Product Recovery Trench
Slurry Wall, 2 ft. wide by 20 ft. deep
Trench, 15 ft. wide by 3 ft. deep
N
0
50
APPROXIMATE SCALE IN FEET
Note:
1. Tank farm is shown for illustrative purposes only. Tank farm has been demolished and paved.
PES Environmental, Inc.
Engineering & Environmental Services
Alternative 4 - Containment, Enhanced Product Recovery
Port of Seattle Terminal 91
Seattle, Washington
FIGURE
26
948.002.16.001 948-00216001_DCAP_26 2/10
JOB NUMBER DRAWING NUMBER REVIEWED BY DATE

Exhibit B

Site Diagram of Port of Seattle Terminal 91 Facility

948002_factsheet-a

Note: For areas shown as Tank Farm Affected Area ("TFAA") that are outside the Tank Farm Lease Parcel, the TFAA includes only soil and ground water below the water table. Soil above the water table (and outside the Tank Farm Lease Parcel) is outside the TFAA.

N

0 700 feet

The locations of all features are approximate.

Explanation

- Port of Seattle Property Limits
- Tank Farm Lease Parcel
- Tank Farm Affected Area
- Submerged Land

Port of Seattle Terminal 91 Facility

2001 W. Garfield St., Seattle, WA 98119

Exhibit C

Releases Requiring Corrective Action

Terminal 91 Site - Known Discrete Units of Contamination

Discrete Units to Be Addressed During Redevelopment (Section VII.C.1.a)			
	SWMU, AOC, or Other Area	**Description**	**Status**
A.1.	AOC 2	USTs and UST Releases on Terminal 91 Premises—Tanks A-G	Incomplete; plan to follow up during redevelopment work

Discrete Units to Be Addressed under Work Plans and Schedules (Section VII.C.1.b)			
	SWMU, AOC, or Other Area	**Description**	**Status**
B.1.	SWMU 32	Oil Blending Station	Complete; Ecology letter 4/20/05
B.2.	SWMU 33	Solid Waste Yard	Complete; Ecology letter 4/20/05
B.3.	SWMU 35	Storage Area Outside Building W-47	Complete; Ecology letter 4/20/05
B.4.	SWMU 36	Storage Inside Building W-47	Complete; Ecology letter 4/20/05
B.5.	SWMU 37	Car Wash Station	Complete; Ecology letter 4/20/05
B.6.	SWMU 38	Paint and Motor Oil Waste Building C-154	Complete; Ecology letter 4/20/05
B.7.	SWMU 39	Paint Filter Waste Storage Area	Complete; Ecology letter 4/20/05
B.8.	SWMU 40	Short Fill	Complete after restrictive covenant; Ecology letter 4/20/05
B.9.	SWMU 43	Berth Stations and Valve Vaults	Complete; Ecology letter 4/20/05
B.10.	SWMU 44	Waste Oil Storage Shed	Complete; Ecology letter 4/20/05
B.11.	SWMU 45	Storm Drain at North End of Terminal 91	Complete; Ecology letter 4/20/05
B.12.	SWMU 46	Two Storm Drains at Center of Terminal 91	Complete; Ecology letter 4/20/05
B.13.	SWMU 47	Abandoned Oil/Water Separator	Complete; Ecology letter 4/20/05
B.14.	SWMU 48	Transfer Piping	Complete; Ecology letter 4/20/05

B.15.	AOC 2	USTs and UST Releases on Terminal 91 Premises—Tanks H and I	Complete; Ecology letter 4/20/05
B.16.	AOC 2	USTs and UST Releases on Terminal 91 Premises—Tank J	Complete; Ecology letter 4/20/05
B.17.	AOC 2	USTs and UST Releases on Terminal 91 Premises–Tank K	Complete; Ecology letter 4/20/05
B.18.	AOC 2	USTs and UST Releases on Terminal 91 Premises–Tank T	Complete; Ecology letter 11/16/11
B.19.	AOC 2	USTs and UST Releases on Terminal 91 Premises–Tank Z	Complete; Ecology letter 4/20/05
B.20.	AOC 4	Leaking Motor	Complete; Ecology letter 4/20/05
B.21.	AOC 5	PCB Transformer Pad	Complete; Ecology letter 4/20/05
B.22.	AOC 7--Pier 91 Area	Concrete Aprons (see also 1991 Soil Investigation for Pier 91 Chill Facility)	Incomplete; Ecology letter 11/16/11. Within eighteen months of this Order's effective date, the Port will either: (1) submit a work plan for proposed remedial action with a proposed date for completion; (2) request confirmation that no further action is required: or (3) perform the remedial work pursuant to the requirements of Section VII.C.1.a. of this Order.
B.23.	AOC 16	Inactive Transformers	Complete; Ecology letter 4/20/05
B.24.	Other Area (from Baseline Report)	1990 PNO Pipeline Break South of Building T-38, Pier 91	Complete after restrictive covenant; Ecology letter 4/20/05
B.25.	Other Area (from Baseline Report)	1991 PNO Pipeline Break at South End of Pier 91	Complete; Ecology letter 4/20/05
B.26.	Other Area (from Baseline Report)	1994 Transformer Pad	Complete; Ecology letter 4/20/05
B.27.	Other Area (from Baseline Report)	1994 DAS Building Site Investigation	Complete; Ecology letter 4/20/05
B.28.	Other Area (from Baseline Report)--Pier 90 Area	1991 Soil Investigation for Pier 91 Chill Facility--Pier 90 Area (see also AOC 7)	Complete; Ecology letter 11/16/11
B.29.	Other Area (from Baseline Report)	1996 PNO Pipeline Alignment Soil Remediation, Pier 90	Complete; Ecology letter 11/16/11

B.30.	Other Area (from Baseline Report)	1996 PNO Pipeline Break, Pier 91	Incomplete; Ecology letter 11/16/11. Within eighteen months of this Order's effective date, the Port will either: (1) submit a work plan for proposed remedial action with a proposed date for completion; (2) request confirmation that no further action is required: or (3) perform the remedial work pursuant to the requirements of Section VII.C.1.a. of this Order.
B.31.	Other Area (from Baseline Report)	1994 DAS Utility Trench Investigation	Complete; Ecology letter 11/16/11
B.32.	Other Area (Independent Cleanup)	1999 PNO Pipeline Release on Pier 90	Investigative work ongoing per December 2009 work plan as modified by subsequent communications between Port and Ecology.
B.33.	Other Area (Independent Cleanup)	Pier 91 Pipeline Decommissioning and Historic Pipeline Releases in the Vicinity of the Carnitech Building	Incomplete; Ecology letter 11/16/11. Within eighteen months of this Order's effective date, the Port will either: (1) submit a work plan for proposed remedial action with a proposed date for completion; (2) request confirmation that no further action is required: or (3) perform the remedial work pursuant to the requirements of Section VII.C.1.a. of this Order.

B.34.	Other Area (Independent Cleanup)	Pier 91 Pipeline Decommissioning and Historic Pipeline Releases in the Vicinity of the Cruise Ship Terminal	Incomplete; Ecology letter 11/16/11. Within eighteen months of this Order's effective date, the Port will either: (1) submit a work plan for proposed remedial action with a proposed date for completion; (2) request confirmation that no further action is required: or (3) perform the remedial work pursuant to the requirements of Section VII.C.1.a. of this Order.
B.35.	Other Area (Independent Cleanup)	Pier 91 Historic Pipeline Releases	Investigative work ongoing per December 2009 work plan as modified by subsequent communications between Port and Ecology.
B.36.	Other Area (Brownfields Investigation)	Building 136	Investigative work ongoing per December 2009 work plan as modified by subsequent communications between Port and Ecology.
B.37.	Other Area (Brownfields Investigation)	Locomotive Fueling Area	Investigative work ongoing per December 2009 work plan as modified by subsequent communications between Port and Ecology.
B.38.	Other Area (Brownfields Investigation)	Incinerator UST Area	Within eighteen months of this Order's effective date, the Port will either: (1) submit a work plan for proposed remedial action with a proposed date for completion; (2) request confirmation that no further action is required: or (3) perform the remedial work pursuant to the requirements of Section VII.C.1.a. of this Order.
B.39.	Tank Farm Affected Area Interim Action	Stormwater Sump Bottom Filling Interim Remedial Action	Complete; Ecology letter 12/7/2011.

Discrete Units Addressed under the Contamination Contingency Plan			
	SWMU, AOC, or Other Area	**Description**	**Status**
C.1.	**[intentionally blank]**	**[intentionally blank]**	**[intentionally blank]**

REFERENCES

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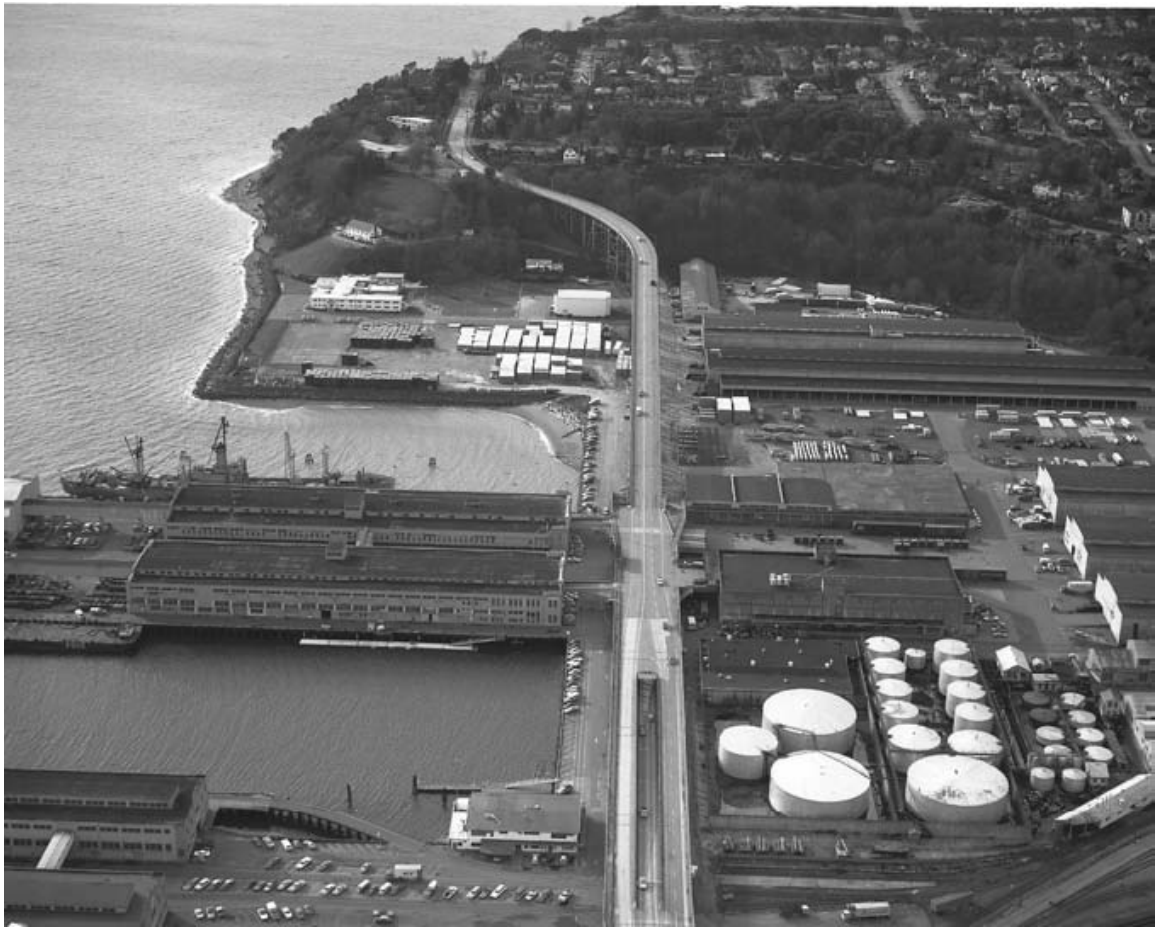
Exhibit D

