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Work Plan for Remedial Investigation/Feasibility Study and Interim Action Solid Wood Incorporated Site (West Bay Park)

City of Olympia Parks, Arts and Recreation Department

City of
OLYMPIA

May 2008

Parametrix

Work Plan for Remedial Investigation/Feasibility Study and Interim Action
Solid Wood Incorporated Site
(West Bay Park)

Prepared for

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CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned.

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Prepared by Lara Linde

FOR

Checked by Scott Elkind, P.E.

Approved by David Dinkuhn, P.E.

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ACRONYMS

µg/L	Micrograms Per Liter
AET	Puget Sound Apparent Threshold Levels
ARARs	Applicable or Relevant and Appropriate Requirements
bgs	Below Ground Surface
BNSF	Burlington Northern Santa Fe
BTEX	Benzene, Toluene, Ethylbenzene & Xylenes
cPAHs	Carcinogenic Polycyclic Aromatic Hydrocarbons
cy	Cubic Yards
DO	Dissolved Oxygen
DQIs	Data Quality Indicators
DQOs	Data Quality Objectives
Ecology	Washington State Department of Ecology
EIM	Environmental Information Monitoring
EPA	U.S. Environmental Protection Agency
ESA	Environmental Site Assessment
gpm	Gallon Per Minute
GPS	Global Positioning System
HAZWOPER	Hazardous Waste Operations and Emergency Response
HPAH	High Molecular Weight Polycyclic Aromatic Hydrocarbon
IA	Interim Action
ID	Internal Diameter
IDW	Investigation derived waste
LPAH	Low Molecular Weight Polycyclic Aromatic Hydrocarbon
mg/kg	Milligrams per Kilogram
MS/MSD	Material Sources/Material Sources Data
MTCA	Model Toxics Control Act
NTUs	Nephelometric Turbidity Units
OD	Outside Diameter
OPARD	City of Olympia Parks, Arts, and Recreation Department
ORC	Oxygen Releasing Compound
ORP	Oxidation-reduction potential
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls

ACRONYMS (CONTINUED)

PID	Photoionization Detector
PP	Priority Pollutant
PVC	Poly Vinyl Chloride
QA/QC	Quality Assurance/Auality Control
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
SEPA	State Environmental Policy Act
SIM	Selected Ion Monitoring
SMS	Sediment Management Standard
SOPs	Standard Operating Procedures
SQS	Sediment Quality Standards
SVOCs	Semivolatile Organic Compounds
TOC	Total Organic Carbon
USCS	Unified Soil Classification System
VOCs	Volatile Organic Compounds
WDFW	Washington State Department of Fish and Wildlife

1. INTRODUCTION AND BACKGROUND INFORMATION

This document is a work plan for conducting a Remedial Investigation/Feasibility Study (RI/FS) and Interim Action (IA) at the Solid Wood Incorporated Site (West Bay Park), located at 900 West Bay Drive NW in Olympia, Washington (Figure 1). The site, which formerly contained a lumber mill, was purchased by the City of Olympia Parks, Arts, and Recreation Department (OPARD) for development as a waterfront park. The City purchased the site in two separate purchase agreements for the following areas: 1) the main upland area formerly owned by the Port of Olympia, and 2) the Burlington Northern Santa Fe (BNSF) railroad spur right of way which runs through the middle of the site. Parametrix completed Phase I and Phase II Environmental Site Assessments (ESAs) targeting both parcels prior to the City entering into purchase agreements with the Port and BNSF (Parametrix 2004a,b; 2007).

This work plan was developed in cooperation with the Washington State Department of Ecology (Ecology). The RI/FS and IA will be conducted under an Agreed Order between the City and Ecology. The RI/FS is to be performed to investigate the nature and extent of any site contamination and to aid in the development of cleanup actions. The City is currently in the design and permitting stages of Phase I Park development on the site (see the Phase I Park boundary on Figure 2). This work plan contains a proposed Interim Action for addressing contaminant sources within or near the Phase I Park development. The IA will be performed concurrently with the construction of the Phase I Park development. The purpose of combining the RI/FS and IA into one work plan is to provide a single document that will form the basis for the Agreed Order.

The proposed IA in this document is based on preliminary RI/FS sampling conducted in late 2007/early 2008. This sampling was performed prior to the finalization of the RI/FS work plan so that the IA could be designed and funding, planning, and design of the park could remain on schedule. Currently, the IA and park construction are scheduled to be performed in summer 2008. Once the RI/FS is completed, the draft Cleanup Action Plan will be prepared.

A State Environmental Policy Act (SEPA) environmental checklist, a companion document required under an Agreed Order, is included in Appendix A.

1.1 SITE DESCRIPTION AND HISTORY

The Solid Wood, Inc. (West Bay Park) site is approximately 17 acres in size and historically operated as a lumber mill. The site lies on West Bay in Budd Inlet, east of West Bay Drive, north of the Fourth Avenue Bridge, and south of the Reliable Steel facility

(Figure 2). Lagoon/tide flats (Port Lagoon) located south of the site lie within a federal wildlife habitat easement.

The most recent commercial/industrial activity on the site was a lumber yard (Solid Wood, Incorporated) that closed in 2002. The site is currently vacant industrial land that contains extensive asphalt pavement, concrete foundations from former buildings, wood piling remnants, and encroaching low-lying vegetation. Inactive railroad tracks (a former BNSF rail spur) run the entire length of the site. In the southern portion of the site adjacent to the lagoon, the rail spur runs on top of a causeway that is connected to the mainland by two trestles.

According to the Phase I ESA report for the site (Parametrix 2004), the railway operated through the property as early as 1898. It is not known when the railway was vacated; however, aerial photographs show railcars on the property as late as 1996.

A 2004 Phase II ESA conducted at the site (for areas outside of the rail spur right of way) concluded that there were no significant environmental impacts present. A supplemental Phase II ESA targeting the rail spur was conducted in 2007 (Parametrix 2007). During this Phase II ESA, petroleum contamination was discovered in three areas in exceedance of the Model Toxics Control Act (MTCA) Method A clean up levels for unrestricted land use. Low-level (slightly exceeding the MTCA A cleanup levels) surface soil contamination related to creosote-treated rail ties was also discovered in several areas. Phase II ESA sample locations are shown on Figures 3 through 5. A description of the 2007 Phase II ESA sampling results is provided in Section 3. Section 3 also describes the preliminary RI/FS sampling.

2. PROJECT ORGANIZATION AND MANAGEMENT

2.1 PROJECT ORGANIZATION

Specific project roles and responsibilities for oversight and sampling are described in Table 2-1.

Table 2-1. Project Roles and Responsibilities

Personnel	Responsibilities
David Dinkuhn Parametrix Project Manager (360)850-5319 ddinkuhn@parametrix.com	Oversees technical team performance to ensure successful accomplishment of the project objectives. Scopes and coordinates field effort; oversees day to day project activities; coordinates site access with property owners; insures all field sampling and handling procedures are followed and documented, and that field QA objectives are met.
Lara Linde Parametrix Field Sampler/Field Health and Safety Officer (360)850-5332 llinde@parametrix.com	Reports directly to the Project Manager. Ensures all project health and safety requirements are followed; conducts field sampling activities; coordinates sample deliveries to lab; reports to the Project Manager any deviations from the work plan.
Stuart Currie Parametrix Project Chemist/Data QA Manager (425)458-6273 scurrie@parametrix.com	Reports directly to Project Manager and works directly with laboratory QA manager. Reviews laboratory data; ensures chemical data quality; performs QA evaluations of data.
David Baumeister Project Manager OnSite Environmental Inc. (425)883-3881	Works with Data QA Manager and Project Manager to ensure that all laboratory QA objectives are met and data package QA/QC deliverables from the laboratory are correctly documented and reported.

The Field Sampler will be responsible for the initial coordination of sampling and analysis activities with the selected analytical laboratory. The Project Chemist may review laboratory procedures to establish that protocols for chemical analysis, quality assurance/quality control (QA/QC), and reporting are acceptable. He will also act as the primary point of contact with the laboratory for any analysis or QA/QC issues arising during project completion.

The Field Sampler will be responsible for coordinating daily sampling and analysis activities with the project laboratory and for notifying the laboratory of sample delivery, assuring samples are packaged properly for transportation, and delivering samples to the laboratory.

The Data QA Manager will assess data quality by conducting data review/verification, and validation, as needed.

2.2 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) were developed according to U.S. Environmental Protection Agency's (EPA's) DQOs Process (EPA 2000). The DQO process is a seven-step planning approach to develop sampling designs for data collection activities that support decision-making. It provides a systematic procedure for defining the criteria that a data collection design should satisfy. The DQOs for the project are shown in Table 2-2.

Table 2-2. Design Characterization Sampling DQOs

DQO	Description
State the Problem	What is the nature and extent of soil and groundwater contamination at the site?
Identify the Decisions	Is the collected chemical data adequate to identify and delineate the extent of the contamination?
Identify the Inputs to the Decisions	Analytical results (What are the detected concentrations? Are they above cleanup levels? Was QA/QC criteria met?). Actual sample locations (correct location and depth?).
Define the Study Boundaries	The study area will be limited to the Solid Wood, Inc. (West Bay Park) property.
Develop a Decision Rule	Results will be compared to the cleanup levels established for the site. Determination of whether the collected data is adequate will be generally be based on overall investigation results and professional judgment.
If/Then Statement	If the extent of contamination cannot be adequately evaluated, then additional sampling may be required.
Specify Tolerable Limits on Decision Errors	The extent of contamination will be determined based on the sampling results and established cleanup levels. Tolerable limits of uncertainty regarding the sampling results will be developed by stakeholders based on professional judgment.
Optimize the Design	Sampling strategies may be adjusted in the field based on visual observations made during characterization activities. This may include collection of additional samples, moving planned sampling locations, and adding analyses to better characterize the site. Second phase sampling events may be employed if, based on first phase sampling results, contaminant delineation is insufficient for the purposes of selecting an appropriate final action.

2.3 DATA QUALITY INDICATORS

Data quality and usability are evaluated in terms of performance criteria. Performance and acceptance criteria are expressed in terms of data quality indicators (DQIs). The principal indicators of data quality are precision, accuracy, bias, sensitivity, completeness, comparability, and representativeness. Table 2-3 provides a description of project DQIs.

Table 2-3. General Description of DQIs

DQI	Description
Precision:	A measure of agreement among repeated measurements of the same property under identical conditions. Usually assessed as a relative percent difference (RPD between duplicate measurements. RPD guidelines for laboratory duplicate analyses are contained in the standard operating procedures (SOPs) for each analytical method and will be obtained from the laboratory for validation purposes.
Accuracy:	A measure of the overall agreement of a measurement to a known value. Analytical accuracy is assessed as percent recovery from matrix spike or reference material measurements. Percent recovery guidelines are contained in laboratory SOPs for each analytical method.
Bias:	The systematic or persistent distortion of a measurement process that causes error in one direction. Usually assessed with reference material or matrix spike measurements. Bias as reported by the laboratory will be used to assess data validity.
Sensitivity:	The capability of a method or instrument to meet prescribed reporting limits. Assessed by comparison with risk-based reporting limits, method reporting limits, instrument reporting limits, or laboratory quantitation limits, as appropriate. In general, reporting limits for the analytical methods used will be at or below cleanup levels.
Completeness:	A measurement of the amount of valid data needed to be obtained for a task. Assessed by comparing the amount of valid results to the total results set. Project requirements for completeness are 90%.
Comparability:	A qualitative term that expresses the measure of confidence that one data set can be compared to another. Assessed by comparing sample collection and handling methods, sample preparation and analytical procedures, holding times, reporting units, and other QA protocols. To ensure comparability of data collected for the site, standard collection and measurement techniques will be used.
Representativeness:	A qualitative term that expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variation at a sample point, or environmental condition. To ensure representativeness, the sampling design will incorporate sufficient samples so that contamination is detected, if present. Additionally, all sampling procedures detailed in this work plan will be followed.

2.4 SPECIAL TRAINING AND CERTIFICATION

All personnel conducting sampling activities on the project site must be 40-hour hazardous waste operations and emergency response (HAZWOPER) trained per 29CFR 1910.120 and be current with their annual 8-hour refresher course.

All personnel working at the project site will be briefed on potential site hazards, health and safety procedures, and sampling procedures. Following completion of this training, all personnel will be required to sign an acknowledgement form verifying that they have completed the task-specific training.

2.5 SAMPLING DOCUMENTATION AND RECORDS

The sampling records provided in Table 2-4 will be maintained for the project.

Table 2-4. Sampling and Sample Handling Records

Record	Use	Responsibility/Requirements
Field Notebook	Record significant events and observations.	Maintained by field sampler/geologist; must be bound; all entries must be factual, detailed, objective; entries must be signed and dated.
Sampling Field Data Sheet	Provide a record of each sample collected (Appendix B).	Completed, dated, and signed by sampler; maintained in project file.
Sample Label	Accompanies sample; contains specific sample identification information.	Completed and attached to sample container by sampler.
Chain-of-Custody Form	Documents chain-of-custody for sample handling (Appendix B).	Documented by sample number. Original accompanies sample.
Chain-of-Custody Seal	Seals sample shipment container (e.g., cooler) to prevent tampering or sample transference.	Completed, signed, and applied by sampler at time samples are transported.
Sampling and Analysis Request	Provides a record of each sample number, date of collection/transport, sample matrix, analytical parameters for which samples are to be analyzed.	Completed by sampler at time of sampling/transport; copies distributed to laboratory project file.

2.5.1 Field Notebook and Field Data Sheets

A bound field notebook and/or field data sheets will be maintained to provide daily records of significant events and observations that occur during field investigations. All entries are to be made in waterproof ink, signed, and dated. Pages of the field notebook are not to be removed, destroyed, or thrown away. Corrections will be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside. The correction will be initialed and dated. Most corrected errors will require a footnote explaining the correction.

If an error made on a document is assigned to one person, that individual may make corrections simply by crossing out the error and entering the correct information. The erroneous information should not be obliterated. Any error discovered on a document should be corrected by the person who made the entry.

All field logs and forms will be retained in the project files.

2.5.2 Photographs

All photographs taken of field activities will be documented with the following information noted in the field notebook:

- Date, time, and location of photograph taken

- Description of photograph taken
- Reasons photograph was taken
- Viewing direction

Digital photographs will be reviewed in the field to assess quality and need to re-shoot the photograph. For non-digital photographs, the photographer will review the photographs or slides when they return from developing, and compare them to the log, to assure that the log and the photographs match.

2.6 REPORTING

2.6.1 RI/FS Report

Parametrix will provide a report at the completion of the RI/FS containing:

- A summary of field activities completed.
- Figures showing surveyed sampling locations.
- A description and discussion of the nature and extent of contamination found. Figures diagramming contamination extent will be included.
- A summary of laboratory analytical results and a comparison to screening levels.
- All boring logs and sampling forms.
- Laboratory data sheets and the results of data review/validation.
- An electronic laboratory data submittal consistent with the requirements of Ecology's Environmental Information Monitoring (EIM) system.
- The results of the feasibility study including the cleanup alternatives evaluated, the evaluation results and a description of the preferred remedy selected.

2.6.2 IA Memorandum

At the completion of the IA activities involving soil excavation and soil cap installation, an IA memorandum will be provided containing:

- A summary of field activities completed.
- Figures showing the extent of soil excavations as completed, locations of confirmation samples collected, monitoring wells locations, and the outline of the as-constructed soil cap.
- •Analytical results for the soil confirmation samples collected and a comparison to remedial levels.
- The results of beach sediment and piling sediment samples collected as part of the RI.
- All field sampling forms.
- Laboratory data sheets and the results of data review/validation.
- An electronic laboratory data submittal consistent with the requirements of Ecology's EIM system.

2.6.3 Groundwater Monitoring Reporting

At the completion of each of the first three groundwater monitoring events, a groundwater monitoring report will be provided. The fourth groundwater monitoring event will be reported in the RI/FS Report. All groundwater reporting will include:

- A summary of field activities completed.
- Figures showing the monitoring wells locations and the extent of any contaminated groundwater plume.
- Analytical results for the groundwater monitoring samples collected and a comparison to screening levels.
- All boring logs and sampling forms.
- Laboratory data sheets and the results of data review/validation.
- An electronic laboratory data submittal consistent with the requirements of Ecology's EIM system (Portable Document Format – PDF).

2.6.4 Draft Cleanup Action Plan

Parametrix will provide a Draft Cleanup Action Plan (CAP) at the completion of the RI/FS containing:

- A description and discussion of the nature and extent of contamination found during the RI/FS.
- A description of the proposed cleanup action and a summary of the rationale used for selecting the proposed alternative.
- A brief summary of the other cleanup alternatives evaluated.
- Cleanup standards and, where appropriate, remediation levels.
- A schedule for implementation of the cleanup action.
- A description of the required institutional controls, the types and concentration of contaminants left on site, and measures that will be used to prevent contact with these substances.

All draft and final deliverables will be submitted to Ecology as five hard copies and one electronic copy (portable document format [PDF]). All laboratory data will be provided in an electronic submittal consistent with the requirements of Ecology's EIM system.

3. RI/FS ACTIVITIES

3.1 REMEDIAL INVESTIGATION ACTIVITIES PERFORMED TO DATE

3.1.1 Push-Probe and Surface Soil Sampling

Preliminary RI/FS soil and groundwater sampling was conducted in December 2007 to investigate the nature and extent of contamination within or near the Phase I Park boundary. During the 2007 Phase II Environmental Site Assessment (ESA), subsurface soil and/or groundwater contaminated with lube-oil range hydrocarbons above MTCA Method A cleanup levels was detected in push probes SB-03, SB-04, SB-05, and SB-07 (see figures 3 through 5 for the Phase II ESA sampling locations). In addition, carcinogenic polycyclic aromatic hydrocarbons (cPAHs) concentrations above MTCA Method A cleanup levels were detected in surface soil samples SS-03, SS-05, and SS-06 (Parametrix 2007). Phase II ESA sample results are presented in Tables 5-1 through 5-4 in Appendix C. These tables are reproduced from the Phase II ESA Report.

