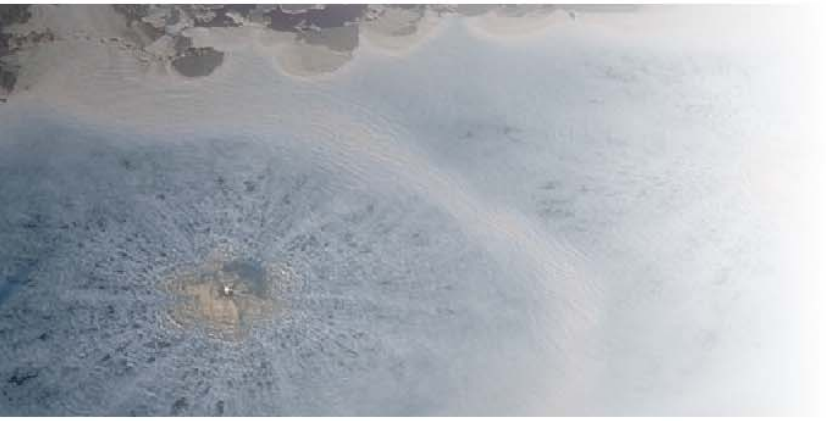

Compliance Monitoring Work Plan Port of Tacoma Parcel 88

Prepared for
Port of Tacoma

May 30, 2013
17652-00

HARTCROWSER

Compliance Monitoring Work Plan
Port of Tacoma Parcel 88

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Prepared by
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FIGURES

COMPLIANCE MONITORING WORK PLAN
PORT OF TACOMA/PARCEL 88
PIERCE COUNTY, WASHINGTON
1621 MARINE VIEW DRIVE, TACOMA, WA 98422

1.0 INTRODUCTION

We prepared this compliance monitoring work plan pursuant to the May 22, 2013, Agreed Order No. DE 9745 between the Port of Tacoma (Port) and the Washington State Department of Ecology (Ecology). This work plan lays out a monitoring program to confirm that the Port's cleanup of Parcel 88 (Site) has resulted in the reduction of contaminants in groundwater to below cleanup levels. The Cleanup Action Plan (CAP) for the Site (Ecology 2013) describes the Site and the Port's cleanup, presents the cleanup levels that have been adopted for the Site, and outlines requirements for compliance monitoring.

This work plan meets the requirements of WAC 173-340-410. It includes the elements a sampling and analysis plan required by WAC 173-340-820, describes the quality assurance and quality control (QA/QC) measures that will be implemented, and provides a schedule for the monitoring rounds and reports.

Figure 1 shows the location of the Site.

2.0 BACKGROUND

Pre-cleanup groundwater sampling at the Site indicated that metals at two monitoring stations, P-1 and MW-109, exceeded cleanup levels. Figure 2 shows the locations of these stations. At P-1, mercury was detected at 0.054 ug/L; this exceeded the cleanup level of 0.025 ug/L. At MW-109, copper was detected at 4 ug/L; this exceeded the cleanup level of 3.1.

Post-cleanup groundwater sampling to date indicates that the Port's cleanup addressed these exceedances. This is because results of the initial post-cleanup sampling of monitoring wells MW-201 and -202 did not exceed cleanup levels for mercury and copper. The samples from MW-201 and -202 were collected on October 12, 2012, and results were presented in the Remedial Investigation/Feasibility Study (RI/FS) (Hart Crowser 2013).

Compliance monitoring wells MW-201 and -202 were installed after the cleanup. The pre-cleanup monitoring stations, including P-1 and MW-109, had been decommissioned as part of the cleanup. As shown on Figure 2, MW-201 was installed at the former location of P-1. Well MW-202 was installed just

downgradient from the former location of MW-109, between that well and the shore, to monitor groundwater conditions near the point of discharge into surface water.

3.0 MONITORING APPROACH

As described in the CAP, compliance monitoring is intended to confirm that the Port's cleanup has resulted in the reduction of contaminants in groundwater to below cleanup levels. To do this, the CAP requires that MW-201 and -202 be sampled periodically until contaminant concentrations remain below cleanup levels for four consecutive rounds. In addition to copper and mercury, the CAP requires that the wells also be monitored for arsenic, lead, zinc, and diesel- and oil-range petroleum hydrocarbons.