Public Participation Plan

DEPARTMENT OF ECOLOGY
State of Washington

Port of Seattle Terminal 91
Public Participation Plan



Historical photo from 1975, prior to Tank Farm Demolition

Prepared by
Washington State Department of Ecology
3190 160th Avenue SE
Bellevue, WA 98008-5452
December 2011

TABLE OF CONTENTS

Introduction

The Washington State Department of Ecology (Ecology) developed this Public Participation Plan (PPP) pursuant to the **Model Toxics Control Act (MTCA)**. The purpose of the participation plan is to promote meaningful community involvement for cleanup at **Port of Seattle Terminal 91.** The Site is located at the north end of Elliott Bay at 2001 West Garfield Street in Seattle, Washington. The public comment period is for public review of the new Agreed Order, which implements the Cleanup Action Plan for the Tank Farm Affected Area of the Site and contains provisions for addressing cleanup of other areas of the Site.

Based on Ecology's MTCA regulations (Washington Administrative Code (WAC) 173-340-600 public participation), this plan:

- Outlines the tools and methods that Ecology uses to inform the public about Site activities.
- Identifies opportunities for the community to get involved.
- Addresses potential community concerns regarding the cleanup.
- Defines public participation activities that will take place as a part of the cleanup process.

Ecology is committed to an open dialogue with the community to ensure that interested parties can receive information as well as provide input during the decision-making process.

Ecology and Port of Seattle negotiated a legal agreement called an Agreed Order (No. DE 8938) that formally describes their working relationship and outlines the scope of work. The Port will continue to clean up the Site.

Steps in the Cleanup Process

The MTCA rules detail each step in the cleanup process to ensure that cleanups are thorough and protect human health and the environment. The chart below defines these steps and how they apply to the project site. Legal documents such as "Agreed Orders" or "Consent Decrees" further define some of the steps and associated time frames.

1. Site Discovery and Initial Investigation: Sites may be discovered in a variety of ways including reports from the owner, an employee, or concerned citizens. Following discovery, an initial investigation is conducted to determine whether or not a site warrants further investigation.

2. Site Hazard Assessment and Hazard Ranking: An assessment is conducted to confirm the presence of hazardous substances and determine the relative threat the site poses to human health and the environment. Sites then are ranked from 1 (highest) to 5 (lowest).

> **Port of Seattle Terminal 91 is listed on the state's Hazardous Sites List with a rank of 1; primarily due to the potential to contaminate Puget Sound.**

3. Remedial Investigation (RI): A Remedial Investigation is a study to define the nature, extent, and magnitude of contamination at a site. Before a remedial investigation can be conducted, a detailed workplan must be prepared that describes how the investigation work will be done.

4. Feasibility Study: The Feasibility Study takes the information from the Remedial Investigation and identifies and analyzes the cleanup alternatives available. As with the Remedial Investigation, a workplan will be prepared which describes how the study will be done.

5. Cleanup Action Plan (CAP): A Cleanup Action Plan is developed using information gathered in the Remedial Investigation and Feasibility Study. The plan specifies cleanup standards and identifies cleanup methods. It will also describe the steps to be taken, including additional environmental monitoring required during and after the cleanup. Finally it will describe the schedule for cleanup activities.

6. Cleanup: Implementation of the Cleanup Action Plan includes pre-design, design, construction, operations, and compliance monitoring.

> **Port of Seattle Terminal 91 is currently at the beginning of this phase of the cleanup process.**

Timeline of Technical and Public Involvement Activities

Schedule	Technical Activity	Public Participation/ Communications Activity
November 1997	Pier 91 Treatment and Storage Facility Permit Modification and Terminal 91 Tank Farm Site Agreed Order for Remedial Investigation and Feasibility Study.	• Fact sheet mailed - week of November 5th. • Public notice – November 5th. • Public comment period - draft PPP, Agreed Order, and permit modification November 5 through December 19, 1997.
January 1998	Finalize Pier 91 Treatment and Storage Facility Permit Modification and Terminal 91 Tank Farm Site 1998 Agreed Order for RI/FS.	• Reviewed and evaluated public comments. • Prepared responsiveness summary. • Prepared final PPP.
March-July 2005	Terminal 91 Tank Farm Demolition Independent Interim Remedial Action.	• Provided written notification to Ecology Site Register, and Seattle and King County Public Health Departments (January 10, 2005). • Provided written notification to Seattle Department of Planning and Development (February 9, 2005). • Provided written notification to potentially liable persons (January 4, 2005). • Posted a sign at the location visible to the general public indicating what cleanup actions were being conducted and identifying a person to contact for more information.
February 2010	Complete negotiations for second (2010) Agreed Order for Terminal 91(incorporating areas of Terminal 91 facility outside of the Tank Farm Affected Area).	• Prepared final draft PPP. • Published notice in Site Register. • Public notice of Agreed Order.
January 2012	Complete negotiations for third (2012) Agreed Order for Terminal 91 (incorporating the selected cleanup action, and including compliance monitoring activities).	• Prepared updated PPP • Published notice in Site Register • Public Notice of Agreed Order
2010 through mid-2013	Prepare Engineering Design report including plans, specifications, compliance monitoring plan, and operations and maintenance plan.	♦ Publish notice in Site Register.
Mid-2013 through mid-2014	Cleanup Action construction.	♦ Publish notice in Site Register.
Starting in 2014	Long-term operations, maintenance, and monitoring.	

Five years following completion of cleanup action construction	Periodic review.	♦ Public Comment Period.

Site History

There have been various owners and companies of the Port of Seattle Terminal 91 (T91) Complex throughout its history. From the late 1800s through 1920, owners of the T91 Complex included various railroads, land development companies, and private individuals.

The Great Northern Railroad began to develop the area in the early 1900s by filling in the area between Magnolia Bluff and Queen Anne Hill. Fill material was added to the area through 1920. A tank farm was present at the four-acre Tank Farm Lease Parcel (Lease Parcel) portion of the Terminal, and that tank farm was for a time (beginning in 1980) used as a permitted dangerous waste **treatment and storage facility (TSD)**. Constructed in the 1920s, it operated partially or fully as a fuel storage facility during the late 1920s through the time it was demolished in 2005.

Another former tank farm historically was located in the area southwest of the Lease Parcel. Historical documents for Terminal 91 showed this tank farm consisted of nine tanks containing gasoline and oil, and that it was in existence from approximately 1927 to 1942.

The U.S. Navy acquired the entire T91 Complex in 1942 through condemnation and operated the tank farm on the Lease Parcel until 1972. During the Navy's possession of the T91 Complex, the Lease Parcel was used primarily as a fuel and lubricating oil transfer station. The Navy began leasing T91 back to **Port of Seattle (the Port)** in 1972 and deeded it to the Port in 1976.

Chemical Processors, Inc. (Chempro), a predecessor of **Burlington Environmental Inc. (BEI)** and **Philip Services Corporation (PSC)**, subleased the Lease Parcel from the Port when the Port leased it back from the Navy. The main activities conducted by Chempro and its successors were waste oil recovery and wastewater treatment. Typical waste streams included oil and coolant emulsions, industrial wastewater, and industrial waste sludge. Bilge and ballast waters were primarily received from ships and transferred to the Lease Parcel via pipeline. Other wastes and wastewater were received via tankers or in drums.

Chempro notified the U.S. **Environmental Protection Agency (EPA)** of its dangerous waste activities at the Lease Parcel on November 14, 1980, and federal permitting requirements became effective November 19, 1980 for its waste management operations. BEI and the Port (as operator and owner, respectively) were issued a Part B **Resource Conservation and Recovery Act (RCRA)** permit effective August 22, 1992 for the continued operation of a permitted dangerous waste management facility at the Lease Parcel. In September 1995, BEI ceased operations at the Lease Parcel and terminated its lease with the Port. BEI subsequently performed aboveground closure activities of all permit-related facility equipment, secondary containment, and treatment units pursuant to an Ecology-approved closure plan. The closure activities performed under this plan were approved by Ecology in October 2003. A Part B RCRA permit remains in effect for

