REMEDIAL INVESTIGATION WORK PLAN
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA
OLYMPIA, WASHINGTON
ECOLOGY FACILITY/SITE NO. 5785176
AGREED ORDER NO. DE5471

OCTOBER 22, 2008

FOR
PORT OF OLYMPIA

GEOENGINEERS

Remedial Investigation Work Plan
East Bay Redevelopment
Olympia, Washington
File No. 0615-034-07

October 22, 2008

Prepared for:

Port of Olympia
915 Washington Street NE
Olympia, Washington 98501-6931

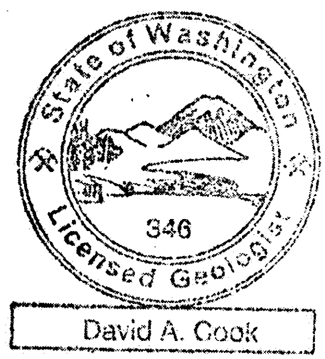
Attention:

Prepared by:

GeoEngineers, Inc.
Plaza 600 Building
600 Stewart Street, Suite 1700
Seattle, Washington 98101
(206) 728-2674

and

Pioneer Technologies Corporation
2612 Yelm Highway SE, Suite B
Olympia, Washington 98501-4826
(360) 570-1700



Jay C. Lucas, LG
Senior Project Manager

David A. Cook, LG, RBP
Principal

Chris Waldron, Principal
Pioneer Technologies Corporation

DAC:JCL:bmw
SEAT:\0\0615034\07\Finals\Revised RI Workplan Oct 08\061503407RI_WP revised 102208.doc

TABLE OF CONTENTS

Page No.

TABLE OF CONTENTS (CONTINUED)

List of Tables

List of Figures

APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

AO	Agreed Order
BGS	Below ground surface
CAP	Cleanup action plan
CLARC	Cleanup Levels and Risk Calculations database
COPCs	Contaminants of potential concern
cPAHs	Carcinogenic polycyclic aromatic hydrocarbons
CSM	Conceptual Site Model
CSEM	Conceptual Site Exposure Model
CSCT	Conceptual Site Contaminant Transport Model
CUL	Cleanup Level
CSL	Cleanup Screening Level
D/F	Dioxns/Furans
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
GPS	Global positioning system
HASP	Health and Safety Plan
LNAP	Light Non-Aqueous Phase Liquid
LOTT	LOTT Alliance
ug/L	Micrograms per liter
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MHHW	Mean higher high water

LIST OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

MLLW	Mean lower low water
MTCA	Model Toxics Control Act
ng/kg	Nanograms per kilogram
NOAA	U.S. National Oceanic and Atmospheric Administration
OC	Organic carbon
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PID	Photoionization detector
Port	Port of Olympia
PVC	Polyvinyl chloride
QAPP	Quality assurance project plan
RI	Remedial investigation
SAP	Sampling and analysis plan
SVOCs	Semivolatile organic compounds
TEF	Toxicity equivalency factor
TEQ	Toxicity equivalent quotient
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons
VCP	Voluntary Cleanup Program
VOCs	Volatile organic compounds
WAC	Washington Administrative Code

REMEDIAL INVESTIGATION WORK PLAN
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA
OLYMPIA, WASHINGTON
FOR
PORT OF OLYMPIA

1.0 INTRODUCTION

This document is a work plan for conducting a Remedial Investigation (RI) at the Port of Olympia's (Port's) 13-acre East Bay Redevelopment Site (Site) located at 315 Jefferson Street NE in Olympia, Washington. The Site is an area in transition from historical lumber milling activity that began in the late 1800s to that of future commercial uses. The Site lies on the south end of the Port Peninsula adjacent to the East Bay of Budd Inlet. The location of the Site relative to surrounding physical features is shown in Figure 1.

This work plan was prepared in compliance with Agreed Order (AO) No. DE5471 and satisfies the requirements for an RI work plan in Chapter 173-340 Washington Administrative Code (WAC). The work plan outlines planned sampling and analysis activities associated with the RI and summarizes results of previous sampling and testing activities. Previous environmental site characterization activities have been completed at the Site and presented to Washington State Department of Ecology (Ecology). Additional information is needed to more fully understand the nature and extent of contamination and the potential risks to human health and the environment, and to evaluate cleanup actions.

The planned elements outlined in this RI work plan will supply the information necessary to move this project forward so that the first phase of redevelopment can be completed. That phase includes an interim action and infrastructure construction (roads and utilities) planned for spring of 2009. This RI work plan relies on (a) past site characterization results (previously presented to Ecology) and (b) newly developed information such as fill histories , geologic cross sections, and groundwater characteristic information to develop the sampling and analysis approach for this RI.

1.1 SITE DESCRIPTION

The East Bay Redevelopment area includes part of Parcel 1 and all of Parcels 2, 3, 4, 5, 6, 7 and 9 and associated near-by infrastructure areas. The Site is shown in Figure 2. As defined in Model Toxics Control Act (MTCA) and stated in the AO, the Site is defined by the extent of contamination caused by the release of hazardous substances at the subject property.

The West and East Bays of Budd Inlet have been dredged, and dredge spoils have been placed as fill on the peninsula since the late 1800s (Figure 3). Most of the Site is situated on fill material. Fill sources or types include dredge spoils, debris derived from historical lumber milling operations (such as wood debris and shredded wood), construction debris (such as concrete, bricks and dimensional lumber), and roadway fill for Marine View Drive and Olympia Avenue.

The Site is relatively flat, with ground surface elevations ranging from approximately 10 to 12 feet (National Geodetic Vertical Datum [NGVD] 29). The northern and western portions of the Site are paved with asphalt, and the southern and eastern portions are covered with crushed rock and bare land vegetated with low grasses. Most of the Site is currently fenced. A rail spur runs along Jefferson Street NE, and a crude road runs along the eastern side of a large former mill warehouse building, which was recently demolished.

1.2 PURPOSE AND OBJECTIVES

The Site is currently under an AO with Ecology. This RI work plan provides a summary of site characterization results completed to date and outlines proposed additional study for the purposes of:

- Characterizing the nature and extent of contamination at the Site;
- Assessing the potential risk to human and ecological receptors; and
- Providing the information that will allow evaluation and selection of cleanup action alternatives.

The project objectives are:

1. Completion of an RI report in general accordance with Chapter 173-340 WAC and AO No. DE-08-TCPSR-5471 and in accordance with Section VII (C) of the AO;
2. Preparation of an interim action work plan and completion of an interim action in accordance with Section VII (A) of the AO that will facilitate infrastructure development (roads and utilities) around the Site; and
3. Preparation of a Feasibility Study (FS) and Cleanup Action Plan (CAP) to facilitate redevelopment of the subject property. Although the information obtained in this (and any subsequent) RI will be used to complete a FS and CAP, a FS and CAP are not part of this AO. A separate AO or consent decree will be negotiated between Ecology and the Port.

1.3 WORK PLAN ORGANIZATION

As described previously, a significant amount of study has been completed at the Site. However, this RI work plan is being used as a document not only to plan for additional study, but also provides new information, such as fill history maps, geologic cross sections, and groundwater monitoring information that supplements the last subsurface characterization (December 20, 2007). For example supplemental groundwater monitoring information and dioxin/furan groundwater testing from MW-16 are summarized below (Section 4.3.2) and included in Appendices A and C.

This work plan includes sections that summarize historical site use, current and future land use, site subsurface conditions, contaminant transport and exposure models and a preliminary conceptual site model (CSM) (Sections 2 through 6, respectively). The information contained in these sections and their associated figures were used to establish the supplemental RI data objectives and tasks described in Section 7. Section 7 and Tables 1 through 3 describe proposed new soil and groundwater explorations and testing. After the supplemental soil and groundwater data are acquired, a risk assessment will be performed to develop cleanup levels and remediation levels as appropriate as outlined in Section 8. References are included in Section 9. This RI work plan also includes a sampling and analysis plan (SAP), quality assurance project plan (QAPP), and health and safety plan (HASP) in Appendices D and E.

1.4 REGULATORY FRAMEWORK

Ecology identified the Port as a “potentially liable person” (PLP) for the Site under RCW 70.105D.020 (21) and RCW 70.105D.040. AO No. DE5471 between Ecology and the Port was issued October 3, 2008 and requires completion of an RI and Interim Action for the Site. The AO was developed cooperatively between the Port and Ecology. The AO outlines the work to be performed and ensures that the Site will be investigated and cleanup alternatives evaluated in a timely fashion in accordance with applicable laws and regulations. The Port performed investigative studies under the MTCA on a voluntary basis with oversight by Ecology prior to and during development of the AO.

2.0 SITE HISTORY

Detailed information describing the Site, including its known history, current uses, existing property features, soil and groundwater conditions and a summary of environmental investigations completed at the Site between 1888 and the present, is presented in a Phase I ESA of the Site (GeoEngineers, March 2007), a Supplemental Site Use History and Soil and Groundwater Sampling Clarifications Report (GeoEngineers, August 2007) and a Draft RI/FS and Conceptual CAP, dated December 20, 2007 (GeoEngineers, December 2007). As outlined in these documents and summarized in the AO, the site history is as follows:

- Historical documents provided to Ecology show that the earliest documented activities on portions of the Site were related to several types of lumber milling operations (such as sawmill, planing mill, shingle mill and veneer/plywood manufacture). Lumber milling operations were conducted under various owners/operators from at least 1888 until about 1968. Historical owners/operators included the St. Paul & Tacoma Lumber Company (mid-1940s through early 1970s, Parcels 2 through 7); Olympia Veneer Company (1924 to mid-1940s, Parcels 1 through 5); Olympia Planing Mill (owned/operated by Springer and White, 1888-1891, Parcel 3); Olympia Sawmill (owned/operated by Allen & Harknes, 1888, Parcel 3); G.S. Allen's Saw Mill (1891, Parcel 3); Olympia Door and Lumber Company's planing mill and the East Side Lumber Company's saw mill (1896, Parcel 3); H.G. Richardson's Shingle Mill (1908, Parcel 3); the Olympia Door Company Sash and Door Factory (1908-1924, Parcel 9); Puget Sound Pipe Company (wooden pipes, 1888-1896, Parcel 1); and the National Wood Pipe Company (1908, Parcels 3 through 6).
- Based on historical maps, the lumber milling operations included various support facilities that included: machine/electrical/repair shops, dry kilns, veneer driers, power plants, hog fuel boilers, transformers, engine rooms, bulk fuel storage areas, blacksmith shops and tar dipping tanks. Also, historical aerial photographs show that logs were rafted in the bay, presumably for transport along Budd Inlet to various sawmills.
- Historical documents also revealed that dredged spoils from Budd Inlet have been placed on the peninsula since 1892. For example, a Sanborn Map dated 1888 indicated that several buildings were present. These buildings were likely constructed on piers that extended over the water and/or mudflats that existed prior to significant filling operations that occurred from 1896 to 1911. The newly reclaimed land is currently known as the Port Peninsula.
- Since lumber milling operations ceased in 1968, the Port and its tenants have used portions of the Site for commercial and light industrial activities and/or storage.

As noted in the AO and previously prepared reports submitted to Ecology, past operations on property that is part of the Site have resulted in the contamination of soil and/or groundwater at levels that exceed the MTCA cleanup standards for all of the following constituents: total petroleum hydrocarbons (TPH), carcinogenic polycyclic aromatic hydrocarbons (cPAHs), chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans (dioxins/furans [D/F]), polychlorinated biphenyls (PCBs) and metals. Additional details regarding the magnitude and extent of these contaminants are provided in later sections of this RI work plan.

Figure 4 shows where these past historical operation areas were located on the Site, and Figure 5 groups the historical operation areas into areas of concern relative to historic shorelines (past fill history). Figure 5 also outlines chemicals of potential concern (COPC) that may be associated with the historic operational areas.

3.0 CURRENT AND FUTURE LAND USE

Current and future land use for the Site can be divided into three general time categories: 1) Current Land Use, 2) Construction Phase, and 3) Future Land Use – Post Construction. Currently the Site is mostly vacant and unused, although boats are currently being stored on a portion of the Site. The construction phase will be temporary and will include excavation and activities typically associated with major development construction projects. Future development plans by the Port and City of Olympia call for construction of buildings, pavement and may include other engineered barriers on top of existing Site soil. The Port recently initiated short platting of the Site into eight parcels (1 through 7 and 9) for sale or lease for redevelopment. Proposed development uses for these parcels are presented in the table below.

East Bay Redevelopment Parcel Details

Parcel Number	Parcel Area (acres)	Proposed Development Use
1	1.6	Mixed Use/Commercial
2	1.2	Mixed Use/Commercial
3	2.7	Mixed Use/Commercial
4	0.83	Public Plaza (Sale to LOTT Alliance pending)
5	1.8	Hands on Children's Museum (HOCM) (Sale to HOCM pending)
6	0.9	Mixed Use/Commercial
7	0.9	Mixed Use/Commercial
9	0.5	Mixed Use/Commercial
Infrastructure	2.5	Roadway and Utility Improvements
Total Area	12.9	—

The area of each parcel is based on drawings provided by Skillings Connolly, dated February 2008, and is subject to change.

Additionally, as outlined in the AO, the Site is immediately west of the LOTT Alliance Wastewater Treatment Plant Expansion ("LOTT Expansion") Site. The LOTT Expansion Site includes the area of the existing LOTT Alliance Budd Inlet Wastewater Treatment Plant (500 Adams Street NE), the parking lot south of the plant, and Parcel 8, as shown in Figure 2. The LOTT Expansion Site is currently enrolled in Ecology's Voluntary Cleanup Program (VCP) because of residual soil and groundwater contamination from former lumber mills (VCP identification number SW0933). Former lumber mill operators on the LOTT Expansion Site include the Olympia Door Company and the Springer Mill Company. Available historical information does not conclusively indicate whether the operational area of the St. Paul & Tacoma Lumber Company (one of the former operators of the Site) included the LOTT Expansion Site. Also, it is not currently believed that contamination from the LOTT Expansion Site and the Site are commingled. Therefore, the LOTT Expansion Site (Parcel 8) is not included in the scope of the AO and is not part of the Site. However, if Ecology determines in writing that adequate evidence exists to support combining the two sites, the LOTT Expansion Site will become part of the Site.

