Revised Cleanup Action Plan

Former Olympia Manufactured Gas Plant Site
Olympia, Washington

for
Puget Sound Energy

July 30, 2012

GeoEngineers
Earth Science + Technology

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Plaza 600 Building
600 Stewart Street, Suite 1700
Seattle, Washington 98101
206.728.2674

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Former Olympia Manufactured Gas Plant Site
Olympia, Washington

File No. 0186-774-00

July 30, 2012

Prepared for:

Puget Sound Energy
PO Box 90868, PSE-11N
Bellevue, Washington 98009-0868

Attention: Greg Andrina

Prepared by:

GeoEngineers, Inc.
Plaza 600 Building
600 Stewart Street, Suite 1700
Seattle, Washington 98101
206.728.2674

Carla E. Brock, LG
Environmental Geologist

Robert C. Leet, PhD, LG
Project Manager

Stephen C. Woodward, LG
Principal

RCL:CEB:SCW:csv

cc: Eugene Radcliffe/Washington State Department of Ecology (one hard copy)
Pat Rants/The Rants Group (one hard copy)

GEOENGINEERS

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1.0 INTRODUCTION

This Revised Cleanup Action Plan (CAP) has been prepared for Puget Sound Energy's (PSE's) former Olympia manufactured gas plant (MGP) property located at 320 Columbia Street NW in Olympia, Washington (the "Property;" Figure 1). PSE is performing the Property cleanup as an independent action under the Washington State Department of Ecology's (Ecology's) Voluntary Cleanup Program (VCP). The cleanup action will address concentrations of carcinogenic polycyclic aromatic hydrocarbons (cPAHs), petroleum hydrocarbons, and metals beneath the Property that exceed Washington State Model Toxics Control Act (MTCA) Method A cleanup levels. These constituents are collectively referred to as the constituents of concern (COCs).

This CAP has been revised since the original version submitted to Ecology on November 14, 2011 to include a disproportionate costs analysis (DCA) performed under Chapter 173-340-360 of the Washington Administrative Code (WAC 173-340-360). The DCA compares the relative benefits and costs of three cleanup alternatives that meet MTCA threshold requirements. Based on the results of the DCA, the current CAP presents Alternative 3 as the selected remedy that is permanent to the maximum extent practicable. The results of the DCA are presented in Appendix A.

The cleanup action described herein specifically addresses the known soil and groundwater contamination within the Property boundaries. Off-Property soil sampling conducted by PSE in 2010 indicates that the "site," which is defined by the MTCA Cleanup Regulation as any location where a hazardous substance has come to be located, extends beyond the Property boundaries in two areas near the northeast and southeast corners of the Property. PSE is conducting the Property-specific cleanup described in this CAP so that the Property owner (The Rants Group) can proceed with development plans for the Property. The objective of the cleanup is to implement a remedy on the Property that is permanent to the maximum extent practicable and to obtain a property-specific "No Further Action" determination from Ecology. The remainder of the site (i.e., off-Property contamination) will be addressed after the Property cleanup is completed.

This CAP has been prepared in general accordance with MTCA, WAC 173-340. A detailed summary of the Property history and the results of previous environmental investigations are provided in the *Data Summary Report, Former Olympia Manufactured Gas Plant, Olympia, Washington* (GeoEngineers, 2011a). A summary of the relevant details is presented herein; however, the Data Summary Report should be referenced for additional information.

1.1. Purpose

This CAP has been prepared in general accordance with WAC 173-340-380 to present the proposed Property cleanup action and to specify cleanup standards and other requirements for the cleanup action. The cleanup action will meet the threshold requirements of WAC 173-340-360 to protect human health and the environment, comply with cleanup standards and applicable state and federal laws, and provide for compliance monitoring.

The proposed Property cleanup action consists of the following components:

- Excavation of soil containing COC concentrations that exceed MTCA Method A cleanup levels to the maximum extent practicable;

- Disposal of the excavated soil at a permitted facility;
- Implementation of institutional controls; and
- Compliance monitoring.

1.2. Property Description and Background

The Property occupies approximately 0.33 acres at the southeast corner of the intersection of Columbia Street NW and Thurston Avenue NW in Olympia, Washington (Figure 1) and is currently vacant. It is identified as Thurston County tax parcel number 78500200100 and is located in the southwest quarter (SW 1/4) of the northwest quarter (NW 1/4) of Section 14, Township 18 North, Range 2 West of the Public Land Survey System land grid. The Property is bounded by Thurston Avenue NE to the north, Columbia Street NW to the west, and commercial properties to the east and south. Budd Inlet is located approximately 300 feet west of the Property (Figure 1).

The Property was developed as a manufactured gas plant in 1908 by the Olympia Gas and Power Company. The Olympia MGP produced gas from oil and distributed the gas through underground pipes to limited areas of Olympia for residential uses such as lighting, heating, and cooking. The Olympia MGP was a primary source of Olympia's residential gas supply between April 1908 and August 1910. By August 1910, construction of a gas pipeline between Tacoma and Olympia was completed. This pipeline carried gas produced at an MGP in Tacoma, which became Olympia's primary gas source. Consequently, from 1910 until approximately 1923 or 1924, the Olympia MGP served as a backup/auxiliary plant, producing gas only as needed during temporary interruptions in the Tacoma gas supply.

Historical records indicate that all gas production at the Olympia MGP ceased by approximately 1924. The Property was used for gas storage and distribution from approximately 1924 until the late 1940s; a 50-foot diameter, aboveground spherical gas storage tank called a "Hortonsphere" was present on the Property during this time. By the early 1950s all gas production and storage facilities were dismantled, and a new office building had been constructed on the Property. The Property was owned by Washington Natural Gas from the early 1950s until 1974, and a private law firm owned the Property from 1974 to 2008. The Property is currently owned by The Rants Group and has been vacant since October 2009, when the office building was demolished by PSE to allow for environmental sampling within the building footprint. The existing and historical features on the Property are depicted on Figure 2.

2.0 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

Four phases of environmental investigation were conducted at the Property between 2006 and 2011. Detailed summaries of these previous investigations are presented in the Data Summary Report (GeoEngineers, 2011a). The previous investigations identified cPAHs, benzene, gasoline- and lube oil-range petroleum hydrocarbons, lead, and mercury in Property soil at concentrations exceeding the MTCA Method A cleanup levels. In addition, cPAHs have been detected in shallow groundwater at concentrations exceeding the MTCA Method A cleanup level in a limited area near the eastern Property boundary. Details regarding the nature and extent of contamination at the Property are presented in the Data Summary Report.

3.0 CONCEPTUAL SITE MODEL

This section presents the conceptual site model for the COCs identified in soil and groundwater at the Property. The conceptual site model summarizes the contaminant sources, the COCs identified in each medium of concern, and the potential receptors and exposure routes for the identified COCs.

3.1. Contaminant Sources

The concentrations of COCs identified in soil and groundwater at the Property are attributed to releases from the historical manufactured gas operations. The suspected primary source of these contaminants is surface and shallow subsurface releases of petroleum products and/or MGP byproducts in the materials handling, storage, and processing areas. The lead and mercury detected in soil may have originated from metal piping, electrical equipment, or other metal-containing components of the MGP, or they may have been present in the petroleum products used in the manufacturing process. Releases of liquids such as petroleum products likely migrated downward in shallow soil via gravity and stormwater infiltration, adsorbing to soil particles and becoming trapped in the soil pore spaces. Soil impacted by COCs in this way can act as a potential secondary source of contamination to groundwater via leaching.

3.2. COCs Identified in Soil and Groundwater

Details regarding the nature and extent of contamination at the Site are presented in the Data Summary Report (GeoEngineers, 2011a). This section provides a summary of the COCs identified in soil and groundwater.

Previous environmental investigations at the Property indicate that cPAHs are the predominant COCs present in soil. The other soil COCs include benzene, gasoline- and lube oil-range petroleum hydrocarbons, lead, and mercury; these other COCs are more limited in occurrence and generally collocated with the cPAH exceedances. The sampling results also indicate that COC concentrations in soil are generally highest between the ground surface and a depth of 4 feet below ground surface (bgs), and attenuate with depth. The mass of cPAHs in soil as a function of depth has been calculated to support the evaluation of cleanup alternatives and the design of the cleanup action; the results indicate that 96% of the total mass of cPAHs in soil at the Property is located between the ground surface and 6 feet bgs. Figure 3 shows COC concentrations detected in soil that exceed MTCA Method A cleanup levels. Figure 4 shows the calculated cPAH mass distribution with depth.

Groundwater is typically measured at depths ranging from 4 to 6 feet below the top of the casing in monitoring wells located on the Property. Based on the water level data that has been collected at the Property, seasonal groundwater fluctuations consist of higher water levels in the winter and spring and lower water levels in the summer and fall. Eight groundwater monitoring events were conducted between August 2008 and July 2011. During these monitoring events, groundwater samples were collected from up to seven on-Property monitoring wells and eight off-Property monitoring wells. Petroleum hydrocarbons, benzene, lead, and mercury have not been detected in groundwater at concentrations exceeding MTCA Method A cleanup levels, with the exception of one sampling event (August 2008) in which lead was detected in monitoring well MW-3 at a concentration slightly exceeding the MTCA Method A cleanup level (Figure 5). Chromium also was detected in well MW-4 at a concentration slightly exceeding the MTCA Method A cleanup level in August 2008; however, chromium was not detected in this well during four subsequent monitoring events. The chromium detection in MW-4 in 2008 may have been caused by the presence of chromium in suspended sediments in the unfiltered groundwater sample obtained from this well soon after the well was installed and developed. Because the initial detections of lead and chromium concentrations above MTCA Method A cleanup levels were not confirmed during subsequent monitoring events, these metals are not COCs in groundwater.

The only COC potentially related to the former MGP operations that has been consistently detected in groundwater at concentrations exceeding the MTCA Method A cleanup level is cPAHs in monitoring well MW-7 (Figure 5). cPAH concentrations exceeded the MTCA Method A cleanup level in well MW-7 during five of six monitoring events conducted between November 2009 and July 2011 (GeoEngineers, 2011b). However, cPAHs have not been detected at concentrations greater than the Method A cleanup level in any other monitoring wells. The cumulative groundwater dataset indicates that the concentrations of cPAHs in soil beneath the Property have caused minor groundwater impacts in the immediate vicinity of monitoring well MW-7, but that the other COCs in soil have not significantly impacted groundwater. Figure 5 shows COC concentrations detected in groundwater that exceed MTCA Method A cleanup levels. The groundwater sample results from soil borings B-2 through B-6 completed during the 2006 baseline environmental assessment (Environmental Partners Inc. [EPI], 2006) are considered screening-level data only, as these samples were obtained from temporary well screens placed in hollow-stem auger borings that were subsequently abandoned. Groundwater sample results from monitoring wells are considered more representative of groundwater conditions.

Although not a COC for the proposed Property cleanup action, arsenic has been consistently detected above the MTCA Method A cleanup level in groundwater in on- and off-Property monitoring wells (Figure 5). Extensive sampling and analysis for arsenic in soil during the previous investigations indicates that arsenic concentrations in Property soils are consistent with Washington state natural background concentrations. Furthermore, arsenic has not been detected in any soil samples at a concentration greater than the MTCA Method A cleanup level. As discussed in detail in the Data Summary Report (GeoEngineers 2011a), multiple lines of evidence indicate that the arsenic concentrations detected in groundwater are not related to the former MGP operations.

3.3. Potential Receptors and Exposure Routes

Human receptors that could potentially be exposed to the COCs identified in soil include construction workers and visitors during construction work, or residents and visitors under a hypothetical future unrestricted land use (residential) exposure scenario. Construction workers, visitors, and residents may be exposed to contaminated soil through dermal contact, dust inhalation, or incidental ingestion.

Human receptors that could potentially be exposed to COCs in groundwater include construction workers during soil excavation that extends below the depth of the groundwater table. Construction workers may be exposed to contaminated groundwater through dermal contact. Groundwater beneath the Property is not used as drinking water, nor is it likely to be used as drinking water in the future due to the proximity of marine surface water in Budd Inlet and the availability of a municipal water supply. Accordingly, human ingestion of groundwater is not currently an exposure pathway of concern. Nevertheless, if groundwater beneath the Property were to be used as drinking water in the future, residents or others could potentially be exposed to contaminated groundwater through ingestion.