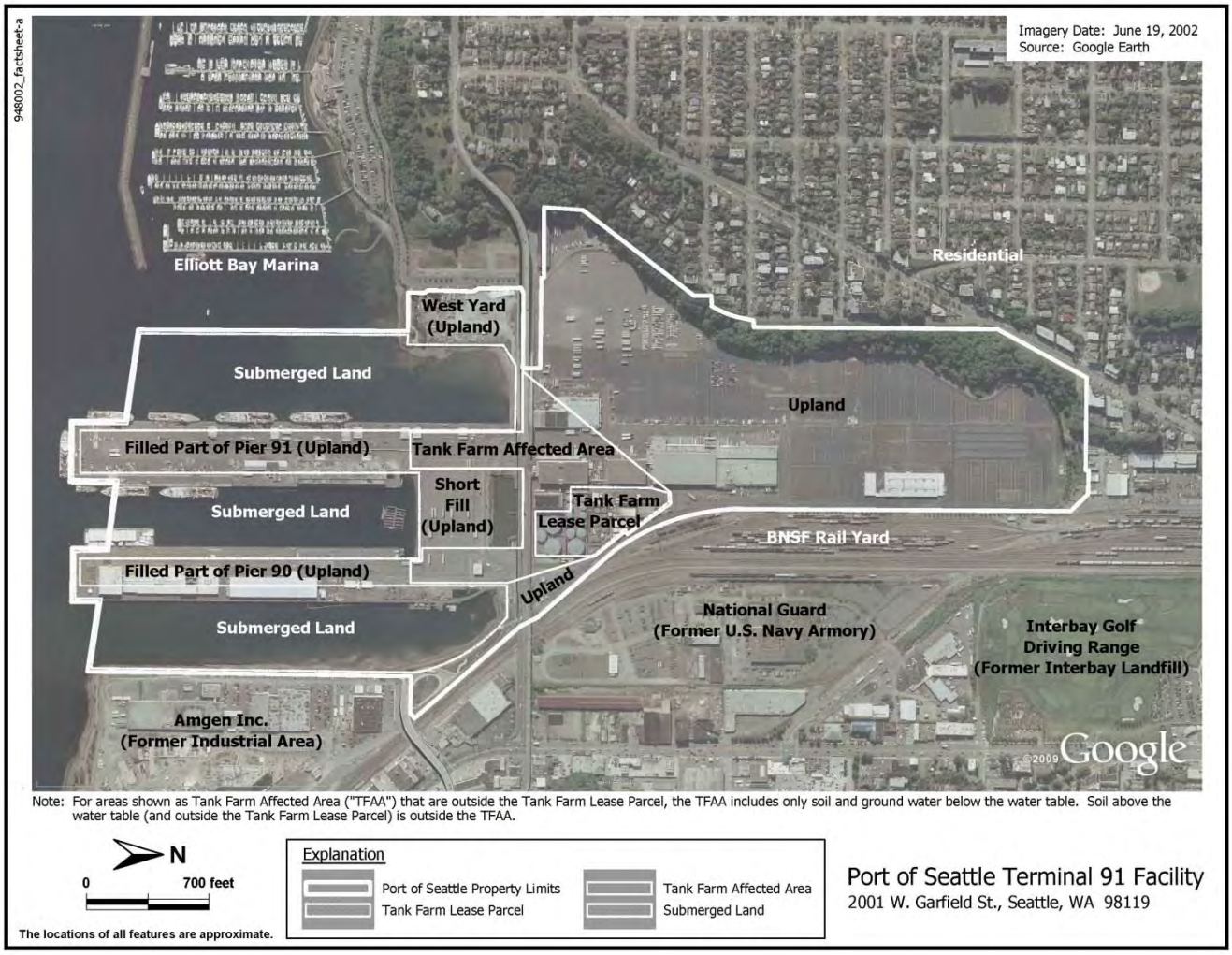
the Site; however, it has been modified over time so that it now permits only corrective action activities. Dangerous waste storage or treatment activities, for example, are no longer authorized.

From about 1974 through 1995, Chempro and its successors also sublet a portion of the Lease Parcel to **Pacific Northern Oil Corporation (PNO)** for storage of non-regulated bunker oil and other fuel products. PNO used aboveground and underground piping systems at the Site to transfer bunker oil and fuels in the Lease Parcel and other areas of the Terminal 91 Complex. This included blending and storage of marine boiler fuel, diesel, and other petroleum products.

PNO entered a new lease for the entire Lease Parcel to continue operations of the bunker oil, lube oil, and fuels product storage and blending facility after PSC's above closure action. PNO terminated its lease with the Port in 1999 and discontinued its fuel product and blending operations at the Site. Subsequently, the Port entered into an agreement with **Fuel and Marine Marketing (FAMM)**, and that entity conducted bunker oil and fuel product storage, blending and marketing operations at the Site until early 2003, when FAMM terminated its lease of the facility. FAMM also subleased the lube-oil portion of the operation to Rainier Petroleum in order to operate tankage at the tank farm until August 2003. Delta Western was hired to provide terminaling operations during this period, and, after August 2003, monitored the facility in caretaker status.

The tank farm remained idle after 2003. The Port decided to remove the remaining aboveground equipment to reduce risks of hazardous substance releases. In the spring of 2005, the Port initiated product removal and demolition activities, including paving of the Lease Parcel, as part of an independent interim remedial action. That interim action was completed in the summer of 2005.

Port of Seattle Terminal 91 Site Map



2.0 Chemicals of Concern

Historically, chemicals of concern at the Lease Parcel include petroleum products, which are considered hazardous substances under MTCA, as well as volatile organic compounds, semi-volatile organic compounds (including polycyclic aromatic hydrocarbons), metals, and polychlorinated biphenyls. These substances were released to soil and groundwater primarily from aboveground storage tanks, fuel distribution piping systems, and other activities associated with historical operations at the Site. These activities included storage of petroleum products and treatment and storage of dangerous waste. Results from soil and groundwater investigations and monitoring performed over the past twenty years have been submitted to Ecology.

3.0 Public Participation Activities and Responsibility

The purpose of this Public Participation Plan is to promote public understanding and participation in the cleanup process for this site. This section addresses how Ecology will keep the public informed about site activity and provide opportunity for being involved in the cleanup.

Ecology will continue to use a variety of tools to facilitate public participation in the planning and cleanup of this site. These tools are: formal comment periods and responsiveness summaries, fact sheets, public meeting (if required), information repositories, site register, and web tools including a web-based events calendar. Ecology will consider and implement constructive input provided by the community whenever possible.

Ecology urges the public to become involved in the remedial action process. Information will be provided regularly to allow several opportunities to review materials and submit comments. This plan is intended to be a flexible working document that will be updated as community concerns emerge and/or more information becomes available during the cleanup process. To arrange for a briefing with project staff, ask questions, or provide comments on the plan or other aspects of the cleanup, please contact one of the persons listed below. This public participation plan will be a working document as the project progresses.

For technical questions, please contact:

Galen Tritt, Site Manager
Washington State Department of Ecology
Bellingham Field Office
1440 10th Street, Suite 102
Bellingham, WA 98225-7028
Phone: (360) 715-5232
E-mail: galen.tritt@ecy.wa.gov

For Community Involvement questions for Port of Seattle, please contact:

Rosie Courtney
Port of Seattle-Community Relations, Public Affairs
P.O. Box 1209
Seattle, WA 98111
Phone: (206) 787-3414
E-mail: courtney.r@portseattle.org

Goal of this Public Participation Plan

MTCA states that public participation plans are intended to encourage coordinated and effective public involvement tailored to the public's needs at a particular facility. The goals of this plan are to:

- Identify people and organizations with an interest or potential interest in the Site.
- Identify community concerns related to the Cleanup and ways to address those concerns.
- Promote public understanding of the proposed Agreed Order process and findings.
- Encourage communication and collaboration among Ecology, the Port, and the community.
- Meet public participation requirements under MTCA and the Dangerous Waste Regulations (WAC 173-340-530(6), WAC 173-340-600, and WAC 173-303-840).

Roles and Responsibilities

- Ecology maintains overall responsibility and approval authority for the activities outlined in this plan in accordance with MTCA requirements.
- Ecology conducts public comment periods as required by MTCA. Activities performed during the public comment periods include:
  - Receiving comments.
  - Making decisions.
  - Preparing responsiveness summaries, if necessary.

Public Outreach Activities

- A 45-day public comment period will be scheduled for the proposed Agreed Order and Resource Conservation and Recovery Act ("RCRA")/Dangerous Waste Permit modification.
- A formal public notice for the comment period will include:
  - A fact sheet distributed to the affected community and surrounding areas.
  - A notice placed in the *Seattle Times* and the *Queen Anne/Magnolia News*.
  - A notice published in Ecology's Site Register and Public Involvement Calendar.
  - All public documents available on Ecology's website for public review.
  - A public meeting held if ten or more people request a meeting during the public comment period.

Formal Public Comment Period

Comment periods are the primary method Ecology uses to get feedback from the public on proposed cleanup decisions, which Ecology presents as draft documents. Comment periods usually last for a minimum of 30 days and are required during the investigation and cleanup process before final decisions are made.

During a comment period, the public can comment in writing. Oral comments are taken if a public hearing is held. After formal comment periods, Ecology reviews all comments received and may respond in a document called a Responsiveness Summary.

Ecology will consider changes or revisions to draft documents based on input from the public. If significant changes are made, a second comment period may be held. If no significant changes are made, the draft document(s) will be finalized.

Public Meetings and Hearings

Public meetings may be held during the cleanup process. Ecology may also offer public meetings for actions of particular interest to the community. Also, if ten or more people request a public meeting or hearing during the comment period, Ecology will hold a public meeting for the purpose of taking oral comments on draft documents.

Information Repositories

Information repositories are convenient places where the public can go to read and review site information. The information repositories are often at libraries or community sites to which the public has access. During the comment period, the public comment documents will be available for review at each repository listed below. These documents will remain at the repositories for the entire duration of the comment period. The entire site file is available for review at Ecology's Northwest Regional Office by appointment. For special accommodation or translation assistance, please contact Galen Tritt at (360) 715-5232. Persons with hearing loss, call 711 for Washington Relay Service. Persons with speech disability call (877) 833-6341.

Seattle Public Library—Central

1000 Fourth Avenue
Seattle, WA 98104
(206) 386-4636

Seattle Public Library—Magnolia Branch

2801 34th Avenue W.
Seattle, WA 98199
(206) 386-4225

Port of Seattle—Pier 69

2711 Alaskan Way
Seattle, WA 98121
(206) 787-3414

Department of Ecology

3190 160th Ave., S.E.
Bellevue, WA 98008
Call for an appointment: Sally Perkins
(425) 649-7190
(425) 649-4450 FAX
E-mail: sally.perkins@ecy.wa.gov
Hours: Tues. – Thur., 8 AM – 12:00 PM and 1:00 – 4:30 PM

Site Register and Public Involvement Calendar

Ecology's Toxics Cleanup Program uses Site Register and web-based Public Involvement Calendar to announce all of its public meetings and comment periods as well as additional site activities. To receive the Site Register in electronic or hard copy format, call (360) 407-7000. The Public Involvement Calendar is available on Ecology's Web site at http://apps.ecy.wa.gov/pubcalendar/calendar.asp

Mailing List

Ecology compiled and maintains a list of interested parties, organizations, and residents living near the cleanup site. This list will be used to disseminate information by mail (fact sheets, site updates, public notices, etc.). If you wish to be added to the mailing list for this site please contact Galen Tritt at 360-715-5232 or by e-mail at galen.tritt@ecy.wa.gov. In the subject line, please indicate Port of Seattle Terminal 91 mailing list.