To investigate the areas of subsurface contamination found during the Phase II ESA, RI/FS soil and groundwater samples were collected from fourteen push-probes (SB-8 through SB-21) installed near SB-03, SB-05, and SB-07. In addition, five surface soil samples (SS-12 through SS-16), were collected to further assess surface soil along the rail spur for the presence of contaminants. All samples collected were analyzed for diesel, lube oil, and polycyclic aromatic hydrocarbons (PAHs). An exception is the groundwater samples from the probes located near SB-03. These samples were also analyzed for dissolved lead, as lead was observed in the groundwater sample from SB-03 at a level exceeded the MTCA A cleanup level. Summaries of the analytical results are provided in Tables 3-1 and 3-2. Push-probe field logs are included in Appendix D.

Based on the sampling results, the primary contaminant sources in these areas appear to consist of Bunker C fuel and lube-oil range hydrocarbons. Bunker C was specifically identified by the laboratory as present in the soil sample from SB-13. Both Bunker C and lube-oil range hydrocarbons contain cPAHs. There was likely a major spill of these materials near the former rail loading dock (Figure 5). Bunker C or other similar fuel oil may have been used historically for kiln drying or other similar activities. In addition to the oil sources, creosote rail ties are the likely source of near-surface cPAHs along the former rail spur.

The estimated footprints of soil contamination around SB-05 and SB-07 are shown on Figure 7 and are designated Area A and Area B, respectively. Both the vertical and the horizontal extent of contamination at Area B appear to be limited. For planning purposes, the soil within the contaminated footprint is assumed to be contaminated above cleanup levels from the ground surface to a depth of 3 feet below ground surface (bgs).

Contamination near SB-5 and the former loading dock is more extensive (Area A). Note that the sample from SB-13 contained 140,000 milligrams per kilogram (mg/kg) Bunker C (14 percent). For planning purposes, contaminated soil above cleanup levels is assumed to be present, on average, between the depths of 4 feet and 8 feet bgs within the footprint. This zone corresponds to where the majority of contaminated soil was observed in the push probes and is representative of the likely “smear zone” that occurs as a result of floating groundwater contamination movement with tidal fluctuations. Note that in the area of SB-5, contaminated soils may extend to 10 feet bgs.

Depth to groundwater at the site was observed to range from approximately 4 feet to 9 feet bgs during the most recent two sampling events. Due to the site's proximity to the shoreline, groundwater table elevations are likely tidally influenced.

One of the surface soil samples contained carcinogenic polycyclic aromatic hydrocarbons (cPAHs) at a concentration just above the cleanup level (SS-12). Based on the RI and Phase II ESA sampling results, it is likely that low-level cPAHs are present in surface soil adjacent to the rail ties along the entire length of the rail spur (Area C).

Groundwater samples collected near SB-07 did not contain contaminants at concentrations above cleanup levels. Groundwater in this area does not appear to be impacted. The majority of the groundwater samples collected near SB-05 did contain contamination exceeding the cleanup levels. The boundaries of the groundwater plume roughly coincide with the contaminated soil boundary shown as Area A in Figure 7, with the exception of the downgradient edge, which appears to extend beyond the most downgradient sampling location (SB-19).

3.1.2 Sediment Sampling

A total of five sediment samples were collected from the beach near the former wood burner at the locations shown on Figure 5 (SD07 through SD11). The samples were collected on February 12, 2008. Sample locations were recorded using a hand-held global positioning system (GPS) device. The recorded positions were used to map the sampling locations shown. The purpose of the samples was to further assess potential impacts from wood burning activities. All sediment samples were analyzed for Sediment Management Standards (SMS) parameters and total organic carbon (TOC). Sample results are provided in Table 3-3. As shown in the table, no SMS criteria were exceeded. In addition, sediment sample results are compared to the Puget Sound Apparent Effects Threshold (AET) concentrations in Table 3-4. As shown, no AET concentrations were exceeded.

During the December 2007 Phase II ESA, beach sediment samples (SD-01 through SD-06) were collected and analyzed for dioxins and total organic carbon. Total 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD) equivalent concentrations were calculated and are provided in Table 5-4 in Appendix C. It should be noted that Table 5-4 has been revised from the original version to reflect the recalculation of the total TCDD equivalent concentrations using one-half the reporting limit for non-detected concentrations.

3.1.3 Burner Area Test Pit Sampling

Test Pit TP-10 was excavated on February 19, 2008 at the location of the former wood burner to investigate for contaminated ash and soil resulting from burning activities (Figure 5). The test pit was excavated to a depth of seven feet bgs. The soil profile within the pit was observed to consist of two feet of soil underlain by a 3-foot-thick ash layer overlying soil mixed with fine wood and bark debris. A field test pit log is provided in Appendix D.

Three samples were collected from the test pit and analyzed for PAHs, Priority Pollutant (PP) metals and dioxins/furans. Sample results are provided in Table 3-5. As shown, MTCA cleanup levels were exceeded for lead and dioxins in samples from 1.5 feet and 2 feet bgs. Screening levels consisting of Washington SMS chemical criteria and soil background levels (Ecology 1994) were exceeded for copper, nickel, and zinc.

Following receipt of the TP-10 results, additional test pits (TP-11 through TP-14; Figure 5) were excavated on March 24, 2008 to delineate the extent of contamination. Results for the samples collected from the test pits are provided in Table 3-6. Dioxin concentrations did not exceed the screening level. The MTCA Method A cleanup level for lead was exceeded in one sample. Screening concentrations were exceeded for nickel in one sample. The approximate horizontal extent of contamination was estimated based on the sample data and visual observations and is presented as Interim Action Area D on Figure 7.

Table 3-1. Preliminary RI/FS Soil Sample Results Summary

		Push Probe No.	**SB-8**	**SB-9**	**SB-10**	**SB-11**	**SB-12**	**SB-13**
		Sample Depth (ft):	**2**	**2**	**2**	**2**	**3.5**	**6**
		Groundwater Depth (ft):	**6.5**	**4**	**4**	**6**	**4**	**4.5**
PARAMETERS	**Units**	**Date Sampled:**	**12/3/2007**	**12/3/2007**	**12/3/2007**	**12/7/2007**	**12/7/2007**	**12/7/2007**
		MTCA A						
TOTAL PETROLEUM HYDROCARBONS								
Diesel	mg/kg	2000	29.0 U	29.0 U	28 U	30.0 U	28.0 U	1600.0 U
Motor Oil	mg/kg	2000	93	57 U	55 U	70.0	210.0	140000.0
CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBONS								
Benzo(a)anthracene	mg/kg	-	0.0095	0.0077 U	0.0073 U	0.0079 U	0.0074 U	2.4
Chrysene	mg/kg	-	0.048	0.0077 U	0.0073 U	0.0079 U	0.0089	6.1
Benzo(b)fluoranthene	mg/kg	-	0.027	0.0077 U	0.0073 U	0.0079 U	0.0074 U	0.66
Benzo(k)fluoranthene	mg/kg	-	0.0078 U	0.0077 U	0.0073 U	0.0079 U	0.0074 U	0.28
Benzo(a)pyrene	mg/kg	0.1	0.0078 U	0.0077 U	0.0073 U	0.0079 U	0.0074 U	1.6
Indeno(1,2,3-cd)pyrene	mg/kg	-	0.0078 U	0.0077 U	0.0073 U	0.0079 U	0.0074 U	0.32
Dibenzo(a,h)anthracene	mg/kg	-	0.0078 U	0.0077 U	0.0073 U	0.0079 U	0.0074 U	0.18
Total cPAHs as Benzo(a)pyrene*	mg/kg	0.1	0.0092	0.0059	0.0056	0.006	0.0056	2.05

(Table Continues)

Table 3-1. Preliminary RI/FS Soil Sample Results Summary (Continued)

		Push Probe No.	SB-14	SB-15	SB-16	SB-17	SB-18	SB-19
		Sample Depth (ft):	5.5	6	5.5	6.5	6.5	6.5
		Groundwater Depth (ft):	3.5	3	3.5	4	6.5	6.5
Parameters	**Units**	**Date Sampled:**	**12/7/2007**	**12/7/2007**	**12/7/2007**	**12/7/2007**	**12/7/2007**	**12/7/2007**
		MTCA A						
TOTAL PETROLEUM HYDROCARBONS								
Diesel	mg/kg	2000	150.0 U	280.0 U	31 U	35.0 U	39.0 U	28.0 U
Motor Oil	mg/kg	2000	4600	13000	470 U	1600.0	110.0	55.0
CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBONS								
Benzo(a)anthracene	mg/kg	-	0.092	0.26	0.0082 U	0.027	0.019	0.0073 U
Chrysene	mg/kg	-	0.25	0.69	0.022	0.074	0.034	0.0073 U
Benzo(b)fluoranthene	mg/kg	-	0.075	0.068	0.0082 U	0.017	0.025	0.0073 U
Benzo(k)fluoranthene	mg/kg	-	0.053	0.036	0.0082 U	0.01	0.018	0.0073 U
Benzo(a)pyrene	mg/kg	0.1	0.068	0.22	0.0082 U	0.016	0.02	0.0073 U
Indeno(1,2,3-cd)pyrene	mg/kg	-	0.05	0.034	0.0082 U	0.0094 U	0.018	0.0073 U
Dibenzo(a,h)anthracene	mg/kg	-	0.014	0.017	0.0082 U	0.0094 U	0.01 U	0.0073 U
Total cPAHs as Benzo(a)pyrene*	mg/kg	0.1	0.010	0.27	0.0064	0.023	0.029	0.0056

(Table Continues)

Table 3-1. Preliminary RI/FS Soil Sample Results Summary (Continued)

		Push Probe No.	**SB-20**	**SB-21**	**SS-12**	**SS-13**	**SS-14**	**SS-15**
		Sample Depth (ft):	**5.5**	**6.5**	**0.5**	**0.5**	**0.5**	**0.5**
		Groundwater Depth (ft):	**4**	**3.5**	**-**	**-**	**-**	**-**
Parameters	**Units**	**Date Sampled:**	**12/7/2007**	**12/7/2007**	**12/7/2007**	**12/7/2007**	**12/7/2007**	**12/7/2007**
		MTCA A						
TOTAL PETROLEUM HYDROCARBONS								
Diesel	mg/kg	2000	28.0 U	560.0[a]	35 U	50.0 U	34.0 U	68.0 U
Motor Oil	mg/kg	2000	230	2800	69 U	100.0 U	68.0 U	1600.0
CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBONS								
Benzo(a)anthracene	mg/kg	-	0.0075 U	0.022	0.063	0.013 U	0.014	0.018 U
Chrysene	mg/kg	-	0.0079	0.13	0.13	0.024	0.021	0.041
Benzo(b)fluoranthene	mg/kg	-	0.0075 U	0.027	0.15	0.027	0.017	0.052
Benzo(k)fluoranthene	mg/kg	-	0.0075 U	0.0097	0.096	0.015	0.012	0.021
Benzo(a)pyrene	mg/kg	0.1	0.0075 U	0.018	0.084	0.014	0.011	0.018 U
Indeno(1,2,3-cd)pyrene	mg/kg	-	0.0075 U	0.0088 U	0.078	0.016	0.0091 U	0.021
Dibenzo(a,h)anthracene	mg/kg	-	0.0075 U	0.0088 U	0.027	0.013 U	0.0091 U	0.018 U
Total cPAHs as Benzo(a)pyrene*	mg/kg	0.1	0.0058	0.026	0.127	0.033	0.016	0.021

(Table Continues)

Table 3-1. Preliminary RI/FS Soil Sample Results Summary (Continued)

		Push Probe No.	SS-16	
		Sample Depth (ft):	0.5	
		Groundwater Depth (ft):	-	
PARAMETERS	Units	Date Sampled:	12/3/2007	
		MTCA A		
TOTAL PETROLEUM HYDROCARBONS				
Diesel	mg/kg	2000	36.0	U
Motor Oil	mg/kg	2000	420	
CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBONS				
Benzo(a)anthracene	mg/kg	-	0.019	
Chrysene	mg/kg	-	0.088	
Benzo(b)fluoranthene	mg/kg	-	0.1	
Benzo(k)fluoranthene	mg/kg	-	0.034	
Benzo(a)pyrene	mg/kg	0.1	0.018	
Indeno(1,2,3-cd)pyrene	mg/kg	-	0.033	
Dibenzo(a,h)anthracene	mg/kg	-	0.011	
Total cPAHs as Benzo(a)pyrene*	mg/kg	0.1	0.039	

Notes:

cPAHs = Carcinogenic polycyclic aromatic hydrocarbons.

mg/kg = milligrams per kilogram

MTCA = Model Toxics Control Act.

U = Analyte not detected above given method detection limit.

▨ Shaded Cells Exceeds MTCA cleanup levels.

[a]= Exceeds Priority Contaminant of Ecological Concern concentration for unrestricted land use (MTCA Table 749-2).

*= Total of Individual cPAHs multiplied by benzo(a)pyrene toxicity equivalency factor – ½ the reporting limit was used for non-detected concentrations.

- = Not available/not analyzed.

Table 3-2. Preliminary RI/FS Groundwater Sample Results Summary

		Push Probe No.	**SB-8**	**SB-9**	**SB-10**	**SB-11**	**SB-12**	**SB-13**
		Sample Depth (ft):	**6.5**	**4**	**4**	**6**	**4**	**6**
		Groundwater Depth (ft):	**6.5**	**4**	**4**	**6**	**4**	**4.5**
PARAMETERS	**Units**	**Date Sampled:**	**12/3/2007**	**12/3/2007**	**12/3/2007**	**12/7/2007**	**12/7/2007**	**12/7/2007**
		MTCA A						
TOTAL PETROLEUM HYDROCARBONS								
Diesel	mg/L	0.5	0.25 U	0.25 U	0.26 U	0.17 U	0.28 U	0.26 U
Motor Oil	mg/L	0.5	0.25 U	0.25 U	0.25 U	0.25 U	0.64	11.0
CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBONS								
Benzo(a)anthracene	ug/L	-	0.017	0.0098	0.011	0.012 U	0.0096 U	0.28
Chrysene	ug/L	-	0.03	0.016	0.021	0.012 U	0.0096 U	0.81
Benzo(b)fluoranthene	ug/L	-	0.019	0.0098 U	0.012	0.012 U	0.0096 U	0.16
Benzo(k)fluoranthene	ug/L	-	0.0098 U	0.0098 U	0.0095 U	0.012 U	0.0096 U	0.025
Benzo(a)pyrene	ug/L	0.1	0.0098 U	0.0098 U	0.0095 U	0.012 U	0.0096 U	0.2
Indeno(1,2,3-cd)pyrene	ug/L	-	0.0099	0.0098 U	0.0095 U	0.012 U	0.0096 U	0.036
Dibenzo(a,h)anthracene	ug/L	-	0.0098 U	0.0098 U	0.0095 U	0.012 U	0.0096 U	0.035
Total cPAHs as Benzo(a)pyrene*	ug/L	0.1	0.0108	0.008	0.0088	0.0091	0.0072	0.26
METALS								
Dissolved Lead	ug/L	15	-	-	-	-	1.0 U	1.0 U

(Table Continues)

Table 3-2. Preliminary RI/FS Groundwater Sample Results Summary (Continued)

		Push Probe No.	**SB-14**	**SB-15**	**SB-16**	**SB-17**	**SB-18**	**SB-19**
		Sample Depth (ft):	**3.5**	**3**	**3.5**	**4**	**6.5**	**6.5**
		Groundwater Depth (ft):	**3.5**	**3**	**3.5**	**4**	**6.5**	**6.5**
PARAMETERS	**Units**	**Date Sampled:**	**12/7/2007**	**12/7/2007**	**12/7/2007**	**12/7/2007**	**12/7/2007**	**12/7/2007**
		MTCA A						
TOTAL PETROLEUM HYDROCARBONS								
Diesel	mg/L	0.5	0.27 U	0.26 U	0.25 U	0.25 U	0.25 U	0.25 U
Motor Oil	mg/L	0.5	0.48	0.91	0.25 U	0.63	0.25 U	0.68
CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBONS								
Benzo(a)anthracene	ug/L	-	0.0097 U	0.029	0.0095 U	0.0095 U	0.011 U	0.011
Chrysene	ug/L	-	0.011	0.064	0.01	0.0095 U	0.015	0.037
Benzo(b)fluoranthene	ug/L	-	0.0097 U	0.047	0.01	0.0095 U	0.011 U	0.018
Benzo(k)fluoranthene	ug/L	-	0.0097 U	0.012	0.0095 U	0.0095 U	0.011 U	0.011
Benzo(a)pyrene	ug/L	0.1	0.0097 U	0.032	0.0095 U	0.0095 U	0.011 U	0.011
Indeno(1,2,3-cd)pyrene	ug/L	-	0.0097 U	0.022	0.0095 U	0.0095 U	0.011 U	0.011
Dibenzo(a,h)anthracene	ug/L	-	0.0097 U	0.01 U	0.0095 U	0.0095 U	0.011 U	0.011
Total cPAHs as Benzo(a)pyrene*	ug/L	0.1	0.0075	0.044	0.0078	0.0072	0.0084	0.0099
METALS								
Dissolved Lead	ug/L	15	1.0 U	1.1	1.0 U	1.0 U	1.0 U	1.0 U

(Table Continues)

Table 3-2. Preliminary RI/FS Groundwater Sample Results Summary (Continued)

		Push Probe No.	**SB-20**	**SB-21**
		Sample Depth (ft):	**4**	**3.5**
		Groundwater Depth (ft):	**4**	**3.5**
PARAMETERS	**Units**	**Date Sampled:**	**12/7/2007**	**12/7/2007**
		MTCA A		
TOTAL PETROLEUM HYDROCARBONS				
Diesel	mg/L	0.5	0.25 U	2.2
Motor Oil	mg/L	0.5	0.25 U	8.4
CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBONS				
Benzo(a)anthracene	ug/L	-	0.013	0.017
Chrysene	ug/L	-	0.017	0.14
Benzo(b)fluoranthene	ug/L	-	0.015	0.072
Benzo(k)fluoranthene	ug/L	-	0.0095 U	0.0095 U
Benzo(a)pyrene	ug/L	0.1	0.0095 U	0.0095 U
Indeno(1,2,3-cd)pyrene	ug/L	-	0.0095 U	0.0095 U
Dibenzo(a,h)anthracene	ug/L	-	0.0095 U	0.0095 U
Total cPAHs as Benzo(a)pyrene*	ug/L	0.1	0.0092	0.0165
METALS				
Dissolved Lead	ug/L	15	1.0 U	1.0 U

Notes:

cPAHs = Carcinogenic polycyclic aromatic hydrocarbons.