4.0 SITE SUBSURFACE CONDITIONS

4.1 SITE GEOLOGY

Understanding of the geology and fill history beneath the Site is well understood based on compiled data from multiple sources, including historic aerial photographs, Sanborn Fire Insurance Maps, U.S. Army Corps of Engineers dredging maps, and the 65 explorations advanced at the Site by GeoEngineers and others. The approximate locations of the explorations completed at the Site to date (including those completed by others) are shown on Figures 3, 5 and 6. The Site is underlain by fill that varies in thickness from approximately 5 to 15 feet. Native sand, silts, and clays underlie the fill. Locations of geologic cross sections are shown in Figure 6 (cross section locations overview) and Figures 7a to 7f to illustrate the geology beneath the Site.

4.1.1 Fill Materials (Lithologies and Fill Type and Timeframe)

There are four principal fill lithologies beneath the Site that are generally (but not in all cases) listed below from youngest to oldest; or from highest to lowest in the geologic section:

- Silty gravel associated principally with the post-1975 fill. This gravel is exposed along the shoreline bluff where the Site adjoins Budd Inlet.
- Light colored coarse- to fine-grained sand with a trace of silt and occasional gravel, construction debris and localized pockets of wood debris. The wood debris is composed of burnt wood, wood chips, shredded wood and decomposed wood related to former sawmill and log rafting activities.
- Dark colored coarse- to fine-grained sand with wood debris. The wood debris is more prevalent in this fill unit than the light sand fill unit.
- Beneath some portions of the Site, disturbed silt with wood debris separates the fill from the underlying undisturbed native sediments. This is thought to be silt deposited at the base of East Bay in tidal flats and/or by Moxlie Creek, and subsequently mixed with wood debris by natural erosion/deposition and filling activities by humans. This silt could be categorized as both fill and/or native.

Gravel from the post-1975 fill forms the shoreline adjacent to Budd Inlet.

The lithology of fill beneath the Site varies laterally and vertically depending on the age of the fill (the time interval when fill was placed). The fill was placed in five main episodes, with the last fill placed after 1975. Figures 3and 6 show the lateral extent of fill from the five main fill episodes, based on aerial photographs. The principal lithologies associated with the fill episodes are summarized from oldest to youngest below.

- Pre-1891: This fill is present beneath the southwest portion of the Site and appears to consist mostly of the dark sand lithology with some pockets of wood debris and pockets of silt.

- 1891 to 1908: This fill is present beneath much of the central portion of the Site (Figures 3 and 6). Based on historical records, this fill is material dredged from Budd Inlet to deepen the marine channel and consists of a dark brown to black coarse to fine sand.
- 1908 to 1948: This fill is present beneath the northwest portion of the Site and appears to consist mostly of the light sand with pockets of wood debris and pockets of gravel.
- 1948 to 1975: This fill is present beneath the eastern portion of the Site and appears to consist mostly of the light colored sand with pockets of wood debris.
- Post-1975: This fill is present along the eastern portion of the Site along the bay front and appears to consist of a silty sandy gravel.

4.1.2 Native Sediments

Underlying the disturbed silt and is fine- to medium-grained sand that varies in thickness from about 5 to 25 feet and greater. Below the sand is a thick deposit of silt and clay that forms the regional aquitard. The aquitard is not being studied as part of this RI but was described by Pacific Groundwater Group (2007) as part of their study for a nearby property. In that report, the aquitard is described as 45 to 95 feet of fine-grained sediments which, because of its relatively low permeability, is classified as an aquitard. In addition, three deep (75 to 100 feet bgs) cone penetrometer borings were drilled on the Site for geotechnical purposes and confirmed the presence of the aquitard which was at least 30 to 35 feet thick beneath Parcel 3. Two of these borings that were drilled to 89 and 65 feet below ground surface are shown in the geologic cross sections C-C’ and E-E’ (Figures 7c and 7e).

4.2 SITE HYDROGEOLOGY

4.2.1 Groundwater Occurrence

Groundwater beneath the Site occurs in a shallow unconfined aquifer. Depth to groundwater varies from 1 to 9 feet below ground surface (bgs) based on measurements from a groundwater monitoring well network consisting of 20 wells. The shallow aquifer is separated from deeper artesian aquifers by a thick (45- to 95-foot) layer of lower permeable silts and clays that compose the regional aquitard. Because the natural water flow direction in the artesian aquifers is generally upward (Robinson & Noble, Inc., 1999 and Pacific Groundwater Group, 2005) and the aquitard physically separates the aquifers (Pacific Groundwater Group 2007), groundwater in the shallow aquifer does not impact water quality in the deeper aquifers. Therefore, the deeper aquifers are not part of the RI.

4.2.2 Shallow Groundwater Flow

Groundwater flow was evaluated based on groundwater monitoring events completed by GeoEngineers in August 2007 and by Greylock Consulting LLC (Greylock) on July 16, 2008. Greylock’s monitoring was associated with a tidal influence study. Greylock’s technical memorandum describing this study with tables showing groundwater measurements and groundwater elevation contour figures are included in Appendix A. Groundwater elevations based on these monitoring events are summarized in Table 1 of Appendix A. Interpolated groundwater elevation contours for the GeoEngineers August 2007 monitoring event and the Greylock July 16, 2008 event are shown in Figures included in Appendix A.

Groundwater flow patterns at low tide and high tide are similar, with the exception of a steeper gradient near the shoreline during low tide. Most of the groundwater flow across the Site is towards Budd Inlet. However, a groundwater mound is present at both low and high tide at the southwest portion of the Site near two monitoring wells (MW14 and MW06). Because of this mound, some groundwater in this portion of the Site flows away from Budd Inlet. A groundwater high was also present around offsite monitoring well MW17, on Parcel 8, near the northwestern portion of the Site, during both high and low tides. Greylock postulated that these groundwater highs are likely caused by leakage from artesian wells that are alleged to be present in these vicinities based on conversations with old-timers in the area and artesian well maps provided by the City of Olympia. Artesian wells on Site are discussed further in Appendix B and potential locations of artesian wells are shown on Figure 4. The horizontal groundwater gradient varied from about 0.003 feet per foot in the portion of the Site not affected by tides to approximately 0.08 feet per foot in the area affected by tides near the shoreline.

All of the groundwater monitoring events occurred during drier months, and additional monitoring is proposed to collect data representative of wetter months in order to evaluate seasonal fluctuations in groundwater elevations.

Four potential groundwater seeps along the shoreline were identified by Greylock during a low tide on July 16, 2008. The locations of the seeps were surveyed and are shown on the groundwater flow maps in Appendix A. The seeps are thought to represent areas where shallow groundwater discharges to the East Bay of Budd Inlet, immediately west of the Site. Verification of the potential groundwater seeps as groundwater, rather than surface water leakage or discharge from buried pipes, will be conducted as part of the RI. Methods for evaluating the seeps are presented in the SAP (Appendix D).

4.2.3 Tidal Influence Studies

Two tidal influence studies have been completed at the Site:

- A tidal influence study using downhole transducers and data loggers at Parcel 3 was completed by GeoEngineers in February 2007. This study was completed over an approximately 72-hour period and involved monitoring wells MW05, MW06, MW07 and MW09. The results of that study indicated that shallow groundwater beneath the southwestern portion of the Site does not appear tidally influenced (GeoEngineers, April 2007).
- Greylock completed a tidal study by measuring water levels in groundwater monitoring wells at low tide and at high tide on July 16, 2008. Comparing the low tide and high tide groundwater elevations provides a basis to evaluate what portions of the Site are affected by tidal fluctuations. The low tide was -1.4 Mean Lower Low Water (MLLW) and the high tide was +14.4 MLLW. During this 15.5-foot tidal fluctuation, only two (MW12 and MW18) of the twenty wells showed greater than one foot of change in groundwater elevation between low tide and high tide. MW12 and MW18 are screened in the silty gravel post-1975 fill that borders the entire Site adjacent to Budd Inlet. Both wells are located within 110 feet of the shoreline. Greylock concluded that tidal influence on groundwater elevations is limited to the area of coarse fill within 110 feet of the shoreline.

4.2.4 Groundwater Use

There are no shallow aquifer groundwater supply wells located on the Site. At this time, shallow groundwater at the Site is not thought to be potable. The potential use of shallow groundwater at the Site as potable water will be discussed further in the RI/FS reports.

4.3 SUMMARY OF PREVIOUSLY COLLECTED CHEMISTRY DATA

4.3.1 Soil

Soil chemistry data have been collected from 122 soil samples obtained from 45 explorations (DP-01 through DP-25 and MW-01 through MW-20) and four soil samples obtained from four test pits (TP-01 to TP-04). The findings of the studies completed to date indicate that chemicals of potential concern (COPCs) appear to be associated with previous activities at the Site (for example, lumber milling operations such as fueling, machining, maintenance and other related industrial activities). According to previous environmental studies, soil contamination is present on Parcels 1, 2, 3, 4, 5 and 7 and portions of the infrastructure parcel.

Gasoline-, diesel- and motor oil-range petroleum hydrocarbons, naphthalene, bis(2-ethylhexyl)phthalate (BEP), arsenic, cadmium, cPAHs (Toxicity Equivalent Concentration[1] [TEQ]) and D/F (TEQ) were detected in soil at one or more locations at concentrations greater than MTCA Method A and/or Method B screening levels. The petroleum hydrocarbons, cPAHs and metals concentrations exceeding these MTCA screening levels in soil are presented in Figures 8 through 11. The magnitude and extent of the soil with concentrations greater than the MTCA screening levels appears localized to areas adjacent to historical sources of COPCs (Figure 5).

Soil chemical analytical data are also graphically presented on the geologic cross sections on Figures 12a through 12f. The figures illustrate the thoroughness of sample testing in each lithologic unit and across the Site. These figures were used to evaluate the sample density in different fill types and episodes and identify where additional samples are needed.

4.3.2 Groundwater

Groundwater chemical data have been collected from 19 monitoring wells. Impacted groundwater has been observed beneath Parcels 2 and 5. However, additional groundwater monitoring is necessary to further evaluate groundwater conditions at the Site. Arsenic, petroleum hydrocarbons and bis(2-ethylhexyl) phthalate[2] are the only three COPCs that have been detected at elevated concentrations in groundwater samples obtained from shallow groundwater monitoring wells. Groundwater chemical analytical results from 2006 and 2007 are included in Figure 13. The following additional groundwater testing was conducted in July 2008 to evaluate the presence of D/F at MW16:

- **Sampling of MW16:** A groundwater sample was obtained from monitoring well MW16 on July 29, 2008, and tested for D/F, semivolatile chemicals and selected metals. This sample was obtained to support a National Pollutant Discharge Elimination System (NPDES) permit application related to the future discharge of water during an infrastructure improvement project. Monitoring well MW16 is located close to test pit TP02 where the highest measured D/F concentration in soil was identified. Additionally, MW16 is a downgradient well located at an historic potential D/F source location (former boiler house). The analytical reports are included in Appendix C.

---

[1] Regulatory evaluation of cPAHs and D/F are completed using Ecology's toxicity equivalency methodology. This methodology is completed by multiplying the detected concentrations of specific analytes (for cPAHs) and congeners (for D/Fs) by their respective toxicity equivalency factors (TEFs). The results of the calculations are then added to produce a toxicity equivalency concentration.

[2] Bis(2-ethylhexyl) phthalate was detected in MW06, MW08 and MW10 on January 18, 2007, and was likely the result of lab or sampling error.

- **Results:**
  - The sample was analyzed for D/F by U.S Environmental Protection Agency (EPA) Method 1613B. This testing was performed by Columbia Analytical Services. Of the 17 congeners tested, only two (OCDD and OCDF) were detected. MTCA requires evaluation of dioxin and furan results based on toxicity equivalent (TEQ) methodology. Using the TEQ approach, the TEQ for this sample is 0.00381 picograms per liter (pg/L).
  - The groundwater sample was also analyzed for semivolatile compounds and metals by EPA Methods 8270C, 6020, and 7470A. This testing was performed by TestAmerica Laboratories. All of the results were less than MTCA Method A and/or Method B screening levels.

4.4 NATURE AND EXTENT OF CONTAMINATION BASED ON PREVIOUS RI DATA

This section summarizes the nature and extent of contamination based on data that has been collected to-date. These data show that contamination is proximate to specific historical sources of contamination and is not widespread.

4.4.1 On-Site Soils

The highest concentration and most impacted soil on the Site is located on Parcel 3, which has had the longest use. In addition, isolated areas of impacted soil were identified throughout the Site (Parcels 2, 4, 5, and 7) as identified in specific borings and test pits. Locations and depths of samples where COPCs were detected in soil at concentrations above the screening levels are shown in Figures 8 through 11, and on cross-sections in Figures 12a through 12f.

The borings and test pits that are impacted with various COPCs in soil are as follows:

- **Petroleum-impacted soil:** MW02, MW06, DP02, DP04, DP06, DP08, DP13, DP15 and DP24 (Parcel 3); DP17 and DP18 (Parcel 4); DP21 and MW19 (Parcel 7); MW15 and DP19 (Parcel 9).
- **Metals-impacted soil:** arsenic and cadmium at DP04 and cadmium at MW05 (Parcel 3); lead at DP11 (Parcel 5); arsenic at DP17 (Parcel 4); arsenic at DP21 (Parcel 7), and; lead at Delta Consultants boring B-2 (Parcel 1).
- **Semivolative organic compound (SVOC)-impacted soil (naphthalene only):** DP06 (Parcel 3).
- **cPAH-impacted soil:** DP02, DP06, DP08, DP14, DP15, DP16, MW05 and MW10 (Parcel 3); DP16 (Parcel 4); DP11 and MW04 (Parcel 5).
- **D/F-impacted soil:** TP01 and TP02 (Parcel 4); TP03 and TP04 (Parcel 3).

