APPENDIX A

Sampling and Analysis Plan

Appendix A Contents

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A1 Introduction

This Sampling and Analysis Plan (SAP) has been prepared for the Alexander Avenue Petroleum Tank Facilities Site (Site). This SAP is Appendix A to the Work Plan for a Remedial Investigation/Feasibility Study (RI/FS) Work Plan to meet the requirements of Agreed Order No. DE 9835 (Agreed Order) between the Washington State Department of Ecology (Ecology), Mariana Properties, Inc. (Mariana), and the Port of Tacoma (Port). The Agreed Order was executed on October 3, 2013.

The purpose of this SAP is to ensure that field sample collection, handling, and laboratory analysis conducted during the RI/FS will generate data to meet project-specific data quality objectives (DQOs) in accordance with the Model Toxics Control Act (MTCA) requirements (WAC 173-340-350). This SAP comprises two major components: a Field Sampling Plan (FSP) defining field protocols and a Quality Assurance Project Plan (QAPP) defining analytical protocols. It is the responsibility of the Aspect Consulting, LLC (Aspect) personnel and subcontracted analytical laboratory personnel performing the RI/FS sampling and analysis activities to adhere to the requirements of the FSP and QAPP.

The FSP and QAPP are presented below in Section A2 and Section A3, respectively.

A2 Field Sampling Plan

Field investigation and sampling procedures to be followed during the RI/FS are described in the following sections. Specific sample locations and chemical analysis are provided in Section 9 of the Work Plan and summarized in Table A-1. Explorations will be located in the field using field GPS equipment and the survey coordinates of proposed explorations are included in Table A-1. Exploration locations may be adjusted in the field based on the presence of utilities, structures, or other obstructions that may be encountered.

A2.1 Soil Borings and Soil Sampling

Soil sampling will be conducted during the RI to address existing data gaps related to the nature and extent of soil contamination at the Site. The specific soil sample locations, depths, and chemical analyses are provided in Section 9 of the Work Plan. The following subsections detail the procedures for soil sample collection, handling, identification, and sample quality assurance/quality control (QA/QC).

Aspect will subcontract with a Washington-licensed resource protection well driller to complete soil borings in accordance with requirements of Chapter 173-160 WAC. Soil borings will be advanced using direct push (i.e., Geoprobe).

Soil borings will be sampled on a continuous basis. Each boring will be advanced to collect samples at depth intervals specified in the Work Plan or as determined by field screening. The direct-push drilling method provides continuous cores of soil, depending

on soil recovery, returned within disposable 1.5-inch-diameter plastic liners (4-foot or 5-foot lengths). The liners are sliced longitudinally and opened to access the soil core.

In order to minimize carry down of any contaminants located near the water table, all direct push drilling will be conducted using a dual-tube drilling system. In a dual tube drilling system, the outer core barrel remains in place while extracting soil cores or groundwater drive point screens.

A2.1.1 Soil Sample Collection and Handling Procedures

An Aspect geologist will oversee the drilling activities and preparation of a geologic log for each of the explorations completed. The field representative will visually classify the soils in accordance with American Society for Testing and Materials (ASTM) Method D 2488 and record soil descriptions, field screening results, and other relevant details (e.g., staining, debris, odors, etc.) on the boring log form. If samples are collected for chemical analysis, the sample ID and depth will also be recorded on the log.

In addition to soil classification, the field representative will screen the soil core in multiple locations (depths) using a photoionization detector (PID) to monitor for the presence of volatile organic compounds (VOCs). A minimum of one PID reading will be recorded for each soil type within each soil core, additional readings will be recorded where elevated PID readings are noted. In areas of known or suspected petroleum contamination, soil samples can also be field-screened for presence of petroleum using a sheen test: placing a small aliquot of soil into a cup containing water, gently shaking, and watching for the presence of petroleum sheen. Care will be taken to differentiate sheen created by petroleum (i.e., iridescent swirl of colors, does coalesce after being disturbed) versus other organic matter (i.e., angular "waxy" sheets", does not coalesce after being disturbed), and recording the information appropriately.

All soil samples to be submitted for VOC analyses will be collected in accordance with U.S. Environmental Protection Agency (USEPA) Method 5035A. The soil aliquot for VOC analysis will be collected from the undisturbed soil sample core using a laboratory-supplied modified disposable plastic syringe as required by USEPA Method 5035A, and placed in pre-weighed laboratory supplied vials.

For all other analyses, the soil samples will be removed from the sampler using a stainless steel spoon and placed in a stainless steel bowl for homogenization with the stainless steel spoon. Gravel-sized material greater than approximately 0.5 inch will be removed from the sample during mixing. A representative aliquot of the homogenized soil will be placed into certified-clean jars supplied by the analytical laboratory.

QC soil samples (e.g., field duplicates, and trip blanks) will be collected at the respective frequencies prescribed in Section A3.5 of this QAPP.

Each soil boring not completed as a monitoring well will be decommissioned with hydrated granular bentonite in accordance with requirements of Chapter 173-160 WAC.

A2.1.2 Soil Sample Identification

Each soil sample collected for chemical analysis will be assigned a unique sample identification number including the boring number (without a hyphen) and the depth from

which the sample was collected. For example, the soil sample collected from boring B-102 at a depth of 7 to 8 feet below ground surface (bgs) would be identified as B102-7-8.

A2.1.3 Groundwater Grab Sample Collection from Soil Borings

During the RI Data Gaps investigation, groundwater grab samples will be collected from direct-push soil borings to determine appropriate locations for permanent groundwater monitoring wells.

The groundwater grab samples will be collected using a decontaminated stainless steel drive point screen. The tip of the sampling tool will be advanced to the lower depth of the desired groundwater sampling interval. The driller will then retract the drive rods 3 or 4 feet, depending on screen length, to expose the groundwater sample screen to the subsurface. Groundwater samples representative of the 15-foot zone and the 25-foot zone will be collected with the screen placed at depths from approximately 8 to 12 feet bgs and 20 to 24 feet bgs, respectively. At the discretion of the field geologist, sample intervals may be adjusted slightly up or down so that groundwater samples will be collected from more permeable soil types where available.

Groundwater sampling will be completed using a peristaltic pump and low-flow sampling techniques. Disposable tubing will be placed down the drive rods to the mid-point of the sample screen. A relatively small volume of water, at least equal to one volume of the tubing, will be pumped from the temporary well. Additional purging will be completed to minimize turbidity of the drive point to the extent practicable, provided that the drive point produces sufficient water for continued purging. Purge water will be collected and containerized along with the drilling decontamination water generated at the end of each work day. Field parameters (temperature, pH, electrical conductance, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) will be measured periodically during the purging process and will be recorded on the boring log at the interval where the sample was collected. Once purging is completed, samples will be collected by directly filling laboratory supplied, pre-cleaned containers.

Sample identification and handling will be performed similar to groundwater samples collected from a monitoring well, as described in Section A2.3.1.

All non-disposable sampling equipment (e.g., drive rods and sampling screens) will be decontaminated before collection of each sample. New disposable tubing will be used at each sampling location and depth.

A2.2 Monitoring Well Installation and Development

A2.2.1 Monitoring Well Installation

Monitoring wells will be constructed by a state-licensed, resource protection well driller in accordance with Chapter 173-160 WAC. An Aspect field geologist will oversee and document installation of each monitoring well, including completion of an As-Built Well Completion Diagram.

New monitoring wells will be constructed with 2-inch-diameter threaded Schedule 40 PVC slotted screen and blank casing. Depending on field conditions, ¾-inch well screens may be used. Well screens will be 0.010-inch (10 slot) slotted screens. New monitoring wells will be completed similar to the existing monitoring well network on the Site; 15-

foot-zone wells will be constructed with 10-foot screens and 25-foot-zone wells will be constructed with 5-foot screens. An artificial filter pack consisting of 20/40 silica sand will be pre-packed around the well screen, and an annular seal consisting of bentonite chips will be placed above the filter pack. A concrete surface seal will be set at grade for each new monitoring well. The finished monitoring wells will be protected with steel flush-mount monument (truck rated), or steel above-ground monument, embedded in the concrete surface seal.

A2.2.2 Monitoring Well Development

Following installation, each new monitoring well will be developed to remove fine-grained material from inside the well casing and filter pack to the extent practical, and to improve hydraulic communication between the well screen and the surrounding water-bearing formation. Each well will be developed until visual turbidity is reduced to minimal levels or until a maximum of 15 casing volumes of water has been removed.

A2.3 Groundwater Sampling

Groundwater samples will be collected from monitoring wells and analyzed as summarized in Table A-2. Groundwater samples will be collected and handled in accordance with the procedures described below:

- Groundwater samples from wells located within 200 feet of the Hylebos Waterway shoreline will be sampled within 2 hours before or 3 hours after a lower low tide. Depending on data objectives, groundwater samples could also be collected at higher tides, but this would be discussed beforehand with Ecology.
- Groundwater sampling at any new or recently developed monitoring wells will not occur within 1 week of development to allow for settling of any suspended solids that may remain inside the well casing.
- The locking well cap will be removed and the depth-to-groundwater will be measured from the surveyed location to the nearest 0.01 foot using an electronic water level measuring device. The depth to the bottom of the monitoring well will also be measured to evaluate siltation of the monitoring well. The water level indicator will be decontaminated between wells.
- The presence of light non-aqueous phase liquid (LNAPL) will be evaluated in all wells screened in the 15-foot zone adjacent to or within the area of LNAPL indicators depicted in Figure 6.5-1 of the Work Plan. LNAPL presence and thickness will be evaluated using an electronic oil/water interface probe. If a measurable thickness of LNAPL is present (i.e., greater than a trace), a groundwater sample will not be collected, but a product sample may be collected for hydrocarbon identification via HCID. The oil/water interface probe will be decontaminated between wells.
- Each monitoring well will be purged at a low-flow rate using a peristaltic pump and dedicated tubing (polyethylene tubing with a short length of silicon tubing through the pump head). VOC loss will be minimized by regulating flowrate to prevent the entrainment of air bubbles in the tubing. The tubing intake will be placed just below the center of the saturated section of well screen. During well purging, field parameters (temperature, pH, specific electrical conductance, DO,

and ORP) will be monitored using a YSI meter and flow-through cell, or equivalent. These field parameters will be recorded at 2- to 5-minute intervals throughout well purging until they stabilize. Stabilization is defined as three successive readings where the parameter values vary by less than 10% (or 0.5 mg/L DO if the readings are below 1 mg/L). However, no more than three well casing volumes will be purged prior to groundwater sample collection. At least one turbidity measurement will be made before collecting the sample.

- Samples with a field-measured specific electrical conductance greater than 1,000 microseimens per centimeter (µS/cm) or turbidity greater than 25 nephelometric turbidity units (NTU) will be denoted as such on the chain-of-custody (COC) form, so that the laboratory can employ appropriate sample preparation techniques to avoid analytical interferences for specific analyses (refer to Section A3.3.2).
- If the monitoring well is completely dewatered during purging, samples will be collected when sufficient recharge has occurred to allow filling of all sample containers.
- Once purging is complete, the groundwater samples will be collected using the same low-flow rate directly into laboratory-supplied sample containers.
- QC groundwater samples (e.g., field duplicates, and trip blanks) will be collected at the respective frequencies prescribed in Section A3.5.1.
- Following sampling, the well cap and monument cap will be secured. Each well's dedicated tubing will be retained in a labeled Ziploc bag for subsequent sampling events. Damaged or defective well caps or monuments will be noted and scheduled for replacement, if necessary.

A2.3.1 Groundwater Sample Identification

Each groundwater sample will be assigned a unique sample identification number that includes the well number (no hyphen) and the 8-digit date on which the sample was collected. For example, a groundwater sample collected from monitoring well MW4-25 on May 30, 2014, would be identified as MW4-25-053014.

A2.4 Sediment Sampling

The field methods for sampling sediment are described below. Field activities will be performed under the direction of Aspect. Assistance with sample collection will be performed by Research Support Services, Inc.

A2.4.1 Location Positioning

Sampling locations identified in Section 9 of the Work Plan will be field-located using the survey coordinates provided in Table A-1 and a Global Positioning Unit (GPS) unit with a horizontal accuracy of within 1 meter. Washington State Plane Coordinate System South coordinates in North American Datum 1983 (NAD83) will be used for the horizontal datum.

A2.4.2 Sediment Sample Collection

Once the sample location has been confirmed, the time of sampling will be recorded, the depth of mudline will be measured[1] and sediment samples will be collected from the upper 10 centimeters (cm; 4 inches) of sediment using either a stainless steel trowel during low tide, for intertidal sample locations, or using a Van Veen power grab sampler for sample locations below mean lower low water (MLLW). The sediment sample collected with a Van Veen sampler is enclosed within the sampler and brought intact to the surface. Surface water overlying the sediment in the sampler will be removed using a siphon.

Sediment samples for VOC analysis will be collected as a discrete aliquot from the Van Veen sampler. Sediment samples for TPH and PAH analysis will be transferred to a stainless steel bowl for homogenization with a stainless steel spoon. Gravel-sized material greater than approximately 0.5 inch will be removed from the sample during mixing by sieving in the field. A representative aliquot of the homogenized sediment will be placed into certified-clean jars supplied by the analytical laboratory.

In addition to samples collected and submitted to the laboratory for analysis, an additional surface sediment sample (0 to 10 cm) will be collected from each sampling location, placed in laboratory-supplied jars, and archived for potential subsequent bioassay analysis, pending review of analytical chemistry results.

QC sediment samples (e.g., field duplicates) will be collected at the respective frequencies prescribed in Section A3.5 of this QAPP.

Biological testing of sediment will be performed in accordance with Recommended Protocols for Conducting Laboratory Bioassays on Puget Sound Sediments (PSEP 1995) for the larval abnormality/mortality test using the resuspension modifications described in 2013 DMMP/SMS clarification paper (Kendall 2013), if necessary. All bioassay analyses, including retests, are required to commence within 56 days after sediment sample collection to meet holding times.

Bioassay testing requires that test sediments be matched and conducted simultaneously with appropriate reference sediment in order to factor out sediment grain size effects on bioassay organisms. The selection of the reference sediment will be based on the percent fines determined from the analytical laboratory's grain-size analysis of the test sediments. The laboratory determination of grain size will be performed on an expedited schedule in order to select the appropriate reference sediment prior to bioassay initiation.

The samples for bioassay testing will be placed into laboratory specified plastic bags with no head space and stored in coolers at approximately 4° ± 2°C until transported to the laboratory. Temperature within the coolers will be monitored, and COC procedures will be followed throughout sample handling by the laboratory. The laboratory will hold sample mass within the required temperature range until they are prepared for testing.

[1] The depth of mudline and time of sampling will be used in conjunction with local tide tables to estimate the mudline elevation at the sample location.

A2.4.3 Sediment Sample Identification

Each sediment sample collected for chemical analysis will be assigned a unique sample identification number identical to the sample location ID. For example, the sediment sample collected from location ASP-SS4 would be identified as ASP-SS4.

A2.5 Seep Sampling

The field methods for sampling seeps are described below. Field activities will be performed by Aspect.

A2.5.1 Location Positioning

Sampling locations identified in Section 9 of the Work Plan will be field-located at the coordinates listed in Table A-1 using a GPS unit with a horizontal accuracy of within 1 meter. Washington State Plane Coordinate System North coordinates in NAD83 will be used for the horizontal datum. The area surrounding the coordinate position will be inspected and a seep selected for sampling. If no seeps are visible, a temporary well point may be driven in at the proposed sample location to collect a sample.

A2.5.2 Seep Sample Collection

Seep samples for VOC and TPH analysis will be collected as follows:

- A shallow 'bowl' will be excavated using hand tools at the location of the seep. The bowl will be deep enough to allow suspended solids to settle and sample tubing be inserted to withdraw water.
- Samples will be collected using a peristaltic pump and dedicated tubing (polyethylene tubing with a short length of silicon tubing through the pump head). VOC loss will be minimized by regulating flowrate to prevent the entrainment of air bubbles in the tubing. Field parameters (temperature, pH, specific electrical conductance, DO, and ORP) will be monitored using a YSI meter and flow-through cell, or equivalent. At least one turbidity measurement will be made before collecting the sample.
- Samples with a field-measured specific electrical conductance greater than 1,000 microseimens per centimeter (µS/cm) or turbidity greater than 25 nephelometric turbidity units (NTU) will be denoted as such on the chain-of-custody (COC) form, so that the laboratory can employ appropriate sample preparation techniques to avoid analytical interferences for specific analyses (refer to Section A3.3.2).
- Once field parameters are recorded, the seep samples will be collected using the same low-flow rate directly into laboratory-supplied sample containers.
- QC seep samples (e.g., field duplicates) will be collected at the respective frequencies prescribed in Section A3.5.1.

A2.5.3 Seep Sample Identification

Each seep sample will be assigned a unique sample identification number that includes the seep location and the 8-digit date on which the sample was collected. For example, a

seep sample collected from seep SP-101 on May 30, 2014, would be identified as SP101--053014.

A2.6 Sample Custody and Field Documentation

A2.6.1 Sample Custody

Upon collection, samples will be placed upright in a cooler. Ice or blue ice will be placed in each cooler to meet sample preservation requirements. Inert cushioning material will be placed in the remaining space of the cooler as needed to limit movement of the sample containers. If the sample coolers are shipped, not hand carried, to the laboratory, the COC form will be placed in a waterproof bag within the cooler for shipment.

After collection, samples will be maintained in Aspect's custody until formally transferred to the analytical laboratory courier or the shipper. For purposes of this work, custody of the samples is defined as follows:

- In plain view of the field representatives;
- Inside a cooler that is in plain view of the field representative; or
- Inside any locked space such as a cooler, locker, car, or truck to which the field representative has the only immediately available key(s).

A COC record provided by the laboratory will be initiated at the time of sampling for all samples collected. The record will be signed by the field representative and others who subsequently take custody of the sample. Couriers or other professional shipping representatives are not required to sign the COC form; however, shipping receipts will be collected and maintained in project files as a part of custody documentation. A copy of the COC form with appropriate signatures will be kept by Aspect's project manager.

Upon sample receipt, the laboratory will fill out a cooler receipt form to document sample delivery conditions. A designated sample custodian will accept custody of the shipped samples and will verify that the COC form matches the samples received. The laboratory will notify the Aspect project manager, as soon as possible, of any issues noted with the sample shipment or custody.

A2.6.2 Field Documentation

While conducting field work, the field representative will document pertinent observations and events, specific to each activity, on field forms (e.g., boring log form, as-built well completion form, well development form, groundwater sampling form, etc.) and/or in a field notebook, and, when warranted, provide photographic documentation of specific sampling efforts. Field notes will include a description of the field activity, sample descriptions, and associated details such as the date, time, and field conditions.

A2.7 Groundwater Level Monitoring

Depth-to-groundwater measurements will be conducted in monitoring wells using an electric well sounder, graduated to 0.01 foot. Where there is potential for LNAPL, as described in section 9.3 of the Work Plan, an oil-water interface probe will be used to measure water levels and evaluate the presence of separate-phase product.

A2.8 LNAPL Recovery

LNAPL recovery will be evaluated in accordance with the procedures outlined below:

- The initial thickness of LNAPL will be measured using an electronic oil/water interface probe;
- LNAPL will be removed down to a sheen using a peristaltic pump, absorbent sock , or other method;
- The LNAPL thickness and elapsed time will be measured and recorded as LNAPL recovers. The frequency of monitoring will depend upon the rate of recovery; and
- Once LNAPL approaches the initial thickness or is no longer significantly accumulating in the well, LNAPL will be removed again and the rate of recovery will be measured one more time.

A2.9 Exploration Surveying

Horizontal coordinates for each soil sampling location will be recorded using a hand-held GPS instrument with real-time differential correction. The horizontal coordinates and elevations of new monitoring wells included in the assessment will be surveyed by a licensed surveyor relative to the Washington State Plane South horizontal coordinate system and the National Geodetic Vertical Datum of 1929 (NGVD29) vertical datum. Elevations will be also be converted to the NAVD88 vertical datum for reporting to Ecology's EIM database. Monitoring well top-of-casing elevations will be surveyed to the nearest 0.01 foot, and horizontal coordinates to the nearest 0.1 foot, or better. Each well will be surveyed at the marked spot on the top of the PVC well casing from which depth-to-water measurements are collected.

A2.10 Decontamination and Investigative-Derived Waste Management

All non-disposable sampling equipment (e.g., stainless steel spoons and bowls) will be decontaminated before collection of each sample. The decontamination sequence consists of a scrub with a non-phosphate (Alconox) solution, followed by a tap water (potable) rinse, and then a thorough spraying with deionized or distilled water.

Investigation-derived waste (IDW) water generated during equipment decontamination and monitoring well development and sampling will be placed in labeled Department of Transportation (DOT) approved drums pending the analytical results to determine appropriate disposal. The drums will be temporarily consolidated on-site, profiled based on available analytical data, and disposed of appropriately at a permitted off-site disposal facility.

Soil cuttings from borings and disposable personal protective equipment (PPE) will be placed in labeled DOT-approved drums pending the analytical results to determine appropriate disposal. The drums will be temporarily consolidated on-site, profiled based on available analytical data, and disposed of appropriately at a permitted off-site disposal facility.

Documentation for off-site disposal of IDW will be maintained in the project file.

A3 Quality Assurance Project Plan

This QAPP identifies QC procedures and criteria required to ensure that data collected during the RI/FS are of known quality and acceptable to achieve project objectives. Specific protocols and criteria are also set forth in this QAPP for data quality evaluation, upon the completion of data collection, to determine the level of completeness and usability of the data. It is the responsibility of the project personnel performing or overseeing the sampling and analysis activities to adhere to the requirements of the FSP and this QAPP.

A3.1 Purpose of the QAPP

As stated in Ecology's Guidelines for Preparation of Quality Assurance Project Plans for Environmental Studies (Ecology Publication No. 04-03-030, July 2004), specific goals of this QAPP are as follows:

- Focus project manager and project team to factors affecting data quality during the planning stage of the project;
- Facilitate communication among field, laboratory, and management staff as the project progresses;
- Document the planning, implementation, and assessment procedures for QA/QC activities for the investigation;
- Ensure that the DQOs are achieved; and
- Provide a record of the project to facilitate final report preparation.

The DQOs for the project include both qualitative and quantitative objectives, which define the appropriate type of data, and specify the tolerable levels of potential decision errors that will be used as a basis for establishing the quality and quantity of data needed to support the environmental assessment. To ensure that the DQOs are achieved, this QAPP details aspects of data collection including analytical methods, QA/QC procedures, and data quality reviews. This QAPP describes both quantitative and qualitative measures of data to ensure that the DQOs are achieved. DQOs dictate data collection rationale, sampling and analysis designs that are presented in the main body of the Work Plan, and sample collection procedures that are presented in the FSP (Section A2) of this SAP.

A3.2 Project Organization and Responsibilities

The project consultant team involved with data generation includes representatives from Aspect, Pyron Environmental, Inc. (Pyron), and ARI. ARI will also subcontract specific chemical analyses to Freidman & Bruya, Inc. (FBI). Key individuals and their roles on this project are as follows:

Project Manager – Jeremy Porter, PE, Aspect. The project manager is responsible for the successful completion of all aspects of this project, including day-to-day management, production of reports, liaison with the Port and Mariana, and coordination with the project team members. The project manager is also responsible for resolution of non-conformance issues, is the lead author on project plans and reports, and will provide regular, up-to-date progress reports and other requested project information to the Port, Mariana, and in select cases, Ecology.

RI Task Manager – Dave Rugh, LHG, Aspect. The RI task manager is responsible for overseeing the field sampling program outlined in this plan, including collecting representative samples and ensuring that they are handled properly prior to transfer of custody to the project laboratory. The field manager will manage procurement of necessary field supplies, assure that monitoring equipment is operational and calibrated in accordance with the specifications provided herein, and act as the Site Health and Safety Officer.

Data Quality Manager – Mingta Lin, Pyron. The data quality manager is responsible for developing data quality objectives, selecting analytical methods, coordinating with the analytical laboratory, overseeing laboratory performance, and approving QA/QC procedures. The data quality manager is also responsible for conducting QA validation of the analytical data reports received from the project laboratory.

Laboratory Project Manager – Mark Harris, ARI. The laboratory project manager is responsible for ensuring that all laboratory analytical work for soil and water media complies with project requirements. The laboratory project manager also, while acting as liaison with the project manager, field manager, and data quality manager, fulfills project needs on the analytical laboratory work. This responsibility applies to work the laboratory project manager subcontracts to another laboratory.

A3.3 Analytical Methods and Reporting Limits

Analytical methodologies applied to the analyses of samples collected during the RI/FS are in accordance with the following documents:

- USEPA SW Methods – USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- USEPA Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, Office of Water, U.S. Environmental Protection Agency, August 2002, EPA-821-R-02-019.
- USEPA Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983 and updates.
- Standard Methods for the Examination of Water and Wastewater, American Public Health Association, 20th Edition, 1995.
- Ecology Analytical Methods for Petroleum Hydrocarbons, Publication No. ECY 97-602, June 1997.

Table A-3 lists the laboratory analytical methods for soil and groundwater analyses to be performed during the RI/FS, along with samples containers, preservation, and analytical holding times for each analysis.

A3.3.1 Method Detection Limit and Method Reporting Limit

The method detection limit (MDL) is the minimum concentration of a compound that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero. MDLs are established by the laboratory using prepared samples, not samples of environmental media.

The method reporting limit (RL) is defined as the lowest concentration at which a chemical can be accurately and reproducibly quantified, within specified limits of precision and accuracy, for a given environmental sample. The RL can vary from sample to sample depending on sample size, sample dilution, matrix interferences, moisture content, and other sample-specific conditions. As a minimum requirement for organic analyses, the RL should be equivalent to or greater than the concentration of the lowest calibration standard in the initial calibration curve and equivalent to or, preferably less than, the project screening levels. The expected RLs are summarized in Table A-5 and A-6 for water and soil/sediment samples, respectively.

A3.3.2 Sample Preparation for Metals Analysis of Brackish and/or Turbid Water Samples

Saline water samples may create analytical interferences for trace metals analyses due to the high levels of dissolved solids in the samples. To achieve optimal detection limits and minimize accuracy bias for metals in brackish water samples, reductive precipitation (EPA Method 1640) may be applied at the discretion of the analyst. Saline groundwater samples are indicated by elevated specific electrical conductance of the samples. To assist the laboratory in identifying saline groundwater samples, the field-measured specific conductance for each groundwater sample with conductance greater than 1,000 µS/cm will be recorded on the corresponding COC document.

Turbid water samples may create a high bias for NWTPH-Dx analyses due to suspended solids in the sample. To ensure that sample results are representative of groundwater concentrations, samples with a field measured turbidity greater than 25 Nephelometric Turbidity Units (NTUs) will be centrifuged at the laboratory prior to analysis. Samples with a field measured turbidity greater than 25 NTUs will be recorded on the corresponding COC document.

A3.4 Data Quality Objectives

DQOs, including the Measurement Quality Indicators (MQIs)—precision, accuracy, representativeness, comparability, completeness, and sensitivity (namely PARCCS parameters)—and sample-specific RLs are dictated by the DQOs, project requirements, and intended uses of the data. For this project, the analytical data must be of sufficient technical quality to determine whether contaminants are present and, if present, whether their concentrations are greater than or less than applicable screening criteria based on protection of human health and the environment.

The quality of data generated through this RI will be assessed against the MQIs set forth in this QAPP. Specific QC parameters associated with each of the MQIs are summarized in Table A-4. Specific MQI goals and evaluation criteria (i.e., MDLs, RLs, percent recovery (%R) for accuracy measurements, relative percent difference (RPD) for precision measurements, are defined in Table A-5 and A-6. Definitions of these parameters and the applicable QC procedures are presented below.

A3.4.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared with their average values. Analytical precision is measured through matrix spike/matrix spike duplicate (MS/MSD) samples and laboratory control samples/laboratory control sample duplicate (LCS/LCSD) for organic analysis and through laboratory duplicate samples for inorganic analyses.

Analytical precision is quantitatively expressed as the RPD between the LCS/LCSD, MS/MSD, or laboratory duplicate pairs and is calculated with the following formula:

$$RPD\ (\%) = 100 \times \frac{|S - D|}{(S + D)/2}$$

where:
S = analyte concentration in sample
D = analyte concentration in duplicate sample

Analytical precision measurements will be carried out at a minimum frequency of 1 per 20 samples for each matrix sampled, or one per laboratory analysis group. Laboratory precision will be evaluated against laboratory quantitative RPD performance criteria provided with the laboratory's analytical data report. If the control criteria are not met, the laboratory will supply a justification of why the limits were exceeded and implement the appropriate corrective actions. The RPD will be evaluated during data review and validation. The data reviewer will note deviations from the specified limits and will comment on the effect of the deviations on reported data.

A3.4.2 Accuracy

Accuracy measures the closeness of the measured value to the true value. The accuracy of chemical test results is assessed by "spiking" samples with known standards (surrogates, blank spikes, or matrix spikes) and establishing the average recovery. Accuracy is quantified as the %R. The closer the %R is to 100%, the more accurate the data.

Surrogate recovery will be calculated as follows:

$$\text{Recovery}\ (\%) = \frac{MC}{SC} \times 100$$

where:
SC = spiked concentration

MC = measured concentration

MS percent recovery will be calculated as follows:

$$\text{Recovery (\%)} = \frac{MC - USC}{SC} \times 100$$

where:
SC = spiked concentration
MC = measured concentration
USC = unspiked sample concentration

Accuracy measurements on MS samples will be carried out at a minimum frequency of 1 in 20 samples per matrix analyzed. Blank spikes will also be analyzed at a minimum frequency of 1 in 20 samples per matrix analyzed. Surrogate recoveries for organic compounds will be determined for each sample analyzed for respective compounds. Laboratory accuracy will be evaluated against the laboratory's quantitative MS and surrogate spike recovery performance criteria as provided with the laboratory's analytical data report. If the control criteria are not met, the laboratory will supply a justification of why the limits were exceeded and implement the appropriate corrective actions. Percent recoveries will be evaluated during data review and validation, and the data reviewer will comment on the effect of the deviations on the reported data.

A3.4.3 Representativeness

Representativeness measures how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the matrix sampled. The FSP sampling techniques and sample handling protocols (e.g., homogenizing, storage, preservation, and use of duplicates and blanks) have been developed to ensure representative samples. Sampling locations for RI/FS activities are described in Section 9 of the RI/FS Work Plan. The RI/FS field sampling procedures are described in the FSP (Section A2) of this SAP.

A3.4.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. This goal will be achieved through the use of standard techniques to collect samples, USEPA-approved standard methods to analyze samples, and consistent units to report analytical results. Data comparability also depends on data quality. Data of unknown quality cannot be compared.

A3.4.5 Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid. Results will be considered valid if the precision, accuracy, and representativeness objectives are met and if RLs are sufficient for the intended uses of the data. Completeness is calculated as follows:

$$\textit{Completeness}\ (\%) = \frac{V}{P} \times 100$$

where:
V = number of valid measurements
P = number of measurements taken

Valid and invalid data (i.e., data qualified with the R flag [rejected]) will be identified during data validation. The target completeness goal for this project is 95%.

A3.5 Quality Control Procedures

Field and laboratory QC procedures are outlined below.

A3.5.1 Field Quality Control

Beyond use of standard sampling and decontamination protocols defined in the FSP, field QC procedures include maintaining the field instrumentation used. Field instruments (e.g., PID for evaluating presence of VOCs in soil samples, and the YSI or equivalent meter for measuring field parameters during groundwater sampling) are maintained and calibrated regularly prior to use, in accordance with manufacturer recommendations.

In addition, field QC samples will be collected and submitted for analyses to monitor the precision and accuracy associated with field procedures. Field QC samples to be collected and analyzed for this RI include field duplicates, and trip blanks. The definition and sampling requirements for field QC samples are presented below.

Field Duplicates

Field duplicate samples are used to check for sampling and analysis reproducibility; however, the field duplicate sample results include variability introduced during both field sampling and laboratory preparation and analysis, and USEPA data validation guidance provides no specific evaluation criteria for field duplicate samples. Advisory evaluation criteria are set forth at 35% for RPD (if both results are greater than 5 times the RL) and 2 times the RLs for concentration difference (if either of the result is less than 5 times the RL) between the original and field duplicate results.

Field Duplicates will be submitted "blind" to the laboratory as discrete samples (i.e., given unique sample identifiers to keep the duplicate identity unknown to the laboratory), but will be clearly identified in the field log. **Field duplicate samples will be collected at a frequency of 5% (1 per 20) of the field samples for each matrix and analytical method, but not less than one duplicate per sampling event per matrix.**

Trip Blank

Trip blank samples will be used to monitor possible VOC cross contamination occurring during sample transport. Trip blank samples will be prepared and supplied by the laboratory: organic-free reagent-grade water will be placed into a VOC vial prior to the collection of field samples. The trip blank sample vials will be placed with and accompany the VOC and gasoline-range TPH samples through the entire transporting process. **One trip blank will be collected for each soil sampling round and each groundwater sampling round where VOC or gasoline-range TPH analyses are conducted.**

In case a target compound is present in a trip blank, results for all samples shipped with this trip blank will be evaluated and data qualified accordingly if determined that the results are affected.

A3.5.2 Laboratory Quality Control

The laboratories' analytical procedures must meet requirements specified in the respective analytical methods or approved laboratory standard operating procedures (SOPs), e.g., instrument performance check, initial calibration, calibration check, blanks, surrogate spikes, internal standards, and/or labeled compound spikes. Specific laboratory QC analyses required for this project will consist of the following at a minimum:

- Instrument tuning, instrument initial calibration, and calibration verification analyses as required in the analytical methods and the laboratory SOPs;
- Laboratory and/or instrument method blank measurements at a minimum frequency of 5% (1 per 20 samples) or in accordance with method requirements, whichever is more frequent; and
- Accuracy and precision measurements as defined in Table A-4, at a minimum frequency of 5% (1 per 20 samples) or in accordance with method requirements, whichever is more frequent. In cases where a pair of MS/MSD or MS/laboratory duplicate analyses are not performed on a project sample, a set of LCS/LCSD analyses will be performed to provide sufficient measures for analytical precision and accuracy evaluation.

The laboratory's QA officers are responsible for ensuring that the laboratory implements the internal QC and QA procedures detailed in ARI's Quality Assurance Manual.

A3.6 Corrective Actions

If routine QC audits by the laboratory result in detection of unacceptable conditions or data, actions specified in the laboratory SOPs will be taken. Specific corrective actions are outlined in each SOP used and can include the following:

- Identifying the source of the violation;
- Reanalyzing samples if holding time criteria permit;
- Resampling and analyzing;
- Evaluating and amending sampling and analytical procedures; and/or
- Accepting but qualifying data to indicate the level of uncertainty.

If unacceptable conditions occur, the laboratory will contact Aspect's project manager to discuss the issues and determine the appropriate corrective action. Corrective actions taken by the laboratory during analysis of samples for this project will be documented by the laboratory in the case narrative associated with the affected samples.

In addition, the project data quality manager will review the laboratory data generated for this investigation to ensure that project DQOs are met. If the review indicates that non-conformances in the data have resulted from field sampling or documentation procedures or laboratory analytical or documentation procedures, the impact of those non-conformances on the overall project data usability will be assessed. Appropriate actions,

including re-sampling and/or re-analysis of samples may be recommended to the project manager to achieve project objectives.

A3.7 Data Reduction, Quality Review, and Reporting

All data will undergo a QA/QC evaluation at the laboratory, which will then be reviewed by the Aspect database manager and the project data quality manager. Initial data reduction, evaluation, and reporting at the laboratory will be carried out in full compliance with the method requirement and laboratory SOPs. The laboratory internal review will include verification (for correctness and completeness) of electronic data deliverable (EDD) accompanied with each laboratory report. The Aspect database manager will verify the completeness and correctness of all laboratory deliverables (i.e., laboratory report and EDDs) before releasing the deliverables for data validation.

A3.7.1 Minimum Data Reporting Requirements

The following sections specify general and specific requirements for analytical data reporting to provide sufficient deliverables for project documentation and data quality assessment.

General Requirements

The following requirements apply to laboratory reports for all types of analyses:

- A laboratory report will include a cover page signed by the laboratory director, the laboratory QA officer, or his/her designee to certify the eligibility of the reported contents and the conformance with applicable analytical methodology.
- Definitions of abbreviations, data flags and data qualifiers used in the report.
- Cross reference of field sample names and laboratory sample identity for all samples in the sample delivery group (SDG).
- Completed COC document signed and dated by parties who acquired and received the samples.
- Completed sample receipt document with record of cooler temperature and sample conditions upon receipt at the laboratory. Anomalies such as inadequate sample preservation, inconsistent bottle counts, and sample container breakage, and communication record and corrective actions in response to the anomalies will be documented and incorporated in the sample receipt document. The document will be initialed and dated by personnel that complete the document.
- Case narrative that addresses any anomalies or QC outliers in relation to sample receiving, sample preparation, and sample analysis on samples in the SDG. The narrative will be presented separately for each analytical method and each sample matrix.
- All pages in the report are to be paginated. Any insertion of pages after the laboratory report is issued will be paginated with starting page number suffixed with letters (e.g., pages inserted between pages 134 and 135 should be paginated as 134A, 134B, etc.)

- Any resubmitted or revised report pages will be submitted to Aspect with a cover page stating the reason(s) and scope of the resubmission or revision, and signed by the laboratory director, QA officer, or the designee.

Specific Requirements

The following presents specific requirements for laboratory reports:

- Sample results: Sample results will be evaluated and reported down to the MDLs. Detections at levels greater than the MDLs but less than the RLs will be reported and flagged with "J". Results less than the MDLs (or EDLs) will be reported at the MDLs and flagged with "UJ". All soil sample results will be reported on a dry-weight basis. The report pages for sample results (namely Form 1s) will, at a minimum, include sample results, RLs, unit, proper data flags, dates of sample collection, preparation, and analysis, dilution factor, percent moisture (for solid samples), and sample volume (used for analysis).
- Instrument run log: The run log will list, in chronological order, all analytical runs on field samples, QC samples, calibrations, and calibration verification analyses in the SDG with data file name (and/or legible laboratory codes) and analysis date/time for each analytical run.
- Original sample preparation and analyst worksheet: Initialed and dated by analyst and reviewer.
- Gas Chromatography/Mass Spectrometry (GC/MS) and inductively coupled plasma (ICP)/MS tune report: Including ion abundance ratios and criteria for all required ions.
- Initial calibration summary: Including data file name for each calibration standard file; response factor (RF) or calibration factor (CF) for each calibration standard and each target and surrogate compound; average RF or CF, percent relative standard deviation (%RSD), correlation coefficient, or coefficient of determination; and absolute and relative retention times and ion ratios for high-resolution GC/MS (HRGC/HRMS) methods for each target compound and surrogate (labeled) compounds.
- Calibration verification summary: Including true amount, calculated amount, and percent difference (%D), or percent drift ($\%D_f$) as applicable for target compounds.
- Method blank results.
- LCS and LCSD (if MSD analysis is not performed) results with laboratory acceptance criteria for %R and RPD.
- Surrogate spike results with laboratory acceptance criteria for %R.
- MS and MSD results with laboratory acceptance criteria for %R and RPD. In cases where MS/MSD analyses were not performed on a project sample, LCS/LCSD analyses should be performed and reported instead.
- Internal standard (as applicable) results: Internal standard response areas in field samples, QC analyses, and associated calibration verification analyses.

A3.8 Data Quality Verification and Validation

Reported analytical results will be qualified by the laboratory to identify QC concerns in accordance with the specifications of the analytical methods. Additional laboratory data qualifiers may be defined and reported by the laboratory to more completely explain QC concerns regarding a particular sample result. All data qualifiers will be defined in the laboratory's narrative reports associated with each case.

The project data quality manager, or other as directed by Aspect, will conduct an independent Level III (or Stage 2b as defined in USEPA, 2009) data verification and validation for all chemical data submitted by the analytical laboratories during the independent environmental assessment, following the guidance below:

- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, Office of Superfund Remediation and Technical Innovation, U.S. Environmental Protection Agency, January 2010, USEPA 540/R-10/011.
- USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technical Innovation, U.S. Environmental Protection Agency, June 2008, USEPA-540-R-08-01.

The data validation will examine and verify the following parameters against the method requirements and laboratory control limits specified in Tables A-5 and A-6:

- Sample management and holding times;
- Instrument performance check, calibration, and calibration verification;
- Laboratory and field blank results;
- Detection and reporting limits;
- Laboratory replicate results;
- MS/MSD results;
- LCS and/or standard reference material results;
- Field duplicate results;
- Surrogate spike recovery (organic analyses only);
- Internal standard recovery (internal calibration methods only);
- Inter-element interference check (ICP analyses only);
- Serial dilution (metals only);
- Labeled compound recovery (isotope dilution methods only); and
- Ion ratios for detected compounds (HRGC/HRMS methods only).

Data qualifiers will be assigned based on the outcome of the data validation. Data qualifiers are limited to and defined as follows:

- J - The analyte was positively identified at levels greater than the MDLs but less than the RLs; the associated numerical value is an estimate of the approximate concentration of the analyte in the sample.
- UJ - The analyte was not detected above the reported quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte cannot be verified.
- DNR - Do not report from this analysis; the result for this analyte is to be reported from an alternative analysis.

In cases of multiple analyses (such as an undiluted and a diluted analysis) performed on one sample, the optimal result will be determined and only the determined result will be reported for the sample.

The scope and findings of the data validation will be documented and discussed in the Data Validation Report(s). The Data Validation Report(s) will be appended to the RI report.

A3.9 Preventative Maintenance Procedures and Schedules

Preventative maintenance in the laboratory will be the responsibility of the laboratory personnel and analysts. This maintenance includes routine care and cleaning of instruments and inspection and monitoring of carrier gases, solvents, and glassware used in analyses. Details of the maintenance procedures are addressed in the respective laboratory SOPs.

Precision and accuracy data are examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance will be performed when an instrument begins to change as indicated by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or another of the method-specific QC criteria.

Maintenance and calibration of instruments used in the field for sampling (e.g., PID for evaluating presence of VOCs in soil samples, and the YSI meter for measuring field parameters during groundwater sampling) will be conducted regularly in accordance with manufacturer recommendations prior to use.

A3.10 Performance and System Audits

The Aspect project manager has responsibility for reviewing the performance of the laboratory QA program; this review will be achieved through regular contact with the analytical laboratory's project manager. To ensure comparable data, all samples of a given matrix to be analyzed by each specified analytical method will be processed consistently by the same analytical laboratory.

A3.11 Data and Records Management

Records will be maintained documenting all activities and data related to field sampling and chemical analyses.

A3.11.1 Field Documentation

The Aspect project manager will ensure that the field team receives and understands the final approved version of this QAPP, the Site Health and Safety Plan, and the SAP prior to the initiation of field activities and that all approved plans are followed at all times. Field documents will be maintained in the project file.

A3.11.2 Analytical Data Management

Raw data received from the analytical laboratory will be reviewed, entered into a computerized database, and verified for consistency and correctness. The database will be updated based on data review and independent validation if necessary.

The following field data will be included in the database:

- Sample location coordinates
- Sample type (i.e., groundwater or soil)
- Soil or groundwater sampling depth interval

Information regarding whether concentrations represent total phase (unfiltered samples) or dissolved phase (filtered samples) will be compiled and stored in the database. Data will be submitted to Ecology's Environmental Information Management (EIM) database once data have been reviewed and validated.