(µg/L) = micrograms per liter

MTCA = Model Toxics Control Act.

U = Analyte not detected above given method detection limit.

Shaded Cells Exceeds MTCA cleanup levels.

- = Not available/not analyzed.

*= Total of Individual cPAHs multiplied by benzo(a)pyrene toxicity equivalency factor – ½ the reporting limit was used for non-detected concentrations.

Table 3-3. Sediment Sample SMS Results

			Sample No.	SD-07	SD-08	SD-09	SD-10	SD-10 Dup.	SD-11
			Sample Depth (cm)	0-10	0-10	0-10	0-10	0-10	0-10
Analyte			Date Sampled	2/12/08	2/12/08	2/12/08	2/12/08	2/12/08	2/12/08
	SQS	**CSL**	**UNITS**						
Moisture Content			%	57	47	53	55	54	64
Total Organic Carbon			%	5.18	2.95	4.52	4.63	4.91	4.79
Metals									
Arsenic	57	93	mg/kg dw	23 U	19 U	21 U	22 U	22 U	28 U
Cadmium	5.1	6.7	mg/kg dw	1.2 U	0.94 U	1.1 U	1.1 U	1.1 U	1.4 U
Chromium	260	270	mg/kg dw	27	19	19	20	21	26
Copper	390	390	mg/kg dw	43	27	37	40	40	53
Lead	450	530	mg/kg dw	12	9.4 U	12	14	14	17
Mercury	0.41	0.59	mg/kg dw	0.29 U	0.24 U	0.27 U	0.28 U	0.27 U	0.35 U
Silver	6.1	6.1	mg/kg dw	1.2 U	0.94 U	1.1 U	1.1 U	1.1 U	1.4 U
Zinc	410	960	mg/kg dw	63	44	55	63	59	83
Semivolatiles									
Total LPAHs	370	780	mg/kg oc	0.309 U	0.508	2.058	0.518	1.487	1.148
Naphthalene	99	170	mg/kg oc	0.309 U	0.441 U	0.310 U	0.324 U	0.285 U	0.397 U
Acenaphthylene	66	66	mg/kg oc	0.309 U	0.441 U	0.310 U	0.324 U	0.285 U	0.397 U
Acenaphthene	16	57	mg/kg oc	0.309 U	0.441 U	0.310 U	0.324 U	0.285 U	0.397 U
Fluorene	23	79	mg/kg oc	0.309 U	0.441 U	0.310 U	0.324 U	0.285 U	0.397 U
Phenanthrene	100	480	mg/kg oc	0.309 U	0.508	1.615	0.518	1.141	1.148
Anthracene	220	1200	mg/kg oc	0.309 U	0.441 U	0.442	0.324 U	0.346	0.397 U
2-Methylnaphthalene	38	64	mg/kg oc	0.309 U	0.441 U	0.310 U	0.324 U	0.285 U	0.397 U
Total HPAHs	960	5300	mg/kg oc	3.784	5.186	12.920	5.616	10.204	7.411
Fluoranthene	160	1200	mg/kg oc	0.985	1.220	3.097	1.253	2.240	1.900
Pyrene	1000	1400	mg/kg oc	0.849	1.153	3.097	1.274	2.444	2.067
Benzo(a)anthracene	110	270	mg/kg oc	0.463	0.712	1.327	0.734	1.100	0.689
Chrysene	110	460	mg/kg oc	0.579	0.712	1.549	0.778	1.120	0.939
Benzo(b)fluoranthene	-	-	mg/kg oc	0.541	0.847	1.327	0.691	1.079	0.835
Benzo(k)fluoranthene	-	-	mg/kg oc	0.309 U	0.441 U	0.420	0.324 U	0.407	0.397 U
Total Benzofluoranthenes	230	450	mg/kg oc	0.541	0.847	1.748	0.691	1.487	0.835
Benzo(a)pyrene	99	210	mg/kg oc	0.367	0.542	0.973	0.562	0.835	0.585
Indeno(1,2,3-cd)pyrene	34	88	mg/kg oc	0.309 U	0.441 U	0.553	0.324 U	0.468	0.397 U
Dibenz(a,h)anthracene	12	33	mg/kg oc	0.309 U	0.441 U	0.310 U	0.324 U	0.285 U	0.397 U
Benzo(g,h,i)perylene	31	78	mg/kg oc	0.309 U	0.441 U	0.575	0.324	0.509	0.397
1,2-Dichlorobenzene	2.3	2.3	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U
1,4-Dichlorobenzene	3.1	9	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U
1,2,4-Trichlorobenzene	0.81	1.8	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U
Hexachlorobenzene	0.38	2.3	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U
Dimethylphthalate	53	53	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U
Diethylphthalate	61	110	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U
Di-n-butylphthalate	220	1700	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U
Butylbenzylphthalate	4.9	64	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U
Bis(2-ethylhexyl)phthalate	47	78	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U
Di-n-octylphthalate	58	4500	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U
Dibenzofuran	15	58	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U
Hexachlorobutadiene	3.9	6.2	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U
N-Nitrosodiphenylamine	11	11	mg/kg oc	1.506 U	2.136 U	1.571 U	1.598 U	1.466 U	1.942 U

(Table Continues)

Table 3-3. Sediment Sample SMS Results (Continued)

Analyte			Sample No.	SD-07	SD-08	SD-09	SD-10	SD-10 Dup.	SD-11
			Sample Depth (cm)	0-10	0-10	0-10	0-10	0-10	0-10
			Date Sampled	2/12/08	2/12/08	2/12/08	2/12/08	2/12/08	2/12/08
	SQS	**CSL**	**UNITS**						
Moisture Content			%	57	47	53	55	54	64
Total Organic Carbon			%	5.18	2.95	4.52	4.63	4.91	4.79
PCBs									
Aroclor 1016	-	-	mg/kg oc	2.317 U	3.186 U	2.434 U	2.376 U	2.240 U	2.923 U
Aroclor 1221	-	-	mg/kg oc	2.317 U	3.186 U	2.434 U	2.376 U	2.240 U	2.923 U
Aroclor 1232	-	-	mg/kg oc	2.317 U	3.186 U	2.434 U	2.376 U	2.240 U	2.923 U
Aroclor 1242	-	-	mg/kg oc	2.317 U	3.186 U	2.434 U	2.376 U	2.240 U	2.923 U
Aroclor 1248	-	-	mg/kg oc	2.317 U	3.186 U	2.434 U	2.376 U	2.240 U	2.923 U
Aroclor 1254	-	-	mg/kg oc	2.317 U	3.186 U	2.434 U	2.376 U	2.240 U	2.923 U
Aroclor 1260	-	-	mg/kg oc	2.317 U	3.186 U	2.434 U	2.376 U	2.240 U	2.923 U
Aroclor 1262	-	-	mg/kg oc	2.317 U	3.186 U	2.434 U	2.376 U	2.240 U	2.923 U
Aroclor 1268	-	-	mg/kg oc	2.317 U	3.186 U	2.434 U	2.376 U	2.240 U	2.923 U
Total PCBs	12	65	mg/kg oc	2.317 U	3.186 U	2.434 U	2.376 U	2.240 U	2.923 U
Phenols									
Phenol	420	1200	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
2-Methylphenol	63	63	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
4-Methylphenol	670	670	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
2,4-Dimethylphenol	29	29	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
Pentachlorophenol	360	690	mg/kg dw	0.390 U	0.310 U	0.350 U	0.370 U	0.360 U	0.460 U
Benzyl Alcohol	57	73	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
Benzoic Acid	650	650	mg/kg dw	0.780 U	0.630 U	0.710 U	0.740 U	0.720 U	0.930 U

Notes:

CSL: Cleanup Screening Levels.
dw: Dry weight.
HPAHs: High molecular weight polycyclic aromatic hydrocarbons.
LPAHs: Low molecular weight polycyclic aromatic hydrocarbons.
mg/kg: Milligrams per kilogram.
oc: Organic carbon.
PCBs: Polychlorinated biphenyls.
SMS: Sediment Management Standards.
SQS: Sediment Quality Standards.
U: Analyte not detected above given practical quantitation limit.
-: Not available.

Table 3-4. Sediment Sample Results Compared to AET Values

Analyte	Dry Weight Analogs of SMS Criteria					SD-07	SD-08	SD-09	SD-10	SD-10 Dup.	SD-11
					Sample Depth (cm)	0-10	0-10	0-10	0-10	0-10	0-10
					Date Sampled	2/12/08	2/12/08	2/12/08	2/12/08	2/12/08	2/12/08
	SQS	**Source[a]**	**CSL**	**Source[a]**	**UNITS**						
Moisture Content					%	57	47	53	55	54	64
Total Organic Carbon					%	5.18	2.95	4.52	4.63	4.91	4.79
Metals											
Arsenic	57	LAET-B	93	2LAET-A	mg/kg dw	23 U	19 U	21 U	22 U	22 U	28 U
Cadmium	5.1	LAET-B	6.7	2LAET-A	mg/kg dw	1.2 U	0.94 U	1.1 U	1.1 U	1.1 U	1.4 U
Chromium	260	LAET-B	270	2LAET-A	mg/kg dw	27	19	19	20	21	26
Copper	390	LAET-O/M	390	2LAET-O/M	mg/kg dw	43	27	37	40	40	53
Lead	450	LAET-B	530	2LAET-M	mg/kg dw	12	9.4 U	12	14	14	17
Mercury	0.41	LAET-M	0.59	2LAET-O	mg/kg dw	0.29 U	0.24 U	0.27 U	0.28 U	0.27 U	0.35 U
Silver	6.1	LAET-A	6.1	LAET-A	mg/kg dw	1.2 U	0.94 U	1.1 U	1.1 U	1.1 U	1.4 U
Zinc	410	LAET-B	960	2LAET-A	mg/kg dw	63	44	55	63	59	83
Semivolatiles											
Total LPAHs	5200	LAET-O/M	5200	2LAET-O/M	mg/kg dw	0.016 U	0.015	0.093	0.024	0.073	0.055
Naphthalene	2100	LAET-O/M	2100	2LAET-O/M	mg/kg dw	0.016 U	0.013 U	0.014 U	0.015 U	0.014 U	0.019 U
Acenaphthylene	1300	LAET-A/B	1300	2LAET-A/B	mg/kg dw	0.016 U	0.013 U	0.014 U	0.015 U	0.014 U	0.019 U
Acenaphthene	500	LAET-O/M	500	2LAET-O/M	mg/kg dw	0.016 U	0.013 U	0.014 U	0.015 U	0.014 U	0.019 U
Fluorene	540	LAET-O/M	540	2LAET-O/M	mg/kg dw	0.016 U	0.013 U	0.014 U	0.015 U	0.014 U	0.019 U
Phenanthrene	1500	LAET-O/M	1500	2LAET-O/M	mg/kg dw	0.016 U	0.015	0.073	0.024	0.056	0.055
Anthracene	960	LAET-O/M	960	2LAET-O/M	mg/kg dw	0.016 U	0.013 U	0.020	0.015 U	0.017	0.019 U
2-Methylnaphthalene	670	LAET-O/M	670	2LAET-O/M	mg/kg dw	0.016 U	0.013 U	0.014 U	0.015 U	0.014 U	0.019 U
Total HPAHs	12000	LAET-M	17000	2LAET-O	mg/kg dw	0.196	0.153	0.584	0.260	0.501	0.355
Fluoranthene	1700	LAET-M	2500	2LAET-O	mg/kg dw	0.051	0.036	0.140	0.058	0.110	0.091
Pyrene	2600	LAET-M	3300	2LAET-O	mg/kg dw	0.044	0.034	0.140	0.059	0.120	0.099
Benzo(a)anthracene	1300	LAET-M	1600	2LAET-O	mg/kg dw	0.024	0.021	0.060	0.034	0.054	0.033
Chrysene	1400	LAET-M	2800	2LAET-O	mg/kg dw	0.030	0.021	0.070	0.036	0.055	0.045
Benzo(b)fluoranthene	-		-		mg/kg dw	0.028	0.025	0.060	0.032	0.053	0.040
Benzo(k)fluoranthene	-		-		mg/kg dw	0.016 U	0.013 U	0.019	0.015 U	0.020	0.019 U
Total Benzofluoranthenes	3200	LAET-M	3600	2LAET-O	mg/kg dw						

(Table Continues)

Table 3-4. Sediment Sample Results Compared to AET Values (Continued)

					Sample No.	SD-07	SD-08	SD-09	SD-10	SD-10 Dup.	SD-11
					Sample Depth (cm)	0-10	0-10	0-10	0-10	0-10	0-10
Analyte					Date Sampled	2/12/08	2/12/08	2/12/08	2/12/08	2/12/08	2/12/08
	Dry Weight Analogs of SMS Criteria										
	SQS	Source[a]	CSL	Source[a]	UNITS						
Moisture Content					%	57	47	53	55	54	64
Total Organic Carbon					%	5.18	2.95	4.52	4.63	4.91	4.79
Benzo(a)pyrene	1600	LAET-O/M	1600	2LAET-O/M	mg/kg dw	0.019	0.016	0.044	0.026	0.041	0.028
Indeno(1,2,3-cd)pyrene	600	LAET-M	690	2LAET-O	mg/kg dw	0.016 U	0.013 U	0.025	0.015 U	0.023	0.019 U
Dibenz(a,h)anthracene	230	LAET-O/M	230	2LAET-O/M	mg/kg dw	0.016 U	0.013 U	0.014 U	0.015 U	0.014 U	0.019 U
Benzo(g,h,i)perylene	670	LAET-M	720	2LAET-O/M	mg/kg dw	0.016 U	0.013 U	0.026	0.015	0.025	0.019
1,2-Dichlorobenzene	35	LAET-M	50	2LAET-O/B	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
1,4-Dichlorobenzene	110	LAET-O/M	110	2LAET-O/M	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
1,2,4-Trichlorobenzene	31	LAET-M	51	2LAET-A	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
Hexachlorobenzene	22	LAET-B	70	2LAET-M	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
Dimethylphthalate	71	LAET-M	160	2LAET-O	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
Diethylphthalate	200	LAET-B	1200	2LAET-A = HAET	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
Di-n-butylphthalate	1400	LAET-A/O/M	5100	HAET-B	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
Butylbenzylphthalate	63	LAET-M	900	2LAET-A/B = HAET	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
Bis(2-ethylhexyl)phthalate	1300	LAET-B	3100	HAET-A	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
Di-n-octylphthalate	6200	LAET-B	6200	LAET-B = HAET	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
Dibenzofuran	540	LAET-O/M	540	2LAET-O/M	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
Hexachlorobutadiene	11	LAET-B	120	2LAET-M	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
N-Nitrosodiphenylamine	28	LAET-B	40	2LAET-M	mg/kg dw	0.078 U	0.063 U	0.071 U	0.074 U	0.072 U	0.093 U
PCBs											
Aroclor 1016	-		-		mg/kg dw	0.120 U	0.094 U	0.110 U	0.110 U	0.110 U	0.140 U
Aroclor 1221	-		-		mg/kg dw	0.120 U	0.094 U	0.110 U	0.110 U	0.110 U	0.140 U
Aroclor 1232	-		-		mg/kg dw	0.120 U	0.094 U	0.110 U	0.110 U	0.110 U	0.140 U
Aroclor 1242	-		-		mg/kg dw	0.120 U	0.094 U	0.110 U	0.110 U	0.110 U	0.140 U
Aroclor 1248	-		-		mg/kg dw	0.120 U	0.094 U	0.110 U	0.110 U	0.110 U	0.140 U
Aroclor 1254	-		-		mg/kg dw	0.120 U	0.094 U	0.110 U	0.110 U	0.110 U	0.140 U
Aroclor 1260	-		-		mg/kg dw	0.120 U	0.094 U	0.110 U	0.110 U	0.110 U	0.140 U
Aroclor 1262	-		-		mg/kg dw	0.120 U	0.094 U	0.110 U	0.110 U	0.110 U	0.140 U
Aroclor 1268	-		-		mg/kg dw	0.120 U	0.094 U	0.110 U	0.110 U	0.110 U	0.140 U
Total PCBs	130	LAET-M	1000	2LAET-B	mg/kg dw	0.120 U	0.094 U	0.110 U	0.110 U	0.110 U	0.140 U

(Table Continues)

Table 3-4. Sediment Sample Results Compared to AET Values (Continued)

Analyte	SQS	Source[a]	CSL	Source[a]	UNITS	SD-07		SD-08		SD-09		SD-10		SD-10		SD-11	
Sample Depth (cm)						0-10		0-10		0-10		0-10		0-10		0-10	
Date Sampled						2/12/08		2/12/08		2/12/08		2/12/08		2/12/08		2/12/08	
Moisture Content					%	57		47		53		55		54		64	
Total Organic Carbon					%	5.18		2.95		4.52		4.63		4.91		4.79	
Phenols																	
Phenol	420	LAET-O	1200	2LAET-A/B/M	mg/kg dw	0.078	U	0.063	U	0.071	U	0.074	U	0.072	U	0.093	U
2-Methylphenol	63	LAET-A/B	63	2LAET-A/B	mg/kg dw	0.078	U	0.063	U	0.071	U	0.074	U	0.072	U	0.093	U
4-Methylphenol	670	LAET-O/M	670	2LAET-O/M	mg/kg dw	0.078	U	0.063	U	0.071	U	0.074	U	0.072	U	0.093	U
2,4-Dimethylphenol	29	LAET-O/M	29	2LAET-O/M	mg/kg dw	0.078	U	0.063	U	0.071	U	0.074	U	0.072	U	0.093	U
Pentachlorophenol	360	LAET-A	690	2LAET-B	mg/kg dw	0.390	U	0.310	U	0.350	U	0.370	U	0.360	U	0.460	U
Benzyl Alcohol	57	LAET-M	73	2LAET-O	mg/kg dw	0.078	U	0.063	U	0.071	U	0.074	U	0.072	U	0.093	U
Benzoic Acid	650	LAET-O/B/M	650	2LAET-O/B/M	mg/kg dw	0.780	U	0.630	U	0.710	U	0.740	U	0.720	U	0.930	U

SQS, Source, CSL, Source: Dry Weight Analogs of SMS Criteria

Notes:

AET: Puget Sound Apparent Effects Threshold.
CSL: Cleanup Screening Levels.
dw: Dry weight.
HPAHs: High molecular weight polycyclic aromatic hydrocarbons.
LPAHs: Low molecular weight polycyclic aromatic hydrocarbons.
mg/kg: Milligrams per kilogram.
PCBs: Polychlorinated biphenyls.
SMS: Sediment Management Standards.
SQS: Sediment Quality Standards.
U: Analyte not detected above given practical quantitation limit.
'-: Not available.