Website Information

Ecology Web site for Seattle Port Terminal 91:
https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=2674

4.0 Public Participation Grants and Technical Assistance

Additionally, citizen groups living near contaminated sites may apply for public participation grants (during open application periods). These grants help citizens receive technical assistance in understanding the cleanup process and create additional public participation avenues. For more information about the public participation grant, please go to Ecology's Web site at www.ecy.wa.gov/programs/swfa/grants/ppg.html.

NOTE: Ecology currently does not have a citizen technical advisor for providing technical assistance to citizens on issues related to the investigation and cleanup of the Site.

5.0 Public Participation Plan Amendments

This Plan was developed by Ecology and complies with the Model Toxics Control Act regulations (Chapter 173-340 WAC). It will be reviewed as cleanup progresses and may be amended if necessary. Requests for amendments may be submitted to Ecology's site manager, Galen Tritt, for review and consideration.

Appendix A – Glossary

Agreed Order: An order issued by the Department of Ecology under WAC 173-340-530 with which the potentially liable person receiving the order agrees to comply.

Cleanup: The implementation of a cleanup action, or interim action.

Cleanup Action: Any remedial action, except interim actions, taken at a site to eliminate, render less toxic, stabilize, contain, immobilize, isolate, treat, destroy, or remove a hazardous substance that complies with WAC 173-340-350 through 173-340-390.

Chemicals of Concern (COCs): Chemicals of Concern are hazardous substances of particular concern at this Site.

Comment Period: A time period during which the public can review and comment on various documents and proposed actions. For example, a comment period may be provided to allow community members to review and comment on proposed cleanup action alternatives and proposed plans.

Consent Decree: A legal document approved and issued by a court which formalizes an agreement reached between the state and potentially liable persons (PLPs) on actions needed at a site. A decree is subject to public comment. If a decree is substantially changed, an additional comment period is provided.

Containment: A container, vessel, barrier, or structure, whether natural or constructed, which confines a hazardous substance within a defined boundary and prevents or minimizes its release into the environment.

Contaminant: Any hazardous substance that does not occur naturally or occurs at greater than natural background levels.

Dangerous Waste permit: An authorization allowing a person to perform dangerous waste transfer, storage, treatment, or disposal operations, and typically includes specific conditions for such facility operations. A dangerous waste permit is necessary through corrective action work even after dangerous waste operations stop.

Environment: Any plant, animal, natural resource, surface water (including underlying sediments), ground water, drinking water supply, land surface (including tidelands and shorelands) or subsurface strata, or ambient air within the state of Washington.

Facility: Any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly-owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, vessel, or aircraft; or any site or area where a hazardous substance, other than a consumer product

in consumer use, has been deposited, stored, disposed of, placed, or otherwise come to be located there.

Interim Action: Any remedial action that partially addresses the cleanup of a site. An action that is technically necessary to reduce a threat to human health or the environment by eliminating or substantially reducing pathways for exposure from? a hazardous substance at a facility; an action that corrects a problem that may become substantially worse or cost substantially more to address if the action is delayed; an action needed to provide for completion of a site hazard assessment, state remedial investigation/feasibility study, or design of a cleanup action.

Model Toxics Control Act (MTCA): Refers to Chapter 70.105D RCW, first approved by voters in the state of Washington in the November 1988 general election as Initiative 97, and since then, as amended by the Legislature.

Public Notice: At a minimum, adequate notice mailed to all persons who have made a timely request to Ecology and notice to persons residing in the potentially affected vicinity of the proposed action; mailed to appropriate news media; published in the local (city or county) newspaper of largest circulation; and the opportunity for interested persons to comment.

Public Participation Plan (PPP): A plan prepared under the authority of WAC 173-340-600 to encourage coordinated and effective public involvement tailored to the public's needs at a particular site.

RCRA: The Resource Conservation and Recovery Act was enacted by Congress in 1976. RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner.

Responsiveness Summary: A compilation of all questions and comments into a document open for public comment and their respective answers/replies by Ecology. The responsiveness summary is mailed, at a minimum, to those who provided comments, and its availability is announced in the Site Register.

Site Register: Publication issued every two weeks of major activities conducted statewide related to the study and cleanup of hazardous waste sites under the Model Toxics Control Act. To receive this publication, please call (360) 407-7200.

Underground Storage Tank (UST): An underground storage tank and connected underground piping as defined in the rules adopted under Chapter 90.76 RCW.

Exhibit E

Contamination Contingency Work Plan

Roth Consulting

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Roth Consulting

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1.0 INTRODUCTION

1.1 Purpose and Application

This Work Contamination Contingency Plan ("CCP") has been developed to provide standard procedures to be followed for routine sampling, characterization, and disposal of unanticipated contaminated soil, excavation water, debris, underground storage tanks ("USTs"), underground fuel pipelines, and/or management of other potential source structures that may be discovered during construction activities at the Port of Seattle's ("Port's") Terminal 91 Site ("Site") within or outside of the Tank Farm Affected Area ("TFAA"). This CCP will cover new discoveries made during the following activities:

- Planned construction projects that are part of redevelopment activities at the Site and that often include soil excavation as part of the scope of work. These projects are typically carried out by third-party construction firms under contract to the Port.

- General maintenance and repair activities including Port underground utilities excavations. These typically are performed by Port maintenance personnel, the Port's construction division [i.e., Port Construction Services ("PCS")], the Port's third-party contractors, or utility companies with right-of-way access to Port property (e.g., Puget Sound Energy's gas main).

Due to the nature of contractual issues and scheduling requirements for these construction projects and activities, it may be necessary to make relatively quick decisions regarding handling of contaminated materials that might be encountered but that were not anticipated despite prior review of known environmental conditions. This CCP provides procedures for handling these specific situations with the Washington Department of Ecology's ("Ecology's") advance approval (i.e., by Ecology's approval of this CCP and its incorporation into the Agreed Order for the Site).

1.2 Site Location and Background

The Terminal 91 Facility is the real property owned by the Port of Seattle encompassing approximately 216 acres and located at 2001 West Garfield Street, Seattle, Washington. The Site includes areas where releases of Hazardous Substances originating from the Terminal 91 Facility have come to be located. The Site is defined by the extent of contamination caused by the releases of hazardous substances and may include both submerged lands and uplands. The Site location is shown on Figure 1, and a Site plan is provided as Figure 2.

The Site is comprised of three separate and distinct areas: (1) the TFAA; (2) the Submerged Lands Area; and (3) the Upland Area. The TFAA comprises the Tank Farm Lease Parcel and any areas where hazardous substances originating from the Tank Farm Lease Parcel have come to be located. The Submerged Lands Area means that part of the Terminal 91 Facility covered by marine waters, generally located on the southern portion of the Terminal 91 Facility and adjacent to Piers 90 and 91. The Upland Area means that part of the Terminal 91 Facility other than the Submerged Lands Area and the TFAA.

The Tank Farm Lease Parcel was used historically for fuel storage and dangerous waste treatment and storage. Aboveground closure of the former dangerous waste treatment and storage facility was approved by Ecology in October 2003, and the tank farm was demolished in 2005 as part of an independent interim remedial action. Aboveground and underground piping systems at the Site were used to transfer bunker oil and fuels between the Tank Farm Lease Parcel and ship berths.

The rest of the Terminal 91 Facility outside the Tank Farm Lease Parcel has been used for various industrial uses such as ship berthing and fueling, naval supply depot activities, parking of cars and school buses, cruise ship terminal operations, fish-processing equipment manufacturing, and cold storage. Another historic fuel tank farm also was located to the west of the Tank Farm Lease Parcel.

1.3 CCP Organization

This CCP is organized in the following manner:

- Sections 1 through 5 discuss the CCP's background and applicability, how the work will be implemented, key personnel responsibilities, and reporting requirements.
- Figures 1 and 2 show the location of the Site and relevant areas within the Site.
- Figure 3 is a flowchart showing how new discoveries of unanticipated contamination will be reported to Ecology.
- Table 1 lists the types of samples that generally would be collected under this CCP.
- Table 2 lists Port-approved treatment/disposal facilities that could be used under this CCP.
- Appendix A contains Standard Operating Procedures ("SOPs") that will be performed under this CCP.

2.0 CONSTRUCTION ENVIRONMENTAL OVERSIGHT

2.1 Scope of Environmental Oversight Activities

The Port's Seaport Environmental Program group coordinates and provides oversight of environmental management activities for Port construction projects at Terminal 91. Oversight includes review of construction plans and specifications, review of background information (e.g., historical environmental data), review of contractor work plans, and field oversight during construction--including field sampling, waste characterization, and disposal facility coordination. With respect to Terminal 91, oversight responsibilities also include compliance with the Agreed Order. Environmental oversight is provided by Port environmental management staff and its environmental consultants, and is coordinated with Ecology as described in the following sections.

2.2 Roles and Responsibilities

The specific roles and responsibilities of Port environmental personnel associated with Terminal 91 construction activities are described as follows.

The Port's Site Project Manager provides project input on environmental conditions and remedial options and oversees the Agreed Order work.

The Port has a designated Environmental Management Specialist who is responsible for oversight of environmental management activities as part of the Port's construction projects. The Environmental Management Specialist provides review of construction plans and specifications, background environmental information, and contractor and consultant work plans; and provides oversight of the Field Environmental Consultants. The Environmental Management Specialist assists the Port's Site Project Manager in selection of remedial options.

The Port has designated a consultant to act as Agreed Order Project Coordinator on behalf of the Port of Seattle, and as such the consultant is the primary contact with Ecology's Project Coordinator.

Field Environmental Consultants for the project are environmental scientists, engineers, or technicians that are trained in contaminated soil and water identification, sampling, waste characterization and profiling, and remediation oversight. The Field Environmental Consultants report to the designated Environmental Management Specialist on environmental construction activities. Their responsibilities include collection of soil, water, and media samples; waste characterization profiling; assistance in remedial planning; and observation of contractor activities involving handling of contaminated media.

3.0 ENVIRONMENTAL DISCOVERY AND REMEDIAL PLANNING

3.1 Discovery of Unanticipated Contamination

As described in Sections 2.1 and 2.2, Port environmental management personnel review construction plans prior to implementation, and assess the potential for construction excavation activities to encounter contaminated soil based on factors such as previous sampling and historic activities at the construction project location. However, it is still possible that unanticipated contamination (e.g., contaminated soil, excavation water, or debris) and/or potential source structures such as underground fuel storage or transfer facilities may be found during excavation activities. Potentially contaminated media or potential source structures typically are identified and reported by the contractor, the resident engineer and/or inspector, Port environmental staff, or the Field Environmental Consultant during periodic site visits. When potentially contaminated media or potential source structures are identified, the Port's field representative in charge of supervising the construction project (i.e., the resident engineer, inspector, superintendent, or foreman) typically contacts the Port's Environmental Management Specialist and/or the Field Environmental Consultant to further investigate the report. These primary points of contact are based on the chain-of-command that is established for each project. This section describes the process for environmental management of these potential discoveries.