The nature and extent of soil contamination at the Site has largely been defined. In some areas, additional information is needed for vertical and horizontal delineation of COPCs. In addition, data is needed to plan the management of soil that will be excavated as part of the infrastructure improvements planned for early 2009. These data gaps are the purpose for this supplemental RI. Objectives for supplemental sampling are discussed in Section 7.0 below.

4.4.2 Groundwater

Over an 18-month period, one complete round of groundwater monitoring from the well network has been completed. Groundwater analytical results are presented on Figure 13. COPC concentrations exceeding

MTCA Method A cleanup levels were detected in groundwater from only two of the 19 on-site monitoring wells located on the Site in this sampling:

- MW04 (arsenic), Parcel 5
- MW13 (diesel and arsenic) Parcel 2

Arsenic exceeding screening levels was also identified in off-site well MW17, located on the adjacent LOTT property (Parcel 8).

The nature and extent of groundwater contamination appears to be limited to isolated locations of arsenic and diesel range hydrocarbons identified in one well (concentration identified in this well was equal to the MTCA Method A cleanup level for diesel-range hydrocarbons but did not exceed it). However, additional groundwater monitoring is proposed in this supplemental RI to confirm the nature and extent of COPCs in groundwater.

5.0 CONCEPTUAL SITE CONTAMINANT TRANSPORT MODEL

A conceptual site contaminant transport model (CSCTM) was developed to show the historical release(s) of hazardous substances at the Site and the subsequent potential migration of those hazardous substances in environmental media. The model was developed to help direct the RI exploration program. A separate conceptual model related to potential exposure pathways is presented in Section 6.0.

The CSCTM is shown graphically in Figure 14 and possible contaminant sources and transport mechanisms are summarized below:

- Former sawmills and other industries directly discharged contaminants to the ground surface as a result of leaks, spills and operational discharges. These discharges were to the ground surface at the time an industry was operating (“historical working surface”), and that ground surface has now been covered by more recent fill.
- Airborne contaminated particles emitted from on-site sources (such as the hog fuel burner or the power house on Parcels 3-4), off-site sources (such as hog burners, forest fires, and/or the refuse fire area on Parcel 8) were deposited on the historical ground surfaces across the entire Site.
- As the Site was filled with dredged material, potential sources of contamination such as burnt wood were incorporated into the fill. Some of this material now exists in the subsurface below the Site.
- Some dredged material that was used as fill in the Site may contain contaminants.
- Stormwater and general surface runoff while industries were operating transported contaminants to areas being filled at that time.
- Some contaminants in soil leach into groundwater and are transported as dissolved chemicals in groundwater.
- Petroleum hydrocarbons might have been discharged in sufficient quantities to accumulate as free product on top of the groundwater table (shown as a hypothetical oil spill on Figure 14).
- Groundwater flows towards Budd Inlet, where it discharges through seeps in the shoreline bluff.
- Water from deeper aquifers may move upward through the aquitard into the shallow aquifer or Budd Inlet. The upward movement of water prevents contaminated water in the shallow aquifer from moving downward.

- Some of the recharge to the shallow aquifer comes from surplus water from artesian wells that is discharged directly onto the ground surface and leakage through artesian well casings.

6.0 CONCEPTUAL SITE EXPOSURE MODEL

As part of the development of this work plan, PIONEER Technologies Corporation developed a Conceptual Site Exposure Model (CSEM) for the Site (Figure 15). The CSEM evaluated potentially exposed populations (receptors) and exposure pathways[3] as summarized below. The CSEM is based on current Site data (GeoEngineers 2007), Site land use presented in Section 3.0 and the CSCTM presented in Section 5.0. The CSEM will be refined as necessary once more data are collected pursuant to this RIWP. It should be noted that reasonable maximum exposure scenarios were used to represent and be protective of all possible exposure scenarios as mentioned in this section and the Figure 15 footnotes.

6.1 HUMAN HEALTH EXPOSURE PATHWAYS

Potential receptors and exposure pathways were identified and evaluated in the CSEM for the following three distinct land uses at the Site:

- Current Land Use (that is, prior to redevelopment of the Site)
- Construction Phase (that is, during redevelopment of the Site)
- Future Land Use (that is, following redevelopment of the Site)

In accordance with WAC 173-340-740, the following potential soil-based exposure pathways were evaluated for human health at the Site:

- Direct Contact with Soil
- Soil to Outdoor Air (dust)
- Soil to Indoor Air (vapor intrusion)
- Soil to Surface Water (runoff)
- Soil to Groundwater

In accordance with WAC 173-340-720, the following potential groundwater-based exposure pathways were evaluated for human health at the Site:

- Groundwater as Drinking Water
- Groundwater to Indoor Air (vapor intrusion)
- Groundwater to Surface Water/Sediment

6.1.1 Current Land Use

This former industrial property is currently being prepared for redevelopment. As such, the Site is mostly vacant and unused, although boats are currently stored on a portion of the Site. Most of the Site is

[3] A complete exposure pathway is comprised of: (1) a source of COPCs and a release to the environment (e.g., a spill), (2) an environmental transport medium for the release COPCs (e.g., soil), (3) an exposure point (i.e., the point of potential human contact with the affected medium), and (4) an exposure route (e.g., ingestion). In order for a COPC to pose a risk to human health a complete exposure pathway must be present.

currently fenced. A small amount of ponded water (suspected to be from below grade artesian wells) is currently present on-site, but should be eliminated in the near-term with the planned decommissioning of artesian wells. One CSTCM component that should be reiterated here is the historical working surface, which is the historical grade where industrial buildings were located and operations were conducted on the Site prior to later filling and grading. In general, the historical working surface (which is where site releases would have occurred) is approximately 1 to 4 feet below existing grade.

The Site is bounded by existing commercial and/or industrial land use to the north, west and south. A recreational walking path is located immediately east of the Site. The East Bay of Budd Inlet is also located east of the Site.

Potential human receptors that were considered for current land use were residents, commercial/industrial workers, trespassers and recreators (for example, recreational users of the adjacent walking path and the East Bay of Budd Inlet). Based on the CSEM, complete or potentially complete exposure pathways (pending further evaluation) for these potential receptors during current land use are:

- **Trespassers**:
  - Incidental ingestion of soil
  - Dermal contact with soil
  - Inhalation of vapors
  - Dermal contact with suspected ponded groundwater
- **Recreators**:
  - Incidental ingestion of off-site surface water
  - Dermal contact with off-site surface water
  - Consumption of seafood from East Bay

Based on existing information, other potential exposure pathways are not complete in the CSEM during current land use for the following reasons:

- All of the exposure pathways are incomplete for residents and commercial/industrial workers under current land use since there are no residents or regular commercial/industrial workers on-site currently. Nor will there be any residential or commercial/industrial land uses prior to redevelopment. It should be noted that the current trespasser exposure scenario is more conservative and therefore protective for other current receptor scenarios, such as a scenario for people who access boats that are currently stored on a portion of the site.
- Inhalation of particulates by on-site trespassers, off-site recreators, and other potential off-site receptors are incomplete pathways because the historical working surface (which is where site releases would have occurred) is approximately 1 to 4 feet below existing grade.
- All of the on-site pathways (for instance, incidental ingestion of soil, dermal contact with soil, inhalation of vapors, dermal contact with suspected ponded groundwater) are incomplete for recreators because there is no on-site recreational land use prior to redevelopment.
- Soil to surface water is an incomplete pathway for all potential receptors since storm water generally infiltrates rather than runs off (see soil to groundwater pathway for leaching scenarios) and the historical working surface (which is where site releases would have occurred) is approximately 1 to 4 feet below existing grade.

- The soil to groundwater and groundwater as drinking water pathways are incomplete for all potential current receptors since there are no current drinking water wells in shallow groundwater on-site or downgradient of the site, and the confined aquifer in which existing on-site artesian wells are completed is not impacted by a release from the site. Furthermore, existing artesian wells are not usable since they are completed below ground surface and will be decommissioned.
- Incidental ingestion of suspected ponded groundwater is an incomplete pathway for all potential receptors since this pathway is based on activities in which water is routinely near the mouth (for instance, swimming).
- The surface water as drinking water pathway is incomplete for all receptors since the marine water in the East Bay of Budd Inlet is not suitable for use as a domestic water supply in accordance with WAC 173-340-730(2)(b)(ii).
- The groundwater to surface water/sediment pathway is not applicable for residents, commercial/industrial workers or trespassers because the exposure routes (incidental ingestion of surface water, dermal contact with surface water and consumption of seafood) are based on recreational pursuits. In addition, the current recreator exposure scenario is more conservative and therefore protective for other current human receptor scenarios with respect to the groundwater to surface water/sediment pathway.

6.1.2 Construction Phase

During the temporary construction phase of Site redevelopment, land use will be typical of a major construction project and will include utility infrastructure excavations and other significant earthwork. Standard construction practices such as fencing and site control will be in place to limit site access for recreators and other members of the public during the construction phase. In addition, site-specific construction plans will incorporate best management practices and worker safety programs appropriate for the presence of COPCs in soil.

Potential human receptors that were considered for construction phase land use were utility workers (who will be building the utility infrastructure during the first portion of the construction phase), construction workers (who will be conducting general earthwork during the second portion of the construction phase), and trespassers. Based on the CSEM, complete or potentially complete exposure pathways (pending further evaluation) for these potential receptors during the construction phase are:

- **Utility Workers**:
  - Incidental ingestion of soil
  - Dermal contact with soil
  - Inhalation of particulates
  - Inhalation of vapors
  - Dermal contact with on-site groundwater in a utility excavation
- **Construction Workers**:
  - Incidental ingestion of soil
  - Dermal contact with soil
  - Inhalation of particulates
  - Inhalation of vapors

- **Trespassers**:
  - Incidental ingestion of soil
  - Dermal contact with soil
  - Inhalation of particulates
  - Inhalation of vapors
  - Dermal contact with on-site groundwater in a utility excavation

The soil to surface water, soil to groundwater, groundwater as drinking water, and groundwater to surface water/sediment pathways are not complete in the CSEM for these construction phase receptors for the same reasons given above in the current land use discussion. Incidental ingestion of on-site groundwater in a utility excavation is an incomplete pathway for all potential receptors since this pathway is based on activities in which water is routinely near the mouth (for instance, swimming). Dermal contact with on-site groundwater in a utility excavation is an incomplete pathway for construction workers conducting general earthwork since these workers will not be accessing on-site shallow groundwater in a utility excavation.

6.1.3 Future Land Use

Future land use is described in Section 3.0. There is little uncertainty about the imminent redevelopment of the Site given the nature of existing plans, agreements and commitments made by Port leadership, City of Olympia leadership and other stakeholders.

Potential human receptors that were considered for future land use were urban residents (for instance, condominium or apartment dwellers living above ground-level retail), commercial workers (for instance, workers in ground-level retail), utility workers (for instance, workers conducting maintenance on existing utilities, and recreators (for instance, recreational users of the Hands On Children's Museum, the public plaza, and the East Bay of Budd Inlet). It should be noted that the future urban residential exposure scenario is more conservative and therefore protective for the other similar exposure scenarios such as hotel guests. It should also be noted that trespassers are not potential receptors because access to the Site after redevelopment will not be restricted. Based on the CSEM, complete or potentially complete exposure pathways (pending further evaluation) for these potential receptors during future land use are:

- **Urban Residents**:
  - Incidental ingestion of soil
  - Dermal contact with soil
  - Inhalation of particulates
  - Inhalation of vapors
  - Ingestion of drinking water from on-site groundwater wells
  - Dermal contact with drinking water from on-site groundwater wells
- **Commercial Workers**:
  - Incidental ingestion of soil
  - Dermal contact with soil
  - Inhalation of particulates

  - Inhalation of vapors
  - Ingestion of drinking water from on-site groundwater wells
  - Dermal contact with drinking water from on-site groundwater wells
- **Utility Workers**:
  - Incidental ingestion of soil
  - Dermal contact with soil
  - Inhalation of particulates
  - Inhalation of vapors
  - Ingestion of drinking water from on-site groundwater wells
  - Dermal contact with on-site groundwater in a utility excavation
- **Recreators**:
  - Incidental ingestion of soil
  - Dermal contact with soil
  - Inhalation of particulates
  - Inhalation of vapors
  - Ingestion of drinking water from on-site groundwater wells
  - Incidental ingestion of off-site surface water
  - Dermal contact with off-site surface water
  - Consumption of seafood from East Bay

Based on existing information, other potential exposure pathways are not complete in the CSEM during future land use for the following reasons:

- Soil to surface water is an incomplete pathway for all potential receptors following redevelopment since it is expected that the Site will be covered by buildings, pavement, and other features that minimize transport from soil to surface water.
- Dermal contact with drinking water from on-site groundwater wells is an incomplete pathway for utility workers and recreators since this pathway is based on routine showering with water from on-site drinking water wells.
- Incidental ingestion of on-site groundwater in a utility excavation is an incomplete pathway for all potential receptors since this pathway is based on activities in which water is routinely near the mouth (for instance, swimming).
- Dermal contact with on-site groundwater in a utility excavation is an incomplete pathway for urban residents, commercial workers, and recreators since these receptors will not be accessing on-site shallow groundwater in a utility excavation.
- The surface water as drinking water pathway is incomplete for all receptors since the marine water in the East Bay of Budd Inlet is not suitable for use as a domestic water supply in accordance with WAC 173-340-730(2)(b)(ii).

- The groundwater to surface water/sediment pathway is not applicable for urban residents, commercial workers or utility workers because the exposure routes (incidental ingestion of surface water, dermal contact with surface water and consumption of seafood) are based on recreational pursuits. In addition, the future recreator exposure scenario is more conservative and therefore protective for other future human receptor scenarios with respect to the groundwater to surface water/sediment pathway. It should also be noted that the future off-site recreator scenario is more conservative and therefore protective of the construction phase off-site recreator scenario.