[a] = The source of the sediment quality criterion or value, from *1988 Update and Evaluation of Puget Sound AET, prepared for EPA by R. Barrick, S. Becker, L. Brown, H. Beller, and R. Pastorak, 1988* , unless otherwise noted.

The code represents the type of value (e.g., LAET) and the type of test organism that set the value
LAET = Lowest Apparent Effects Threshold
2LAET = Second Lowest Apparent Effects Threshold
3LAET = Third Lowest Apparent Effects Threshold
EQP = Equilibrium Parttioning
A = amphipod mortality
O = oyster larval abnormality
B = benthic abundance
M = microtox luminesence

Table 3-5. RI/FS Test Pit Results, February 2008 Samples

		Test Pit No.	TP-10	TP-10 (dup.)	TP-10	TP-10
		Sample Depth (ft):	**1.5**	**1.5**	**2**	**7**
Analyte		**Date Sampled:**	**2/19/08**	**2/19/08**	**2/19/08**	**2/19/08**
PP Metals	**Units**	**MTCA A**				
Antimony	mg/kg	-	76	95	170	18 U
Arsenic	mg/kg	20	18	19	24[4]	18 U
Beryllium	mg/kg	2**	0.86 U	0.91 U	1 U	1.8 U
Cadmium	mg/kg	2	0.86 U	0.91 U	1 U	1.8 U
Chromium	mg/kg	19/2000 CrVI/CrIII	200[4]	160[4]	88[4]	18
Copper	mg/kg	390*	350[4]	440[4]	620[4]	42
Lead	mg/kg	250	250[4]	300[4]	840[4]	24
Mercury	mg/kg	2	0.43 U	0.45 U	0.74	0.89 U
Nickel	mg/kg	38**	46	52	67	13
Selenium	mg/kg	-	17 U	18 U	21 U	36 U
Silver	mg/kg	-	2	1.9	2	1.8 U
Thallium	mg/kg	-	8.6 U	9.1 U	10 U	18 U
Zinc	mg/kg	410*	460[4]	490[4]	780[4]	51
cPAHs						
Benzo(a)anthracene	mg/kg	-	-	-	0.014 U	0.024
Chrysene	mg/kg	-	-	-	0.014 U	0.034
Benzo(b)fluoranthene	mg/kg	-	-	-	0.014 U	0.028
Benzo(k)fluoranthene	mg/kg	-	-	-	0.014 U	0.024 U
Benzo(a)pyrene	mg/kg	0.1	-	-	0.014 U	0.024 U
Indeno(1,2,3-cd)pyrene	mg/kg	-	-	-	0.014 U	0.024 U
Dibenzo(a,h)anthracene	mg/kg	-	-	-	0.014 U	0.024 U
Total cPAHs as Benzo(a)pyrene[1]	mg/kg	0.1	-	-	0.011	0.021
Dioxins/Furans						
Total TCDD-TEQ[2]	ng/kg	11[3]	-	-	18.44	2.73

Notes:

cPAHs = Carcinogenic polycyclic aromatic hydrocarbons.

MTCA = Model Toxics Control Act.

mk/kg = Milligrams per kilogram.

nk/kg = Nanograms per kilogram.

PP = Priority pollutant.

Shaded cells = Exceeds MTCA A cleanup levels.

TCDD = 2,3,7,8-Tetrachloro-dibenzo-p-dioxin.

TEQ = Toxicity Equivalency Concentration.

U = Analyte not detected above given reporting limit.

▨ = Exceeds MTCA A cleanup levels.

* = Screening concentration (Washington SMS Sediment Quality Standards criteria).

** = Screening concentration (Washington state-wide soil background concentration).

[1] = Total of individual cPAHs multiplied by benzo(a)pyrene toxicity equivalency factor. 1/2 the reporting limit was used for non-detected concentrations.

[2] = Total TCDD-TEQ calculated by multiplying the isomer concentration by the toxicicity equivalency factor and summing across all isomers. 1/2 the reporting limit was used for non-detected concentrations.

[3] = MTCA B cleanup level.

[4] = Exceeds Priority Contaminant of Ecological Concern concentration for unrestricted land use (MTCA Table 749-2).

\- = Not available/not analyzed.

Table 3-6. RI/FS Test Pit Results, March 2008 Samples

		Test Pit No.	TP-10	TP-12	TP-14	TP-14	TP-14
		Sample Depth (ft):	2.5	2.5	1.5	5.0	8.0
Analyte		**Date Sampled:**	3/24/08	3/24/08	3/24/08	3/24/08	3/24/08
PP Metals	**Units**	**MTCA A**					
Antimony	mg/kg	-	-	14 U	6.8 U	100	43
Arsenic	mg/kg	20	-	14 U	14 U	15 U	19 U
Beryllium	mg/kg	2*	-	1.4 U	0.68 U	0.77 U	1.9 U
Cadmium	mg/kg	2	-	1.4 U	0.68 U	0.77 U	1.9 U
Chromium	mg/kg	19/2000 CrVI/CrIII	32	23	16	29	17
Copper	mg/kg	390*	-	150[4]	40	120[4]	77
Lead	mg/kg	250	47	76	6.8 U	700[4]	180
Mercury	mg/kg	2	-	0.69 U	0.34 U	0.38 U	0.96 U
Nickel	mg/kg	38**	-	69	19	35	20
Selenium	mg/kg	-	-	28 U	14 U	15 U	38 U
Silver	mg/kg	-	-	1.4 U	0.68 U	1.2	1.9 U
Thallium	mg/kg	-	-	14 U	6.8 U	7.7 U	19 U
Zinc	mg/kg	410*	-	230	46	340[4]	240
TCLP Metals	**Units**	**WAC 173-303**					
Chromium	mg/L	5	0.02 U	-	-	-	-
Lead	mg/L	5	0.2 U	-	-	-	-
Dioxins/Furans							
Total TCDD-TEQ[1]	ng/kg	11[2]	-	3.4	-	-	2.24

Notes:

MTCA = Model Toxics Control Act.

WAC = Washington Administrative Code

mk/kg = Milligrams per kilogram.

nk/kg = Nanograms per kilogram.

PP = Priority pollutant.

TCDD = 2,3,7,8-Tetrachloro-dibenzo-p-dioxin.

TEQ = Toxicity Equivalency Concentration.

U = Analyte not detected above given reporting limit.

▨ = Exceeds MTCA A cleanup levels.

* = Screening concentration (Washington SMS Sediment Quality Standards criteria).

** = Screening concentration (Washington state-wide soil background concentration).

[1] = Total TCDD-TEQ calculated by multiplying the isomer concentration by the toxicicity equivalency factor and summing across all isomers.

[2] = MTCA B cleanup level.

[-] = Not available/not analyzed.

[4] = Exceeds Priority Contaminant of Ecological Concern concentration for unrestricted land use (MTCA Table 749-2).

3.2 RI/FS SAMPLING TO BE PERFORMED

RI/FS sampling to be performed will focus on four areas:

1. The area around SB-04 (Figure 4), where groundwater concentrations of petroleum and lead exceeding cleanup levels were detected during the December 2007 Phase II ESA sampling,
2. The former wood burner area, where low levels of metals in soils detected during the test pit sampling present a potential to impact nearby marine surface water,
3. Beach sediments in areas not fully characterized during previous sampling, and
4. Sediments adjacent to creosote piling that are to be removed as part of the Phase I park development.

Soil and groundwater samples results will be compared to the screening levels provided in Table 3-7. The screening levels shown consist of MTCA cleanup levels, Applicable or Relevant and Appropriate Requirements (ARARs) for surface water, Washington State background soil concentrations, and State and Federal maximum contaminant levels (MCLs). Sediment sample results will be compared to SMS criteria (Table 3-8).

3.2.1 Push-Probe Soil and Groundwater Sampling

3.2.1.1 SB-04 AREA

Up to eight push-probes will be installed in a cluster surrounding previous soil boring SB-04 to investigate the extent of contaminated soil and groundwater at this location. During the 2007 Phase II ESA, concentrations of lube oil and cPAHs exceeding cleanup levels were detected in the groundwater sample from SB-04. Proposed sampling locations are shown on Figure 4.

In general, a single soil sample will be collected from each of the eight push-probes for analysis. Up to five additional soil samples will be collected at the discretion of the field sampler. A single groundwater sample will be collected from each push-probe. Soil and groundwater samples will be submitted for laboratory analysis for diesel, lube oil, cPAHs, benzene, toluene, ethylbenzene, and xylenes (BTEX) and lead. Groundwater analyses for lead will consist of dissolved lead only.

In each push-probe, soil will be sampled continuously from the ground surface to 2 feet below the groundwater table. It is anticipated that the probes will be extended to approximately 12 feet bgs. The entire sampled soil column, including soil from the ground surface at the probe locations, will be field-screened using a photoionization detector (PID) and visual/olfactory methods. The sample with the highest potential to contain contamination (based on the field screening) will be submitted for laboratory analysis. Detailed notes describing the appearance and location of contaminated soil within the probe will be kept. The purpose of the notes is to aid in the vertical delineation of soil to be cleaned up.

In addition to the eight push probes, three monitoring wells will be installed in the SB04 area to assess groundwater concentration trends with time. Well locations will be selected based on the information provided by the probe sampling. One well will be installed upgradient of the SB04 source area and two wells will be installed downgradient. Proposed well locations are shown on Figure 4.

No soil samples will be collected from the wells; however, the entire sampled soil column, including soil from the ground surface at the well locations will be field-screened using a PID and visual/olfactory methods. Soil conditions will be logged including descriptions of any noticeable staining or odors from apparent contamination. The wells will be sampled quarterly for a year following installation. Groundwater samples will be submitted for laboratory analysis for diesel, lube oil, cPAHs, benzene, toluene, ethylbenzene & xylenes (BTEX), lead (total and dissolved), nitrate, oxidation-reduction potential (ORP), dissolved oxygen (DO), nitrate, nitrite, and alkalinity. Note that DO and ORP are field tests.

3.2.1.2 Former Wood Burner Area

Three push-probes will be installed in the former wood burner area at the locations shown on Figure 5. The purpose of the probes is to assess groundwater for the presence of metals that may present the potential to impact surface water receptors in the adjacent marine water. Metals at concentrations of potential concern were detected in several test pit samples (Section 3.1.3).

No soil samples will be collected from the probes; however, the entire sampled soil column, including soil from the ground surface at the probe locations, will be field-screened using a PID and visual/olfactory methods. Soil conditions will be logged including descriptions of any noticeable staining or odors from apparent contamination. A single groundwater sample will be collected from each push-probe and analyzed for dissolved PP metals.

The groundwater results from the probes will be used to assess the potential impacts to marine surface water from metals in soils. Based on this assessment, the soil screening levels for metals provided in Table 3-7 will be evaluated and may be adjusted if appropriate. In addition, the installation of groundwater monitoring wells following the IA may be appropriate so that metals concentrations in groundwater can be monitored.

3.2.2 Additional Beach Sediment Sampling

A total of five sediment samples will be collected from the beach along the railroad causeway at the southern portion of the site (Figure 3). The five sediment samples will be collected from the top 10 centimeters (cm) of sediment. Four additional sediment samples will be collected from two locations on the beach downgradient of the contaminated soil area near probe SB-05 (Figure 4). At these two locations, sediment samples will be collected from the surface (0 to 10 centimeters) and from a depth between 2 and 3 feet. The deep samples will be collected using a hand auger and a new section of 4-inch internal diameter (ID) poly vinyl chloride (PVC) pipe used to case the boreholes as they are advanced.

The purpose of the samples is to further assess potential impacts to recreational park users or ecological receptors. All sediment samples will be analyzed for Sediment Management Standards chemical parameters [semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and metals], diesel, lube oil, dioxins/furans, total organic carbon, and grain size. The location of each sediment sampling station will be sketched on a field map and recorded using a hand-held GPS device.

3.2.3 Piling Characterization Sampling

As part of the Phase I park development, a total of 277 creosote pilings will be removed. The pilings are located in a large group near the former wood handling area and singly along the shoreline (Figure 6). Approximately half of the piles have been cut off at ground level. Sediments adjacent to the piles will be sampled prior to the removal activities to provide an assessment of existing sediment conditions and what the impacts to surface sediments might be as a result of the piling removal. When the pre-removal sample results have been received, an assessment will be made of potential impacts to surface sediments caused by piling removal. At this time, OPARD will consult with Ecology, the Washington State Department of Fish and Wildlife (WDFW), and the Washington State Department of Natural Resources (WDNR) as to the appropriateness of the piling removal. If potential impacts are deemed significant, cutting the piling off at grade may be considered as an alternative to removal. If the removal is performed, sediment samples will be collected to assess post-removal conditions.

Six piling sediment sampling stations have been selected as shown on Figure 6. At each sampling station, sediment samples will be collected from the top 10 centimeters and a depth between 2 and 3 feet. The deep samples will be collected using a hand auger and a new section of 4-inch ID PVC pipe used to case the boreholes as they are advanced. If large gravel and cobbles are present, the boreholes may be advanced using a post-hole digger or shovel. Boreholes will be located within 6 to 8 inches of the selected pile. This distance allows for the use of a hand auger for piles that are standing up. Following removal, a single surface (0 to 10 cm) sediment sample will be collected from the same six sampling stations.

All 18 samples will be analyzed for PAHs (SMS constituents), diesel, lube oil, TOC, and grain size. The location of each sediment sampling station will be sketched on a field map and recorded using a hand-held GPS device.

3.2.4 Soil and Groundwater Screening Levels

Soil and groundwater sample results will be compared to MTCA cleanup levels, surface water Applicable or Relevant and Appropriate Requirements (ARARs) – (173-201A WAC; National Toxics Rule), and background soil concentrations (Table 3-7).

Table 3-7. Soil and Groundwater Screening Levels

Analyte	Ground Water, Method A, Table Value (µg/L)	Soil, Method A, Unrestricted Land Use, Table Value (mg/kg)
TPH, Diesel Range Organics	500	2000
TPH, Lube Oil Range Organics	500	2000
Volatile Organic Compounds		
Benzene	5	-
Toluene	1,000	-
Ethylbenzene	700	-
Xylenes	1,000	-
cPAHs[a]	0.1	0.1
Benzo[a]anthracene	–	–
Chrysene	–	–
Benzo[a]pyrene	0.1	0.1
Indeno[1,2,3-cd]pyrene	–	–
Dibenzo[a,h]anthracene	–	–
Benzo[b]fluoranthene	–	–
Benzo[k]fluoranthene	–	–

(Table Continues)

Table 3-7. Soil and Groundwater Screening Levels (Continued)

Analyte	Ground Water, Method A, Table Value (µg/L)	Soil, Method A, Unrestricted Land Use, Table Value (mg/kg)
Priority Pollutant Metals		
Antimony	6[b]	–
Arsenic	5	20
Beryllium	4[b]	2[d]
Cadmium	5	2
Chromium	50	19/2000 (Cr VI/Cr III)
Copper	2.4[c]	390[e]
Lead	8.1[c]	250
Mercury	0.025[c]	2
Nickel	8.2[c]	38[d]
Selenium	50[b]	–
Silver	1.9[c]	–
Thallium	0.47[c]	–
Zinc	81[c]	410[e]
Dioxins/Furans		
Total TCDD-TEQ[f]	–	11[g]

Notes:

[a] Total carcinogenic PAHs using toxicity equivalency method.

[b] State and Federal Groundwater MCL

[c] Surface water ARAR

[d] Screening concentration (Washington state-wide soil background concentration)

[e] Screening concentration (Washington SMS Sediment Quality Standards Criteria

[f] Total TCDD-TEQ calculated by multiplying the isomer concentration by the toxicity equivalency factor and summing across all isomers. ½ the reporting limit will be used for non-detected concentrations.

[g] MTCA Method B cleanup level (nanograms/kg).

(mg/kg) = Milligrams per kilogram
(µg/L) = Micrograms per liter
- Not available/Not applicable
TCDD = 2,3,7,8 – Tetrachloro-dibenzo-p-dioxin

3.2.4.1 Sediment Management Standards

Sediment results will be compared to Sediment Management Standard (SMS) Criteria (Table 3-8).