3.2 Field Screening and Assessment

After receiving a report of potentially contaminated media or potential source structures, the Field Environmental Consultant or Port Environmental Management Specialist will visit the site to perform the initial field screening and assessment. Contaminated areas will be screened using visual observations, olfactory clues, and/or photoionization detector ("PID") measurements. If warranted in the environmental professional's judgment, samples would be collected to determine if contamination exists in a project area, to evaluate the extent of contamination, to design cleanup actions, to document residual concentrations remaining in the project area after completion of interim cleanup actions, to document completion of a

cleanup action, and/or to characterize waste material for reuse or disposal/treatment purposes. For potentially contaminated media, screening and sampling (if appropriate) will be performed as described in SOP-1 (Appendix A). For USTs, sampling also will be performed as described in SOP-6 (Appendix A).

Screening and laboratory analyses to be performed on samples will be selected based on the Ecology-approved Guidance for Waste Designation Procedures at Terminal 91 (November 11, 2008; Appendix B) and Management of the Port of Seattle's T-91 Facility's Tank Farm Site Subsurface Debris (December 18, 2008; Appendix C).

3.3 Remedial Planning and Remedial Actions

After the field screening and initial assessment have been completed, the Field Environmental Consultant will work with the Port Environmental Management Specialist and/or the Port Site Project Manager as appropriate to plan appropriate remedial actions for the contaminated media or source structure. Planning considerations for remedial actions to be conducted during the construction activity will include the type of contamination, potential extent, contact with ground water, and type of construction activity being performed.

Potential remedial actions to be considered for contaminated soil typically include a range of options. For example, the range could vary from appropriate disposal of only the media that was required to be removed from the excavation in order to complete the planned construction activities, to over-excavation of all impacted soil in the vicinity. The remedial option selected for implementation during the construction project would depend upon such factors as the contractor's scheduling and/or contractual requirements, placement of structures during the construction project that would make the location inaccessible for future remedial activities, and/or project budget constraints. Common remedial actions that typically could be included in this selection process are as follows:

- Excavation and disposal of soil at an appropriate facility

- Skimming of floating product from excavation water, or dewatering the excavation, and hauling or discharging the product and/or water to an appropriate facility

- Installation of product collection devices such as product monitoring/recovery wells in open excavations prior to backfilling to facilitate later product monitoring/recovery activities

- Addition of commonly used remediation products such as Oxygen Release Compound ("ORC™") to open excavations to enhance natural attenuation processes.

Remedial action procedures to be followed for this work are provided in SOP-2 through SOP-5 (Appendix A).

For USTs, remedial actions will include decommissioning and site assessment activities in accordance with Ecology's UST regulations and guidance, as described in SOP-6 (Appendix A).

For underground fuel pipelines or other structures, remedial actions will include decommissioning by cleaning as necessary, sampling any pipe coatings for potential asbestos-containing materials (if indicated), removal, and disposal at an appropriate facility. A separate consultant or contractor will be hired by the Port to provide sampling and material-handling services for the asbestos evaluation and material-handling work. Remedial action procedures to be followed for this work are provided in SOP-7 (Appendix A).

3.4 Waste Disposal Characterization and Profiling

Samples of soil, water, or debris will be collected and analyzed as necessary to characterize waste material for reuse or disposal purposes. The types of analyses to be performed will be dependent on the past uses of the area. The number of samples to be collected will be based on the requirements of the receiving disposal/treatment facility. Waste profiles will be prepared by POS environmental management staff or environmental consultants, as authorized by POS. Waste characterization, profiling, and management will be performed

using Ecology-approved Guidance for Waste Designation Procedures at Terminal 91 (November 11, 2008; Appendix B) and Management of the Port of Seattle's T-91 Facility's Tank Farm Site Subsurface Debris (December 18, 2008; Appendix C).

4.0 REMEDIAL ACTION AND CONFIRMATION SAMPLING

4.1 Field Observation of Remedial Action

The Field Environmental Consultant or Port Environmental Management Specialist will observe remedial actions that are performed by the third-party contractor, PCS, or Port maintenance personnel. If the remedial action consists of contaminated soil excavation, the Field Environmental Consultant or Port Environmental Management Specialist will be responsible for screening of contaminated soil that is removed from excavation in order to assist the third-party contractor, PCS, or Port maintenance personnel in determining the total quantity of soil to be removed. The Field Environmental Consultant or Port Environmental Management Specialist also will observe other remedial activities such as removal of free product from excavation water and cleaning and removal of USTs, underground fuel pipelines, or other potential source structures, if discovered.

4.2 Cleanup Action and Soil Profiling

For remedial actions involving soil excavation, the third-party contractor, PCS, or Port maintenance personnel will be responsible for excavation of contaminated material and transport to the recycling, treatment, disposal facility or transfer station. Oversight of the contaminated soil excavation will be provided by the Field Environmental Consultant or Port Environmental Management Specialist, as described in Section 4.1. Soil profiling for the receiving facility typically will be performed by Port environmental management staff or environmental consultants and provided to the contractor and the receiving facility.

4.3 Contaminated Media Transport and Disposal/Treatment

Contaminated media will be transported to appropriate receiving facilities by the third-party contractor, PCS, or Port maintenance personnel. The Port requires that media be sent to

Port-approved facilities, or requires prior Port approval before a facility can be used. Port-approved receiving facilities are listed in Table 2.

4.4 Confirmation Sampling and Analysis

Where the remedial action consists of soil excavation, the Field Environmental Consultant will collect confirmation samples of soil remaining in the bottom and sidewalls of the remedial excavation, as appropriate, in order to confirm that cleanup has been completed and/or to document contaminated soil left in place. Confirmation soil samples will be collected at appropriate intervals depending on the size and configuration of the excavated contaminated soil. Laboratory analytical methods to be performed will be dependent on the source of the release. At a minimum, sample intervals will be selected as shown in Table 1.

4.5 Site Restoration

Site restoration typically will be determined in advance by the nature of the construction project. Typically if soil excavation is performed, the purpose is to install underground structures such as ductbanks and/or other utilities, manholes, vaults, and building footings or to facilitate improvements such as replacement pilings along the piers. Materials placed back in the excavation can include these structures as well as clean fill material excavated from other portions of the site during construction activities, or from other Port properties, or imported clean fill materials such as crushed rock. The nature of these materials will depend on the needs of the construction project and will be determined by the Port resident engineer and contractor.

5.0 REPORTING

5.1 Notification

After the initial discovery and assessment have been made as described in Section 3.2, and the presence of contaminated media (or underground fuel pipelines, a UST, or other similar structures) has been confirmed, the Project Coordinator on behalf of the Port or the Port's Site Project Manager or designee will contact Ecology's Site Project Coordinator by phone or email within 24 hours of the confirmation that contaminated media are present. For this Site, samples of media shall be considered contaminated if the environmental professional concludes that the concentration of chemical constituents exceeds MTCA Method A industrial cleanup levels. Because the scheduling of construction projects can involve work at night and on weekends, or 24-hour 7-day shifts, it will not always be possible for the Port to establish immediate contact with Ecology's Project Coordinator. In those cases, due to the nature of the construction project requirements, it may be necessary to proceed with the Port's selected remedial action. Figure 3 shows the decision tree to be used in the event that Ecology's Site Project Coordinator is not immediately available, and immediate action needs to be taken in order to continue work on the project.

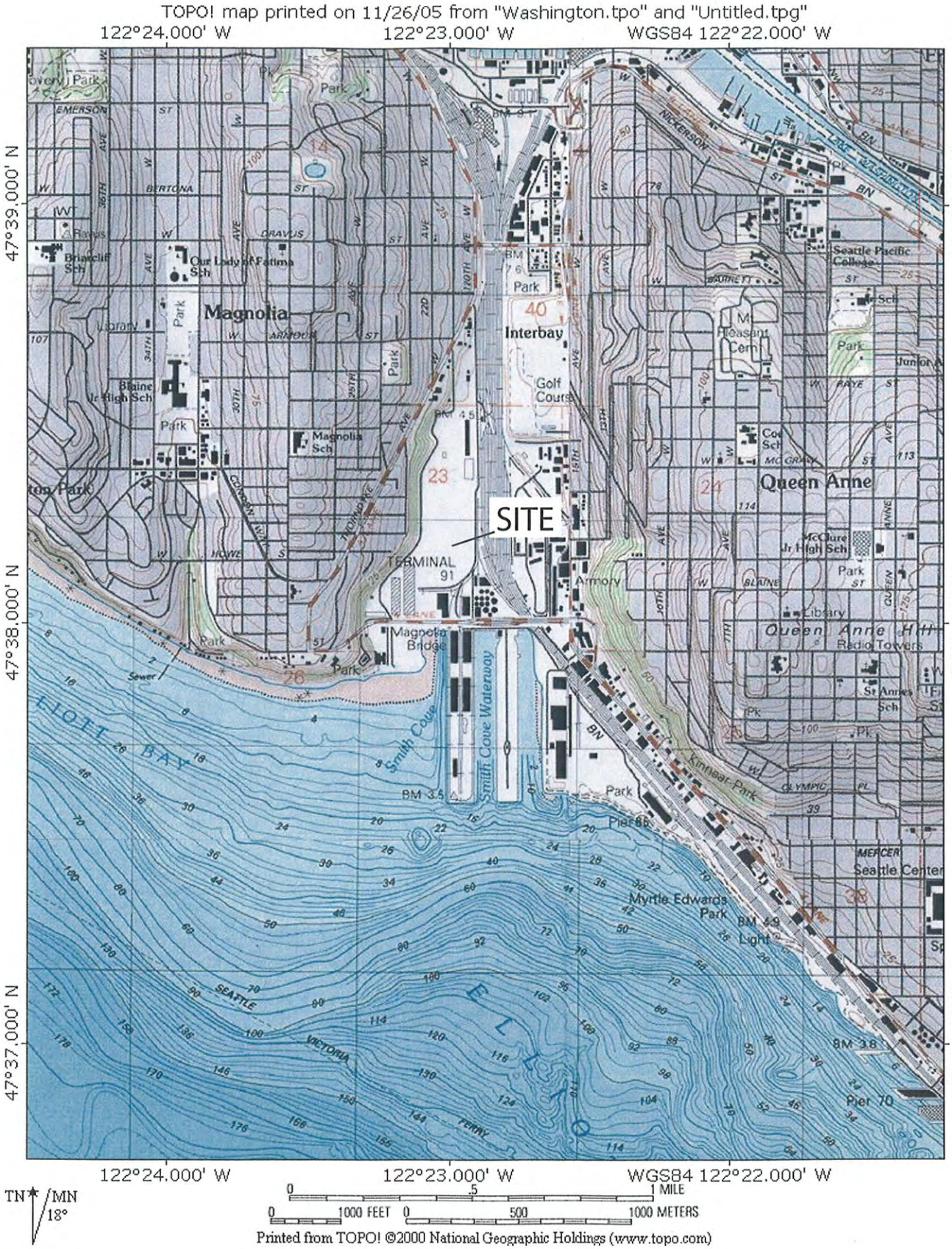
5.2 Status Reports

Field observations, field screening results, sample analytical results, cleanup actions performed, and quantities of media transported for recycling or disposal will be reported to Ecology during the first quarterly status report following the actions.