6.2 ECOLOGICAL EXPOSURE PATHWAYS

The potential pathways for ingestion, dermal contact, and inhalation of COPCs by terrestrial ecological organisms are potentially complete pending further evaluation. The potential pathways for ingestion and dermal contact of COPCs by aquatic ecological organisms are potentially complete pending further evaluation of future groundwater and seep data.

7.0 SUPPLEMENTAL REMEDIAL INVESTIGATION DATA OBJECTIVES AND TASKS

Based on data gaps identified from evaluating preliminary RI data and comments received from Ecology, additional data is required to complete the RI. This section and Tables 1 through 3 describe the collection of this additional data. The details of the proposed exploration locations, sample selection and testing rationale are summarized in Tables 1 and 2 (soil and groundwater, respectively). Table 3 outlines rationale for additional groundwater monitoring at existing and proposed Site monitoring wells. These tables have specific references and responses to Ecology comments (Ecology February 5, 2008). Locations of proposed soil explorations and monitoring wells are shown on Figures 16 and 17, and are shown on Figure 18 relative to potential historic source areas, COPCs, and historic shorelines. Figure 19 shows the planned maximum depths of excavation for installing infrastructure (sewer, storm and water lines) at the Site. The proposed depths of the utilities and width of the infrastructure are also presented on the geologic cross-sections (Figures 7a through 7f). The reader is referred to these tables and figures to understand the details of the sampling and testing program. The locations of explorations and samples may change, with Ecology's approval, based on results after completing the first phase of explorations (see Section 7.2). The remainder of this section outlines the objectives and tasks associated with this supplemental RI.

Proposed New Soil Explorations Include
• 22 Direct-push Borings • Up to five new monitoring wells (part of 22 direct-push borings) • Testing D/F from 12 borings • Eight Phase I explorations to be completed Fall 2008 to support development of Infrastructure Interim Action Plan

The supplemental remedial investigation has seven main objectives:

1. Provide a direct response to Ecology's concerns regarding additional characterization of soil contamination at specific locations. Because of gaps in the existing data, there is some uncertainty regarding the nature and extent of identified soil contamination at some locations. The supplemental soil sampling will provide data to characterize the horizontal and vertical extent of soil contamination at these locations.
2. Locate suspected artesian wells and obtain information necessary to evaluate feasibility, costs and approach to decommission these wells. Suspected locations of these artesian wells are identified on Figures 4 and 20 and discussed in Appendix B. Actual decommissioning of confirmed artesian wells will be discussed in the IAP or a separate plan that will be submitted to Ecology for

approval. The affect of decommissioning artesian wells on the shallow aquifer will be assessed by measuring ground water levels and sampling/testing of groundwater.

3. Use additional soil characterization to supplement existing information regarding fill history and soil types.

4. Provide additional information on the extent of D/F concentrations that have been detected in shallow soil at the Site. The supplemental sampling locations were selected to provide D/F data that will be used to:

- Evaluate the vertical and horizontal extent of D/F in soil;
- Characterize soil in the infrastructure corridor; and
- Additionally characterize soil on Parcels 2, 3, 4, 5, 6, 7 and 9.

5. Conduct quarterly groundwater monitoring for at least one year. More than one year of monitoring may be needed, depending on the length of time it takes for water levels to stabilize after artesian wells are decommissioned. Sampling of groundwater and seeps will not start until water levels have stabilized following decommissioning of the artesian wells. If the artesian wells are not located, quarterly groundwater monitoring will start after installation of the new monitoring wells.

Proposed Groundwater Monitoring, Sampling, and Testing Includes
• At least one year of quarterly groundwater monitoring. • Sampling of 17 (plus 5 new wells, if installed) Groundwater Monitoring Wells for all COPCs in first sample event after artesian wells are decommissioned. • Verify if four seeps represent groundwater. If deemed to be groundwater seeps, the seeps will be sampled. • Monitoring shallow groundwater wells for the presence of LNAPL.

Each quarterly monitoring event will include measuring the depth to groundwater, evaluating the groundwater flow direction, and obtaining groundwater samples for chemical analytical testing. Groundwater analytical testing will consist of an initial round for all COPCs from all wells. The number of wells and COPCs analyzed will be reduced during subsequent monitoring events based on the results from the previous sampling events to focus ion potential compliance wells and wells where COPCs exceed the screening criteria. Evaluating the potential for floating free-phase product (light nonaqueous phase liquids [LNAPL]) in areas where petroleum concentrations in soil exceed screening criteria is part of the groundwater monitoring program.

If, after the artesian wells are abandoned, water levels do not drop below the top of the well screens in monitoring wells located in these areas, it may be necessary to install new monitoring wells with shallower screen intervals. This Workplan includes the installation of up to five new shallow-screened monitoring wells.

6. Provide data necessary to assess the risks to human and ecological receptors.

7. Provide information to facilitate evaluation of cleanup action alternatives in the FS.

7.1 Identification of Data Needs

Data gaps identified from preliminary RI sampling locations indicate the need for additional data as follows:

- Horizontal and vertical delineation of existing contaminant exceedances in soil.
- Additional soil chemical analytical coverage on parcels with limited data.
- Characterize the nature and extent of D/F in soil.
- Impact of leakage from artesian wells on groundwater flow and quality in shallow aquifer.

The supplemental data will be used to:

1. Complete and augment the CSMs for contaminant transport and site exposure pathways.
2. Provide information to evaluate COPC fate and transport. This information will include testing for soil physical properties such as total organic carbon (TOC) and grain size.
3. Complete and augment understanding of groundwater, including groundwater flow direction, gradient and fluctuations, and groundwater chemistry before and after decommissioning of the artesian wells.
4. Complete the risk modeling, using additional soil chemical analytical data, soil physical properties and groundwater data as above.
5. Provide information to support infrastructure construction project planned for early 2009.
6. Provide information to support a future feasibility study and cleanup action(s).

7.2 PROJECT PLANNING AND SCHEDULE

Field work for the supplemental RI will be conducted in phases. The initial phase of the RI will be completed in Fall 2008 in order to provide data critical to the planning of the infrastructure improvement project. The initial phase includes completing eight explorations located in or near the infrastructure corridor. The initial eight exploration locations include borings DP27, DP30, DP32, DP33, DP34, DP36, DP38, and DP40, which are also highlighted on Table 1. The initial phase will also include locating suspected artesian wells, as described in Appendix B. All proposed exploration locations and infrastructure corridors are shown on cross-sections A through F (Figures 12a - 12f) and Figures 16 and 17. A health and safety plan (HASP) for use by GeoEngineers field personnel is included as Appendix E of this RI work plan. Subsequent phases of field work will be completed after data from the first phase has been evaluated and after decommissioning of the artesian wells.

Phase I field work is expected to take one week to complete. It will take an additional four weeks for chemical testing and validation of test results.

Phase II (explorations not included in Phase I and all new monitoring wells) is expected to take two weeks to complete plus four weeks to receive and validate analytical results.

The first groundwater monitoring event will occur after water levels have stabilized following decommissioning of the artesian wells. Each monitoring event is expected to take one week to complete, plus four weeks to receive and validate analytical results.

7.3 SAMPLE COLLECTION AND ANALYSIS

Sampling methods and procedures are presented in the Sampling and Analysis Plan (SAP) included as Appendix D. The SAP includes the quality assurance project plan (QAPP).

7.3.1 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) procedures and standards that will be implemented during the supplemental RI and subsequent compliance groundwater monitoring activities are presented in the SAP/QAPP (Appendix D). The purposes of the SAP and QAPP are to describe sampling protocol, analysis and quality control procedures that will be implemented to produce chemical and field data that are representative, valid and accurate for use in evaluating the effectiveness of the data collection.

8.0 DEVELOPMENT OF CLEANUP LEVELS AND REMEDIATION LEVELS

To-date MTCA Method A or Standard Method B cleanup levels have been used as a reference for evaluating analytical chemistry results. However, as part of the RI Report, PIONEER Technologies Corporation will develop Site soil cleanup levels, Site soil remediation levels and groundwater screening levels based on an updated CSEM that accounts for data collected pursuant to this RIWP. Input parameters for cleanup level and remediation level calculations will be obtained from Ecology's Cleanup Levels and Risk Calculations (CLARC) database, as appropriate.

8.1 IDENTIFICATION OF COPCS

COPCs will be identified based on analytes that are detected in at least one soil or groundwater sample above MTCA cleanup levels based on unrestricted land use, and are not attributable to off-site sources.

Based on existing data (GeoEngineers 2007), the on-site COPCs are:

- arsenic
- benzo[a]pyrene
- cadmium
- lead
- 2,3,7,8-tetrachloro dibenzo-p-dioxin (2,3,7,8-TCDD)
- total naphthalenes
- TPH-D
- TPH-G
- TPH-MO

Regarding the above COPC list, it should be noted that:

- Bis (2-ethylhexyl) phthalate, which is a ubiquitous plasticizer that has been detected in some soil and groundwater samples to date (GeoEngineers 2007), is not be considered a COPC because its presence is most likely the result of sample collection and analysis procedures rather than a release from the Site.
- The cleanup and screening levels for total cPAHs and total D/F will be calculated based on TEFs relative to acceptable levels for benzo[a]pyrene and 2,3,7,8-TCDD, respectively, in accordance with WAC 173-340-708(8).
- TPH-G cleanup and screening levels will likely be based on TPH-G without benzene because benzene has not been detected in any soil or groundwater sample to date above its MTCA Method A cleanup levels in Table 740-1 or Table 720-1 (GeoEngineers 2007).
- Additional COPCs may be identified based on data collected pursuant to this RIWP.

8.2 SOIL CLEANUP LEVELS BASED ON UNRESTRICTED LAND USE

MTCA regulations require implementation of an institutional control (IC) remedy at a minimum whenever COPCs are present above MTCA cleanup levels based on an unrestricted land use exposure scenario. As a result, soil cleanup levels based on an unrestricted land use exposure scenario will be developed for Site COPCs in accordance with WAC 173-340-740 even though an unrestricted land use exposure scenario is not consistent with the CSEM presented in Section 6. It is anticipated that this tier of Site soil cleanup levels will be used to delineate which portions of the Site do not require further action and which portions will require a formal cleanup remedy (for example, an IC remedy at a minimum).

8.3 SOIL CLEANUP LEVELS AND REMEDIATION LEVELS

Risk-based soil cleanup levels and/or remediation levels will be developed for the Site based on an updated CSEM that accounts for data collected pursuant to this RIWP. These levels will be calculated for Site COPCs using procedures in WAC 173-340-357, -708, -740, and -745 with reasonable maximum exposure assumptions for receptors exposed via complete exposure pathways. It is anticipated that this tier of Site soil cleanup levels will be used to determine whether certain remedial alternatives are protective of human health and the environment based on actual land use. In addition, these risk-based levels will likely be used as remediation levels for determining locations in which certain remedial actions are required.

8.4 GROUNDWATER SCREENING LEVELS

Arsenic and TPH-D are the only potential groundwater exceedances to date (GeoEngineers 2007), and the single TPH-D detection at the Site (MW13) may be from an off-site source. MTCA Method A groundwater cleanup levels (which are not necessarily the same as the lookup values in MTCA Table 720-1) will be calculated in accordance with WAC 173-340-720(3) and -730(2) for use as groundwater screening levels. These screening levels will assist in the evaluation of potential exposure pathways (for example, soil to groundwater, groundwater as drinking water, vapor intrusion and groundwater to surface water) in the RI Report. If necessary, Site groundwater cleanup levels will also be developed.

9.0 REFERENCES

Robinson & Noble, Inc in Association with Brown and Caldwell. March 26, 1999, Technical Memorandum 1204 LOTT Wastewater Resource Management Plan.

Thurston County Health Department and Pacific Groundwater Group for Friends of the Artesians. June 2005, Proposed City of Olympia Artesian Well Background Information on Groundwater Flow and Quality in Downtown Olympia Report Prepared in response to Well Site Permit Denial.

Pacific Groundwater Group. October 11, 2007, Deep Aquifer Hydrogeology Cascade Pole Site, Olympia, WA, Port of Olympia.

GeoEngineers, Inc. March 14, 2007. Phase I ESA, Port of Olympia East Bay Redevelopment. Prepared for the Port of Olympia.

GeoEngineers, Inc. April 24, 2007. RI/FS CAP [now known as the RI/FS IA], Port of Olympia East Bay Redevelopment, City Hall lot. Prepared for The Rants Group.

GeoEngineers, Inc. August 3, 2007. Supplemental Site Use History and Soil and Groundwater Sampling Clarifications, Port of Olympia East Bay Redevelopment. Prepared for the Port of Olympia.

GeoEngineers, Inc. December 20, 2007. Draft Remedial Investigation/Feasibility Study and Conceptual Cleanup Action Plan East Bay Redevelopment, Port of Olympia.