Table 3-8. Sediment Management Standards

	Sediment Management Standards	
	SQS	**CSL**
Metals (mg/kg dry weight, ppm)		
Arsenic	57	93
Cadmium	5.1	6.7
Chromium	260	270
Copper	390	390
Lead	450	530
Mercury	0.41	0.59
Silver	6.1	6.1
Zinc	410	960
Organics (mg/kg organic carbon)		
Naphthalene	99	170
Acenaphthylene	66	66
Acenaphthene	16	57
Fluorene	23	79
Phenanthrene	100	480
Anthracene	220	1,200
2-Methylnaphthalene	38	64
Total LPAH[a]	370	780
Fluoranthene	160	1,200
Pyrene	1,000	1,400
Benz(a)anthracene	110	270
Chrysene	110	460
Benzofluoranthenes (b+k)[b]	230	450
Benzo(a)pyrene	99	210
Indeno(1,2,3-c,d)pyrene	34	88
Dibenzo(a,h)anthracene	12	33
Benzo(g,h,I)perylene	31	78
Total HPAH[c]	960	5,300
Chlorinated Hydrocarbons		
1,2-Dichlorobenzene	2.3	2.3
1,4-Dichlorobenzene	3.1	9
1,2,4-Trichlorobenzene	0.81	1.8
Hexachlorobenzene (HCB)	0.38	2.3

(Table Continues)

Table 3-8. Sediment Management Standards (Continued)

	Sediment Management Standards	
	SQS	**CSL**
Phthalates		
Dimethyl phthalate	53	53
Diethyl Phthalate	61	110
Di-n-butyl phthalate	220	1,700
Butyl benzyl phthalate	4.9	64
Bis(2-ethylhexyl)phthalate	47	78
Di-n-octyl phthalate	58	4,500
Dibenzofuran	15	58
Hexachlorobutadiene	3.9	6.2
N-Nitrosodiphenylamine	11	11
Total PCBs	12	65
Phenols (µg/kg dry weight, ppb)		
Phenol	420	1,200
2-Methylphenol	63	63
4-Methylphenol	670	670
2,4-Dimethylphenol	29	29
Pentachlorophenol	360	690
Benzyl alcohol	57	73
Benzoic acid	650	650
Conventional Parameters		
Total Organic Carbon (%)	-	-

Note:

[a] The total LPAH criterion under the SMS represents the sum of the concentration of the following LPAH compounds: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene. 2-Methylnaphthalene is not included in the LPAH definition under the SMS.

[b] The total benzofluoranthenes criterion represents the sum of the concentrations of the b, j, and k isomers of benzofluoranthene.

[c] The total HPAH criterion under the SMS represents the sum of the concentration of the following HPAH compounds: fluoranthene, pyrene, benz(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

(HPAH): High molecular weight polycyclic aromatic hydrocarbon
(LPAH): Low molecular weight polycyclic aromatic hydrocarbon
(mg/kg): Milligrams per kilogram
PCB: Polychlorinated biphenyl
SQS: Sediment quality standards
CSL: Cleanup screening level
SMS: Sediment Management Standard (WAC 173-204)
(µg/kg): Micrograms per kilogram

3.3 TERRESTRIAL ECOLOGICAL EVALUATION

A terrestrial ecological evaluation will be performed during the RI according to WAC 173-340-7490. The evaluation will be performed to identify potential threats to the terrestrial environment and will be used to develop appropriate actions for the protection of terrestrial plants and animals.

Terrestrial receptors identified in the SEPA environmental checklist developed for the site (Appendix A) consist of heron, bald eagle, purple martin, great egret, Vaux's swift, and mink. No endangered or threatened terrestrial species were identified.

3.4 FEASIBILITY STUDY

A feasibility study will be conducted based on the information derived during the RI. The purpose of a FS is to develop and evaluate cleanup action alternatives, with the objective of selecting a preferred alternative. A FS should include the evaluation of a reasonable number of cleanup action alternatives that protect human health and the environment. Current cleanup goals for the site include:

- Meeting the requirements of MTCA for the protection of human health and the environment.
- Using permanent solutions where possible. MTCA rules state that cleanup action shall use permanent solutions "to the maximum extent practicable" and provide for a "reasonable restoration time frame."
- Integrate cleanup design with features and function of park development.

The Interim Action proposed here has been selected with the intention of meeting the stated goals. The IA will be reviewed against the remedy selection criteria as part of the RI/FS process. OPARD anticipates that the IA will meet the requirements for a final cleanup remedy. Proposed future cleanup actions outside of the Phase I Park boundary (if appropriate based on the RI) will also be developed during the FS. The preferred cleanup remedy will be presented in the RI/FS Report.

4. INTERIM ACTION AND GROUNDWATER MONITORING

At the current time, the IA is planned to consist of:

- Source removal by excavation of contaminated soils in Areas A, B, and D.
- In-situ enhanced bioremediation of dissolved and adsorbed hydrocarbons in the Area A contaminated plume using oxygen releasing compounds,
- Placement of a 12-inch thick soil cap as a physical barrier in Area C, and
- One year of quarterly groundwater monitoring in Area A.

In source excavations, confirmation samples will be collected at the base and sidewalls of excavations to confirm that remedial levels have been met. Stockpiles will also be sampled to confirm and characterize contaminant levels for disposal purposes. Soil sample results will be compared to the remedial levels provided in Table 4-1. Results for groundwater samples collected to assess the effectiveness of the IA will also be compared to the remedial levels in Table 4-1.

4.1 AREA A SOIL REMOVAL

Source soils within Area A will be removed by excavation. The actual extent of the excavation will be determined in the field by real-time observation and field screening. Once the apparent limit of contaminated soil is reached, the bottom and sidewalls of the excavation will be sampled to confirm removal. Both clean and contaminated soils will be stockpiled separately and sampled. Soils that are confirmed clean (by confirmation sampling following Ecology guidelines) will be returned to the excavation as backfill. Contaminated soils will be transported to a permitted landfill. The remaining excavation will be backfilled with clean pit run. A detailed description of these activities as well as the application of oxygen-releasing compound and groundwater monitoring is provided below.

4.1.1 Contaminated Soil Removal

- Demolish steel rails ties, and asphalt. Recycle asphalt and steel rails.
- Excavate contaminated soils from the Area A footprint shown on Figure 7. Field screen all excavated soils so that potentially “clean” and “contaminated” soils can be segregated and stockpiled separately. Conduct field screening using visual/olfactory methods and by headspace measurements using a PID.
- Excavate contaminated soils to limits defined by on-site field screening. Note that the contaminated soil footprint shown on Figure 7 is an estimate; the excavated footprint may change based on actual conditions encountered in the field. Determine the limits of the excavation using field screening and professional judgment.
- Conduct excavations during the dry summer months (May through September) so that the groundwater table is at the seasonal low. Plan excavations to occur as one of the initial steps in the grading phase of the Phase I Park development. Time excavations to occur during low tides so that the groundwater table is below the contaminated soil at the time of excavation.
- Collect confirmation soil samples from the base and sidewalls of the excavations. A total of eleven confirmation soil samples will be collected and analyzed for diesel, lube oil, lead, BTEX, and cPAHs. Proposed confirmation sample locations are shown

on Figure 7. Samples are to be spaced 40 to 50 feet apart. Confirmation sample results will be compared to the remedial levels provided in Table 4-1.

- Stockpile “contaminated” soil on plastic sheeting. Cover unworked stockpiles with sheeting at the end of each workday to prevent windblown dust migration and to prevent rainwater infiltration.
- Collect confirmation soil samples from both the “clean” and “contaminated” stockpiles. An estimated 1200 cubic yards (cy) of clean soils and 1200 cy of contaminated soils will be stockpiled. Based on this estimate, a total of 20 stockpile soil samples will be collected and a analyzed for diesel, lube oil, lead, BTEX, and cPAHs. Samples numbers may be reduced based on Ecology guidelines if stockpile volumes are less than estimated. Dispose of contaminated soil at a permitted landfill. Rabanco’s Centralia transfer station has been identified as the shortest haul to a receiving facility and is a potential preferred landfill. At the current planning level, it is assumed that no soil will require disposal as hazardous waste.

Restore site by backfilling using the stockpiled “clean” soil and imported pit run. Backfill using lifts no greater than 12 inches loose thickness. Compact backfilled soil to a density of at least 90 percent of the maximum value as determined by the Modified Proctor test. Perform a minimum of five density tests for each material type to confirm compaction.

4.1.2 Residual Plume Treatment

Spread a predetermined amount of Oxygen Releasing Compound (ORC) evenly over the base of the excavation at the completion of excavation and before backfilling begins. ORC is available in powder form and can be spread using a backhoe arm. It is critical that the ORC is placed at sufficient depth so that it remains submerged beneath the groundwater table for most of the year. The ORC will slowly provide dissolved oxygen (DO) to the groundwater for about one year. The enhanced DO will encourage destruction of residual hydrocarbons in soil and groundwater by naturally-occurring aerobic bacteria in the soil. At this planning stage, it has been assumed that the contaminated groundwater plume at the site has dimensions of 110 feet by 125 feet and that ORC supplied by Regenesis of San Clemente, California, will be applied. It is estimated that 2,500 pounds of ORC will be required. The actual source and amount of ORC required will be re-evaluated during the FS and made available for insertion into the project’s bid documents.

4.1.3 Groundwater Monitoring

- Install four new groundwater monitoring wells at the approximate locations shown in Figure 7. These well locations are intended to allow for monitoring of upgradient and downgradient conditions. Install the wells with 10-foot screened sections that span the groundwater water table interface. It is anticipated that a screened interval of from approximately 4 to 14 feet bgs will be appropriate. New well locations will be surveyed with an accuracy of +/- 1 foot horizontally and +/- 0.01 foot vertically.
- Conduct groundwater monitoring quarterly for one year following application of the ORC. Sample for one year to assess the effectiveness of the IA and evaluate the need for further monitoring.
- Collect four groundwater samples per event and analyze them for diesel, lube oil, cPAHs, BTEX, lead (total and dissolved), oxidation-reduction potential (ORP), dissolved oxygen (DO), nitrate, nitrite, and alkalinity. Note that DO and ORP are field tests.

4.2 AREA B SOIL REMOVAL

Source soils within Area B will be removed by excavation similar to Area A above. A detailed description of removal activities is provided below.

4.2.1 Contaminated Soil Removal

- Demolish steel rails ties, and asphalt. Recycle asphalt and steel rails.
- Excavate contaminated soils from the Area B footprint shown on Figure 7. It is anticipated that the contaminated soil zone may begin just beneath the existing ground surface. Field screen all excavated soils so that potentially "clean" and "contaminated" soils can be segregated and stockpiled separately. Conduct field screening using visual/olfactory methods and by headspace measurements, using a PID.
- Excavate contaminated soils to limits defined by on-site field screening. Note that the contaminated soil footprint shown on Figure 7 is an estimate; the excavated footprint may change based on actual conditions encountered in the field. Determine the limits of the excavation using field screening and professional judgment.
- Conduct excavations during the dry summer months (May through September) so that the groundwater table is at the seasonal low. Plan excavations to occur as one of the initial steps in the grading phase of the Phase I park development. It is anticipated that the excavation will not extend to the groundwater table.
- Collect confirmation soil samples from the base and sidewalls of the excavation. A total of five soil samples will be collected and analyzed for diesel, lube oil, cPAHs, BTEX, and lead. Samples shall be spaced a maximum of 40 to 50 feet apart. If the excavation area exceeds the estimated footprint shown, more confirmation samples may be required.
- Stockpile "contaminated" soil on plastic sheeting. Cover unworked stockpiles with sheeting at the end of each workday to prevent windblown dust migration and to prevent rainwater infiltration.
- Collect confirmation soil samples from both the "clean" and "contaminated" stockpiles. An estimated 50 cy of clean soils and 100 cy of contaminated soils will be stockpiled. Based on this estimate, a total of six stockpile soil samples will be collected and analyzed for diesel, lube oil, lead, BTEX, and cPAHs. Dispose of contaminated soil at a permitted landfill. At the current planning level, it is assumed that no soil will require disposal as hazardous waste.
- Restore site by backfilling using the stockpiled "clean" soil and imported pit run. Backfill using lifts no greater than 12 inches loose thickness. Compact backfilled soil to a density of at least 90 percent of the maximum value as determined by the Modified Proctor test. Perform a minimum of two density tests for each material type to confirm compaction.

4.3 AREA C SOIL CAP

Surface soils within Area C will be capped with a physical barrier of soil a minimum of 12-inches thick to prevent direct contact. The cap will extend a minimum of 5 feet horizontally from the outside edge of the steel rails. The steel rails and rail ties will be removed prior to capping. Steel rails will be salvaged. Rail ties will be disposed of at the same permitted landfill as the contaminated soil. The soil cap will consist of a combination of clean fill and topsoil. A geotextile fabric barrier layer will be placed beneath the cap as a marker. Trenching for utilities will not be allowed beneath the soil cap. In areas where trees are to be planted through the cap, the planting holes will be pre-excavated by the remediation contractor. The holes will be excavated to a sufficient diameter and depth to receive tree root bulbs. A 6-inch layer of clean topsoil will be placed at the bottom of the holes to provide a barrier. All excavated soils from the planting holes shall be managed and disposed of as contaminated soil.

A 12 inch layer of soil is considered adequate because it provides a physical barrier that is not easily removed. The cap surface will be vegetated, which will protect it from erosion. The geotextile placed beneath the cap will provide a visual marker for park maintenance personnel. An example of the use of a similar cap is provided by the Bunker Hill Superfund Site in Coeur d' Alene, Idaho. At this Superfund site, the remedy for residential yard cleanup (as documented in the site's Record of Decision) is to remove contaminated soil to a depth of 12 inches and backfill with clean soil.

Area C represents an area of widespread, low level cPAHs contamination. Based on the sampling results, some areas contain contamination exceeding MTCA Method A cleanup levels for both individual and total cPAHs. The MTCA Method A levels were derived to be protective of direct human contact (173-340 WAC Table 740-1). The soil cap will effectively prevent direct contact.

The cap is not intended to cut off surface water infiltration because it is anticipated that the cPAHs concentrations detected in the surface soils are protective of groundwater. This assessment is based on modeling performed using the fixed parameter three-phase partitioning model provided in Equation 747-1 in the MTCA regulations. In addition, the concentrations of benzo(a)pyrene in Area C are below the screening soil concentration for benzo(a)pyrene provided MTCA Table 749-2 Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure. Based in these evaluations, the City anticipates that the IA soil cap will be protective of groundwater and terrestrial receptors for the purposes of the final cleanup action.

4.4 AREA D SOIL/ASH REMOVAL

Source soils and ash within Area D will be removed by excavation similar to Areas A and B. A detailed description of removal activities is described below.

- Excavate contaminated soils and ash from the Area D footprint shown on Figure 7. It is anticipated that the contaminated soil zone may begin at an average depth of 1 foot bgs. The maximum anticipated depth of contaminated soil/ash is 5 feet bgs. Field screen all excavated soils/ash so that potentially "clean" and "contaminated" materials can be segregated and stockpiled separately. Conduct field screening using visual/olfactory methods. The ash layer is clearly discernable by its black color. Contaminated soil overlying the ash within the former burner footprint was observed to exhibit a red staining. The ash was observed to be underlain by soils and fine wood/bark debris that was not contaminated above screening levels.
- Excavate contaminated soils to limits defined by on-site field screening. Note that the contaminated soil/ash footprint shown on Figure 7 is an estimate; the excavated footprint may change based on actual conditions encountered in the field. Determine the limits of the excavation using field screening and professional judgment.

- Conduct excavations during the dry summer months (May through September) so that the groundwater table is at the seasonal low. Time excavations to occur during low tide so that the groundwater table is below the contaminated soil at the time of removal.
- Collect confirmation soil samples from the base and sidewalls of the excavation. A total of 10 soil samples will be collected and analyzed for dioxins/furans and PP metals (individual metals contained in the PP metals suite are shown in Table 4-1). Confirmation soil samples are shown on Figure 7. Samples are to be spaced 40 to 50 feet apart.
- Stockpile "contaminated" soil on plastic sheeting separately from other contaminated soil stockpiles. Cover un-worked stockpiles with sheeting at the end of each workday to prevent windblown dust migration and to prevent rainwater infiltration.
- Collect confirmation soil samples from both the "clean" and "contaminated" stockpiles. An estimated 800 cy of clean soils and 1,150 cy of contaminated soils will be stockpiled. Based on this estimate, a total of 17 stockpile soil samples will be collected and analyzed for PP metals and dioxins/furans. Dispose of contaminated soil at a permitted landfill. At the current planning level, it is assumed that no soil will require disposal as hazardous waste.
- Restore site by backfilling using the stockpiled "clean" soil and imported pit run. Backfill the last 12 inches to grade using topsoil. Backfill using lifts no greater than 12 inches loose thickness. Compact backfilled soil to a density of at least 90 percent of the maximum value, as determined by the Modified Proctor test. Perform a minimum of five density tests for each material type to confirm compaction. Do not compact topsoil layer.

4.4.1 Groundwater Monitoring

- Depending on the results of the RI/FS groundwater sampling using probes, it may be appropriate to install monitoring wells at Area D following the IA so that metals concentrations in groundwater can be monitored. In this case, install three new groundwater monitoring wells at the approximate locations shown in Figure 7. Install the wells with 10-foot screened sections that span the groundwater water table interface. It is anticipated that a screened interval of from approximately 4 to 14 feet bgs will be appropriate. New well locations will be surveyed with an accuracy of +/- 1 foot horizontally and +/- 0.01 foot vertically.
- Conduct groundwater monitoring quarterly following installation. Sample quarterly for one year to assess the effectiveness of the IA and evaluate the need for further monitoring.
- Collect three groundwater samples per event and analyze them for PP metals (total and dissolved).

4.4.2 Remedial Levels

Soil and groundwater sample results from the IA will be compared to the remedial levels contained in Table 4-1 below.