A MTCA terrestrial ecological evaluation was completed for the Property in 2010 (GeoEngineers, 2010). Using the criteria in WAC 173-340-7491, the evaluation concluded that the Property qualifies for an exclusion from further evaluation due to the lack of significant areas (i.e., less than 1.5 acres) of contiguous undeveloped land on or within 500 feet of the Property.

4.0 FEASIBILITY STUDY

The purpose of the feasibility study is to meet the substantive requirements of MTCA for the development and evaluation of cleanup action alternatives, and to select a preferred cleanup action alternative for the Property.

4.1. Cleanup Action Objectives

Cleanup action objectives consist of chemical- and medium-specific goals for protecting human health and the environment. The cleanup action objectives specify the media and COCs, potential exposure routes and receptors, and proposed cleanup goals.

The objective of the proposed cleanup action is to eliminate, reduce, or otherwise control to the extent feasible and practicable, risks to human health and the environment posed by the COCs in soil and groundwater at the Property, in accordance with MTCA and other applicable regulatory requirements. Specifically, the cleanup action objectives include:

- Mitigate risks to human health posed by direct contact (dermal contact, dust inhalation, and incidental ingestion) with soil containing COCs at concentrations exceeding cleanup levels protective of human health.
- Mitigate potential future risks to human health posed by ingestion of groundwater containing cPAHs at concentrations exceeding cleanup levels protective of human health. Although human ingestion of groundwater is not currently an exposure pathway of concern, the groundwater ingestion pathway could pose health risks in the future if groundwater beneath the Property were to be developed as a source of drinking water.

4.2. Preferred Cleanup Action Alternative

The preferred cleanup action alternative for the Property is excavation of soil containing COC concentrations exceeding MTCA Method A cleanup levels to the maximum extent practicable, followed by disposal of the excavated soil at a permitted facility and implementation of institutional controls. A disproportionate costs analysis was performed to evaluate excavation cleanup action alternatives and select the alternative that is permanent to the maximum extent practicable. Based on the results of the DCA, the preferred cleanup action was identified as Alternative 3. The DCA results are presented in Appendix A. Details of the cleanup action are described in Section 6.0. In addition to mitigating risks associated with direct contact with contaminated soil, this alternative may lead to a reduction of cPAH concentrations in groundwater as a result of removing most of the contaminated soil from the Property. The effects of the remedy on groundwater quality will be confirmed through post-construction monitoring. The institutional controls will include an environmental (restrictive) covenant to prevent potential future exposure to concentrations of COCs exceeding MTCA Method A cleanup levels in soil and groundwater that will remain beneath the portions of the Property after the cleanup action.

This cleanup action alternative meets the MTCA threshold requirements to protect human health and the environment, comply with cleanup standards, comply with applicable state and federal laws, and provide for compliance monitoring (WAC 173-340-360[2][a]). The preferred cleanup action alternative also meets the MTCA criteria for a routine cleanup action by using obvious and undisputed cleanup standards for each hazardous substance and implementing an obvious and limited choice among cleanup alternatives that has been proven capable of accomplishing cleanup standards. In addition, the cleanup does not require preparation of an environmental impact statement and the site qualifies for an exclusion from conducting a simplified or site-specific terrestrial ecological evaluation.

5.0 CLEANUP REQUIREMENTS

Cleanup actions conducted under MTCA must comply with MTCA cleanup standards for the identified contaminants and affected media, as well as applicable regulatory requirements based on state and federal laws (WAC 173-340-710). This section identifies the cleanup standards and the applicable regulatory requirements for the proposed cleanup action.

5.1. Constituents and Media of Concern

The COCs for the cleanup action are those hazardous substances that have been detected in soil or groundwater at concentrations exceeding the cleanup levels defined in Section 5.2.1, and includes:

- cPAHs in soil and groundwater;
- Benzene in soil;
- Gasoline- and lube oil-range petroleum hydrocarbons in soil; and
- Lead and mercury in soil.

As noted in Section 3.2, although arsenic has been consistently detected in groundwater at concentrations exceeding the MTCA Method A cleanup level, multiple lines of evidence indicate that the arsenic is not related to the historical MGP operations (GeoEngineers, 2011a). Consequently, arsenic is not a COC for the cleanup action.

5.2. Cleanup Standards

Cleanup standards consist of: (1) cleanup levels that are protective of human health and the environment, (2) the points of compliance at which the cleanup levels must be met, and (3) regulatory requirements established in applicable state and federal laws. The site-specific cleanup levels and points of compliance are summarized in this section. Applicable state and federal laws are discussed in Section 5.3.

5.2.1. Cleanup Levels

Cleanup levels for the proposed Property cleanup action were developed in accordance with MTCA for the protection of human health. The MTCA Cleanup Regulation states that MTCA Method A cleanup levels, which are described in 173-340-700(5)(a) and 173-340-704, are protective of human health and are designed for cleanup actions that are relatively straightforward or involve only a few hazardous substances. Accordingly, the MTCA Method A cleanup levels for the COCs identified in Section 5.1 above will be used as the soil and groundwater cleanup levels for the proposed cleanup action. These cleanup levels are presented in Table 1. The MTCA Method A cleanup levels presented in Table 1 were obtained from WAC 173-340-900, Tables 720-1 and 740-1.

5.2.2. Points of Compliance

The MTCA Cleanup Regulation defines the point of compliance as the point or points where the cleanup levels must be attained for a site to be in compliance with the cleanup standards. The proposed point of compliance for soil is throughout the Property from the ground surface to 15 feet bgs. Per WAC 173-340-740(6)(d), this is the MTCA standard point of compliance for soil cleanup levels based on human exposure via direct contact. The proposed point of compliance for groundwater is throughout the Property from the uppermost level of the saturated zone extending vertically to the lowermost depth that could potentially be affected by the Property. This is the MTCA standard point of compliance for groundwater as defined in WAC 173-340-720(8)(b).

5.3. Applicable Regulatory Requirements

The applicable laws and regulations provide the framework for the cleanup action. In addition to the cleanup standards developed through MTCA, other regulatory requirements must be considered in the selection and implementation of the cleanup action. MTCA requires the cleanup standards to be “at least as stringent as all applicable state and federal laws” (WAC 173-340-700[6][a]). Besides establishing minimum requirements for cleanup standards, applicable state and federal laws may also impose certain technical and procedural requirements for performing cleanup actions. These requirements are described in WAC 173-340-710. Potentially applicable state and federal laws are identified below.

The Property cleanup action will be performed pursuant to MTCA as an independent remedial action under Ecology’s VCP. The permits or other state, federal, or local requirements that are applicable or potentially applicable to the cleanup action and that are known at this time include the following:

- Thurston County Construction Permit (Thurston County Code Chapter 14.37);
- Washington State Environmental Policy Act (SEPA; Revised Code of Washington [RCW] 43.21C);
- Solid Waste Handling Standards (WAC 173-350);
- Hazardous Waste Management Act (RCW 70.105);
- Washington Industrial Safety and Health Act (RCW 49.17); and

- Federal Occupational Safety and Health Act (Code of Federal Regulations [CFR] Title 29, Parts 1910 and 1926). Any necessary permits that are applicable to the cleanup action will be obtained prior to implementing the cleanup action.

6.0 CLEANUP ACTION

6.1. Cleanup Action Description

The preferred cleanup action, Alternative 3, will include the following activities, listed below in the general sequence in which they will be completed:

- Decommissioning the existing groundwater monitoring wells that are located within the cleanup action excavation area;
- Implementing erosion control and site security measures;
- Excavating soil containing concentrations of one or more of the COCs exceeding the MTCA Method A cleanup levels (Table 1) from the ground surface to a maximum depth of 6 feet bgs, or as close to this depth as practicable using sloped excavation sidewalls around the Property perimeter to protect the integrity of surrounding structures.
- Transporting excavated soils for disposal at an off-site, permitted facility;
- Managing surface water, stormwater, and groundwater as necessary during excavation activities;
- Collecting and analyzing verification soil samples at the limits of the remedial excavation;
- Backfilling the excavation area(s) with clean, imported fill to meet structural specifications;
- Implementing institutional controls;
- Installing one or more new groundwater monitoring wells within the backfilled remedial excavation; and
- Monitoring groundwater for at least four quarters to confirm the long-term effectiveness of the cleanup action.

6.2. Cleanup Action Components

This section describes the scope of work to be completed for each major component of the cleanup action.

6.2.1. Site Preparation

Prior to soil excavation, underground utilities will be located and marked, and existing asphalt/concrete pavement will be removed to facilitate removal of contaminated soil. Existing monitoring wells MW-1, MW-2, MW-3, MW-4, MW-5, MW-7, and MW-8 will be decommissioned except where they can be protected during the cleanup activities. Site security, erosion control measures, and traffic control measures will be implemented as necessary to meet regulatory requirements.

6.2.2. Soil Excavation

The cleanup will be conducted in late summer or early fall, when groundwater levels at the Property are lowest, and include excavation of soil to a maximum depth of approximately 6 feet bgs. The sidewalls will be sloped at a 2H:1V (horizontal to vertical) slope to protect adjacent structures and underground utilities (Figure 6). The sidewalls may be sloped steeper than 2H:1V along the northern, western and southern Property boundaries depending on an assessment of sidewall stability at the time of construction. Adjacent sidewalks, if damaged as a result of sidewall sloughing, will be repaired after backfilling is completed.

Verification soil samples will be collected from the base and sidewalls of the excavation once the excavation depth has been reached. Sidewall samples will be collected from each 20-foot linear length of sidewall at the approximate center of the vertical cut. Verification soil samples will be collected from the base of the excavation at the approximate center of 20-foot by 20-foot cells. An estimated total of 3,400 cubic yards of contaminated soil exceeding cleanup levels will be excavated from the Property. The excavated soil will be transported to an off-site, permitted disposal facility as discussed in Section 6.2.3.

As a result of this excavation plan, soil with concentrations of cPAHs exceeding the MTCA Method A cleanup level will remain beneath the Property at depths greater than 6 feet bgs, and at shallower depths adjacent to one or more of the Property boundaries. This aspect of the preferred alternative is supported by the DCA (Appendix A), which indicates that the cost of removing all contaminated soil within the Property boundary to the standard point of compliance (15 feet bgs) is disproportionate to the incremental benefits. The DCA was completed in accordance with WAC 173-340-360.

6.2.3. Soil Transport and Disposal

The excavated soil will be managed and disposed in accordance with applicable requirements of the MTCA Cleanup Regulation, Washington State Solid Waste Handling Standards, WAC 173-350, and Washington State Dangerous Waste Regulations, WAC 173-303. The excavated soil is expected to be classified as either non-hazardous/non-dangerous waste, suitable for disposal at a Subtitle D landfill, or hazardous/dangerous waste requiring either: (a) disposal at a Subtitle C facility, or (b) treatment followed by disposal at a Subtitle D landfill. Based on the existing soil analytical data, it is anticipated that the majority of excavated soil will be classified as non-hazardous/non-dangerous waste. Previously detected lead and mercury concentrations in a limited number of soil samples indicate that some excavated soil may be classified as hazardous/dangerous waste based on the toxicity characteristic defined in WAC 173-303-090(8). Samples of this soil will be collected and analyzed using the Toxicity Characteristic Leaching Procedure (Environmental Protection Agency Test Method 1311) for waste designation purposes. Following waste designation, profiling, and acceptance by the permitted disposal facility, the excavated soil will be loaded onto trucks and transported to the disposal facility.

6.2.4. Site Restoration

The remedial excavation will be backfilled with clean, imported structural fill and compacted to meet the Property owner's needs. Excavated areas will be restored to match the approximate existing grade. The final grade will be finished with crushed rock, gravel, or other suitable material to prevent erosion.

6.2.5. Institutional Controls

Following completion of excavation and site restoration activities, a restrictive (environmental) covenant will be prepared and submitted as a draft to Ecology for review. Following approval by Ecology, the restrictive (environmental) covenant will be recorded with the appropriate land planning agency.