A4 References

USEPA, 2008, Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technical Innovation, U.S. Environmental Protection Agency, June 2008, USEPA-540-R-08-01.

USEPA, 2009, Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, January 13 2009. EPA 540-R-08-005.

USEPA, 2010, Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, Office of Superfund Remediation and Technical Innovation, U.S. Environmental Protection Agency, January 2010, USEPA 540/R-10/011.

Table A-1 - Exploration Plan

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

	Location			Sampling Interval(s)				Soil/Sediment Analytes								Groundwater/ Porewater Analytes			
Exploration Name	Description	Northing (WA 1983 State Plane South)	Easting (WA 1983 State Plane South)	Depth in Feet	TPH and VOC Soil Sampling Depth Intervals in Feet[1]	Lead Soil Sampling Depth Intervals in Feet	Approximate Screen Interval Depth in Feet	NWTPH-G	NWTPH-Dx	VOCs (8260)	PAHs	Total Lead	Organic Lead	TOC	Bioassay	NWTPH-G	NWTPH-Dx	VOCs (8260)	Dissolved Lead
Soil Borings																			
B-101	905 Shoreline	714812	1168865	24	0-5, 5-15, 15-24	0-5	8-12, 20-24	X	X	X		X	AR	AR		X		X	
B-102	905 - North end	714740	1168793	24	0-5, 5-15, 15-24	0-5	8-12, 20-24	X	X	X		X	AR	AR		X		X	
B-103	905 - North end	714648	1168810	24	0-5, 5-15, 15-24	0-5	8-12, 20-24	X	X	X		X	AR	AR		X		X	
B-104	905 - North end	714577	1168743	24	0-5, 5-15, 15-24	0-5	8-12, 20-24	X	X	X		X	AR	AR		X		X	
B-105	905 - North end	714509	1168614	24	0-5, 5-15, 15-24	0-5	8-12, 20-24	X	X	X		X	AR	AR		X		X	
B-106	721 Tank Farm Area	714603	1168474	24	0-5, 5-15, 15-24	0-5	8-12	X	X	X		X	AR			X		X	
B-107	721 Tank Farm Area	714656	1168539	24	0-5, 5-15, 15-24	0-5	8-12	X	X	X		X	AR			X		X	
B-108	721 Tank Farm Area	714542	1168406	24	0-5, 5-15, 15-24	0-5	8-12	X	X	X		X	AR			X		X	
B-109	721 Tank Farm Area	714534	1168483	24	0-5, 5-15, 15-24	0-5	8-12	X	X	X		X	AR			X		X	
B-110	721 Shoreline	714871	1168708	24	0-5, 5-15, 15-24	0-5	8-12, 20-24	X	X	X		X	AR	AR		X		X	
B-111	721 Shoreline	714856	1168731	24	0-5, 5-15, 15-24	0-5	8-12, 20-24	X	X	X		X	AR	AR		X		X	
B-112	709 West of Landfill	714839	1168486	24	0-5, 5-15, 15-24	0-5, 5-15	8-12, 20-24	X	X	X		X	AR			X		X	X
B-113	709 West of Landfill	714840	1168405	24	0-5, 5-15, 15-24	0-5, 5-15	8-12, 20-24	X	X	X		X	AR			X		X	X
B-114	709 West of Landfill	714776	1168420	24	0-5, 5-15, 15-24	0-5, 5-15	8-12, 20-24	X	X	X		X	AR			X		X	X
B-115	605 - South end	714673	1168044	15	0-5, 5-15	--	8-12	X	X	X				AR		X		X	
B-116	605 - South end	714613	1167987	15	0-5, 5-15	--	8-12	X	X	X				AR		X		X	
B-117	905 - Northwest corner	714154	1168228	24	0-5, 5-15, 15-24	--	8-12, 20-24	X	X	X				AR		X		X	
B-118	500 - South of UST N-11	714025	1168119	24	5-15, 15-24	--	8-12, 20-24	X	X	X						X		X	
B-119	Alexander Avenue right-of-way	714107	1168191	24	5-15, 15-24	--	8-12, 20-24	X	X	X						X		X	
B-120	Alexander Avenue right-of-way	714195	1168098	24	5-15, 15-24	--	8-12, 20-24	X	X	X						X		X	
B-121	Alexander Avenue right-of-way	714176	1168117	24	5-15, 15-24	--	8-12, 20-24	X	X	X						X		X	
B-122	500 - South of UST N-11	714048	1168003	24	0-5, 5-15, 15-24	--	8-12, 20-24	X	X	X				AR		X		X	
B-123	500 - North of UST N-11	714252	1167905	24	0-5, 5-15, 15-24	--	8-12, 20-24	X	X	X				AR		X		X	
B-124	500 - West of UST N-11	714146	1167874	24	0-5, 5-15, 15-24	--	8-12, 20-24	X	X	X				AR		X		X	
B-125	500 - West of UST N-11	714118	1167902	24	0-5, 5-15, 15-24	--	8-12, 20-24	X	X	X				AR		X		X	
B-126	500 - West of UST N-11	714096	1167928	24	0-5, 5-15, 15-24	--	8-12, 20-24	X	X	X				AR		X		X	
B-127	721- Former USAF Sludge Area	714416	1168306	15	0-5, 5-15	--	8-12	X	X	X						X		X	
B-128	721 - West of Tank 13	714328	1168181	15	0-5, 5-15	--	8-12	X	X	X						X		X	

Table A-1 - Exploration Plan

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

	Location			Sampling Interval(s)				Soil/Sediment Analytes								Groundwater/ Porewater Analytes			
Exploration Name	Description	Northing (WA 1983 State Plane South)	Easting (WA 1983 State Plane South)	Depth in Feet	TPH and VOC Soil Sampling Depth Intervals in Feet[1]	Lead Soil Sampling Depth Intervals in Feet	Approximate Screen Interval Depth in Feet	NWTPH-G	NWTPH-Dx	VOCs (8260)	PAHs	Total Lead	Organic Lead	TOC	Bioassay	NWTPH-G	NWTPH-Dx	VOCs (8260)	Dissolved Lead
New Monitoring Wells																			
MW-101-15	905 Shoreline	714796	1168892	15	--	--	5 to 15									To be determined - See Groundwater Monitoring Plan			
MW-101-25	905 Shoreline	714803	1168877	25	--	--	20 to 25												
MW-104-15	905 - North end	714568	1168734	15	--	--	5 to 15												
MW-104-25	905 - North end	714587	1168754	25	--	--	20 to 25												
MW-105-15	905 - North end	714522	1168628	15	--	--	5 to 15												
MW-105-25	905 - North end	714507	1168642	25	--	--	20 to 25												
MW-106-15	721 Tank Farm Area	714603	1168474	15	--	--	5 to 15												
MW-107-15	721 Tank Farm Area	714656	1168539	15	--	--	5 to 15												
MW-110-15	721 Shoreline	714859	1168712	15	--	--	5 to 15												
MW-110-25	721 Shoreline	714871	1168720	25	--	--	20 to 25												
MW-125-15	500 - West of UST N-11	714094	1167879	15	--	--	5 to 15												
MW-125-25	500 - West of UST N-11	714106	1167890	25	--	--	20 to 25												
Seep Samples																			
SP-101	721 Intertidal Area	714899	1168764	--	--	--	--									X	X	X	
SP-102	721 Intertidal Area	714869	1168831	--	--	--	--									X	X	X	
Surface Sediment Samples																			
SS-101	709 Dock Area - Offshore	715025	1168627	0-0.25	--	--	--	X	X	X	X			X	AR				
SS-102	709 Dock Area - Offshore	715033	1168665	0-0.25	--	--	--	X	X	X	X			X	AR				
SS-103	709 Dock Area - Offshore	715001	1168688	0-0.25	--	--	--	X	X	X	X			X	AR				
SS-104	721 Dock Area - Offshore	715007	1168735	0-0.25	--	--	--	X	X	X	X			X	AR				
SS-105	721 Dock Area - Offshore	714975	1168757	0-0.25	--	--	--	X	X	X	X			X	AR				
SS-106	721 - Offshore	714917	1168835	0-0.25	--	--	--	X	X	X	X			X	AR				
SS-107	709 Dock Area - Nearshore	714971	1168615	0-0.25	--	--	--	X	X	X	X			X	AR				
SS-108	721 Dock Area - Nearshore	714943	1168681	0-0.25	--	--	--	X	X	X	X			X	AR				
SS-109	721 - Nearshore	714913	1168744	0-0.25	--	--	--	X	X	X	X			X	AR				
SS-110	721 - Nearshore	714907	1168784	0-0.25	--	--	--	X	X	X	X			X	AR				
SS-111	721 - Nearshore	714880	1168853	0-0.25	--	--	--	X	X	X	X			X	AR				
SS-112	905 - Nearshore	714876	1168887	0-0.25	--	--	--	X	X	X	X			X	AR				
SS-BACKGROUND-1	Background	714855	1168975	0-0.25	--	--	--	X	X	X	X			X					
SS-BACKGROUND-2	Background - 11th Ave. Bridge (4 point composite sample)	714618	1170015	0-0.25	--	--	--	X	X	X	X			X					
		714660	1170055	0-0.25	--	--	--	X	X	X	X			X					
		714598	1170057	0-0.25	--	--	--	X	X	X	X			X					
		714645	1170100	0-0.25	--	--	--	X	X	X	X			X					

Notes:

[1] Approximately one discrete sample within each interval will be selected for analysis based on field observations including sheen, odor, and PID readings. If evidence of contamination is encountered in the lowest interval, the boring will be advanced lower and another sample collected.

AR = Archived for potential future analysis

Table A-2 - Groundwater Monitoring Plan

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Exploration Name	Screen Interval Depth in Feet	Field Parameters	Water Level	Product Thickness	NWTPH-G	NWTPH-Dx	VOCs (8260)	Dissolved Lead	Total Lead	MNA Parameters
Monitoring Wells - 15-Foot-Zone										
709-MW3-15	5 to 15	X	X		X	X	X	X		
709-MW9-15	5 to 15	X	X		X	X	X	X		X
709-MW10-15	5 to 15		X	X						
709-MW11-15	5 to 15		X	X						
709-MW12-15	5 to 15	X	X		X	X	X	X		X
709-MW13-15	5 to 15	X	X		X	X	X	X		
709-MW14-15	5 to 15		X	X						
709-MW15-15	5 to 15	X	X		X	X	X	X		
709-MW17-15	5 to 15	X	X		X	X	X	X		
709-MW20-15	5 to 15	X	X		X	X	X	X	X	X
709-MW21-15	5 to 15		X	X						
721-MW1	5 to 15		X	X						
721-MW2	5 to 15	X	X	X	X	X	X	X		
721-MW3	5 to 15	X	X	X	X	X	X	X		
721-MW4	5 to 15		X	X						
721-MW5-15	5 to 15	X	X		X	X	X	X		
721-MW6-15	5 to 15		X	X						
721-MW8-15	5 to 15	X	X		X	X	X	X		
721-MW9-15	5 to 15	X	X		X	X	X	X	X	
721-MW10-15	5 to 15	X	X		X	X	X	X	X	
721-MW11-15	5 to 15		X	X						
721-MW12-15	5 to 15	X	X	X	X	X	X	X		X
721-MW13-15	5 to 15	X	X		X	X	X	X		
721-MW14-15	5 to 15		X	X						
721-MW15-15	5 to 15	X	X		X	X	X	X		
95-15	5 to 15	X	X		X	X	X	X		
29-14	5 to 15	X	X		X	X	X	X		
HC-N11-6	5 to 15	X	X		X	X	X	X		X
MW-101-15	5 to 15	X	X		X	X	X	X		
MW-104-15	5 to 15	X	X		X	X	X	X		
MW-105-15	5 to 15	X	X		X	X	X	X		
MW-106-15	5 to 15	X	X	X	X	X	X	X		
MW-107-15	5 to 15	X	X	X	X	X	X	X		X
MW-110-15	5 to 15	X	X		X	X	X	X	X	X
MW-125-15	5 to 15	X	X		X	X	X	X		

Table A-2 - Groundwater Monitoring Plan

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Exploration Name	Screen Interval Depth in Feet	Field Parameters	Water Level	Product Thickness	NWTPH-G	NWTPH-Dx	VOCs (8260)	Dissolved Lead	Total Lead	MNA Parameters
Monitoring Wells - 25-Foot-Zone										
709-MW9-25	20 to 25	X	X		X	X	X	X		
709-MW16-25	20 to 25	X	X		X	X	X	X		X
709-MW18-25	20 to 25	X	X		X	X	X	X		
709-MW20-25	20 to 25	X	X		X	X	X	X		X
709-MW21-25	20 to 25	X	X		X	X	X	X		
721-MW9-25	20 to 25	X	X		X	X	X	X		
721-MW10-25	20 to 25	X	X		X	X	X	X	X	
721-MW11-25	20 to 25	X	X		X	X	X	X		
721-MW12-25	20 to 25	X	X		X	X	X	X		X
721-MW13-25	20 to 25	X	X		X	X	X	X		
721-MW15-25	20 to 25	X	X		X	X	X	X		
95C-25	20 to 25	X	X		X	X	X	X		
MW-101-25	20 to 25	X	X		X	X	X	X		
MW-104-25	20 to 25	X	X		X	X	X	X		
MW-105-25	20 to 25	X	X		X	X	X	X		
MW-110-25	20 to 25	X	X		X	X	X	X	X	X
MW-125-25	20 to 25	X	X		X	X	X	X		
Monitoring Wells - 50-Foot-Zone										
721-MW-13	40 to 50	X	X		X		X			

Notes:
Field Parameters include: temperature, pH, conductivity, dissolved oxygen, ORP
MNA Parameters include: ferrous iron; dissolved manganese; nitrate/nitrite; sulfate; alkalinity; dissolved gases (methane, ethane, ethene); and total organic carbon.

Table A-3 Analytical Methods, Sample Containers, Preservation, and Holding Times

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Sample Matrix	Analytical Parameter	Analytical Method	Sample Container	No. Containers	Preservation Requirements	Holding Time
Soil and Sediment	Gasoline Range TPH	NWTPH-Gx	Method 5035A, 40-mL vials	4	4°C ±2°C, Freeze within 48 hours to <-7°C	14 days
	Diesel and Motor Oil Range TPH	NWTPH-Dx/SW846 Method 3630 (Silica Gel Cleanup)	4 ounce jar	1	4°C ±2°C	14 days for extraction; 40 days for analysis
	Soil VOCs	Method 8260 B	Method 5035A, 40-mL vials	4	4°C ±2°C, Freeze within 48 hours to <-7°C	14 days
	Sediment VOCs	Method 8260 B	2-ounce jar	2	Zero head space/4°C ±2°C	14 days
	Total Lead	Method 6020	4-ounce jar	1	4°C ±2°C	6 months
	Tetraethyl lead	Modified EPA Method 8082	4-ounce jar	1	4°C ±2°C	14 days
	Sediment PAHs	EPA Method 8270	4-ounce jar			
	Total Organic Carbon	Method 9060 (EPA, 1986)	4-ounce jar	2	4°C ±2°C	28 days
Water	Gasoline Range TPH	Method NWTPH-Gx	40-mL VOA vials	3	4°C ±2°C, HCl pH < 2	14 days
	Diesel and Motor Oil Range TPH	NWTPH-Dx/SW846 Method 3630 (Silica Gel Cleanup)	500-mL amber glass bottle	1	4°C ±2°C	7 days for extraction, 40 days for analysis
	VOCs	Method 8260	40-mL VOA vials	3	4°C ±2°C, 1 with HCl pH < 2, 2 without HCl	14 days for analysis
	Dissolved Lead	Method 6020	500-ml HDPE bottle	1	pH < 2 (after filtration)	28 days

Notes:
HCL – hydrochloric acid
HNO_3 – nitric acid
TPH – total petroleum hydrocarbons
VOA – volatile organic analysis
VOC – volatile organic compound

Table A-4 QC Parameters Associated with PARCCS

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Data Quality Indicators	QC Parameters
Precision	RPD values of:
	(1) LCS/LCS Duplicate
	(2) MS/MSD
	(3) Field Duplicates
Accuracy/Bias	Percent Recovery (%R) or Percent Difference (%D) values of:
	(1) Initial Calibration and Calibration Verification
	(2) LCS
	(3) MS
	(4) Surrogate Spikes
	Results of:
	(1) Instrument and Calibration Blank
	(2) Method (Preparation) Blank
	(3) Trip Blank
	(4) Equipment Rinsate Blank (if appropriate)
Representativeness	Results of All Blanks
	Sample Integrity (Chain-of-Custody and Sample Receipt Forms)
	Holding Times
Comparability	Sample-specific Reporting Limits
	Sample Collection Methods
	Laboratory Analytical Methods
Completeness	Data Qualifiers
	Laboratory Deliverables
	Requested/Reported Valid Results
Sensitivity	MDLs and MRLs

Notes:

LCS – laboratory control sample

MDL – method detection limit

MRL – method reporting limit

MS/MSD – matrix spike/matrix spike duplicate

Table A-5 Measurement Quality Objectives for Water Samples

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Name	MDL[(A)]	MRL	PSL	LCS/LCS %R[(A)]	RPD (%)	Surrogate %R[(A)]
Volatile Organic Compounds (VOCs) by SW8260C (µg/L)						
1,1,1,2-Tetrachloroethane	0.040	0.2	n/a	80 – 128	≤40	n/a
1,1,1-Trichloroethane	0.041	0.2	n/a	79 – 124	≤40	n/a
1,1,2,2-Tetrachloroethane	0.060	0.2	4	80 – 120	≤40	n/a
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.043	0.2	n/a	76 – 124	≤40	n/a
1,1,2-Trichloroethane	0.129	0.2	n/a	80 – 120	≤40	n/a
1,1-Dichloroethane	0.053	0.2	n/a	80 – 120	≤40	n/a
1,1-Dichloroethene	0.054	0.2	3.2	74 – 120	≤40	n/a
1,1-Dichloropropene	0.034	0.2	n/a	80 – 120	≤40	n/a
1,2,3-Trichlorobenzene	0.110	0.5	n/a	80 -125	≤40	n/a
1,2,3-Trichloropropane	0.131	0.5	n/a	80 – 120	≤40	n/a
1,2,4-Trichlorobenzene	0.107	0.5	n/a	77 – 127	≤40	n/a
1,2,4-Trimethylbenzene	0.024	0.2	61	80 – 122	≤40	n/a
1,2-Dibromo 3-Chloropropane	0.366	0.5	n/a	79 – 129	≤40	n/a
1,2-Dibromoethane (Ethylene Dibromide)	0.075	0.2	n/a	80 – 120	≤40	n/a
1,2-Dichlorobenzene	0.036	0.2	n/a	80 – 120	≤40	n/a
1,2-Dichloroethane	0.072	0.2	37	80 – 121	≤40	n/a
1,2-Dichloropropane	0.035	0.2	n/a	80 – 120	≤40	n/a
1,3,5-Trimethyl Benzene	0.015	0.2	--	80 – 120	≤40	n/a
1,3-Dichlorobenzene	0.036	0.2	n/a	80 – 120	≤40	n/a
1,3-Dichloropropane	0.062	0.2	n/a	80 – 120	≤40	n/a
1,4-Dichlorobenzene	0.040	0.2	n/a	80 – 120	≤40	n/a
2,2-Dichloropropane	0.052	0.2	n/a	72 – 133	≤40	n/a
2-Butanone	0.814	5.0	n/a	73 – 123	≤40	n/a
2-Chloro Toluene	0.024	0.2	n/a	80 – 120	≤40	n/a
2-Chloroethylvinyl Ether	0.250	1.0	n/a	62 – 130	≤40	n/a
2-Hexanone	0.902	5.0	n/a	80 – 129	≤40	n/a
4-Chloro Toluene	0.016	0.2	n/a	80 – 120	≤40	n/a
4-Isopropyl Toluene	0.026	0.2	--	80 – 124	≤40	n/a
4-Methyl-2-Pentanone	0.974	5.0	n/a	80 – 125	≤40	n/a
Acetone	2.057	5.0	--	64 – 125	≤40	n/a
Acrolein	2.476	5.0	n/a	60 – 124	≤40	n/a
Acrylonitrile	0.604	1.0	160	76 – 123	≤40	n/a
Benzene	0.027	0.2	24	80 – 120	≤40	n/a
Bromobenzene	0.060	0.2	n/a	80 – 120	≤40	n/a
Bromochloromethane	0.061	0.2	n/a	80 – 120	≤40	n/a

Table A-5 Measurement Quality Objectives for Water Samples

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Name	MDL[A]	MRL	PSL	LCS/LCS %R[A]	RPD (%)	Surrogate %R[A]
Volatile Organic Compounds (VOCs) by SW8260C (µg/L)						
Bromodichloromethane	0.051	0.2	n/a	80 – 122	≤40	n/a
Bromoethane	0.041	0.2	n/a	77 – 122	≤40	n/a
Bromoform	0.062	0.2	n/a	62 – 149	≤40	n/a
Bromomethane	0.252	1.0	n/a	68 – 130	≤40	n/a
Carbon Disulfide	0.037	0.2	n/a	77 – 124	≤40	n/a
Carbon Tetrachloride	0.044	0.2	n/a	71 – 139	≤40	n/a
Chlorobenzene	0.023	0.2	n/a	80 – 120	≤40	n/a
Chloroethane	0.086	0.2	n/a	68 – 133	≤40	n/a
Chloroform	0.027	0.2	12	80 – 120	≤40	n/a
Chloromethane	0.095	0.5	n/a	77 – 122	≤40	n/a
cis 1,3-dichloropropene	0.061	0.2	n/a	80 – 127	≤40	n/a
cis-1,2-Dichloroethene	0.043	0.2	--	78 – 120	≤40	n/a
Dibromochloromethane	0.048	0.2	n/a	80 – 120	≤40	n/a
Dibromomethane	0.145	0.2	n/a	80 – 120	≤40	n/a
Dichlorodifluoromethane	0.052	0.2	n/a	68 – 133	≤40	n/a
Ethyl Benzene	0.037	0.2	3	80 – 120	≤40	n/a
Hexachloro-1,3-Butadiene	0.073	0.5	0.2	80 – 135	≤40	n/a
Iodomethane (Methyl Iodide)	0.227	1.0	n/a	76 – 123	≤40	n/a
iso-propyl Benzene	0.021	0.2	1600	80 – 120	≤40	n/a
Methylene Chloride	0.485	1.0	590	71 – 125	≤40	n/a
Methyl-tert-butyl ether	0.073	0.5	n/a	79 – 121	≤40	n/a
Naphthalene	0.118	0.5	93	80 – 128	≤40	n/a
n-Butyl Benzene	0.025	0.2	--	80 – 125	≤40	n/a
n-Propyl Benzene	0.023	0.2	--	80 – 120	≤40	n/a
sec-Butyl Benzene	0.024	0.2	--	80 – 121	≤40	n/a
Styrene	0.045	0.2	n/a	80 – 121	≤40	n/a
tert-Butyl Benzene	0.026	0.2	n/a	80 – 121	≤40	n/a
Tetrachloroethene	0.047	0.2	3.3	80 – 120	≤40	n/a
Toluene	0.040	0.2	15000	80 – 120	≤40	n/a
trans 1,3-Dichloropropene	0.081	0.2	n/a	79 – 132	≤40	n/a
trans-1,2-Dichloroethene	0.048	0.2	250	75 – 120	≤40	n/a
trans-1,4-Dichloro 2-Butene	0.324	1.0	n/a	47 – 147	≤40	n/a
Trichloroethene	0.049	0.2	8.4	80 – 120	≤40	n/a
Trichlorofluoromethane	0.037	0.2	n/a	74 – 135	≤40	n/a
Vinyl Acetate	0.069	0.2	n/a	74 – 120	≤40	n/a
Vinyl Chloride	0.069	0.2	2.4	74 – 120	≤40	n/a
m,p-xylene	0.052	0.4	9[B]	80 – 120	≤40	n/a
o-Xylene	0.035	0.2		80 – 120	≤40	n/a

Table A-5 Measurement Quality Objectives for Water Samples

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Name	MDL[(A)]	MRL	PSL	LCS/LCS %R[(A)]	RPD (%)	Surrogate %R[(A)]
Volatile Organic Compounds (VOCs) by SW8260C (µg/L)						
1,2-Dichloroethane-d4	n/a	n/a	n/a	80 – 130	≤40	80 – 120
1,2-Dichlorobenzene-d4	n/a	n/a	n/a	80 – 120	≤40	80 – 120
Toluene-d8	n/a	n/a	n/a	80 – 120	≤40	80 – 120
4-Bromofluorobenzene	n/a	n/a	n/a	80 – 120	≤40	80 – 120
Gasoline Range Hydrocarbons by NWTPH-Gx (µg/L)						
Gasoline Range Hydrocarbons	0.057	0.25	800	80 – 120	≤40	n/a
Bromobenzene	n/a	n/a	n/a	77 – 120	≤40	n/a
Diesel and Motor Oil Range Hydrocarbons by NWTPH-Dx with Silica Gel Cleanup (µg/L)						
Diesel Range Hydrocarbons	39	100	500	61-104	≤40	n/a
Oil Range Hydrocarbons	10	200	500	60 – 130	≤40	n/a
o-Terphenyl	n/a	n/a	n/a	50 – 150	≤40	n/a
Metals						
Lead	0.046	0.1	8.1	80 – 120	≤20	75 – 125

Notes:

[(A)] – Based on current laboratory control criteria. Some values may vary slightly between instruments and can be subject to change as the laboratory updates the charted values periodically.

[(B)] - PSL is based on total Xylenes

%R – percent recovery

LCS/LCSD – laboratory control samples and laboratory control sample duplicate

MDL – method detection limit

MRL – method reporting limit

n/a – not applicable

RPD – relative percent difference

µg/L – microgram per liter

(--) – No PSL identified

Table A-6 Measurement Quality Objectives for Soil and Sediment Samples

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Name	MDL[(A)]	MRL	PSL (Soil)	PSL (Sediment)	LCS/LCS %R[(A)]	RPD (%)	Surrogate %R[(A)]
Volatile Organic Compounds (VOCs) by SW8260C (mg/kg)							
1,1,1,2-Tetrachloroethane	0.000233	0.001	n/a	n/a	80 – 120	≤40	n/a
1,1,1-Trichloroethane	0.000226	0.001	n/a	n/a	78 – 133	≤40	n/a
1,1,2,2-Tetrachloroethane	0.000253	0.001	0.005	--	71 – 120	≤40	n/a
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.000287	0.002	n/a	n/a	72 – 142	≤40	n/a
1,1,2-Trichloroethane	0.000286	0.001	n/a	n/a	77 – 120	≤40	n/a
1,1-Dichloroethane	0.000203	0.001	n/a	n/a	65 – 139	≤40	n/a
1,1-Dichloroethene	0.000336	0.001	0.005	--	73 – 138	≤40	n/a
1,1-Dichloropropene	0.000312	0.001	n/a	n/a	80 – 123	≤40	n/a
1,2,3-Trichlorobenzene	0.000305	0.005	n/a	n/a	76 – 122	≤40	n/a
1,2,3-Trichloropropane	0.000517	0.002	n/a	n/a	75 – 120	≤40	n/a
1,2,4-Trichlorobenzene	0.000332	0.005	n/a	n/a	75 – 130	≤40	n/a
1,2,4-Trimethylbenzene	0.00023	0.001	--	--	77 – 125	≤40	n/a
1,2-Dibromo-3-Chloropropane	0.000586	0.005	n/a	n/a	61 – 128	≤40	n/a
1,2-Dibromoethane (Ethylene Dibromide)	0.000176	0.001	n/a	n/a	79 – 120	≤40	n/a
1,2-Dichlorobenzene	0.000293	0.001	n/a	n/a	77 – 120	≤40	n/a
1,2-Dichloroethane	0.000191	0.001	0.01	--	77 – 120	≤40	n/a
1,2-Dichloropropane	0.000162	0.001	n/a	n/a	74 – 120	≤40	n/a
1,3,5-Trimethylbenzene	0.000254	0.001	--	--	77 – 126	≤40	n/a
1,3-Dichlorobenzene	0.000227	0.001	n/a	n/a	76 – 120	≤40	n/a
1,3-Dichloropropane	0.000209	0.001	n/a	n/a	77 – 120	≤40	n/a
1,4-Dichlorobenzene	0.000232	0.001	n/a	n/a	75 – 120	≤40	n/a
2,2-Dichloropropane	0.000292	0.001	n/a	n/a	77 – 137	≤40	n/a
2-Butanone	0.000513	0.005	n/a	n/a	64 – 120	≤40	n/a
2-Chloroethyl Vinyl Ether	0.000276	0.005	n/a	n/a	20 – 157	≤40	n/a
2-Chlorotoluene	0.0003	0.001	n/a	n/a	76 – 120	≤40	n/a
2-Hexanone	0.000439	0.005	n/a	n/a	62 – 128	≤40	n/a
4-Chlorotoluene	0.000277	0.001	n/a	n/a	75 – 121	≤40	n/a
4-Isopropyl Toluene	0.000236	0.001	--	--	78 – 131	≤40	n/a
4-Methyl-2-Pentanone	0.00042	0.005	n/a	n/a	70 – 124	≤40	n/a
Acetone	0.000482	0.005	3150000	--	48 – 132	≤40	n/a
Acrolein	0.003809	0.05	n/a	n/a	60 – 130	≤40	n/a
Acrylonitrile	0.001026	0.005	--	--	59 – 124	≤40	n/a
Benzene	0.000296	0.001	0.02	--	80 – 120	≤40	n/a
Bromobenzene	0.000153	0.001	n/a	n/a	75 – 120	≤40	n/a
Bromochloromethane	0.000323	0.001	n/a	n/a	69 – 133	≤40	n/a
Bromodichloromethane	0.000254	0.001	n/a	n/a	80 – 122	≤40	n/a
Bromoethane	0.00044	0.002	n/a	n/a	74 – 132	≤40	n/a
Bromoform	0.000297	0.001	n/a	n/a	63 – 120	≤40	n/a
Bromomethane	0.000187	0.001	n/a	n/a	40 – 172	≤40	n/a
Carbon Disulfide	0.000559	0.001	n/a	n/a	72 – 146	≤40	n/a
Carbon Tetrachloride	0.000213	0.001	n/a	n/a	76 – 136	≤40	n/a
Chlorobenzene	0.000219	0.001	n/a	n/a	80 – 120	≤40	n/a
Chloroethane	0.000462	0.001	n/a	n/a	53 – 154	≤40	n/a
Chloroform	0.000234	0.001	0.16	--	75 – 126	≤40	n/a
Chloromethane	0.000263	0.001	n/a	n/a	65 – 129	≤40	n/a
cis-1,2-Dichloroethene	0.00024	0.001	35000	--	75 – 124	≤40	n/a
cis-1,3-Dichloropropene	0.000226	0.001	n/a	n/a	80 – 124	≤40	n/a
Dibromochloromethane	0.000266	0.001	n/a	n/a	77 – 123	≤40	n/a
Dibromomethane	0.000147	0.001	n/a	n/a	80 – 120	≤40	n/a
Dichlorodifluoromethane	0.000207	0.001	n/a	n/a	67 – 142	≤40	n/a
Ethyl Benzene	0.000202	0.001	0.005	0.01	80 – 120	≤40	n/a
Hexachloro-1,3-Butadiene	0.00041	0.005	0.01	0.011	72 – 135	≤40	n/a
Iodomethane (Methyl Iodide)	0.000215	0.001	n/a	n/a	34 – 181	≤40	n/a
Isopropyl Benzene	0.000233	0.001	350000	--	77 – 127	≤40	n/a
Methylene Chloride	0.000635	0.002	0.18	--	61 – 128	≤40	n/a
Methyl-t-butyl ether (MTBE)	0.000231	0.001	n/a	n/a	68 – 124	≤40	n/a
Naphthalene	0.000429	0.005	0.14	2.1	71 – 122	≤40	n/a
n-Butylbenzene	0.000262	0.001	--	--	75 – 134	≤40	n/a
n-Propyl Benzene	0.000272	0.001	--	--	76 – 126	≤40	n/a
s-Butylbenzene	0.00024	0.001	--	--	77 – 127	≤40	n/a
Styrene	0.000138	0.001	n/a	n/a	80 – 122	≤40	n/a
t-Butylbenzene	0.000306	0.001	n/a	n/a	77 – 125	≤40	n/a
Tetrachloroethene	0.000257	0.001	0.005	0.057	76 – 131	≤40	n/a
Toluene	0.000151	0.001	6.4	--	78 – 120	≤40	n/a

Table A-6 Measurement Quality Objectives for Soil and Sediment Samples

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Name	MDL[(A)]	MRL	PSL (Soil)	PSL (Sediment)	LCS/LCS %R[(A)]	RPD (%)	Surrogate %R[(A)]
Volatile Organic Compounds (VOCs) by SW8260C (mg/kg)							
trans-1,2-Dichloroethene	0.000266	0.001	3.25	--	73 – 131	≤40	n/a
trans-1,3-Dichloropropene	0.000216	0.001	n/a	n/a	80 – 126	≤40	n/a
trans-1,4-Dichloro-2-Butene	0.000437	0.005	n/a	n/a	62 – 127	≤40	n/a
Trichloroethene	0.000212	0.001	0.01	--	80 – 120	≤40	n/a
Trichlorofluoromethane	0.000266	0.001	n/a	n/a	57 – 161	≤40	n/a
Vinyl Acetate	0.000381	0.005	n/a	n/a	54 – 138	≤40	n/a
Vinyl Chloride	0.000235	0.001	0.005	--	74 – 134	≤40	n/a
m,p-Xylene	0.000392	0.001	0.005[(B)]	0.04[(B)]	80 – 123	≤40	n/a
o-Xylene	0.000224	0.001			80 – 120	≤40	n/a
1,2-Dichloroethane-d4	n/a	n/a	n/a	n/a	80 – 149	≤40	80 – 122
1,2-Dichlorobenzene-d4	n/a	n/a	n/a	n/a	80 – 120	≤40	80 – 120
Toluene-d8	n/a	n/a	n/a	n/a	77 – 120	≤40	80 – 120
4-Bromofluorobenzene	n/a	n/a	n/a	n/a	80 – 120	≤40	80 – 120
Gasoline Range Hydrocarbons by NWTPH-Gx (mg/kg)							
Gasoline Range Hydrocarbons	0.057	0.25	30	--	80 – 120	≤40	n/a
Bromobenzene	n/a	n/a	n/a	n/a	49 – 143	≤40	n/a
Diesel and Motor Oil Range Hydrocarbons by NWTPH-Dx with Silica Gel Cleanup (mg/kg)							
Diesel Range Hydrocarbons	1.28	5	2000	--	60 – 108	≤40	n/a
Oil Range Hydrocarbons	1.57	10	2000	--	60 – 130	≤40	n/a
o-Terphenyl	n/a	n/a	n/a	n/a	50 – 150	≤40	n/a
Metals							
Lead	n/a	0.1	81	450	80-120	≤20	75-125
Organic Lead	0.1	0.25	0.35	--	n/a	n/a	n/a

Notes:

[(A)] – Based on current laboratory control criteria. Some values may vary slightly between instruments and can be subject to change as the

[(B)] - PSL is based on total Xylenes

%R – Percent recovery

LCS/LCSD – Laboratory control samples and laboratory control sample duplicate

MDL – Method detection limit

mg/kg – milligram per kilogram

MRL – Method reporting limit

n/a – not applicable

RPD – Relative percent difference

(--) – No PSL identified

APPENDIX B

Preliminary Chemicals of Concern and Screening Levels Technical Memorandum (Port of Tacoma, 2013) and the Port's Response to Ecology's January 2014 Comments

Technical Memorandum

Preliminary Chemicals of Concern and Screening Levels
Alexander Avenue Petroleum Tank Facilities Site

Prepared by the Port of Tacoma

October 31, 2013

Prepared for the Washington Department of Ecology

Deliverable 1 under Agreed Order DE 9835

Technical Memorandum

Preliminary Chemicals of Concern and Screening Levels

Alexander Avenue Petroleum Tank Facilities Site

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Tables

1 Introduction

This memorandum presents preliminary chemicals of concern (PCOCs) and associated preliminary screening levels (PSLs) for the Alexander Avenue Petroleum Tank Facilities Site (the Site). The Site is being evaluated to determine the source areas and extent of contamination, the need for further cleanup actions, and, if needed, the best further cleanup actions for petroleum-related contamination under Agreed Order DE 9835 (AO) between the Washington Department of Ecology (Ecology), the Port of Tacoma, and Mariana Properties, Inc. This memorandum fulfills AO scope of work item VII(A).

Preliminary screening levels (PSLs) have been developed for the Site to assist with the evaluation of historical Site data prior to implementing a Site Remedial Investigation (RI). Comparing historical Site data to the PSLs will allow an initial assessment of the nature and extent of contamination at the Site and what RI and Feasibility Study (FS) data gaps remain. That information then will be used to develop a Site RI Work Plan.

Site PSLs were developed for each of the Preliminary Chemicals of Concern (PCOCs) based on the exposure pathways and receptors that exist or could be expected to exist in the foreseeable future at the Site.

PSLs are not cleanup levels. They are intentionally conservative, reflecting the most stringent of multiple potential exposure pathways. Exceedances of PSLs do not indicate that cleanup will be required, but rather that additional assessment may be warranted. The need for additional assessment, and the nature of that assessment, will be addressed in the Site RI Work Plan. Following completion of the RI, Site-specific cleanup levels will be developed.

2 Preliminary Chemicals of Concern

For the purposes of this initial deliverable, a broad list of PCOCs was developed. In the RI Work Plan, historical Site data will be compared to PSLs to determine which PCOCs should be retained for further assessment. The list of PCOCs comprises three categories:

- Petroleum-related chemicals potentially released from former petroleum storage and processing facilities at the Site;
- Chemicals related to the nearby “Occidental site” that may have intermixed with chemicals released at the Site; and
- Other chemicals that may be associated with former operations at the Site or that may have been mobilized by chemicals from former operations at the Site.

2.1 Petroleum-related Preliminary Chemicals of Concern

The Site AO addresses contamination “caused by the release of hazardous substances originating from activities associated with historic petroleum storage and processing facilities that were operated on the

Site." Therefore, the primary chemicals of concern under the AO are petroleum-related chemicals that have been detected at the Site:

Volatile Organic Compounds (VOCs)
Benzene
Toluene
Ethylbenzene
Xylene (m)
Xylene (o)
Xylene (p)
Dichloroethane -1,2 (EDC)
Isopropylbenzene
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
n-Butylbenzene
p-Isopropyltoluene
n-Propylbenzene
sec-Butylbenzene

Semivolatile Organic Compounds (SVOCs)
Polycyclic aromatic hydrocarbons (PAHs)

Organometals
Tetraethyl Lead

Total Petroleum Hydrocarbons (TPH)
Gasoline Range TPH
Diesel Range TPH
Heavy Oil Range TPH

The petroleum-related chemicals MTBE and EDB, typical additives to petroleum fuels, have been tested previously at the Site and not detected, and therefore are not identified as PCOCs for the Site.

2.2 Occidental site COCs

The Site is directly south of another contaminated industrial property, which is being addressed separately as the Occidental site under an Administrative Order on Consent between the US Environmental Protection Agency (EPA), Ecology, and Occidental Chemical Corporation. Extensive previously collected environmental data from both sites indicate that the majority of the contamination from the Occidental site is located to the north in deeper soils and groundwater in relation to the contamination at the Site and may be separate from the contamination subject to the Site AO. However, there is potential that intermixing of contamination from the Occidental site with contamination from the former petroleum facilities has occurred at the Site. To address uncertainties about if and/or where intermixing occurs, primary chemicals of concern related to the separate Occidental site that appear in historical Site data have been included in the list of Site PCOCs as other chemicals of interest. These are:

VOCs
Chloroform
Methylene Chloride
Tetrachloroethane-1,1,2,2
Tetrachloroethylene (PCE)
Trichloroethylene (TCE)
cis-1,2-Dichloroethene (cis-DCE)
trans-1,2-Dichloroethene (trans-DCE)
Vinyl Chloride (VC)

SVOCs
Bis-2ethylhexyl Phthalate
Hexachlorobenzene
Hexachloro1,3-butadiene
Pentachlorophenol

2.3 Other Chemicals

Uncertainties in former Site operations include the type of "solvent" or solvents that were stored in an above-ground tank in the southwestern portion of the Site, and whether non-petroleum products were stored in tanks in the southeastern portion of the Site. These uncertainties suggest that chemicals not typically associated with petroleum (other volatile and semivolatile organic chemicals) should be conservatively included in a preliminary list of Site chemicals of concern. In addition, elevated levels of a few heavy metals have been documented in shallow soil and/or groundwater at the Site and may be related to historical operations or could be mobilized by the petroleum contamination. Therefore, as a result of these uncertainties, additional potential chemicals of concern for the Site appear warranted.

After a review of the Site database, the following VOCs, SVOCs, and metals not included in the above lists but that have been detected at the Site will be included as Site PCOCs as other chemicals of interest:

VOCs	**SVOCs**	**Metals**
Acetone	Carbazole	Arsenic
Acrylonitrile	Dibenzofuran	Copper
	Diethyl Phthalate	Lead
	Dimethyl Phthalate	Nickel
	Phenol	Zinc

3 Preliminary Exposure Pathways and Receptors

Exposure pathways and receptors of concern at a site are a function of site use and physical setting.

3.1 Site Use

Under MTCA, exposure pathways and receptors of concern are determined not just for the current site use but also the reasonably anticipated future site use(s).

The Site is located on an industrialized peninsula in the Tacoma tideflats within Commencement Bay and is zoned Maritime Industrial. The Site is bounded on its eastern side (project-east; true northeast[1]) by the Hylebos Waterway; on the west by Alexander Avenue, across which is an active marine terminal; and on the north and south by current and formerly industrialized properties. Currently, the southern half of the Site is paved, leased, and managed as a freight transfer location. A small open-bay "warehouse" is located in the southeastern portion of the Site and just to the south of the Site is a large warehouse with offices serving freight transfer operations. The northern portion of the Site was historically industrial but is currently not paved or developed due to ongoing investigations related to the Occidental site. Both the northern and southern portions of the Site are fenced and locked, preventing general public access.

[1] This document uses a project north oriented along the axis of the peninsula, and all compass directions are relative to project north, except where noted.

In all regards, the Site qualifies as an industrial property under MTCA (WAC 173-340-200 and -745).

3.2 Physical Setting

Petroleum-related contamination is known to exist in shallow soil and groundwater at the Site. The upper groundwater-bearing zone is partially or wholly perched on the silty materials of the native tideflats, upon which up to 20 feet of fill was placed in the early 1900s to create the Site and the surrounding peninsula. The upper water-bearing zone is exposed at the shoreline of the Hylebos Waterway. Some petroleum-related chemicals are found in the second (deeper) water bearing zone, which is semi-confined by the silty materials of the native tideflats, and is variable in thickness. The second water-bearing zone is interconnected with the Hylebos Waterway.