Table 4-1. Soil and Groundwater Remedial Levels

Analyte	Ground Water (µg/L)	Soil (mg/kg)
TPH, Diesel Range Organics	500	2000
TPH, Lube Oil Range Organics	500	2000
Volatile Organic Compounds		
Benzene	5	-
Toluene	1,000	-
Ethylbenzene	700	-
Xylenes	1,000	-
cPAHs[a]	0.1	0.1
Benzo[a]anthracene	–	–
Chrysene	–	–
Benzo[a]pyrene	0.1	0.1
Indeno[1,2,3-cd]pyrene	–	–
Dibenzo[a,h]anthracene	–	–
Benzo[b]fluoranthene	–	–
Benzo[k]fluoranthene	–	–
Priority Pollutant Metals		
Antimony	6[b]	–
Arsenic	5	20
Beryllium	4[b]	2[d]
Cadmium	5	2
Chromium	50	19/2000 (Cr VI/Cr III)
Copper	2.4[c]	390[e]
Lead	8.1[c]	250
Mercury	0.025[c]	2
Nickel	8.2[c]	38[d]
Selenium	50[b]	–
Silver	1.9[c]	–
Thallium	0.47[c]	–
Zinc	81[c]	410[e]

(Table Continues)

Table 4-1 Soil and Groundwater Remedial Levels (Continued)

Analyte	Ground Water, Method A, Table Value (µg/L)	Soil, Method A, Unrestricted Land Use, Table Value (mg/kg)
Dioxins/Furans		
Total TCDD-TEQ[f]	–	11[g]

Notes:

[a] Total carcinogenic PAHs using toxicity equivalency method.

[b] State and Federal Groundwater MCL

[c] Surface water ARAR (173-201A WAC; National Toxics Rule)

[d] Screening concentration (Washington state-wide soil background concentration)

[e] Screening concentration (Washington SMS Sediment Quality Standards Criteria)

[f] Total TCDD-TEQ calculated by multiplying the isomer concentration by the toxicity equivalency factor and summing across all isomers.
½ the reporting limit will be used for non-detected concentrations.

[g] MTCA Method B cleanup level (nanograms/kg).

- Not available/Not applicable

(µg/L) = Micrograms per liter
(mg/kg) = Milligrams per kilogram
TCDD = 2,3,7,8 – Tetrachloro-dibenzo-p-dioxin

5. FIELD AND LABORATORY METHODS

Descriptions of the specific sampling and laboratory methods for the project are presented in this section. The methods described are intended to supplement the standard operating procedures (SOPs) provided in Appendix E. Sampling field forms are provided in Appendix B.

5.1 SAMPLING METHODS AND PROCEDURES

5.1.1 General Sampling Procedures

All soil/sediment samples will be placed into the appropriate sample containers using dedicated, disposable polyethylene scoops. All sample containers will be provided by the analytical laboratory. Bowls used during sample collection will be dedicated, disposable, and constructed of polyethylene. Non-volatile soil samples will be thoroughly homogenized before being placed in the sample containers. Surface and subsurface samples will be collected from discrete locations. Soil samples will be logged by a qualified scientist using the Unified Soil Classification System (USCS). Following sampling collection, the location of all samples will be tied to existing site features and sketched in the field logbook. Sample locations and any new monitoring wells will be located by survey in state plane coordinates.

5.1.2 Field Screening

During sample collection, soil samples will be field screened using a PID and visual/olfactory methods. A portion of each sample will be placed in a re-sealable plastic bag for headspace screening using the PID. The headspace sample will be allowed to heat in the sun for approximately 10 minutes and will then be shaken vigorously. A headspace vapor measurement will be then be collected and recorded on the field sampling form. During sampling, observations will also be made for signs of contamination such as odors, staining, or a sheen on saturated samples from below the water table. Such observations will also be recorded on the field sampling form. Field screening information will be used to aid in the selection of samples for laboratory analysis.

5.1.3 Push-Probe Sampling (Soil and Groundwater)

A Geoprobe® or equivalent push-probe rig will be used to collect subsurface soil and groundwater samples. For soil sampling, the stainless steel core sampler will be fitted with a new disposable acetate sleeve for each sample run. Soil samples will generally be collected continuously from the ground surface to the planned depth of the borings. Where petroleum contamination is suspected, probes will be extended to the groundwater table at a minimum.

Once the sampling depth is reached for each sample run, the coring device will be retracted and the acetate sleeve will be cut length-wise and opened to allow for observation of the soil core. The soil core will be logged and selected sections will be placed into the appropriate sample containers.

For groundwater sample collection, a 4-foot-long stainless steel sampling screen will be attached to the end of the probe rods and installed so that the screen is set to span the desired sampling depth. At a minimum, the sampling depth will be 1 foot below the groundwater surface. Groundwater samples will be collected using a peristaltic pump; new, disposal polyethylene tubing will be used for each sample. Prior to sample collection, groundwater will be purged from the probe to remove disturbed, sediment-laden water. The goal of the purging is to produce a non-turbid sample. The turbidity of the purged water will be observed periodically during purging. Purging will be considered complete when no significant improvement of turbidity is observed over several 3-minute monitoring periods or when a maximum of 3 gallons of purge water are generated. Visual observations will be recorded on the field sampling log.

5.1.4 Sediment Sampling

All sediment samples shall be discrete and shall be collected from the top 10 centimeters of sediments using dedicated polyethylene bowls and spoons. Sample collection shall target the fine-grained portion of sediments. Any unrepresentative material (e.g., wood debris, shells, and rocks) will be removed at the discretion of the sampler. Detailed notes regarding the sample composition shall be recorded in the field notebook.

Sample stations shall be located by recording the station's position using a hand-held GPS device.

5.1.5 Monitoring Well Installation, Development, and Sampling

Monitoring wells will be installed by a licensed driller according to applicable Ecology regulations (Chapter 173-160 WAC). The monitoring wells will be constructed using 2-inch inside diameter (ID) polyvinyl chloride (PVC) casings fitted with 10-foot screens (with 0.01-inch or 0.02-inch slots). Completed well monuments will be flush-mounted; a 2-foot square concrete pad will be constructed around the monument as a surface seal.

Completed monitoring wells will be allowed to set for at least 24 hours before development to allow grout or bentonite chip seals to set. Development will be achieved by over-pumping at a flow rate of up to 1 gallon per minute (gpm) using an 5/8-inch outside diameter (OD) inertial lift pump fitted with a surge block. New polyethylene tubing shall be used for developing each well. Water quality parameters (specific conductance, pH, temperature, and turbidity) will be measured during development. Development will be continued until the parameters stabilize as determined by the lack of appreciable change in measurement over several 3-minute monitoring periods or if a turbidity reading of 10 nephelometric turbidity units (NTUs) or less is attained. The 10 NTU criteria is based on EPA sampling guidelines (EPA 2002).

Groundwater sampling will be conducted no earlier than 24 hours following development to allow undisturbed water to enter the well column. Groundwater samples for volatile organic compounds (VOCs) analysis will be collected using a decontaminated, positive-displacement down-hole pump or a disposable bailer. Non-volatile samples may be collected using a peristaltic pump. New, disposable polyethylene tubing will be used at each sample location. For samples collected near the groundwater table, the sample pump will be lowered to 2-feet below the water surface. For deeper samples, the pump will be lowered to the mid-point of the well screen.

Groundwater will be purged and sampled from the wells using low flow techniques. The measured purging and sampling flow rate shall be 0.5 liters per minute or less. Water quality parameters will be measured during sampling; purging shall be considered complete when the criteria shown in Table 5-1 are met over at least three 3-minute monitoring periods.

Table 5-1. Purging Stabilization Criteria

Parameter	Stabilization Criteria
pH	+\- 0.1 unit
Specific conductance	+\- 3%
Oxidation-reduction potential (ORP)	+\- 10 millivolts
Turbidity	+\- 10% (when greater that 10 NTUs)
Dissolved Oxygen	+\- 0.3 milligrams per liter

If a turbidity of 10 NTUs or less is not attained during purging, both filtered and non-filtered metals samples will be collected. Filtered samples will be collected using a 0.45 micron filter placed in line with the sample tubing.

5.1.6 Decontamination Procedures

Decontamination of all non-disposable tools and equipment will be conducted prior to each sampling event and between each sampling location. The following steps will be taken for decontamination of hand-held sampling equipment:

- Scrub with non-phosphate detergent (i.e., Alconox or similar)
- Rinse with tap water
- Rinse thoroughly with deionized water
- Allow to air dry and place in a new plastic bag for storage

For decontamination of larger tools and equipment, such as push-probe rods, a high-pressure, hot water washer or similar device will be used. Loose soil materials will be removed from equipment using a "dry" decontamination technique consisting of the removal of loose soil using a shovel or brush.

5.1.7 Investigation Derived Waste

Investigation derived waste (IDW) from sampling activities will be containerized onsite in 55-gallon drums. Composite samples will be collected for waste characterization. Disposal options for the IDW will be based on the analytical results. Disposal shall be managed by Parametrix.

All drums will be labeled indicating date filled, content, location, company, and a unique identification number. All drums and containers will be tracked on a waste-tracking log.

All disposable sampling materials and personal protective equipment, such as disposable coveralls, gloves, and paper towels used in sample processing will be placed inside polyethylene bags or other appropriate containers. Disposable materials will be placed in a refuse container and disposed of as solid waste.

5.2 SAMPLE HANDLING AND CUSTODY

5.2.1 Sample Identification and Labeling

Prior to the field investigation, each sample location will be assigned a unique code. Each sample collected at that location will be pre-assigned an identification code using the sampling site followed by other specific information describing the sample. The sample numbering protocol is shown in Table 5-2.

Table 5-2. Sample Numbering Protocol

Site	WB = West Bay Waterfront Park
Matrix	SO = Soil SD = Sediment GW = Groundwater WT = Rinsate/trip blank water
Sampling Station	SB22 = Soil Boring No. 22 (for continuity with past work, push probe numbering will begin with 22) SD12 = Sediment Station 12 (for continuity with past work, sediment numbering will begin with 12) MW01 = Monitoring Well 1
Sample Type/Sample Depth	0000 = Field sample collected at a depth of 0.0 feet 1010 = Field duplicate collected at a depth of 1.0 feet 4050 = Rinsate Blank collected following the collection of a sample at a depth of 5.0 feet.

Example: WB-SO-SB22-0150 = Soil sample collected from soil boring SB-22 at a depth of 15.0 feet.

5.2.2 Sample Storage, Packaging, and Transportation

Samples will be placed in a cooler following collection and chilled to approximately 4ºC. Following completion of each days sampling, all samples will be transported and/or shipped to the analytical laboratory, as appropriate. Samples which are routinely delivered to the laboratory on the same day as collection may not have sufficient time to chill to 4ºC.

5.2.3 Sample Custody

The chain-of-custody procedures used for this project will provide an accurate written or computerized record that can be used to trace the possession of each sample from the time each is collected until the completion of all required analyses. A sample is in custody if it is in any of the following places:

- In someone’s physical possession
- In someone’s view
- In a secured container
- In a designated secure area

The following information will be provided on the chain-of-custody form:

- Sample identification numbers
- Matrix type for each sample

- Analytical methods to be performed for each sample
- Number of containers for each sample
- Sampling date and time for each sample
- Names of all sampling personnel
- Signature and dates indicating the transfer of sample custody

All samples will be maintained in custody until formally transferred to the laboratory under a written chain-of-custody. Samples will be kept in sight of the sampling crew or in a secure, locked vehicle at all times. Samples that leave the custody of field personnel will be sealed by placing a signed and dated Custody Seal across the seam of the shipping container.

5.3 ANALYTICAL METHODS

All samples will be submitted to a commercial analytical laboratory certified by the Washington State Department of Ecology to perform the required analyses. The selected laboratory for the project is OnSite Environmental located in Redmond, Washington. Laboratory reporting limits will be verified prior to analyses to ensure that, at a minimum, reporting limits for each analyte are equal to or lower than MTCA Method A cleanup levels for soil and groundwater. Matrix interferences may make it impossible to achieve the desired reporting limits and associated QC criteria. In such instances, the laboratory shall report the reason for noncompliance with QC criteria or elevated detection limits.

5.4 QUALITY ASSURANCE/QUALITY CONTROL

QA/QC checks consist of measurements performed in the field and laboratory.

5.4.1 Field Methods

Table 5-3. Guidelines for Minimum QA/QC Samples for Field Sampling

	Field		
Media	**Field Duplicate**	**Trip Blank**	**Equipment Blank**
Soil, Sediment and Groundwater	1 per 20 samples per analysis	1 per cooler containing water VOCs samples	1 per 20 samples (per non-disposable equipment type)

5.4.1.1 Field Duplicates

A minimum of one blind field duplicate will be analyzed per 20 samples. Field duplicates will be collected following field samples. Soil duplicates samples for non-volatiles analysis will be homogenized and split. Duplicate samples will be coded so the laboratory cannot discern which samples are field duplicates.

5.4.1.2 Trip Blanks

A trip blank shall accompany each cooler containing groundwater samples for VOCs analysis. The trip blank shall be obtained from the laboratory or will be made by filling the appropriate sample containers with certified analyte-free deionized water. Trip blanks will be analyzed for VOCs with the field samples.

5.4.1.3 Equipment Blanks

One equipment blank will be collected per 20 samples when non-disposable equipment is used for sampling. Equipment blanks will be collected by capturing deionized water rinsed over (or through) sampling equipment after decontamination. Equipment blanks will be analyzed for the same constituents as the field samples.

5.4.2 Laboratory QA/QC Methods

Specific procedures and frequencies for laboratory QA procedures and QC analyses are detailed in the laboratory's QA Plan and SOPs for each method. QC analyses will be performed by the laboratory according to their Ecology-approved SOPs.

5.4.3 Summary of Sample Media, Numbers, and Analyses

Total numbers of samples to be collected are summarized by medium in Table 5-4. Note that these sample quantities include all work described in this work plan yet to be performed, including the RI/FS sampling and the IA confirmation soil and groundwater samples.

Table 5-4. Summary of Sample Types, Analyses, and Number

Sample Medium	Analysis	No. Field Samples	No. Duplicate Samples[a]	No. Equipment Blanks	No. Trip Blanks	Total No.
Groundwater	Diesel/Lube Oil	37	5	1	-	43
	cPAHs	37	5	1	-	43
	BTEX	39	5	-	4	48
	Lead	69	4	1	-	74
	Alkalinity	28	-	-	-	28
	Nitrate	28	-	-	-	28
	Nitrite	28	-	-	-	28
	PP Metals	3	1	-	-	4
Soil	Diesel/Lube Oil	56	3	-	-	59
	cPAHs	56	3	-	-	59
	BTEX	42	3	-	-	45
	Lead	42	3	-	-	45
	PP Metals	26	2	-	-	28
	Dioxins/Furans	26	2	-	-	28

(Table Continues)

Table 5-4. Summary of Sample Types, Analyses, and Number (Continued)

Sample Medium	Analysis	No. Field Samples	No. Duplicate Samples[a]	No. Equipment Blanks	No. Trip Blanks	Total No.
Sediment	SMS Criteria	9	1	1	-	11
	TOC	27	-	-	-	27
	Diesel/Lube Oil	18	2	-	-	20
	Dioxins/Furans	9	1	1	-	11
	cPAHs	18	2	-	-	20
	Grain Size	27	-	-	-	29

[a] Total number of field duplicates is based on individual sampling events.
cPAHs: Carcinogenic Polycyclic Aromatic Hydrocarbons
PP: Priority Pollutant
SMS: Sediment Management Standards
TOC: Total organic carbon

5.4.4 Sample Containers, Preservation, and Holding Times

Analytical methods, sample containers, preservation, and holding times are summarized in Table 5-5.

Table 5-5. Sample Containers, Preservation, and Holding Times

Analysis	Method	Matrix	Container	Preservation	Holding Time
Diesel and Lube Oil	NWTPH-Dx	Soil	8 oz cwm	Cool 4°C	14 days
		Groundwater	1 liter amber	HCl pH < 2, cool 4°C	7 days ext, 40 days
cPAHs	8270C SIM	Soil/Sediment	8 oz cwm	Cool 4°C	14 days ext, 40 days
		Groundwater	1 liter amber	Cool 4°C	7 days ext, 40 days
Lead/ PP Metals	6010 B/ 6020	Soil	4 oz cwm	Cool 4°C	6 months
		Groundwater	500 mL	HN03 pH < 2	6 months
SMS Criteria	6010 B/ 6020/7471A/ 8270SIM/8082	Sediment	8 oz cwm	Cool 4°C	14 days
TOC	PSEP	Sediment	4 oz cwm	Cool 4°C	14 days
Alkalinity	310.1	Groundwater	250 mL HDPE	Cool 4°C	14 days
Nitrate	353.3	Groundwater	125 mL HDPE	Cool 4°C	48 hours
Nitrite	353.3	Groundwater	125 mL HDPE	Cool 4°C	48 hours
Dioxins/ Furans	8290	Soil/Sediment	4 oz amber cwm	Cool 4°C	30 days

Notes:
HCl: Hydrochloric acid
NWTPH: Northwest total petroleum hydrocarbons
SIM: Selected Ion Monitoring
TOC: Total organic carbon
cPAHs: Carcinogenic Polycyclic Aromatic Hydrocarbons
cwm: clear, wide-mouth jar
mL: Milliliter
oz: Ounce
PP: Priority Pollutant

5.5 FIELD INSTRUMENT/EQUIPMENT CALIBRATION, INSPECTION, AND MAINTENANCE

The types of field instruments and equipment that are anticipated to be used during sampling include, but are not limited to:

- PIDs

Equipment maintenance will be performed according to manufacturers' specifications by the equipment supplier. Field personnel will be responsible for inspection and calibration of field equipment. An equipment user's manual will be provided to all field personnel working with the equipment. All equipment will be inspected and calibrated prior to use. The results of calibration, as well as any problems encountered and corrective actions, will be documented in the activity field notebook.

5.6 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Field supplies such as sample containers and trip/rinsate blank water shall be obtained from reputable suppliers and shall be certified analyte free. Records of certification shall be kept by the laboratory (for laboratory-supplied supplies) or by Parametrix in the project file. Sampling spoons and bowls shall be food-grade and shall be purchased new.

5.7 DATA MANAGEMENT

The objectives of data management are to assure that large volumes of information and data are technically complete, accessible, and efficiently handled.

5.7.1 Field Data

The original hard (paper) copies of all field notes and laboratory reports will be stored in the project file. Photocopies of these documents should be prepared for working copies as needed.