The groundwater cleanup levels for metals established in the CAP are based on protection of aquatic life in surface water and are as follows:

- Arsenic (dissolved): 36 ug/L
- Copper (dissolved): 2.4 ug/L
- Lead (dissolved): 8.1 ug/L
- Mercury (total): 0.025 ug/L
- Zinc (dissolved): 81 ug/L

The CAP does not establish a numeric cleanup level for petroleum hydrocarbons. Instead, it references a narrative criterion for protection of surface water that prohibits the formation of a sheen on the water surface.

4.0 REPORTING AND SCHEDULE

As mentioned above, the first compliance monitoring round was conducted in October 2012 and documented in the RI/FS. We will begin the second groundwater monitoring round within 30 days of Ecology's approval of this compliance monitoring work plan. Subsequent rounds will be conducted at approximately three-month intervals. Our tentative schedule for the next three rounds is:

- Round 2: June 2013
- Round 3: September 2013
- Round 4: December 2013

We will extend the quarterly sampling program if results of the first four rounds do not meet cleanup levels. In that case, we would submit a proposed schedule for the additional sampling to Ecology for review and approval.

Data reports will be submitted to Ecology within 45 days after each quarterly round. Each report will present cumulative data from the preceding rounds. A comprehensive summary report will be submitted within 60 days after the final round, after four "clean" quarters have been documented. Analytical results will also be uploaded to Ecology's Environmental Information Management database after each round.

5.0 PROJECT TEAM AND RESPONSIBILITIES

Key staff members and their project functions are listed below.

- Leslee Conner, Port of Tacoma Project Manager
- Mark Dagel, Hart Crowser Project Manager
- Roger McGinnis, Project Chemist
- Field Geologist/Engineer – To Be Determined

Chemical analysis will be performed by Analytical Resources, Inc. (ARI), located in Tukwila, Washington. ARI is accredited by the State of Washington for the proposed analytical methods. The ARI project manager will be Kelly Bottem.

6.0 FIELD SAMPLING METHODS

6.1 Groundwater Monitoring

Monitoring wells MW-201 and -202 will be sampled during each quarterly round. The wells will be purged and sampled using a peristaltic pump and low-flow methodology. Before sampling, wells will be purged until field measurements of pH, temperature, electrical conductivity, and dissolved oxygen stabilize. To minimize the potential diluting effect of tidally influenced surface water on the groundwater samples, the wells will be sampled during the falling tide.

Samples will be analyzed for arsenic, copper, lead, mercury, zinc, and petroleum hydrocarbons (diesel- and heavy oil-range).

- Samples for arsenic, copper, lead, and zinc analysis will be field filtered at 0.45 microns to allow comparison with surface-water-based cleanup levels, which are based on dissolved constituents.

- Mercury samples will be analyzed for total (unfiltered) mercury to allow comparison with surface-water-based cleanup levels, which are based on total mercury.

- Total petroleum hydrocarbon (TPH) samples will not be filtered and will be analyzed for diesel- and heavy oil-range fractions (DRO and ORO). TPH analysis will include silica-gel cleanup to reduce potential errors caused by naturally occurring organics (from wood waste) in groundwater.

6.2 Equipment Decontamination Procedures

Precleaned or disposable equipment will be used for all groundwater sampling to eliminate the need for decontamination.

6.3 Investigation-Derived Waste Management

Non-hazardous solid waste, including personal protective equipment (e.g., gloves), paper towels, and other disposable materials will be double-bagged in heavy-duty garbage bags, sealed with duct tape, and disposed of as solid waste in a municipal landfill. Results of the October 2012 sampling round indicates that constituents in groundwater from MW-201 and -202 are far below levels that would require management as dangerous waste. Therefore, well purge water will be discharged to the ground surface near the wells following sample collection and allowed to infiltrate.