3.3 Preliminary Exposure Pathways and Receptors

With this setting and current/future land uses, the following preliminary receptors of concern and the associated preliminary exposure pathways have been identified for the Site:

- Marine benthic and aquatic organisms in the Hylebos Waterway, if sediments are impacted by contaminants that were historically released to the Waterway, or if groundwater contaminants migrate and discharge to the marine sediment and surface water.
- Fisherpersons consuming benthic and/or aquatic organisms which could be impacted if sediments are impacted by contaminants that were historically released to the Hylebos Waterway, or if groundwater contaminants migrate and discharge to the marine sediment and surface water.
- Occasional industrial site workers who could be exposed to contaminated soil and/or groundwater or could inhale volatilized contaminants from unsaturated soils or groundwater during construction, maintenance and/or utility work.
- Onsite office and warehouse workers that could be exposed to contaminants in indoor air if groundwater or soil PCOCs volatilize and migrate into indoor work areas via vapor intrusion.

Not all of these potential exposure pathways would result in the same level of exposure to receptors, and not all of these potential receptors would be equally exposed to PCOCs. The upcoming RI/FS work will identify the applicable exposure pathways and receptors for the Site, evaluate risks associated with these pathways and to these receptors, and identify those receptors that may be exposed currently or in the future to unacceptable levels of risk.

MTCA specifies that exposure pathways are to be identified based on the highest beneficial use of the site, and presumes that the highest beneficial of groundwater is drinking water. However, MTCA recognizes that in some situations, including locations in Commencement Bay such as this Site, use of groundwater for drinking water is not a reasonable exposure scenario. Site groundwater is considered non-potable for several reasons: it does not serve as a current drinking water source; it is in direct contact with marine surface water; and is sufficiently hydraulically connected to the marine surface water that it would not be practical to use as a drinking water source. Also, local regulations would not allow a drinking water well to be installed into the upper or second water-bearing zones based on

natural water quality and the existence of available public drinking water. Lastly, the Site properties are subject to restrictive covenants restricting land use, including prohibition against groundwater extraction, supply, or use for drinking or other human consumption or domestic use of any kind.[2]

MTCA also requires evaluation of the terrestrial ecological pathway. Due to the Site's location within a heavily industrialized area with fencing, and future redevelopment that will most certainly include paving and/or buildings covering the ground surface, the terrestrial pathway is not considered a reasonable potential exposure pathway for the Site. The Site therefore qualifies for an exclusion from conducting a terrestrial ecological evaluation (TEE) in accordance with WAC 173-340-7491(1)(b).

4 Preliminary Screening Levels

Site PSLs for soil and groundwater were derived in accordance with MTCA regulations [WAC 173-340-700 through -750]. The derivation processes are discussed further below and the resulting PSLs are presented in Tables 1 (groundwater) and 2 (soil). Because Site sediments are located within the Commencement Bay Superfund Site, Site PSLs for sediment (Table 3) are the Commencement Bay Nearshore/Tideflats Hylebos Waterway Sediment Quality Objectives (SQOs).

Site PSLs include a combination of published values for certain exposure pathways and calculated values for other exposure pathways. Tables 1 through 3 provide citations for the sources of the PSLs, and for those that were calculated, underlying toxicity and physical/chemical properties are provided in Table 4.

Finally, the last subsection discusses differences between the Site PSLs in relation to screening levels currently in use at the nearby Occidental site.

4.1 Groundwater PSLs

Groundwater PSLs were developed to protect the potential receptors noted in the previous section of this memorandum: marine benthic and aquatic organisms, fisherpersons, occasional industrial site workers, and onsite office and warehouse workers.

Potential exposure to groundwater by occasional industrial site workers is a direct groundwater exposure pathway; all of the other identified potential groundwater exposure pathways are indirect. Therefore, groundwater PSLs for the Site are a combination of direct exposure PSLs and cross-media PSLs that account for transfer of contaminants from groundwater to surface water or sediment and to indoor air prior to contact with potential receptors.

Groundwater screening levels protective of marine surface water were identified by setting the screening levels equal to marine surface water quality criteria developed per the process identified in WAC 173-340-730. Marine surface water quality criteria were determined by first tabulating marine surface water ARARs[3] for both ecological and human receptors. For those chemicals for which a

[2] Quit Claim Deed (Corrected) recorded on April 28, 1997 (Pierce County Auditor Recording No. 9704280734); Restrictive Covenant recorded on May 5, 2003 (Pierce County Auditor Recording No. 200305050452).
[3] Applicable or Relevant and Appropriate Requirements.

sufficiently protective human health ARAR does not exist, human-health screening levels were calculated based on the MTCA risk equations 730-1 and 730-2. For TPH, MTCA Method A groundwater cleanup levels were used as Site PSLs.

Surface water quality ARARs identified for the Site are all of the following:

- State Surface Water Quality Standards in Chapter 173-201A WAC. For Site PCOCs, the applicable values protective of aquatic species are those listed in Table 240(3) for chronic marine exposures.
- Federal Clean Water Act (CWA) Section 304(a) water quality standards. For the Site PCOCs, the applicable values are protective of both aquatic species (chronic marine exposures) and of human health (via consumption of marine organisms).
- Federal Clean Water Act "National Toxics Rule (NTR)" in 40 CFR 131.36. As with the CWA Section 304(a) water quality standards, the NTR presents water quality standards protective of both aquatic species (chronic marine exposures) and of human health (via consumption of marine organisms).

Under MTCA, human health ARARs are considered "sufficiently protective" if they meet the MTCA maximum acceptable levels of risk, which for carcinogens is an excess risk level of one in one hundred thousand and for non-carcinogens is a maximum hazard quotient of one. The human health ARARs noted above are sufficiently protective for carcinogens as they are based on excess cancer risks of no more than one in one million, but they are not necessarily sufficiently protective for non-carcinogens. Therefore, human health risk-based values for carcinogens were only calculated using MTCA equation 730-1 for those Site CPOCs for which a value was not available from ARARs, but human health risk-based values for non-carcinogens were calculated using MTCA equation 730-2 for all CPOCs.

Groundwater screening levels based on the transfer of contaminants from groundwater to marine sediment were calculated by dividing the Commencement Bay Nearshore/Tideflats Hylebos Waterway SQOs (dry weight; EPA 2009) by the associated partition coefficients identified in Ecology's Cleanup Level and Risk Calculation (CLARC) database.

The Site PSLs for groundwater also take into account volatilization of certain PCOCs from groundwater and their subsequent potential transfer to indoor air. Pre-calculated Tier 1 screening levels in Ecology's draft vapor intrusion guidance (Ecology 2009), adjusted for current MTCA industrial air cleanup levels, were chosen as the PSLs for this potential exposure pathway. The vapor-intrusion-based SLs are based in part on the lowest slab attenuation factor (0.1, or 10x attenuation from soil gas to indoor air) suggested in the Ecology guidance, which is an intentionally conservative assumption. Conservative SLs are used because of the following Site characteristics: subsurface utility lines (with unknown bedding) and shallow backfill that could provide preferential pathways for vapor migration, the presence of free phase petroleum product, and shallow groundwater (less than 15 feet deep).

As a last step, the lowest PSLs for each exposure pathway for each PCOC were compared to state background concentrations and laboratory practical quantitation limits (PQLs). Values higher than

background and PQLs were carried forward as Site groundwater PSLs, however per WAC 173-340-700(b)(d), those that were lower than background concentrations or PQLs were adjusted upward to the higher of the two. Table 1 presents not only the Site groundwater PSLs so determined, but also documents all of the interim values developed as noted above, the lowest of these for each PCOC, and which PLSs result from adjustments for background concentrations or PQLs.

As noted at the beginning of this memorandum, PSLs are by nature conservative towards being more protective than may be necessary to protect receptors. In addition to the conservative slab attenuation factor noted above, conservative aspects of the Site groundwater PSLs include the following:

- The groundwater PSLs based on protection of marine surface water and sediment do not reflect groundwater concentration changes that naturally occur within the aquifer due to tidal mixing or chemical/biological attenuation prior to groundwater discharge to the marine environment.
- No accounting was made for biodegradation in the derivation of the indoor air quality SLs. Biodegradation in unsaturated soil is known to be relatively high for petroleum related volatile chemicals, resulting in significant reduction of petroleum-related contamination over time.

Whether and/or to what extent these conservatisms are justified for this Site will be evaluated when Site-specific cleanup levels are developed following completion of the RI.

4.2 Soil PSLs

As with groundwater PSLs, Site soil PSLs also were developed to protect potential receptors noted earlier in this memorandum. Some of the identified potential soil exposure pathways for potential receptors are direct and some are indirect. Direct soil PSLs account for occasional onsite industrial workers. Indirect soil PSLs are cross-media screening levels, accounting for transfer of contaminants from soil to groundwater.

Direct contact screening levels for soil were identified by using the process outlined in WAC 173-340-745 for industrial sites using the MTCA equations 745-1 and 745-2.

Soil screening levels based on transfer of contaminants from soil to groundwater via leaching were identified for both unsaturated and saturated soils by using the MTCA cross-media calculation 747-1. For purposes of this memorandum, the MTCA default fraction of organic carbon (0.001 gram/gram, equivalent to 0.1% by weight) was used in the calculations.

As a last step, the lowest of the direct contact and the cross-media soil screening levels were compared to background concentrations (local natural background, except for the 20 mg/kg state background concentration for arsenic) and laboratory PQLs. Values higher than background and PQLs were carried forward as Site soil PSLs, however per WAC 173-340-700(b)(d), those lower than background concentrations or PQLs were adjusted upward to the higher of the two. Table 2 presents not only the Site soil PSLs so determined but also documents all of the interim soil values developed as noted above, the lowest of these for each PCOC, and which PSLs result from adjustments for background concentrations or PQLs.

Conservative aspects of the Site soil PSLs include the following:

- For soil PSLs based on the transfer of contaminants from soil to groundwater via leaching, the aforementioned elements of conservatism in the groundwater PSLs result in the same level of conservatism in the soil PSLs.
- Conservative assumptions in the standard MTCA equations for soil-to-groundwater calculations, including conservative K_d and dilution factors.

Sampling during the RI may allow for subsequent reduction in conservatism in Site screening levels through the use of empirical groundwater and soil data.

4.3 Comparison to Occidental site screening levels

The proximity to and potential co-mingling of portions of Site contamination with that from the Occidental site raises numerous issues of comparability, including the comparability of cleanup levels for the two sites. Although it is premature to identify site-specific cleanup levels for either site, the Site PSLs were compared to the current Occidental site SLs to assess comparability.

Tables 1 and 2 include columns showing corresponding Occidental site SLs for each Site PCOC. For approximately half of the Site PCOCs, there either is not a corresponding value for the Occidental site (or vice versa) or there exist differences between the two. An attempt was made to identify the sources of the differences. Tables 1 and 2 include a column with a difference key, and these are summarized below.

- Groundwater:
  - There are no corresponding Occidental site SLs for seven Site PSLs. Three of these appear to result from inclusion of vapor intrusion guidance values in Site PSL evaluations, and four appear to be due to the fact that the corresponding Site PCOCs are not COCs for the Occidental site.
  - Three Occidental site SLs have no corresponding Site PSLs. In all three cases, either no surface water ARARs exist and/or one or more of the toxicological values needed to calculate risk-based PSLs are not currently available.
  - Thirteen Site PSLs are lower than the Occidental site SLs for the same PCOCs. Of these, eight appear to be due to using Clean Water Act Section 304(a) values as Site ARARS and/or vapor intrusion guidance values in Site PSL evaluations. The remaining five appear to be due to inclusion of cross-media calculations based on sediment SQOs in the Site PSL evaluations.
  - Six Site PSLs are higher than the Occidental site SLs for the same PCOCs. The reasons for four of the differences are one Site PSL adjustment for background, use in the Occidental SLs of an NTR value (copper) which is not applicable to Washington surface water quality standards, Site development of PSLs for individual xylene isomers compared to a summed isomer value for the Occidental site SL, and a difference in the total organic carbon values used by the sites in one cross-media calculation based on a sediment SQO. The reasons for the remaining two differences are not clear.

- Soil:
  - There are no corresponding Occidental site SLs for thirteen Site PLSs. Seven of these appear to be due to use of MTCA calculations for human health in the Site PSL evaluations, five appear to be due to lack of corresponding Occidental groundwater SLs for cross-media calculations, and one appears to be due to Site use of a MTCA TEQ value for cPAHs. The reasons for the remaining two differences are not clear.
  - Fourteen Site PSLs are lower than the Occidental site SLs. Six of these are directly attributable to lower Site groundwater SLs used in cross-media calculations but the underlying basis for the other eight is not clear.
  - Eleven Site PSLs are higher than the Occidental site SLs for the same PCOCs. One is directly attributable to a higher Site groundwater PSL used in a cross-media calculation and five are due to Site PSL adjustments based on PQLs. For the remaining five, the underlying basis is not clear.

5 References

Ecology 2009. *Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action, Review Draft*, October, Publication No. 09-09-047.

Ecology 2007. *Model Toxics Control Act Statute and Regulation*, Publication No. 94-06. November.

EPA 2009. *Five Year Review Report for Commencement Bay Nearshore/Tideflats Superfund Site, Tacoma, Washington*. December 23.

Table 1
Groundwater Preliminary Screening Levels
Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

CAS	Potential Chemical of Concern	Compiled Applicable Screening Values (ug/L): Ecological: Marine Toxicity: ARARs: WA State SW Regs (Ch 173-201A WAC) (chronic)	ARARs: Clean Water Act Section 304(a) (chronic)	ARARs: National Toxics Rule (40 CFR 131) (chronic)	Calculated: Cross-Media Groundwater to Marine Sediment	Lowest Value, Marine Toxicity	Human Health via Marine Water: ARARs: Clean Water Act Section 304(a)	ARARs: National Toxics Rule (40 CFR 131.36)	MTCA Method A: Table 720-1 WAC 173-340-900	Calculated MTCA Cleanup Levels (applicable if is no sufficiently protective criterion in ARARs): Method B (Carcinogen)	Method B (Non-Carcinogen)	Method C (Carcinogen)	Method C (Non-Carcinogen)	Lowest Value, Human Health via Surface Water	Ecology Guidance Screening Level (Method C Carcinogen)	Ecology Guidance Screening Level (Method C Non-Carcinogen)	Risk Driver (Carcinogen or Non-Carcinogen)	Lowest Value, Human Health via Indoor Air	Lowest Value, All Receptor Pathways	Modifying Factors: Puget Sound Natural Back-ground Concen-trations	Modifying Factors: Practical Quanti-tation Limits (PQLs)	Alexander Avenue Site Preliminary Groundwater Screening Levels (ug/L)	Nearby Occidental site Screening Levels (CRA, 2012)	Difference Code
Petroleum Hydrocarbons																										
na	Gasoline	--	--	--	--	--	--	--	800	--	--	--	--	--	--	--	--	--	800	-	250	**800**	800	--
na	Diesel	--	--	--	--	--	--	--	500	--	--	--	--	--	--	--	--	--	500	-	250	**500**	500	--
na	Heavy Oil	--	--	--	--	--	--	--	500	--	--	--	--	--	--	--	--	--	500	-	500	**500**	500	--
Volatile Organics																										
67-64-1	Acetone	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	20	**--**	--	--
107-13-1	Acrylonitrile	--	--	--	--		--	--	--	--	--	--	--	--	160	850	C	160	160	-	0.5	**160**	--	NV (VI)
71-43-2	Benzene	--	--	--	--	--	51	71	--	23	1994	567	4986	51	24	230	C	24	24	-	0.5	**24**	71	304(a); VI
67-66-3	Chloroform	--	--	--	--	--	470	470	--	283	6914	7084	17284	470	12	--	C	12	12	-	1	**12**	470	VI
107-06-2	Dichloroethane -1,2 (EDC)	--	--	--	--	--	37	99	--	59	43210	1484	108025	37	42	--	C	42	37	-	0.5	**37**	--	NV
156-59-2	Dichloroethene - cis 1,2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.5	**--**	16	No Parms
156-60-5	Dichloroethene - trans 1,2	--	--	--	--	--	10000	--	--	--	32818	--	82044	10000	--	250	NC	250	250	-	0.5	**250**	10000	VI
75-35-4	Dichloroethene -1,1	--	--	--	--	--	7100	3.2	--	--	23148	--	57870	3.2	--	280	NC	280	3.2	-	0.5	**3.2**	3.2	--
100-41-4	Ethylbenzene	--	--	--	49	49	2100	29000	--	--	6914	--	17284	2100	--	6100	NC	6100	49	-	0.5	**49**	3.1	Seds TOC
98-82-8	Isopropylbenzene (cumene)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1600	NC	1600	1600	-	2	**1600**	--	NV (VI)
75-09-2	Methylene Chloride	--	--	--	--	--	590	1600	--	960	172840	24005	432099	590	940	--	C	940	590	-	2	**590**	1600	304(a)
104-51-8	n-Butylbenzene	--	--	--	--		--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.5	**--**	--	--
103-65-1	n-Propylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	2	**--**	--	--
99-87-6	p-Isopropyltoluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.5	**--**	--	--
135-98-8	sec-Butylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.5	**--**	--	--
127-18-4	Tetrachlolorethene (PCE)	--	--	--	215	215	3.3	8.9	--	100	502	2489	1254	3.3	240	100	NC	100	3.3	-	0.5	**3.3**	8.9	304(a)
79-34-5	Tetrachloroethane-1,1,2,2	--	--	--	--	--	4.0	11	--	6.5	--	162	--	4.0	--	--		--	4.0	-	0.5	**4.0**	11	304(a)
108-88-3	Toluene	--	--	--	--	--	15000	200000	--	--	19384	--	48460	15000	--	34000	NC	34000	15000	-	0.5	**15000**	640	?
79-01-6	Trichloroethene (TCE)	--	--	--	--	--	30	81	--	63	118	1579	295	30	26	8.4	NC	8.4	8.4	-	0.5	**8.4**	81	304(a); VI
95-63-6	Trimethylbenzene -1,2,4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	61	NC	61	61	-	2	**61**	--	NV (VI)
108-67-8	Trimethylbenzene-1,3,5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	2	**--**	--	--
75-01-4	Vinyl Chloride	--	--	--	--	--	2.4	525	--	--	6648	--	16619	2.4	3.5	120	C	3.5	2.4	-	0.5	**2.4**	2.4	--
108-38-3	Xylene (m)	--	--	--	see ortho	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.5	**--**	*	Summed
95-47-6	Xylene (o)	--	--	--	166	166	--	--	--	--	--	--	--	--	--	--	--	--	166	-	0.5	**166**	*	Summed
106-42-3	Xylene (p)	--	--	--	see ortho	--	15000	200000	--	--	--	--	--	15000	--	--	--	--	15000	-	0.5	**15000**	*	Summed
Semivolatile Organics																										
117-81-7	Bis-2ethylhexyl Phthalate	--	--	--	1.2	1.2	2.2	5.9	--	4	399	89	997	2.2	--	--	--	--	1.2	-	1.0	**1.2**	1	--
86-74-8	Carbazole	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.2	**--**	--	--
132-64-9	Dibenzofuran	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.2	**--**	--	--
84-66-2	Diethyl Phthalate	--	--	--	2439	2439	44000	120000	--	--	28412	--	71030	28412	--	--	--	--	2439	-	0.2	**2439**	--	NV
131-11-3	Dimethyl Phthalate	--	--	--	--	--	1100000	2900000	--	--	72016	--	180041	72016	--	--	--	--	72016	-	0.2	**72016**	--	NV
87-68-3	Hexachloro 1,3-butadiene	--	--	--	0.2	0.2	18	50	--	30	187	747	466	18	8.1	--	C	8.1	0.2	-	0.2	**0.2**	0.2	--
118-74-1	Hexachlorobenzene	--	--	--	0.3	--	0.00029	0.00077	--	0.0005	--	--	1	0.00029	--	--	--	--	0.00029	-	0.2	**0.2**	0.2	--
87-86-5	Pentachlorophenol	7.9	7.9	7.9	608	7.9	3.0	8.2	--	5	7071	123	17677	3.0	--	--	--	--	3	-	1	**3.0**	7.9	304(a)
108-95-2	Phenol	--	--	--	14583	14583	1.70E+06	4.60E+06	--	--	1111111	--	2777778	1111111	--	--	--	--	14583	-	0.5	**14583**	--	NV
cPAHs																										
56-55-3	Benz(a)anthracene	--	--	--	4.5	4.5	0.018	0.031	--	0.30	--	7.0	--	0.018	--	--	--	--	0.02	-	0.02	**0.02**	0.02	--

Table 1
Groundwater Preliminary Screening Levels
Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

CAS	Potential Chemical of Concern	Compiled Applicable Screening Values (ug/L)																	Modifying Factors		Alexander Avenue Site Preliminary Groundwater Screening Levels (ug/L)	Nearby Occidental site Screening Levels (CRA, 2012)	Difference Code
		Ecological: Marine Toxicity					Human Health via Marine Water																
		ARARs			Calculated		ARARs		MTCA Method A	Calculated MTCA Cleanup Levels (applicable if is no sufficiently protective criterion in ARARs)													
		WA State SW Regs (Ch 173-201A WAC) (chronic)	Clean Water Act Section 304(a) (chronic)	National Toxics Rule (40 CFR 131) (chronic)	Cross-Media Groundwater to Marine Sediment	Lowest Value, Marine Toxicity	Clean Water Act Section 304(a)	National Toxics Rule (40 CFR 131.36)	Table 720-1 WAC 173-340-900	Method B (Carcinogen)	Method B (Non-Carcinogen)	Method C (Carcinogen)	Method C (Non-Carcinogen)	Lowest Value, Human Health via Surface Water	Ecology Guidance Screening Level (Method C Carcinogen)	Ecology Guidance Screening Level (Method C Non-Carcinogen)	Risk Driver (Carcinogen or Non-Carcinogen)	Lowest Value, Human Health via Indoor Air	Lowest Value, All Receptor Pathways	Puget Sound Natural Back-ground Concen-trations	Practical Quanti-tation Limits (PQLs)			
50-32-8	Benzo(a)pyrene	--	--	--	1.7	1.7	0.018	0.031	--	0.03	--	1.0	--	0.018	--	--	--	--	0.02	-	0.02	**0.02**	0.02	--
205-99-2	Benzo(b)fluoranthene	--	--	--	see B(k)F	see B(k)F	0.018	0.031	--	0.30	--	7.0	--	0.018	--	--	--	--	0.02	-	0.02	**0.02**	0.02	--
207-08-9	Benzo(k)fluoranthene	--	--	--	2.9	2.9	0.018	0.031	--	2.96	--	74	--	0.018	--	--	--	--	0.02	-	0.02	**0.02**	0.02	--
218-01-9	Chrysene	--	--	--	7	7	0.018	0.031	--	29.60	--	740	--	0.018	--	--	--	--	0.02	-	0.02	**0.02**	0.02	--
53-70-3	Dibenz(a,h)anthracene	--	--	--	0.1	0.1	0.018	0.031	--	0.03	--	1.0	--	0.018	--	--	--	--	0.02	-	0.02	**0.02**	0.02	--
193-39-5	Indeno (1,2,3-cd)pyrene	--	--	--	0.2	0.2	0.018	0.031	--	0.30	--	7.0	--	0.018	--	--	--	--	0.02	-	0.02	**0.02**	0.02	--
na	cPAH (TEQ)	--	--	--	--	--	0.018	0.031	--	0.03	--	1.0	--	0.018	--	--	--	--	0.02	-	0.02	**0.02**	0.02	--
	Other PAHs																							
208-96-8	Acenaphthylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.02	**--**	--	--
83-32-9	Acenaphthene	--	--	--	102	102	990	--	--	--	643	--	1607	643	--	--	--	--	102	-	0.02	**102**	643	SQO Calc
120-12-7	Anthracene	--	--	--	41	41	40000	110000	--	--	25926	--	64815	25926	--	--	--	--	41	-	0.02	**41**	110000	SQO Calc
191-24-2	Benzo(g,h,i)perylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.02	**--**	--	--
206-44-0	Fluoranthene	--	--	--	51	51	140	370	--	--	90	--	225	90	--	--	--	--	51	-	0.02	**51**	90.2	SQO Calc
86-73-7	Fluorene	--	--	--	70	70	5300	14000	--	--	3457	--	8642	3457	--	--	--	--	70	-	0.02	**70**	640	SQO Calc
90-12-0	Methylnaphthalene-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.02	**--**	--	--
91-57-6	Methylnaphthalene-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.02	**--**	32	No Parms
91-20-3	Naphthalene	--	--	--	1763	1763	--	--	--	--	86420	--	216049	86420	--	360	NC	360	360	-	0.02	**360**	160	?
94-09-7	Phenanthrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.02	**--**	--	--
129-00-0	Pyrene	--	--	--	49	49	4000	11000	--	--	2593	--	6481	2593	--	--	--	--	49	-	0.02	**49**	480	SQO Calc
	Metals																							
	Heavy Metals																							
7440-38-2	Arsenic	36	36	36	1966	36	0.14	0.14	--	0.10	18	2.0	44	0.14	--	--	--	--	0.14	5.00	0.50	**5.0**	0.5	Bkgd
7440-50-8	Copper	3.1	3.1	--	17727	3.1	--	--	--	--	2665	--	6662	2665	--	--	--	--	3.1	-	0.1	**3.1**	2.4	NTR NA
7439-92-1	Lead	8.1	8.1	8.1	45	8.1	--	--	--	--	--	--	--	--	--	--	--	--	8.1	-	0.02	**8.1**	8.1	--
7440-02-0	Nickel	8.2	610	8.2	2154	8.2	4600	4600	--	--	1103	--	2758	1103	--	--	--	--	8.2	-	0.2	**8.2**	8.2	--
7440-66-6	Zinc	81	7400	81	6613	81	26000	--	--	--	16548	--	41371	16548	--	--	--	--	81	-	0.5	**81**	81	--
	Organometals																							
78-00-0	Tetraethyl Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	-	0.0005	**--**	0.0008	No Parms

-- Indicates that no value is available. In the case of ARARs, the referenced sources do not publish value for the noted chemicals. In the case of calculated Screening Levels, one or more input parameter values is not available.

***** Occidential SL is 1600 ug/L for total xylenes.

5 Gray-shaded values are not applicable under MTCA, given that other "sufficiently protective" values are available under other regulations.

Difference Codes:	
--	No difference.
?	Basis for difference not clear from available information.
304(a)	Site PSLs used Clean Water Act Section 304(a) values as ARARs.
Bkgd	Site PSLs adjusted to background concentrations when background concentrations exceeded the lowest ARARs and calculated values.
No Parms	Incomplete physical, chemical, or toxicologic parameters needed to calculate risk-based values
NTR NA	Site PSLs do not use the National Toxics Rule value due to its inapplicability to WA state.
NV	No corresponding value for comparison.
SQO Calc	Site PSLs include cross-media values calculated from Sediment Quality Objectives (SQOs) for Commencement Bay/Nearshore Tideflats Superfund Site.
Summed	Individual isomer values summed and therefore not directly comparable.
VI	Site PSLs include Ecology's draft Vapor Intrusion Tier I screening levels.

Table 2
Soil Preliminary Screening Levels
Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

		Compiled Applicable Screening Values (mg/kg)															
		MTCA Table Values (Human Health) (Tables 740-1 & 745-1)		MTCA Methods B & C Calculated Values (Human Health)				MTCA Cross-Media (Soil to Groundwater to Surface Water) Calculated Values					Modifying Factors				
				Method B		Method C		Unsaturated Soils		Saturated Soils							
CAS	Potential Chemical of Concern	Method A Unrestricted Land Use	Method C Industrial Land Use	Unrestricted Land Use (carcinogen)	Unrestricted Land Use (non carcinogen)	Industrial Land Use (carcinogen)	Industrial Land Use (non carcinogen)	Ecological	Human Health	Ecological	Human Health	**Lowest Value, All Receptor Pathways (mg/kg)**	Puget Sound Natural Back-ground Concen-trations	Practical Quanti-tation Limits (PQLs)	**Alexander Avenue Site Preliminary Screening Levels (mg/kg)**	Nearby Occidental site Screening Levels; Lowest of Saturated and Un-saturated Soils	Difference Code
	Petroleum Hydrocarbons																
na	Gasoline	dw	30**	--	--	--	--	--	--	--	--	30	--	5	**30**	30	--
na	Diesel	dw	2000**	--	--	--	--	--	--	--	--	2000	--	25	**2000**	2000	--
na	Heavy Oil	dw	2000**	--	--	--	--	--	--	--	--	2000	--	100	**2000**	2000	--
	Volatile Organics																
67-64-1	Acetone	--	--	--	72000	--	3150000	--	--	--	--	72000	--	0.02	**72000**	--	NV
107-13-1	Acrylonitrile	--	--	--	--	--	--	--	--	--	--	--	--	na	**--**	--	--
71-43-2	Benzene	dw	dw	18	320	2386	14000	--	0.3	--	0.02	0.02	--	0.005	**0.02**	0.025	--
67-66-3	Chloroform	--	--	164	800	21516	35000	--	2.5	--	0.16	0.16	--	0.005	**0.16**	0.16	--
107-06-2	Dichloroethane -1,2 (EDC)	--	--	11	1600	1442	70000	--	0.2	--	0.012	0.012	--	0.005	**0.012**	--	NV
156-59-2	Dichloroethene - cis 1,2	--	--	--	800	--	35000	--	--	--	--	800	--	0.005	**800**	--	NV
156-60-5	Dichloroethene - trans 1,2	--	--	--	1600	--	70000	--	54.3	--	3.2	3.2	--	0.005	**3.2**	3.2	--
75-35-4	Dichloroethene -1,1	--	--	--	4000	--	175000	--	0.023	--	0.001	0.001	--	0.005	**0.005**	0.001	PQL
100-41-4	Ethylbenzene	dw	dw	--	8000	--	350000	0.4	18	0.02	1.0	0.02	--	0.01	**0.02**	0.63	?
98-82-8	Isopropylbenzene	--	--	--	8000	--	350000	--	--	--	--	8000	--	0.02	**8000**	--	NV
75-09-2	Methylene Chloride	dw	dw	133	4800	17500	210000	--	2.6	--	0.18	0.18	--	0.01	**0.18**	0.48	GW
104-51-8	n-Butylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	na	**--**	--	--
103-65-1	n-propylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	0.02	**--**	--	--
99-87-6	p-Isopropyltoluene	--	--	--	--	--	--	--	--	--	--	--	--	na	**--**	--	--
135-98-8	sec-Butylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	na	**--**	--	--
127-18-4	Tetrachlolorethene (PCE)	dw	dw	476	480	62500	21000	2.3	0.04	0.12	0.002	0.002	--	0.005	**0.005**	0.005	--
79-34-5	Tetrachloroethane-1,1,2,2	--	--	5	--	656	--	--	0.022	--	0.001	0.001	--	0.005	**0.005**	0.004	PQL
108-88-3	Toluene	dw	dw	--	6400	--	280000	--	109	--	6.4	6.4	--	0.01	**6.4**	0.27	GW
79-01-6	Trichloroethene (TCE)	dw	dw	107	40	14068	1750	--	0.2	--	0.01	0.01	--	0.005	**0.01**	0.031	?
95-63-6	Trimethylbenzene -1,2,4	--	--	--	--	--	--	--	--	--	--	--	--	na	**--**	--	--
108-67-8	Trimethylbenzene-1,3,5	--	--	--	--	--	--	--	--	--	--	--	--	na	**--**	--	--
75-01-4	Vinyl Chloride	--	--	--	240	--	10500	--	0.015	--	0.0007	0.0007	--	0.005	**0.005**	0.00073	PQL
108-38-3	Xylene (m)	--	--	--	16000	--	700000	--	--	--	--	16000	--	0.005	**16000**	--	NV
95-47-6	Xylene (o)	--	--	--	16000	--	700000	1.5	--	0.1	--	0.1	--	0.005	**0.1**	--	NV
106-42-3	Xylene (p)	dw	dw	--	16000	--	700000	--	161	--	9.0	9.0	--	0.005	**9.0**	--	NV
	Semivolatile Organics																
117-81-7	Bis-2ethylhexyl Phthalate	--	--	71	1600	9375	70000	3	4.9	0.13	0.2	0.13	--	0.10	**0.13**	0.08	?
86-74-8	Carbazole	--	--	--	--	--	--	--	--	--	--	--	--	na	**--**	--	--
132-64-9	Dibenzofuran	--	--	--	160	--	7000	--	--	--	--	160	--	0.0005	**160**	--	NV
84-66-2	Diethyl Phthalate	--	--	--	64000	--	2800000	14	160	0.9	10	0.9	--	0.01	**0.9**	--	NV

Table 2
Soil Preliminary Screening Levels
Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

CAS	Potential Chemical of Concern	Compiled Applicable Screening Values (mg/kg): MTCA Table Values (Human Health) (Tables 740-1 & 745-1): Method A Unrestricted Land Use	MTCA Table Values (Human Health) (Tables 740-1 & 745-1): Method C Industrial Land Use	MTCA Methods B & C Calculated Values (Human Health): Method B: Unrestricted Land Use (carcinogen)	Method B: Unrestricted Land Use (non carcinogen)	Method C: Industrial Land Use (carcinogen)	Method C: Industrial Land Use (non carcinogen)	MTCA Cross-Media (Soil to Groundwater to Surface Water) Calculated Values: Unsaturated Soils: Ecological	Unsaturated Soils: Human Health	Saturated Soils: Ecological	Saturated Soils: Human Health	**Lowest Value, All Receptor Pathways (mg/kg)**	Modifying Factors: Puget Sound Natural Back-ground Concen-trations	Modifying Factors: Practical Quanti-tation Limits (PQLs)	**Alexander Avenue Site Preliminary Screening Levels (mg/kg)**	Nearby Occidental site Screening Levels; Lowest of Saturated and Un-saturated Soils	Difference Code
131-11-3	Dimethyl Phthalate	--	--	--	80000	--	3500000	--	--	--	--	80000	--	0.01	**80000**	--	NV
87-68-3	Hexachloro 1,3-butadiene	--	--	13	16	1683	700	0.2	19	0.01	1	0.01	--	0.01	**0.01**	0.0007	?
118-74-1	Hexachlorobenzene	--	--	0.6	64	82	2800	--	0.0005	--	0.00002	0.00002	--	0.010	**0.01**	0.00006	PQL
87-86-5	Pentachlorophenol	--	--	8.3	2400	1094	105000	0.13	0.05	0.01	0.003	0.003	--	0.10	**0.10**	0.007	PQL
108-95-2	Phenol	--	--	--	48000	--	2100000	67	5084	4.6	351	4.6	--	0.03	**4.6**	--	NV
	cPAHs																
56-55-3	Benzo(a)anthracene	see TEQ	see TEQ	1.4	--	180	--	32	0.1	1.6	0.006	0.006	--	0.0005	**0.006**	0.0064	--
50-32-8	Benzo(a)pyrene	0.1	0.1	0.14	--	18	--	32	0.3	1.6	0.02	0.02	--	0.001	**0.02**	0.029	?
205-99-2	Benzo(b)fluoranthene	see TEQ	see TEQ	1.4	--	180	--	--	0.4	--	0.02	0.02	--	0.001	**0.02**	0.022	--
207-08-9	Benzo(k)fluoranthene	see TEQ	see TEQ	14	--	1798	--	72	0.4	4	0.02	0.02	--	0.001	**0.02**	0.022	--
218-01-9	Chrysene	see TEQ	see TEQ	137	--	17979	--	56	0.1	3	0.007	0.007	--	0.001	**0.007**	0.007	--
53-70-3	Dibenz(a,h)anthracene	see TEQ	see TEQ	0.14	--	18	--	5	0.6	0.2	0.03	0.03	--	0.001	**0.03**	0.032	--
193-39-5	Indeno(1,2,3-cd)pyrene	see TEQ	see TEQ	1.4	--	180	--	14	1.2	1	0.06	0.06	--	0.001	**0.06**	0.062	--
na	cPAH (TEQ)	0.1	0.1	--	--	--	--	--	--	--	--	0.02		0.001	**0.02**	--	NV
	Other PAHs																
208-96-8	Acenaphthylene	--	--	--	--	--	--	--	--	--	--	--	--	0.0005	**--**	--	--
83-32-9	Acenaphthene	--	--	--	4800	--	210000	10	66	0.5	3	0.5	--	0.001	**0.5**	3.3	GW
120-12-7	Anthracene	--	--	--	24000	--	1050000	19	12285	1.0	617	1.0	--	0.001	**1.0**	2616	GW
191-24-2	Benzo(g,h,i)perylene	--	--	--	--	--	--	--	--	--	--	--	--	0.0005	**--**	--	--
206-44-0	Fluoranthene	--	--	--	3200	--	140000	50	89	2.5	4	2.5	--	0.001	**2.5**	4.5	GW
86-73-7	Fluorene	--	--	--	3200	--	140000	11	547	0.6	28	0.6	--	0.001	**0.6**	0.51	?
90-12-0	Methylnaphthalene-1	--	--	--	--	--	--	--	--	--	--	--	--	0.001	**--**	--	--
91-57-6	Methylnaphthalene-2	--	--	--	320	--	14000	--	--	--	--	320	--	0.001	**320**	0.0003	?
91-20-3	Naphthalene	dw	dw	--	80000	--	3500000	49	--	2.6	--	2.6	--	0.001	**2.6**	0.24	?
94-09-7	Phenanthrene	--	--	--	--	--	--	--	--	--	--	--	--	0.0005	**--**	--	--
129-00-0	Pyrene	--	--	--	2400	--	105000	66	3536	3.3	177	3.3	--	0.001	**3.3**	33	GW
	Metals																
	Heavy Metals																
7440-38-2	Arsenic	dw	dw	0.7	24	88	1050	21	0.08	1.1	0.004	0.004	20	0.5	**20**	146	?
7440-50-8	Copper			--	2960	--	129500	1.4	1183	0.07	59	0.07	36	0.1	**36**	53.5	?
7439-92-1	Lead	250	1000	--	--	--	--	1620	--	81	--	81	24	0.05	**81**	81002	?
7440-02-0	Nickel		70000	--	1600	--	70000	11	1438	0.5	72	0.5	48	0.2	**48**	535	?
7440-66-6	Zinc		1050000	--	24000	--	1050000	101	20586	5.0	1031	5.0	85	0.5	**85**	5045	?
	Organometals																
78-00-2	Tetraethyl Lead	--	--	--	--	0.35	--	--	--	--	--	0.35	--	--	**0.35**	--	NV

Table 2
Soil Preliminary Screening Levels
Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

		Compiled Applicable Screening Values (mg/kg)													
		MTCA Table Values (Human Health) (Tables 740-1 & 745-1)		MTCA Methods B & C Calculated Values (Human Health)				MTCA Cross-Media (Soil to Groundwater to Surface Water) Calculated Values					Modifying Factors				
				Method B		Method C		Unsaturated Soils		Saturated Soils							
CAS	**Potential Chemical of Concern**	Method A Unrestricted Land Use	Method C Industrial Land Use	Unrestricted Land Use (carcinogen)	Unrestricted Land Use (non carcinogen)	Industrial Land Use (carcinogen)	Industrial Land Use (non carcinogen)	Ecological	Human Health	Ecological	Human Health	**Lowest Value, All Receptor Pathways (mg/kg)**	Puget Sound Natural Back-ground Concen-trations	Practical Quanti-tation Limits (PQLs)	**Alexander Avenue Site Preliminary Screening Levels (mg/kg)**	Nearby Occidental site Screening Levels; Lowest of Saturated and Un-saturated Soils	Difference Code

***** Occidental Site screening levels for total xylenes for unsaturated zone and saturated zone soils, respectively, are 14.6 and 0.8 mg/kg.

** Denotes value from MTCA Method A Industrial Table where no value can be calculated under MTCA Methods B or C. Value based on preventing accumulation of free product.

dw Identifies that a value exists in MTCA tables but that value is not applicable to this site because it is based on protecting drinking water sources.

Puget Sound background metals concentrations from *Natural Background Soil Metals Concentrations in Washington State* (Ecology, 1994), except arsenic which is based on Washington State background concentrations.

Difference Codes:

--	No difference.
?	Basis for difference not clear from available information.
Bkgd	Site PSLs adjusted to background concentrations when background concentrations exceeded the lowest ARARs and calculated values.
GW	Difference in soil PSL directly attributable to difference in groundwater PSLs used in cross-media calculations.
NV	No corresponding value for comparison.
PQL	Difference due to adjustments to Practical Quantitation Limits (PQLs).
Xmedia	Site PSL based on soil-to-groundwater cross-media value; no Occidental site groundwater SL on which to calculate a cross-media value.