6.2.6. Compliance Monitoring

Compliance monitoring will be performed in accordance with WAC 173-340-410. The compliance monitoring will include the following:

- Protection monitoring to confirm that human health and the environment are protected during the construction phase of the cleanup action;
- Performance monitoring to confirm that the cleanup action has met cleanup standards; and
- Confirmational monitoring to confirm the long-term effectiveness of the cleanup action.

Protection monitoring will be performed during the cleanup action in accordance with the existing Site Health and Safety Plan, which will be updated to include construction-related hazards. Additionally, construction controls and protection monitoring will be implemented as necessary to meet the requirements of applicable Thurston County and City of Olympia permits.

Performance monitoring will include documentation of the physical limits of the excavated areas and verification soil sampling to assess concentrations of COCs at the limits of excavation. Verification soil samples will be collected and analyzed from the base and sidewalls of the excavation to document the concentrations of COCs in soil at the final excavation limits. The verification samples will be collected from locations where field screening evidence suggests contamination may be present, or if no such evidence exists, the samples will be collected from base and sidewalls of the excavation. All verification soil samples will be analyzed for the COCs identified in Section 5.1.

Confirmational monitoring will consist of one year of quarterly groundwater monitoring for cPAHs, the only soil COC that is also a COC in groundwater. Wells to be monitored include existing off-Property monitoring wells MW-6 and MW-10 and the new monitoring wells to be installed on the Property following completion of excavation and site restoration. If the groundwater monitoring results indicate that further monitoring is necessary, additional plans for long-term monitoring will be developed and discussed with Ecology. Future compliance groundwater monitoring will be conducted in accordance with a plan to be developed and submitted to Ecology for review.

6.3. Permits/Regulatory Requirements

Permits and regulatory requirements that will need to be obtained or met prior to implementing the cleanup action include the following:

Thurston County Construction Permit. A construction permit is required by Thurston County for grading work that involves more than 50 cubic yards of excavation or fill. The submittal requirements consist of the Master Application, the Construction Permit Supplemental Application, and plans and specifications detailing the proposed work, including an engineering design (required for excavation or fill quantities exceeding 500 cubic yards) and an erosion control plan.

State Environmental Policy Act Review. The SEPA review provides a way to identify possible environmental impacts that may result from governmental decisions. These decisions may be related to issuing permits for private projects, constructing public facilities, or adopting regulations, policies or plans. Information provided during the SEPA review process helps agency decision-makers, applicants, and the public understand how a proposal will affect the environment. Any proposal that requires a state or local agency decision to license, fund, or undertake a project, or the proposed adoption of a policy, plan, or program, can trigger environmental review under SEPA (see WAC 197-11-704 for a complete definition of agency action). The SEPA review is a required part of the Thurston County construction permit for quantities of grading, fill, and excavation exceeding 500 cubic yards of material. The submittal requirements consist of a completed SEPA checklist.

It is anticipated that a City of Olympia street use permit and traffic control plan also will be required. Permitting and regulatory requirements will be further defined during development of construction plans and specifications.

6.4. Schedule

The cleanup action is currently scheduled to be conducted in 2012 pending review and approval of applicable permits and regulatory requirements by Ecology, Thurston County, and the City of Olympia.

7.0 REFERENCES

Environmental Partners, Inc. (EPI), 2006. “Historical Review and Focused Baseline Environmental Assessment., Parcels 7850-02-00100, 9900-00-06800, and 9900-08-32500 in Thurston County, 320 Columbia Street NW, Olympia, Washington.” September 13, 2006.

GeoEngineers, Inc., 2010. “Supplemental Site Investigation Report, Former Columbia Street Manufactured Gas Plant Property, Olympia, Washington.” GEI File No. 0186-774-00, January 29, 2010.

GeoEngineers, Inc., 2011a. “Data Summary Report, Former Olympia Manufactured Gas Plant Site, Olympia, Washington.” GEI File No. 0186-774-00, October 17, 2011.

GeoEngineers, Inc., 2011b. “Groundwater Monitoring Technical Memorandum, July 2011 Monitoring Event, PSE Former Olympia MGP Site, 320 Columbia Street NW, Olympia, Washington.” GEI File No. 0186-774-00, Task 0400, September 20, 2011.

TABLES

Table 1

Proposed Cleanup Levels for Soil and Groundwater

Former Olympia Manufactured Gas Plant Site

Olympia, Washington

Constituent of Concern	Soil Cleanup Level [1]	Soil Cleanup Level Units	Groundwater Cleanup Level [2]	Groundwater Cleanup Level Units
Benzene	0.03	mg/kg	--	--
Gasoline-Range Total Petroleum Hydrocarbons	30 [3]	mg/kg	--	--
Lube Oil-Range Total Petroleum Hydrocarbons	2,000	mg/kg	--	--
cPAHs (TEC)	0.1	mg/kg	0.1	ug/l
Lead	250	mg/kg	--	--
Mercury	2	mg/kg	--	--

Notes:

[1] Listed soil cleanup levels are based on MTCA Method A soil cleanup levels for unrestricted land use (WAC 173-340-740[2]).

[2] Listed groundwater cleanup levels are based on MTCA Method A cleanup levels for potable groundwater (WAC 173-340-720[3]).

[3] MTCA Method A cleanup level for gasoline-range petroleum hydrocarbons when benzene is present.

-- = The analyte is not a constituent of concern in the listed medium; therefore, a cleanup level was not developed for the cleanup action.

cPAHs = Carcinogenic polycyclic aromatic hydrocarbons

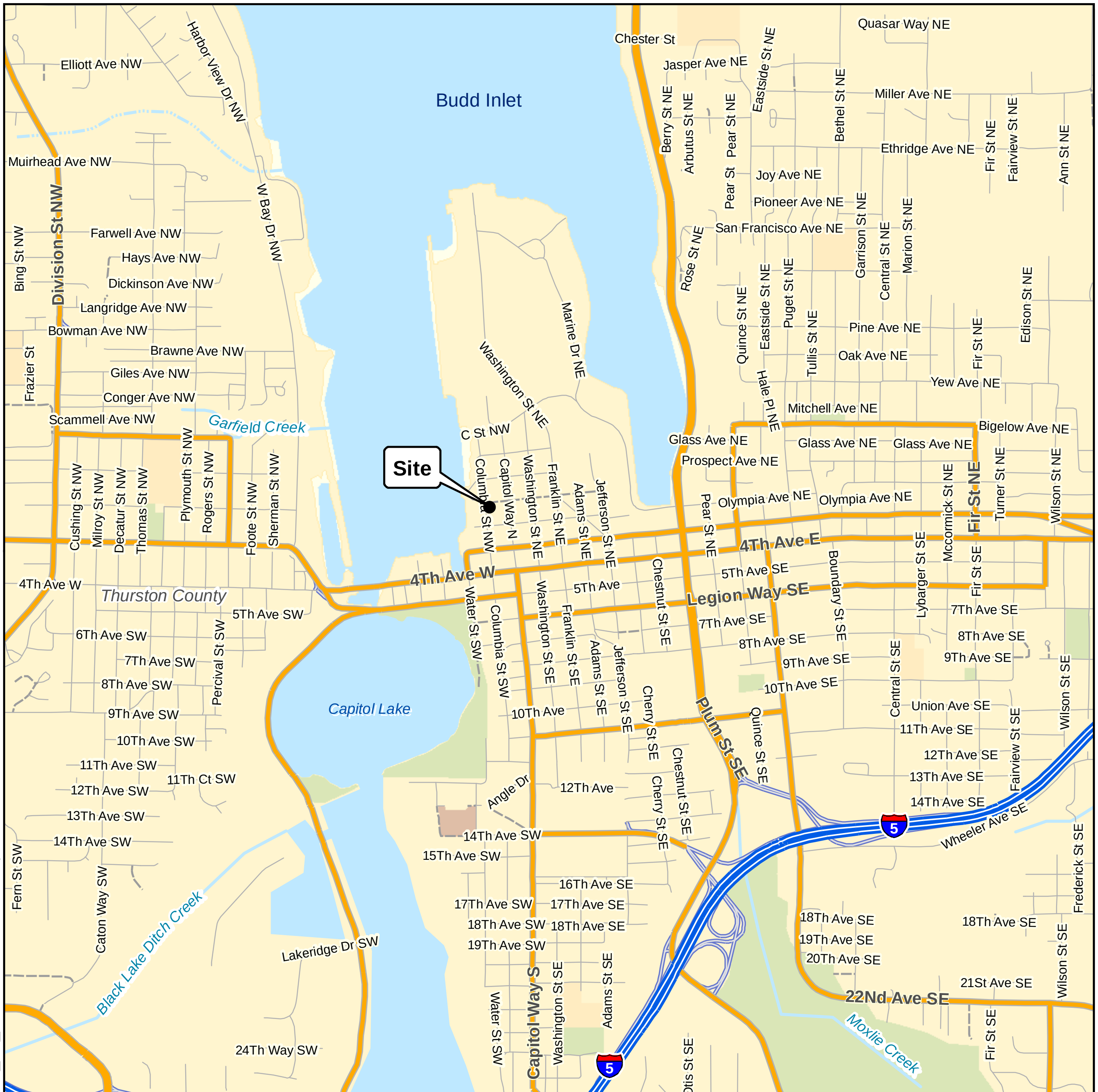
TEC = Total toxic equivalent concentration calculated per WAC 173-340-708[8][e][iii][A].

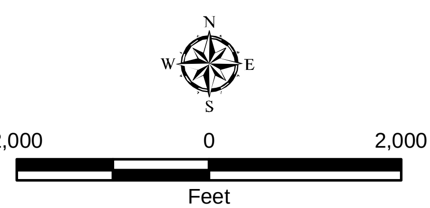
MTCA = Washington State Model Toxics Control Act

mg/kg = Milligrams per kilogram

ug/l = Micrograms per liter

FIGURES





Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: ESRI Data & Maps, Street Maps 2005

Transverse Mercator, Zone 10 N North, North American Datum 1983
North arrow oriented to grid north

Vicinity Map

Former Olympia MGP Site
Olympia, Washington

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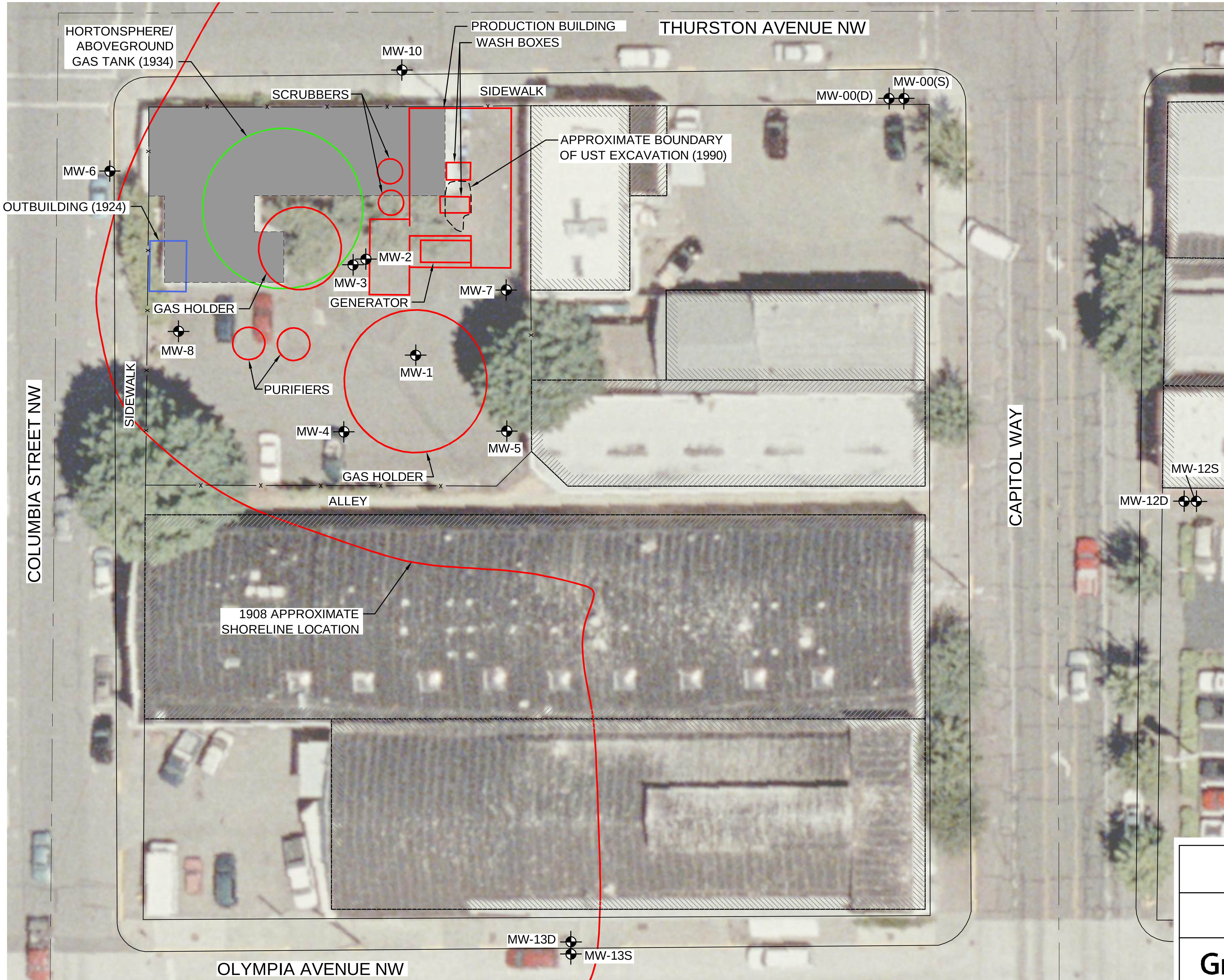
Figure 1