TABLE 1
PROPOSED NEW BORING AND MONITORING WELL RATIONALE
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Ecology Comment	Response to Ecology Comments/Sampling Rationale	Exploration: Boring (DP) Well (MW)	Sampling Depth Interval (ft bgs)[1]	Soil Analyses: NWTPH-Dx	NWTPH-G	BTEX	Total Metals (As, Cd, Pb)[2]	D/F	PAHs	PCBs	TOC[3]	Planned Utilities - Maximum Depth (feet)	Anticipated Soil Type / Lithologic Unit
1. Additional characterization is needed to define the extent of soil contamination at the site. The aerial and vertical extent of soil contamination needs to be further defined in the vicinity of DP02 and DP04 (including westward beneath Jefferson Street and on adjacent offsite parcels if necessary) and north of DP18.	TPH-D, TPH-MO, arsenic, and cadmium in the 2-6 feet interval were the only COPC exceedances at DP04. These COPCs have been delineated laterally in this interval to the northeast and south with MW08 and DP03, respectively. A new soil boring will be advanced northwest of DP04 to complete the lateral delineation of COPC screening level exceedances in the 2-6 feet interval. Soil samples will also be obtained from beneath existing railroad tracks to be removed during infrastructure construction activities. The railroad tracks are currently embedded in the asphaltic pavement along Jefferson Street and we expect that the section beneath the pavement will consist of railroad ties supporting the rail and ballast material (typically 3 feet of crushed rock) supporting the ties. Soil samples will be collected at the soil/ballast interface. We will analyze soil collected beneath the ballast material for cPAHs (using EPA Method 8270C), TPH, and metals to assess potential residual soil contamination associated with the ties.	DP37	0-2										
			2-6	x [a]	X	X	x		x	X			light sand fill
			6-10	X	X	X	x			X			dark sand fill
	TPH-MO in the 2-6 feet interval was the only significant COPC exceedance at DP02. This COPC has been delineated laterally in this interval to the north and southeast with DP03 and DP16, respectively. A new soil boring will be advanced southwest of DP02 to complete the lateral delineation of the TPH-MO screening level exceedance in the 2-6 feet interval. A sample from 10 to 14 feet from the monitoring well boring for MW25S will be tested for TPH-MO to evaluate the vertical extent of this COPC identified in previous samples from DP02. Proposed shallow screen interval for MW25S addresses Ecology Comment #9 for detected TPH in soil at DP02 and DP04. Soil samples from below the railroad tracks will also be collected and analyzed from DP38 and analyzed for PAHs. PAHs will be tested in sample from 10 to 14 foot depth interval in the boring for MW25S to evaluate the vertical extent of this COPC identified previously at DP02 and DP16. One sample from DP38 will be tested for dioxins/furans to evaluate soil within the infrastructure corridor.	DP38	1-3				x		x				
			4-6	x	X	X	x	x	x		x		light sand fill
			6-10	X	X	X	x	x	x		x	9	Silt or dark sand fill
		MW25S	0-2										
			2-6										
			6-10	x	X	X	X		X				Silt or dark sand fill
			10-14	x	X	X	X		x				Silt or dark sand fill
	TPH-MO in the 10-14 feet interval was the only significant potential COPC exceedance at DP18. This COPC has been delineated latreally in the vadose zone and saturated zone with MW03, MW16, and DP17 but has not been delineated laterally north of DP18. Soil samples from the boring for MW23S will provide this information. Proposed screen interval for MW23S addresses Ecology Comment #9 for detected TPH in soil at DP18. TPH-MO will be tested in MW-23S at the 6 to 10 and 10 to 14 foot intervals to evaluate the vertical extent of TPH-MO identified previously at DP18.	MW23S	0-2										
			2-6										
			6-10	x [a]	X	X	X		X				light sand fill
			10-14	x	X	X	X		X				light sand fill
2. Additional characterization is needed to define the extent of soil contamination at the site. The vertical extent of contamination needs to be defined in the vicinity of DP06 and DP08.	TPH-G in the 2-6 feet interval was the only significant potential COPC exceedance at DP06 and needs to be defined at depth and to the south. TPH-D and TPH-MO in the 2-6 feet interval were the only significant potential COPC exceedances at DP08. TPH-D and TPH-MO exceedance was identified in the 2-6 feet interval in DP-13. The vertical extent of gasoline, diesel and oil contaminated soil has been delineated with DP24, DP15, DP14, MW-5, MW-8 and MW-10. MW24S, along with the other proposed and existing wells, will be used to evaluate the leaching to groundwater pathway via empirical demonstration per WAC 173-340-747(9) an (10)(c). Proposed shallow screen interval for MW24S addresses Ecology Comment #9 for detected TPH in soil at DP06, DP08, DP24, and DP13.	MW24S	4-6	X	X	X	X		X				
			6-10	X	X	X	X		X				
	Evaluate lateral extent of TPH-D and MO identified previously at DP08 and DP13. Evaluate lateral extent of gasoline exceedance at DP08 and DP13.	DP39	0-2	X	X	X	X		X				
			2-6	x [a]	X	X	X		X				dark sand fill
	Lateral and vertical extent of dioxins/furans by TP03. Evaluate thickness of pre-1891 fill. Collect data to support management of soil that will be excavated as part of the infrastructure improvements. DP40 will also help evaluate the extent of diesel and oil contamination previously observed in DP13 and DP08 at 2-6 feet.	DP40	0-2	x	X	X	x	x	x				light sand fill
			2-4	x	X	X	x	x	x		x		light sand fill
			4-6	x	X	X	x	x	x		x	3.5	dark sand fill
3. Additional characterization is needed to define the extent of soil contamination at the site. The aerial extent of contamination has not been defined in the vicinity of MW19.	TPH-G in the 2-6 feet interval was the only potential COPC exceedance at MW19. Two soil borings (DP28 and the boring for MW21s) will be located near MW19 to evaluate the aerial extent of the screening level exceedance of TPH-G at MW19 in the 2-6 feet interval. The proposed screen interval (2 to 7 feet bgs) for MW21S addresses Ecology Comment #9 for detected TPH in soil at MW19. Moreover, a soil boring advanced to the west of MW19 in response to Ecology Comment #7 (i.e. DP27) will also be sampled for TPH-G in the 2-6 feet interval to provide lateral delineation to the west. To address Ecology comment 7, if evidence of burned wood or ash is observed in boring DP28, which is located on the northern edge of parcel 1 near the former Refuse Fire Area, a sample of this material will be analyzed for dioxins and furans.	DP28	0-2	X	X	X	X						
			2-6	X	x	X	X						light sand fill
		MW21S	0-2										
			2-6		x [a]								light sand fill

TABLE 1
PROPOSED NEW BORING AND MONITORING WELL RATIONALE
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Ecology Comment	Response to Ecology Comments/Sampling Rationale	Exploration: Boring (DP) Well (MW)	Sampling Depth Interval (ft bgs)[1]	Soil Analyses: NWTPH-Dx	NWTPH-G	BTEX	Total Metals (As, Cd, Pb)[2]	D/F	PAHs	PCBs	TOC[3]	Planned Utilities - Maximum Depth (feet)	Anticipated Soil Type / Lithologic Unit
4. Additional characterization is needed to define the extent of soil contamination at the site. Area of Concern (AOC) #16 (pad mounted transformer) needs to be evaluated. Soil samples should be collected from this area for petroleum hydrocarbons and PCBs. The location of well MW04 does not appear to be close enough to this AOC to be adequate.	One new boring will be advanced and sampled within AOC 16 as recommended by Ecology. The targeted depth for the soil sample collected from this boring is the elevation of the former transformer pad located in AOC 16. The sample from this boring will be analyzed for PCBs and mineral oil range petroleum hydrocarbons (NWTPH-Dx).	DP35	0-2										
			2-6	x						x			gravel fill
5. Parcel 1 needs to be assessed. AOCs #43 through 48 and #50 have not been adequately assessed. Also, the northern portion of Parcel 1 needs to be assessed.	The first sentence of this comment does not apply because the East Bay Redevelopment Project Area only includes the northwest portion of Parcel 1. A new boring (DP36) located in the right-of-way of Olympia avenue adjacent to the northwest portion of Parcel 1will address Ecology's concern regarding the northern portion of Parcel 1. However, the primary purpose of this boring is to evaluate soil conditions to assist in planning of future infrastructure improvements in this area and evaluate residual concentrations of COPCs in an area where historical sources were not located.	DP36	1-3					x					gravel fill
			2-6	x	x	X	x	X					silt
			6-10					X				9	silt
6. Additional characterization of dioxins/furans is needed. As shown in the report, concentration of dioxins/furans that exceed the MTCA Method B Soil Cleanup Level of 11 nanograms per kilogram (ng/kg) or parts per trillion (ppt), expressed as a Total Toxicity Equivalency Factor (TEF), were observed at all four locations tested for this constituent. The reported TEF values from these locations range from 57.9 to 645 ng/kg. Because the highest concentration (TP02) is near the east property line and near an adjacent public walking path and grassy area, additional samples for dioxins/furans should be collected in this adjacent area. Also, an analysis of wind direction should be performed to help predict locations that may show higher dioxin concentrations.	New boring DP33 will provide vertical profile of dioxins/furans concentrations near TP2. Selection of sample locations based on prediction of wind direction is not necessary because the proposed dioxins/furans sample locations (as outlined in this table) provide spatial coverage across the site.	DP33	0-2				x	x	x				gravel fill
			2-4				x	x	x		x		gravel fill
			4-6				x	x	x				light sand fill
			6-8					x				9	light sand fill
7. Additional characterization of dioxins/furans is needed. Parcel 7 is located adjacent to the Refuse Fire Area (Area of Concern #1), which is a potential source of dioxins/furans contamination. Additional soil samples for dioxins/furans analyses should be performed in Parcel 7. These samples will provide additional dioxins/furans data for the site and may help to determine whether AOC #1 was a source.	Additional samples which address Ecology's comment 7 will be collected and tested for dioxins/furans from a boring advanced near AOC 1 (DP27) and a boring advanced at the northern edge of Parcel 7 (DP28). In addition, DP27 will be sampled for TPH-G to address gasoline contamination identified in soil at MW-19 (see response to Ecology Comment #3). Samples from boring DP27 will also be analyzed for PAHs to evaluate the lateral and vertical extent of cPAHs identified in soil samples from MW-20, near the Refuse Fire Area. Note that Parcel 8, which is adjacent to the northwest portion of the Site, is being addressed by LOTT Alliance through Ecology's Voluntary Cleanup Program.	DP27	0-2				x	x	x				light sand fill
			2-4		x	X	x	x	x		x		light sand fill
			4-6				x	x	x		x		silt
			6-8				x	x				3	silt

TABLE 1
PROPOSED NEW BORING AND MONITORING WELL RATIONALE
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Ecology Comment	Response to Ecology Comments/Sampling Rationale	Exploration: Boring (DP) Well (MW)	Sampling Depth Interval (ft bgs)[1]	Soil Analyses: NWTPH-Dx	NWTPH-G	BTEX	Total Metals (As, Cd, Pb)[2]	D/F	PAHs	PCBs	TOC[3]	Planned Utilities - Maximum Depth (feet)	Anticipated Soil Type / Lithologic Unit
8. Additional characterization of dioxins/furans is needed. Section 4.3.1 states that "dioxin testing appears to indicate that the historical working surface (depth of about 2 feet below existing grade) is impacted." Please provide more detail on what is meant by "historical working surface" and how it is distinguished. According to the Supplemental Site Use History report, the boiler house (AOC #17) operated circa 1932 and the power house (AOC #22-24) operated from at least 1941 through 1958. Was 2.0 feet below current grade the historical grade for these facilities? If so, what evidence is there for this? Dioxin samples were collected at the 2.0 foot depth at AOC #17, at the 3.5 depth at AOC #22-24, and at the 1.5 and 2.0 foot depths at the two randomly selected locations. It is recommended that additional samples be collected at AOC #17 so that a concentration verses depth profile can be determined.	The "historical working surface" is the sometimes woody and compacted historical grade where industrial buildings were located and operations were conducted on the property prior to later filling and grading. Based on our review of historical information the working surface is located about 1 to 4 feet below existing grade, however it can be difficult to identify in borings due to similarity in lithology of fill in this depth interval. Because of Ecology's questioning of the historical working surface and difficulty in determining its exact location in borings, a more appropriate rationale for the location of explorations where vertical profiles for dioxins/furans testing is as follows:1) complete a profile (DP33) adjacent to previous sample with high dioxins concentrations (TP02) and 2) complete a profile that represents temporal fill sequences.	See DP 33 (Comment 6) and borings and "Additional Explorations" rationale below.											
9. Additional characterization of groundwater contamination, flow direction, and gradient is needed. Groundwater monitoring wells MW-1 through MW-11 and MW-14 were installed with their screened interval submerged below the water table. Wells that monitor for light non-aqueous phase liquids (LNAPL, such as petroleum hydrocarbons) should be completed so that their screen straddles the water table. Therefore, to accurately evaluate whether groundwater is contaminated from LNAPL constituents, it will be necessary to install additional groundwater monitoring wells with screens that extend above the water table at selected locations where the existing monitoring wells are not adequate. Please present your proposed new well locations to us for review and approval.	Given the general lack of dissolved-phase petroleum constituent detections in the groundwater samples collected from existing MWs (as well as the relatively low TPH soil concentrations detected in soil samples collected from areas with suspected hydrocarbon contamination), it is unlikely that the typical placement of the screened intervals straddling the water table would result in measurable LNAPL thicknesses or even a screening level TPH exceedance at any MW at this site. Nonetheless, five shallow MWs (MW21S through MW25S) with screens straddling the water table are proposed to address this comment. MW21S and MW24S are discussed in the responses to Ecology Comments #2 and #3, respectively. Proposed MW22S will be used to evaluate LNAPL thicknesses and petroleum constituent concentrations near MW06. MW23S and MW25S are discussed in the response to Ecology Comment #1. This Ecology comment is further addressed by in the Groundwater Monitoring Plan. Based on recent comments from Ecology (9/22/08 Ecology comment letter and subsequent discussion), because artesian wells at the Site may be influencing shallow groundwater, an attempt will be made to locate and decommission or otherwise mitigate leakage from the artesian wells. If the artesian wells are found and decommissioned, water levels and the need for shallow monitoring wells will be reevaluated.	MW22S	No analysis of soil samples unless field observations indicate the presence of contamination. Anticipated screened interval is 1-6 feet bgs.										
Additional Explorations													
Additional explorations to evaluate the nature and extent of contamination, including dioxins/furans. These explorations will provide data related to: a) regional area background concentrations of dioxins/furans and metals not related to a site release, b) management of soil that will be excavated as part of the infrastructure improvements, and c) evaluation of COPC distribution in different fill types and spatial coverage related to general extent of COPCs.	Evaluate extent of lead and PAHs at DP11.	DP29	0-2						x				light sand fill
			2-6				x						silt or gravel
			6-10				x						silt or gravel
			10-14						x				silt or gravel
	Evaluate dioxins/furans in fill (1891 to 1908 time interval), evaluate dioxins/furans in soil within the infrastructure corridor, and provide additional sampling data for parcel 9.	DP30	0-2				x	x					light sand fill
			2-4				x	x	x				light sand fill or silt
			6-8				x	x (if silt)				9	light sand fill or silt