6.4 Sample Containers and Labels

Samples will be collected in pre-cleaned, pre-preserved (as appropriate) laboratory glass jars. Sample containers shall be cleaned following the requirements described in OSWER Directive 92.0-05a, Specifications and Guidance for Contaminant-Free Sample Containers (EPA 1992).

Sample jars will be labeled with the sample name, date, time, sampler initials, and required analysis.

6.5 Field Documentation

Field notes will be maintained during sampling and processing operations. The following will be included in the field notes:

- Site name and location;
- Date and time;
- Names of the person collecting the samples;
- Weather conditions;
- Date, time, and identification of each sample, including number of jars and tests requested;
- Details of sample collection, including GPS coordinates and sample depths; actual sampling point locations will be recorded on a site map;
- Any deviation from the approved SAP; and
- General observations.

7.0 SAMPLE HANDLING PROCEDURES

7.1 Sample Preservation and Holding Times

Samples will be placed on ice after collection and cooled to below 6°C. Metals samples will be collected in sample containers pre-preserved with nitric acid. TPH samples will be collected in sample containers pre-preserved with hydrochloric acid. The holding times for sample extraction and analysis are 28 days for mercury and 6 months for the other metals. TPH samples must be extracted with in 14 days and analyzed within 40 days.

7.2 Chain of Custody Procedures

Sample custody procedures will be followed to provide a documented record that can be used to follow possession and handling of a sample from collection through analysis. A sample is considered to be in custody if it meets at least one of the following conditions:

- The sample is in someone's physical possession or view;
- The sample is secured to prevent tampering (i.e., custody seals); and/or
- The sample is locked or secured in an area restricted to authorized personnel.

A chain of custody form will be completed in the field as samples are packaged. At a minimum, the information on the custody form shall include the sample number, date and time of sample collection, sampler, analysis, and number of containers. Two copies of the custody form will be placed in the cooler before sealing for delivery to the laboratory with the respective samples. The other copy will be retained and placed in the project files after review by the Project Chemist or Hart Crowser Project Manager. Custody seals will be placed on

each cooler or package containing samples so the package cannot be opened without breaking the seals.

7.3 Delivery of Samples to Analytical Laboratory

After sample containers have been filled, they will be packed on ice in coolers. The coolers will be transferred to ARI in Tukwila, Washington, for chemical analysis. Specific procedures are as follows:

- Samples will be packaged and shipped in accordance with U.S. Department of Transportation regulations as specified in 49 CFR 173.6 and 49 CFR 173.24.
- Individual sample containers will be packed to prevent breakage.
- The coolers will be clearly labeled with sufficient information (name of project, time, and date container was sealed, person sealing the cooler, and the Hart Crowser office name and address) to enable positive identification.
- A sealed envelope containing custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- Signed and dated custody seals will be placed on all coolers before shipping.
- Samples will either be shipped by courier or will be hand delivered to the laboratory by Hart Crowser personnel.
- Upon transfer of sample possession to the testing laboratories, the custody form will be signed by the persons transferring custody of the coolers. Upon receipt of samples at the laboratory, the shipping container custody seal will be broken and the laboratory sample-receiving custodian will compare samples to information on the chain of custody form and record the condition of the samples received.

8.0 LABORATORY ANALYTICAL METHODS

Samples will be submitted to ARI located in Tukwila, Washington, and analyzed using the following methods:

- Dissolved metals (arsenic, copper, lead, and zinc) by EPA Method 200.8
- Total and dissolved mercury by EPA Method 7470A

- TPH by NWTPH-Dx (extended), with silica gel cleanup

9.0 QUALITY ASSURANCE AND QUALITY CONTROL

A quality assurance data validation review will be performed on all analytical sample results. Validated data will be entered into Ecology's Environmental Information Management (EIM) system. Sampling results and laboratory data will be compiled and compared to cleanup levels. Sampling locations, procedures, and analytical methods are discussed in subsequent sections of this work plan.