Office: SEA Path: \\seal\projects\0\0186774\GIS\018677400_F1_VM.mxd Map Revised: 14 October 2011 amanza



Legend

- 1908 Site facilities / features
- Existing building
- Former office building (demolished 10/2009)
- Existing fence
- Monitoring well

N E S W

30 0 30
FEET

Notes

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Reference: Base aerial image from USGS Seamless Imagery Server.

Existing and Historical Features

Former Olympia MGP Site
Olympia, Washington

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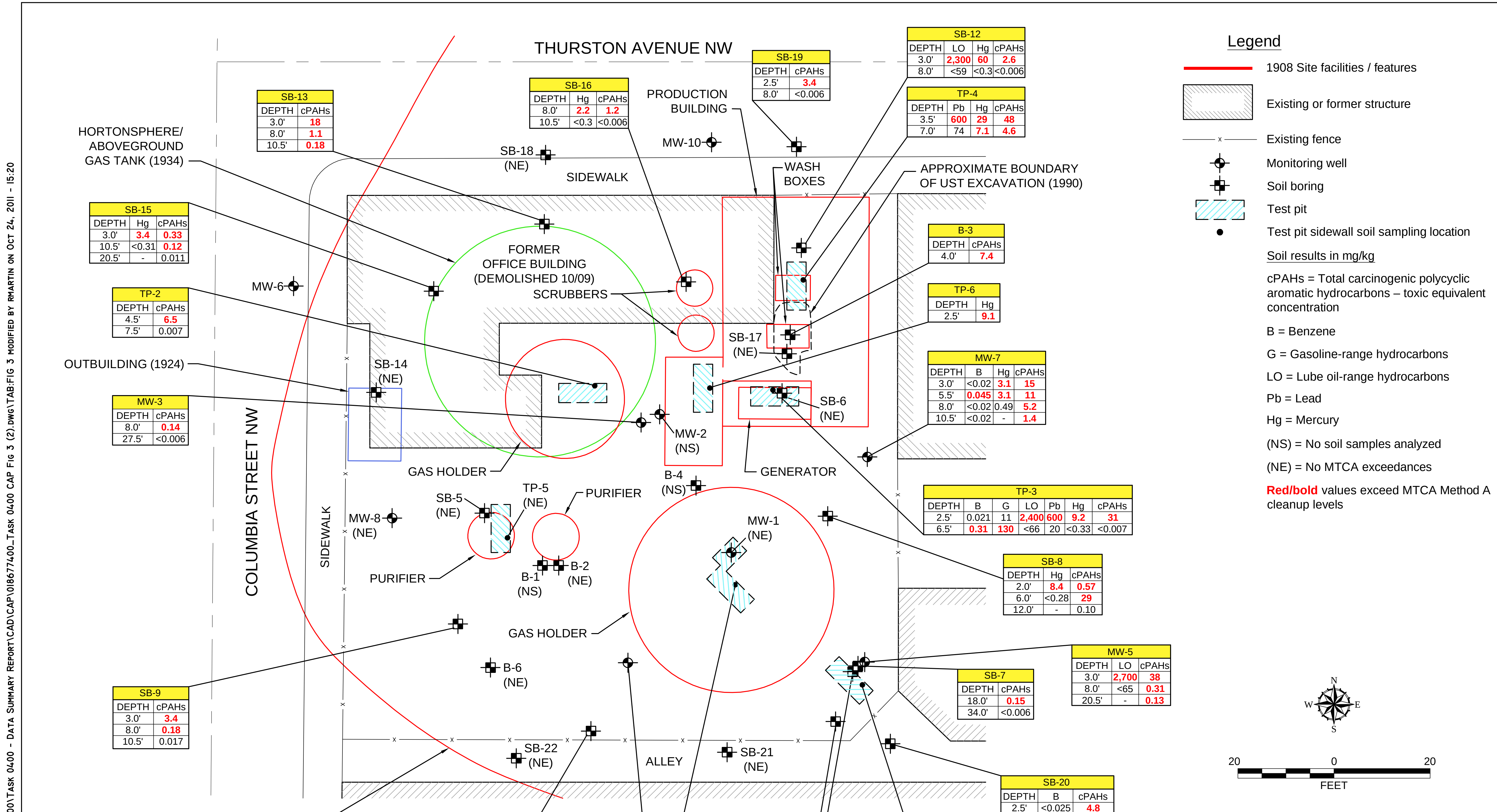
Figure 2

\\SEA\PROJECTS\0\0186774\00\TASK 0400 - DATA SUMMARY REPORT\CAD\CAP\018677400_TASK 0400 CAP FIG 2.DWG\TAB:F2 MODIFIED BY TMICHAUD ON OCT 16, 2011 - 17:24



SB-13

DEPTH	cPAHs
3.0'	**18**
8.0'	**1.1**
10.5'	**0.18**

SB-16

DEPTH	Hg	cPAHs
8.0'	**2.2**	**1.2**
10.5'	<0.3	<0.006

SB-19

DEPTH	cPAHs
2.5'	**3.4**
8.0'	<0.006

SB-12

DEPTH	LO	Hg	cPAHs
3.0'	**2,300**	**60**	**2.6**
8.0'	<59	<0.3	<0.006

TP-4

DEPTH	Pb	Hg	cPAHs
3.5'	**600**	**29**	**48**
7.0'	74	**7.1**	**4.6**

SB-15

DEPTH	Hg	cPAHs
3.0'	**3.4**	**0.33**
10.5'	<0.31	**0.12**
20.5'	-	0.011

TP-2

DEPTH	cPAHs
4.5'	**6.5**
7.5'	0.007

MW-3

DEPTH	cPAHs
8.0'	**0.14**
27.5'	<0.006

B-3

DEPTH	cPAHs
4.0'	**7.4**

TP-6

DEPTH	Hg
2.5'	**9.1**

MW-7

DEPTH	B	Hg	cPAHs
3.0'	<0.02	**3.1**	**15**
5.5'	**0.045**	**3.1**	**11**
8.0'	<0.02	0.49	**5.2**
10.5'	<0.02	-	**1.4**

TP-3

DEPTH	B	G	LO	Pb	Hg	cPAHs
2.5'	0.021	11	**2,400**	**600**	**9.2**	**31**
6.5'	**0.31**	**130**	<66	20	<0.33	<0.007

SB-8

DEPTH	Hg	cPAHs
2.0'	**8.4**	**0.57**
6.0'	<0.28	**29**
12.0'	-	0.10

MW-5

DEPTH	LO	cPAHs
3.0'	**2,700**	**38**
8.0'	<65	**0.31**
20.5'	-	**0.13**

SB-7

DEPTH	cPAHs
18.0'	**0.15**
34.0'	<0.006

SB-9

DEPTH	cPAHs
3.0'	**3.4**
8.0'	**0.18**
10.5'	0.017

SB-20

DEPTH	B	cPAHs
2.5'	<0.025	**4.8**
8.0'	<0.025	**0.36**
10.5'	**1.0**	**0.15**
15.5'	-	0.031

SB-10

DEPTH	cPAHs
5.5'	**1.2**
10.5'	0.012

MW-4

DEPTH	Pb	cPAHs
4.0'	**330**	**0.38**
6.0'	<5.3	<0.005

B-5

DEPTH	cPAHs
4.0'	**120**

TP-1

DEPTH	Pb	cPAHs
3.0'	**310**	**2.3**
4.0'	-	0.007

SB-11

DEPTH	cPAHs
3.0'	**0.92**
8.0'	<0.006

TP-7

DEPTH	B	LO	Pb	cPAHs
4.0'	**0.28**	**3,900**	**2,800**	**120**
7.0'	<0.020	71	18	**1.4**

Notes

1. Only data for constituents exceeding MTCA Method A cleanup levels at each sampling location are shown in this figure, including data from the shallowest sample with no exceedances where such data exist.
2. The locations of all features shown are approximate.
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Constituents Detected Above MTCA Method A Cleanup Levels in Soil

Former Olympia MGP Site
Olympia, Washington

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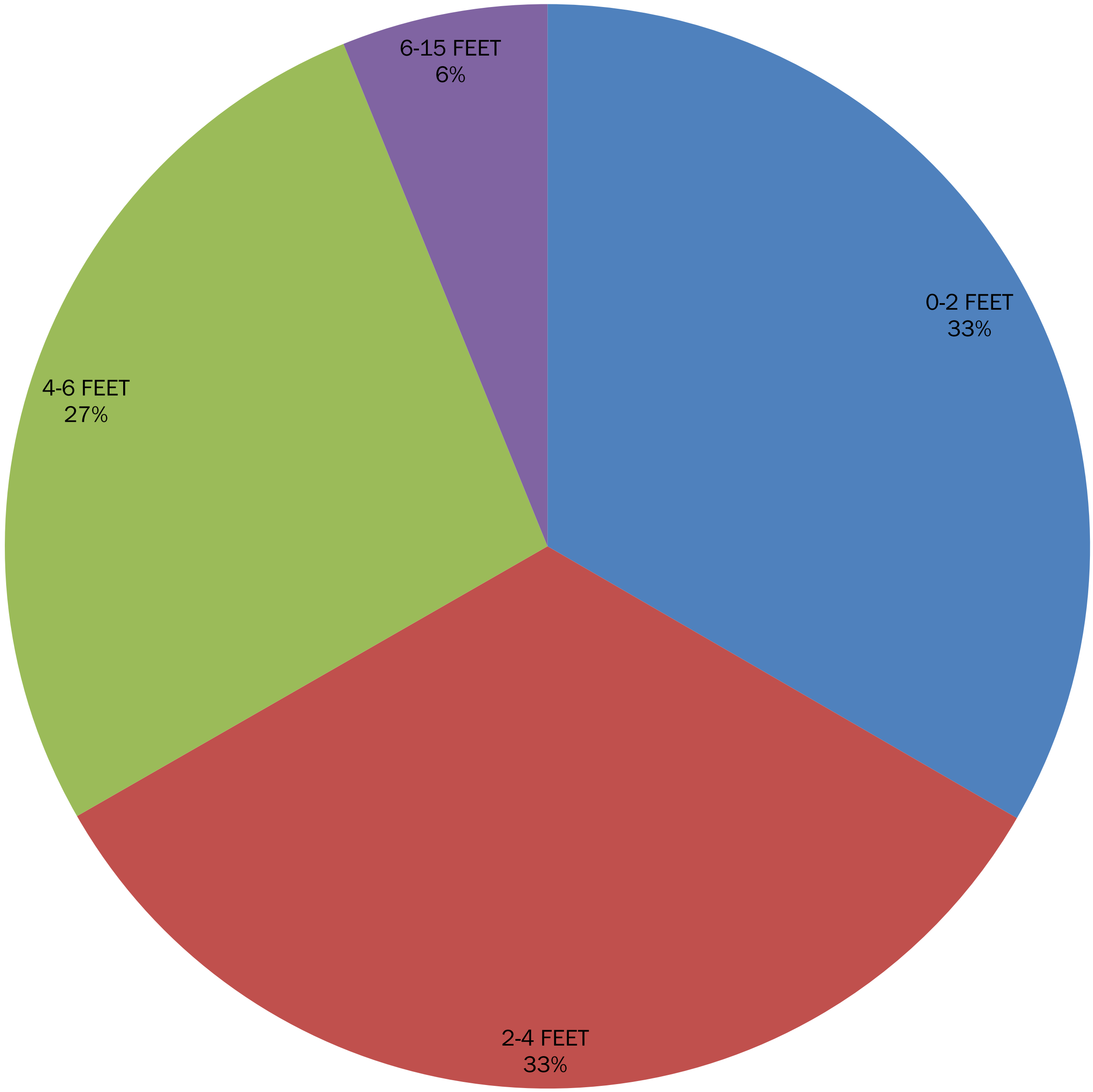
Figure 3