TABLE 1
PROPOSED NEW BORING AND MONITORING WELL RATIONALE
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Ecology Comment	Response to Ecology Comments/Sampling Rationale	Exploration: Boring (DP) Well (MW)	Sampling Depth Interval (ft bgs)[1]	Soil Analyses: NWTPH-Dx	NWTPH-G	BTEX	Total Metals (As, Cd, Pb)[2]	D/F	PAHs	PCBs	TOC[3]	Planned Utilities - Maximum Depth (feet)	Anticipated Soil Type / Lithologic Unit
	Locations DP31 and DP41 are selected to obtain dioxins/furans data from soil not associated with any AOC source. This data will be used to evaluate dioxins/furans concentrations related to regional dioxin sources and regional background levels as it is possible that detected concentrations of dioxins/furans and metals in soil samples collected to date are attributable to an area or regional background rather than a site release. DP31 is located on parcel 6 in an area where no historical sources (AOCs) were located and the underlying fill is from the 1948 to 1975 time period. DP41 is located on parcel 2 in an area where no historical sources (AOCs) were located and the underlying fill is from the post 1975 time period.	DP31	0-2					x					light sand fill
			2-6	x			x	x					light sand fill
		DP41	0-2					x					gravel fill
			2-6				x	x					silt
	Evaluate dioxins/furans in post-1975 fill within the infrastructure corridor. These data will assist with evaluating background conditions as well as inform waste characterization and disposal associated with the excavated infrastructure corridor soils.	DP32	0-2					x			x		gravel fill
			2-6				x	x	x		x		gravel fill
			6-9					x				9	gravel fill
	Evaluate dioxins/furans in fill (1891 to 1908 time interval) near infrastructure corridor and on Parcel 4.	DP34	0-2					x					light sand fill
			2-6	X	X	X	x	x	x		x		light sand fill
			8-10	X	X	X	x	x	x			10	light sand fill or gravel
	These borings are located on Parcel 4 and the locations were selected to gather information to support soil characterization during construction activities associated with the Children's Hands on Museum.	DP26	0-2				X	x	X				light sand fill
			2-6					x	X				silt or light sand fill
			6-10				X	X					
		DP42	0-2				X	x					gravel fill
			2-6				X	x					light sand fill
			6-10				X	X					

Notes:

Blank boxes (no X) indicate that soil samples will be collected from the specified depth intervals and held for potential analyses by the analytical laboratory

Shaded cells indicate explorations and samples that will be collected in first phase of investigation

[1] Samples will be collected approximately every 2 feet in soil borings for field screening and potential chemical analyses. Discrete soil samples will be obtained from within the depth intervals shown in this column (rather than composite samples.) The depth ranges represent the intervals that a sample will be analyzed for the COPCs identified in the Soil Analyses columns. Additional samples may be analyzed if field observations indicate the presence of contamination.

[2] The metals listed; arsenic, cadmium and lead, represent metals that had concentrations exceeding screening levels in one or more locations. Some soil samples collected from the infrastructure corridor may also be analyzed for "RCRA 8" metals to provide data needed by soil disposal facilities. The RCRA metals include arsenic, barium, cadmium, chromium, lead, mercury, selenium & silver.

[3] TOC= total organic carbon. TOC and other physical soil properties such as grain size may also be analyzed at various locations for the possibility of establishing site specific Method B cleanup levels.

[a] Also analyze for EPH.
[b] Also analyze for total organic carbon
x = sample collected for analytical testing. Red X = additional analytical testing requested by Ecology in it's September 22, 2008 comment letter.
As = Arsenic, Cd = Cadmium, Pb = Lead
PCBs = Polychlorinated biphenyls
HCID = Hydrocarbon Identification test (NWTPH-HCID)
NWTPH-Dx = Diesel-range and motor oil-range total petroleum hydrocarbons
TPH-MO = motor oil-range petroleum hydrocarbons
D/F = Dioxins and furans
NWTPH-G = Gasoline-range total petroleum hydrocarbons

SEAT:\0\0615034\07\Finals\Revised RI Workplan Oct 08\061503407 RIWP Tables.xls

TABLE 2
PROPOSED NEW MONITORING WELL RATIONALE
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

				Existing Well Data[2]		
Well I.D.	**Purpose**	**Installation Method/Well Diameter**	**Proposed Well Screen Interval (BGS-feet)[1]**	**Nearest Existing well**	**Highest DTW**	**Lowest DTW**
MW21s	MW21S addresses Ecology Comment #9 for detected TPH in soil at MW19.	Direct push/1-inch	2 to 7	MW19	3.47	3.78
MW22s	MW22S will be used to evaluate LNAPL thicknesses and petroleum constituent concentrations near MW06.	Direct push/1-inch	1 to 6	MW6	0.84	1.14
MW23s	MW23S addresses Ecology Comment #9 for detected TPH in soil at DP18.	Direct push/1-inch	4 to 9	MW16	5.41	6.35
MW24s	MW24S addresses Ecology Comment #9 for detected TPH in soil at DP06, DP08, DP24, and DP13.	Direct push/1-inch	2.5 to 7.5	MW10	3.48	3.8
MW25s	MW25S addresses Ecology Comment #9 for detected TPH in soil at DP02 and DP04	Direct push/1-inch	2 to 7	MW7 and MW8	5.0 & 2.55	5 & 2.62

Notes:

Based on recent comments from Ecology, because artesian wells at the Site may be influencing groundwater levels, an attempt will be made to locate and decommission the artesian wells. If the artesian wells are found and decommissioned, the need for shallow monitoring wells will be reevaluated.

[1]Across water table with one foot of screen above predicted high water table elevation and four feet of screen below this elevation, subject to approval by Ecology and issuance of well construction variance.

[2] Based on depth to water measurements collected August 2007 and July 2008 during low and high tides.

bgs=below ground surface

DTW = depth to water in feet as measured from top of well casing. Top of well casings for referenced wells is approximately at ground surface.

SEAT:\0\0615034\07\Finals\Revised RI Workplan Oct 08\061503407 RIWP Tables.xls

TABLE 3
PROPOSED GROUNDWATER MONITORING AND CHEMICAL ANALYTICAL TESTING PLAN
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Well No.[3,4,5]	Associated Historic Source Area/Concern and Contaminant of Potential Concern (COPC)	Past Groundwater Monitoring and Sampling Events												Proposed Future Groundwater Monitoring									
		Last Sampling Events			Chemical Analytical Testing Completed									Physical Parameter Monitoring		Chemical Analytical Testing Proposed							
		Jan-07	Jun-07	Aug-07	TPH-Gasoline	TPH-Diesel	TPH-Oil	VOCs	Total PP Metals	SVOCs (and PAHs)[6]	PCBs[7]	Dioxins/Furans[8]	Previous Exceedance of Screening Level (MTCA A or B)	Depth to Water	Conductivity, pH, ORP, Turbidity, DO, Salinity, Fe^{2+} (using a Horiba U-10 flow through cell)	TPH-Gasoline	TPH-Diesel	TPH-Oil	VOCs (BETX and HVOCs)	Total RCRA Metals	PAHs[6]	PCBs[7]	Dioxins/Furans[8]
MW01	Oil House (TPH)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW02	Machine Shops (TPH, metals, PAHs, VOCs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x [1]	x	--	--
MW03	Tar Dipping Tank (TPH, PAHs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW04	Near former Transformers (PCBs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	**arsenic**	x	x	x	x	x	x	x [1]	x	x	--
MW05 [2]	Power House Area (TPH, metals, VOCs, D/F)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	x	x
MW06	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	See MW22s (if MW22s is not installed, MW06 wil be sampled for parameters planned for MW22s)							
MW07	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW08	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW09	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW10	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	See MW24s (if MW24s is not installed, MW10 wil be sampled for parameters planned for MW24s)							
MW11	None: downgradient from offsite gasoline station	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW12 [2]	Power House Area (TPH, metals, VOCs)	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW13	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	**arsenic, diesel**	x	x	x	x	x	x	x [1]	x	--	--
MW14	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	N	N	N	N	N	N	N	N	N	N	N	N/A	x	x	x	x	x	x	x	x	--	--
MW15 [2]	None	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW16 [2]	Boiler House Area (TPH, PAHs)	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	x (tested Aug-08)
MW17	Shops (TPH, PAHs, Metals, VOCs)	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	**arsenic**	x	x	x	x	x	x	x [1]	x	--	--
MW18 [2]	None: downgradient well near Marine View Drive	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW19	Panel Oiling (TPH, PAHs)	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	See MW21s (if MW21s is not installed, MW19 wil be sampled for parameters planned for MW21s)							
MW20	Refuse Fire Area (TPH, metals, PAHs, D/F)	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
Proposed Wells and/or Sampling Locations																							
MW21s (paired with MW19)[9]	Panel Oiling (TPH, PAHs)													x	x	x	x	x	x	x	x	--	--
MW22s (paired with MW06)[9]	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)													x	x	x	x	x	x	x	x	--	--
MW23s (paired with MW16)[9]	Boiler House Area (TPH, PAHs)													x	x	x	x	x	--	--	--	--	--
MW24s (paired with MW10)[9]	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)													x	x	x	x	x	x	x	x	--	--
MW25s (no pairing)	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)													x	x	x	x	x	x	x	x	--	--
Seep 1[10]	Groundwater/surface water interface													NA	x	x	x	x	x	x	x	--	--
Seep 2 [10]	Groundwater/surface water interface													NA	x	x	x	x	x	x	x	--	--
Seep 3 [10]	Groundwater/surface water interface													NA	x	x	x	x	x	x	x	--	--
Seep 4 [10]	Groundwater/surface water interface													NA	x	x	x	x	x	x	x	--	--

Notes:

[1]Dissolved metals to be tested in addition to total metals at locations where metals exceedances have been measured. Also test these samples for aluminum and iron (Al and Fe^{3+}) to represent suspended clay particles. Results to potentially be used for evaluating sorption of COPCs.

[2]MW05, MW12, MW16 and MW18 are downgradient wells between the subject property and East Bay. These wells will be considered for potential future compliance wells.

[3]MW04, 05, 06, 07, 08, 10 were sampled and tested July 13, 2007 for diesel-range hydrocarbons only.

[4]MW01 through MW10 were installed in January 2007. MW11 through MW20 were installed in July and August 2007.

[5]MW14 was not sampled in 2007 because other monitoring wells surrounding MW14 were sampled and tested.

[6]Note on SVOCs. The only SVOC exceedances were cPAHs, therefore only cPAHs will be analyzed, rather than the full SVOC list.

[7]Note on PCBs. PCBs have not been detected in any of the groundwater samples obtained from MW01 through MW20 at the site; nor have they been detected above soil screening levels. Therefore PCBs will only be tested at locations where low level detections of PCBs were detected in soil on Parcel 3 and near the former transformer location (MW04).

[8]Note on Dioxins/Furans. Dioxin/Furans were not detected in a groundwater sample obtained and tested from MW16 in August 2008. Dioxin sampling and testing approach is based on obtaining samples from potential source area wells that are also downgradient compliance wells (MW05 and MW16). If dioxins/furans are detected in groundwater at MW05 or MW16, then additional testing will be conducted at the other compliance wells (MW04, MW11, MW12

[9]This well will not be installed if water levels drop sufficiently after the artesian wells are decommissioned if the existing paired monitoring well screen is not totally submerged.

[10]Water from this seep area will only be sampled if it is determined to represent groundwater (see Section 5.4.2 of Sample and Analysis Plan)

x = sample collected for analytical testing

Y = Yes; N = No; NA = not applicable; "--" = Not tested

TPH-Gasoline by Ecology Method NWTPH-Gx

TPH-Diesel and Oil by Ecology Method NWTPH-Dx

VOCs (volatile organic compounds) by EPA Method 8260B

RCRA Metals (As, Ba, Cd, Cr, Pb, Ag, Se, Hg) by EPA Methods 6000/7000

PAHs (polycyclic aromatic hydrocarbons) by EPA Method 8270sim

PCBs (polychlorinated biphenyls) by EPA Method 8082

Dioxins/Furans by EPA Method 1613B

ORP = Oxidation Reduction Potential

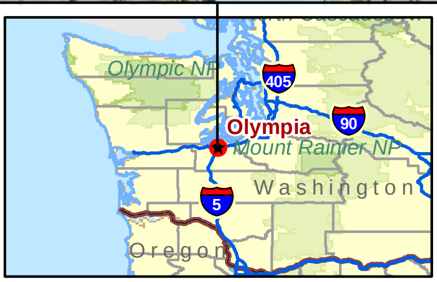
DO = Dissolved Oxygen

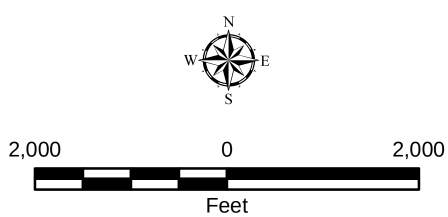
Fe = Iron

Al = Aluminum

COPCs = contaminants of potential concern

SEAT:\0\0615034\07\Finals\Revised RI Workplan Oct 08\061503407 RIWP Tables.xls





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. cannot 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: Interstates, state routes, and roads from TIGER 2000. County boundaries, cities, and waterbodies from Department of Ecology. U.S. topographic map from National Geographic Society.