The quality of laboratory measurements will be assessed by reviewing results for analysis of method blanks, matrix spikes, duplicate samples, laboratory control samples, instrument calibrations, performance evaluation samples, interference checks, etc., as specified in the analytical methods to be used. The following general procedures will be followed:

- Laboratory blank measurements at a minimum frequency of 5 percent or one per batch of 20 samples or fewer;
- Matrix spike analysis to assess accuracy at a minimum frequency of 5 percent or one per batch of 20 samples or fewer; and
- Matrix duplicate analysis to assess precision at a minimum frequency of 5 percent or one per batch of 20 samples or fewer.

9.1 Data Quality Indicators

The overall quality assurance objectives for this sampling event are to produce data of known and appropriate quality. The procedures and quality control checks specified herein will be used so that known and acceptable levels of accuracy and precision are maintained for each data set. This section defines the objectives for accuracy and precision for measurement data. These goals are primarily expressed in terms of acceptance criteria.

9.1.1 Precision

Precision is the degree of reproducibility or agreement between independent or repeated measurements. Analytical variability will be expressed as the relative percent difference (RPD) between laboratory replicates. RPD will be used to measure precision for this investigation and is defined as follows:

$$RPD = \frac{(D_1 - D_2)}{(D_1 + D_2)/2} \times 100$$

Where,

D_1 = Sample value
D_2 = Duplicate sample value

9.1.2 Accuracy

Accuracy is the agreement between a measured value and its true or accepted value. While it is not possible to determine absolute accuracy for environmental samples, the analysis of standards and spiked samples provides an indirect assessment of accuracy.

Laboratory accuracy will be assessed as the percent recovery of matrix spikes, matrix duplicates, and laboratory control samples. Accuracy will be defined as the percentage recoverable from the true value and is defined as follows:

$$\%Recovery = \frac{(SSR - SR)}{SA} \times 100$$

Where,

SSR = spiked sample result
SR = sample results
SA = amount of spike added

9.1.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Care has been taken in the design of the sampling program to confirm sample locations are selected properly, sufficient numbers of samples are collected to accurately reflect conditions at the site, and samples are representative of sampling locations.

9.1.4 Completeness

Completeness is the percentage of measurements made that are judged to be valid. Results must also contain all quality control check analyses required to verify the precision and accuracy of results to be considered complete. Data

qualified as estimated during the validation process will be considered valid for the purpose of assessing completeness. Nonvalid measurements will be results that are rejected during the validation review or samples for which no analytical results were obtained. Completeness will be calculated for each analysis using the following equation:

$$\text{Completeness} = \frac{\text{valid data points obtained}}{\text{total data points planned}} \times 100$$

The target goal for completeness is a minimum of 95 percent. Completeness will be monitored on an ongoing basis so that archived sample extracts can be reanalyzed, if required, without remobilization.

9.1.5 Comparability

Comparability is the degree to which data from separate data sets may be compared. For instance, sample data may be compared to data from background locations, to established criteria or guidance, or to data from earlier sampling events.

Sample collection will be performed in a consistent manner by field personnel at all sampling locations to verify all data collected as part of this study are comparable. Comparability is attained by careful adherence to standardized sampling and analytical procedures, based on rigorous documentation of sample locations (including depth, time, and date).

The use of standardized methods to collect and analyze samples, along with laboratory instrument calibration against National Institute for Standards and Technology (NIST) and US EPA traceable standards will also confirm comparability.

Comparability also depends on other data quality characteristics. Only when data are judged to be representative of the environmental conditions, and when precision and accuracy are known, can data sets be compared with confidence.

9.2 Data Quality Assurance Review

A project chemist at Hart Crowser will perform an independent data quality review of the chemical analytical results provided by ARI. This review will assess the adequacy of the reported detection limits in achieving the project screening levels; the precision, accuracy, representativeness, and completeness of the data;

and the usability of the analytical data for project objectives. Exceedances of analytical control limits will be summarized and evaluated.