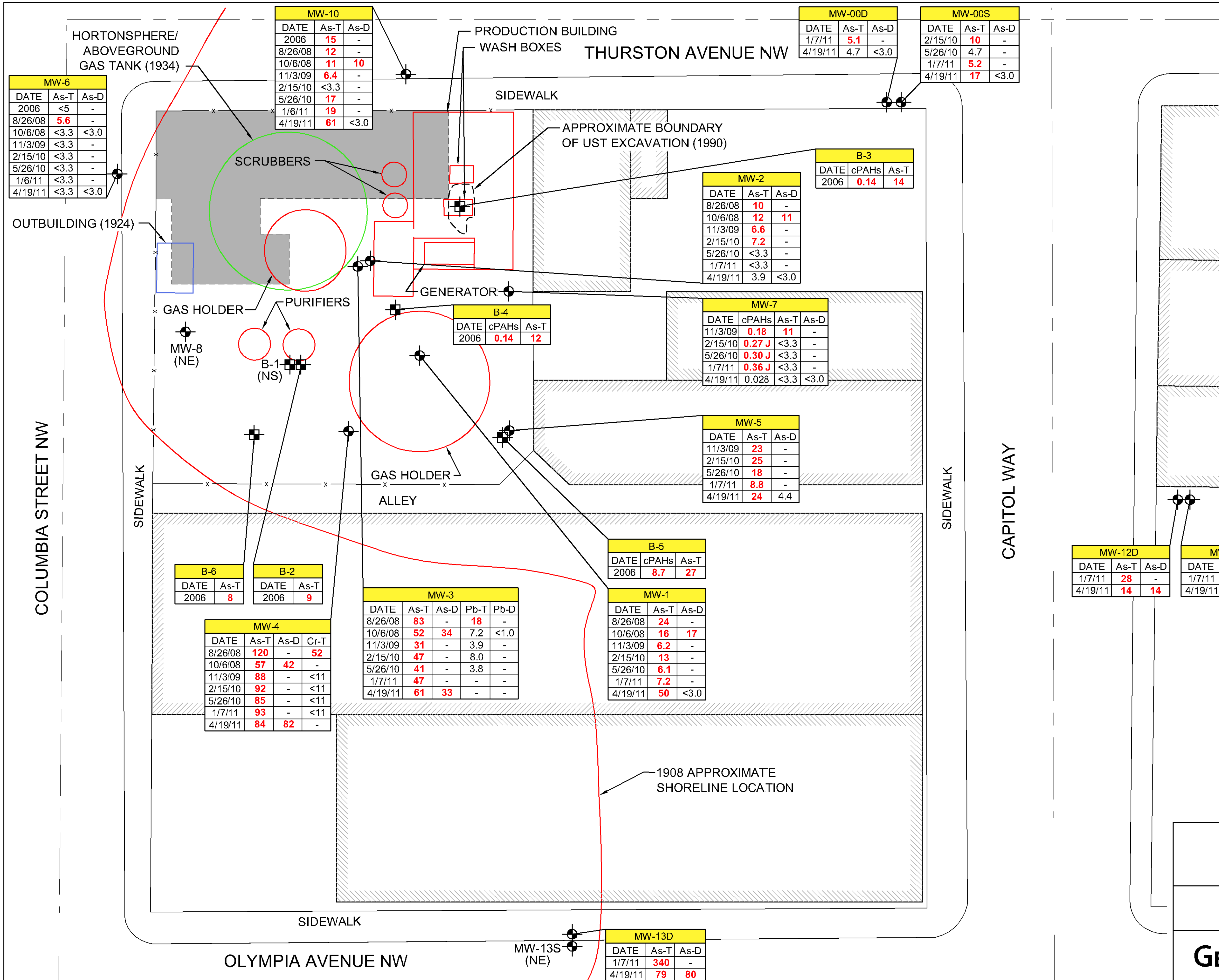


Calculated Relative Mass of Total cPAHs by Depth Below Ground Surface

Former Olympia MGP Site
Olympia, Washington

GeoEngineers

Figure 4



MW-10

DATE	As-T	As-D
2006	**15**	-
8/26/08	**12**	-
10/6/08	**11**	**10**
11/3/09	**6.4**	-
2/15/10	<3.3	-
5/26/10	**17**	-
1/6/11	**19**	-
4/19/11	**61**	<3.0

MW-6

DATE	As-T	As-D
2006	<5	-
8/26/08	**5.6**	-
10/6/08	<3.3	<3.0
11/3/09	<3.3	-
2/15/10	<3.3	-
5/26/10	<3.3	-
1/6/11	<3.3	-
4/19/11	<3.3	<3.0

MW-00D

DATE	As-T	As-D
1/7/11	**5.1**	-
4/19/11	4.7	<3.0

MW-00S

DATE	As-T	As-D
2/15/10	**10**	-
5/26/10	4.7	-
1/7/11	**5.2**	-
4/19/11	**17**	<3.0

B-3

DATE	cPAHs	As-T
2006	**0.14**	**14**

MW-2

DATE	As-T	As-D
8/26/08	**10**	-
10/6/08	**12**	**11**
11/3/09	**6.6**	-
2/15/10	**7.2**	-
5/26/10	<3.3	-
1/7/11	<3.3	-
4/19/11	3.9	<3.0

B-4

DATE	cPAHs	As-T
2006	**0.14**	**12**

MW-7

DATE	cPAHs	As-T	As-D
11/3/09	**0.18**	**11**	-
2/15/10	**0.27 J**	<3.3	-
5/26/10	**0.30 J**	<3.3	-
1/7/11	**0.36 J**	<3.3	-
4/19/11	0.028	<3.3	<3.0

MW-5

DATE	As-T	As-D
11/3/09	**23**	-
2/15/10	**25**	-
5/26/10	**18**	-
1/7/11	**8.8**	-
4/19/11	**24**	4.4

B-5

DATE	cPAHs	As-T
2006	**8.7**	**27**

B-6

DATE	As-T
2006	**8**

B-2

DATE	As-T
2006	**9**

MW-4

DATE	As-T	As-D	Cr-T
8/26/08	**120**	-	**52**
10/6/08	**57**	**42**	-
11/3/09	**88**	-	<11
2/15/10	**92**	-	<11
5/26/10	**85**	-	<11
1/7/11	**93**	-	<11
4/19/11	**84**	**82**	-

MW-3

DATE	As-T	As-D	Pb-T	Pb-D
8/26/08	**83**	-	**18**	-
10/6/08	**52**	**34**	7.2	<1.0
11/3/09	**31**	-	3.9	-
2/15/10	**47**	-	8.0	-
5/26/10	**41**	-	3.8	-
1/7/11	**47**	-	-	-
4/19/11	**61**	**33**	-	-

MW-1

DATE	As-T	As-D
8/26/08	**24**	-
10/6/08	**16**	**17**
11/3/09	**6.2**	-
2/15/10	**13**	-
5/26/10	**6.1**	-
1/7/11	**7.2**	-
4/19/11	**50**	<3.0

MW-12D

DATE	As-T	As-D
1/7/11	**28**	-
4/19/11	**14**	**14**

MW-12S

DATE	As-T	As-D
1/7/11	**5.2**	-
4/19/11	**29**	<3.0

MW-13D

DATE	As-T	As-D
1/7/11	**340**	-
4/19/11	**79**	**80**

Legend

- 1908 Site facilities / features
- Existing building
- Former office building (demolished 10/2009)
- Existing fence
- Monitoring well
- Soil boring; groundwater grab samples collected from upper 4-6 ft of saturated zone

Groundwater results in ug/l

As-T = Total arsenic

As-D = Dissolved arsenic

Pb-T = Total lead

Pb-D = Dissolved lead

Cr-T = Total chromium

cPAHs = Total carcinogenic polycyclic aromatic hydrocarbons - toxic equivalent concentration

J = Estimated concentration

(NS) = No groundwater samples analyzed

(NE) = No MTCA exceedances

Red/bold values exceed MTCA Method A cleanup levels

Notes

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Constituents Detected Above MTCA Method A Cleanup Levels in Groundwater

Former Olympia MGP Site
Olympia, Washington

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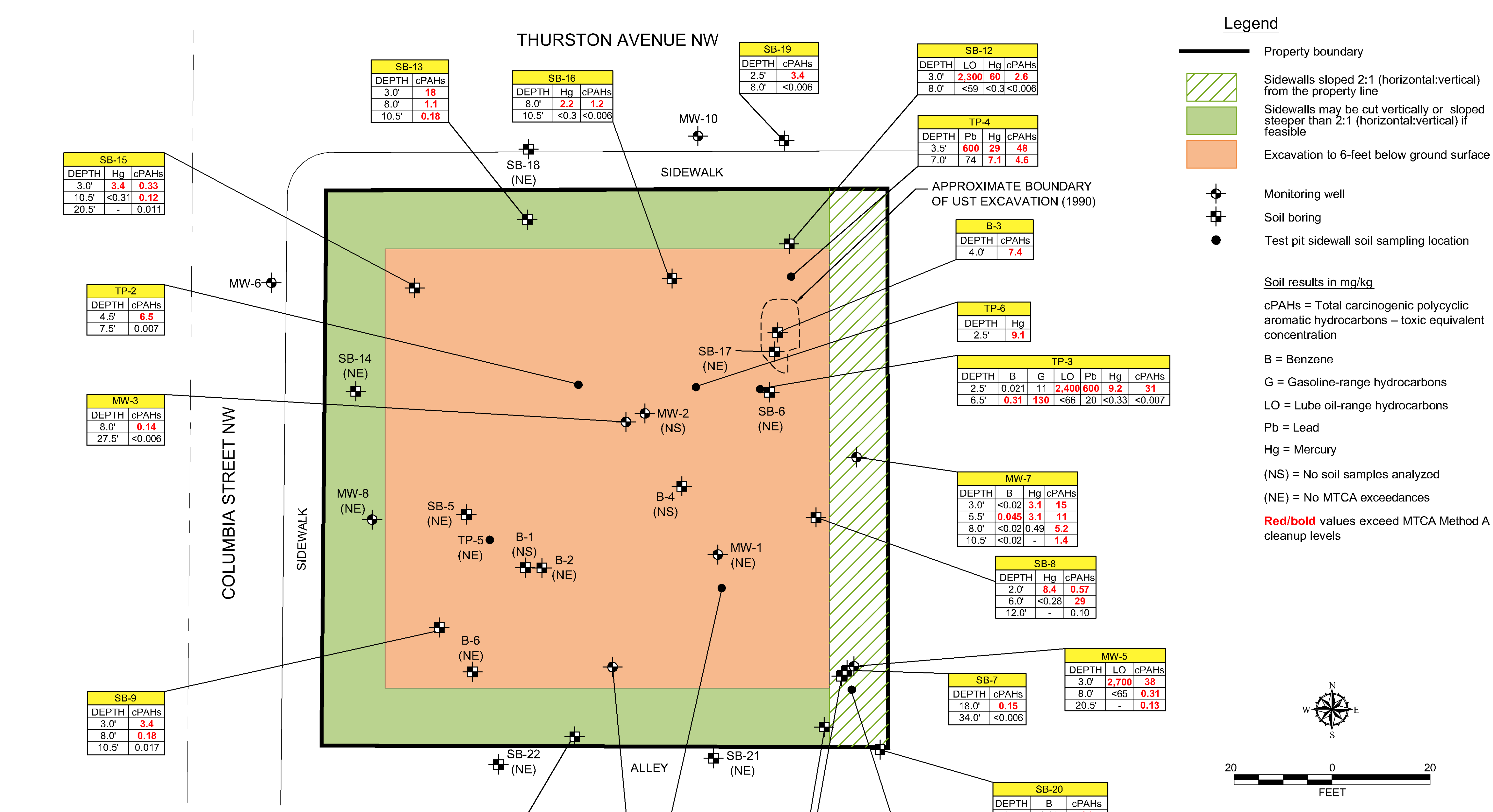
Figure 5