Table 3
Sediment Preliminary Screening Levels
Alexander Avenue Petroleum Tank Facilitites Site
Tacoma, WA

CAS	Potential Chemical of Concern	CB/NT SQO (mg/kg)
Petroleum Hydrocarbons		
na	Gasoline	--
na	Diesel	--
na	Heavy Oil	--
Volatile Organics		
67-64-1	Acetone	--
107-13-1	Acrylonitrile	--
71-43-2	Benzene	--
67-66-3	Chloroform	--
107-06-2	Dichloroethane -1,2 (EDC)	--
156-59-2	Dichloroethene - cis 1,2	--
156-60-5	Dichloroethene - trans 1,2	--
75-35-4	Dichloroethene -1,1	--
100-41-4	Ethylbenzene	0.01
98-82-8	Isopropylbenzene	--
75-09-2	Methylene Chloride	--
104-51-8	n-Butylbenzene	--
103-65-1	n-propylbenzene	--
99-87-6	p-Isopropyltoluene	--
135-98-8	sec-Butylbenzene	--
127-18-4	Tetrachlolorethene (PCE)	0.057
79-34-5	Tetrachloroethane-1,1,2,2	--
108-88-3	Toluene	--
79-01-6	Trichloroethene (TCE)	--
95-63-6	Trimethylbenzene -1,2,4	--
108-67-8	Trimethylbenzene-1,3,5	--
75-01-4	Vinyl Chloride	--
108-38-3	Xylene (m)	see ortho
95-47-6	Xylene (o)	0.04
106-42-3	Xylene (p)	see ortho
Semivolatile Organics		
117-81-7	Bis-2ethylhexyl Phthalate	0.13
86-74-8	Carbazole	--
132-64-9	Dibenzofuran	0.54
84-66-2	Diethyl Phthalate	0.2
131-11-3	Dimethyl Phthalate	0.16
87-68-3	Hexachloro 1,3-butadiene	0.011
118-74-1	Hexachlorobenzene	0.022
87-86-5	Pentachlorophenol	0.36
108-95-2	Phenol	0.42

Table 3
Sediment Preliminary Screening Levels
Alexander Avenue Petroleum Tank Facilitites Site
Tacoma, WA

CAS	Potential Chemical of Concern	CB/NT SQO (mg/kg)
	cPAHs	
56-55-3	Benzo(a)anthracene	1.6
50-32-8	Benzo(a)pyrene	1.6
205-99-2	Benzo(b)fluoranthene	see B(k)F
207-08-9	Benzo(k)fluoranthene	3.6
218-01-9	Chrysene	2.8
53-70-3	Dibenz(a,h)anthracene	0.23
193-39-5	Indeno(1,2,3-cd)pyrene	0.69
na	cPAH (TEQ)	
	Other PAHs	
208-96-8	Acenaphthylene	0.13
83-32-9	Acenaphthene	0.5
120-12-7	Anthracene	0.96
191-24-2	Benzo(g,h,i)perylene	0.72
206-44-0	Fluoranthene	2.5
86-73-7	Fluorene	0.54
90-12-0	Methylnaphthalene-1	--
91-57-6	Methylnaphthalene-2	0.67
91-20-3	Naphthalene	2.1
94-09-7	Phenanthrene	1.5
129-00-0	Pyrene	3.3
Metals		
	Heavy Metals	
7440-38-2	Arsenic	57
7440-50-8	Copper	390
7439-92-1	Lead	450
7440-02-0	Nickel	140
7440-66-6	Zinc	410
	Organometals	
78-00-2	Tetraethyl Lead	--

Table 4
Calculation Parameters for Preliminary Site Screening Levels
Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

		Parameters for Cross-Media Calculations						Toxicological Parameters					
CAS	Potential Chemical of Concern	Henry's Law constant	Kd	Foc	Koc	BCF	CB/NT SQO (mg/kg)	CPFo	RfDo	CPFi	RfDi	Inhalation Correction Factor	TEQ Multiplier
Petroleum Hydrocarbons													
na	Gasoline	--	--	--	--	--	--	--	--	--	--	--	--
na	Diesel	--	--	--	--	--	--	--	--	--	--	--	--
na	Heavy Oil	--	--	--	--	--	--	--	--	--	--	--	--
Volatile Organics													
67-64-1	Acetone	0.00159	0.0006	0.001	0.575	--	--	--	0.9	--	--	2	--
107-13-1	Acrylonitrile	--	--	--	--	30	--	0.54	--				--
71-43-2	Benzene	0.228	0.062	0.001	62	5.2	--	0.055	0.004	0.0273	0.00857	2	--
67-66-3	Chloroform	0.15	0.053	0.001	53	3.75	--	0.0061	0.01	--	--	--	--
107-06-2	Dichloroethane -1,2 (EDC)	0.0401	0.038	0.001	38	1.2	--	0.091	0.02	--	--	--	--
156-59-2	Dichloroethene - cis 1,2	0.167	0.036	0.001	35.5	--	--	--	0.01	--	--	--	--
156-60-5	Dichloroethene - trans 1,2	0.385	0.038	0.001	38	1.58	--	--	0.02	--	--	--	--
75-35-4	Dichloroethene -1,1	1.07	0.065	0.001	65	5.6	--	--	0.05	--	--	--	--
100-41-4	Ethylbenzene	0.323	0.20	0.001	204	37.5	0.01	--	0.1	--	0.286	2	--
98-82-8	Isopropylbenzene	--	--	--	--	--	--	--	0.1	--	--	--	--
75-09-2	Methylene Chloride	0.0898	0.010	0.001	10	0.9	--	0.0075	0.06	0.00	--	2.00	
104-51-8	n-Butylbenzene												
103-65-1	n-propylbenzene	--	--	--	--	--	--	--	--	--	--	--	--
99-87-6	p-Isopropyltoluene												
135-98-8	sec-Butylbenzene												
127-18-4	Tetrachlolorethene (PCE)	0.754	0.27	0.001	265	31	0.057	0.0021	0.006	0.00091	0.0114	2	--
79-34-5	Tetrachloroethane-1,1,2,2	0.014	0.079	0.001	79	5	--	0.2	--				--
108-88-3	Toluene	0.272	0.14	0.001	140	10.7	--	--	0.08	--	1.43	2	--
79-01-6	Trichloroethene (TCE)	0.422	0.094	0.001	94	11	--	0.00933	0.0005	see notes	see notes	2	--
95-63-6	Trimethylbenzene -1,2,4												
108-67-8	Trimethylbenzene-1,3,5												
75-01-4	Vinyl Chloride	1.11	0.019	0.001	18.6	1.17	--	--	0.003	--	0.028571	2	--
108-38-3	Xylene (m)	0.301	0.20	0.001	196	--	see ortho	--	0.2	--	--	2	--
95-47-6	Xylene (o)	0.213	0.24	0.001	241	--	0.04	--	0.2	--	--	2	--
106-42-3	Xylene (p)	0.314	0.31	0.001	311	--	see ortho	--	0.2	--	--	2	--
Semivolatile Organics													
117-81-7	Bis-2ethylhexyl Phthalate	4.18E-08	111	0.001	111000	130	0.13	0.014	0.02	--	--	--	--
86-74-8	Carbazole												
132-64-9	Dibenzofuran	--	--	--	--	--	0.54	--	0.002	--	--	--	--
84-66-2	Diethyl Phthalate	0.000019	0.082	0.001	82	73	0.2	--	0.8	--	--	--	--
131-11-3	Dimethyl Phthalate	--	--	--	--	36	0.16	--	1	--	--	--	--
87-68-3	Hexachloro 1,3-butadiene	0.334	54	0.001	53700	2.78	0.011	0.0780	0.0002	--	--	--	--

Table 4
Calculation Parameters for Preliminary Site Screening Levels
Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

		Parameters for Cross-Media Calculations						Toxicological Parameters					
CAS	Potential Chemical of Concern	Henry's Law constant	Kd	Foc	Koc	BCF	CB/NT SQO (mg/kg)	CPFo	RfDo	CPFi	RfDi	Inhalation Correction Factor	TEQ Multiplier
118-74-1	Hexachlorobenzene	0.054	80	0.001	80000	8690	0.022	1.6000	0.0008	--	--	--	--
87-86-5	Pentachlorophenol	0.000001	0.59	0.001	592	11	0.36	0.12	0.03	--	--	--	--
108-95-2	Phenol	1.63E-05	0.029	0.001	28.8	1.4	0.42	--	0.6	--	--	--	--
	cPAHs												
56-55-3	Benzo(a)anthracene	0.000137	358	0.001	357537	30	1.6	0.73	--	--	--	1	0.1
50-32-8	Benzo(a)pyrene	4.63E-05	969	0.001	968774	30	1.6	7.3	--	--	--	1	1
205-99-2	Benzo(b)fluoranthene	0.00455	1230	0.001	1230000	30	see B(k)F	0.73	--	--	--	1	0.1
207-08-9	Benzo(k)fluoranthene	0.000034	1230	0.001	1230000	30	3.6	0.07	--	--	--	1	0.1
218-01-9	Chrysene	0.00388	398	0.001	398000	30	2.8	0.01	--	--	--	1	0.01
53-70-3	Dibenz(a,h)anthracene	6.03E-07	1789	0.001	1789101	30	0.23	7.30	--	--	--	1	0.1
193-39-5	Indeno(1,2,3-cd)pyrene	6.56E-05	3470	0.001	3470000	30	0.69	0.73	--	--	--	1	0.1
na	cPAH (TEQ)							--	--	--	--	--	--
	Other PAHs												
208-96-8	Acenaphthylene	--	--	--	--	--	0.13	--	--	--	--	--	--
83-32-9	Acenaphthene	0.00636	4.9	0.001	4898	242	0.5	--	0.06	--	--	1	--
120-12-7	Anthracene	0.00267	23	0.001	23493	30	0.96	--	0.3	--	--	--	--
191-24-2	Benzo(g,h,i)perylene	--	--	--	--	--	0.72	--	--	--	--	--	--
206-44-0	Fluoranthene	0.00066	49	0.001	49096	1150	2.5	--	0.04	--	--	--	--
86-73-7	Fluorene	0.00261	7.7	0.001	7707	30	0.54	--	0.04	--	--	--	--
90-12-0	Methylnaphthalene-1	--	--	--	--	--	--	--	--	--	--	--	--
91-57-6	Methylnaphthalene-2	--	--	--	--	--	0.67	--	0.004	--	--	--	--
91-20-3	Naphthalene	0.0198	1.2	0.001	1191	10.5	2.1	--	1	--	0.000857	2	--
94-09-7	Phenanthrene	--	--	--	--	--	1.5	--	--	--	--	--	--
129-00-0	Pyrene	0.000451	68	0.001	67992	30	3.3	--	0.03	--	--	--	--
Metals													
	Heavy Metals												
7440-38-2	Arsenic	0	29	--	--	44	57	1.5	0.0003	15.05	--	1	--
7440-50-8	Copper	0	22	--	--	36	390	--	0.037	--	--	--	--
7439-92-1	Lead	0	10000	--	--	--	450	--	--	--	--	--	--
7440-02-0	Nickel	0	65	--	--	47	140	--	0.02				--
7440-66-6	Zinc	0	62	--	--	47	410	--	0.3				--
	Organometals												
78-00-2	Tetraethyl Lead	--	--	--	--	--	--	--	1.0E-07	--	--	2	--

Response to Ecology Review Comments on *Draft Technical Memorandum, Preliminary Chemicals of Concern and Screening Levels, Alexander Avenue Petroleum Tank Facilities Site, October 31, 2013*

Reproduced below are Ecology's comments on the draft Technical Memorandum sent via email to Leslee Conner, Clint Babcock, and Joyce Mercuri on January 7, 2014. Below each comment we have inserted responses **in bold** as to how the comments will be addressed. In accordance with Ecology's email accompanying the comments, the resulting changes are made directly into the final Remedial Investigation/Feasibility Study (RI/FS) Work Plan. We have provided these comments responses to accompany the draft Technical Memorandum in an appendix to the Work Plan for documentation.

Table 1- Groundwater Screening Levels:

1. TPH – It is acceptable to use the MTCA Method A value for drinking water protection as a human health value for TPH for surface waters. However, MTCA Method B also requires protection for environmental effects (173-340-730(3)(b)(ii). May need to do WET testing to evaluate protectiveness of groundwater to surface water for TPH. Alternatively, Method A specifies the water must be below natural background or PQL). Note that CWA does have a narrative criterion for protection of surface waters. http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/upload/2009_01_13_criteria_goldbook.pdf (not sure whether this is still relevant today – it is quite old).

   The Work Plan identifies WET testing as a contingency in the event that TPH discharging to surface waters is detected. WET testing would be performed under a Work Plan Addendum if necessary.

2. TPH Diesel/Heavy Oil –Since the site did not deal in heavy oil, we would likely apply the Dx result as one value instead of splitting between diesel and oil. See Ecology Implementation Memo # 4. It may be useful to run some HCID tests to try to identify the products present.

   As indicated, it is expected that the contamination at the site generally does not include heavy oil TPH. Therefore, applying the Dx result as one value (adding diesel- and oil-range concentrations) may generally be appropriate as has been adopted in the Work Plan. However, results may be evaluated on a case-by-case basis to confirm this assumption by looking at chromatograms or HCID results (when available).

3. Chloroform – I'm curious about the MTCA formula carcinogen values for this – the CLARC database doesn't include values for chloroform. (Does not make a difference in the SL)

   The table should not have included calculated MTCA carcinogenic values. It appears that the CLARC update of April 2011 (when the CPFo for chloroform was removed) was not captured in the draft memo. The table has been corrected.

4. Cis 1,2 Dichloroethene – table shows this as blank, but the Ecy VI guidance does include a non-carcinogenic GW screening value for this of 350 ug/l.

The table is correct. The CLARC update of April 2011, in which the RFDi for this chemical was removed, post-dates Ecology's Review Draft VI guidance document, which was published in 2009 and is out of date for many VOCs.

5. Trans 1,2 Dichloroethene – table value is 250, but vapor intrusion guidance document shows this as 290.

   The table is correct. The CLARC update of April 2011, in which the RFDi for this chemical was revised, post-dates Ecology's Review Draft VI guidance document, which was published in 2009.

6. PCE – The indoor air SL for carcinogens is shown as 240, which I presume is based on calculations using the newer cancer potency and reference dose values. When we apply the ratio of the old to new indoor air values to the groundwater SLs, we come up with 228 ppb, not 240.

   We believe the table is correct. We have verified the concentration using the newer values. It is possible that the difference between the table value and the 228 ppb value is due to rounding to two significant figures of numerous calculation input parameters; our table carried the unrounded values through the calculation.

7. 1,1,2,2 PCE – table shows the MTCA calculated values for non-carcinogens as blank, but the CLARC database includes values of 1000 and 2600 for MTCA method B and C respectively. Also, the table shows the vapor pathway as blank, but the Ecy VI guidance shows a carcinogenic groundwater screening level for this of 62. (Does not make a difference in the SL).

   We assume that this comment is for 1,1,2,2-PCA, not PCE.

   The lack of non-carcinogenic values in the table is an error. It appears that the CLARC update of April 2011, when a CPFo for 1,1,2,2-PCA was added, was not captured in the draft memo. The table has been corrected.

   Conversely, the value for the vapor intrusion pathway in the table is correct, as it reflects the CLARC update of April 2011, when a CPFi for 1,1,2,2-PCA was removed.

8. Toluene – the indoor air screening level for non-carcinogen should be 33,000 instead of 34,000 according to the VI Guidance screening level table (does not make a difference in the SL).

   We believe the table is correct, and the difference may be due to rounding. See response to comment #6.

9. TCE – The method B carcinogen value for surface water is shown as 63, but in CLARC it is 13; for Method C it is shown as 1579 yet in CLARC it is 320. There are also slight differences in the other MTCA formula values shown on the table vs. the CLARC database. (Does not make a difference in the SL).

   The table has been corrected. The CPFo that was used in the calculations was based on Kidney Cancer with Mutagenic Mode of Action and Potential for Early-life Exposure (9.33E-03 mg/kg-day). The CPFo has been updated to reflect the summed total cancer risk from 3 types

of cancer as provided in IRIS (4.64E-02 mg/kg/day). This summed CPFo results in carcinogenic Method B and C surface water cleanup levels that are consistent with CLARC.

10. 1,2,4 Trimethylbenzene – table shows 61 as gw SL for non-carc, but Ecy VI guidance shows 52.

    The table is correct. The CLARC update of April 2011, in which the RFDi for this chemical was revised, post-dates Ecology's Review Draft VI guidance document, which was published in 2009.

11. 1,3,5 Trimethylbenzene – table shows this as blank, but Ecy VI guidance shows gw sl (nc) of 54

    The table is correct. The CLARC update of April 2011, in which the RFDi for this chemical was removed, post-dates Ecology's Review Draft VI guidance document, which was published in 2009.

12. Xylenes – why are they broken out individually for this project, while summed at Oxy?

    Both approaches have pros and cons (e.g., different xylene isomers have different toxicity values), but in the interest of comparability with criteria used at the Oxy site, we recommend using summed values in the final Screening Levels. The table has been modified to reflect summed xylenes.

13. Xylenes –the table shows the VI pathway as blank, but Ecy VI guidance includes groundwater SLs for non-carcinogenic effects for (m)- (670 ug/l) and (o) - (960 ug/l) xylenes.

    The table is correct. The CLARC update of April 2011, in which the RFDi for this chemical was removed, post-dates Ecology's Review Draft VI guidance document, which was published in 2009.

14. Xylene (p) – there are values in the table for CWA and NTR, but I don't see xylenes on those EPA lists.

    The CWA and NTR do not include p-xylene. The table has been corrected.

15. Bis-2 ethylhexyl phthalate – I think the sediment value used for calculating the cross-media pathway is incorrect – it should have been 1.3, not 0.13, resulting in a sediment protective value of 11.7.

    The table has been corrected. The new groundwater screening level for Bis-2 ethylhexyl phthalate is 2.2 ug/L, based on the CWA ARAR.

16. Dimethyl phthalate – it looks like this is the only chemical which has a screening level driven by the MTCA calculated value. However, I don't see a calculated value for this chemical in the CLARC database. What is this value based on?

    The table should not have included calculated MTCA carcinogenic values. It appears that the CLARC update of April 2011 (when the CPFo for dimethyl phthalate was removed) was not captured in the draft memo. The table has been corrected.

17. Phenol – the value in the column for CWA (human health) is different from the EPA web site. (1,700,000 vs. 860,000).

    The table has been corrected to reflect a CWA (human health) value of 860,000 ug/L (note: CLARC still lists the CWA value as 1,700,000).

18. PAHS – for human health CWA driver - shouldn't cPAH TEQ of 0.18 be applied in lieu of individual PAH water values?

    Under the CWA, there are individual criteria for individual cPAHs. MTCA specifies that cPAHs will be measured using the TEQ approach. Table 1 mixed these approaches. The table will be modified to show the CWA approach in the CWA columns, the MTCA approach in the MTCA columns, and the MTCA approach in the Preliminary Screening level column (cPAH TEQ only). We have added a footnote to the table to clarify.

19. PAHs - 5 of the non-carcinogenic PAH SL's are quite a bit lower for this site than for OCC, because of setting the value for protection of sediments. I am curious why the OCC site doesn't also evaluate this pathway?

OCC site screening levels were determined in consultation with Ecology and EPA. Note that existing surface sediment data available for the OCC site reveal that concentrations of these PAHs are below Commencement Bay Nearshore/Tideflats remedial action levels, indicating the groundwater-surface water pathway was not impacting sediments for these PAHs.

20. Nickel – CWA Marine toxicity value is shown as 610, but I believe it should be 8.2.

    The table has been corrected.

21. General comments for Table 1:

- We need to confirm and clarify the list of Occidental screening levels. Several of the SL's shown on this table are different from the CRA QAPP for the OCC supplemental investigation (CRA 2012). (xylenes, bis-2 ethylhexyl phthalate, cPAHs, flourene, 2-methylnapthalene, naphthalene, pyrene).

  The SLs in the table are consistent with those shown in the Data Summary Report (CRA 2013); CRA has confirmed that these are correct and should be consistent with the final QAPP.

- A few chemicals don't have SL's. We still want to see the results reported for those.

  Results for chemicals included in standard lab analyses will be reported, whether they have a screening level or not.

- Add n-Hexane and PCBs to the table (see requirements from Table 830-1)

n-Hexane has been added to Table 1. However, PCBs are not preliminary chemicals of concern for the site based on screening of existing data (as discussed in the work plan), and their analysis is only required at sites with heavy oil/waste oil contamination, which are not expected at this site (see Ecology comment #2 for Table 1, above).

- RI should provide reference for not including EDB and MTBE as chemicals of concern.

  The rationale for not including EDB and MTBE is provided in Section 6 of the RI/FS Work Plan.

- I believe that using the organic carbon default value from the soil-to-groundwater calculation equation in MTCA is not really applicable for calculating protective values for sediments, which typically have higher TOC values than uplands soils. There should be TOC data from nearby intertidal samples on the OCC and Hylebos waterway, which could be evaluated to determine a more realistic TOC value to use for the screening level equation.

  Sediment TOC data collected in this general area of the Hylebos Waterway during pre-design and remedial design phases indicated TOC values ranging from approximately 1.5 to 2.3 percent (dry weight basis). We used the midpoint of the range (1.9%) and adjusted SLs accordingly. TOC analysis for sediments has been added to the work plan, and SLs will be adjusted based on future site-specific TOC collection.

- Are there other chemicals being evaluated on the OCC site that may be useful to also evaluate on this site to help differentiate/define the solvent plume in relationship to the sites? For example, the OCC list includes 1,1,2-trichloroethane, carbon tetrachloride, and 1,2,4 trichlorobenzene.

  The RI/FS Work Plan includes analyses for the full suite of VOCs (EPA Method 8260, including the VOCs listed above). Data for the other OCC chemicals listed above will be considered in the RI to help clarify potential sources of chlorinated VOCs.

<u>Table 2 - Soils</u>

1. Does Table 2 include protectiveness for surface water to impact sediments? i.e. - Does "ecological" in the cross media column refer only to protective water values for benthic water quality or also levels protective of sediment values?

   Table 2 is specific to screening levels for upland soil. The "ecological" cross-media values were back-calculated to be protective of marine surface water and marine sediment, by taking the lowest Ecological groundwater screening level for each chemical under "Ecological, Marine Toxicity" in Table 1.

   However, for those chemicals for which the lowest Ecological groundwater screening level was driven by the Hylebos sediment SQOs, the resulting cross-media value provides protection for human health as well as ecological receptors.

2. Need to determine framework to determine soil level to protect SW/Seds from TPH for ecological health
   a. (for protection of surface water for human health, ok to use MTCA method A soil values)

A soil level protective of SW/sediments will depend on the surface water screening level. See response to Table 1 Comment #1.

3. TPH Diesel/Heavy Oil –Since the site did not deal in heavy oil, we would likely apply the Dx result as one value instead of splitting between diesel and oil. See Ecology Implementation Memo # 4. It may be useful to run some HCID tests to try to identify the products present.

   As indicated, it is expected that most of the contamination at the site would not include heavy oil TPH. Therefore, applying the Dx result as one value (adding diesel- and oil-range concentrations) may generally be appropriate. However, results may be evaluated on a case-by-case basis to confirm this assumption by looking at chromatograms or HCID results (when available).

4. Add N-hexane, PCBs per table 830-1.

   n-Hexane has been added to Table 1. However, PCBs are not preliminary chemicals of concern for the site, and their analysis is only required at sites with heavy oil/waste oil contamination, which are not expected at this site (see Ecology comment #2 for Table 1, above).

5. Bis-2 ethylhexyl phthalate – possibly incorrect due to mistake in SQO to develop GW SL?

   The table has been corrected.

6. cPAH – what is screening level of 0.02 based on?

   The screening level of 0.02 resulted from rounding the most stringent screening level of 0.017 mg/kg (calculated soil-to-groundwater).

7. cPAH – For human health protection for direct contact (MTCA B and C calculated values) we would use the TEQ of all cPAH and compare to cleanup level for Benzo(a)Pyrene, not individual PAHs as shown on the table.

   As noted under comment 18 for Table 1, the table will be modified to reflect the MTCA approach.

8. cPAH – we need to determine framework to evaluate soil-to-groundwater pathway to be protective of cPAH TEQ. *have CPAH been detected in GW? (may not need a PAH CUL for this pathway if not ever detected in gw)

   As described in the RI/FS Work Plan, the only cPAH groundwater concentrations above the exceedingly stringent groundwater screening level were detected in wells hundreds of feet from the Hylebos Waterway. No groundwater cPAH exceedances are detected in proximity to the Waterway. As such, the data indicate that cPAHs are not pCOCs in groundwater, and thus soil screening levels based on groundwater protective of the marine environment are not needed in the RI.

9. I spot checked a few of the Method B and C calculated values and they are not the same as CLARC database (e.g. naphthalene, anthracene, pyrene). This doesn't make a difference in the SL but I am curious about what method you are using to calculate MTCA values and why they would be different from CLARC. Also note that tetraethyl lead does have a method B screening level of .008 ppm (shown as blank on this table).

   The RfDo in the table for naphthalene was incorrect, and the table has been corrected for that and for tetraethyl lead. The anthracene and pyrene value differences appear to be the result of significant figures and rounding.

   As described in the screening level memo and the RI/FS Work Plan, the site is an industrial site, so the Method B unrestricted use cleanup levels do not apply. For clarity, we will remove the Method B columns from the table. The Method C screening level for tetraethyl lead will be shown.

10. Need reference for background values.

    The table has been modified with a footnote providing references for background values.

Table 3 - Sediments

1. SQO for Bis-2 ethylhexyl phthalate should be 1.3, not 0.13.

   The table has been corrected.

2. Need values for total HPAH and total LPAH as well as individual PAHs

   These will be added to the table.

3. SQO for acenapthylene should be 1.3, not 0.13

   The table has been corrected.

4. Ultimately, will need to establish human health screening levels for sediments.

   The groundwater/surface water protection screening levels summarized in the memorandum already incorporate human health protection considerations. Regarding human health considerations for sediments—as part of the Superfund work in Commencement Bay, EPA conducted a full human health and ecological risk assessment which included evaluation of tissue data to assess the human health pathway. Based on the tissue data, with the exception of PCBs, human health effects were not the risk driver in setting SQOs. The SQO for PCBs is based on human health protection, while EPA determined it was not necessary to establish human health-based SQOs for other constituents because the risk assessment did not indicate other chemicals were present in tissues at levels above EPA acceptable risk ranges. Need for additional screening levels will be reviewed after the first round of RI sediment data collection.

5. Sediments should be tested for all SMS chemicals (Table 1 of SMS), with the addition of TPH. (e.g., include PCBs).

   Sediment testing is planned for Site cPOCs potentially released to sediments at the docks or through groundwater discharge, including TPH, VOCs, and PAHs. PCBs were not identified as a Site cPOC in the Work Plan.

6. Will need to identify a TPH screening level for sediments.

   The work plan calls for determining if TPH is present above area background. If so, bioassays would be used to evaluate toxicity.

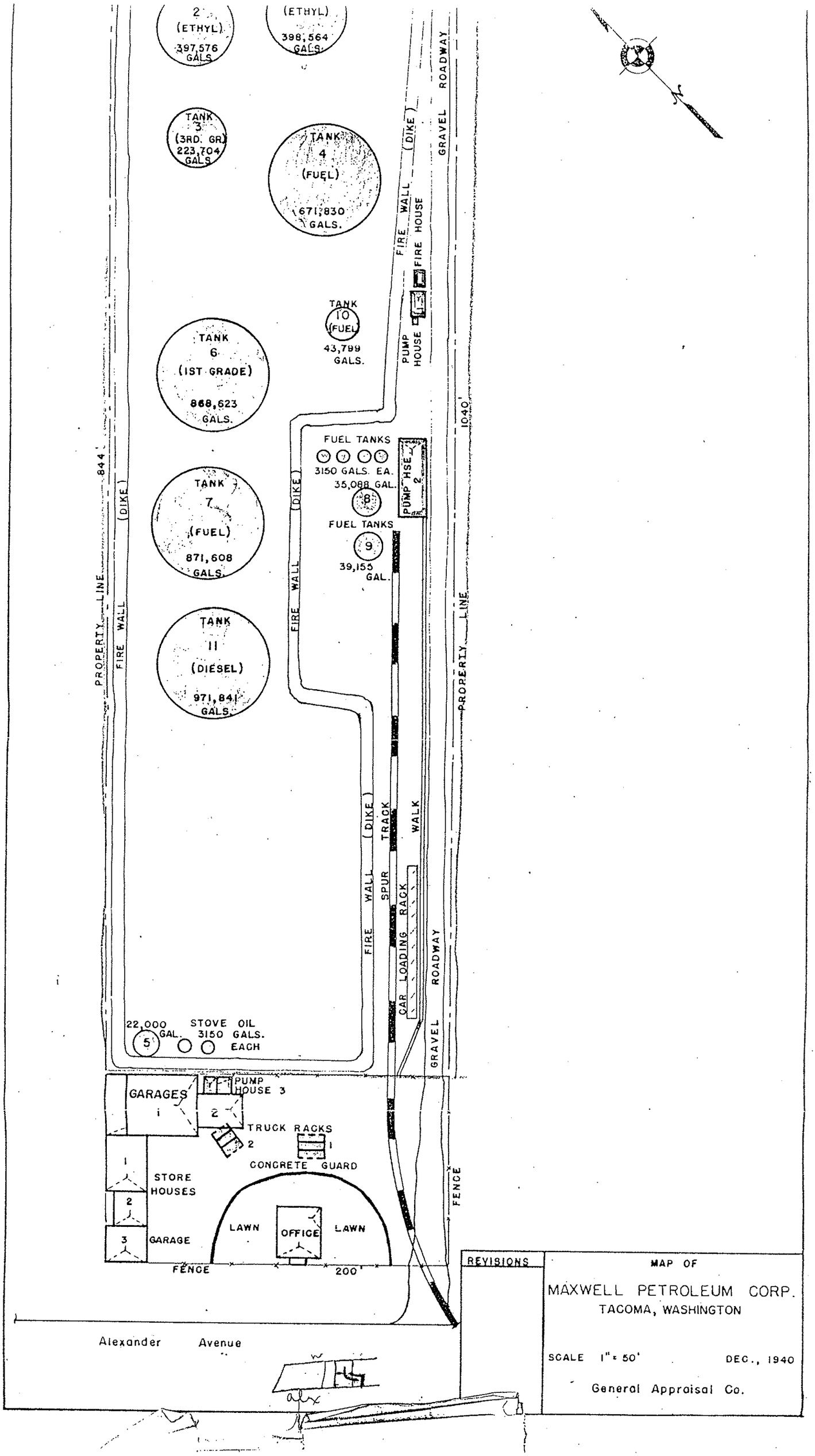
7. If the RI sampling indicates the presence of chemicals in the sediments that do not have SQO's, we will need to determine screening levels for those chemicals (e.g., benzene).

   If petroleum facility-related chemicals without SQOs such as benzene are detected, screening levels may need to be determined; however, soluble VOCs such as benzene are unlikely to sorb strongly onto sediments, and may be more appropriately evaluated by comparing seep/porewater data to groundwater screening levels. As noted above, groundwater protection screening levels summarized in the memorandum are protective of surface water.

APPENDIX C

Selected Historical Documents

Appendix C Contents



REVISIONS

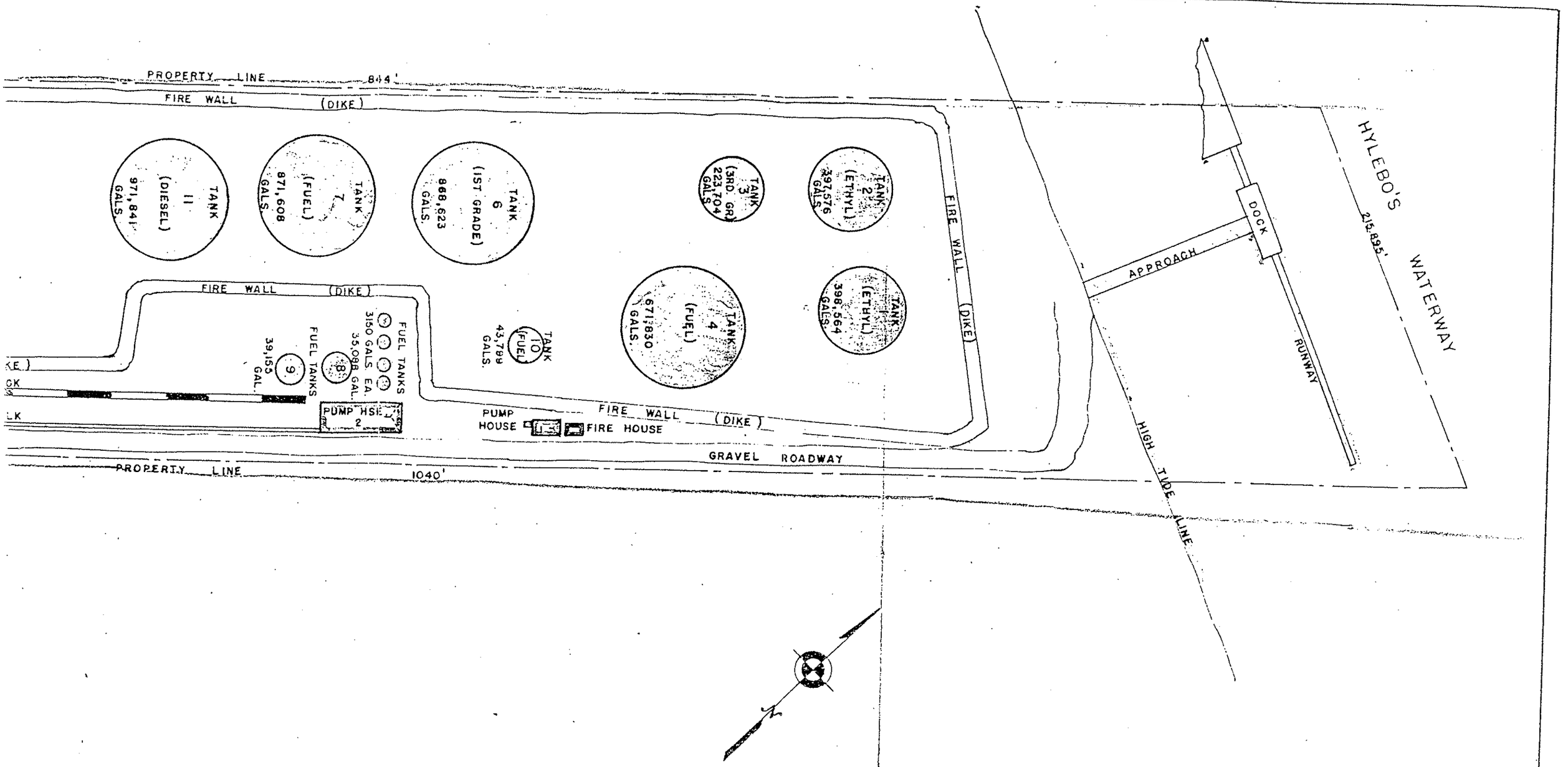
MAP OF

MAXWELL PETROLEUM CORP.

TACOMA, WASHINGTON

SCALE 1" = 50' DEC., 1940

General Appraisal Co.



PLOT PLAN

TODD PACIFIC SHIPYARDS INC.
TACOMA DIVISION. - TACOMA, WASH.

SCALE 1" = 100' ◇ NOV. 25, 1943

W.J.M.
PLANT ENGINEERING DEPT.

S 20+00
S 25+00
S 30+00
S 35+00
S 40+00
S 45+00
S 50+00
S 55+00
E 15+00
E 10+00

MARINE ELEVATOR
NAVY COMMISSIONING PIER
#112 UTILITY BLDG.
INCINERATOR
STEEL
GUARD
STORAGE
YARD
FENCE
BARRACK
BARRACK
NAVY
BARRACK
BARRACK
RECEIVING
BARRACK
COMMANDANT
STATION
GALLEY
RECREATION
NAVY COMMISSIONING WAREHOUSE BLDG. No. 110
RR TRACK
FENCE
GATE & GUARD HOUSE
SIDEWALK
FLETCHER OIL Co.
MAXWELL PETROLEUM Co.
R.R. TRACKS
TAYLOR WAY
PARKING LOT
GUARD HOUSE
STREET
ALEXANDER AVENUE
BASE LINE
EAST EIGHTH
GATES
GUARDS
AIR REDUCTION SALES CO.
LOCKERS
#39 DUPLEX
PLATE STORAGE YARD
RR TRACK
CABLE STORAGE SHED
CABLE STORAGE SHED
#103 PERSONNEL DEPARTMENT
CASCADE WAREHOUSE BLDG. No. 103
CLATSKEED
GUARD
BOILER HOUSE
BULKHEAD LINE
SANDBLAST SHED
PIERHEAD LINE
PARKING LOT
STORAGE AREA
GUARD HOUSE
WHIRLEY CRANEWAY
STORAGE YARD
RR TRACK
TANKS

HYLEBOS WATERWAY

OUTFITTING PIER No. 3

WHIRLEY CRANEWAY

PIERHEAD LINE

OUTFITTING PIER No. 2 CRANEWAY

OUTFITTING PIER No. 1 WHIRLEY CRANEWAY

CRANEWAY No. 1

SHIPWAY No. 1

CRANEWAY No. 2

SHIPWAY No. 2

CRANEWAY No. 3

SHIPWAY No. 3

CRANEWAY No. 4

SHIPWAY No. 4

CRANEWAY No. 5

SHIPWAY No. 5

CRANEWAY No. 6

SHIPWAY No. 6

CRANEWAY No. 7

SHIPWAY No. 7

CRANEWAY No. 8

SHIPWAY No. 8

CRANEWAY No. 9

OUTFITTING PIER No. 4

WHIRLEY CRANEWAY

SHOPS BUILDING No. 88

YARD OFFICES
MATERIAL CONTROL WAREHOUSE BLDG No. 92

PAINT SHOP BLDG. 96

ACETYLENE BUILDING

MAINTENANCE BUILDING No. 102

GARAGE

SCRAP BIN

INCINERATOR

BAG SHED

SALVAGE LOT

RIGGER'S OFFICE

BURNER'S OFFICE

OUTFITTING OFFICES

POWER HOUSE

STORES DEPT. BLDG # 80

RIGGER'S LOFT BLDG. No. 76

BLACKSMITH SHOP

TOOL ROOM

OIL HOUSE

FIRE CART

MOLD LOFT BLDG. No. 44

PAINT

TEMPLATE STORAGE

NAVY OFFICE BLDG. #40

MAINTENANCE SHOP #52

BOILER HOUSE

TOILETS

TOOL ROOM

TRANSFORMER

TRANSFORMERS

R.R. TRACK

THERMIT

SHEAR

WATER TANK

FENCE

SUPERVISOR'S PARKING LOT

VICTORY BUS PARKING

BUS LOADING ZONE

PARKING AREA

HOOKER PARKING LOT

HOOKER ELECTROCHEMICAL COMPANY

1

2

STEEL SHED "A" BUILDING No. 32

STORAGE

OFFICES

OXYGEN

WOMEN'S # GATE BLDG. # 12

CAFETERIA BLDG. No. 10

STORES

GUARDS

STEEL SHED "B" BLDG. No. 7

MAIN OFFICE BLDG. No. 23

NAVY OFFICE BLDG. No. 31

MATERIAL CONTROL STORES BLDG #21

BOILER HOUSE

WATER CREEK #13

FIRE STATION #33

POWER HOUSE #35

CHEMICAL READINGS #29

GATE

ALEXANDER AVENUE E. 7

SIDEWALK

RR TRACK

SHOPS BUILDING No 97

PIPE & COPPER SHOP

SHEET-METAL SHOP

CARBON DISP.

PIPE PICKLING SHED

WOODWORKING SHOPS

MACHINE SHOP BLDG. 41

#2 WOMENS BUILDING No. 39

PAINT BOOTH

TOILETS

STEEL CONSTR. BLDG. #81

ACETYL. BLDG. #43

HOSPITAL AND TRAINING SCHOOL BLDG. No. 37

SCHOOLS

120 CRANEWAY

BOILER

STACK

WATER TANK

PIPE SHOP PAINT

WELDER TRAINING ROOMS #65

LUMBER #63

M.G.

ELECTRIC SHOP BUILDING No. 91

TIMBER SHED #30

#35 OFFICES

AIR REDUCTION SALES CO.

SANDBLAST SHED

GATES

GUARDS

TRANSFORMERS & COMPRESSORS

SLAB #1

SLAB #2

SLAB #3

SLAB #4

SLAB No. 5

SLAB No. 6

SLAB No. 7

SLAB No. 8

COMPRESSOR

COMPRESSORS

SHIPFITTERS

LABORERS

TOILETS

CARPENTERS

MACHINISTS

WELDERS

PAINTERS

PIPE FITTERS

ELECTRICIANS

TOOL ROOM

9-10 STATION SLAB #11 & WASH ROOM

LEGEND

1 - ORIGINAL YARD COMPLETED IN 1940.

2 - MARITIME COMMISSION ADDITION FOR C-3 CARGO VESSEL YARD COMPLETED IN FALL 1941, PRIOR TO PEARL HARBOR AND U.S. WAR ENTRY.

REMAINDER BUILT AS NAVAL VESSEL YARD DURING WAR EMERGENCY.

CONNELLY'S BAY

BASE LINE & ALEXANDER AVENUE

BASE LINE 0+00

N 10+00

N 5+00

S 5+00

S 10+00

S 15+00

S 20+00

E 15+00

W 5+00

WAPATO WATERWAY

BHP

Associate General Counsel
and Assistant Secretary

BHP Hawaii

November 29, 1995

File Name PRI Northwest
County Pierce
Site Code TCP
Work Order = Mohsen.K

Mohsen Kourehdar
Site Engineer
Toxics Cleanup Program
Department of Ecology
Southwest Regional Office
P. O. Box 47775
Olympia, WA 98504-7775

Re: PRI Northwest, Inc.

Dear Mr. Kourehdar:

Enclosed, for your information, are a set of aerial photographs which we found recently and which are being submitted as part of PRI Northwest Inc.'s response to the Hylebos Participation Questionnaire. We are informed that these photos were taken during the period 1940-45. We added the labels noting the current ownership of the respective properties.

Sincerely,

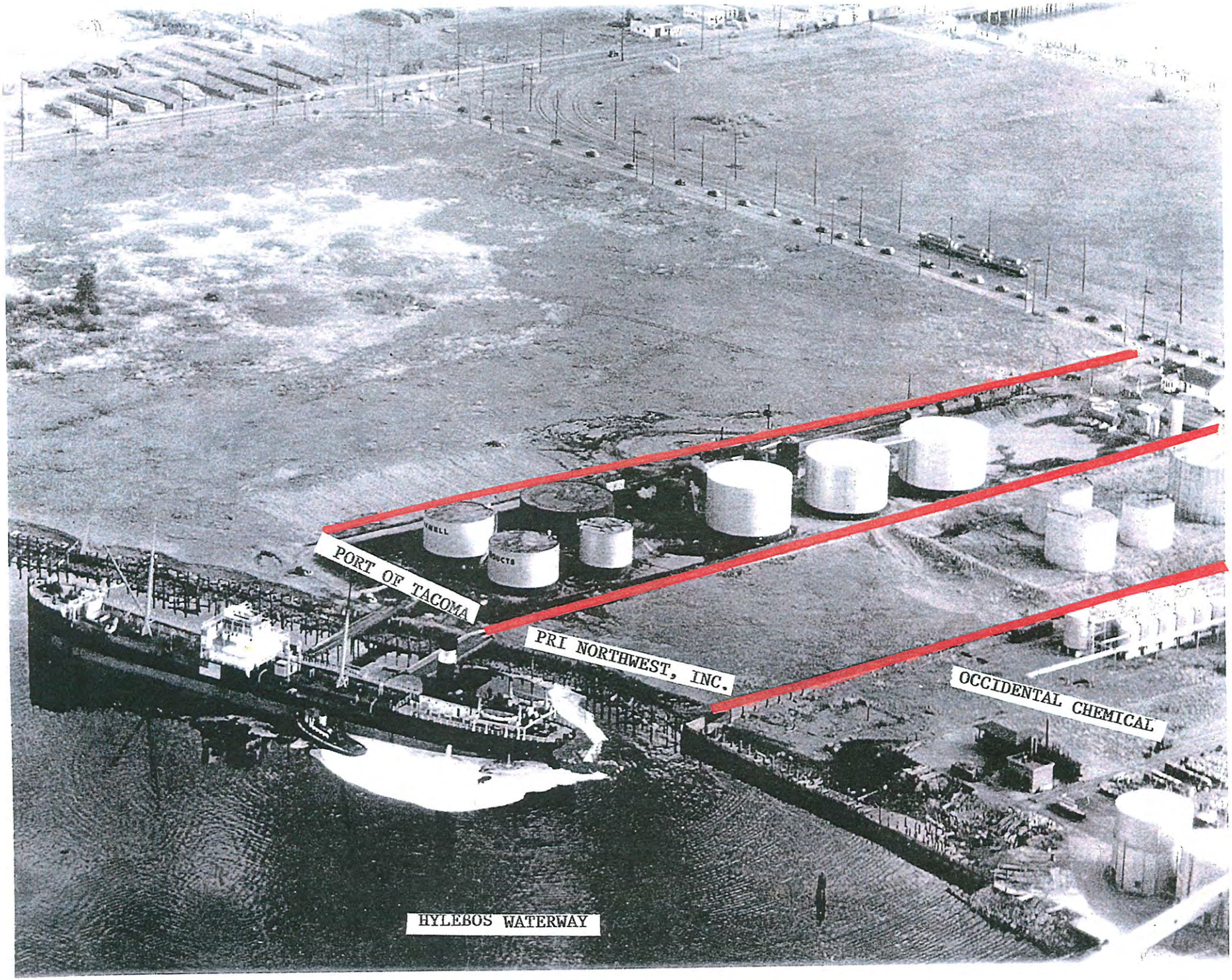
PRI NORTHWEST, INC.