The data evaluation review will be performed on all results using QC summary sheet results provided by the laboratory for each data package. The data evaluation review is based on the Quality Control Requirements previously described and follows the format of the EPA National Functional Guidelines for Inorganic (EPA 2010) Superfund Data Review. Raw data (instrument tuning, calibrations, instrument printouts, bench sheets, and laboratory worksheets) will be requested from the laboratory for review, if required, to resolve problems or discrepancies discovered during the routine evaluation. The following is an outline of the data evaluation review format:

- Verify that sample numbers and analyses match the chain of custody request;
- Verify sample preservation and holding times;
- Verify that instrument tuning, calibration, and performance criteria were achieved;
- Verify that laboratory blanks were performed at the proper frequency and that no analytes were present in the blanks;
- Verify that laboratory duplicates, matrix spikes, and laboratory control samples were run at the proper frequency and that control limits were met; and
- Verify that required detection limits have been achieved.

Data qualifier flags, beyond any applied by the laboratory, will be applied to sample results that fall outside the QC acceptance criteria by the Hart Crowser project chemist based on professional judgment and in accordance with the EPA guidance document (EPA 2010). An explanation of data qualifiers to be applied during the review is provided below:

U The compound was analyzed for but was not detected. The associated numerical value is the sample reporting limit.

J The associated numerical value is an estimated quantity because QC criteria were slightly exceeded.

UJ The compound was analyzed for, but not detected. The associated numerical value is an estimated reporting limit because QC criteria were not met.

R Data are not usable because of significant exceedance of QC criteria. The analyte may or may not be present; resampling and/or reanalysis would be necessary to obtain usable data.

10.0 DATA ANALYSIS AND REPORTING

Each laboratory data report will include the following:

- Case narrative identifying the laboratory analytical batch number, matrix and number of samples included, analyses performed and analytical methods used, and description of any problems or exceedance of QC criteria and corrective action taken. The laboratory manager or their designee must sign the narrative.

- Copy of chain of custody forms for all samples included in the analytical batch.

- Tabulated sample analytical results with units, data qualifiers, percent solids, sample weight or volume, dilution factor, laboratory batch and sample number, Hart Crowser sample number, and dates sampled, received, extracted, and analyzed all clearly specified.

- Summary of QC results with calculated percent recovery and relative percent differences when applicable.

- Electronically formatted data deliverable results.

11.0 REFERENCES

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US EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review. EPA-540-R-10-011, January 2010.

Hart Crowser 2013. Remedial Investigation/Feasibility Study, Port of Tacoma Parcel 88, 1621 Marine View Drive, Tacoma, Washington. Prepared for Port of Tacoma. February 15, 2013.