5.3 Summary Reports

After completion of remedial actions under this work plan, a summary report of the remedial action will be produced. The summary report will include a map of sample locations, a map of the extent of the excavation or other remedial activity, laboratory analytical reports of samples collected, tabulated summaries of laboratory analytical results, materials disposal documentation, and summaries of quantities of materials disposed. The

remedial action report will be delivered to Ecology within 90 days of completion of the construction project that includes the remedial action.



Roth Consulting

Figure 1
Site Location
Terminal 91 Site

Base Image - Google Earth, 2002

Note: For areas shown as Tank Farm Affected Area ("TFAA") that are outside the Tank Farm Lease Parcel, the TFAA includes only soil and ground water below the water table. Soil above the water table (and outside the Tank Farm Lease Parcel) is outside the TFAA.

N

0 600 1,200 feet

Scale: 1-inch = 600 feet

The locations of all features are approximate.

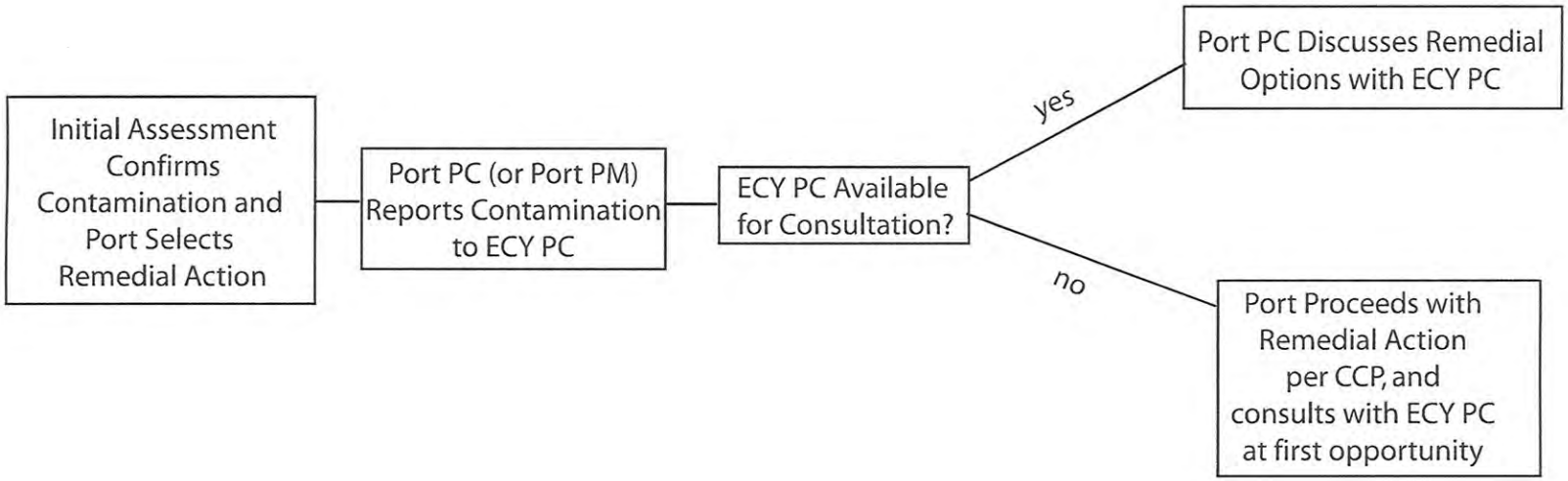
Explanation

- Port of Seattle Property Limits
- Tank Farm Lease Parcel
- Tank Farm Affected Area
- Submerged Land

Figure 2--Site Plan

Port of Seattle Terminal 91 Facility and Tank Farm Lease Parcel

Seattle, Washington



Roth Consulting

Figure 3
Discovery Reporting Flowchart
Terminal 91 Agreed Order

Roth Consulting

Table 1

Summary of Sample Collection Information
Terminal 91 Site Unanticipated Contamination

Location	Sample Purpose	Matrix	Minimum Number of Samples	Sample Method
Excavation	Confirmation	Soil	3[a]	Discrete
Trench	Confirmation	Soil	Every 100 feet	Discrete
Stockpiles In-Situ Soil Containers	Waste Characterization Profiling	Soil Liquids Debris	Per Disposal Facility Requirements	Composite
Quality Assurance	Quality Assurance	Soil	1	Duplicate

Notes:

a. The total number of samples will be selected based on size of the excavation.

Table 2

List of Port-Approved Treatment/Disposal Facilities
Terminal 91 Agreed Order

Rabanco/Allied Waste

Roosevelt Regional Landfill
500 Roosevelt Grade Road
Roosevelt, WA 99356

Waste Management/Chem. Waste Management

Chemical Waste Management of the Northwest
17629 Cedar Springs Lane
Arlington, OR 97812

Columbia Ridge Recycling and Landfill
18177 Cedar Springs Lane
Arlington, OR 97812

LaFarge/Systech

LaFarge/Systech - Seattle
5400 W. Marginal Way S.W.
Seattle, WA 98106

LaFarge/Systech - Fredonia Kansas
1420 South Cement Road
Fredonia, Kansas 66736

Rinker

Rinker - Everett Soil Remediation
6300 Glenwood Ave
Everett, WA 98213-0037

Clean Harbors

Clean Harbors Deer Park, L.P.
2027 Independence Parkway South
La Porte, TX 77571

Clean Harbors Aragonite, LLC
11600 North Aptus Road
Dugway, UT 84022

Clean Harbors Environmental Services, Inc. - Kimball
2247 South Highway 71
Kimball, NE 69145

Clean Harbors El Dorado, LLC
309 American Circle
El Dorado, AR 71730

Emerald Services

Emerald Services - Airport Way
1500 Airport Way South
Seattle, WA 98134

Emerald Services - Tacoma
1825 Alexander Avenue
Tacoma, WA 98421

US Ecology

US Ecology - Grand View Idaho
20400 Lemley Rd.
Grand View, ID 83624

Appendix A

Standard Operating Procedures

STANDARD OPERATING PROCEDURE (SOP) # 1
Field Screening and Initial Assessment Soil Sample Collection

PID Screening

1. Calibrate the photoionization detector ("PID") at least daily in accordance with the manufacturers' written instructions.

2. Hold the PID probe to freshly exposed surfaces of the potentially contaminated soil found within the excavation, excavation stockpile, or backhoe bucket.

3. Alternatively, place soil in a zip-lock plastic bag or sample jar and screen using a headspace analysis.

4. Document the sample location on a figure and results in the field log.

Visual and Olfactory Screening

1. Observe suspected contaminated media in comparison to typical clean media.

2. Document any unusual colors, textures, materials, or odors in the field log.

Sheen-Test Screening (for Soil)

1. Place small quantity of soil in plastic bag or clean jar and add an equivalent amount of potable or distilled water.

2. Document observed sheen or the absence of sheen in the field log.

Soil Sample Collection

1. Soil samples may be collected depending on the results of the field screening. If field screening does not indicate the presence of potential contamination, soil sampling may not be required.

2. Document the soil sample collection, if performed, in field log. Record sample location, sample number, date and time collected, and results of any field screening as described above.

STANDARD OPERATING PROCEDURE (SOP) # 2
Excavation of Unanticipated Contaminated Soil

1. The contractor will excavate contaminated soil under the direction of the Field Environmental Consultant. The contaminated soil will be direct-hauled to the approved disposal/treatment facility or stockpiled, depending on the nature of the contamination and the status of the waste characterization profiling.

2. The Field Environmental Consultant will observe the contractor's activities during excavation of contaminated soil for disposal/treatment. The Field Environmental Consultant will document in the field log the extent of the area containing contaminated soil, the excavation extent, environmental test results, test locations, and the actions taken to comply with the CCP.

STANDARD OPERATING PROCEDURE (SOP) # 3
Recovery of Free Product from Excavation Water

1. If free product collects in a standing body of water at the bottom of an excavation, the Field Environmental Consultant will work with the Port resident engineer and the contractor to develop a site-specific remedial action plan to be approved by the Port. The free product remedial action will involve using sorbent pads or booms to extract the free product and pumping the excavation water and/or product to a holding tank or an oil-water separator.

2. The Field Environmental Consultant will document in the field log the extent of the area containing free product, the excavation extent, test results, and the actions taken to comply with this CCP.

STANDARD OPERATING PROCEDURE (SOP) # 4
Installation of Product Monitoring/Recovery Wells

Product monitoring/recovery wells may be installed in an excavation in order to facilitate future product monitoring and/or recovery efforts in areas where LNAPL is suspected to be present on the water table. These wells would be installed during backfilling of the excavation as part of site restoration activities. Well installation will be performed in accordance with the Minimum Standards for Construction and Maintenance of Wells (WAC 173-160).

STANDARD OPERATING PROCEDURE (SOP) # 5
Application of ORC™ or Other Commonly Used Remedial Products

This procedure could be used to enhance natural attenuation processes in areas where petroleum hydrocarbons have been detected in ground water. In the case of an open excavation, ORC™ or other commonly used remedial products could be applied directly to groundwater in order to assist in degrading petroleum constituents. The procedure to be used is as follows.

1. The Field Environmental Consultant and/or Port Environmental Management Specialist will consult with the applicable vendor to determine an appropriate rate, volume, and method for application of the product based on site-specific conditions. Materials Safety Data Sheets ("MSDSs") for the product will be obtained and kept on file for use in reporting.

2. The Field Environmental Consultant and/or Port Environmental Management Specialist will oversee the contractor or vendor's application of the product at the Site.

3. The Field Environmental Consultant and/or Port Environmental Management Specialist will record the details of timing, location, volumes and methods for application of product applied to the excavation. These data will be kept on file for use in reporting.

STANDARD OPERATING PROCEDURE (SOP) # 6
Removal of Unanticipated Underground Storage Tanks

1. The Port resident engineer or inspector will notify the Field Environmental Consultant if an unanticipated underground storage tank ("UST") is encountered during excavation.