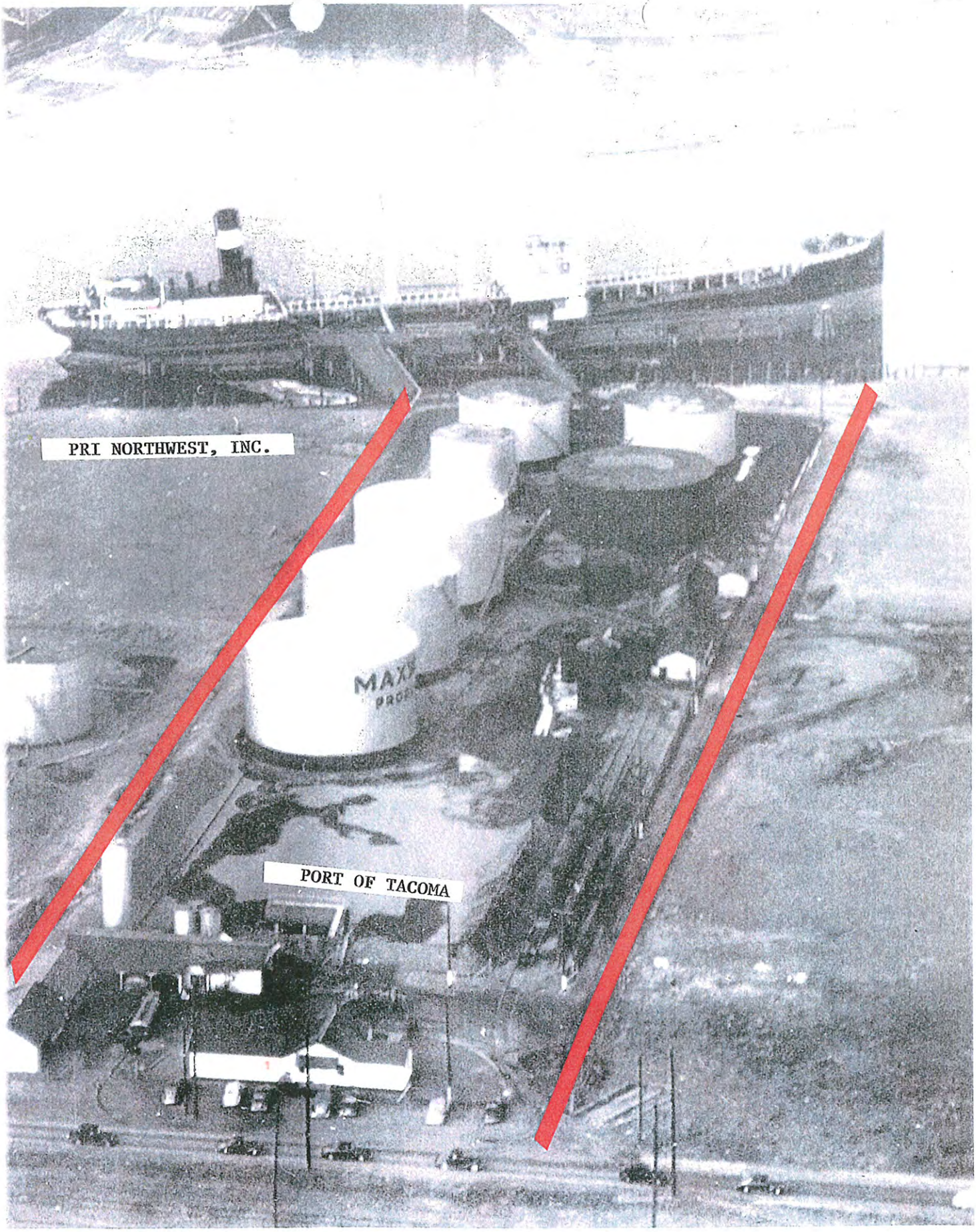
George T. Aoki
Associate General Counsel

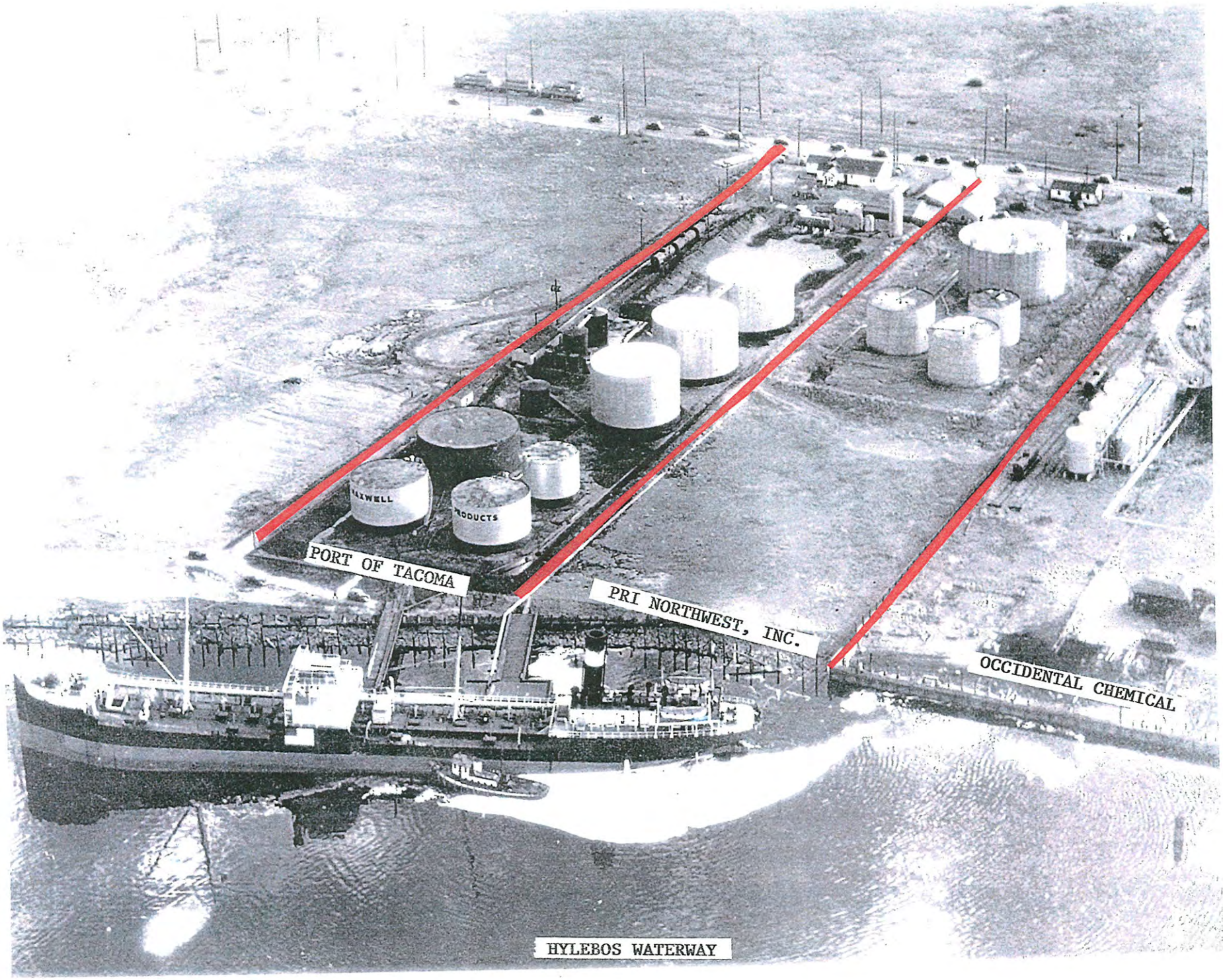
GTA:rtt
Enclosure

cc: Dave Tunison (w/o encl.)
Alison Wachterman, Esq. (w/o encl.)

BHP Hawaii Inc
733 Bishop Street, Suite 2700
PO Box 3379 Honolulu Hawaii 96842 USA
Telephone 808 547 3282 Facsimile 808 547 3014


PORT OF TACOMA
PRI NORTHWEST, INC.
OCCIDENTAL CHEMICAL
HYLEBOS WATERWAY


PRI NORTHWEST, INC.
PORT OF TACOMA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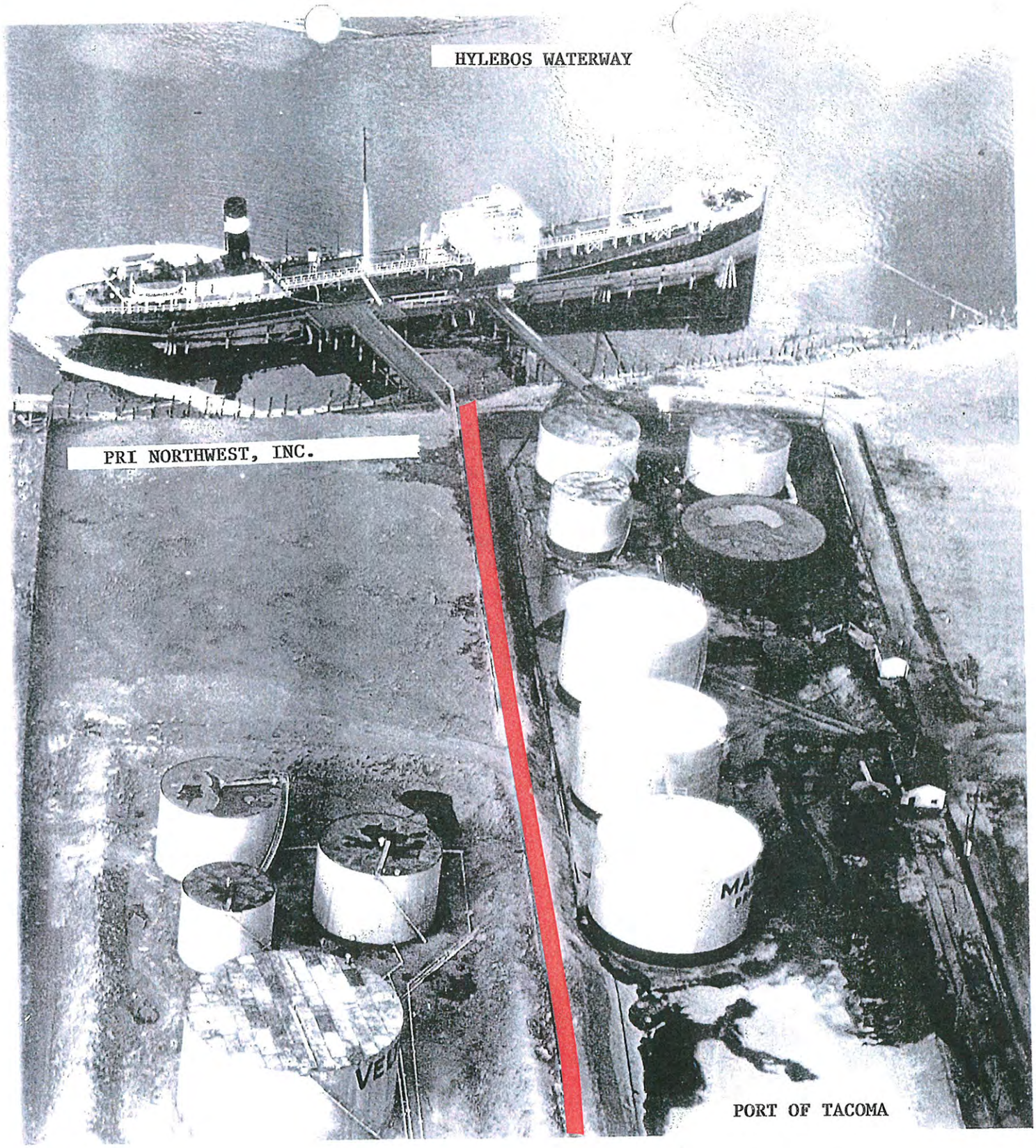
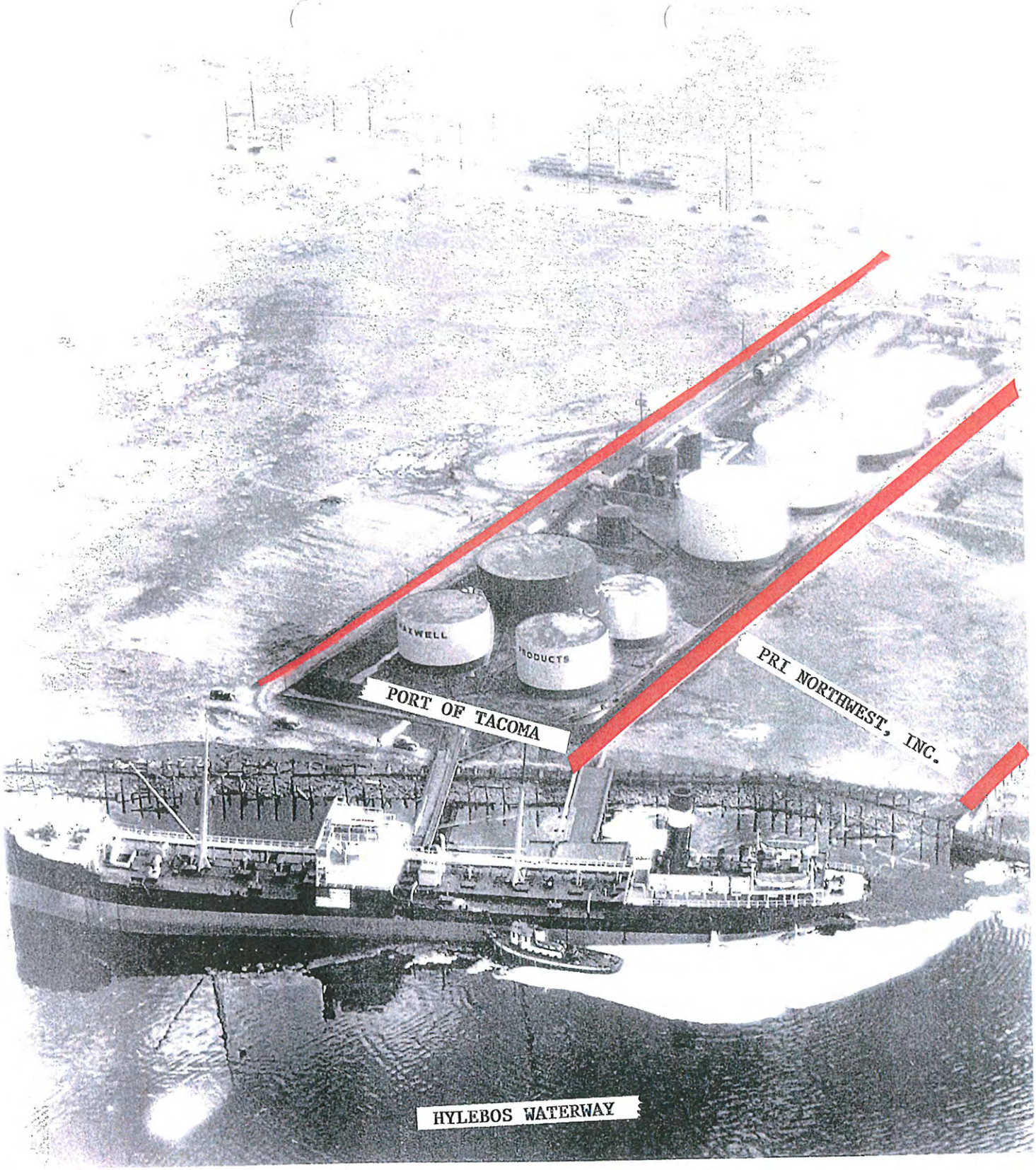
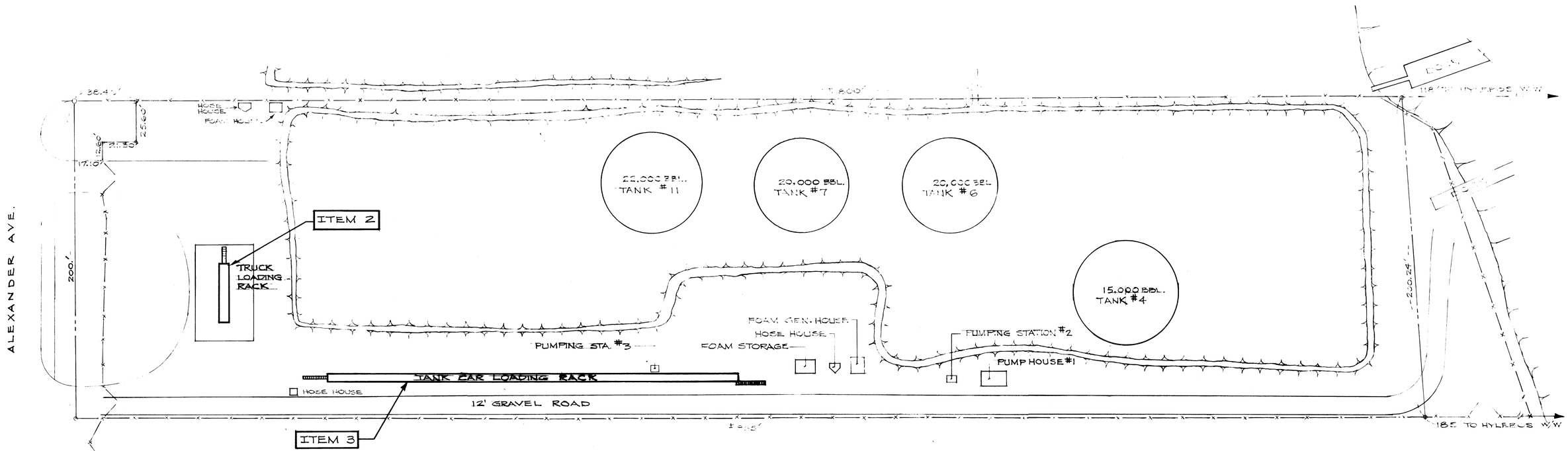
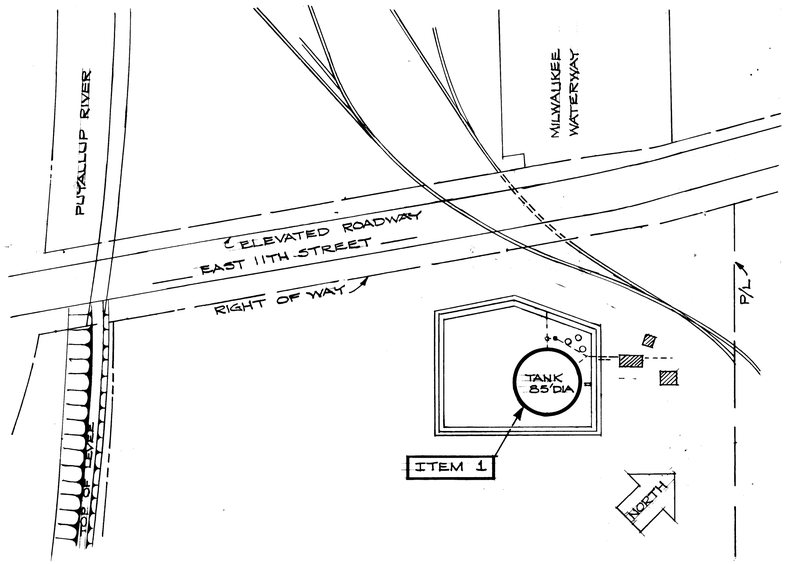
PRI NORTHWEST, INC.
OCCIDENTAL CHEMICAL
HYLEBOS WATERWAY


HYLEBOS WATERWAY
PRI NORTHWEST, INC.
PORT OF TACOMA

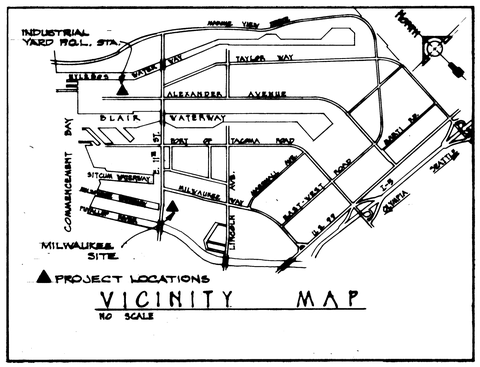

PORT OF TACOMA
PRI NORTHWEST, INC.
HYLEBOS WATERWAY



INDUSTRIAL YARD, P.O.L. STATION
SITE PLAN 1" = 30'



TANK AT MILWAUKEE SITE



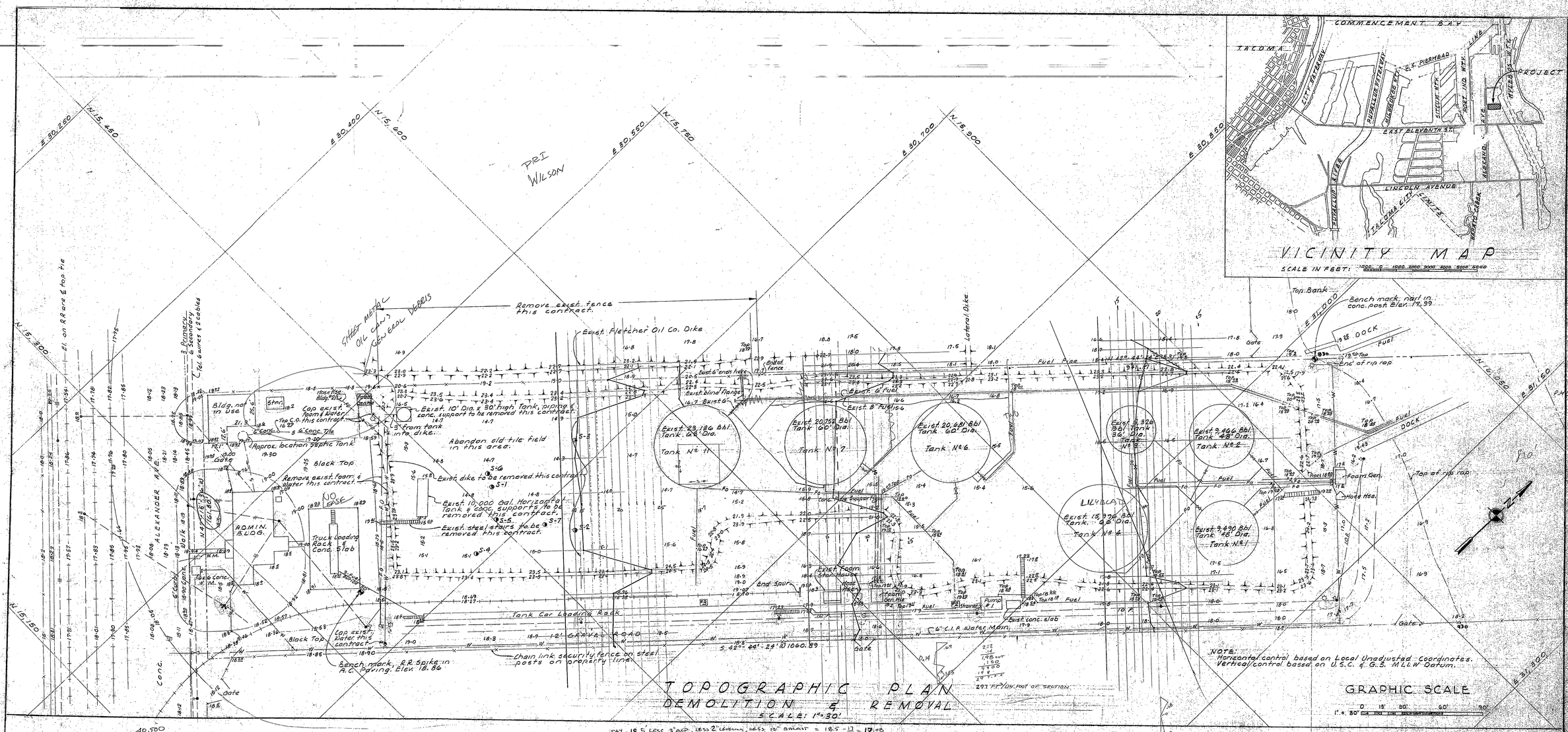
▲ PROJECT LOCATIONS
VICINITY MAP
NO SCALE

REF. DWG. EP-3617-12

S.W.R.# 251

DRAWN ALB DATE 8-10-81	PORT OF TACOMA
CHECKED C.C.D. DATE 10-8-79	DEMOLITION OF PETROLEUM FACILITIES
CHECKED DATE	
CONT. NO. SW.R.# 251	
FIELD BOOK (S)	SCALE 1" = 30'-0"
APPROVED R.L. MacLeod CHIEF ENGINEER DATE 6-8-77	DRAWING NO. EP-3730-4
	SHEET 1 OF 1

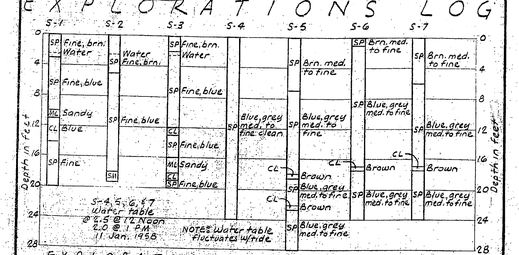
MARK	REVISION	BY	APP.	DATE
1	REMOVED OFFICE BLDG. AND RE-CLASSIFIED TANKS	ALB	SAL	1-5-82



40,500
40,095
94,500
175,095 FT³
16,485 CU YD TO BE EXCAVATED
FOOT OF BALLAST = 200' x 1060 x 1/3 = 212,000 FT³
7,852 CU YD @ 40 LB/CU FT UNCONSOLIDATED
9,422 CU YD @ 120 LB/CU FT CONSOLIDATED
2' OF CRUSHED LEVELLING IS 1/2 BALLAST
1,570 CU YD @ 100% COMPACTION
135' x 300 FT = 40500 FT³ CUT
SAT 18.5 LESS 8" ASP, LESS 2" LEVELING, LESS 12" BALLAST = 18.5 - 1 1/2 = 17.08
240' x 0 =
135' x 297 FT²/FT = 40095 FT³ CUT
375' x 252 FT²/FT = 94500 FT³ CUT

TACOMA P.O.L. DEPOT, WASHINGTON
STORAGE DEPOT AVFUEL

EXPLORATIONS LOG



EXPLORATION LOG LEGEND

SP — Sand or Gravelly Sand, poorly graded
SM — Silty Sand or Silty Gravelly Sand
ML — Silt, Sandy Silts, Gravelly Silts, or Diatomaceous Soils
CL — Lean Clays, Sandy Clays, or Gravelly Clays

NOTES

1. Holes S-1 to S-3 Drilled 8-9 Apr. 1964.
2. Holes S-4 to S-7 Drilled 11 Jan. 1958.

LEGEND

EXISTING

Building
Tank
Chain link fence
Dike
Bench mark
15.9 Ground surface elevation
Fuel — Fuel line & valve
Railroad track
Property line
Stair over dike
W — Water line & fire hydrant
Fo — Foam line
S — Sanitary sewer
S-1 — Exploration & number
Aerial primary line
Aerial secondary line
Street light

THIS CONTRACT

Tank
Concrete dike wall
Earth dike
Line of depression
SD — Storm drain & manhole
F — Fuel line & valve
Spring support
Roller support
SL — Slop line with collection funnel
E — Electrical overhead wiring
Electrical underground wiring
G — Ground grid conductor
Ground rod
Existing pole with new down guy

DRAWING INDEX

DISTRICT FILE NO.	SHEET	TITLE
81-s/78-01-02	1	TOPOGRAPHIC PLAN DEMOLITION AND REMOVAL
81-s/78-01-02	2	GRADING PLAN AND DETAILS CIVIL
81-s/78-01-02	3	SITE PLAN AND DETAILS MECHANICAL AND ELECTRICAL
81-s/78-01-02	4	STORAGE TANK AND DETAILS MECHANICAL
81-s/78-01-02	5	STORAGE TANK DETAILS MECHANICAL
81-s/78-01-02	6	DETAILS MECHANICAL AND ELECTRICAL

LINE ITEM NO. 411-151

SYMBOL	DESCRIPTION	DATE	APPROVAL
	REVISIONS		

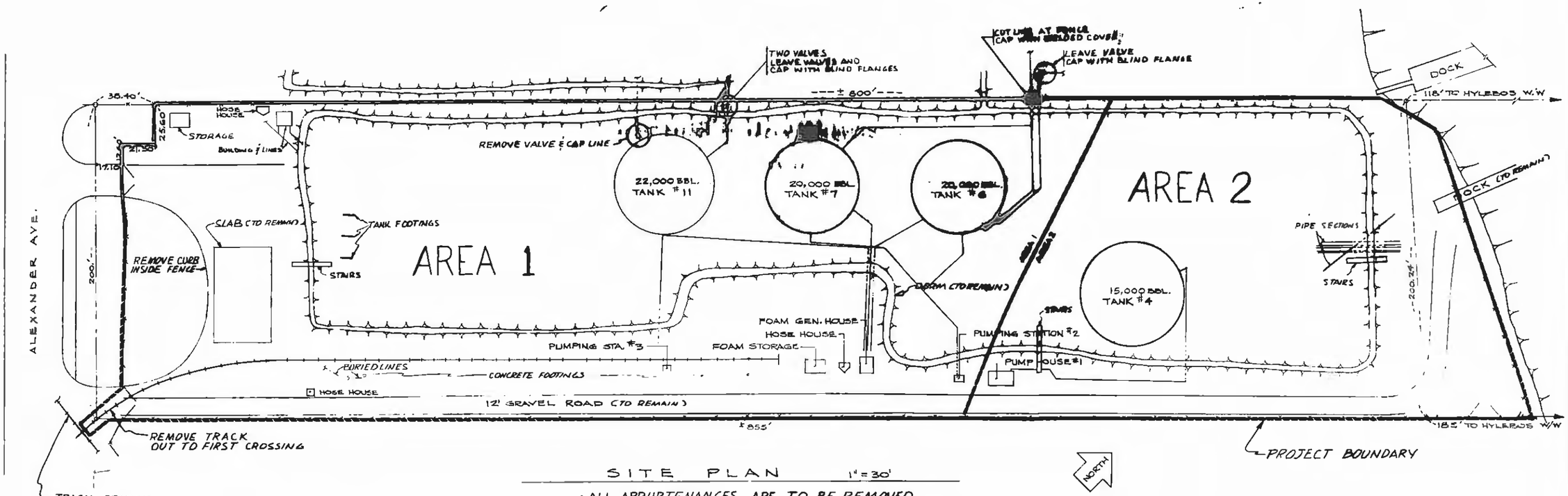
BOUILLON AND GRIFFITH, Professional Engineers, SEATTLE, WASHINGTON
CORPS OF ENGINEERS, U.S. ARMY, OFFICE OF THE DISTRICT ENGINEER, SEATTLE, WASHINGTON

DRAWN BY:
TRACED BY:
CHECKED BY:
PREPARED:
REVIEWED:
APPROVED: DATE:
CHIEF, SAFETY BRANCH
SUBMITTED: COLONEL, CORPS OF ENGINEERS
CHIEF, DESIGN BRANCH
RECOMMENDED:
CHIEF, ENGINEERING DIVISION

TACOMA P.O.L. DEPOT, WASHINGTON
STORAGE DEPOT AVFUEL
TOPOGRAPHIC PLAN
DEMOLITION & REMOVAL

SCALE: AS SHOWN
SPEC. NO.
DRAWING NUMBER 78-01-02
SHEET 1 OF 6

District File No. 81-s/78-01-02



SITE PLAN 1"=30'

- ALL APPURTENANCES ARE TO BE REMOVED
- APPURTENANCES SHOWN ARE REPRESENTATIVE NOT DETAILED CONDITIONS
- FIRE HYDRANTS TO REMAIN

MARK	REVISION	BY	APP.	DATE

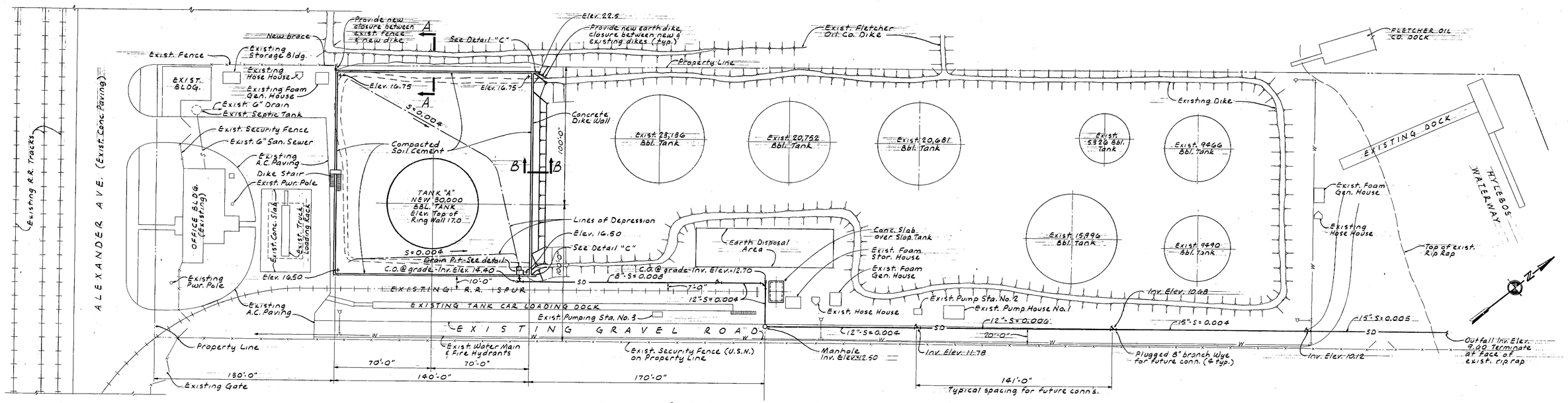
DRAWN A.L.B. DATE 9-28-79
CHECKED D.D.S. DATE 5-17-83
CHECKED DATE
CONT. NO. 539
FIELD BOOK (S):

PORT OF TACOMA

DEMOLITION OF TANK FARM AT 721½ ALEXANDER AVE

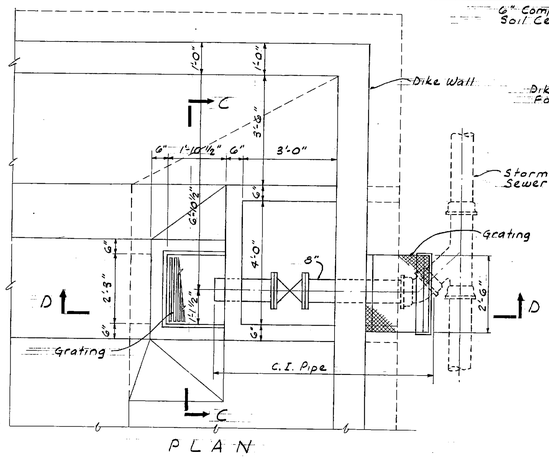
APPROVED 5/17/83 DATE
CHIEF ENGINEER

SCALE 1"= 30'-0"
DRAWING NO. EP-3833-12
SHEET 1 OF 1

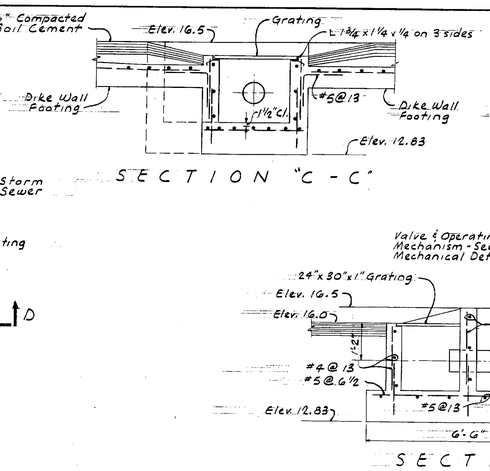


GRADING PLAN

SCALE: 1" = 30'



PLAN

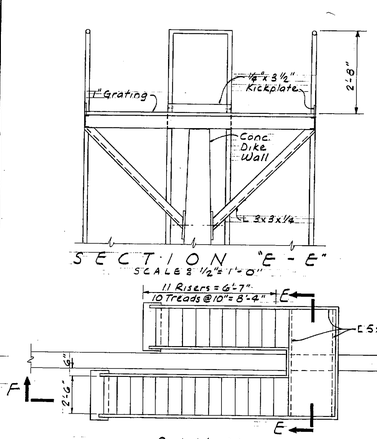


SECTION "C - C"

SECTION "D - D"

DETAILS OF DIKE DRAIN

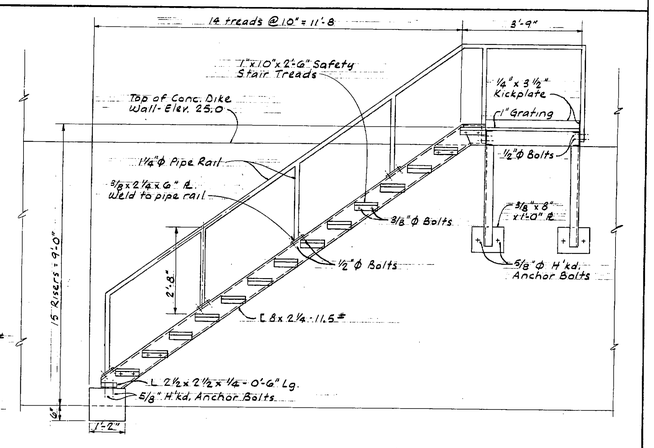
SCALE: ½" = 1'-0"



SECTION "E - E"

SCALE: ½" = 1'-0"

PLAN

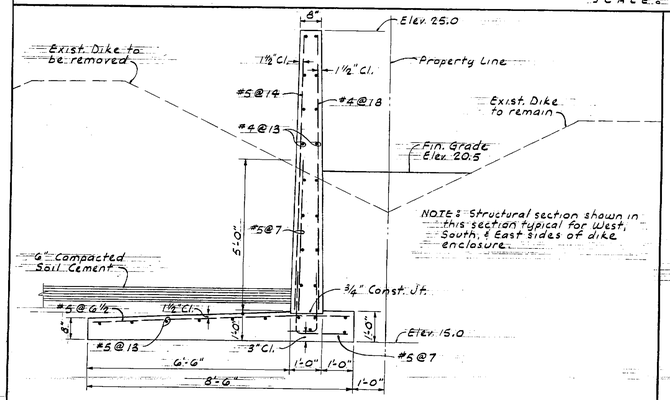


SECTION "F - F"

SCALE: ½" = 1'-0"

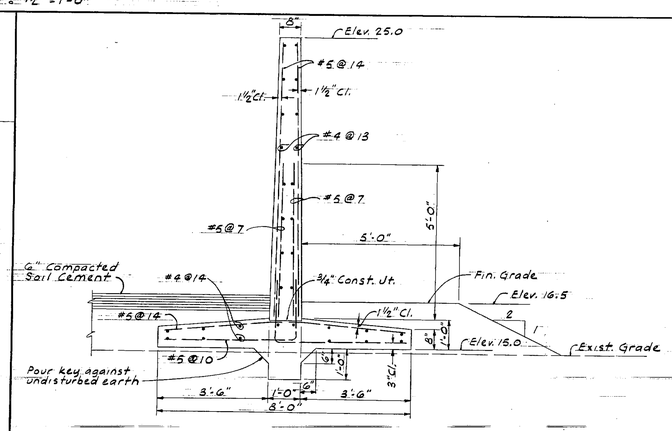
DETAILS OF DIKE STAIRS

SCALE: AS SHOWN



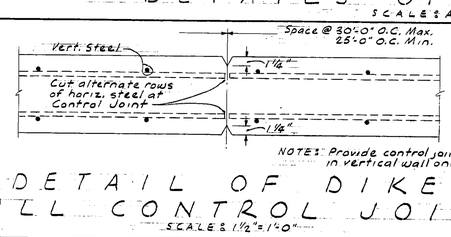
SECTION "A - A"

SCALE: ½" = 1'-0"



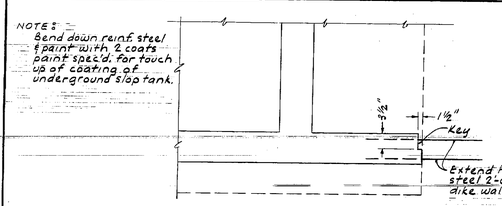
SECTION "B - B"

SCALE: ½" = 1'-0"



DETAIL OF DIKE WALL CONTROL JOINT

SCALE: 1½" = 1'-0"



DETAIL "C"

SCALE: ½" = 1'-0"

GRAPHIC SCALES

1/4" = 1'-0" — 0, 5', 10'

1/2" = 1'-0" — 0, 1', 2', 3', 4', 5'

1½" = 1'-0" — 0, 3", 6", 9", 1', 2'

1" = 30' — 0, 15', 30', 60', 90'

SYMBOL	DESCRIPTION	DATE	APPROVAL
	REVISIONS		

BOUILLON AND GRIFFITH, Professional Engineers, SEATTLE, WASHINGTON

CORPS OF ENGINEERS, U. S. ARMY, OFFICE OF THE DISTRICT ENGINEER, SEATTLE, WASHINGTON

DRAWN BY: J. Trilling

TRACED BY: J. M. Sale

CHECKED BY:

PREPARED:

REVIEWED:

TACOMA P.O.L. DEPOT, WASHINGTON
STORAGE DEPOT AVFUEL

GRADING PLAN & DETAILS

CIVIL

APPROVED FOR THE DISTRICT ENGINEER: DATE:

CHIEF, ENGINEERING DIVISION

CHIEF, SAFETY BRANCH

CHIEF, PLANNING & A. E. SECTION

CHIEF, DRAWING BRANCH

SCALE: AS SHOWN | SPEC. NO.