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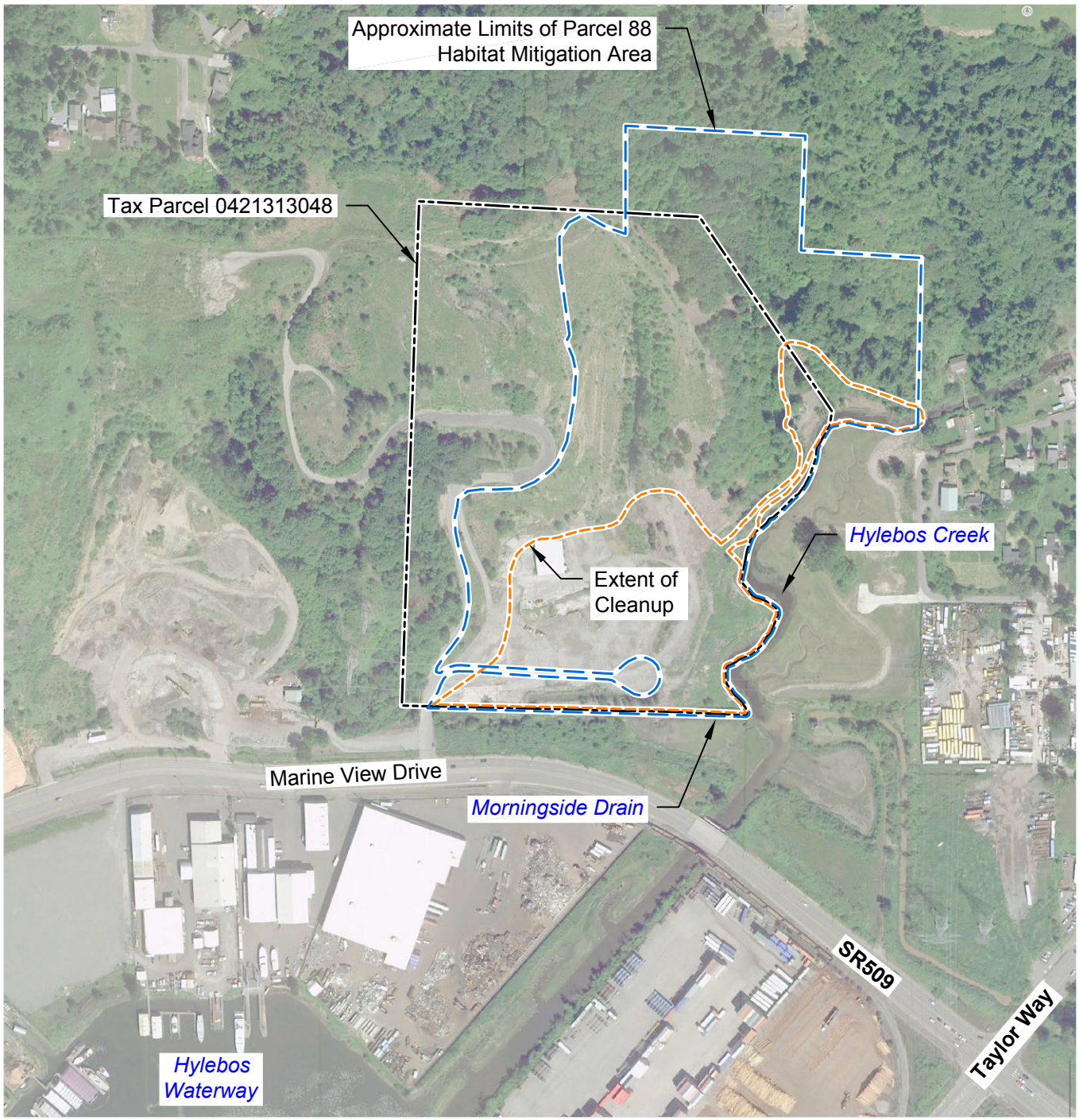

Source: **Base map prepared from Google Earth Pro, 2010.**

N

0 400 800

Scale in Feet

Port of Tacoma Parcel 88, Compliance Monitoring Plan
Tacoma, Washington

Vicinity Map

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Figure
1

EAL 05/20/13 1765200-CMP-001.dwg

Exploration Location and Number

MW-201 Compliance Monitoring Well

MW-101S Pre-Cleanup Monitoring Well

MW-101D Pre-Cleanup Monitoring Well - Deep

P-1 Pre-Cleanup Push Probe (grab groundwater sample)

9.3 Dissolved metals concentrations in µg/L

Pre-cleanup groundwater concentrations below cleanup levels.

Pre-cleanup groundwater concentrations exceeded cleanup levels.

Metal	Groundwater Cleanup Level (ug/L)
Arsenic	36
Copper	3.1
Lead	8.1
Mercury	0.025
Zinc	81

Metals Contamination Area

Tidal Channel

P-10

P-8

Unpaved Roadway

Creek

Hylebos

MW-108

MW-1

MW-202

MW-107

MW-109

Cu 4

P-7

Main Fill Area

MW-105

P-2

P-4

MW-104

MW-101S

MW-101D

Tidal Channel

MW-103

MW-106

Tidal Channel

P-9

P-3

MW-2

P-5

MW-201

MW-102

P-1

Hg 0.054

BPA Access Road

P-6

Morningside Drain

N

0 100 200

Scale in Feet

Notes:

1. Results shown are maximum values from 7/09 and 11/09 sampling events.
2. Post-cleanup topography shown.
3. Vertical datum is MLLW.

Port of Tacoma Parcel 88, Compliance Monitoring Plan
Tacoma, Washington

Pre-Cleanup Groundwater Exceedances and Compliance Monitoring Wells

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Figure 2

EAL 05/20/13 1765200-CMP-002.dwg