Field data should be recorded in bound notebooks or individual sampling sheets. The field team members should review the field data for completeness prior to placing it in the files.

5.7.2 Laboratory Data

The laboratory data reports will be archived in the project files. The electronic data will be incorporated into Excel spreadsheets and archived on electronic media and placed in the project file. An electronic laboratory data submittal consistent with the requirements of Ecology's EIM system will be submitted with the RI/FS report and archived in the project file.

6. DATA VERIFICATION AND VALIDATION

Techniques for data verification and validation will be in accordance with the Guidance on Environmental Data Validation and Verification (EPA 2001).

6.1 DATA REVIEW, VERIFICATION AND VALIDATION

Analytical data will be reviewed by the Laboratory QA Officer to assure that the method-specific QC objectives have been met. These reviews will identify the occurrence of deficiencies in time to take corrective action. If the required QC objectives are not met after the corrective action is performed, the Task Manager will be notified by the laboratory before data submittal. The Task Manager and Data QA Manager will determine if additional corrective action should be taken, such as re-analysis, if applicable. All data packages provided by the laboratory will provide a summary of QC results adequate to enable reviewers to determine the quality of the data.

The Data QA Manager is responsible for conducting checks for internal consistency, transmittal errors, and for adherence to the field and laboratory QC elements. The Data QA Manager will review the data package submitted by the laboratory to ensure that documentation has been provided, appropriate QC checks have been performed, that appropriate corrective actions have been taken, and that the data is valid and useable. The Data QA Manager will also determine the potential effects of any deviations or corrective actions on the suitability of the data.

6.2 VERIFICATION AND VALIDATION METHODS

The Data QA Manager will review the following:

- Chain-of-custody documentation
- Holding times
- Equipment/trip blank results
- Field Duplicate results
- Method blank results
- Compliance with project data quality indicators (DQIs); i.e. precision, accuracy, bias, sensitivity, completeness, compatibility, and representativeness.

A limited review (minimum 20 percent) of the following laboratory QC data results will be conducted:

- Laboratory material sources/material sources data (MS/MSD) and/or matrix duplicate results
- Laboratory surrogate recoveries
- Laboratory check samples

If, based on this limited review the QC data results indicate potential data quality problems, further evaluations will be conducted.

6.3 RECONCILIATION AND USER REQUIREMENTS

The Data QA Manager will prepare a technical memorandum for each data package describing the results of the data review and describing any qualifiers that were added to the data. The technical memorandum will include recommendations on whether additional actions such as re-sampling are necessary. The technical memorandum will be submitted with the technical report.

7. SCHEDULE

The project schedule is provided below in Table 7-1.

Table 7-1. Schedule

Work Element	Complete or Submitted By
Interim Action (Soil Excavation and Place Cap)	September 15, 2008
RI/FS Field Work	July 15, 2009
IA Memorandum	November 17, 2008
1st Quarter Groundwater Sampling	October 15, 2008
1st Quarter Groundwater Monitoring Report	December 1, 2008
2nd Quarter Groundwater Sampling	January 15, 2009
2nd Quarter Groundwater Monitoring Report	March 2, 2009
3rd Quarter Groundwater Sampling	April 16, 2009
3rd Quarter Groundwater Monitoring Report	June 1, 2009
4th Quarter Groundwater Sampling	July 15, 2009
Draft RI/FS Report	October 1, 2009
Draft Final RI/FS Report	30 days after Ecology's written comments on Draft RI/FS are received
Final RI/FS Report	30 days after Ecology's written comments on Draft Final RI/FS are received
Draft Cleanup Action Plan	30 days after Ecology approves the Final RI/FS Report (paper and electronic format)

8. REFERENCES

Ecology. 1994. Natural Background Soil Metals Concentrations in Washington State. Publication # 94-115. October.

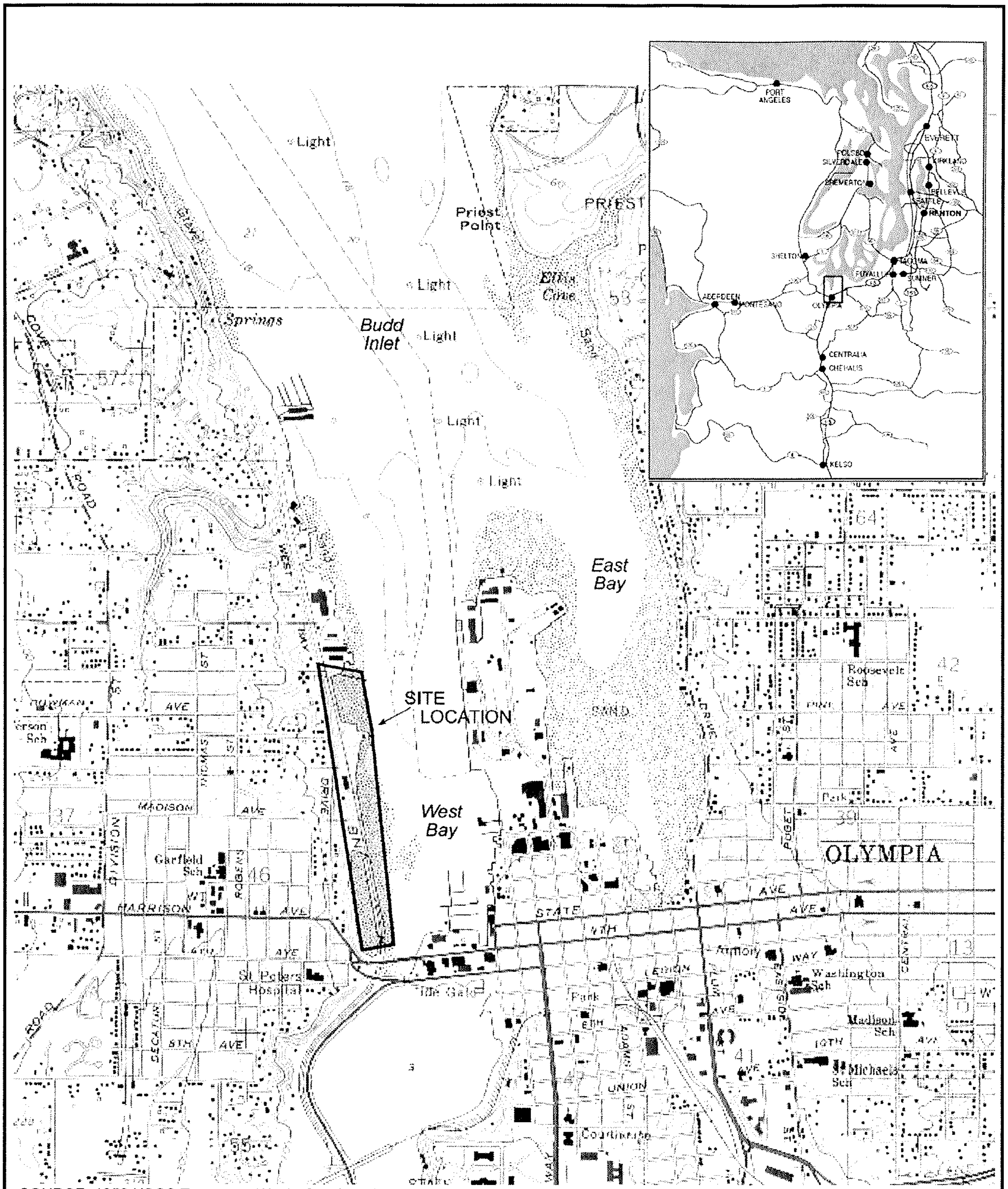
EPA. 2001. Guidance on Environmental Data Validation and Verification. EPA QA/G-8.

EPA. 2000. Data Quality Objectives Process, EPA QA/G-4, Final. August.

Parametrix 2004a. West Bay Phase I Environmental Site Assessment, Port of Olympia Property. Prepared for the City of Olympia. June.

Parametrix. 2004b. West Bay Phase II Environmental Site Assessment. Prepared for the City of Olympia Parks, Arts, and Recreation Department. June.

Parametrix. 2007. West Bay Rail Spur Phase II Environmental Site Assessment. Prepared for the City of Olympia Parks, Arts, and Recreation Department. August.



SOURCE: 1959 USGS Tumwater, Wash. Quadrangle

Parametrix DATE: Jan 18, 2008 FILE: BR1577024P03T01F-01

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Figure 1
West Bay Park Property
Olympia, Washington
Site Location Map

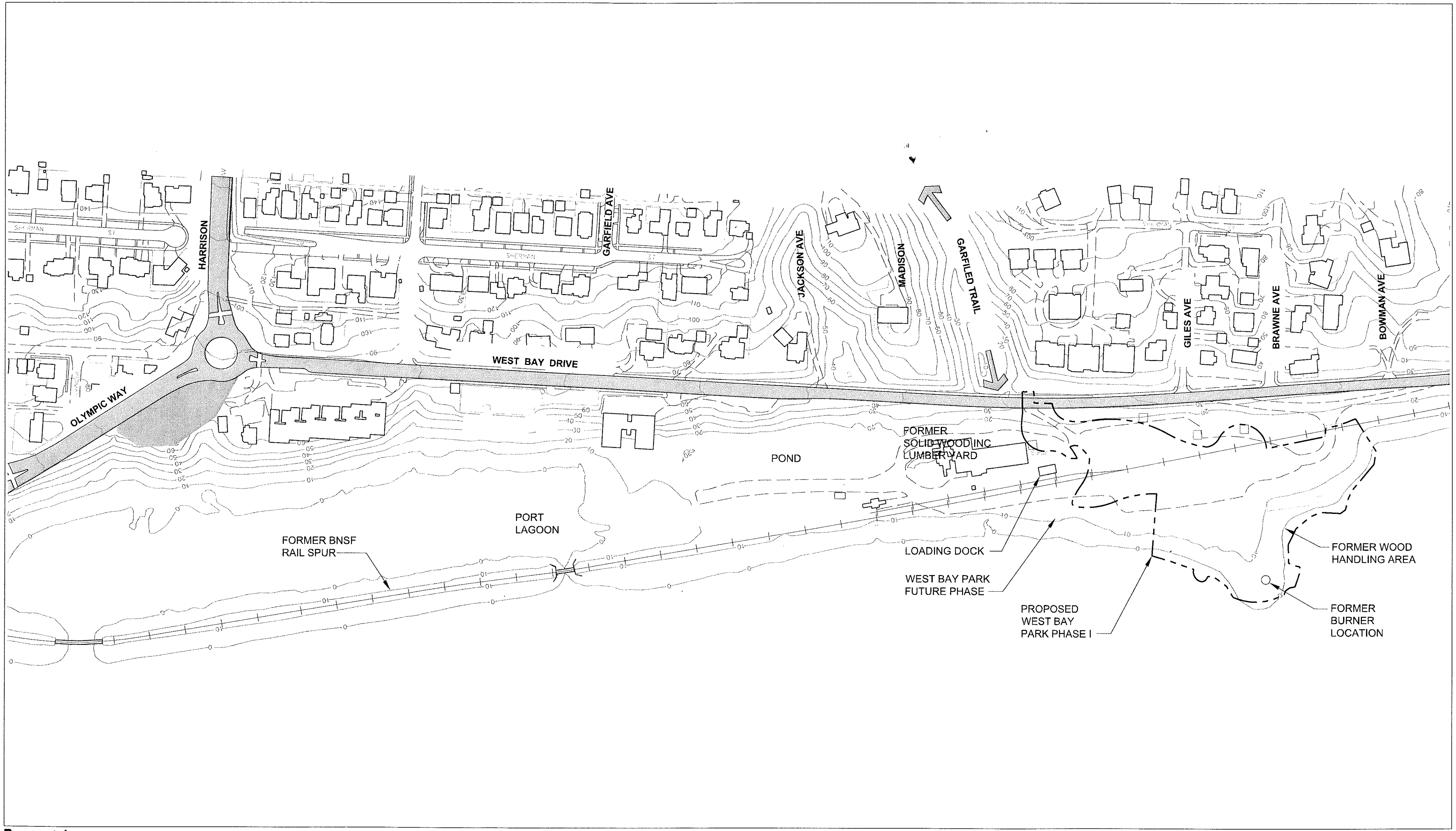

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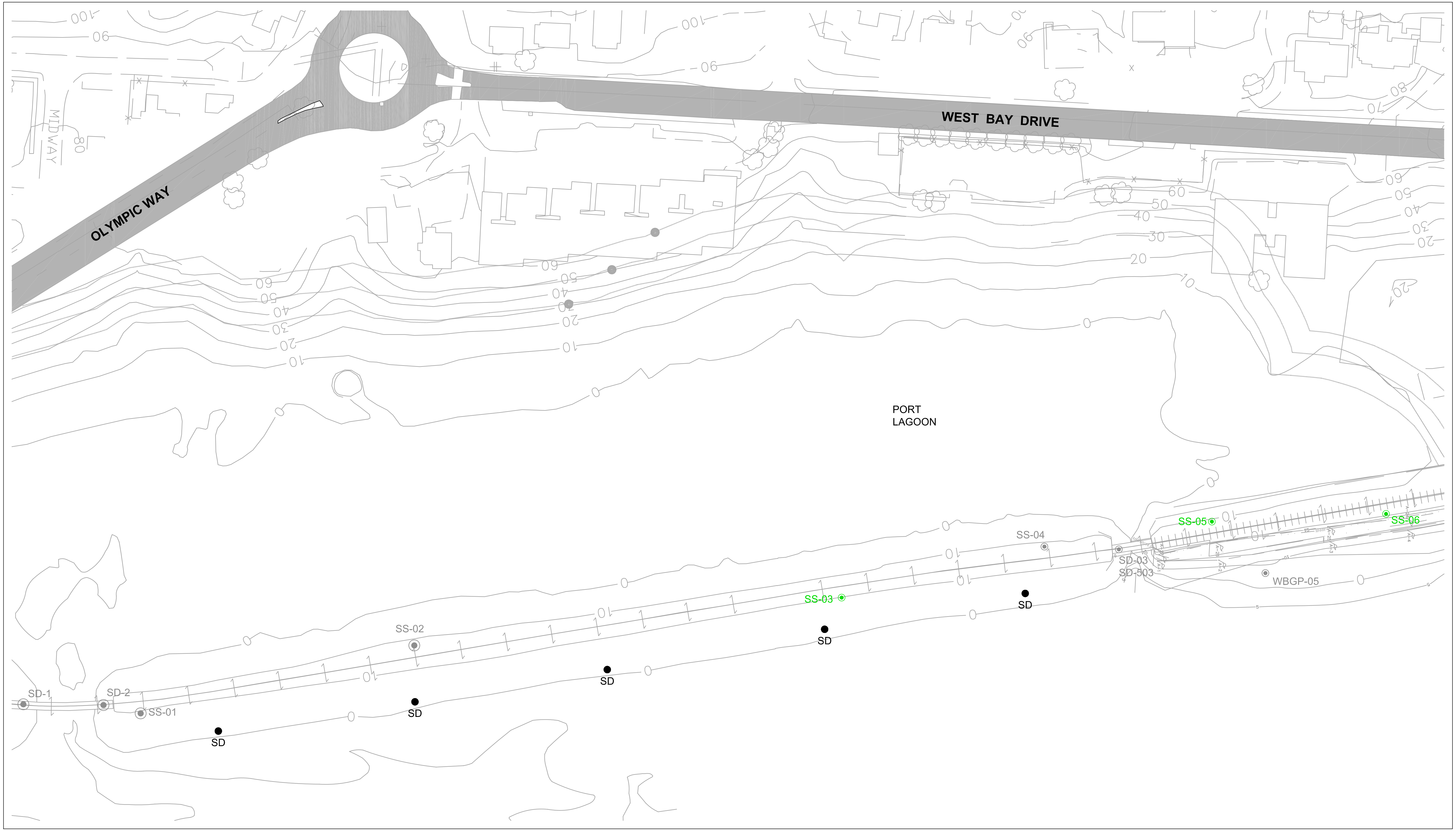
Figure 2
West Bay Park Property
Site Plan