Lambert Conformal Conic, Washington State Plane North, North American Datum 1983

Vicinity Map

East Bay Redevelopment Project Area
Olympia, Washington

GeoEngineers

Figure 1

Office: TAC Path: P:\0\0615034\02\GIS\061503407_RIWP_FIG1_VICINITYMAP.mxd CDB:TCK Map Revised: October 18, 2008

Office:TAC Path: P:\0\0615034\07\GIS\061503407_RIWP_FIG2_SITEPLAN.mxd CDB:TCK Map Revised: October 22, 2008

Approximate Infastructure Improvement Corridor

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

East Bay Redevelopment Project Area

N W E S

150 0 150

Feet

Site Plan

East Bay Redevelopment Project Area
Olympia, Washington

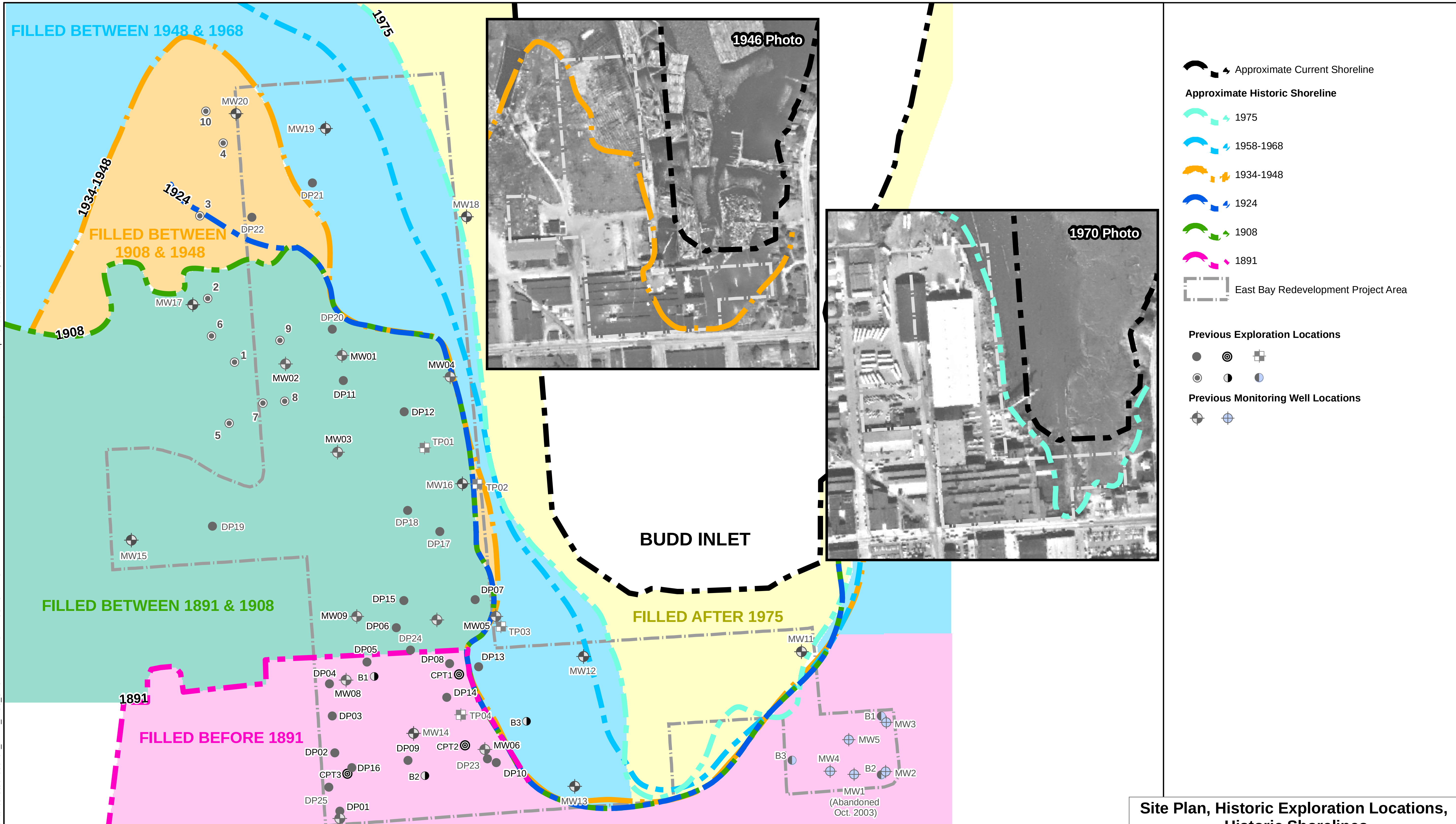
GEOENGINEERS

Figure 2

Reference: Parcel boundaries are based on information provided by the Port of Olympia. Approximate Infastructure Improvement Corridor per Skillings Connolly Drawing. Aerial Photo (dated April 2008) from Skillings Connolly.

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.



Reference: Historic shoreline (1975) from "Proposed Dredging, Fill & Marina Facilities in Budd Inlet, Plate No. 1," revised April 7, 1975.
Historic shorelines (1888, 1908, 1924, 1958 and 1968) digitized from Sanborn maps.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.

N W E S

150 0 150

Feet

Site Plan, Historic Exploration Locations, Historic Shorelines

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 3

Map Revised: October 22, 2008

JCL:CDB:TCK

Path: P:\0\0615034\07\GIS\061503407_RIWP_FIG3_SHORELINE.mxd

Office:TAC

Office:TAC Path: P:\0\0615032\02\GIS\061503407_RIWP_FIG4_HISTORIC_OPERATIONS.mxd CDB:TCK Map Revised: October 21, 2008

Springer Sawmill (1924-1947)

Olympia Door Co. Sawmill (1908)

Olympia Door Co. Sash and Door Factory (1908-1924)

Hyak Lumber Co. Millwork (1946-1968)

Potential Location of Artesian Wells as reported by others

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

East Bay Redevelopment Project Area

H.G. Richardson's Shingle Mill (1908)

Olympia Veneer Co. (1924)

Planing Mill & Sawmill (1888-1896)

St. Paul and Tacoma Lumber Co. (1942 - 1968)

N W E S

150 0 150

Feet

Reference: Historic features were identified from Sanborn maps (dates ranging from 1888 to 1968) and air photos (dates ranging from 1934 to 1996). Aerial photograph (dated April 2008) from Skillings Connolly. East Bay Redevelopment Site and Parcel Boundaries are provided by Port of Olympia.

Notes: 1. Only primary mill facilities are shown. Lumber sheds, outbuildings and lumber storage areas are not shown.
2. The locations of all features shown are approximate.
3. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.

Extent of Historic Operations

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 4

Office:TAC Path: P:\0\0615034\07\GIS\061503407_RIWP_FIG5_AOCs.mxd CDB:TCK Map Revised: October 22, 2008

Test Pit (GeoEngineers, Inc. - Oct. 2007)

Monitoring Well (GeoEngineers, Inc. - Jan. & July 2007)

Direct-Push Boring (GeoEngineers, Inc. - Sept. 2006, Jan. & July 2007)

Direct-Push Boring (GeoEngineers Inc.Sept. 2006, Jan. 2007)

Monitoring Well (GeoEngineers, Inc. Jan. 2007)

Direct-Push Boring (Brown and Caldwell - Nov. 2006, Jan. & Feb. 2007)

Historic Operation Areas

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

Cone Penotrometer Test (Landau - May 2007)

Boring (Landau - May 2007)

Monitoring Well (Delta Environmental - June 2003)

Direct-Push Boring (Northwest Testing Company, Oct. 2006)

East Bay Redevelopment Project Area

TPH = Total Petroleum Hydrocarbons
PAHs - Polycyclic Aromatic Hydrocarbons
METALS = Total or Dissolved Metals
VOCs = Volatile Organic Compounds
PCBs = Polychlorinated Biphenyls
D/F = Dioxins/Furans

150 0 150
Feet

N W E S

Reference: Historic features were identified from Sanborn maps (dates ranging from 1888 to 1968) and air photos (dates ranging from 1934 to 1996). Aerial photograph (dated April 2008) from Skillings Connolly. Parcel boundaries are based on information provided by the Port of Olympia.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for infomation 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 oth this communication.

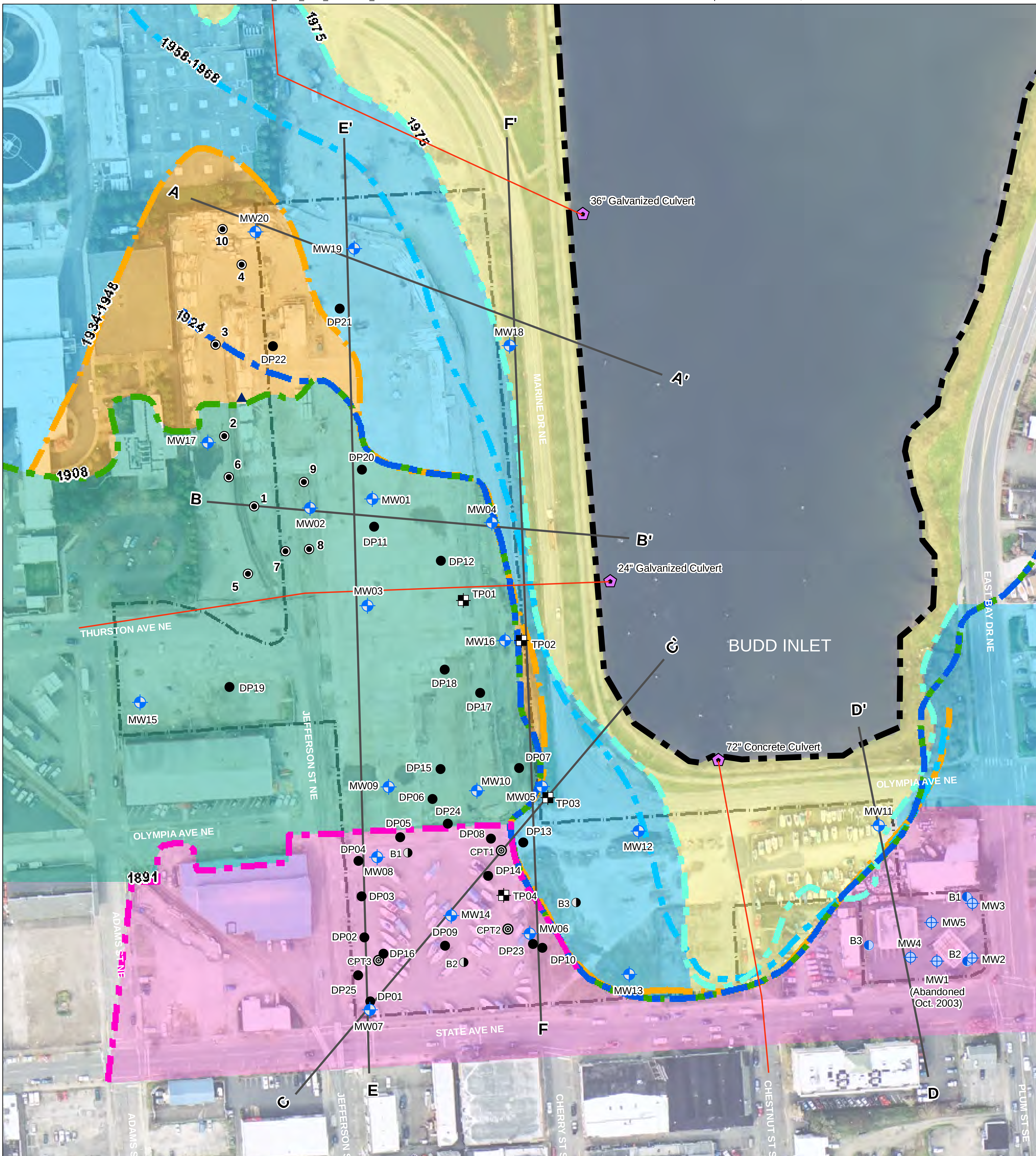
Potential Historical Source Areas

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 5

Office:TAC Path: P:\0\0615034\07\GIS\061503407_RIWP_FIG6_HISTORIC_SHORE.mxd JCL:CDB:TCK Map Revised: October 22, 2008



Test Pit (GeoEngineers, Inc. - Oct. 2007)

Monitoring Well (GeoEngineers, Inc. - Jan. & July 2007)

Direct-Push Boring (GeoEngineers, Inc. - Sept. 2006, Jan. & July 2007)

Direct-Push Boring (Brown and Caldwell - Nov. 2006, Jan. & Feb. 2007)

Artesian Well (Maintained by Port)

Storm Drainage System

Outfall Locations

Monitoring Well (Delta Environmental - June 2003)

Direct-Push Boring (Northwest Testing Company, Oct. 2006)

Cone Penotrometer Test (Landau - May 2007)

Boring (Landau - May 2007)