W:\SEATTLE\PROJECTS\0\0186774\00\TASK 0400 - DATA SUMMARY REPORT, CAP, GW MON\CAD\CAP\20120522\0186774 00_TASK 0400 CAP 5.DWG\TAB:F5 MODIFIED BY CVANSLYKE ON MAY 22, 2012 - 15:56



SB-13

DEPTH	cPAHs
3.0'	**18**
8.0'	**1.1**
10.5'	**0.18**

SB-16

DEPTH	Hg	cPAHs
8.0'	**2.2**	**1.2**
10.5'	<0.3	<0.006

SB-19

DEPTH	cPAHs
2.5'	**3.4**
8.0'	<0.006

SB-12

DEPTH	LO	Hg	cPAHs
3.0'	**2,300**	**60**	**2.6**
8.0'	<59	<0.3	<0.006

TP-4

DEPTH	Pb	Hg	cPAHs
3.5'	**600**	**29**	**48**
7.0'	74	**7.1**	**4.6**

SB-15

DEPTH	Hg	cPAHs
3.0'	**3.4**	**0.33**
10.5'	<0.31	**0.12**
20.5'	-	0.011

B-3

DEPTH	cPAHs
4.0'	**7.4**

TP-2

DEPTH	cPAHs
4.5'	**6.5**
7.5'	0.007

TP-6

DEPTH	Hg
2.5'	**9.1**

TP-3

DEPTH	B	G	LO	Pb	Hg	cPAHs
2.5'	0.021	11	**2,400**	**600**	**9.2**	**31**
6.5'	**0.31**	**130**	<66	20	<0.33	<0.007

MW-3

DEPTH	cPAHs
8.0'	**0.14**
27.5'	<0.006

MW-7

DEPTH	B	Hg	cPAHs
3.0'	<0.02	**3.1**	**15**
5.5'	**0.045**	**3.1**	**11**
8.0'	<0.02	0.49	**5.2**
10.5'	<0.02	-	**1.4**

SB-8

DEPTH	Hg	cPAHs
2.0'	**8.4**	**0.57**
6.0'	<0.28	**29**
12.0'	-	0.10

MW-5

DEPTH	LO	cPAHs
3.0'	**2,700**	**38**
8.0'	<65	**0.31**
20.5'	-	**0.13**

SB-7

DEPTH	cPAHs
18.0'	**0.15**
34.0'	<0.006

SB-9

DEPTH	cPAHs
3.0'	**3.4**
8.0'	**0.18**
10.5'	0.017

SB-20

DEPTH	B	cPAHs
2.5'	<0.025	**4.8**
8.0'	<0.025	**0.36**
10.5'	**1.0**	**0.15**
15.5'	-	0.031

SB-10

DEPTH	cPAHs
5.5'	**1.2**
10.5'	0.012

MW-4

DEPTH	Pb	cPAHs
4.0'	**330**	**0.38**
6.0'	<5.3	<0.005

B-5

DEPTH	cPAHs
4.0'	**120**

TP-1

DEPTH	Pb	cPAHs
3.0'	**310**	**2.3**
4.0'	-	0.007

SB-11

DEPTH	cPAHs
3.0'	**0.92**
8.0'	<0.006

TP-7

DEPTH	B	LO	Pb	cPAHs
4.0'	**0.28**	**3,900**	**2,800**	**120**
7.0'	<0.020	71	18	**1.4**

Notes

1. Only data for constituents exceeding MTCA Method A cleanup levels at each sampling location are shown in this figure, including data from the shallowest sample with no exceedances where such data exist.
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Soil Analytical Data and Remedial Excavation Approach

Former Olympia MGP Site
Olympia, Washington

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Figure 6

APPENDICES

Appendix A
Disproportionate Cost Analysis

APPENDIX A
DISPROPORTIONATE COST ANALYSIS

This document presents the results of a disproportionate cost analysis (DCA) completed for Puget Sound Energy's (PSE) former Olympia manufactured gas plant (MGP) property at 320 Columbia Street NW in Olympia, Washington (the "Property"). The results of a feasibility study, presented in the Cleanup Action Plan, identified a preferred cleanup action alternative that is comprised of the following elements:

- Excavation of soil containing concentrations of one or more of the constituents of concern (COCs) exceeding the Washington State Model Toxics Control Act (MTCA) Method A cleanup levels to the maximum extent practicable;
- Disposal of the excavated soil at an off-site permitted facility; and
- Implementation of institutional controls.

This cleanup action alternative meets the MTCA threshold requirements to protect human health and the environment, comply with cleanup standards, comply with applicable state and federal laws, and provide for compliance monitoring (WAC 173-340-360[2][a]).

CLEANUP ACTION ALTERNATIVES

The DCA has been prepared in accordance with MTCA to select a cleanup action alternative that is permanent to the maximum extent practicable. The DCA compares the relative benefits and costs of cleanup alternatives to determine whether certain alternatives have incremental costs that are disproportionate to their incremental benefits. MTCA states that the costs of a cleanup action are disproportionate to the benefits of the cleanup action if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the lower cost alternative (WAC 173-340-360[3][c]). Three cleanup action alternatives have been evaluated:

- Alternative 1: Excavation of soil to a maximum depth of 15 feet below ground surface (bgs), as necessary to remove soil with concentrations of carcinogenic polycyclic aromatic hydrocarbons (cPAHs) exceeding the MTCA Method A cleanup level. Fifteen feet is the MTCA standard point of compliance for risk to human health through the direct contact pathway. Excavation to this depth would require dewatering and the use of structural controls to protect the integrity of surrounding buildings, sidewalks and streets.
- Alternative 2: Excavation of soil to a maximum depth of approximately 6 feet bgs, with vertical sidewalls around the Property perimeter. Six feet bgs corresponds to the depth at which groundwater is encountered at the Property during low-water conditions. Trench boxes or other excavation methods would be used to protect the integrity of surrounding buildings, sidewalks and streets.
- Alternative 3: Excavation of soil to a maximum depth of 6 feet bgs using sloped excavation sidewalls around the Property perimeter to protect the integrity of surrounding structures.

Alternative 1

Alternative 1 consists of the excavation of soil within the Property boundaries to a maximum depth of 15 feet bgs to meet the MTCA cleanup levels at the standard soil point of compliance. This alternative would require the use of extensive shoring to protect the structural integrity of adjacent buildings to the east, sidewalks to the west and north, alley to the south, and subsurface utilities located around the perimeter of the Property. Buildings to the east would be supported with underpinning, and all excavation sidewalls would be supported at the property lines using sheet piling or similar shoring. A construction dewatering system would be required to drawdown groundwater levels at the Property by more than 10 feet to facilitate excavation below the water table. The dewatering water would require temporary containment, treatment, sampling and discharge to a local sanitary sewer connection or transportation off-site for disposal. This alternative would require that adjacent property owners provide access to allow for the buildings to be underpinned, which would be located within a few feet of the 15-foot-deep eastern excavation sidewall. The total volume of soil removed under this alternative would be dependent upon the results of compliance soil sampling conducted during the excavation activities. The minimum soil volume to be removed under this alternative would be 3,400 cubic yards; the maximum soil volume would be 8,700 cubic yards.

Alternative 2

Alternative 2 consists of the excavation of soil within the Property boundaries to a maximum depth of 6 feet bgs. This alternative would include underpinning the buildings to the east; however, excavation sidewalls would not be supported with shoring. In lieu of shoring, trench boxes, or other excavation methods, would be used to facilitate excavation with 6-foot vertical sidewalls at the property boundary. The excavation would be backfilled at the property perimeter with controlled-density fill (CDF) to act as a slurry-shoring wall. This alternative would require that adjacent property owners provide access to allow for structural reinforcement of the buildings to the east, which would be located within a few feet of the 6-foot-deep eastern excavation sidewall. The approximate volume of soil removed under this alternative would be 3,400 to 3,500 cubic yards. Under this alternative, soil with concentrations of COCs exceeding the MTCA Method A cleanup level would remain beneath the Property at depths between 6 feet bgs and the standard point of compliance (15 feet bgs). Institutional controls, in the form of an environmental (restrictive) covenant, would be implemented to prevent potential future exposure to this deeper contaminated soil.

Alternative 3

Alternative 3 consists of excavation of soil within the Property boundaries to a maximum depth of 6 feet bgs using sloped sidewalls around the Property perimeter. The sloped sidewalls in alternative 3 would be configured to protect the structural integrity of adjacent buildings. The excavation would be backfilled with imported, structural backfill. The total volume of soil removed under this alternative would be 3,400 cubic yards. Under this alternative, a wedge of soil with concentrations of COCs exceeding the MTCA Method A cleanup level would remain around the perimeter of the Property, and beneath the Property at depths greater than 6 feet bgs. Institutional controls, in the form of an environmental (restrictive) covenant, would be implemented to prevent potential future exposure to this remaining contaminated soil.

MTCA EVALUATION CRITERIA

The MTCA analysis of disproportionate costs is used to determine which cleanup alternative that otherwise meets the threshold requirements is permanent to the maximum extent practicable. Evaluation of Alternatives 1 through 3 is discussed below, and summarized in the bottom half of Table 1. The upper half of Table 1 presents a summary of the remedial alternatives relative to the MTCA threshold criteria for cleanup actions.

Overall Protectiveness

All of the alternatives are protective through the permanent removal of soil containing concentrations of COCs that pose a risk to human health and the environment and, in the case of Alternatives 2 and 3, the implementation of institutional controls to prevent exposure to residual contaminated media. Alternative 1 is slightly more protective than Alternatives 2 and 3 because contaminated soil is removed to the standard point of compliance (15 feet bgs) within the entire Property boundary. However, there are no complete exposure pathways under Alternatives 2 and 3 after the implementation of institutional controls. Although the volume of soil removed under Alternative 3 is slightly less than that of Alternative 2, the alternatives are assigned an equal score for overall protectiveness because the difference in soil volume is negligible when compared to the total volume of soil removed.

Permanence

All of the alternatives result in a permanent reduction in the volume of hazardous substances on the Property through the removal, transportation and off-site disposal of soil containing concentrations of COCs exceeding the MTCA Method A cleanup levels. Alternative 1 is slightly more permanent than Alternatives 2 and 3 because it results in a higher percentage of contaminant mass removal than Alternatives 2 and 3 and does not rely on institutional controls to prevent future exposure. Alternatives 2 and 3 are permanent with the implementation of institutional controls.

Long-Term Effectiveness

All alternatives are effective over the long-term by permanently reducing the volume of hazardous substances on the Property. Alternatives 2 and 3 are scored lower than Alternative 1 for effectiveness because institutional controls are relied on for long-term effectiveness.

Short-Term Risks

The short-term risks associated with Alterative 1 are relatively high because of the depth of the planned excavation (15 feet bgs), which requires shoring and structural building reinforcement to protect the buildings to the east, and streets, sidewalks and underground utilities adjacent to the other Property boundaries. Extensive construction dewatering also will be challenging due to the proximity of the Property to surface water. Groundwater levels would need to be lowered from approximately 5- 6 feet bgs, to the base of the 15-foot-deep excavation. City sidewalks, parking lanes and roads are located on three sides of the Property, and structural controls will be required to protect their integrity, as well as the integrity of any subsurface utilities present beneath these rights-of-way.