DRAWING NUMBER 78-01-02

SHEET 2 OF 6

District File No. 81s/78-01-02

APPENDIX D

Data Summary Tables

Table D.1 - Summary of Existing Site Soil Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
TPHs	#2 Diesel	3	3	3	100.0%	220	19000	mg/kg
TPHs	Diesel Range Hydrocarbons	66	173	115	66.5%	2	54000	mg/kg
TPHs	Gasoline Range Hydrocarbons	64	162	67	41.4%	1.6	14000	mg/kg
TPHs	Mineral Spirits	10	11	0	0.0%	NA	NA	mg/kg
TPHs	Oil Range Hydrocarbons	66	170	83	48.8%	4.1	10000	mg/kg
TPHs	Total Petroleum Hydrocarbons (C12-C24)	12	33	11	33.3%	56	290	mg/kg
TPHs	Total Petroleum Hydrocarbons (C7-C12)	12	33	11	33.3%	9	150	mg/kg
TPHs	Total TPHs	78	209	132	63.2%	6.1	54390	mg/kg
Metals	Aluminum	35	146	146	100.0%	3820	16000	mg/kg
Metals	Antimony	44	180	133	73.9%	0.01	12	mg/kg
Metals	Arsenic	64	275	270	98.2%	0.15	268	mg/kg
Metals	Beryllium	9	15	0	0.0%	NA	NA	mg/kg
Metals	Cadmium	49	187	137	73.3%	0.011	1.8	mg/kg
Metals	Chromium (Total)	64	276	276	100.0%	1.88	386	mg/kg
Metals	Copper	64	275	275	100.0%	2.98	7070	mg/kg
Metals	Iron	35	146	146	100.0%	6180	45600	mg/kg
Metals	Lead	80	303	285	94.1%	0.63	37500	mg/kg
Metals	Mercury	63	277	166	59.9%	0.002	0.62	mg/kg
Metals	Nickel	64	275	275	100.0%	0.857	962	mg/kg
Metals	Selenium	9	29	4	13.8%	0.61	13	mg/kg
Metals	Silicon	35	146	146	100.0%	461	2480	mg/kg
Metals	Silver	44	180	129	71.7%	0.008	1.3	mg/kg
Metals	Sodium	1	6	6	100.0%	471	11100	mg/kg
Metals	Tetraethyl Lead	32	128	6	4.7%	0.32	2.1	mg/kg
Metals	Thallium	59	249	168	67.5%	0.011	0.21	mg/kg
Metals	Zinc	64	276	269	97.5%	7.07	2540	mg/kg

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Conventionals	Chloride	1	1	1	100.0%	1.6	1.6	mg/kg
Conventionals	Sulfide	1	1	0	0.0%	NA	NA	mg/kg
Conventionals	Total Organic Carbon	12	18	18	100.0%	0.016	2.23	%
Conventionals	Total Percent Moisture	37	44	44	100.0%	4.2	31	%
Conventionals	Total Solids	1	1	1	100.0%	95.7	95.7	%
PAHs	1-Methylnaphthalene	2	2	2	100.0%	0.14	15	mg/kg
PAHs	2-Methylnaphthalene	63	212	157	74.1%	0.00051	160	mg/kg
PAHs	Acenaphthene	63	231	98	42.4%	0.00097	6.9	mg/kg
PAHs	Acenaphthylene	63	208	35	16.8%	0.00079	0.15	mg/kg
PAHs	Anthracene	63	227	95	41.9%	0.00059	3.3	mg/kg
PAHs	Benzo(b,k)fluoranthene	3	7	7	100.0%	0.28	15.5	mg/kg
PAHs	Benzo(g,h,i)perylene	27	68	11	16.2%	0.015	3.2	mg/kg
PAHs	Benzo(j,k)fluoranthene	2	2	1	50.0%	0.04	0.04	mg/kg
PAHs	Fluoranthene	63	227	121	53.3%	0.001	16	mg/kg
PAHs	Fluorene	63	231	122	52.8%	0.00062	14	mg/kg
PAHs	Naphthalene	63	232	174	75.0%	0.00061	51	mg/kg
PAHs	Phenanthrene	63	231	172	74.5%	0.0016	22	mg/kg
PAHs	Pyrene	63	227	138	60.8%	0.00076	16	mg/kg
PAHs	Total HPAHs	3	7	7	100.0%	1.54	82	mg/kg
PAHs	Total LPAHs	3	7	7	100.0%	0.9	19.5	mg/kg
cPAHs	Benz(a)anthracene	63	227	125	55.1%	0.00073	8.2	mg/kg
cPAHs	Benzo(a)pyrene	63	227	74	32.6%	0.00079	8.1	mg/kg
cPAHs	Benzo(b)fluoranthene	63	227	84	37.0%	0.0011	9.4	mg/kg
cPAHs	Benzo(k)fluoranthene	61	225	52	23.1%	0.00087	6.1	mg/kg
cPAHs	Chrysene	63	227	124	54.6%	0.0008	9.8	mg/kg
cPAHs	Dibenzo(a,h)anthracene	63	227	49	21.6%	0.00082	1.6	mg/kg
cPAHs	Indeno(1,2,3-cd)pyrene	63	227	58	25.6%	0.00088	3.6	mg/kg
cPAHs	Total cPAHs TEQ	4	5	5	100.0%	0.2	50	mg/kg
cPAHs	Total cPAHs TEQ (ND = 1/2 RDL)	63	227	143	63.0%	0.0016	11	mg/kg

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Analyte Group	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Other SVOCs (non-PAH)	1,2,4-Trichlorobenzene	27	69	14	20.3%	0.011	2.3	mg/kg
Other SVOCs (non-PAH)	1,2,4-Trimethylbenzene	13	30	12	40.0%	0.0024	56	mg/kg
Other SVOCs (non-PAH)	1,2-Dichlorobenzene	27	54	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	1,3,5-Trimethylbenzene	13	30	9	30.0%	0.0022	19	mg/kg
Other SVOCs (non-PAH)	1,3-Dichlorobenzene	27	54	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	1,4-Dichlorobenzene	27	74	11	14.9%	0.095	0.65	mg/kg
Other SVOCs (non-PAH)	2,4,5-Trichlorophenol	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2,4,6-Trichlorophenol	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2,4-Dichlorophenol	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2,4-Dimethylphenol	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2,4-Dinitrophenol	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2,4-Dinitrotoluene	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2,6-Dinitrotoluene	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2-Chloronaphthalene	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2-Chlorophenol	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2-Methylphenol	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2-Nitroaniline	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2-Nitrophenol	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	3,3'-Dichlorobenzidine	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	3-Nitroaniline	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	4,6-Dinitro-2-methylphenol	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	4-Bromophenyl phenyl ether	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	4-Chloro-3-methylphenol	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	4-Chloroaniline	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	4-Chlorophenyl phenyl ether	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	4-Methylphenol	22	44	3	6.8%	0.03	0.3	mg/kg
Other SVOCs (non-PAH)	4-Nitroaniline	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	4-Nitrophenol	22	44	0	0.0%	NA	NA	mg/kg

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Other SVOCs (non-PAH)	Aniline	16	22	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Benzidine	12	18	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Benzoic acid	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Benzyl alcohol	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Benzyl butyl phthalate	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Bis(2-chloro-1-methylethyl) ether	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Bis(2-chloroethoxy)methane	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Bis(2-chloroethyl) ether	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Bis(2-ethylhexyl) phthalate	22	63	24	38.1%	0.12	15	mg/kg
Other SVOCs (non-PAH)	Carbazole	6	22	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Dibenzofuran	22	67	12	17.9%	0.022	7.4	mg/kg
Other SVOCs (non-PAH)	Diethyl phthalate	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Dimethyl phthalate	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Di-n-butyl phthalate	22	44	1	2.3%	0.7	0.7	mg/kg
Other SVOCs (non-PAH)	Di-n-octyl phthalate	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Hexachlorobenzene	38	155	39	25.2%	0.0000975	1.4	mg/kg
Other SVOCs (non-PAH)	Hexachlorobutadiene	43	162	51	31.5%	0.0011	9.1	mg/kg
Other SVOCs (non-PAH)	Hexachlorocyclopentadiene	22	63	5	7.9%	0.092	0.92	mg/kg
Other SVOCs (non-PAH)	Hexachloroethane	25	66	17	25.8%	0.14	12	mg/kg
Other SVOCs (non-PAH)	Isophorone	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Nitrobenzene	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	N-Nitrosodimethylamine	16	22	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	N-Nitroso-di-n-propylamine	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	N-Nitrosodiphenylamine	22	44	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Pentachlorophenol	37	139	22	15.8%	0.00166	1.5	mg/kg
Other SVOCs (non-PAH)	Phenol	22	44	3	6.8%	0.14	0.43	mg/kg
Other SVOCs (non-PAH)	Pyridine	4	4	0	0.0%	NA	NA	mg/kg

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VOCs	1,1,1,2-Tetrachloroethane	11	28	0	0.0%	NA	NA	mg/kg
VOCs	1,1,1-Trichloroethane	54	105	2	1.9%	0.005	0.072	mg/kg
VOCs	1,1,2 - Trichlorotrifluoroethane	15	32	0	0.0%	NA	NA	mg/kg
VOCs	1,1,2,2-Tetrachloroethane	104	334	5	1.5%	0.0021	3.1	mg/kg
VOCs	1,1,2-Trichloroethane	104	337	3	0.9%	0.0105	0.165	mg/kg
VOCs	1,1-Dichloroethane	54	105	0	0.0%	NA	NA	mg/kg
VOCs	1,1-Dichloroethene	104	340	13	3.8%	0.00042	0.25	mg/kg
VOCs	1,1-Dichloropropene	11	28	0	0.0%	NA	NA	mg/kg
VOCs	1,2,3-Trichlorobenzene	11	28	0	0.0%	NA	NA	mg/kg
VOCs	1,2,3-Trichloropropane	11	28	0	0.0%	NA	NA	mg/kg
VOCs	1,2,3-Trimethylbenzene	2	2	0	0.0%	NA	NA	mg/kg
VOCs	1,2-Dibromo-3-chloropropane	11	32	0	0.0%	NA	NA	mg/kg
VOCs	1,2-Dibromoethane (EDB)	11	32	0	0.0%	NA	NA	mg/kg
VOCs	1,2-Dichloroethane (EDC)	54	105	0	0.0%	NA	NA	mg/kg
VOCs	1,2-Dichloroethene	39	71	4	5.6%	0.035	13	mg/kg
VOCs	1,2-Dichloropropane	54	105	0	0.0%	NA	NA	mg/kg
VOCs	1,3-Dichloropropane	11	28	0	0.0%	NA	NA	mg/kg
VOCs	1,4-Dichloro-2-Butene	9	26	0	0.0%	NA	NA	mg/kg
VOCs	2,2-Dichloropropane	11	28	0	0.0%	NA	NA	mg/kg
VOCs	2-Butanone	54	105	2	1.9%	0.82	1.1	mg/kg
VOCs	2-Chloroethyl Vinyl Ether	13	30	0	0.0%	NA	NA	mg/kg
VOCs	2-Chlorotoluene	11	28	0	0.0%	NA	NA	mg/kg
VOCs	2-Hexanone	54	105	1	1.0%	0.53	0.53	mg/kg
VOCs	4-Chlorotoluene	11	28	0	0.0%	NA	NA	mg/kg
VOCs	4-Methyl-2-pentanone	54	127	5	3.9%	0.41	2.9	mg/kg
VOCs	Acetone	54	105	18	17.1%	0.0095	4.1	mg/kg
VOCs	Acrolein	9	25	0	0.0%	NA	NA	mg/kg
VOCs	Acrylonitrile	9	26	0	0.0%	NA	NA	mg/kg
VOCs	Benzene	113	274	148	54.0%	0.000078	36	mg/kg
VOCs	Bromobenzene	11	28	0	0.0%	NA	NA	mg/kg
VOCs	Bromochloromethane	11	28	0	0.0%	NA	NA	mg/kg
VOCs	Bromodichloromethane	50	101	0	0.0%	NA	NA	mg/kg
VOCs	Bromoethane	9	26	0	0.0%	NA	NA	mg/kg
VOCs	Bromoform	54	105	0	0.0%	NA	NA	mg/kg
VOCs	Bromomethane	54	105	0	0.0%	NA	NA	mg/kg
VOCs	Carbon disulfide	54	105	10	9.5%	0.0011	0.0058	mg/kg

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VOCs	Carbon tetrachloride	104	360	13	3.6%	0.0018	0.99	mg/kg
VOCs	Chlorobenzene	54	105	0	0.0%	NA	NA	mg/kg
VOCs	Chloroethane	54	105	0	0.0%	NA	NA	mg/kg
VOCs	Chloroform	104	359	42	11.7%	0.004	11	mg/kg
VOCs	Chloromethane	54	105	0	0.0%	NA	NA	mg/kg
VOCs	cis-1,2-Dichloroethene (DCE)	67	270	44	16.3%	0.00028	2.3	mg/kg
VOCs	cis-1,3-Dichloropropene	54	105	0	0.0%	NA	NA	mg/kg
VOCs	Dibromochloromethane	54	105	0	0.0%	NA	NA	mg/kg
VOCs	Dibromodichloromethane	4	4	0	0.0%	NA	NA	mg/kg
VOCs	Dibromomethane	11	28	0	0.0%	NA	NA	mg/kg
VOCs	Dichlorodifluoromethane	7	10	0	0.0%	NA	NA	mg/kg
VOCs	Ethylbenzene	113	297	120	40.4%	0.00014	72	mg/kg
VOCs	Isopropylbenzene	11	28	12	42.9%	0.0013	6.4	mg/kg
VOCs	m,p-Xylene	55	182	108	59.3%	0.00018	180	mg/kg
VOCs	Methyl tert-butyl ether (MTBE)	2	2	0	0.0%	NA	NA	mg/kg
VOCs	Methylene chloride	104	364	87	23.9%	0.0011	5	mg/kg
VOCs	Methyliodide	11	28	0	0.0%	NA	NA	mg/kg
VOCs	n-Butylbenzene	11	28	12	42.9%	0.0013	7.1	mg/kg
VOCs	n-Propylbenzene	11	28	15	53.6%	0.0016	10	mg/kg
VOCs	o-Xylene	55	182	72	39.6%	0.00014	19	mg/kg
VOCs	p-Isopropyltoluene	11	28	13	46.4%	0.0014	7	mg/kg
VOCs	sec-Butylbenzene	11	28	11	39.3%	0.0021	3.6	mg/kg
VOCs	Styrene	54	105	0	0.0%	NA	NA	mg/kg
VOCs	tert-Butylbenzene	11	28	0	0.0%	NA	NA	mg/kg
VOCs	Tetrachloroethene (PCE)	104	362	171	47.2%	0.00024	12	mg/kg
VOCs	Toluene	113	274	153	55.8%	0.0002	180	mg/kg
VOCs	trans-1,2-Dichloroethene	66	269	22	8.2%	0.00033	0.13	mg/kg
VOCs	trans-1,3-Dichloropropene	54	105	0	0.0%	NA	NA	mg/kg
VOCs	Trichloroethene (TCE)	104	362	101	27.9%	0.00021	11	mg/kg
VOCs	Trichlorofluoromethane	17	38	0	0.0%	NA	NA	mg/kg
VOCs	Vinyl acetate	50	97	0	0.0%	NA	NA	mg/kg
VOCs	Vinyl chloride	104	334	27	8.1%	0.00029	0.068	mg/kg
VOCs	Xylenes (total)	58	116	40	34.5%	0.001	300	mg/kg

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Analyte Group	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
PCBs	Aroclor 1016	39	142	0	0.0%	NA	NA	mg/kg
PCBs	Aroclor 1221	39	142	0	0.0%	NA	NA	mg/kg
PCBs	Aroclor 1232	39	142	0	0.0%	NA	NA	mg/kg
PCBs	Aroclor 1242	39	142	0	0.0%	NA	NA	mg/kg
PCBs	Aroclor 1248	39	142	0	0.0%	NA	NA	mg/kg
PCBs	Aroclor 1254	40	143	3	2.1%	0.14	13.4	mg/kg
PCBs	Aroclor 1260	40	143	7	4.9%	0.0054	10.9	mg/kg
PCBs	Aroclor 1262	1	6	0	0.0%	NA	NA	mg/kg
PCBs	Aroclor 1268	1	6	0	0.0%	NA	NA	mg/kg
PCBs	Total PCBs	52	188	23	12.2%	0.00477	24.3	mg/kg
PCBs	PCB 105	7	12	12	100.0%	0.0000637	0.03171748	mg/kg
PCBs	PCB 114	7	12	9	75.0%	0.00000819	0.00310594	mg/kg
PCBs	PCB 118	7	12	12	100.0%	0.0000265	0.06638483	mg/kg
PCBs	PCB 123	7	12	9	75.0%	0.00000836	0.00182977	mg/kg
PCBs	PCB 126	7	12	9	75.0%	0.00000258	0.00294	mg/kg
PCBs	PCB 156	7	12	12	100.0%	0.00002073	0.00945007	mg/kg
PCBs	PCB 167	7	12	12	100.0%	0.00000783	0.00296832	mg/kg
PCBs	PCB 169	7	12	3	25.0%	0.00000942	0.0000566	mg/kg
PCBs	PCB 170	7	12	12	100.0%	0.00003736	0.02496937	mg/kg
PCBs	PCB 180	7	12	12	100.0%	0.00015885	0.07093691	mg/kg
PCBs	PCB 183	7	12	10	83.3%	0.000058	0.00248009	mg/kg
PCBs	PCB 187	7	12	12	100.0%	0.000228	0.13840648	mg/kg
PCBs	PCB 189	7	12	5	41.7%	0.0000534	0.00183981	mg/kg
PCBs	PCB 70	7	12	12	100.0%	0.00016884	0.08183677	mg/kg
PCBs	PCB 77	7	12	12	100.0%	0.00000554	0.00398863	mg/kg
PCBs	PCB 81	7	12	6	50.0%	0.00000262	0.00023073	mg/kg
PCBs	PCB 99	4	7	7	100.0%	0.000161	0.00189	mg/kg

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Analyte Group	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Pesticides	4,4'-DDD	7	38	1	2.6%	0.069	0.069	mg/kg
Pesticides	4,4'-DDE	7	38	4	10.5%	0.00456	0.0753	mg/kg
Pesticides	4,4'-DDT	7	38	0	0.0%	NA	NA	mg/kg
Pesticides	Aldrin	7	38	0	0.0%	NA	NA	mg/kg
Pesticides	cis-Chlordane	7	38	0	0.0%	NA	NA	mg/kg
Pesticides	Dieldrin	7	38	0	0.0%	NA	NA	mg/kg
Pesticides	trans-Chlordane	7	38	0	0.0%	NA	NA	mg/kg
Dioxins/Furans	1,2,3,4,6,7,8-HpCDD	7	12	12	100.0%	0.000002522	0.000291291	mg/kg
Dioxins/Furans	1,2,3,4,6,7,8-HpCDF	7	12	12	100.0%	0.000002043	0.002761574	mg/kg
Dioxins/Furans	1,2,3,4,7,8,9-HpCDF	7	12	12	100.0%	0.000000673	0.000934937	mg/kg
Dioxins/Furans	1,2,3,4,7,8-HxCDD	7	12	5	41.7%	0.000000984	0.000013105	mg/kg
Dioxins/Furans	1,2,3,4,7,8-HxCDF	7	12	12	100.0%	0.000001567	0.002490486	mg/kg
Dioxins/Furans	1,2,3,6,7,8-HxCDD	7	12	12	100.0%	0.000000264	0.000021764	mg/kg
Dioxins/Furans	1,2,3,6,7,8-HxCDF	7	12	12	100.0%	0.000000388	0.001071343	mg/kg
Dioxins/Furans	1,2,3,7,8,9-HxCDD	7	12	6	50.0%	0.000000249	0.000004885	mg/kg
Dioxins/Furans	1,2,3,7,8,9-HxCDF	7	12	8	66.7%	0.000000487	0.000097169	mg/kg
Dioxins/Furans	1,2,3,7,8-PeCDD	7	12	7	58.3%	0.000000145	0.00001086	mg/kg
Dioxins/Furans	1,2,3,7,8-PeCDF	7	12	12	100.0%	0.000000864	0.004912991	mg/kg
Dioxins/Furans	2,3,4,6,7,8-HxCDF	7	12	10	83.3%	0.00000147	0.000134874	mg/kg
Dioxins/Furans	2,3,4,7,8-PeCDF	7	12	12	100.0%	0.000000515	0.00236548	mg/kg
Dioxins/Furans	2,3,7,8-TCDD	7	12	6	50.0%	0.000000315	0.000020753	mg/kg
Dioxins/Furans	2,3,7,8-TCDF	7	12	12	100.0%	0.000001329	0.01159011	mg/kg
Dioxins/Furans	OCDD	7	12	12	100.0%	0.000022361	0.001824813	mg/kg
Dioxins/Furans	OCDF	7	12	12	100.0%	0.000009877	0.007740443	mg/kg
Dioxins/Furans	Tetrachlorodibenzofurans (TCDF), Total	7	12	12	100.0%	0.000002442	0.029391429	mg/kg
Dioxins/Furans	Total HpCDD	7	12	12	100.0%	0.000005933	0.000711528	mg/kg
Dioxins/Furans	Total HpCDF	7	12	12	100.0%	0.000005915	0.005341935	mg/kg
Dioxins/Furans	Total HxCDD	7	12	9	75.0%	0.000000717	0.000238186	mg/kg
Dioxins/Furans	Total HxCDF	7	12	12	100.0%	0.000003734	0.00993978	mg/kg
Dioxins/Furans	Total PeCDD	7	12	9	75.0%	0.000000805	0.000114695	mg/kg
Dioxins/Furans	Total PeCDF	7	12	12	100.0%	0.000005803	0.015875425	mg/kg
Dioxins/Furans	Total TCDD	7	12	10	83.3%	0.000000328	0.000160329	mg/kg

Table D.2 - Summary of Existing Site Groundwater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
TPHs	-	Diesel Range Hydrocarbons	87	100	49	49.0%	12	25000	ug/L
TPHs	-	Gasoline Range Hydrocarbons	89	109	72	66.1%	13	15000	ug/L
TPHs	-	Oil Range Hydrocarbons	86	95	17	17.9%	21	850	ug/L
TPHs	-	Total Petroleum Hydrocarbons (C12-C24)	8	20	1	5.0%	5000	5000	ug/L
TPHs	-	Total Petroleum Hydrocarbons (C7-C12)	8	20	1	5.0%	7000	7000	ug/L
TPHs	-	Total TPHs	88	120	52	43.3%	39	26250	ug/L
EPH/VPH	-	Aliphatics C12-C16	28	31	2	6.5%	130	140	ug/L
EPH/VPH	-	Aliphatics C16-C21	28	31	3	9.7%	51	150	ug/L
EPH/VPH	-	Aliphatics C21-C34	28	31	0	0.0%	NA	NA	ug/L
EPH/VPH	-	Aromatics C10-C12	28	31	1	3.2%	110	110	ug/L
EPH/VPH	-	Aromatics C12-C13	28	31	0	0.0%	NA	NA	ug/L
EPH/VPH	-	Aromatics C12-C16	27	30	2	6.7%	52	54	ug/L
EPH/VPH	-	Aromatics C16-C21	27	30	5	16.7%	76	100	ug/L
EPH/VPH	-	Aromatics C21-C34	27	30	1	3.3%	350	350	ug/L
EPH/VPH	-	Aromatics C8-C10	28	31	0	0.0%	NA	NA	ug/L
Metals	D	Aluminum	13	14	5	35.7%	120	1400	ug/L
Metals	D	Antimony	8	9	1	11.1%	32	32	ug/L
Metals	D	Arsenic	28	134	64	47.8%	1.2	618	ug/L
Metals	D	Barium	3	3	3	100.0%	33	100	ug/L
Metals	D	Beryllium	8	9	0	0.0%	NA	NA	ug/L
Metals	D	Cadmium	14	20	0	0.0%	NA	NA	ug/L
Metals	D	Calcium	3	5	5	100.0%	102000	170000	ug/L
Metals	D	Chromium (Total)	28	134	25	18.7%	1.5	369	ug/L
Metals	D	Cobalt	3	3	0	0.0%	NA	NA	ug/L
Metals	D	Copper	25	131	71	54.2%	5.9	107	ug/L
Metals	D	Iron	6	8	6	75.0%	76.6	15200	ug/L
Metals	D	Lead	51	162	22	13.6%	0.065	350	ug/L
Metals	D	Magnesium	3	5	5	100.0%	102000	810000	ug/L
Metals	D	Manganese	6	6	6	100.0%	7.8	85.2	ug/L
Metals	D	Mercury	23	118	2	1.7%	0.115	1.5	ug/L
Metals	D	Molybdenum	1	1	1	100.0%	5.1	5.1	ug/L
Metals	D	Nickel	25	131	83	63.4%	9	148	ug/L
Metals	D	Potassium	3	3	3	100.0%	182000	280000	ug/L
Metals	D	Selenium	8	9	1	11.1%	3.2	3.2	ug/L
Metals	D	Silver	8	9	0	0.0%	NA	NA	ug/L
Metals	D	Sodium	21	41	41	100.0%	78300	10900000	ug/L
Metals	D	Strontium	1	1	1	100.0%	2500	2500	ug/L
Metals	D	Thallium	22	117	5	4.3%	1.5	6.9	ug/L

Table D.2 - Summary of Existing Site Groundwater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Metals	D	Tin	1	1	1	100.0%	830	830	ug/L
Metals	D	Titanium	1	1	1	100.0%	420	420	ug/L
Metals	D	Vanadium	3	3	3	100.0%	6.6	330	ug/L
Metals	D	Zinc	25	131	22	16.8%	0.415	130	ug/L
Metals	T	Aluminum	92	104	86	82.7%	7	23000	ug/L
Metals	T	Antimony	91	101	58	57.4%	0.032	11.1	ug/L
Metals	T	Arsenic	94	127	107	84.3%	0.26	570	ug/L
Metals	T	Barium	92	105	104	99.0%	1	977	ug/L
Metals	T	Beryllium	7	8	1	12.5%	3	3	ug/L
Metals	T	Cadmium	94	125	23	18.4%	0.079	41	ug/L
Metals	T	Calcium	99	113	113	100.0%	184	2870000	ug/L
Metals	T	Chromium (Total)	95	129	90	69.8%	0.31	672	ug/L
Metals	T	Cobalt	12	14	2	14.3%	5.1	8.2	ug/L
Metals	T	Copper	95	126	97	77.0%	0.22	2230	ug/L
Metals	T	Iron	100	116	115	99.1%	3.3	193000	ug/L
Metals	T	Lead	119	168	116	69.0%	0.024	34000	ug/L
Metals	T	Magnesium	99	113	113	100.0%	7	983000	ug/L
Metals	T	Manganese	22	25	25	100.0%	1	3090	ug/L
Metals	T	Mercury	92	106	40	37.7%	0.02	2.33	ug/L
Metals	T	Nickel	94	121	79	65.3%	0.2	520	ug/L
Metals	T	Potassium	99	113	113	100.0%	780	910000	ug/L
Metals	T	Selenium	12	17	0	0.0%	NA	NA	ug/L
Metals	T	Silicon	89	101	101	100.0%	6270	5790000	ug/L
Metals	T	Silver	92	111	12	10.8%	0.052	0.378	ug/L
Metals	T	Sodium	98	104	104	100.0%	5670	7650000	ug/L
Metals	T	Strontium	89	101	100	99.0%	12.6	9050	ug/L
Metals	T	Thallium	91	98	13	13.3%	0.0064	0.52	ug/L
Metals	T	Tin	1	1	0	0.0%	NA	NA	ug/L
Metals	T	Vanadium	13	15	10	66.7%	16.2	308	ug/L
Metals	T	Zinc	95	126	59	46.8%	0.84	2270	ug/L
Metals	-	Cyanide (total)	1	1	0	0.0%	NA	NA	ug/L
Metals	-	Magnesium	3	3	3	100.0%	740	6800	ug/L
Metals	-	Potassium	3	3	3	100.0%	8120	239000	ug/L
Metals	-	Tetraethyl Lead	66	70	7	10.0%	0.00087	0.00599	ug/L

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Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Conventionals	D	Alkalinity (Total)	3	3	3	100.0%	337000	1550000	ug/L
Conventionals	D	Ammonia as Nitrogen	3	3	3	100.0%	3400	23600	ug/L
Conventionals	D	Biochemical Oxygen Demand	3	3	3	100.0%	2800	48000	ug/L
Conventionals	D	Boron	1	1	1	100.0%	690	690	ug/L
Conventionals	D	Carbon, Dissolved Organic (DOC)	9	9	9	100.0%	1400	29000	ug/L
Conventionals	D	Chemical Oxygen Demand	3	3	2	66.7%	160000	190000	ug/L
Conventionals	D	Chloride	20	37	37	100.0%	79000	16000000	ug/L
Conventionals	D	Dissolved Organic Carbon	15	70	61	87.1%	585	85300	ug/L
Conventionals	D	Nitrate as Nitrogen	3	3	0	0.0%	NA	NA	ug/L
Conventionals	D	Nitrite as Nitrogen	3	3	0	0.0%	NA	NA	ug/L
Conventionals	D	Phosphorus	1	1	1	100.0%	4200	4200	ug/L
Conventionals	D	Silica (SiO2)	8	11	8	72.7%	1500	970000	ug/L
Conventionals	D	Sulfate	3	3	2	66.7%	152000	233000	ug/L
Conventionals	D	Sulfide	3	3	1	33.3%	7000	7000	ug/L
Conventionals	D	Total Dissolved Solids	97	145	145	100.0%	290	32900000	ug/L
Conventionals	D	Total Organic Carbon	3	3	3	100.0%	2300	12100	ug/L
Conventionals	-	Alkalinity (Bicarbonate)	11	14	10	71.4%	25800	2190000	ug/L
Conventionals	-	Alkalinity (Carbonate)	11	14	6	42.9%	21300	3319000	ug/L
Conventionals	-	Alkalinity (Hydroxide)	11	14	4	28.6%	361000	12271000	ug/L
Conventionals	-	Alkalinity (Total)	108	136	135	99.3%	20600	19800000	ug/L
Conventionals	-	Ammonia as Nitrogen	32	34	32	94.1%	80	28000	ug/L
Conventionals	-	Bicarbonate	89	101	95	94.1%	0	2510000	ug/L
Conventionals	-	Bromide	87	91	77	84.6%	10	58000	ug/L
Conventionals	-	Carbonate	8	10	10	100.0%	0	300000	ug/L
Conventionals	-	Chloride	109	177	178	100.6%	1080	17600000	ug/L
Conventionals	-	Chlorine	8	8	8	100.0%	200000	9100000	ug/L
Conventionals	-	Hardness	3	3	3	100.0%	18000	275000	ug/L
Conventionals	-	Hydroxide	8	10	10	100.0%	0	289000	ug/L
Conventionals	-	Nitrate + Nitrite	20	21	7	33.3%	130	7500	ug/L
Conventionals	-	Nitrate as Nitrogen	9	11	10	90.9%	50	53600	ug/L
Conventionals	-	Silica (SiO2)	3	3	3	100.0%	24300	8220000	ug/L
Conventionals	-	Sulfate	99	115	110	95.7%	510	1500000	ug/L
Conventionals	-	Sulfide	1	1	0	0.0%	NA	NA	ug/L
Conventionals	-	Total Suspended Solids	8	20	18	90.0%	38000	8500000	ug/L
Conventionals	T	Boron	89	101	91	90.1%	21.1	3430	ug/L
Conventionals	T	Phosphorus	8	10	6	60.0%	200	900	ug/L
Conventionals	D	Ethane	3	3	0	0.0%	NA	NA	ug/L
Conventionals	D	Ethene	3	3	1	33.3%	5	5	ug/L

Table D.2 - Summary of Existing Site Groundwater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Conventionals	D	Methane	3	3	2	66.7%	690	25000	ug/L
PAHs	-	1-Methylnaphthalene	3	3	3	100.0%	4.2	140	ug/L
PAHs	-	2-Methylnaphthalene	91	125	79	63.2%	0.0025	200	ug/L
PAHs	-	Acenaphthene	90	124	44	35.5%	0.0044	4.6	ug/L
PAHs	-	Acenaphthylene	90	124	8	6.5%	0.004	0.42	ug/L
PAHs	-	Anthracene	90	124	39	31.5%	0.0038	0.14	ug/L
PAHs	-	Benzo(g,h,i)perylene	34	45	0	0.0%	NA	NA	ug/L
PAHs	-	Benzofluoranthene	3	3	0	0.0%	NA	NA	ug/L
PAHs	-	Fluoranthene	90	124	9	7.3%	0.0048	0.026	ug/L
PAHs	-	Fluorene	91	125	57	45.6%	0.0039	4.7	ug/L
PAHs	-	Naphthalene	111	182	92	50.5%	0.0035	110	ug/L
PAHs	-	Phenanthrene	90	124	44	35.5%	0.005	3.8	ug/L
PAHs	-	Pyrene	90	124	20	16.1%	0.0038	0.073	ug/L
cPAHs	-	Benz(a)anthracene	90	124	13	10.5%	0.0029	0.0083	ug/L
cPAHs	-	Benzo(a)pyrene	90	124	1	0.8%	0.007	0.007	ug/L
cPAHs	-	Benzo(b)fluoranthene	90	124	5	4.0%	0.0028	0.021	ug/L
cPAHs	-	Benzo(k)fluoranthene	90	124	3	2.4%	0.0026	0.017	ug/L
cPAHs	-	Chrysene	90	124	6	4.8%	0.0034	0.0078	ug/L
cPAHs	-	Dibenzo(a,h)anthracene	90	124	5	4.0%	0.0027	0.021	ug/L
cPAHs	-	Indeno(1,2,3-cd)pyrene	90	124	6	4.8%	0.0029	0.033	ug/L
cPAHs	-	Total cPAHs TEQ (ND = 1/2 RDL)	90	124	18	14.5%	0.011	0.062	ug/L
Other SVOCs (non-PAH)	-	1,2,4,5-Tetrachlorobenzene	1	1	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	1,2,4-Trichlorobenzene	35	48	3	6.2%	1	35	ug/L
Other SVOCs (non-PAH)	-	1,2,4-Trimethylbenzene	17	18	9	50.0%	1	54	ug/L
Other SVOCs (non-PAH)	-	1,2-Dichlorobenzene	51	99	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	1,3,5-Trimethylbenzene	17	18	8	44.4%	0.36	9	ug/L
Other SVOCs (non-PAH)	-	1,3-Dichlorobenzene	51	99	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	1,3-Dinitrobenzene	1	1	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	1,4-Dichlorobenzene	51	99	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,3,4,6-Tetrachlorophenol	1	1	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,4,5-Trichlorophenol	31	39	1	2.6%	7	7	ug/L
Other SVOCs (non-PAH)	-	2,4,6-Trichlorophenol	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,4-Dichlorophenol	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,4-Dimethylphenol	31	42	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,4-Dinitrophenol	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,4-Dinitrotoluene	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,6-Dichlorophenol	1	1	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,6-Dinitrotoluene	31	39	0	0.0%	NA	NA	ug/L

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Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Other SVOCs (non-PAH)	-	2-Chloronaphthalene	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2-Chlorophenol	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2-Methylphenol	31	42	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2-Nitroaniline	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2-Nitrophenol	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	3,3'-Dichlorobenzidine	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	3-Nitroaniline	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4,6-Dinitro-2-methylphenol	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Bromophenyl phenyl ether	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Chloro-3-methylphenol	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Chloroaniline	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Chlorophenyl phenyl ether	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Methylphenol	31	42	4	9.5%	14	66	ug/L
Other SVOCs (non-PAH)	-	4-Nitroaniline	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Nitrophenol	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Acetophenone	1	1	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Aniline	9	15	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Benzidine	8	14	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Benzoic acid	30	38	3	7.9%	15	73	ug/L
Other SVOCs (non-PAH)	-	Benzyl alcohol	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Benzyl butyl phthalate	31	42	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Bis(2-chloro-1-methylethyl) ether	23	30	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Bis(2-chloroethoxy)methane	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Bis(2-chloroethyl) ether	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	bis(2-Chloroisopropyl)ether	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Bis(2-ethylhexyl) phthalate	31	44	4	9.1%	1.1	7	ug/L
Other SVOCs (non-PAH)	-	Carbazole	13	14	1	7.1%	1.1	1.1	ug/L
Other SVOCs (non-PAH)	-	Dibenzofuran	34	45	2	4.4%	1.2	1.8	ug/L
Other SVOCs (non-PAH)	-	Diethyl phthalate	32	44	6	13.6%	1	24	ug/L
Other SVOCs (non-PAH)	-	Dimethyl phthalate	31	42	2	4.8%	2.7	3.3	ug/L
Other SVOCs (non-PAH)	-	Di-n-butyl phthalate	32	44	1	2.3%	2	2	ug/L
Other SVOCs (non-PAH)	-	Di-n-octyl phthalate	31	42	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Hexachlorobenzene	43	141	15	10.6%	0.00753	0.14	ug/L
Other SVOCs (non-PAH)	-	Hexachlorobutadiene	47	145	3	2.1%	0.00726	0.1	ug/L
Other SVOCs (non-PAH)	-	Hexachlorocyclopentadiene	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Hexachloroethane	31	42	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Isophorone	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Nitrobenzene	31	39	0	0.0%	NA	NA	ug/L

Table D.2 - Summary of Existing Site Groundwater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Other SVOCs (non-PAH)	-	N-Nitrosodimethylamine	9	15	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	N-Nitroso-di-n-propylamine	31	39	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	N-Nitrosodiphenylamine	31	42	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Pentachlorophenol	33	120	6	5.0%	0.0377	10	ug/L
Other SVOCs (non-PAH)	-	Phenol	32	50	10	20.0%	2	81	ug/L
Other SVOCs (non-PAH)	-	Pyridine	1	1	0	0.0%	NA	NA	ug/L
VOCs	-	1,1,1,2-Tetrachloroethane	18	19	0	0.0%	NA	NA	ug/L
VOCs	-	1,1,1-Trichloroethane	73	143	1	0.7%	3	3	ug/L
VOCs	-	1,1,2 - Trichlorotrifluoroethane	14	15	0	0.0%	NA	NA	ug/L
VOCs	-	1,1,2,2-Tetrachloroethane	143	380	10	2.6%	0.0912	2	ug/L
VOCs	-	1,1,2-Trichloroethane	142	349	2	0.6%	0.318	0.497	ug/L
VOCs	-	1,1-Dichloroethane	74	129	2	1.6%	1	11	ug/L
VOCs	-	1,1-Dichloroethene	156	397	27	6.8%	0.0795	7	ug/L
VOCs	-	1,1-Dichloropropene	17	18	0	0.0%	NA	NA	ug/L
VOCs	-	1,2,3-Trichlorobenzene	17	18	0	0.0%	NA	NA	ug/L
VOCs	-	1,2,3-Trichloropropane	18	19	0	0.0%	NA	NA	ug/L
VOCs	-	1,2-Dibromo-3-chloropropane	34	72	0	0.0%	NA	NA	ug/L
VOCs	-	1,2-Dibromoethane (EDB)	34	72	0	0.0%	NA	NA	ug/L
VOCs	-	1,2-Dichloroethane (EDC)	66	134	2	1.5%	6	13	ug/L
VOCs	-	1,2-Dichloroethene	41	79	47	59.5%	1	190	ug/L
VOCs	-	1,2-Dichloropropane	65	118	0	0.0%	NA	NA	ug/L
VOCs	-	1,3-Dichloropropane	17	18	0	0.0%	NA	NA	ug/L
VOCs	-	1,4-Dichloro-2-Butene	15	16	0	0.0%	NA	NA	ug/L
VOCs	-	2,2-Dichloropropane	17	18	0	0.0%	NA	NA	ug/L
VOCs	-	2-Butanone	78	135	3	2.2%	6	26	ug/L
VOCs	-	2-Chloroethyl Vinyl Ether	17	18	0	0.0%	NA	NA	ug/L
VOCs	-	2-Chlorotoluene	17	18	0	0.0%	NA	NA	ug/L
VOCs	-	2-Hexanone	65	118	1	0.8%	2	2	ug/L
VOCs	-	4-Chlorotoluene	17	18	0	0.0%	NA	NA	ug/L
VOCs	-	4-Methyl-2-pentanone	65	118	0	0.0%	NA	NA	ug/L
VOCs	-	Acetone	86	162	44	27.2%	1.8	1800	ug/L
VOCs	-	Acetonitrile	1	1	0	0.0%	NA	NA	ug/L
VOCs	-	Acrolein	15	16	1	6.2%	4	4	ug/L
VOCs	-	Acrylonitrile	15	16	5	31.2%	1.5	31	ug/L
VOCs	-	Allyl Chloride	1	1	0	0.0%	NA	NA	ug/L
VOCs	-	Benzene	139	287	153	53.3%	0.08	3200	ug/L
VOCs	-	Bromobenzene	17	18	0	0.0%	NA	NA	ug/L
VOCs	-	Bromochloromethane	17	18	0	0.0%	NA	NA	ug/L

Table D.2 - Summary of Existing Site Groundwater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
VOCs	-	Bromodichloromethane	65	118	0	0.0%	NA	NA	ug/L
VOCs	-	Bromoethane	14	15	0	0.0%	NA	NA	ug/L
VOCs	-	Bromoform	65	118	0	0.0%	NA	NA	ug/L
VOCs	-	Bromomethane	66	119	1	0.8%	8	8	ug/L
VOCs	-	Carbon disulfide	65	118	0	0.0%	NA	NA	ug/L
VOCs	-	Carbon tetrachloride	142	349	1	0.3%	0.3	0.3	ug/L
VOCs	-	Chlorobenzene	65	118	1	0.8%	5.6	5.6	ug/L
VOCs	-	Chloroethane	65	118	0	0.0%	NA	NA	ug/L
VOCs	-	Chloroform	156	397	79	19.9%	0.08	39	ug/L
VOCs	-	Chloromethane	77	134	0	0.0%	NA	NA	ug/L
VOCs	-	cis-1,2-Dichloroethene (DCE)	138	305	145	47.5%	0.0696	810	ug/L
VOCs	-	cis-1,3-Dichloropropene	65	118	0	0.0%	NA	NA	ug/L
VOCs	-	Dibromochloromethane	65	118	0	0.0%	NA	NA	ug/L
VOCs	-	Dibromodichloromethane	1	1	0	0.0%	NA	NA	ug/L
VOCs	-	Dibromomethane	18	19	0	0.0%	NA	NA	ug/L
VOCs	-	Dichlorodifluoromethane	33	57	0	0.0%	NA	NA	ug/L
VOCs	-	Dichloroethane	2	2	0	0.0%	NA	NA	ug/L
VOCs	-	Ethyl Methacrylate	1	1	0	0.0%	NA	NA	ug/L
VOCs	-	Ethylbenzene	151	306	119	38.9%	0.05	1000	ug/L
VOCs	-	Isopropylbenzene	17	18	12	66.7%	1.3	33	ug/L
VOCs	-	m,p-Xylene	123	188	74	39.4%	0.11	660	ug/L
VOCs	-	Methacrylonitrile	1	1	0	0.0%	NA	NA	ug/L
VOCs	-	Methyl Methacrylate	1	1	0	0.0%	NA	NA	ug/L
VOCs	-	Methyl tert-butyl ether (MTBE)	31	34	0	0.0%	NA	NA	ug/L
VOCs	-	Methylene chloride	155	389	27	6.9%	0.16	90	ug/L
VOCs	-	Methyliodide	18	19	0	0.0%	NA	NA	ug/L
VOCs	-	n-Butylbenzene	17	18	6	33.3%	1.4	8	ug/L
VOCs	-	n-Propylbenzene	17	18	10	55.6%	1.5	58	ug/L
VOCs	-	o-Xylene	123	188	54	28.7%	0.08	56	ug/L
VOCs	-	Pentachloroethane	1	1	0	0.0%	NA	NA	ug/L
VOCs	-	p-Isopropyltoluene	17	18	6	33.3%	0.22	3.8	ug/L
VOCs	-	sec-Butylbenzene	17	18	8	44.4%	1.3	5.3	ug/L
VOCs	-	Styrene	65	118	0	0.0%	NA	NA	ug/L
VOCs	-	tert-Butylbenzene	17	18	0	0.0%	NA	NA	ug/L
VOCs	-	Tetrachloroethene (PCE)	144	384	162	42.2%	0.0648	1100	ug/L
VOCs	-	Toluene	151	303	123	40.6%	0.06	1800	ug/L
VOCs	-	trans-1,2-Dichloroethene	141	319	59	18.5%	0.08	39	ug/L
VOCs	-	trans-1,3-Dichloropropene	65	118	1	0.8%	2	2	ug/L