2. The Field Environmental Consultant will coordinate with the Port resident engineer and the contractor to develop a plan for removal of the UST. The plan shall include a) determination of UST contents, b) removal of tank contents for recycling or disposal if applicable b) tank inspection and decommissioning in accordance with state underground storage tank regulations, and c) preparation of a UST decommissioning report. The work will be performed in accordance with the State Underground Storage Tank Regulations (WAC 173-360). A licensed tank decommissioner will be present during the tank decommissioning activities.

3. The Field Environmental Consultant will coordinate with the Port resident engineer to verify that the proper tank closure notifications are made and that the contractor performs the specified UST decommissioning and prepares a UST decommissioning report.

4. The Field Environmental Consultant will perform the UST site assessment and prepare the UST site assessment report. The site assessment will be performed using the Department of Ecology's Guidance for Site Checks and Site Assessments for Underground Storage Tanks (Ecology Publication 90-52). A certified site assessor will be present during the site assessment activities.

5. Follow procedures for soil excavation identified in SOP # 2 if contaminated soil is encountered and remedial action is performed as part of the construction project activities.

STANDARD OPERATING PROCEDURE (SOP) # 7
Removal of Unanticipated Underground Fuel Pipelines or Other Potential Source Structures

1. The Port resident engineer or inspector will notify the Field Environmental Consultant if an unanticipated underground fuel pipelines or other potential source structures are encountered during excavation.

2. The Field Environmental Consultant will coordinate with the Port resident engineer and the contractor to develop a plan for removal of the fuel pipelines or other structures, if required by the construction project. The plan shall include a) determination of fuel pipelines or structure contents, b) removal of contents for recycling or disposal if applicable, c) determination if fuel line coatings contain asbestos and d) identification of an appropriate disposal facility for the pipelines or other structures.

3. The Field Environmental Consultant will document in the field log the removal activities, the excavation extent, test results, and the actions taken to comply with this CCP.

4. Follow procedures for soil excavation identified in SOP # 2 if contaminated soil is encountered and remedial action is performed as part of the construction project activities.

Appendix B

Guidance for Waste Designation Procedures at Terminal 91

GUIDANCE FOR WASTE DESIGNATION PROCEDURES AT TERMINAL 91

1.0 BACKGROUND AND REGULATORY FRAMEWORK

A RCRA dangerous waste treatment and storage facility ("TSD") formerly was operated by former tenants of a 4-acre portion [known as the Tank Farm Lease Parcel] within the Port of Seattle's 216-acre Terminal 91 property. Corrective action at the entire Terminal 91 property is required under a RCRA Part B permit because EPA's definition of "facility" for the purposes of corrective action includes all contiguous property under control of the owner or operator. This document provides a basis and rationale for an approach to characterization of cleanup media as dangerous or non-dangerous waste. It is intended for use in cleanups conducted within all areas subject to the 1998 Agreed Order and the 2009 Agreed Order (in progress).

2.0 RATIONALE FOR DETERMINATION IF WASTE MEDIA IS DANGEROUS OR NON-DANGEROUS

2.1 GENERAL PRINCIPLES

Contaminated media (e.g., soil or ground water) is not dangerous waste unless it exhibits a dangerous waste characteristic, state-only criteria or is contaminated with concentrations of hazardous constituents from listed dangerous waste. Note that a "contained-out" determination may be granted by Ecology for environmental media that contains concentrations of listed wastes that are below health-based levels (typically MTCA Method B cleanup levels). Characteristic and state only wastes are determined by means of generator knowledge and standard testing methods and are based upon the properties of the waste. By contrast, determination that a contaminated media contains constituents from a listed dangerous waste requires knowledge that a listed waste was released to and came into actual contact with the media in question. If a facility owner or operator makes a good faith effort to determine if a material is a listed waste but cannot make such a determination because documentation regarding a source of contamination, contaminant or waste is unavailable or inconclusive, the generator of the waste may assume the source, contaminant, or waste is not listed waste and, therefore, provided the material in question does not exhibit a characteristic of dangerous waste or state only criteria, RCRA requirements do not apply (EPA 1998).

2.1.1 Potential for Characteristic and State Only Criteria Wastes at Terminal 91

As with any cleanup site, contaminated media that constitutes characteristic dangerous waste could potentially be encountered wherever cleanup occurs at the Terminal. Therefore, the Port will apply standard waste classifications considerations to determine whether particular wastes might exhibit dangerous waste characteristics of toxicity, ignitability, etc. and does not exhibit a state only criteria.

2.1.2 Potential for Listed Wastes Mixed with Cleanup Media at Terminal 91

Media may be dangerous based on their contact with listed dangerous wastes. They could be encountered wherever listed wastes were released or where such releases have migrated. Characterization of wastes as mixed with listed dangerous wastes may be difficult at Terminal 91, because there is little information regarding historic releases of listed wastes, and because the chemical constituents now found in the media are consistent with various materials known to have been handled at the Terminal, some of which were listed dangerous wastes but the vast majority of which were not. Because many of the chemical constituents likely to be found in media at Terminal 91 could be attributed to either listed dangerous wastes or other wastes (solid wastes or characteristic dangerous wastes), care should be taken to avoid "false positive" identification of media as having been mixed with listed dangerous wastes. Therefore, the Port would characterize media by accounting for professional judgment and other factors in addition to media's chemical constituents. Because undocumented releases of listed dangerous wastes may have occurred, the use of professional judgment in determining the likelihood that environmental media could be contaminated with listed dangerous wastes is required. Some but not all possible examples: soils contaminated with listed constituents, located below or near areas where listed dangerous wastes were managed or located; groundwater contaminated with listed constituents located below, near and downgradient of areas where listed dangerous wastes were managed or located.

The use of professional judgment and other factors relate to the possibility that the media in question could have been contaminated by exposure to releases of listed dangerous waste, and they include:

- knowledge of listed wastes that were and were not handled at the TSD, as well as knowledge of other fuels and wastes historically handled at the Terminal that have constituents in common with the listed wastes handled at the TSD;
- knowledge of where wastes were released (although no releases of listed wastes are specifically known to have occurred);
- undocumented releases of listed dangerous wastes[1];

[1] Although there are no reported and documented releases of listed wastes from the Tank Farm Lease Parcel, the Port will need to assume the possibility of unreported releases of listed dangerous wastes in evaluating contaminated environmental media near areas where listed wastes were managed or located.

- knowledge of locations where listed wastes were or were not handled; and
- consideration of whether media could have been contaminated by releases of constituents other than listed waste, based on knowledge of historic releases of such materials as, for example, fuel oil or bunker oil. Factors relevant under this category include where such releases occurred and concentrations or patterns of the constituents involved.

2.2 FACTORS AFFECTING WASTE DESIGNATION AT TERMINAL 91

2.2.1 Listed Wastes Known to Have Been Handled and Their Locations

The RI/DE Report identified wastes known to have been handled at the Tank Farm Lease Parcel during its operation as a RCRA DW treatment and storage facility [see attached Tables 2.3 (Wastes historically managed at the TSD) and 2.4 (Wastes managed at the time of closure) from the RI/DE Report (PSC 1999), which was incorporated by reference into the final RI Summary Report (Roth Consulting 2007) for the T91 Tank Farm Site]. The wastes historically handled at the facility fell into six categories, five of which were either solid wastes or characteristic dangerous wastes. One of the six categories included some low-level listed wastes. These listed wastes consist of low levels of F001 – F005 waste. Outside of the Tank Farm Lease Parcel, there are no locations of the Terminal where listed dangerous wastes are known to have been handled. However, it is possible that listed dangerous wastes that may have been released from within the Tank Farm Lease Parcel may have migrated with groundwater to portions of the site "outside" the Tank Farm Lease Parcel. This is based on cleanup documents prepared under the 1998 Agreed Order [for example the T91 Baseline Report (Kennedy/Jenks Consultants 1997)] and under EPA's jurisdiction prior to the 1998 Agreed Order [such as the Remedial Facility Assessment (EPA 1994)].

In the case of contaminated saturated soils and groundwater, the Port will need to evaluate site sample data and use professional judgment in considering the likelihood that nearby soils and downgradient contaminated saturated soils and groundwater are contaminated from an unreported and undocumented release of an upgradient listed dangerous waste. The Port may also use other criteria including but not limited to, concentration of contaminants, and the relatively small or large volumes of listed wastes managed (and locations) compared to volumes and locations of non-listed dangerous wastes (with similar chemical constituents) in specific areas to evaluate the likelihood that environmental media is contaminated with a listed dangerous waste. The Port should document its designation justifications and contact the Ecology NWRO if they have questions.

2.2.2 Listed Waste Releases

Media to be removed from any areas where listed dangerous wastes were released would need to be evaluated for possible classification as dangerous wastes. Based on information provided by the former facility operator, PSC, in the RI/DE Report (PSC 1999), however, there were no known releases of listed or other dangerous wastes at the Tank Farm Lease Parcel.[2] PSC did report releases of large quantities of non-dangerous waste or product at the Tank Farm Lease Parcel, including bunker oil, asphalt, fuel oil, and oily water (PSC 1999). There are no reported releases of listed dangerous wastes at the Terminal outside the Tank Farm Lease Parcel.[3]

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[2] *Id.*
[3] *Id.*

3.0 WASTE CHARACTERIZATION PRINCIPLES FOR TERMINAL 91

3.1 MEDIA REMOVED FROM AREAS OUTSIDE THE TANK FARM AFFECTED AREA

Cleanup media to be generated as wastes in connection with cleanup activities outside the Tank Farm Affected Area ("TFAA") will be classified using professional judgment and site-specific knowledge, including knowledge of contaminants known to have been or potentially released in the area and contaminants detected in analysis of the media. Petroleum and fuel-related materials were released outside of the Tank Farm, but as noted above, no releases of listed wastes are known to have occurred anywhere at Terminal 91, and listed dangerous wastes are not believed to have been managed outside the TFAA[4]. Therefore, as cleanup media are generated as wastes outside the TFAA, the Port will conduct routine sampling as necessary for waste screening and disposal purposes. Unless such analyses and professional judgment indicate the likelihood of dangerous waste characteristics, state-only criteria, or listed waste contamination, media from outside the TFAA will be managed as solid waste. Note: "Tank Farm Affected Area" includes areas where constituents (hazardous substances) from the Tank Farm Lease Parcel have come to be located. It is possible that media could be removed from strata overlying saturated zones affected by such migration. If such media are not believed to have come into contact with the migrated constituents because, for example, they are always above the saturated zone, they would not be considered to be from the TFAA, and would not be subject toany presumptions relating to the TFAA, such as increased potential for contact with listed dangerous wastes[5].