Alternative 2 has a slightly increased short-term risk over that of Alternative 3 because of the structural building reinforcement required to protect the adjacent buildings. This reinforcement is needed to facilitate the excavation of 6 foot, vertical sidewalls adjacent to the buildings. Alternative 3 has the smallest short-term risk of the three alternatives because the existing soil beneath the sloped excavation sidewalls will support the adjacent buildings and structures.

Implementability

Alternative 1 requires significant effort in engineering design for the planning and permitting of an excavation with 15 foot vertical sidewalls adjacent to buildings, city rights-of-way and subsurface utilities. A significant effort will be required to protect the structural integrity of these features. The city will likely require a pre-application meeting and a public environmental review of the project prior to approving construction permits. The implementation of Alternatives 1 and 2 will require approval from adjacent property owners to provide access to their property for the construction of structural building reinforcement. Alternative 3 is the most implementable because it does not require access to adjacent properties and although permits from the city will still be required, the planning and design effort is anticipated to be less than that required for Alternatives 1 and 2.

Public Concerns

Some elements of the general public may favor Alternative 1 because it removes more contaminant mass even though Alternatives 2 and 3 are equally protective because of the use of institutional controls. However, the public stakeholders most potentially affected by the cleanup action are the adjacent private property owners and the City of Olympia due to its responsibility to manage public rights-of-way. Alternatives 2 and 3 would pose less concern to adjacent building owners and the City of Olympia because of the reduced potential to affect adjacent properties as a result of excavation instability. In addition, these alternatives are less likely to disrupt adjacent businesses due to the drilling and vibration associated with the installation of shoring (Alternative 1) and building underpinning (Alternative 2).

Costs and Cost Effectiveness

The estimated costs to implement the three alternatives are presented on Table 1. Details comprising the estimated costs are presented in Table 2. Alternative 1 is significantly more costly to implement when compared to Alternatives 2 and 3. The predominant increase in cost of Alternative 1 over Alternatives 2 and 3 is associated with the design and installation of shoring and dewatering. The shoring and dewatering are necessary to excavate up to a maximum depth of 15 feet bgs at any location on the Property, including adjacent to the Property lines. The cost to implement Alternative 2 is slightly higher than that of Alternative 3 because of the need to structurally support adjacent buildings, and carefully excavate vertical sidewalls at the Property boundaries and backfill using CDF. However, Alternative 2 only results in the excavation of an additional 100 cubic yards of soil compared to Alternative 3.

The overall ranking for each remedial alternative is summarized in the table below. The ranking is presented in detail in Table A-1.

REMEDIAL ALTERNATIVES BENEFIT RANKING

Factor	Weighting	Alternative 1		Alternative 2		Alternative 3	
		Rank	Value	Rank	Value	Rank	Value
Protectiveness	0.3	8	2.4	7	2.1	7	2.1
Permanence	0.2	8	1.6	7	1.4	7	1.4
Long-Term Effectiveness	0.2	8	1.6	6	1.2	6	1.2
Short-Term Risk	0.1	4	0.4	6	0.6	7	0.7
Implementability	0.1	4	0.4	5	0.5	7	0.7
Public Concerns	0.1	6	0.6	7	0.7	7	0.7
Sum	**1**	**7.0**		**6.5**		**6.8**	

The relative MTCA scores and estimated costs of each remedial alternative are presented in the chart below. Based on this chart, Alternative 3 is the most permanent solution based on a comparison of costs versus benefits. Alternative 3 provides approximately the same benefits as the other alternatives, but for a substantially lower cost. The incremental costs of Alternative 1 and 2 are disproportionate to their incremental benefits. This DCA supports the selection of Alternative 3 as the preferred remedial alternative for the Property because it is permanent to the maximum extent practicable.

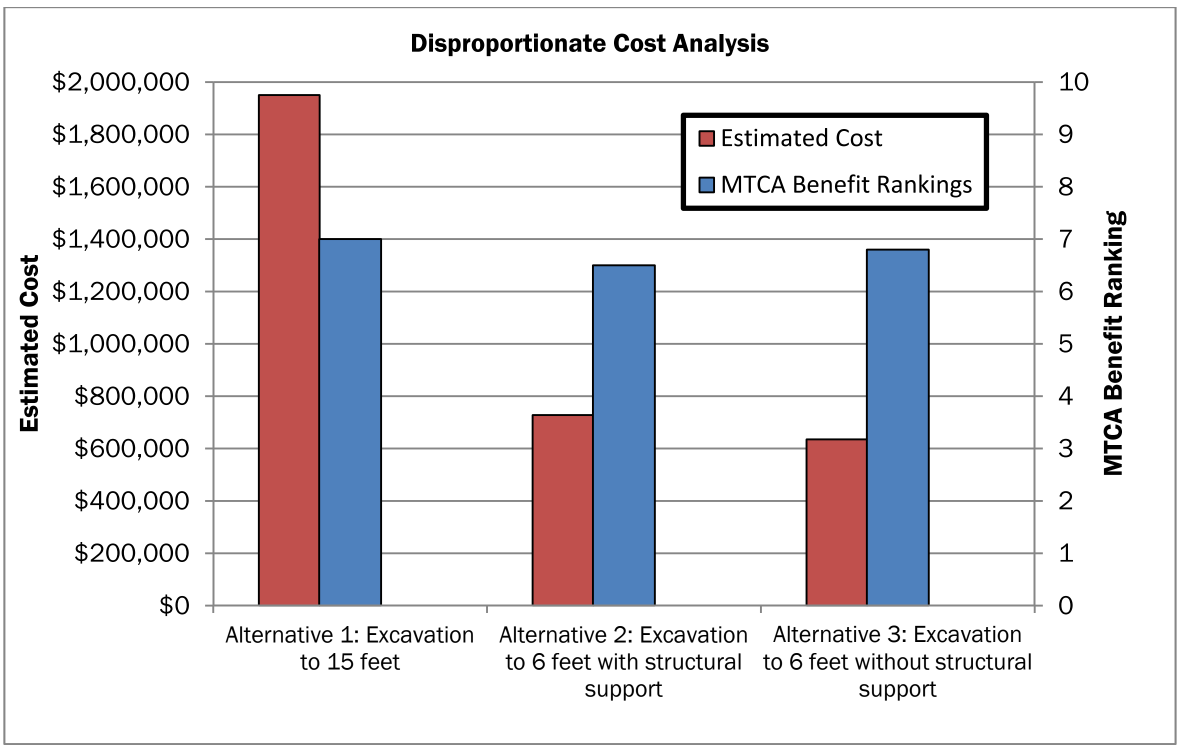

Table A-1

MTCA Evaluation of Cleanup Alternatives
Former Olympia Manufactured Gas Plant Property

Olympia, Washington

Alternative	Alternative 1	Alternative 2	Alternative 3
Description	Soil excavation to maximum depth of 15 feet bgs; underpin buildings to east; shore excavation sidewalls at property line to protect adjacent structures; construction dewatering.	Soil excavation to maximum depth of 6 feet bgs; underpin buildings to east; vertical sidewall excavation using trench boxes or equivalent; institutional controls.	Soil excavation to maximum depth of 6 feet bgs; sloped sidewalls with no underpinning of buildings or excavation shoring; institutional controls.
Volume of Soil Removal (cubic yards)	3,400-8,700	3,400-3,500	3,400
Overall Ranking	7	6.5	6.8
Compliance with MTCA Threshold Criteria			
Protection of Human Health and the Environment	Yes - Alternative 1 will protect human health and the environment by removing contaminated soil to the standard point of compliance (15 feet bgs) based on the human health-direct contact pathway, and removing most or all of the contaminated soil suspected of acting as a source of contamination to groundwater.	Yes - Alternative 2 will protect human health and the environment through the removal of 96% of the estimated total mass of hazardous substances in soil that pose a risk to human health via the direct contact pathway. Most of the soil suspected of acting as a source of contamination to groundwater also will be removed. Institutional controls will be used to mitigate potential exposure to contaminated media left in-place.	Yes - Alternative 3 will protect human health and the environment through the removal of 96% of the estimated total mass of hazardous substances in soil that pose a risk to human health via the direct contact pathway. Most of the soil suspected of acting as a source of contamination to groundwater also will be removed. Institutional controls will be used to mitigate potential exposure to contaminated media left in-place.
Compliance with Cleanup Standards	Yes - Cleanup levels will be met by removing contaminated soil from ground surface to the standard point of compliance (15 feet bgs). This alternative is also assumed to meet the cleanup standards for groundwater within a reasonable time frame following permanent removal of the suspected contamination source to groundwater.	Yes - Cleanup levels will be met in the upper 6 feet and institutional controls will be implemented to prevent exposure to deeper soil. Future site development activities are unlikely to disturb soil deeper than 6 feet bgs. If deeper disturbance is required, a soil handling plan will be produced to support construction actions. This alternative does not remove all contaminated soil that may be acting as a limited and localized source to groundwater on the Property. Exposure to remaining groundwater contamination will be prevented using institutional controls.	Yes - Cleanup levels will be met in the upper 6 feet and institutional controls will be implemented to prevent exposure to deeper soil. Future site development activities are unlikely to disturb soil deeper than 6 feet bgs. If deeper disturbance is required, a soil handling plan will be produced to support construction actions. This alternative does not remove all contaminated soil that may be acting as a limited and localized source to groundwater on the Property. Exposure to remaining groundwater contamination will be prevented using institutional controls.
Compliance with Applicable State and Federal Laws	Yes - Alternative 1 complies with applicable laws.	Yes - Alternative 2 complies with applicable laws.	Yes - Alternative 3 complies with applicable laws.
Provision for Compliance Monitoring	Yes - Alternative 1 includes provisions for compliance monitoring (i.e. compliance soil sampling during excavation and post-excavation groundwater monitoring).	Yes - Alternative includes provisions for compliance monitoring (i.e. compliance soil sampling during excavation and post-excavation groundwater monitoring). To meet the requirements of MTCA, long-term compliance groundwater monitoring will be conducted in accordance with a monitoring plan to be developed for Ecology approval.	Yes - Alternative includes provisions for compliance monitoring (i.e. compliance soil sampling during excavation and post-excavation groundwater monitoring). To meet the requirements of MTCA, long-term compliance groundwater monitoring will be conducted in accordance with a monitoring plan to be developed for Ecology approval.
Restoration Time Frame	Design and implementation is anticipated to take about 1 year. Soil cleanup levels will be achieved on the property as a result of remedial excavation. It is anticipated that groundwater levels will be achieved in 1 to 5 years because the on-property source of groundwater contamination will be removed by excavation.	Soil cleanup levels will be achieved on the property in about 1 year as a result of the remedial action. This alternative may not reduce contaminant concentrations in the isolated area of on-Property groundwater impacts because contaminated soil will remain below 6 feet bgs.	Soil cleanup levels will be achieved on the property in about 1 year as a result of the remedial action. This alternative may not reduce contaminant concentrations in the isolated area of on-Property groundwater impacts because contaminated soil will remain below 6 feet bgs, and at shallower depths along the Property boundaries.