Table D.2 - Summary of Existing Site Groundwater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
VOCs	-	Trichloroethene (TCE)	144	384	182	47.4%	0.1	230	ug/L
VOCs	-	Trichlorofluoromethane	34	72	0	0.0%	NA	NA	ug/L
VOCs	-	Vinyl acetate	50	66	1	1.5%	3	3	ug/L
VOCs	-	Vinyl chloride	156	397	96	24.2%	0.066	270	ug/L
VOCs	-	Xylenes (total)	47	118	40	33.9%	0.55	2500	ug/L
Chlorinated Herbicides	-	2,4,5-T	1	1	0	0.0%	NA	NA	ug/L
Chlorinated Herbicides	-	2,4-D	1	1	0	0.0%	NA	NA	ug/L
Chlorinated Herbicides	-	Silvex	1	1	0	0.0%	NA	NA	ug/L
Pesticides	-	4,4'-DDD	9	40	0	0.0%	NA	NA	ug/L
Pesticides	-	4,4'-DDE	9	40	0	0.0%	NA	NA	ug/L
Pesticides	-	4,4'-DDT	9	40	0	0.0%	NA	NA	ug/L
Pesticides	-	Aldrin	9	40	1	2.5%	0.06	0.06	ug/L
Pesticides	-	Beta-BHC	1	1	1	100.0%	0.029	0.029	ug/L
Pesticides	-	cis-Chlordane	9	40	2	5.0%	0.003	0.05	ug/L
Pesticides	-	Dieldrin	9	40	0	0.0%	NA	NA	ug/L
Pesticides	-	Heptachlor	3	3	0	0.0%	NA	NA	ug/L
Pesticides	-	Lindane	3	3	0	0.0%	NA	NA	ug/L
Pesticides	-	trans-Chlordane	9	40	0	0.0%	NA	NA	ug/L
Nitroaromatics/Nitroamines	-	1,3,5-Trinitrobenzene	1	1	0	0.0%	NA	NA	ug/L
PCBs	-	Aroclor 1016	82	138	0	0.0%	NA	NA	ug/L
PCBs	-	Aroclor 1221	82	138	0	0.0%	NA	NA	ug/L
PCBs	-	Aroclor 1232	82	138	0	0.0%	NA	NA	ug/L
PCBs	-	Aroclor 1242	82	138	0	0.0%	NA	NA	ug/L
PCBs	-	Aroclor 1248	82	138	2	1.4%	0.021	0.094	ug/L
PCBs	-	Aroclor 1254	83	139	0	0.0%	NA	NA	ug/L
PCBs	-	Aroclor 1260	83	139	1	0.7%	0.096	0.096	ug/L
PCBs	-	Total PCBs	89	166	4	2.4%	0.021	0.096	ug/L
PCBs	-	PCB 105	1	1	0	0.0%	NA	NA	ug/L
PCBs	-	PCB 114	1	1	0	0.0%	NA	NA	ug/L
PCBs	-	PCB 118	1	1	0	0.0%	NA	NA	ug/L
PCBs	-	PCB 123	1	1	0	0.0%	NA	NA	ug/L
PCBs	-	PCB 126	1	1	1	100.0%	0.00000865	0.00000865	ug/L
PCBs	-	PCB 156	1	1	0	0.0%	NA	NA	ug/L
PCBs	-	PCB 167	1	1	0	0.0%	NA	NA	ug/L
PCBs	-	PCB 169	1	1	1	100.0%	0.00004443	0.00004443	ug/L
PCBs	-	PCB 170	1	1	1	100.0%	0.00070547	0.00070547	ug/L
PCBs	-	PCB 180	1	1	1	100.0%	0.00611321	0.00611321	ug/L
PCBs	-	PCB 183	1	1	1	100.0%	0.0003913	0.0003913	ug/L

Table D.2 - Summary of Existing Site Groundwater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
PCBs	-	PCB 187	1	1	1	100.0%	0.00816368	0.00816368	ug/L
PCBs	-	PCB 189	1	1	0	0.0%	NA	NA	ug/L
PCBs	-	PCB 70	1	1	0	0.0%	NA	NA	ug/L
PCBs	-	PCB 77	1	1	0	0.0%	NA	NA	ug/L
PCBs	-	PCB 81	1	1	0	0.0%	NA	NA	ug/L

Table D.2 - Summary of Existing Site Groundwater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Dioxins/Furans	-	1,2,3,4,6,7,8-HpCDD	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	1,2,3,4,6,7,8-HpCDF	5	5	1	20.0%	0.000006641	0.000006641	ug/L
Dioxins/Furans	-	1,2,3,4,7,8,9-HpCDF	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	1,2,3,4,7,8-HxCDD	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	1,2,3,4,7,8-HxCDF	5	5	1	20.0%	0.000004364	0.000004364	ug/L
Dioxins/Furans	-	1,2,3,6,7,8-HxCDD	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	1,2,3,6,7,8-HxCDF	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	1,2,3,7,8,9-HxCDD	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	1,2,3,7,8,9-HxCDF	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	1,2,3,7,8-PeCDD	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	1,2,3,7,8-PeCDF	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	2,3,4,6,7,8-HxCDF	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	2,3,4,7,8-PeCDF	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	2,3,7,8-TCDD	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	2,3,7,8-TCDF	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	OCDD	5	5	3	60.0%	0.0000506	0.00017	ug/L
Dioxins/Furans	-	OCDF	5	5	1	20.0%	0.000017899	0.000017899	ug/L
Dioxins/Furans	-	Tetrachlorodibenzofurans (TCDF), Total	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	Total HpCDD	5	5	2	40.0%	0.0000178	0.0000381	ug/L
Dioxins/Furans	-	Total HpCDF	5	5	5	100.0%	0.00000427	0.000016	ug/L
Dioxins/Furans	-	Total HxCDD	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	Total HxCDF	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	Total PeCDD	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	Total PeCDF	5	5	0	0.0%	NA	NA	ug/L
Dioxins/Furans	-	Total TCDD	5	5	0	0.0%	NA	NA	ug/L

Table D.3 - Summary of Existing Site Sediment Porewater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
TPHs	-	Total Petroleum Hydrocarbons (C12-C24	2	3	0	0.0%	NA	NA	ug/L
TPHs	-	Total Petroleum Hydrocarbons (C7-C12)	2	3	0	0.0%	NA	NA	ug/L
TPHs	-	Total TPHs	2	3	0	0.0%	NA	NA	ug/L
Metals	D	Arsenic	2	3	1	33.3%	6.6	6.6	ug/L
Metals	D	Cadmium	1	2	0	0.0%	NA	NA	ug/L
Metals	D	Chromium (Total)	2	3	0	0.0%	NA	NA	ug/L
Metals	D	Copper	4	6	2	33.3%	3.3	6.6	ug/L
Metals	D	Lead	4	6	3	50.0%	15	219	ug/L
Metals	D	Mercury	2	3	0	0.0%	NA	NA	ug/L
Metals	D	Nickel	4	6	3	50.0%	6.4	7.1	ug/L
Metals	D	Zinc	4	6	0	0.0%	NA	NA	ug/L
Metals	T	Antimony	4	4	0	0.0%	NA	NA	ug/L
Metals	T	Arsenic	6	7	1	14.3%	6.7	6.7	ug/L
Metals	T	Cadmium	5	6	0	0.0%	NA	NA	ug/L
Metals	T	Calcium	13	18	18	100.0%	249000	444000	ug/L
Metals	T	Chromium (Total)	6	7	0	0.0%	NA	NA	ug/L
Metals	T	Copper	6	7	6	85.7%	8.3	95.8	ug/L
Metals	T	Iron	13	18	15	83.3%	97.2	1170	ug/L
Metals	T	Lead	5	6	6	100.0%	18.7	260	ug/L
Metals	T	Magnesium	13	18	18	100.0%	813000	1180000	ug/L
Metals	T	Manganese	13	18	12	66.7%	5.1	59.9	ug/L
Metals	T	Mercury	4	4	0	0.0%	NA	NA	ug/L
Metals	T	Nickel	5	6	4	66.7%	5.8	114	ug/L
Metals	T	Potassium	13	18	18	100.0%	261000	349000	ug/L
Metals	T	Silver	4	4	0	0.0%	NA	NA	ug/L
Metals	T	Sodium	13	18	18	100.0%	6770000	8030000	ug/L
Metals	T	Zinc	6	7	3	42.9%	13	23	ug/L

Table D.3 - Summary of Existing Site Sediment Porewater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Conventionals	D	Silica (SiO2)	13	18	18	100.0%	4900	21400	ug/L
Conventionals	D	Total Dissolved Solids	13	18	18	100.0%	22520000	31425000	ug/L
Conventionals	-	Alkalinity (Bicarbonate)	14	19	19	100.0%	87600	212000	ug/L
Conventionals	-	Alkalinity (Carbonate)	14	19	1	5.3%	19900	19900	ug/L
Conventionals	-	Alkalinity (Hydroxide)	14	19	0	0.0%	NA	NA	ug/L
Conventionals	-	Alkalinity (Total)	14	19	19	100.0%	87600	232000	ug/L
Conventionals	-	Chloride	15	21	21	100.0%	6620000	16600000	ug/L
Conventionals	-	Sulfate	13	18	18	100.0%	1510000	2370000	ug/L
Conventionals	-	Total Suspended Solids	2	3	3	100.0%	10000	95000	ug/L
PAHs	-	2-Methylnaphthalene	8	9	0	0.0%	NA	NA	ug/L
PAHs	-	Acenaphthene	8	9	0	0.0%	NA	NA	ug/L
PAHs	-	Acenaphthylene	8	9	0	0.0%	NA	NA	ug/L
PAHs	-	Anthracene	8	9	0	0.0%	NA	NA	ug/L
PAHs	-	Benzo(g,h,i)perylene	8	9	0	0.0%	NA	NA	ug/L
PAHs	-	Fluoranthene	8	9	0	0.0%	NA	NA	ug/L
PAHs	-	Fluorene	8	9	0	0.0%	NA	NA	ug/L
PAHs	-	Naphthalene	9	10	0	0.0%	NA	NA	ug/L
PAHs	-	Phenanthrene	8	9	0	0.0%	NA	NA	ug/L
PAHs	-	Pyrene	8	9	0	0.0%	NA	NA	ug/L
cPAHs	-	Benz(a)anthracene	8	9	0	0.0%	NA	NA	ug/L
cPAHs	-	Benzo(a)pyrene	8	9	0	0.0%	NA	NA	ug/L
cPAHs	-	Benzo(b)fluoranthene	8	9	0	0.0%	NA	NA	ug/L
cPAHs	-	Benzo(k)fluoranthene	8	9	0	0.0%	NA	NA	ug/L
cPAHs	-	Chrysene	8	9	0	0.0%	NA	NA	ug/L
cPAHs	-	Dibenzo(a,h)anthracene	8	9	0	0.0%	NA	NA	ug/L
cPAHs	-	Indeno(1,2,3-cd)pyrene	8	9	0	0.0%	NA	NA	ug/L
cPAHs	-	Total cPAHs TEQ (ND = 1/2 RDL)	7	7	0	0.0%	NA	NA	ug/L

Table D.3 - Summary of Existing Site Sediment Porewater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Other SVOCs (non-PAH)	-	1,2,4-Trichlorobenzene	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	1,2-Dichlorobenzene	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	1,2-Diphenylhydrazine	3	3	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	1,3-Dichlorobenzene	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	1,4-Dichlorobenzene	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,4,5-Trichlorophenol	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,4,6-Trichlorophenol	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,4-Dichlorophenol	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,4-Dimethylphenol	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,4-Dinitrophenol	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,4-Dinitrotoluene	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2,6-Dinitrotoluene	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2-Chloronaphthalene	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2-Chlorophenol	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2-Methylphenol	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2-Nitroaniline	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	2-Nitrophenol	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	3,3'-Dichlorobenzidine	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	3-Nitroaniline	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4,6-Dinitro-2-methylphenol	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Bromophenyl phenyl ether	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Chloro-3-methylphenol	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Chloroaniline	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Chlorophenyl phenyl ether	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Methylphenol	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Nitroaniline	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	4-Nitrophenol	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Aniline	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Benzidine	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Benzoic acid	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Benzyl alcohol	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Benzyl butyl phthalate	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Bis(2-chloro-1-methylethyl) ether	4	5	0	0.0%	NA	NA	ug/L

Table D.3 - Summary of Existing Site Sediment Porewater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Other SVOCs (non-PAH)	-	Bis(2-chloroethoxy)methane	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Bis(2-chloroethyl) ether	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Bis(2-ethylhexyl) phthalate	8	9	1	11.1%	85	85	ug/L
Other SVOCs (non-PAH)	-	Dibenzofuran	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Diethyl phthalate	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Dimethyl phthalate	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Di-n-butyl phthalate	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Di-n-octyl phthalate	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Hexachlorobenzene	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Hexachlorobutadiene	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Hexachlorocyclopentadiene	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Hexachloroethane	8	9	1	11.1%	3.6	3.6	ug/L
Other SVOCs (non-PAH)	-	Isophorone	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Nitrobenzene	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	N-Nitrosodimethylamine	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	N-Nitroso-di-n-propylamine	4	5	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	N-Nitrosodiphenylamine	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Pentachlorophenol	8	9	0	0.0%	NA	NA	ug/L
Other SVOCs (non-PAH)	-	Phenol	9	10	0	0.0%	NA	NA	ug/L
VOCs	-	1,1,1-Trichloroethane	4	5	1	20.0%	1.2	1.2	ug/L
VOCs	-	1,1,2,2-Tetrachloroethane	8	9	2	22.2%	8	400	ug/L
VOCs	-	1,1,2-Trichloroethane	7	8	0	0.0%	NA	NA	ug/L
VOCs	-	1,1-Dichloroethane	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	1,1-Dichloroethene	8	9	0	0.0%	NA	NA	ug/L
VOCs	-	1,2-Dichloroethane (EDC)	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	1,2-Dichloroethene	2	3	3	100.0%	11	58	ug/L
VOCs	-	1,2-Dichloropropane	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	2-Butanone	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	2-Chloroethyl Vinyl Ether	3	3	0	0.0%	NA	NA	ug/L
VOCs	-	2-Hexanone	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	4-Methyl-2-pentanone	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	Acetone	5	6	0	0.0%	NA	NA	ug/L
VOCs	-	Acrolein	3	3	0	0.0%	NA	NA	ug/L

Table D.3 - Summary of Existing Site Sediment Porewater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
VOCs	-	Acrylonitrile	3	3	0	0.0%	NA	NA	ug/L
VOCs	-	Benzene	5	6	0	0.0%	NA	NA	ug/L
VOCs	-	Bromodichloromethane	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	Bromoform	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	Bromomethane	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	Carbon disulfide	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	Carbon tetrachloride	7	8	0	0.0%	NA	NA	ug/L
VOCs	-	Chlorobenzene	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	Chloroethane	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	Chloroform	9	10	4	40.0%	1	11	ug/L
VOCs	-	Chloromethane	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	cis-1,2-Dichloroethene (DCE)	4	4	2	50.0%	17	175	ug/L
VOCs	-	cis-1,3-Dichloropropene	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	Dibromochloromethane	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	Dichlorodifluoromethane	3	3	0	0.0%	NA	NA	ug/L
VOCs	-	Ethylbenzene	9	10	0	0.0%	NA	NA	ug/L
VOCs	-	Methylene chloride	7	8	3	37.5%	8	8.8	ug/L
VOCs	-	Styrene	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	Tetrachloroethene (PCE)	13	14	10	71.4%	1	46	ug/L
VOCs	-	Toluene	5	6	0	0.0%	NA	NA	ug/L
VOCs	-	trans-1,2-Dichloroethene	6	6	4	66.7%	1.6	58	ug/L
VOCs	-	trans-1,3-Dichloropropene	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	Trichloroethene (TCE)	13	14	9	64.3%	1.6	39	ug/L
VOCs	-	Trichlorofluoromethane	3	3	0	0.0%	NA	NA	ug/L
VOCs	-	Vinyl acetate	4	5	0	0.0%	NA	NA	ug/L
VOCs	-	Vinyl chloride	9	10	3	30.0%	4	10	ug/L
VOCs	-	Xylenes (total)	9	10	0	0.0%	NA	NA	ug/L
PCBs	-	Aroclor 1016	7	7	0	0.0%	NA	NA	ug/L
PCBs	-	Aroclor 1221	7	7	0	0.0%	NA	NA	ug/L
PCBs	-	Aroclor 1232	7	7	0	0.0%	NA	NA	ug/L
PCBs	-	Aroclor 1242	7	7	0	0.0%	NA	NA	ug/L
PCBs	-	Aroclor 1248	7	7	0	0.0%	NA	NA	ug/L
PCBs	-	Aroclor 1254	7	7	0	0.0%	NA	NA	ug/L

Table D.3 - Summary of Existing Site Sediment Porewater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
PCBs	-	Aroclor 1260	7	7	0	0.0%	NA	NA	ug/L
PCBs	-	Total PCBs	7	7	0	0.0%	NA	NA	ug/L

Table D.3 - Summary of Existing Site Sediment Porewater Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Total (T) or Dissolved (D)	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Pesticides	-	4,4'-DDD	7	7	1	14.3%	0.1	0.1	ug/L
Pesticides	-	4,4'-DDE	7	7	0	0.0%	NA	NA	ug/L
Pesticides	-	4,4'-DDT	7	7	1	14.3%	0.1	0.1	ug/L
Pesticides	-	Aldrin	7	7	1	14.3%	0.05	0.05	ug/L
Pesticides	-	Alpha-BHC	3	3	0	0.0%	NA	NA	ug/L
Pesticides	-	Beta-BHC	3	3	0	0.0%	NA	NA	ug/L
Pesticides	-	Chlordane	3	3	0	0.0%	NA	NA	ug/L
Pesticides	-	cis-Chlordane	6	7	0	0.0%	NA	NA	ug/L
Pesticides	-	Delta-BHC	3	3	0	0.0%	NA	NA	ug/L
Pesticides	-	Dieldrin	9	10	0	0.0%	NA	NA	ug/L
Pesticides	-	Endosulfan I	3	3	0	0.0%	NA	NA	ug/L
Pesticides	-	Endosulfan II	3	3	1	33.3%	0.05	0.05	ug/L
Pesticides	-	Endosulfan Sulfate	3	3	0	0.0%	NA	NA	ug/L
Pesticides	-	Endrin	3	3	0	0.0%	NA	NA	ug/L
Pesticides	-	Endrin Aldehyde	3	3	0	0.0%	NA	NA	ug/L
Pesticides	-	Heptachlor	8	8	0	0.0%	NA	NA	ug/L
Pesticides	-	Heptachlor Epoxide	3	3	0	0.0%	NA	NA	ug/L
Pesticides	-	Lindane	8	8	0	0.0%	NA	NA	ug/L
Pesticides	-	Toxaphene	3	3	0	0.0%	NA	NA	ug/L
Pesticides	-	trans-Chlordane	6	7	0	0.0%	NA	NA	ug/L

Table D.4 - Summary of Existing Site Sediment Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
TPHs	Diesel Range Hydrocarbons	7	2	2	100.0%	120	290	mg/kg
TPHs	Gasoline Range Hydrocarbons	6	1	0	0.0%	NA	NA	mg/kg
TPHs	Total TPHs	7	2	2	100.0%	290	730	mg/kg
Metals	Antimony	8	3	3	100.0%	7.4	50	mg/kg
Metals	Arsenic	13	8	8	100.0%	4.5	70	mg/kg
Metals	Cadmium	8	3	1	33.3%	1.1	1.1	mg/kg
Metals	Chromium (Total)	13	8	8	100.0%	13.2	39	mg/kg
Metals	Copper	13	8	8	100.0%	26.4	1310	mg/kg
Metals	Lead	13	8	8	100.0%	68.7	130000	mg/kg
Metals	Mercury	13	8	7	87.5%	0.0431	0.37	mg/kg
Metals	Nickel	13	8	8	100.0%	16.2	80.8	mg/kg
Metals	Silver	8	3	3	100.0%	0.6	2	mg/kg
Metals	Thallium	5	5	5	100.0%	0.0415	0.22	mg/kg
Metals	Zinc	13	8	8	100.0%	36	487	mg/kg
Conventionals	Ammonia as Nitrogen	7	2	2	100.0%	0.46	2.5	mg/kg
Conventionals	Total Organic Carbon	2	3	3	100.0%	0.36	1.78	%
Conventionals	Total Percent Solids	7	2	2	100.0%	68.6	74.7	%
Conventionals	Total Volatile Solids	7	2	2	100.0%	55000	66000	mg/kg
PAHs	2-Methylnaphthalene	2	2	1	50.0%	0.028	0.028	mg/kg
PAHs	Acenaphthene	2	2	2	100.0%	0.024	0.072	mg/kg
PAHs	Acenaphthylene	2	2	0	0.0%	NA	NA	mg/kg
PAHs	Anthracene	2	2	2	100.0%	0.091	0.55	mg/kg
PAHs	Benzo(b,k)fluoranthene	8	3	3	100.0%	0.91	2.02	mg/kg
PAHs	Benzo(g,h,i)perylene	8	3	3	100.0%	0.1	0.19	mg/kg
PAHs	Fluoranthene	8	3	3	100.0%	0.65	3.5	mg/kg
PAHs	Fluorene	2	2	2	100.0%	0.03	0.16	mg/kg
PAHs	Naphthalene	2	2	1	50.0%	0.041	0.041	mg/kg
PAHs	Phenanthrene	8	3	3	100.0%	0.37	0.93	mg/kg
PAHs	Pyrene	8	3	3	100.0%	0.69	2.3	mg/kg
PAHs	Total HPAHs	8	3	3	100.0%	4	11.77	mg/kg
PAHs	Total LPAHs	8	3	3	100.0%	0.37	1.816	mg/kg
cPAHs	Benz(a)anthracene	8	3	3	100.0%	0.31	0.91	mg/kg
cPAHs	Benzo(a)pyrene	8	3	3	100.0%	0.24	0.61	mg/kg
cPAHs	Benzo(b)fluoranthene	8	3	3	100.0%	0.49	1.1	mg/kg
cPAHs	Benzo(k)fluoranthene	8	3	3	100.0%	0.42	0.92	mg/kg
cPAHs	Chrysene	8	3	3	100.0%	0.51	1.8	mg/kg
cPAHs	Dibenzo(a,h)anthracene	2	2	2	100.0%	0.052	0.1	mg/kg
cPAHs	Indeno(1,2,3-cd)pyrene	8	3	3	100.0%	0.17	0.38	mg/kg

Table D.4 - Summary of Existing Site Sediment Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
cPAHs	Total cPAHs TEQ (ND = 1/2 RDL)	2	2	2	100.0%	0.39	0.97	mg/kg
Other SVOCs (non-PAH)	1,2,4-Trichlorobenzene	8	3	3	100.0%	0.027	0.086	mg/kg
Other SVOCs (non-PAH)	1,2-Dichlorobenzene	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	1,3-Dichlorobenzene	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	1,4-Dichlorobenzene	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2,4-Dimethylphenol	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	2-Methylphenol	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	4-Methylphenol	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Benzoic acid	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Benzyl alcohol	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Benzyl butyl phthalate	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Bis(2-ethylhexyl) phthalate	8	3	3	100.0%	0.23	0.5	mg/kg
Other SVOCs (non-PAH)	Dibenzofuran	2	2	2	100.0%	0.028	0.067	mg/kg
Other SVOCs (non-PAH)	Diethyl phthalate	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Dimethyl phthalate	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Di-n-butyl phthalate	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Di-n-octyl phthalate	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Hexachlorobenzene	14	9	8	88.9%	0.0046	0.77	mg/kg
Other SVOCs (non-PAH)	Hexachlorobutadiene	14	9	9	100.0%	0.0038	2.3	mg/kg
Other SVOCs (non-PAH)	Hexachloroethane	8	3	3	100.0%	1.1	1.6	mg/kg
Other SVOCs (non-PAH)	N-Nitrosodiphenylamine	2	2	0	0.0%	NA	NA	mg/kg
Other SVOCs (non-PAH)	Pentachlorophenol	6	6	3	50.0%	0.086	0.7	mg/kg
Other SVOCs (non-PAH)	Phenol	2	2	0	0.0%	NA	NA	mg/kg
VOCs	1,1,2,2-Tetrachloroethane	6	6	1	16.7%	0.0639	0.0639	mg/kg
VOCs	1,1,2-Trichloroethane	6	6	0	0.0%	NA	NA	mg/kg
VOCs	Carbon tetrachloride	6	6	2	33.3%	0.026	0.211	mg/kg
VOCs	Chloroform	6	6	2	33.3%	0.49	4.82	mg/kg
VOCs	Methylene chloride	6	6	2	33.3%	0.018	0.021	mg/kg
VOCs	Ethylbenzene	8	3	0	0.0%	NA	NA	mg/kg
VOCs	Xylenes (total)	8	3	0	0.0%	NA	NA	mg/kg
VOCs	1,1-Dichloroethene	6	6	1	16.7%	0.00932	0.00932	mg/kg
VOCs	cis-1,2-Dichloroethene (DCE)	6	6	2	33.3%	0.0035	0.217	mg/kg
VOCs	Tetrachloroethene (PCE)	14	9	6	66.7%	0.0027	8.11	mg/kg
VOCs	trans-1,2-Dichloroethene	6	6	1	16.7%	0.0112	0.0112	mg/kg
VOCs	Trichloroethene (TCE)	14	9	6	66.7%	0.0021	0.494	mg/kg
VOCs	Vinyl chloride	6	6	1	16.7%	0.0145	0.0145	mg/kg

Table D.4 - Summary of Existing Site Sediment Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
PCBs	Aroclor 1016	8	3	0	0.0%	NA	NA	mg/kg
PCBs	Aroclor 1221	9	4	0	0.0%	NA	NA	mg/kg
PCBs	Aroclor 1232	9	4	0	0.0%	NA	NA	mg/kg
PCBs	Aroclor 1242	9	4	0	0.0%	NA	NA	mg/kg
PCBs	Aroclor 1248	9	4	0	0.0%	NA	NA	mg/kg
PCBs	Aroclor 1254	9	4	0	0.0%	NA	NA	mg/kg
PCBs	Aroclor 1260	9	4	0	0.0%	NA	NA	mg/kg
PCBs	Total PCBs	16	12	8	66.7%	0.01595	0.33487	mg/kg
PCBs	PCB 70	6	7	7	100.0%	0.00065978	0.01467782	mg/kg
PCBs	PCB 77	6	7	7	100.0%	0.00003325	0.00075043	mg/kg
PCBs	PCB 81	6	7	1	14.3%	0.00040596	0.00040596	mg/kg
PCBs	PCB 99	1	1	1	100.0%	0.00398	0.00398	mg/kg
PCBs	PCB 105	6	7	7	100.0%	0.00018397	0.00510503	mg/kg
PCBs	PCB 114	6	7	6	85.7%	0.00013287	0.00028319	mg/kg
PCBs	PCB 118	6	7	7	100.0%	0.00039678	0.01300893	mg/kg
PCBs	PCB 123	6	7	1	14.3%	0.000163	0.000163	mg/kg
PCBs	PCB 126	6	7	4	57.1%	0.00003064	0.00009132	mg/kg
PCBs	PCB 156	6	7	7	100.0%	0.00005002	0.00233864	mg/kg
PCBs	PCB 167	6	7	7	100.0%	0.00002703	0.00162774	mg/kg
PCBs	PCB 169	6	7	1	14.3%	0.00021476	0.00021476	mg/kg
PCBs	PCB 170	6	7	7	100.0%	0.00011563	0.00642	mg/kg
PCBs	PCB 180	6	7	7	100.0%	0.0004735	0.0148	mg/kg
PCBs	PCB 183	6	7	5	71.4%	0.00007482	0.00228426	mg/kg
PCBs	PCB 187	6	7	7	100.0%	0.00111676	0.01773478	mg/kg
PCBs	PCB 189	6	7	5	71.4%	0.00003712	0.00086741	mg/kg
Pesticides	4,4'-DDD	14	9	2	22.2%	0.45	0.57	mg/kg
Pesticides	4,4'-DDE	14	9	0	0.0%	NA	NA	mg/kg
Pesticides	4,4'-DDT	14	9	0	0.0%	NA	NA	mg/kg
Pesticides	Aldrin	14	9	0	0.0%	NA	NA	mg/kg
Pesticides	cis-Chlordane	14	9	0	0.0%	NA	NA	mg/kg
Pesticides	Dieldrin	14	9	0	0.0%	NA	NA	mg/kg
Pesticides	Heptachlor	8	3	0	0.0%	NA	NA	mg/kg
Pesticides	Lindane	8	3	0	0.0%	NA	NA	mg/kg
Pesticides	trans-Chlordane	14	9	2	22.2%	0.52	0.53	mg/kg

Table D.4 - Summary of Existing Site Sediment Data

Project #130097 - Alexander Avenue Petroleum Tank Facilities Site
Tacoma, WA

Analyte Group	Analyte	Number of Locations	Number of Samples	Number of Detections	Detection Frequency	Mininum Detected Concentration	Maximum Detected Concentration	Units
Dioxins/Furans	1,2,3,4,6,7,8-HpCDD	6	7	7	100.0%	0.000009677	0.000288055	mg/kg
Dioxins/Furans	1,2,3,4,6,7,8-HpCDF	6	7	7	100.0%	0.000018908	0.000635583	mg/kg
Dioxins/Furans	1,2,3,4,7,8,9-HpCDF	6	7	7	100.0%	0.000005381	0.000253	mg/kg
Dioxins/Furans	1,2,3,4,7,8-HxCDD	6	7	3	42.9%	0.000000828	0.000003829	mg/kg
Dioxins/Furans	1,2,3,4,7,8-HxCDF	6	7	7	100.0%	0.000016507	0.000777	mg/kg
Dioxins/Furans	1,2,3,6,7,8-HxCDD	6	7	6	85.7%	0.000000712	0.000017651	mg/kg
Dioxins/Furans	1,2,3,6,7,8-HxCDF	6	7	7	100.0%	0.000004055	0.00018	mg/kg
Dioxins/Furans	1,2,3,7,8,9-HxCDD	6	7	4	57.1%	0.000001966	0.000011037	mg/kg
Dioxins/Furans	1,2,3,7,8,9-HxCDF	6	7	4	57.1%	0.00000089	0.0000124	mg/kg
Dioxins/Furans	1,2,3,7,8-PeCDD	6	7	3	42.9%	0.000000579	0.000002352	mg/kg
Dioxins/Furans	1,2,3,7,8-PeCDF	6	7	7	100.0%	0.000008905	0.000472	mg/kg
Dioxins/Furans	2,3,4,6,7,8-HxCDF	6	7	7	100.0%	0.000001885	0.0000672	mg/kg
Dioxins/Furans	2,3,4,7,8-PeCDF	6	7	7	100.0%	0.000003976	0.000173	mg/kg
Dioxins/Furans	2,3,7,8-TCDD	6	7	4	57.1%	0.000000357	0.00000165	mg/kg
Dioxins/Furans	2,3,7,8-TCDF	6	7	7	100.0%	0.000010666	0.000743	mg/kg
Dioxins/Furans	OCDD	6	7	7	100.0%	0.000085578	0.002556387	mg/kg
Dioxins/Furans	OCDF	6	7	7	100.0%	0.000086894	0.002193655	mg/kg
Dioxins/Furans	Tetrachlorodibenzofurans (TCDF), Total	6	7	7	100.0%	0.00003327	0.00188	mg/kg
Dioxins/Furans	Total HpCDD	6	7	7	100.0%	0.000038122	0.000781443	mg/kg
Dioxins/Furans	Total HpCDF	6	7	7	100.0%	0.000039231	0.00109	mg/kg
Dioxins/Furans	Total HxCDD	6	7	7	100.0%	0.000002596	0.0000634	mg/kg
Dioxins/Furans	Total HxCDF	6	7	7	100.0%	0.000045237	0.00151	mg/kg
Dioxins/Furans	Total PeCDD	6	7	5	71.4%	0.000000579	0.000032356	mg/kg
Dioxins/Furans	Total PeCDF	6	7	7	100.0%	0.000038473	0.00144	mg/kg
Dioxins/Furans	Total TCDD	6	7	7	100.0%	0.000000423	0.000031315	mg/kg

APPENDIX E

Extent of Occidental Chemical Corporation-related Preliminary Chemicals of Concern in Groundwater

EAST ALEXANDER AVENUE

605

709

721

905

HC-N11-8 (1.7)

HC-N11-5 (5.71)

HC-N11-6 (3.52)

28-15

29-14

30-15

51-15

52-15 (2.61)

709-MW-17 (3.77)

709-MW-16 (5.99)

709-MW-15 (24)

709-MW-03

709-MW-18 (12.6)

709-MW-12

709-MW-13

709-MW-14

709-MW-19 (9.27)

709-MW-02 (15.8)

709-MW-09 (4.09)

HC08-EP18

P-10

709-MW21-15 (1.34)

709-MW-11 (1.75)

709-MW-10

721-MW1

721-MW14-15 (2.48)

721-MW12-15 (1.68)

721-MW2

721-MW15-15 (5.31)

721-MW3

721-MW13-15 (1.6)

721-MW6-15

721-MW5-15 (0.9 J)

721-MW11-15 (2.05)

48-15 (30)

50-15 (15.2)

49-15 (32.9)

709-MW-06 (7.87)

709-MW-08 (51.7)

709-MW-01

709-MW-07 (2.26)

709-MW-05 (3.61)

721-MW9-15 (0.41 J)

721-MW7-15 (26)

721-MW8-15

95-15 (0.74 J)

721-MW10-15 (1.52)

NL-13 (108)

NL-28 (26.7)

709-MW-04 (4.54)

709-MW20-15 (3.29)

NL-29 (544 J)

DOCK2-014 (156)

NL-30 (618)

?

?

Hylebos Waterway

MHHW (5.65' NGVD)

MLLW (-6.17' NGVD)

Tax Parcel Boundary

Former Parcel Line

Historical Building/Tank/Structure

Existing Building/Dock

Former Railroad Spur

Shoreline/Hylebos Waterway

5.0 µg/L Groundwater Arsenic Isoconcentration Line

Exploration Type (symbol shape)

Monitoring Well

Soil Boring/Probe, Piezometer

Most Recent Groundwater Arsenic Result

Non-Detect

Detected, No Exceedance of Screening Level

Above Screening Level (5.0 µg/L), but Less than 10x Screening Level (50.0 µg/L)

Above 10x Screening Level (50.0 µg/L)

No Results

Exploration ID

721-MW5-25 (370)

Arsenic Concentration (in µg/L)

PROJECT NORTH

TRUE NORTH

0 100 200

Feet

1:1,200

Extent of Arsenic in Groundwater 15 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING	MAY-2014	BY: DFR / PPW	FIGURE NO. E-1
	PROJECT NO. 130097-01B	REV BY: EAH	

GIS Path: T:\projects_8\Port_of_Tacoma\AlexanderAve_130097\Delivered\FINAL_RIFS_WORKPLAN_JULY2014\Appendix_E\Figure1E-1 GW Arsenic 0-15.mxd || Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet || Date Saved: 5/29/2014 || User: ecrumbaker || Print Date: 5/29/2014

EAST ALEXANDER AVENUE

605

709

721

905

9-25 (2.01 J)

3-25 (208)

NL-13 (1.2 J)

6A-24.5

709-MW-15A

709-MW16-25 (1.35)

709-MW6-25 (73.6)

709-MW18-25 (3.16)

NL-28 (18.6)

DOCK2-014 (71.6)

NL-30 (364)

709-MW20-25 (1.51)

NL-29 (233 J)

709-MW11-25 (0.6 J)

709-MW9-25 (1.68)

709-MW21-25 (5.06)

721-MW5-25 (9.32)

721-MW14-25 (0.49 J)

721-MW9-25 (24.6)

721-MW12-25 (0.82 J)

95C-25 (2.53)

721-MW15-25 (0.76 J)

721-MW6-25

721-MW11-25 (1.67)

721-MW10-25 (0.26 J)

721-MW13-25 (0.27 J)

93C-25 (0.62 J)

Hylebos Waterway

MLLW (-6.17' NGVD)

MHHW (5.65' NGVD)

Tax Parcel Boundary

Former Parcel Line

Historical Building/Tank/Structure

Existing Building/Dock

Former Railroad Spur

Shoreline/Hylebos Waterway

5.0 µg/L Groundwater Arsenic Isoconcentration Line

Exploration Type (symbol shape)

Monitoring Well

Soil Boring/Probe, Piezometer

Most Recent Groundwater Arsenic Result

Non-Detect

Detected, No Exceedance of Screening Level

Above Screening Level (5.0 µg/L), but Less than 10x Screening Level (50.0 µg/L)

Above 10x Screening Level (50.0 µg/L)

No Results

Exploration ID

721-MW5-25 (370)

Arsenic Concentration (in µg/L)

PROJECT NORTH

TRUE NORTH

0 100 200

Feet

1:1,200

Extent of Arsenic in Groundwater 25 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING	MAY-2014	BY: DFR / PPW	FIGURE NO. E-2
	PROJECT NO. 130097-01B	REV BY: EAH	

EAST ALEXANDER AVENUE

605

709

721

905

28-15
29-14
30-15
51-15
52-15 (1.06)
709-MW-17 (1.02)
709-MW-16 (0.83 J)
709-MW-15 (1.38)
48-15 (6.41)
50-15 (7.42)
709-MW-03 (850)
49-15 (25.5)
709-MW-06 (1.18)
709-MW-18 (0.72 J)
709-MW-12
709-MW-13
709-MW-14
709-MW-19 (5.21)
709-MW-02 (3.89)
709-MW20-15 (2.04)
709-MW-04 (1.32)
709-MW-05 (6.8)
709-MW-09 (1.27)
HC08-EP18 (25)
709-MW-08 (4.68)
709-MW-01 (28)
709-MW-07 (0.5 J)
P-10
709-MW-11 (3.96)
709-MW21-15 (0.24 J)
709-MW-10
721-MW1
721-MW14-15 (0.29 J)
721-MW5-15 (4.24)
721-MW9-15
721-MW7-15 (9.14)
721-MW8-15
721-MW12-15
721-MW2
721-MW15-15 (0.34 J)
721-MW3
721-MW6-15
721-MW11-15 (0.68 J)
721-MW13-15 (0.48 J)
95-15
721-MW10-15 (0.3 J)
NL-13 (65.1)
NL-28 (49.6)
NL-29
NL-30 (51.8 J)
DOCK2-014 (107)
HC-N11-8
HC-N11-5
HC-N11-6
Hylebos Waterway
MLLW (-6.17' NGVD)
MHHW (5.65' NGVD)

Tax Parcel Boundary
Former Parcel Line
Historical Building/Tank/Structure
Existing Building/Dock
Former Railroad Spur
Shoreline/Hylebos Waterway
3.1 µg/L Groundwater Copper Isocentration Line

Exploration Type (symbol shape)

Monitoring Well
Soil Boring/Probe, Piezometer

Most Recent Groundwater Copper Result

Non-Detect
Detected, No Exceedance of Screening Level
Above Screening Level (3.1 µg/L), but Less than 10x Screening Level (31.0 µg/L)
Above 10x Screening Level (31.0 µg/L)
No Results

Exploration ID
721-MW5-25 (370)
Copper Concentration (in µg/L)

PROJECT NORTH
TRUE NORTH
0 100 200
Feet
1:1,200

Extent of Copper in Groundwater 15 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING	MAY-2014	BY: DFR / PPW	FIGURE NO. E-3
	PROJECT NO. 130097-01B	REV BY: EAH	

GIS Path: T:\projects_8\Port_of_Tacoma\AlexanderAve_130097\Delivered\FINAL_RIFS_WORKPLAN_JULY2014\Appendix_E_Figures\E-3 GW Copper 0-15.mxd || Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet || Date Saved: 5/29/2014 || User: ecrumbaker || Print Date: 5/29/2014

EAST ALEXANDER AVENUE

605

709

721

905

9-25 (159)

NL-13 (8.95)

3-25 (1.08)

6A-24.5

709-MW-15A

709-MW16-25 (31.8)

709-MW6-25 (49.9)

709-MW18-25 (26.7)

NL-28 (67.4)

DOCK2-014 (82.2)

NL-30 (51.5 J)

709-MW20-25 (0.85 J)

NL-29 (42.7 J)

709-MW11-25 (0.51 J)

709-MW9-25 (0.53 J)

709-MW21-25 (4.49)

721-MW5-25 (6.96)

721-MW9-25 (117)

721-MW14-25

721-MW12-25

95C-25 (0.34 J)

721-MW15-25

721-MW11-25 (0.79 J)

721-MW10-25 (0.85 J)

721-MW6-25

721-MW13-25

93C-25

Hylebos Waterway

MHHW (5.65' NGVD)

MLLW (-6.17' NGVD)

Tax Parcel Boundary

Former Parcel Line

Historical Building/Tank/Structure

Existing Building/Dock

Former Railroad Spur

Shoreline/Hylebos Waterway

3.1 µg/L Groundwater Copper Isoconcentration Line

Exploration Type (symbol shape)

Monitoring Well

Soil Boring/Probe, Piezometer

Most Recent Groundwater Copper Result

Non-Detect

Detected, No Exceedance of Screening Level

Above Screening Level (3.1 µg/L), but Less than 10x Screening Level (31.0 µg/L)

Above 10x Screening Level (31.0 µg/L)

No Results

Exploration ID

721-MW5-25 (370)

Copper Concentration (in µg/L)

PROJECT NORTH

TRUE NORTH

0 100 200

Feet

1:1,200

Extent of Copper in Groundwater 25 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING	MAY-2014	BY: DFR / PPW	FIGURE NO. E-4
	PROJECT NO. 130097-01B	REV BY: EAH	

GIS Path: T:\projects_8\Port_of_Tacoma\AlexanderAve_130097\Delivered\FINAL_RIFS_WORKPLAN_JULY2014\AppendixE_Figures\E-4 GW Copper 15-30.mxd | | Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet | | Date Saved: 5/29/2014 | | User: ecrumbaker | | Print Date: 5/29/2014

EAST ALEXANDER AVENUE

605

709

721

905

HC-N11-8

HC-N11-5

HC-N11-6

28-15

29-14

30-15

51-15

52-15

48-15 (0.71 J)

50-15 (7.66)

49-15 (22.1)

NL-13 (148)

709-MW-17 (0.56 J)

709-MW-16 (0.83 J)

709-MW-15 (4.98)

709-MW-03

709-MW-06

709-MW-18 (0.51 J)

NL-28 (38.1)

709-MW-04 (0.2 J)

DOCK2-014

NL-30 (36.7)

709-MW20-15 (3.94)

709-MW-02 (1.5 J)

709-MW-12

709-MW-13

709-MW-14

709-MW-19 (0.62 J)

NL-29 (32.2 J)

709-MW-05 (26.1)

P-10

709-MW21-15 (0.76 J)

709-MW-11 (1.32 J)

709-MW-09 (0.8 J)

HC08-EP18

709-MW-08

709-MW-01

709-MW-07

709-MW-10

721-MW1

721-MW14-15 (0.33 J)

721-MW5-15 (0.58 J)

721-MW9-15 (0.21 J)

721-MW12-15

721-MW7-15

721-MW8-15

721-MW2

721-MW15-15

95-15 (0.9 J)

721-MW10-15 (0.25 J)

721-MW3

721-MW6-15 (0.36 J)

721-MW11-15 (1.08 J)

721-MW13-15 (0.95 J)

Hylebos Waterway

MHHW (5.65' NGVD)

MLLW (-6.17' NGVD)

Tax Parcel Boundary

Former Parcel Line

Historical Building/Tank/Structure

Existing Building/Dock

Former Railroad Spur

Shoreline/Hylebos Waterway

8.1 µg/L Groundwater Nickel Isoconcentration Line

Exploration Type (symbol shape)