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[4] *Id.*
[5] *Id.*

3.2 MEDIA FROM THE TANK FARM AFFECTED AREA FOUND NOT TO CONTAIN RELEVANT LISTED WASTE

Media removed from the TFAA will be sampled and analyzed to determine whether it contains constituents associated with listed wastes known to have been handled at the TSD. Those appear to have been limited to the listed wastes F001 - F005. Results from these analyses will be used to designate cleanup media wastes according to the following principles:

- Media found not to contain such F001 – F005 constituents will be managed in the same manner as section 3.1, i.e., as solid wastes (unless they exhibit a dangerous waste characteristic).
- Media found to contain only BTEX constituents will be managed as in section 3.1. This is because there is no information indicating releases[6] of listed dangerous wastes containing BTEX constituents in the TFAA. On the other hand, multiple relatively large-volumes of non-dangerous TPH materials were reportedly released.
- Other media found to contain constituents associated with listed wastes known to have been managed at the TSD (other than BTEX constituents) will be evaluated in light of historic waste handling and release information[7] to determine whether there is evidence that it contains a listed dangerous waste.
- Media found to contain such listed constituents, but at levels (below MTCA Method B), may, with Ecology's approval, be managed as solid wastes in accordance with Ecology's written approval and required management of contained-out environmental media.
- Media found to contain constituents as a result of mixture with listed dangerous wastes will be managed as listed dangerous wastes, unless Ecology approves a contained-out determination.

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[6] *Id.*
[7] *Id.*

TABLE 2.3

WASTES HISTORICALLY MANAGED AT THE SITE BY BEI
TERMINAL 91 TANK FARM SITE RI/DE REPORT

WASTE DESCRIPTION	POTENTIAL CONTAMINANTS
Waste Oils[2]	
Crankcase oils, bunker fuels, diesel and tank cleaning residuals, and waste boiler fuel (fuel oil #6)	1. Metals including cadmium, chromium, lead 2. Other constituents silicon, and phenol (less than 1,000 ppm) 3. Sulfur; and 4. Iron scale
Coolant Oils	
Metal machining waste	1. Metals including aluminum, arsenic, chromium (III), iron, and zinc; 2. Exotic metals including magnesium and titanium; and 3. Chlorinated paraffins (non-hazardous waste)
Oily Industrial Wastewaters	
Tank cleaning waste, bilge waters, etc.	1. Low-level oil contamination; 2. Metals including trivalent chromium, hexavalent chromium, lead, and zinc; 3. Waste oil constituents including cadmium, copper, iron, lead, phenols and silicon; 4. Surfactants including soaps, and defoamers (non-hazardous wastes)
Industrial Wastewaters Without Oil	
Automobile manufacturing waste	1. Low levels of hexavalent chromium (VI) 2. Aluminum
Industrial Wastewaters With Solvents	
Rinsewater from cleaning and stripping of airplanes	1. Low levels of F001-F005 Waste 2. Phenol 3. Low-level (approximately 1000-4000 ppm) methylene chloride
Waste Sludges	
Oily sludges from cleaning of sumps	1. Metals including cadmium, chromium, lead 2. Other constituents silicon, and phenol (less than 1,000 ppm) 3. Sulfur 4. Iron scale

[1]Information obtained from BEI files.
[2]Note: All waste oils have the possibility of low-level PCB contamination and levels of BTEX compounds.

TABLE 2.4

WASTE AND PRODUCTS HANDLED BY BEI[1]
AT THE TIME OF ABOVEGROUND CLOSURE
TERMINAL 91 TANK FARM SITE RI/DE REPORT

WASTE DESCRIPTION	WASTE CODES	DW/EHW
Bunker-C and water	WT02	DW
Cleaners-mixed alkaline, glycol <10%, oil, water	WT02	DW
Crankcase oil	WT02	DW
Cutting fluid/tramp oil: chlorinated paraffins, diethylene	WP02	DW
Dewatered oil tank sludge	WT02	DW
Dewatered tank bottom solids potentially containing arsenic, cadmium, chromium, lead, or mercury	D004, D006, D007, D008, D009	DW
Diesel fuel - with benzene	D018, WT02	DW
Emulsified oil-coolant/water/detergent	WT02	DW
Ethylene glycol/water-antifreeze <12% concentration	WT02	DW
Jet/A-fuel and water	WT02	DW
Machine coolant (Trim-sol)	WT02	DW
Mineral oil	WT02	DW
Mineral oil	D001	DW
Mixed oils	WT02	DW
Non-RCRA waste liquid	WT02	DW
Oil tank bottom solids	WT02	DW
Oil, Bunker C	WT02	DW
Oil, water with trace metals	WT02	DW
Oil/kerosene	WT02	DW
Oily absorbent pads/debris/solids	WT02	DW
Oily floc from water treatment	WT02	DW
Oily floc/water: lead & benzene	D008, D018, WT02	DW
Oily sump sludge	WT02	DW
Paint booth rinsings containing chrome	D007, WT02	DW
Petroleum distillate, dye penetrant/water treatability	WT02	DW
Petroleum oil sludge	WT02	DW
Phenolic water	WT02	DW
Phosphate ester-based hydraulic fluid	WT02	DW
Process water	WT02, D018	DW
Sodium hydroxide (alkaline/phenolic)	WT02	DW

[1]Information obtained from BEI files.

Notes:
Waste Codes - As designated by Ecology and/or EPA.
DW/EHW - Dangerous Waste/Extremely Hazardous Waste
NA - Not Applicable

TABLE 2.4 (Continued)

WASTE AND PRODUCTS HANDLED BY BEI[1]
AT THE TIME OF ABOVEGROUND CLOSURE
TERMINAL 91 TANK FARM SITE RI/DE REPORT

Waste Description	Waste Codes	DW/EHW
Toluene/paint	F005	DW
Tramp oil from machine coolant oil	WT02	DW
Used engine oil	WT02	DW
Waste combustible liquid, n.o.s. (diesel)	WT02, D018	DW
Waste oil	WT02	DW
Water & oil from oil-water separators	WT02	DW
Water with lead <500 ppm	D008, WT02	DW
Water with phenol, coolant, metal chips & debris	WT02	DW
Water, methanol, hydrochloric acid, hexane, sediment	WT02	DW
Water, oil with lead	D008, WC02	DW
Water, oil, coolant	WT02	DW
Water, oil, coolant	WP02	DW
Water, oil, coolant (ethylene glycol)	WT02	DW
Water, oil, sludge	WT02	DW
Water, oil, soap	WT02	DW
Water, oil, soap, grease, contaminated	WT02	DW
Water, synthetic hydraulic fluid, oil	WT02	DW
Water/MEK, acetone, perchloroethylene	F001, F002, F003, F005, D035, D039	DW
Water/oil/hydraulic fluid/antifreeze – auto maintenance	WT02	DW
Water/oil/jet fuel	WT02	DW
Water: phenol < 500 ppm; acetone, toluene, 111-Tri	F001, F002, F003, F005	DW
Well drilling debris: barium, cadmium, chromium, lead	D005, D006, D007, D008	DW
Aqueous wastes containing phenol	non-regulated	NA
Boron wastewater	non-regulated	NA
Bunker C fuel oil	non-regulated	NA
Combustible oily water	non-regulated	NA
Concentrated salt brine with water, iron, nickel, hydroxide	non-regulated	NA
Coolant	non-regulated	NA
Coolant slops	non-regulated	NA
Diesel/water	non-regulated	NA

[1]Information obtained from BEI files.

Notes:
Waste Codes - As designated by Ecology and/or EPA.
DW/EHW - Dangerous Waste/Extremely Hazardous Waste
NA - Not Applicable

TABLE 2.4 (Continued)

WASTE AND PRODUCTS HANDLED BY BEI[1]
AT THE TIME OF ABOVEGROUND CLOSURE
TERMINAL 91 TANK FARM SITE RI/DE REPORT

WASTE DESCRIPTION	WASTE CODES	DW/EHW
Flash Point >100°F	non-regulated	NA
Gasoline/water	non-regulated	NA
Heavy metal aqueous waste	non-regulated	NA
Hydraulic oil	non-regulated	NA
Hydraulic oil/fuel oil, waste	non-regulated	NA
Lube Oil	non-regulated	NA
Mixed oil > 85% BSW therm chem treat	non-regulated	NA
Mixed oil BSW 0% to 12%	non-regulated	NA
Motor oil	non-regulated	NA
Oil sludge & water	non-regulated	NA
Oil/water BSW 13% to 30%	non-regulated	NA
Oil/water BSW 31% to 50%	non-regulated	NA
P.S. 400 - heavy fuel oil	non-regulated	NA
Transformer oil, if recyclable	non-regulated	NA
Treatable aqueous wastes	non-regulated	NA
Turbine oil, if recyclable	non-regulated	NA
Water containing asphalt emulsion/petroleum distills.	non-regulated	NA
Water, oil	non-regulated	NA
Water, oil. coolant	non-regulated	NA
Water/fuel	non-regulated	NA
Weak alkaline non-corrosive	non-regulated	NA

[1]Information obtained from BEI files.

Notes:
Waste Codes - As designated by Ecology and/or EPA.
DW/EHW - Dangerous Waste/Extremely Hazardous Waste
NA - Not Applicable

Exhibit F

Schedule

EXHIBIT F
IMPLMENTATION SCHEDULE
TERMINAL 91 TANK FARM CLEANUP ACTION

Task	Schedule
Submit 30% Design Basis Memorandum (DBM) to Ecology	90 days[1] from effective date of Cleanup Agreed Order
Ecology Review of 30% DBM	30 days from receipt of 30% DBM
Meeting to Review Ecology Comments on 30% DBM	10 days from receipt of Ecology comments
Submit Draft Engineering Design Report (EDR) and 90% Construction Plans and Specifications (CPS) to Ecology	180 days from receipt of Ecology comments on 30% DBM
Ecology Review of Draft EDR and 90% CPS	60 days from receipt of Draft EDR and 90% CPS
Meeting to Review Ecology Comments on Draft EDR and 90% CPS	10 days from receipt of Ecology comments
Submit Final EDR and 100% CPS to Ecology	70 days from receipt of Ecology comments
Ecology Approval[i] of Final EDR and 100% CPS	15 days from receipt of Final EDR and 100% CPS
Construction of Cleanup Action	Per approved schedule in Final EDR
Notes – 1 – Assumes Data Gaps Investigation completed within 30 days of effective date of Cleanup AO	

[i] If Ecology disapproves the proposed Final EDR, the Port shall respond as provided in Section VII.A.4.c of the Agreed Order.