Alternative	Alternative 1	Alternative 2	Alternative 3
Description	Soil excavation to maximum depth of 15 feet bgs; underpin buildings to east; shore excavation sidewalls at property line to protect adjacent structures; construction dewatering.	Soil excavation to maximum depth of 6 feet bgs; underpin buildings to east; vertical sidewall excavation using trench boxes or equivalent; institutional controls.	Soil excavation to maximum depth of 6 feet bgs; sloped sidewalls with no underpinning of buildings or excavation shoring; institutional controls.
Evaluation Criteria			
Protectiveness (30% Weighting Factor)	Score = 8. Alternative achieves highest level of protectiveness relative to Alternatives 2 and 3 because contaminated soil is removed to a depth of 15 feet bgs within the entire Property boundary. This fully addresses the human health-direct contact pathway and likely removes all contaminated soil that is acting as a source of isolated on-Property groundwater impacts.	Score = 7. Alternative achieves medium-high level of protectiveness through permanent removal of more than 96% of the total calculated mass of hazardous substances in soil. Access to soil left in-place after the cleanup and potentially impacted groundwater is restricted through the use of institutional controls.	Score = 7. Alternative achieves medium-high level of protectiveness through permanent removal of more than 96% of the total calculated mass of hazardous substances in soil. Access to soil left in-place after the cleanup and potentially impacted groundwater is restricted through the use of institutional controls.
Permanence (20% Weighting Factor)	Score = 8. Permanently removes contaminated soil exceeding cleanup levels to a depth of 15 feet bgs within the Property boundary, thereby mitigating the direct contact pathway and likely removing the source of contamination to groundwater.	Score = 7. Permanently removes more than 96% of the calculated mass of hazardous substances in soil within the Property boundaries. Exposure to remaining contaminated soil, and potentially remaining contaminated groundwater, will be addressed using institutional controls.	Score = 7. Permanently removes more than 96% of the calculated mass of hazardous substances in soil within the Property boundaries. Exposure to remaining contaminated soil, and potentially remaining contaminated groundwater, will be addressed using institutional controls.
Long-Term Effectiveness (20% Weighting Factor)	Score = 8. Effective over the long-term by permanently reducing the volume of hazardous substances through removal and off-site disposal of contaminated soil.	Score = 6. Relies on a combination of removal and off-site disposal of contaminated soil and long-term maintenance of institutional controls. Less effective than Alternative 1 over the long-term because some contaminated soil is left in-place.	Score = 6. Relies on a combination of removal and off-site disposal of contaminated soil and long-term maintenance of institutional controls. Less effective than Alternative 1 over the long-term because some contaminated soil is left in-place.
Short-Term Risk Management (10% Weighting Factor)	Score = 4. Relatively high short-term risks associated with excavation safety, stability of adjacent structures and transportation of contaminated soil. Excavation would require the design and implementation of engineering measures to ensure stability of adjacent structures, and physical protection of surrounding property. Construction dewatering would require the removal and handling of large volumes of extracted groundwater.	Score = 6. Medium-high short term risks associated with excavation safety, stability of adjacent structures and transportation of contaminated soil. Less short-term risks than Alternative 1 because of smaller soil excavation volume, reduced dependence on engineered structural support features (excavation shoring), and minimal construction dewatering.	Score = 7. Less short-term risks than Alternatives 1 or 2. Excavation stability adjacent to buildings and other structures is achieved by maintaining stable sidewall configurations rather than engineered solutions.
Implementability (10% Weighting Factor)	Score = 4. Would require more complex permitting and engineering design to ensure the protection of adjacent buildings and structures (sidewalks, streets, utilities, etc.). May be difficult to advance sheetpiles due to subsurface obstructions.	Score = 5. Would require permitting and engineering design to ensure the protection of the adjacent buildings and structures during construction. Technical construction considerations are greater than those of Alternative 3 because of the vertical sidewall cuts next to existing structures.	Score = 7. Would require permitting and engineering design to a lesser extent than Alternatives 1 or 2 because no engineered structural support features are used.

Alternative	Alternative 1	Alternative 2	Alternative 3
Description	Soil excavation to maximum depth of 15 feet bgs; underpin buildings to east; shore excavation sidewalls at property line to protect adjacent structures; construction dewatering.	Soil excavation to maximum depth of 6 feet bgs; underpin buildings to east; vertical sidewall excavation using trench boxes or equivalent; institutional controls.	Soil excavation to maximum depth of 6 feet bgs; sloped sidewalls with no underpinning of buildings or excavation shoring; institutional controls.
Public Concerns (10% Weighting Factor)	Score = 6. Removes contaminated soil to the standard soil point of compliance for the protection of human health. Restores property to facilitate re-development. Highest potential to interrupt business operations at adjacent properties due to extensive use of shoring and underpinning of buildings at property line.	Score = 7. Removal of greater than 96% of the total mass of hazardous substances, combined with the use of institutional controls, results in the protection of human health and the environment. Property is restored to facilitate re-development. Alternative 2 has greater certainty about excavation stability, thereby reducing potential to interrupt business operations or transportation on adjacent streets.	Score = 7. Removal of greater than 96% of the total mass of hazardous substances, combined with the use of institutional controls, results in the protection of human health and the environment. Property is restored to facilitate re-development. Alternative 3 has greater certainty about excavation stability, thereby reducing potential to interrupt business operations or transportation on adjacent streets.
Cost	**$1,950,000**	**$728,000**	**$635,000**

Notes:

bgs = below ground surface

Table A-2

Cost Estimate Backup

Former Olympia Manufactured Gas Plant Property

Olympia, Washington

Item	Unit	Unit Cost	Alternative 1 Quantity	Alternative 1 Total Cost	Alternative 2 Quantity	Alternative 2 Total Cost	Alternative 3 Quantity	Alternative 3 Total Cost	Comments
Scenario Number / Description			Soil excavation to maximum depth of 15 feet bgs, use of structural reinforcement of east-adjacent buildings and shoring on all sides of excavation, construction dewatering to facilitate excavation below the water table.		Soil excavation to 6 feet bgs with vertical sidewalls on all sides, structural reinforcement of east-adjacent buildings, use of trench box or equiv. for excavation along east property line. Institutional controls.		Soil excavation to 6 feet bgs, sloped sidewalls with no structural reinforcement of buildings. Institutional controls.		
Design and Planning									
Initial Planning and Scoping	each	LS	1	$17,500	1	$17,500	1	$17,500	$10K geotech; $7.5K estimated environmental
Regulatory Reporting/Planning									
Engineering Design Report (EDR)	each	LS	1	$30,000	1	$25,000	1	$25,000	Est $10K (Alt. 1), $5K (Alts. 2 and 3) geotech; remainder environmental
Compliance Monitoring Plan (CMP)	each	LS	1	$5,000	1	$5,000	1	$5,000	Lump-sum estimate based on best professional judgment (BPJ)
Shoring Design (plans and specs)	each	LS	1	$20,000	1	$10,000	NA	NA	Based on BPJ
Dewatering Design (plans and specs)	each	LS	1	$20,000	NA	NA	NA	NA	Based on BPJ
Aquifer Testing	each	LS	1	$50,000	NA	NA	NA	NA	Includes estimated contractor costs for well installation (2 @ 6 in. dia.), 24-hour pump test, storage and disposal of an estimated 70,000 gallons (~50 gpm) of groundwater to the sanitary sewer, and labor for drilling and pump test observation and preparation of a summary report
Groundwater Characterization	each	LS	1	$5,000	1	$0	1	$0	Estimated labor and analytical costs based on likely permit requirements for Alt. 1. Included in LS construction dewatering cost estimate for Alts. 2 and 3.
Monitoring Well Decommissioning	each	LS	1	$1,500	1	$1,500	1	$1,500	Bid from contractor
Permitting									
Excavation/Grading and Shoring	each	LS	1	$7,500	1	$7,500	1	$5,000	Based on BPJ
Groundwater Discharge	each	LS	1	$7,500	NA	NA	NA	NA	Based on BPJ. Permitting for construction dewatering discharge to POTW for Alt. 1. Off-site disposal (not requiring permits) included in LS construction dewatering cost estimate for Alts. 2 and 3.
Cleanup Action Elements									
Remediation Contractor									
Mobilization	each	LS	1	$10,000	1	$6,000	1	$5,000	Based on contractor cost estimate
Site Access and Security	each	LS	1	$1,500	1	$1,500	1	$1,500	Based on contractor cost estimate
Erosion Control	each	LS	1	$1,500	1	$1,500	1	$1,500	Based on contractor cost estimate
Demolition	each	LS	1	$3,500	1	$3,500	1	$3,500	Based on contractor cost estimate
Underpinnning (two buildings to east)	each	$1,000	24	$24,000	24	$24,000	NA	NA	Assumes 24 4-inch diameter driven piles for Alternatives 1 and 2 and stable cut slopes so underpinning not necessary for Alternative 3. Based on contractor cost estimate.
Shoring Installation/Construction	sq ft	28	23,000	$644,000	NA	NA	NA	NA	Sheetpile shoring will extend to 50 feet deep on all four sides of site for Alt. 1 (50 ' deep x 460 lf = 23,000 sq ft).
Construction Dewatering	each	LS	1	$400,000	1	$25,000	1	$25,000	Alt. 1: based on dewatering system construction/installation and 60 day operation duration at an estimated groundwater flow of 1,000,000 gallons per day, based on k=10-3 to -4 cm/sec or 1,000,000 gal/day. Alts. 2 and 3 based on contractor cost estimate for daily dewatering of accumulated surface/ground water using a trash pump, temporary storage, transport and disposal at SKWMF.
Water Treatment	month	$25,000	3	$75,000	NA	NA	NA	NA	Similar project experience (Clear Water Compliance Services)
Dewatering Discharge	per month	$5,000	3	$15,000	NA	NA	NA	NA	Estimated monthly cost for discharge to the local POTW per public permit information
Concrete Transport & Disposal	tons	$100	30	$3,000	30	$3,000	30	$3,000	Construction debris. Based on contractor cost estimate
Soil Excavation	cubic yd	varies	3,700	$22,200	3,500	$28,000	3,400	$20,400	Based on excavated volume estimates and contractor cost estimate, higher cost for Alt. 2 due to use of trench boxes. Alts. 1 and 3 = $6/cy. Alt. 2 = $8/cy.
Soil Transport & Disposal	tons	$45	6,290	$283,050	5,950	$267,750	5,780	$260,100	Based on contractor cost estimate (assume 1.7 tons/cy)
Backfill & Compaction	cubic yd	varies	4,255	$85,100	4,025	$100,625	3,910	$78,200	Based on excavated volume estimates (with 15% increase over excavated volume to allow for "fluff") and contractor unit costs, higher cost for Alt. 2 because of the use of CDF as backfill around the property perimeter. Structural backfill est. @ $20/cy. Alt. 2 backfill est. @ $25/ton assumes ~180 cy backfill is CDF ($100/cy) and ~3845 cy backfill is structural backfill ($20/cy).
Restoration	each	LS	1	$8,500	1	$8,500	1	$8,500	Based on contractor cost estimate
Sidewalk Replacement	each	LS	NA	NA	1	$6,000	1	$6,000	Based on contractor cost estimate. As necessary if vertical sidwalls on north or west fail, causing damage to the sidewalks.
Observation & Documentation	week	$9,000	8	$72,000	6	$54,000	4	$36,000	Based on detailed cost estimate for labor and expenses of $9000/week.
Laboratory Analytical Costs	each	LS	1	$16,000	1	$16,000	1	$16,000	Lab estimate: 48 for cPAHs, 36 for Gx/BTEX and Dx, 24 for lead and mercury
Reporting	each	LS	1	$18,000	1	$12,000	1	$12,000	Based on detailed cost estimate

		Scenario Number	Alternative 1		Alternative 2		Alternative 3		
		Description	Soil excavation to maximum depth of 15 feet bgs, use of structural reinforcement of east-adjacent buildings and shoring on all sides of excavation, construction dewatering to facilitate excavation below the water table.		Soil excavation to 6 feet bgs with vertical sidewalls on all sides, structural reinforcement of east-adjacent buildings, use of trench box or equiv. for excavation along east property line. Institutional controls.		Soil excavation to 6 feet bgs, sloped sidewalls with no structural reinforcement of buildings. Institutional controls.		
Item	**Unit**	**Unit Cost**	**Quantity**	**Total Cost**	**Quantity**	**Total Cost**	**Quantity**	**Total Cost**	**Comments**
Compliance Groundwater Monitoring									
Monitoring Well Installation	well	$4,500	4	$18,000	4	$18,000	4	$18,000	Unit cost for replacement of on-property monitoirng wells, includes driller, field labor & equip
Sampling and Analysis	yr	$14,000	3	$42,000	3	$42,000	3	$42,000	Quarterly sampling of 6 wells (including 3 new on-property wells and 3 existing off-property wells) for chemical analysis of cPAHs only + annual rpt. (12 total events)
Long Term Sampling & Analysis	each	LS	1	$44,000	1	$44,000	1	$44,000	Assumes long-term groundwater compliance sampling is a requirement of the environmental covenant. Estimates bi-annual sampling for Years 4 and 5 and annual sampling for Years 6 through 20. $3,500/sampling event. Discounted for Net Present Value (rate = 4%). (19 total events).
		Estimated Cost Subtotal		**$1,950,000**		**$728,000**		**$635,000**	

Notes:

bgs = below ground surface

BPJ = Best professional judgement (BPJ): based on experience gleaned from similar activities on similar projects; estimates not based on formal cost estimates

LS = lump-sum

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