Monitoring Well

Soil Boring/Probe, Piezometer

Most Recent Groundwater Nickel Result

Non-Detect

Detected, No Exceedance of Screening Level

Above Screening Level (3.1 µg/L), but Less than 10x Screening Level (31.0 µg/L)

Above 10x Screening Level (31.0 µg/L)

No Results

Exploration ID

721-MW5-25 (370)

Nickel Concentration (in µg/L)

PROJECT NORTH

TRUE NORTH

0 100 200

Feet

1:1,200

Extent of Nickel in Groundwater 15 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING	MAY-2014	BY: DFR / PPW	FIGURE NO. E-5
	PROJECT NO. 130097-01B	REV BY: EAH	

GIS Path: T:\projects_8\Port_of_Tacoma\AlexanderAve_130097\Delivered\FINAL_RIFS_WORKPLAN_JULY2014\Appendix_E\Figures\E-5 GW Nickel 0-15.mxd | Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet | Date Saved: 5/29/2014 | User: ecrumbaker | Print Date: 5/29/2014

EAST ALEXANDER AVENUE

605

709

721

905

9-25 (7.23)

3-25 (48.8)

NL-13 (22.4 J)

6A-24.5

709-MW-15A

709-MW16-25 (5.9)

709-MW6-25 (14.2)

709-MW18-25 (8.33)

NL-28 (44.7)

DOCK2-014

NL-30 (40.7)

709-MW20-25

NL-29 (32.5 J)

709-MW11-25 (0.45 J)

709-MW9-25 (0.42 J)

709-MW21-25 (1.31 J)

721-MW5-25 (3.42)

721-MW14-25 (0.21 J)

721-MW9-25 (19.3)

721-MW12-25

721-MW15-25

95C-25 (1.11 J)

721-MW11-25 (1.21 J)

721-MW10-25 (1.18 J)

721-MW6-25

721-MW13-25 (0.33 J)

93C-25

Hylebos Waterway

MLLW (-6.17' NGVD)

MHHW (5.63' NGVD)

Tax Parcel Boundary

Former Parcel Line

Historical Building/Tank/Structure

Existing Building/Dock

Former Railroad Spur

Shoreline/Hylebos Waterway

8.2 µg/L Groundwater Nickel Isoconcentration Line

Exploration Type (symbol shape)

Monitoring Well

Soil Boring/Probe, Piezometer

Most Recent Groundwater Nickel Result

Non-Detect

Detected, No Exceedance of Screening Level

Above Screening Level (8.2 µg/L), but Less than 10x Screening Level (82 µg/L)

Above 10x Screening Level (82 µg/L)

No Results

Exploration ID

721-MW5-25 (370)

Nickel Concentration (in µg/L)

PROJECT NORTH

TRUE NORTH

0 100 200

Feet

1:1,200

Extent of Nickel in Groundwater 25 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING	MAY-2014	BY: DFR / PPW	FIGURE NO. E-6
	PROJECT NO. 130097-01B	REV BY: EAH	

GIS Path: T:\projects_8\Port_of_Tacoma\AlexanderAve_130097\Delivered\FINAL_RIFS_WORKPLAN_JULY2014\AppendixE_Figures\E-6 GW Nickel 15-30.mxd | | Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet | | Date Saved: 5/29/2014 | | User: ecrumbaker | | Print Date: 5/29/2014

EAST ALEXANDER AVENUE

605

709

721

905

WMUL-01 (9.2)
WMUL-02 (7.6)
28-15 (9.32)
30-15 (9.57)
29-14 (8.62)
51-15 (9.26)
52-15 (7.2)
48-15 (12.83)
50-15 (10.69)
709-MW-15A (7.7)
49-15 (6.39)
709-MW-17 (6.07)
709-MW-16 (6.55)
709-MW-15 (8.98)
709-MW-03 (12.15)
709-MW-06 (9.46)
709-MW-18 (7.36)
P-1 (7.43)
709-MW-12 (7.2)
709-MW-13 (6.6)
709-MW-14 (6.74)
709-MW-19 (8.94)
709-MW-02 (11.67)
P-5 (11.88)
P-8A (12.52)
709-MW20-15 (7.52)
709-MW-09 (5.9)
HC08-EP18 (6.57)
709-MW-11 (6.17)
709-MW21-15 (6.2)
709-MW-08 (11.25)
709-MW-01 (9.62)
709-MW-07 (8.19)
709-MW-10 (6.9)
ESI-3-15-02 (7.5)
ESI-3-16-02 (7.6)
ESI-3-14-02 (8.5)
ESI-3-13-02 (9.3)
ESI-3-11-02 (11.8)
ESI-3-10-02 (11.4)
721-MW5-15 (7.52)
721-GP5 (9.28)
721-MW1
721-MW14-15 (6.65)
721-GP1 (7.8)
721-MW12-15 (6.76)
721-MW2
721-MW15-15 (5.97)
721-GP3 (6.7)
ESI-4-10-02 (7.5)
721-MW3
721-MW13-15 (6.39)
721-MW6-15 (6.74)
721-MW11-15 (6.65)
721-GP2 (6.71)
721-GP4 (8.21)
ESI-4-5-02 (7.8)
ESI-4-4-02 (9.2)
ESI-4-3-02 (7.8)
721-GP6 (10.01)
ESI-4-2-02 (10.7)
ESI-4-8-02 (8.1)
ESI-4-9-02 (8)
ESI-4-7-02 (9.4)
721-GP7 (8.69)
ESI-4-6-02 (7.9)
721-GP9 (8.93)
95-15 (7.55)
721-MW10-15 (6.73)
721-MW7-15 (9.44)
721-MW8-15 (7.47)
721-MW9-15 (7.21)
ESI-4-1-02 (7.5)
721-GP8 (9.83)
ESI-2-24-02 (9.6)
ESI-2-10-02 (8.3)
NL-13 (11.23)
ESI-2-11-02 (8.6)
ESI-2-28-02 (11)
ESI-2-12-02 (9.2)
ESI-2-25-02 (8.1)
ESI-2-13-02 (8.5)
ESI-2-14-02 (7.2)
ESI-2-26-02 (9)
ESI-3-1-02 (7.7)
NL-28 (8.86)
ESI-3-5-02 (4.1)
709-MW-04 (5.91)
DOCK2-014 (8.07)
NL-30 (8.34)
ESI-3-6-02 (8.5)
ESI-3-2-02 (8.1)
NL-29 (8.49)
ESI-3-7-02 (8.6)
ESI-3-3-02 (8.4)
709-MW-05 (7.12)
ESI-3-4-02 (8.5)
ESI-3-8-02 (8.5)
HC-N11-8 (7.25)
HC-N11-5 (6.5)
HC-N11-6 (7.06)
?
?
Hylebos Waterway
MLLW (-6.17' NGVD)
MHHW (5.65' NGVD)

Tax Parcel Boundary
Former Parcel Line
Historical Building/Tank/Structure
Existing Building/Dock
Former Railroad Spur
Shoreline/Hylebos Waterway
Groundwater pH Greater than 8.5 Isoconcentration Line

Exploration Type (symbol shape)
Monitoring Well
Soil Boring/Probe, Piezometer

Most Recent Groundwater pH Result
pH Less than 8.5
pH Greater than 8.5
No Results

Exploration ID
721-MW5-25 (7.88)
pH

PROJECT NORTH
TRUE NORTH
0 100 200
Feet
1:1,200

Groundwater pH
15 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING	MAY-2014	BY: DFR / PPW	FIGURE NO. E-7
	PROJECT NO. 130097-01B	REV BY: EAH	

GIS Path: T:\projects_8\Port_of_Tacoma\AlexanderAve_130097\Delivered\FINAL_RIFS_WORKPLAN_JULY2014\Appendix_E_Figures\E-7 GW pH 0-15.mxd | | Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet | | Date Saved: 5/29/2014 | | User: ecrumbaker | | Print Date: 5/29/2014

EAST ALEXANDER AVENUE

605

709

721

905

ESI-2-24-02 (9.6)
ESI-2-10-02 (8.3)
NL-13 (8.55)
ESI-2-11-02 (8.6)
ESI-2-28-02 (11)
3-25 (7.09)
9-25 (11.07)
ESI-2-25-02 (8.1)
ESI-2-13-02 (8.5)
ESI-2-14-02 (8.4)
ESI-2-26-02 (9)
6A-24.5 (9.38)
709-MW16-25 (8.53)
709-MW-15A (8.52)
709-MW6-25 (12.42)
709-MW18-25 (9.25)
ESI-3-1-02 (7.7)
ESI-3-5-02 (4.1)
NL-28 (8.99)
DOCK2-014 (7.95)
NL-30 (8.02)
ESI-3-6-02 (8.5)
ESI-3-2-02 (8.1)
709-MW20-25 (7.77)
NL-29 (8.55)
ESI-3-7-02 (9.5)
ESI-3-3-02 (8.4)
709-MW11-25 (7.45)
721-PZ-03 (8.4)
709-MW9-25 (7.93)
709-MW21-25 (7.93)
ESI-3-14-02 (8.5)
ESI-3-12-02 (8)
ESI-3-10-02 (11.4)
ESI-3-9-02 (8.1)
ESI-3-8-02 (8.5)
ESI-3-16-02 (7.6)
ESI-3-15-02 (7.5)
ESI-3-13-02 (9.3)
ESI-3-11-02 (9.6)
721-MW5-25 (10.77)
721-GP5 (9.43)
721-MW14-25 (7.05)
721-MW9-25 (10.01)
721-PZ-02 (8.92)
721-MW12-25 (7.18)
ESI-4-3-02 (7.8)
ESI-4-2-02 (8.1)
ESI-4-1-02 (7.5)
ESI-4-5-02 (7.8)
ESI-4-4-02 (9.2)
721-GP6 (7.81)
721-GP8 (8.3)
721-PZ-01 (8.26)
721-GP2 (8.36)
721-GP4 (7.73)
721-PZ-04 (8.2)
ESI-4-8-02 (8.1)
95C-25 (7.34)
721-GP9 (8.16)
ESI-4-7-02 (8.3)
ESI-4-6-02 (7.9)
721-MW15-25 (5.94)
721-GP3 (8.22)
ESI-4-9-02 (8)
721-GP7 (7.8)
ESI-4-10-02 (7.5)
721-MW11-25 (7.33)
721-PZ-05 (7.98)
721-MW6-25 (7.79)
721-MW10-25 (8.38)
721-MW13-25 (7.1)
93C-25 (8.14)

Hylebos Waterway

MHHW (5.63' NGVD)
MLLW (-6.17' NGVD)

Tax Parcel Boundary
Former Parcel Line
Historical Building/Tank/Structure
Existing Building/Dock
Former Railroad Spur
Shoreline/Hylebos Waterway
Groundwater pH Greater than 8.5 Isoconcentration Line

Exploration Type (symbol shape)
Monitoring Well
Soil Boring/Probe, Piezometer

Most Recent Groundwater pH Result
Less than 8.5
Greater than 8.5
No Results

Exploration ID
721-MW5-25 (7.88)
pH

PROJECT NORTH
TRUE NORTH

0 100 200
Feet
1:1,200

Groundwater pH
25 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING	MAY-2014	BY: DFR / PPW	FIGURE NO. E-8
	PROJECT NO. 130097-01B	REV BY: EAH	

GIS Path: T:\projects_8\Port_of_Tacoma\Alexander Ave_130097\Delivered\FINAL_RIFS_WORKPLAN_JULY2014\Appendix E_Figures\E-8 GW pH 15-30.mxd || Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet || Date Saved: 5/29/2014 || User: ecrumbaker || Print Date: 5/29/2014

EAST ALEXANDER AVENUE

605

709

721

905

WMUL-01 (1.5 J)
WMUL-02 (2.6 J)
28-15
29-14 (2.7 J)
30-15 (5)
51-15 (12)
52-15 (11)
47-15 (14)
709-MW-17 (0.17 J)
P-2
709-MW-18 (1.8)
709-MW-16 (0.45 J)
P-3 (36 J)
709-MW-15 (1.5)
709-MW-15A
48-15 (16)
50-15 (12)
709-MW-03 (9.6)
49-15 (2.2)
709-MW-06 (46)
NL-13 (30.1)
NL-28 (0.96 J)
P-4 (100)
P-7 (380 J)
P-5 (33)
709-MW-04 (19)
NL-30
P-8 (61 J)
709-MW20-15 (150)
709-MW-02 (15)
P-11 (1100 J)
709-MW-14 (9.9)
709-MW-19 (28)
NL-29 (0.78 J)
P-1
709-MW-12
709-MW-13
709-MW-05 (42)
HC-N11-8
P-10
709-MW-11 (0.11 J)
709-MW-09
HC08-EP18
709-MW-08 (45)
709-MW-01 (120)
709-MW-07 (0.17 J)
721-PZ-03
P-9 (800 J)
709-MW21-15
709-MW-10
721-MW1
721-MW14-15
721-MW5-15 (0.17 J)
721-GP5 (80)
721-MW9-15
HC-N11-5
721-GP1 (26)
721-MW7-15 (3.8 J)
721-MW12-15
721-MW8-15 (1.8)
721-GP6 (59)
721-GP8 (32)
HC-N11-6
721-MW2
721-GP2
721-GP4 (18)
721-GP9
95-15
721-MW15-15
721-GP7 (17)
721-GP3
721-MW11-15
721-MW10-15
721-MW6-15
721-MW3
721-MW13-15
Hylebos Waterway
MLLW (-6.17' NGVD)
MHHW (5.65' NGVD)

Tax Parcel Boundary
Former Parcel Line
Historical Building/Tank/Structure
Existing Building/Dock
Former Railroad Spur
Shoreline/Hylebos Waterway
3.3 µg/L Groundwater PCE Isoconcentration Line

Exploration Type (symbol shape)
Monitoring Well
Soil Boring/Probe, Piezometer

Most Recent Groundwater PCE Result
Non-Detect
Detected, No Exceedance of Screening Level
Above Screening Level (3.3 µg/L), but Less than 10x Screening Level (33.0 µg/L)
Above 10x Screening Level (33.0 µg/L)
No Results

Exploration ID
721-MW5-25 (370)
PCE Concentration (in µg/L)

PROJECT NORTH
TRUE NORTH
0 100 200
Feet
1:1,200

Extent of Tetrachloroethylene (PCE) in Groundwater 15 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect Consulting	MAY-2014	BY: DFR / PPW	FIGURE NO. E-9
	PROJECT NO. 130097-01B	REV BY: EAH	

GIS Path: T:\projects_8\Port_of_Tacoma\AlexanderAve_130097\Delivered\FINAL_RIFS_WORKPLAN_JULY2014\Appendix_E_Figures\E-9 GW PCE 0-15.mxd || Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet || Date Saved: 5/29/2014 || User: ecrumbaker || Print Date: 5/29/2014

EAST ALEXANDER AVENUE

605

709

721

905

9-25

3-25

NL-13 (2.3 J)

6A-24.5 (21)

709-MW-15A (21)

709-MW16-25

709-MW6-25

709-MW18-25

NL-28 (0.24 J)

NL-30

709-MW20-25 (15)

NL-29 (0.3 J)

709-MW11-25

709-MW9-25

721-PZ-03

709-MW21-25

721-MW5-25

721-GP5

721-PZ-02

721-MW14-25

721-GP1

721-MW9-25

721-MW12-25

721-GP8

721-PZ-01

721-GP6

721-GP2

721-GP4

721-GP9

95C-25

721-MW15-25

721-GP3

721-MW6-25

721-MW11-25

721-MW10-25

721-MW13-25

721-GP7

93C-25

Hylebos Waterway

MLLW (-6.17' NGVD)

MHHW (5.65' NGVD)

Tax Parcel Boundary

Former Parcel Line

Historical Building/Tank/Structure

Existing Building/Dock

Former Railroad Spur

Shoreline/Hylebos Waterway

3.3 µg/L Groundwater PCE Isoconcentration Line

Exploration Type (symbol shape)

Monitoring Well

Soil Boring/Probe, Piezometer

Most Recent Groundwater PCE Result

Non-Detect

Detected, No Exceedance of Screening Level

Above Screening Level (3.3 µg/L), but Less than 10x Screening Level (33.0 µg/L)

Above 10x Screening Level (33.0 µg/L)

No Results

Exploration ID

721-MW5-25 (370)

PCE Concentration (in µg/L)

PROJECT NORTH

TRUE NORTH

0 100 200

Feet

1:1,200

Extent of Tetrachloroethylene (PCE) in Groundwater 25 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING	MAY-2014	BY: DFR / PPW	FIGURE NO. E-10
	PROJECT NO. 130097-01B	REV BY: EAH	

GIS Path: T:\projects_8\Port_of_Tacoma\AlexanderAve_130097\Delivered\FINAL_RIFS_WORKPLAN_JULY2014\AppendixE_Figures\E-10 GW PCE 25-30.mxd || Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet || Date Saved: 5/29/2014 || User: ecrumbaker || Print Date: 5/29/2014

EAST ALEXANDER AVENUE

605

709

721

905

WMUL-01 (25 J)
WMUL-02 (5 J)
28-15
29-14
30-15
51-15 (3.6 J)
48-15 (3.7)
50-15 (4.7)
52-15 (12)
47-15
709-MW-15 (4.4)
709-MW-15A
709-MW-03 (4.2 J)
49-15 (0.96)
709-MW-17
P-2
709-MW-16 (2)
P-3 (71)
709-MW-06 (4)
709-MW-18 (7.1)
P-4 (29)
P-5 (19)
P-7 (160)
NL-28 (0.18 J)
709-MW-04 (2.1)
NL-13 (16.4)
NL-30
P-8 (39)
709-MW-02 (11)
709-MW20-15 (27)
P-11 (47 J)
709-MW-14 (41)
709-MW-13 (2.9 J)
709-MW-19 (6.6)
NL-29 (0.29 J)
P-1 (18)
709-MW-12
709-MW-05 (2.4)
HC-N11-8
P-10
709-MW-11 (0.34 J)
709-MW-09
HC08-EP18
709-MW-08 (24)
709-MW-01 (35)
709-MW-07 (0.51)
721-PZ-03
P-9 (40)
709-MW21-15
709-MW-10
721-MW1
721-MW14-15
721-MW5-15
721-GP5 (32)
721-MW9-15
721-GP1 (22)
721-MW7-15 (11 J)
HC-N11-5
721-MW8-15 (8.2)
721-MW12-15
721-GP6 (96)
721-GP8 (56)
HC-N11-6
721-MW2
721-GP2
721-GP4 (17)
721-GP9
95-15
721-MW15-15
721-GP3
721-GP7 (19)
721-MW11-15
721-MW10-15
721-MW3
721-MW6-15
721-MW13-15
Hylebos Waterway
MLLW (-6.17' NGVD)
MHHW (5.65' NGVD)

Tax Parcel Boundary
Former Parcel Line
Historical Building/Tank/Structure
Existing Building/Dock
Former Railroad Spur
Shoreline/Hylebos Waterway
8.4 µg/L Groundwater TCE Isoconcentration Line

Exploration Type (symbol shape)
Monitoring Well
Soil Boring/Probe, Piezometer

Most Recent Groundwater TCE Result
Non-Detect
Detected, No Exceedance of Screening Level
Above Screening Level (8.4 µg/L), but Less than 10x Screening Level (84.0 µg/L)
Above 10x Screening Level (84.0 µg/L)
No Results

Exploration ID
721-MW5-25 (370)
TCE Concentration (in µg/L)

PROJECT NORTH
TRUE NORTH
0 100 200
Feet
1:1,200

Extent of Trichloroethylene (TCE) in Groundwater 15 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING	MAY-2014	BY: DFR / PPW	FIGURE NO. E-11
	PROJECT NO. 130097-01B	REV BY: EAH	

EAST ALEXANDER AVENUE

605

709

721

905

9-25

6A-24.5 (9.2)

709-MW-15A (23)

709-MW16-25

709-MW6-25

709-MW18-25 (4.8 J)

709-MW11-25

709-MW9-25

709-MW21-25

721-MW14-25

721-MW12-25

721-MW15-25

721-MW13-25

721-MW6-25

721-MW11-25

721-MW5-25 (1.5 J)

721-MW9-25 (1.3 J)

721-GP1

721-GP2

721-GP3

721-GP4

721-GP5

721-GP6

721-GP7

721-GP8

721-GP9

NL-13 (4.23 J)

3-25 (0.1 J)

NL-28

NL-30

709-MW20-25 (6.2)

NL-29

721-PZ-03

721-PZ-02

721-PZ-01

95C-25

721-MW10-25

93C-25

Hylebos Waterway

MLLW (-6.17' NGVD)

MHHW (5.65' NGVD)

Tax Parcel Boundary

Former Parcel Line

Historical Building/Tank/Structure

Existing Building/Dock

Former Railroad Spur

Shoreline/Hylebos Waterway

8.4 µg/L Groundwater TCE Isoconcentration Line

Exploration Type (symbol shape)

Monitoring Well

Soil Boring/Probe, Piezometer

Most Recent Groundwater TCE Result

Non-Detect

Detected, No Exceedance of Screening Level

Above Screening Level (8.4 µg/L), but Less than 10x Screening Level (84.0 µg/L)

Above 10x Screening Level (84.0 µg/L)

No Results

Exploration ID

721-MW5-25 (370)

TCE Concentration (in µg/L)

PROJECT NORTH

TRUE NORTH

0 100 200

Feet

1:1,200

Extent of Trichloroethylene (TCE) in Groundwater 25 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING	MAY-2014	BY: DFR / PPW	FIGURE NO. E-12
	PROJECT NO. 130097-01B	REV BY: EAH	

GIS Path: T:\projects_8\Port_of_Tacoma\AlexanderAve_130097\Delivered\FINAL_RIFS_WORKPLAN_JULY2014\AppendixE_Figures\E-12 GW TCE 1530.mxd || Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet || Date Saved: 5/29/2014 || User: ecrumbaker || Print Date: 5/29/2014

EAST ALEXANDER AVENUE

605

709

721

905

WMUL-01 (0.21 J)
WMUL-02
28-15
29-14
30-15
51-15
52-15
47-15
48-15
50-15
49-15 (0.18 J)
709-MW-17 (2)
P-2 (10)
709-MW-16
P-3
709-MW-15
709-MW-15A
709-MW-03
709-MW-06 (0.87)
709-MW-18 (0.11 J)
P-4
P-5
P-7
NL-28 (3.2)
709-MW-04
NL-30
P-8
709-MW-02
709-MW20-15 (1.6 J)
P-11
709-MW-19
NL-29
P-1 (270)
709-MW-12
709-MW-13
709-MW-14
PDS-1-1
PDS-1-3
PDS-1-2
709-MW-05
HC-N11-8
P-10
709-MW-11
709-MW-09
HC08-EP18 (10)
709-MW-08 (0.87)
709-MW-01
709-MW-07 (1.6)
721-PZ-03 (5.5 J)
P-9
709-MW21-15
709-MW-10
721-MW1
721-MW14-15
721-MW5-15 (2.3)
721-GP5 (16)
HC-N11-5
721-GP1 (6.3 J)
721-MW7-15 (2.9 J)
721-MW9-15 (0.14 J)
721-MW12-15
721-MW8-15 (20)
721-GP6 (2.8)
721-GP8 (29)
HC-N11-6
721-MW2
721-GP2 (11)
721-GP4
721-GP9
95-15 (0.54)
721-MW15-15
721-GP7
721-GP3
721-MW6-15
721-MW11-15
721-MW10-15
721-MW3
721-MW13-15
Hylebos Waterway
MHHW (5.65' NGVD)
MLLW (-6.17' NGVD)

Tax Parcel Boundary
Former Parcel Line
Historical Building/Tank/Structure
Existing Building/Dock
Former Railroad Spur
Shoreline/Hylebos Waterway
2.4 µg/L Groundwater Vinyl Chloride Isoconcentration Line

Exploration Type (symbol shape)
Monitoring Well
Soil Boring/Probe, Piezometer

Most Recent Groundwater Vinyl Chloride Result
Non-Detect
Detected, No Exceedance of Screening Level
Above Screening Level (2.4 µg/L), but Less than 10x Screening Level (24.0 µg/L)
Above 10x Screening Level (24.0 µg/L)
No Results

Exploration ID
721-MW5-25 (370)
Vinyl Chloride Concentration (in µg/L)

PROJECT NORTH
TRUE NORTH
0 100 200
Feet
1:1,200

Extent of Vinyl Chloride in Groundwater 15 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING

MAY-2014	BY: DFR / PPW	FIGURE NO. E-13
PROJECT NO. 130097-01B	REV BY: EAH	

GIS Path: T:\projects_8\Port_of_Tacoma\AlexanderAve_130097\Delivered\FINAL_RIFS_WORKPLAN_JULY2014\Appendix_E_Figures\E-13 GW VC 0-15.mxd | | Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet | | Date Saved: 5/29/2014 | | User: ecrumbaker | | Print Date: 5/29/2014

EAST ALEXANDER AVENUE

605

709

721

905

9-25 (1.2)

6A-24.5 (9.1)

709-MW16-25 (0.52)

709-MW15A

709-MW6-25 (0.75 J)

709-MW18-25 (66)

NL-13 (0.241 J)

3-25 (0.48 J)

NL-28 (5.6)

NL-30

709-MW20-25 (4.8)

NL-29

709-MW11-25 (2.4)

709-MW9-25 (27)

721-PZ-03

709-MW21-25

721-MW5-25 (2.8)

721-GP5

721-MW14-25 (8.1)

721-GP1

721-MW9-25 (3.5 J)

721-PZ-02

721-MW12-25

721-GP8

721-GP6

721-PZ-01

721-GP2

721-GP4

721-GP9

95C-25

721-MW15-25

721-GP7

721-GP3

721-MW11-25

721-MW6-25

721-MW10-25 (0.29 J)

721-MW13-25

93C-25

Hylebos Waterway

MLLW (-6.17' NGVD)

MHHW (5.65' NGVD)

Tax Parcel Boundary

Former Parcel Line

Historical Building/Tank/Structure

Existing Building/Dock

Former Railroad Spur

Shoreline/Hylebos Waterway

2.4 µg/L Groundwater Vinyl Chloride Isoconcentration Line

Exploration Type (symbol shape)

Monitoring Well

Soil Boring/Probe, Piezometer

Most Recent Groundwater Vinyl Chloride Result

Non-Detect

Detected, No Exceedance of Screening Level

Above Screening Level (2.4 µg/L), but Less than 10x Screening Level (24.0 µg/L)

Above 10x Screening Level (24.0 µg/L)

No Results

Exploration ID

721-MW5-25 (370)

Toal Vinyl Chloride Concentration (in µg/L)

PROJECT NORTH

TRUE NORTH

0 100 200

Feet

1:1,200

Extent of Vinyl Chloride in Groundwater 25 Foot Zone

East Alexander Avenue Petroleum Tank Facility
Port of Tacoma, Washington

Aspect CONSULTING	MAY-2014	BY: DFR / PPW	FIGURE NO. E-14
	PROJECT NO. 130097-01B	REV BY: EAH	

GIS Path: T:\projects_8\Port_of_Tacoma\Alexander\Ave_130097\Delivered\FINAL_RIFS_WORKPLAN_JULY2014\Appendix_E_Figures\E-14 GW VC 15-30.mxd | | Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet | | Date Saved: 5/29/2014 | | User: scrumbaker | | Print Date: 5/29/2014

APPENDIX F

Excerpts from Draft Sediment Monitoring Report, Hylebos Bridge Rehabilitation Project (2011)

Draft Sediment Monitoring Report

Hylebos Bridge Rehabilitation Project
Post-Construction Monitoring
Tacoma, Washington

File No. 0570-101-00

December 1, 2011

Prepared for:

City of Tacoma
Engineering Division, Special Projects
747 Market Street, Room 544
Tacoma, Washington 98402-3769

Attention: Said Seddiki

Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

Garrett R. Leque, LG
Environmental Scientist

Iain H. Wingard
Associate

IHW:GRL:cn

GeoEngineers

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COMPARISON OF SURFACE SEDIMENT SAMPLE ANALYTICAL RESULTS

HYLEBOS BRIDGE REHABILITATION PROJECT - PRE- AND POST-CONSTRUCTION

TACOMA, WASHINGTON

		Western Shoreline		South of Western Bridge Abutment		North of Western Bridge Aubtment		North of Eastern Bridge Abutment		South of Eastern Bridge Abutment		Eastern Shoreline	
	Sample Name	HBSWC-01	HBSW-C-01	HBSWC-03	HBSW-C-02	HBSWC-02	HBSW-C-03	HBSEC-01	HBSED-C-01	HBSEC-02	HBSE-C-03	HBSEC-03	HBSE-C-02
	Sample Date	7/2/2009	9/6/2011	7/1/2009	9/6/2011	7/1/2009	9/6/2011	7/2/2009	9/6/2011	7/2/2009	9/7/2011	7/1/2009	9/7/2011
Analyte	SQO												
Conventionals (percent)													
Total Organic Carbon	NE	1.35	1.14	2.08	1.18	1.14	1.25	0.944	2.05	1.55	1.43	1.35	1.19
Total Solids	NE	78.4	74.50	61.7	69.10	58.7	56.90	54.9	52.50	61.4	56.70	69.1	75.20
Metals (mg/kg)													
Arsenic	57	7	16	9	11	11	14	11	14	12	12	12	9
Cadmium	5.1	0.3	0.4	0.3 U	0.3	0.4 U	0.4	0.4 U	0.3	0.3	0.3 U	0.3 U	0.3
Copper	390	51.5	74.7	44.2	38.3	60.6	66.8	68.5	55.5	61.8	26.7	41.6	35.4
Lead	450	119	34	25	24	36	38	30	38	28	29	58	41
Mercury	0.59	0.07	0.14	0.1	0.06	0.11	0.12	0.14	0.12	0.12	0.04	0.06	0.04
Nickel	140	15	16	12	10	16	14	17	13	16	12	14	14
Zinc	410	93 J	80	63 J	55	85 J	80	78 J	71	80 J	60	79 J	78
Organic Compounds													
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (µg/kg)													
1-Methylnaphthalene	NE	19 U	28	20 U	54	20 U	100	20 U	48	19 U	33	19 U	20
2-Methylnaphthalene	670	19 U	48	20 U	98	20 U	77	20 U	86	19 U	49	19 U	28
Acenaphthene	500	19 U	88	21	110	25	160	20 U	59	30	43	19 U	31
Acenaphthylene	1,300	19 U	30	20 U	38	20 U	36	20 U	40	26	33	19 U	74
Anthracene	960	60	110 J	120	130	230 J	200	34	170	52	88	35	120
Fluorene	540	21	77	38	99	29	83	20 U	85	36	49	19 U	31
Naphthalene	2,100	19 U	180	20 U	190	22	300	20 U	220	19	100	19 U	40
Phenanthrene	1,500	180	280 J	150	450	130 J	430	78	290	240	320	100	550
Sum of LPAHs	5,200	261 T	813 T	329 T	1,115 T	436 J T	1,286 T	112 T	950 T	403 T	682 T	135 T	874 T
High Molecular Weight Polycyclic Aromatic Hydrocarbons (µg/kg)													
Benzo(a)anthracene	1,600	150	290 J	110	210	170	280	63	250	110	150	78	830
Benzo(a)pyrene	1,600	140	290 J	97	230	170	360	64	270	110	170	70	610
Benzofluoranthenes (Sum)		430 T	690 J	250 T	500	440 T	970	163 T	860	334 T	360	207 T	1,900
Benzo(ghi)perylene	720	83	130 J	29	130	71 J	190	23	150	36	85	25	180
Chrysene	2,800	330	480 J	210	350	520	690	140	590	300	310	180	1,900
Dibenzo(a,h)anthracene	230	34	44 J	20 U	40	35	65	20 U	60	19 U	30	19 U	89
Fluoranthene	2,500	550	750 J	210	520	370	1,000	170	690	710	490	300	5,800
Indeno(1,2,3-cd)pyrene	690	86	120 J	34	100	76	170	25	140	41	72	27	220
Pyrene	3,300	320 J	700 J	130	610	210 J	1,100	100	700	340	490	190	4,900
Sum of HPAHs	17,000	1,693 J T	3,494 TJ	820 T	2,690 T	1,622 JT	4,825 T	585 T	3,710 T	1,647 T	2,157 T	870 T	10,700 T
Chlorinated Organic Compounds (µg/kg)													
1,2,4-Trichlorobenzene	51	19 U	18 U	20 U	19 U	20 U	19 U	20 U	19 U	19 U	18 U	19 U	20 U
1,2-Dichlorobenzene	50	19 U	18 U	20 U	19 U	20 U	19 U	20 U	19 U	19 U	18 U	19 U	20 U
1,3-Dichlorobenzene	170	19 U	18 U	20 U	19 U	20 U	19 U	20 U	19 U	19 U	18 U	19 U	20 U
1,4-Dichlorobenzene	110	19 U	18 U	20 U	19 U	20 U	19 U	20 U	19 U	19 U	18 U	19 U	20 U
Hexachlorobenzene	22	19 U	18 U	20 U	19 U	20 U	19 U	20 U	19 U	19 U	18 U	19 U	20 U
Hexachloroethane	NE	19 U	18 U	20 U	19 U	20 U	19 U	20 U	19 U	19 U	18 U	19 U	20 U

Analyte	Sample Name	Western Shoreline		South of Western Bridge Abutment		North of Western Bridge Aubtment		North of Eastern Bridge Abutment		South of Eastern Bridge Abutment		Eastern Shoreline	
	Sample Name	HBSWC-01	HBSW-C-01	HBSWC-03	HBSW-C-02	HBSWC-02	HBSW-C-03	HBSEC-01	HBSED-C-01	HBSEC-02	HBSE-C-03	HBSEC-03	HBSE-C-02
	Sample Date	7/2/2009	9/6/2011	7/1/2009	9/6/2011	7/1/2009	9/6/2011	7/2/2009	9/6/2011	7/2/2009	9/7/2011	7/1/2009	9/7/2011
	SQO												
Phthalates (µg/kg)													
Bis(2-Ethylhexyl) Phthalate	1,300	**41**	120 U	**32**	120 U	**73**	**90**	**46**	**200**	**48**	53	**32**	**37**
Butyl benzyl phthalate	900	19 U	18 U	20 U	19 U	20 U	19 U	20 U	19 U	19 U	18 U	19 U	20 U
Dibutyl phthalate	1,400	19 U	18 U	20 U	19 U	20 U	19 U	20 U	19 U	19 U	18 U	19 U	20 U
Diethyl phthalate	200	19 U	46 U	20 U	46 U	20 U	48 U	20 U	47 U	19 U	46 U	19 U	49 U
Dimethyl phthalate	160	19 U	18 U	20 U	19 U	20 U	19 U	20 U	19 U	19 U	18 U	19 U	20 U
Di-N-Octyl Phthalate	6,200	19 U	18 U	20 U	19 U	20 U	19 U	20 U	19 U	19 U	18 U	19 U	20 U
Phenols (µg/kg)													
2,4-Dimethylphenol	29	19 U	18 UJ	20 U	19 UJ	20 U	19 UJ	20 U	18 UJ	19 U	18 UJ	19 U	20 UJ
2-Methyphenol (o-Cresol)	63	19 U	18 U	20 U	20 U	20 U	18 U	20 U	19 U	19 U	18 U	19 U	20 U
4-Methylphenol (p-Cresol)	670	19 U	37 U	20 U	**29**	20 U	**25**	20 U	38 U	19 U	**25**	19 U	**29**
Pentachlorophenol	360	96 UJ	180 U	98 UJ	200 U	97 UJ	180 U	98 UJ	190 U	97 UJ	180 U	96 UJ	200 U
Phenol	420	19 U	**31**	20 U	**130**	**24**	**90**	**24**	**59**	**67**	**90**	19 U	**130**
Miscellaneous Extractable Compounds (µg/kg)													
Benzoic Acid	650	190 U	370 U	200 U	400 U	200 U	370 U	200 U	380 U	190 U	370 U	190 U	400 U
Benzyl Alcohol	73	19 U	18 U	20 U	20 U	20 U	**36**	20 U	**40**	19 U	**36**	19 U	20 U
Dibenzofuran	540	19 U	**77**	**20**	**22**	**22**	**45**	20 U	**99**	**26**	**45**	19 U	**22**
Hexachlorobutadiene	11	9.6 UJ	9.2 UJ	9.8 UJ	**10 J**	9.8 UJ	**10 J**	9.8 UJ	9.2 UJ	9.7 UJ	9.3 UJ	9.6 UJ	9.9 UJ
N-Nitrosodiphenylamine	28	19 U	18 U	20 U	19 U	20 U	19 U	20 U	19 U	19 U	18 U	19 U	20 U
Polychlorinated Biphenyls (mg/kg)													
PCB-aroclor 1016	NE	0.031 U	0.032 U	0.032 U	0.032 U	0.032 U	0.033 U	0.032 U	0.033 U	0.033 U	0.032 U	0.031 U	0.032 U
PCB-aroclor 1221	NE	0.031 U	0.032 U	0.032 U	0.032 U	0.032 U	0.033 U	0.032 U	0.033 U	0.033 U	0.032 U	0.031 U	0.032 U
PCB-aroclor 1232	NE	0.031 U	0.032 U	0.032 U	0.032 U	0.032 U	0.033 U	0.032 U	0.033 U	0.033 U	0.032 U	0.031 U	0.032 U
PCB-aroclor 1242	NE	0.031 U	0.032 U	0.032 U	0.032 U	0.032 U	0.033 U	0.032 U	0.033 U	0.033 U	0.032 U	0.031 U	0.032 U
PCB-aroclor 1248	NE	0.031 U	0.032 U	0.032 U	0.032 U	0.032 U	0.033 U	0.032 U	0.033 U	0.033 U	0.032 U	0.031 U	0.032 U
PCB-aroclor 1254	NE	0.031 U	0.032 U	0.032 U	0.032 U	0.032 U	**0.05**	**0.047**	**0.054**	**0.038**	**0.045**	0.031 U	0.032 U
PCB-aroclor 1260	NE	0.031 U	0.032 U	**0.049 J**	0.032 U	**0.038**	**0.06 J**	**0.042**	**0.056 J**	**0.04 J**	**0.041**	0.031 U	0.032 U
Total Aroclors	0.3	0.031 U	0.032 UT	**0.049 T**	0.032 UT	**0.038 T**	0.11 T	**0.089 T**	0.11 T	**0.078 T**	0.086 T	0.031 U	0.032 UT

Notes:

SQO = Sediment Quality Objective, WAC 173-204.

mg/kg = milligrams per kilogram.

µg/kg = micrograms per kilogram.

U = Not detected at equal to or greater than the concentration identified.

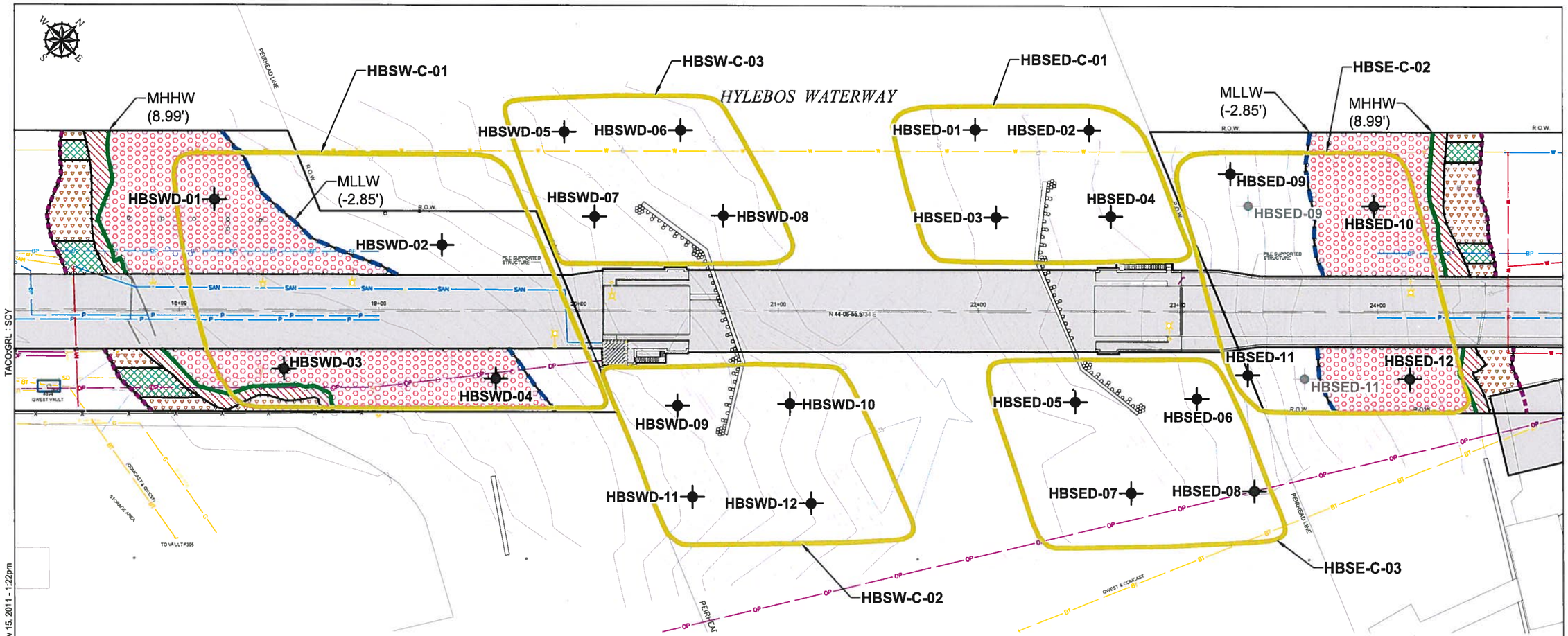
J = The concentration is estimated.

T = Calculated total of the detected concentrations in the chemical group.

NE = Sediment Quality Objective criteria has not been established for this analyte.

Bold identifies detected concentration above reporting limit.

Shading identifies concentration greater than the Sediment Quality Objective.



TACO\GRL : SCY

Legend

- Tidal fringe zone (plant with salt-tolerent species)
- Upland shrub zone (plant with shallow-rooted shrub species)
- Upland forest zone (plant with tree and shrub species)
- Intertidal zone (remove debris, piles, and garbage)
- Bridge, building, and road structure outlines
- Mean Higher High Water (MHHW)
- Mean Lower Low Water (MLLW)
- 25' Shoreline buffer

- HBSWD-01 — Discreet sediment sample number and approximate location (used for composite sample)
- HBSED-09 — Discreet sediment sample number (planned location)

Utility Lines

- W — New water line
- SAN — New sanitary sewer
- BP — New buried power
- P — New power
- W — Abandoned water line
- SAN — Abandoned sanitary sewer
- G — Existing gas
- W — Existing water line
- SD — Existing storm drain
- BT — Existing buried telephone
- SAN — Existing sanitary sewer
- OF — Existing overhead fiber optic
- OP — Existing overhead power

50 0 50
Feet

Notes:
1. Vertical Datum is NAVD 88. Horizontal Datum is NAD83 Washington State Planes, South Zone, US Foot.
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Drawing provided by PB Americas, dated 08/25/08.

Sediment Sample Locations

Hylebos Bridge Rehabilitation Project
Tacoma, Washington

GeoEngineers

Figure 2

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