Parametrix DATE: 5/1/2008 2:03 PM FILE: BR1577024P03T01F-06

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LEGEND

WBGP◉ 2004 GEOPROPE SAMPLING LOCATIONS

◉ 2007 PHASE II ESA SAMPLING LOCATION

● PROPOSED RI/FS SAMPLE LOCATION

SD SEDIMENT SAMPLING LOCATION

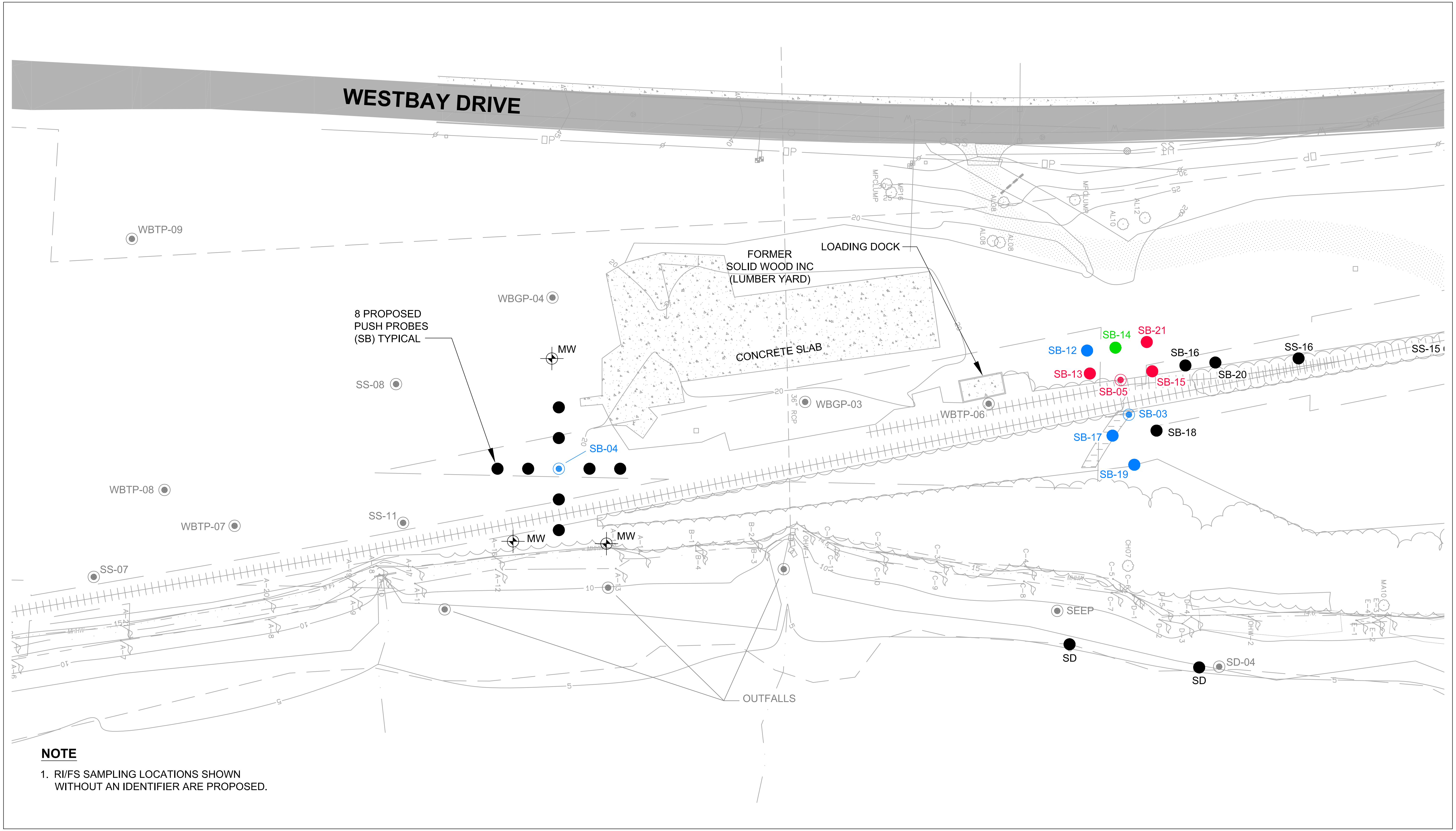
SS SURFACE SOIL SAMPLING LOCATION

◉ SOIL CONCENTRATIONS EXCEED MTCA CLEANUP LEVELS

NOTE

1. RI/FS SAMPLING LOCATIONS SHOWN WITHOUT AN IDENTIFIER ARE PROPOSED.

Figure 3
Solid Wood Incorporated Site
(West Bay Park)
Olympia, Washington
Phase II ESA and RI/FS Sample Locations
Southern Site Area



NOTE

1. RI/FS SAMPLING LOCATIONS SHOWN WITHOUT AN IDENTIFIER ARE PROPOSED.

Parametrix DATE: 03/19/08 09:06am FILE: BR1577024P03T01F-07

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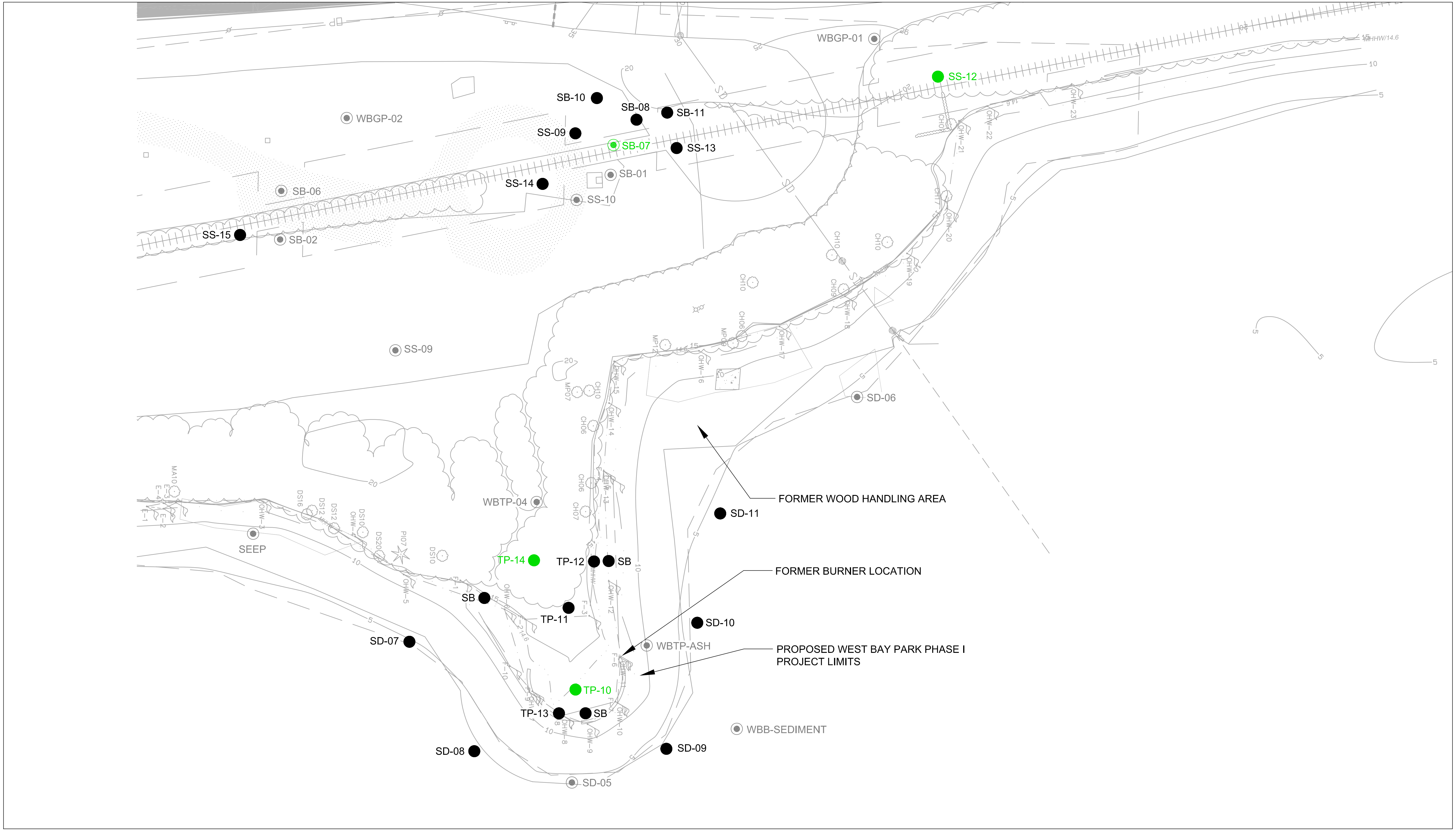
LEGEND

WBGP ◉	2004 GEOPROPE SAMPLING LOCATIONS
WBTP ◉	2004 TEST PIT SAMPLING LOCATION
OUTFALL/SEEP ◉	2004 SEDIMENT AND SURFACE WATER SAMPLING LOCATION
◉	2007 PHASE II ESA SAMPLING LOCATION
●	RI/FS SAMPLING LOCATION (PROPOSED OR COMPLETED)
⌖	PROPOSED MONITORING WELL
◉ ●	GROUNDWATER CONCENTRATIONS EXCEEDED MTCA CLEANUMP LEVELS
◉ ●	SOIL CONCENTRATIONS EXCEED MTCA CLEANUP LEVELS
●	SOIL AND GROUNDWATER CONCENTRATIONS EXCEED MTCA CLEANUP LEVELS

SD	SEDIMENT SAMPLING LOCATION
SS	SURFACE SOIL SAMPLING LOCATION
SB	SOIL BORING LOCATION
TP	TEST PIT LOCATION

Figure 4
Solid Wood Incorporated Site
(West Bay Park)
Olympia, Washington
Phase II ESA and RI/FS Sample Locations
Central Site Area



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LEGEND

WBGP◉ 2004 GEOPROBE SAMPLING LOCATIONS

WBTP◉ 2004 TEST PIT SAMPLING LOCATION

OUTFALL/SEEP◉ 2004 SEDIMENT AND SURFACE WATER SAMPLING LOCATION

◉ 2007 PHASE II ESA SAMPLING LOCATION

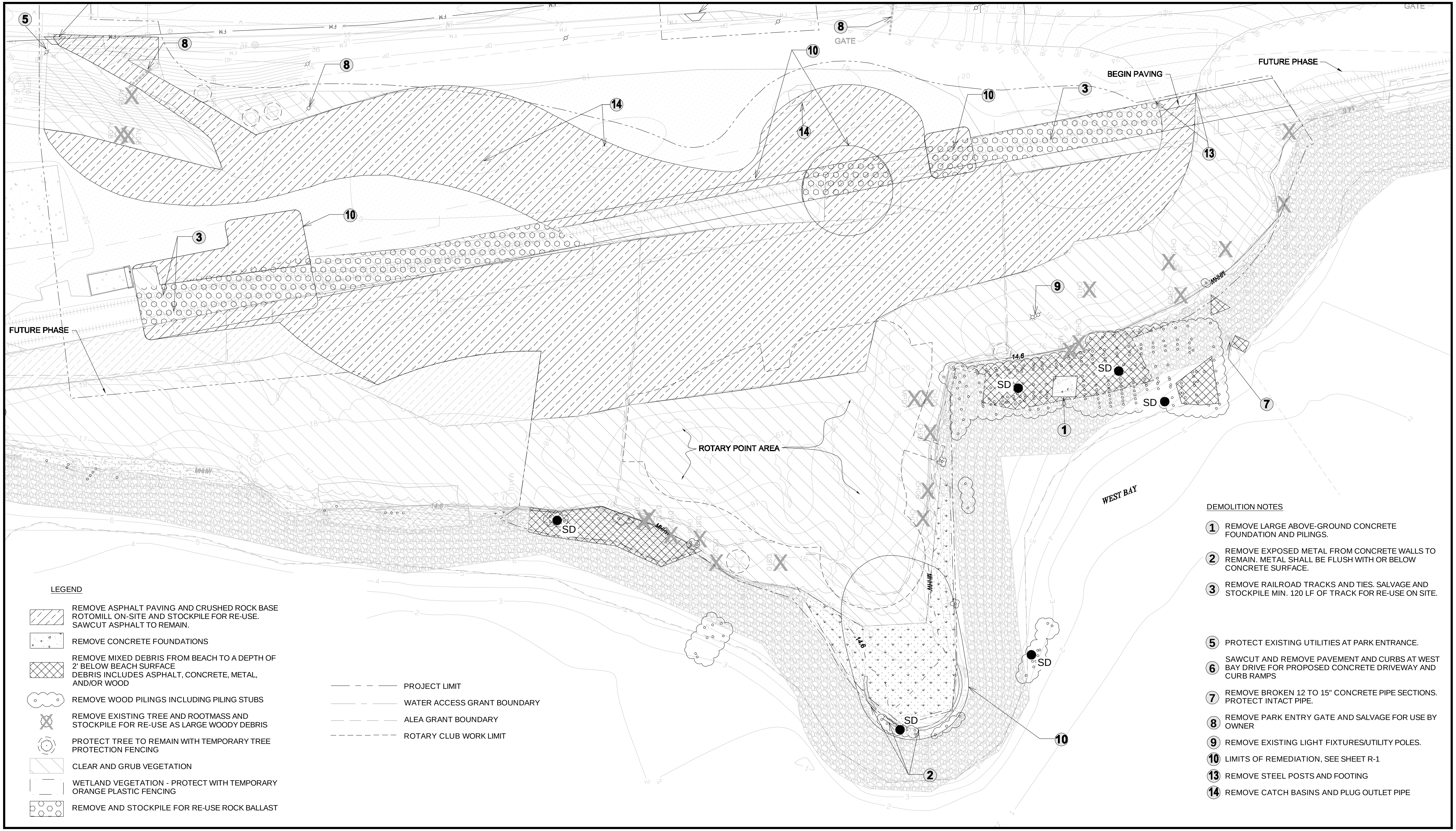
● RI/FS SAMPLING LOCATION (PROPOSED OR COMPLETED)

⌖ PROPOSED MONITORING WELL

◉ ● SOIL CONCENTRATIONS EXCEED MTCA CLEANUP LEVELS

SD	SEDIMENT SAMPLING LOCATION
SS	SURFACE SOIL SAMPLING LOCATION
SB	SOIL BORING LOCATION
TP	TEST PIT LOCATION

Figure 5
Solid Wood Incorporated Site
(West Bay Park)
Olympia, Washington
Phase II ESA and RI/FS Sample Locations
Northern Site Area



Parametrix DATE: May 28, 2008 FILE: BR1577024P03T01F-08

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NOTE

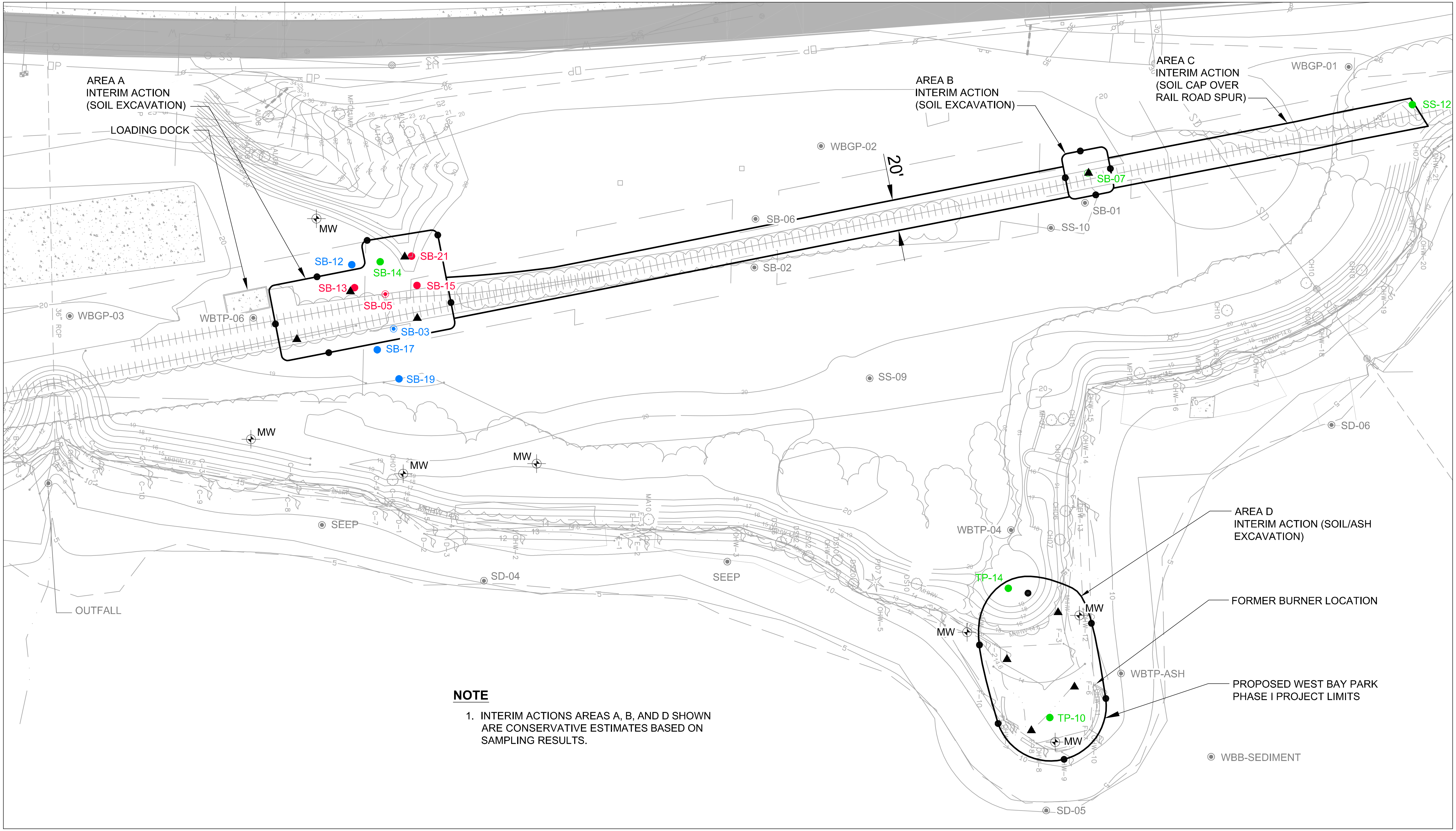
1. SOURCE: REPRODUCTION OF DRAFT PROJECT DEMOLITION AND CLEARING PLAN BY ANCHOR ENVIRONMENTAL.

LEGEND

● PILING SEDIMENT SAMPLING STATION

Figure 6
Piling Sampling Locations

P:\CAD\1577- West Bay\1577-Olympia, City of\1235-1577-024 West Bay Rail Spur\Phase 03\Task 01\Figures\BR1577024P03T01F-08.dwg, 5/28/2008 2:41:38 PM, AcroPlot.pc3



NOTE

1. INTERIM ACTIONS AREAS A, B, AND D SHOWN ARE CONSERVATIVE ESTIMATES BASED ON SAMPLING RESULTS.

Parametrix DATE: 03/19/08 09:06am FILE: BR1577024P03T01F-09

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LEGEND

MW ⌖	PROPOSED MONITORING WELL
●	PROPOSED CONFIRMATION SOIL SIDEWALL SAMPLE LOCATION
▲	PROPOSED CONFIRMATION SOIL BOTTOM SAMPLE LOCATION
—	INTERIM ACTION AREA FOOTPRINT
◉ ●	GROUNDWATER CONCENTRATIONS EXCEEDED MTCA CLEANUMP LEVELS
◉ ●	SOIL CONCENTRATIONS EXCEED MTCA CLEANUP LEVELS
●	SOIL AND GROUNDWATER CONCENTRATIONS EXCEED MTCA CLEANUP LEVELS

Figure 7
Solid Wood Incorporated Site (West Bay Park)
Olympia, Washington
Interim Action Areas