East Bay Redevelopment Project Area

A — A' Cross-Section Location

Approximate Current Shoreline

Approximate Historic Shoreline

1975

1958-1968

1934-1948

1924

1908

1891

Historic Shoreline - Fill Areas

Post-1975

1948 - 1975

1908 - 1948

1891 - 1908

Pre-1891

N E S W

150 0 150

Feet

Site Plan, Historic Shorelines, Cross-Section Locations

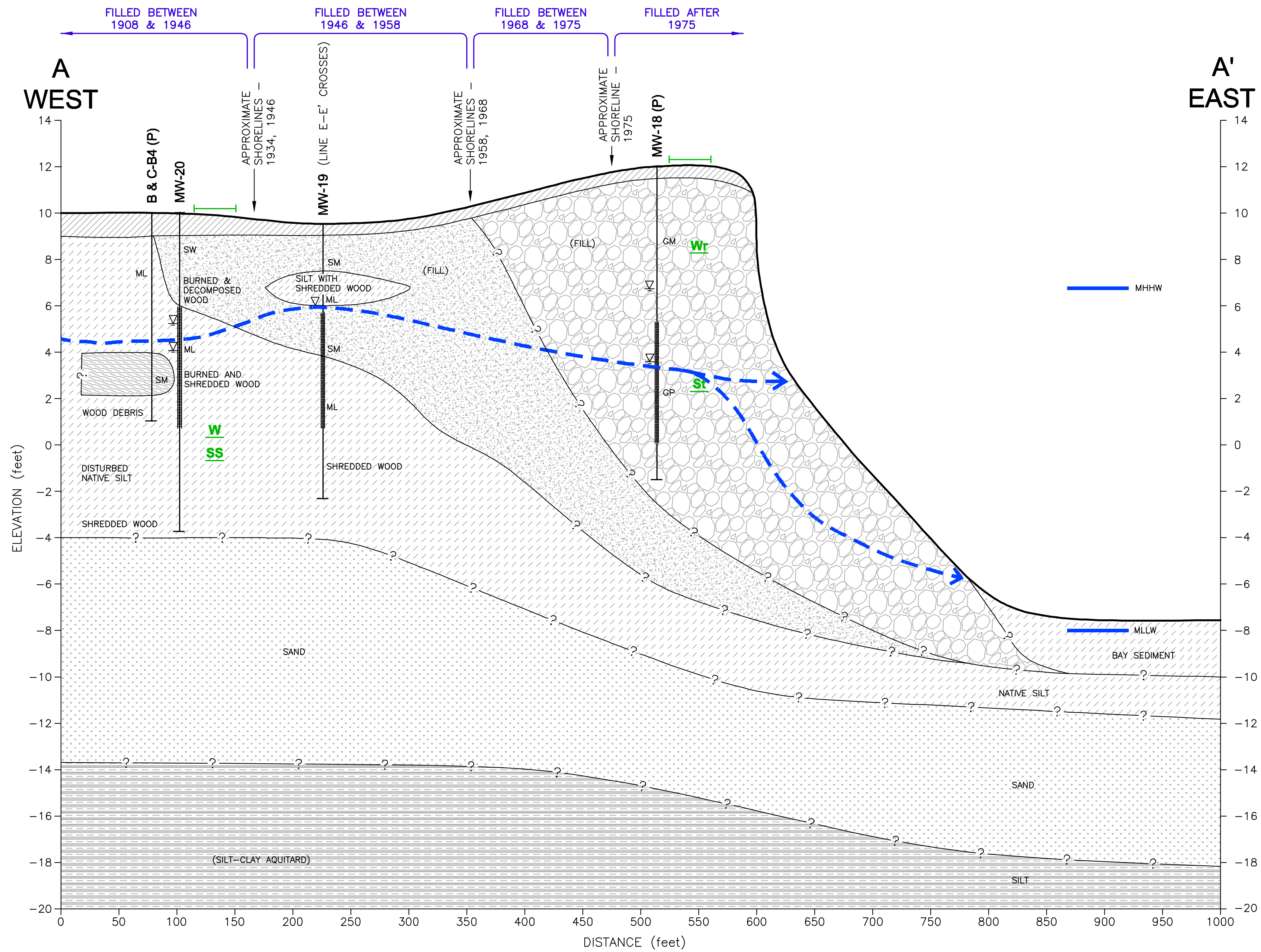
East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 6

Reference: Artesian Well locations and Storm Drainage data are based on information provided by the Port of Olympia. Historic shoreline (1975) from "Proposed Dredging, Fill & Marina Facilities in Budd Inlet, Plate No. 1," revised April 7, 1975. Historic shorelines (1888, 1908, 1924, 1958 and 1968) digitized from Sanborn maps. Aerial photo (dated April 2008) from Skillings Connolly.

Notes: 1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.



PROPOSED UTILITY LINES

- (green line) = Approximate Location of Infrastructure Corridor
- **Wr** = Water (Reclaimed Line)
- **W** = Water
- **SS** = Sanitary Sewer
- **St** = Storm
- (green line) = Approximate Depth of Proposed Utility

LEGEND

FILL
- Pavement Surface (Gravel, Asphalt, Concrete)
- Sand (Light Colored with Construction Debris)
- Wood Debris
- Gravel
- Silt

NATIVE
- Sand (Native)
- Clay

(P) = Projected
▽ = DTW During Drilling
▽ = DTW (MWs) - Aug 07
— — = Interpreted Groundwater Table

EXPLANATION

DP18 BORING NUMBER AND APPROXIMATE LOCATION
Soil Contact
Well Screen

Tidal Elevations Provided by Port of Olympia
MHHW = Mean High High Water (El. 6.83)
MLLW = Mean Low Low Water (El. -7.73)

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. cannot 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.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 20X

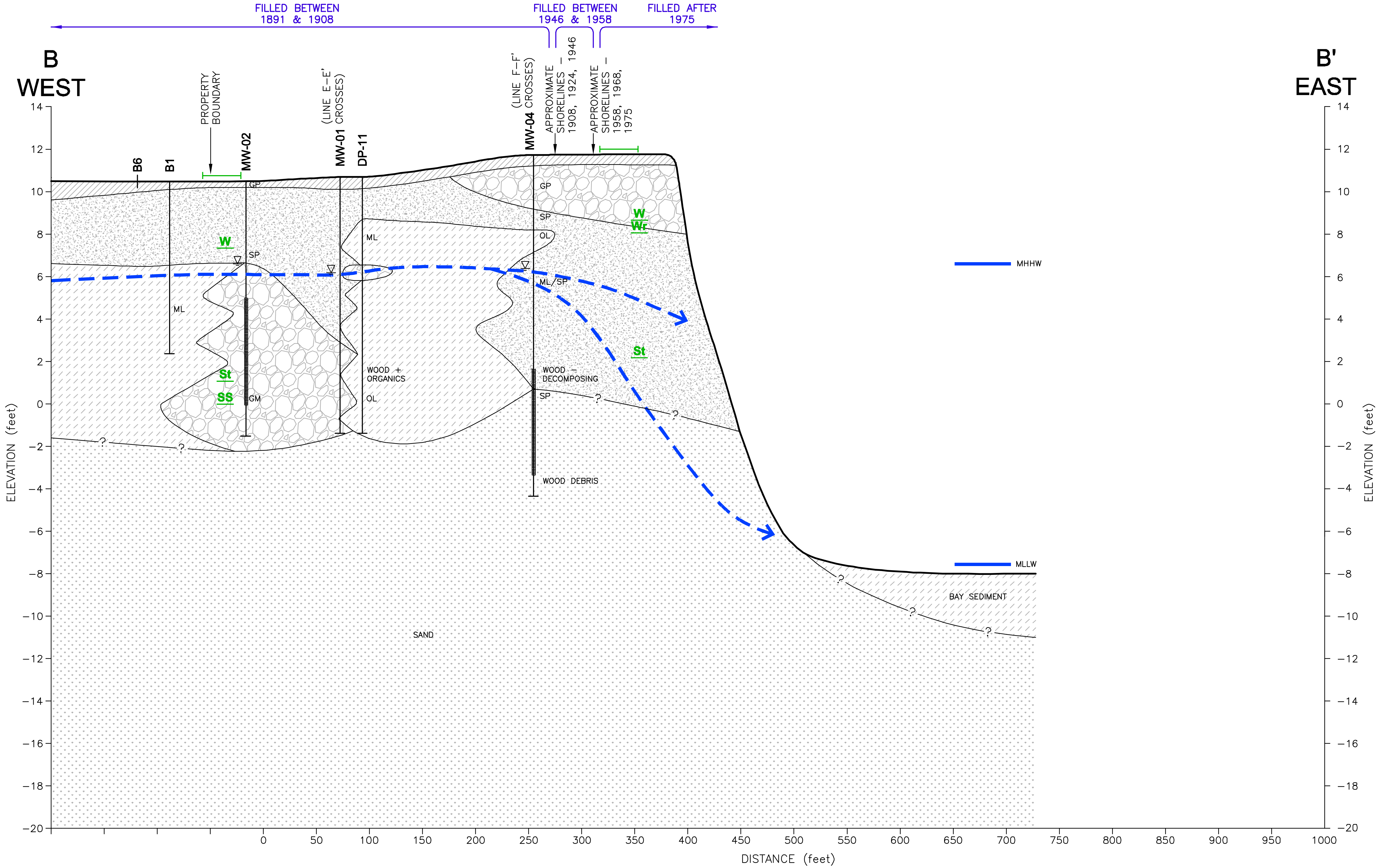
Cross Section A-A'

East Bay Redevelopment Project
Olympia, Washington

GEOENGINEERS

Figure 7A

W:\SEATTLE\PROJECTS\0\0615034\07\WORKING\RI WKPL AUG 08\FIGURES-CAD\CROSS SECTIONS-VERSION2.DWG\TAB:A MODIFIED BY LKNOWLTON ON OCT 20, 2008 - 10:54



PROPOSED UTILITY LINES

- = Approximate Location of Infrastructure Corridor
- **Wr** = Water (Reclaimed Line)
- **W** = Water
- **SS** = Sanitary Sewer
- **St** = Storm
- = Approximate Depth of Proposed Utility

LEGEND

FILL
- Pavement Surface (Gravel, Asphalt, Concrete)
- Sand (Light Colored with Construction Debris)
- Gravel
- Silt (Disturbed)

NATIVE
- Sand (Native)
- Clay

(P) = Projected
= DTW During Drilling
= DTW (MWs) – Aug 07
= Interpreted Groundwater Table

EXPLANATION

DP18 BORING NUMBER AND APPROXIMATE LOCATION
Soil Contact
Well Screen

Tidal Elevations Provided by Port of Olympia
MHHW = Mean High High Water (El. 6.83)
MLLW = Mean Low Low Water (El. −7.73)

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. cannot 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.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 20X

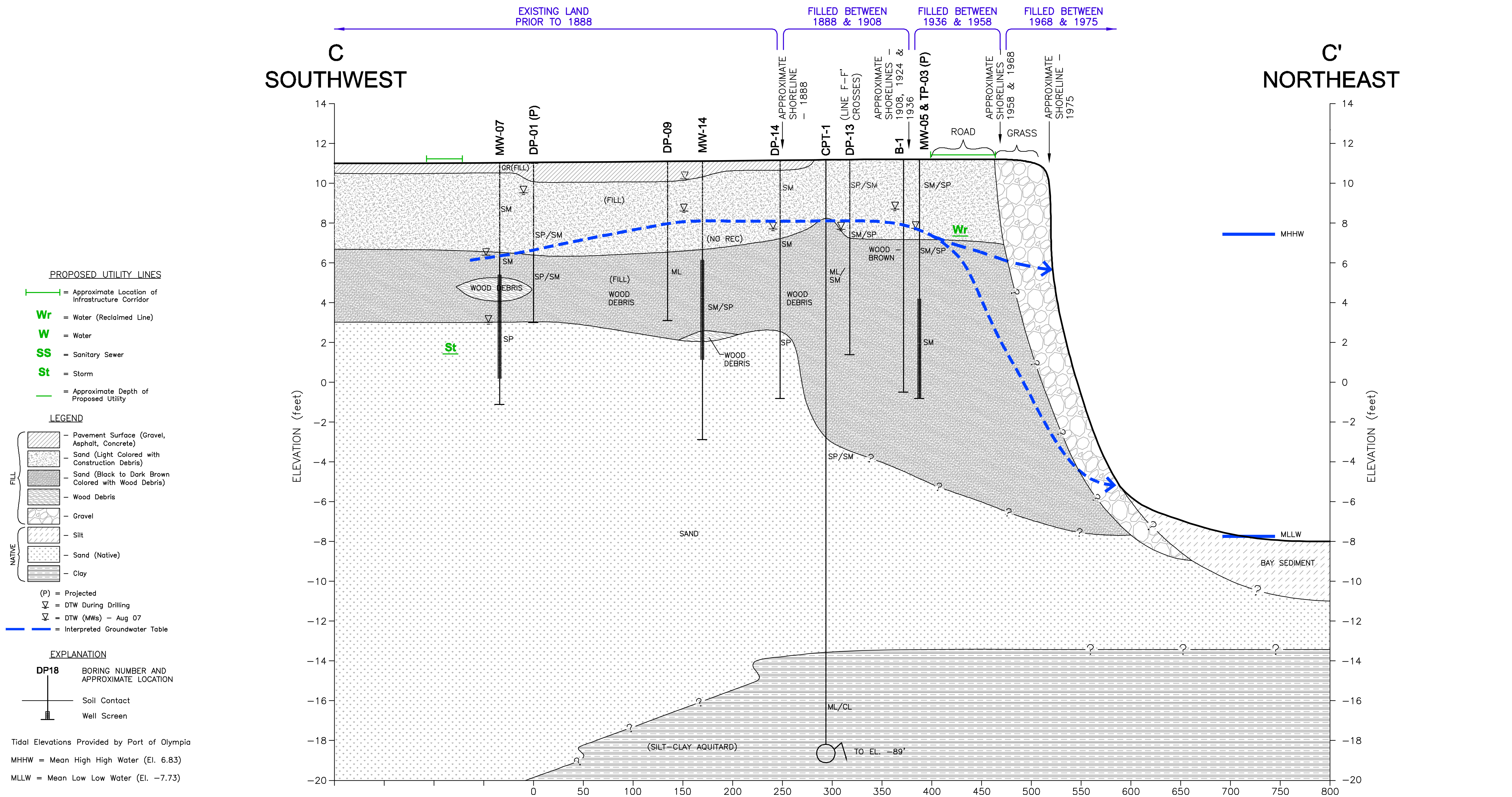
Cross Section B-B'

East Bay Redevelopment Project
Olympia, Washington

GEOENGINEERS

Figure 7B

W:\SEATTLE\PROJECTS\0\0615034\07\WORKING\RI WKPL AUG 08\FIGURES-CAD\CROSS SECTIONS-VERSION2.DWG\TAB:B MODIFIED BY LKNOWLTON ON OCT 20, 2008 - 10:56



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. cannot 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.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 20X

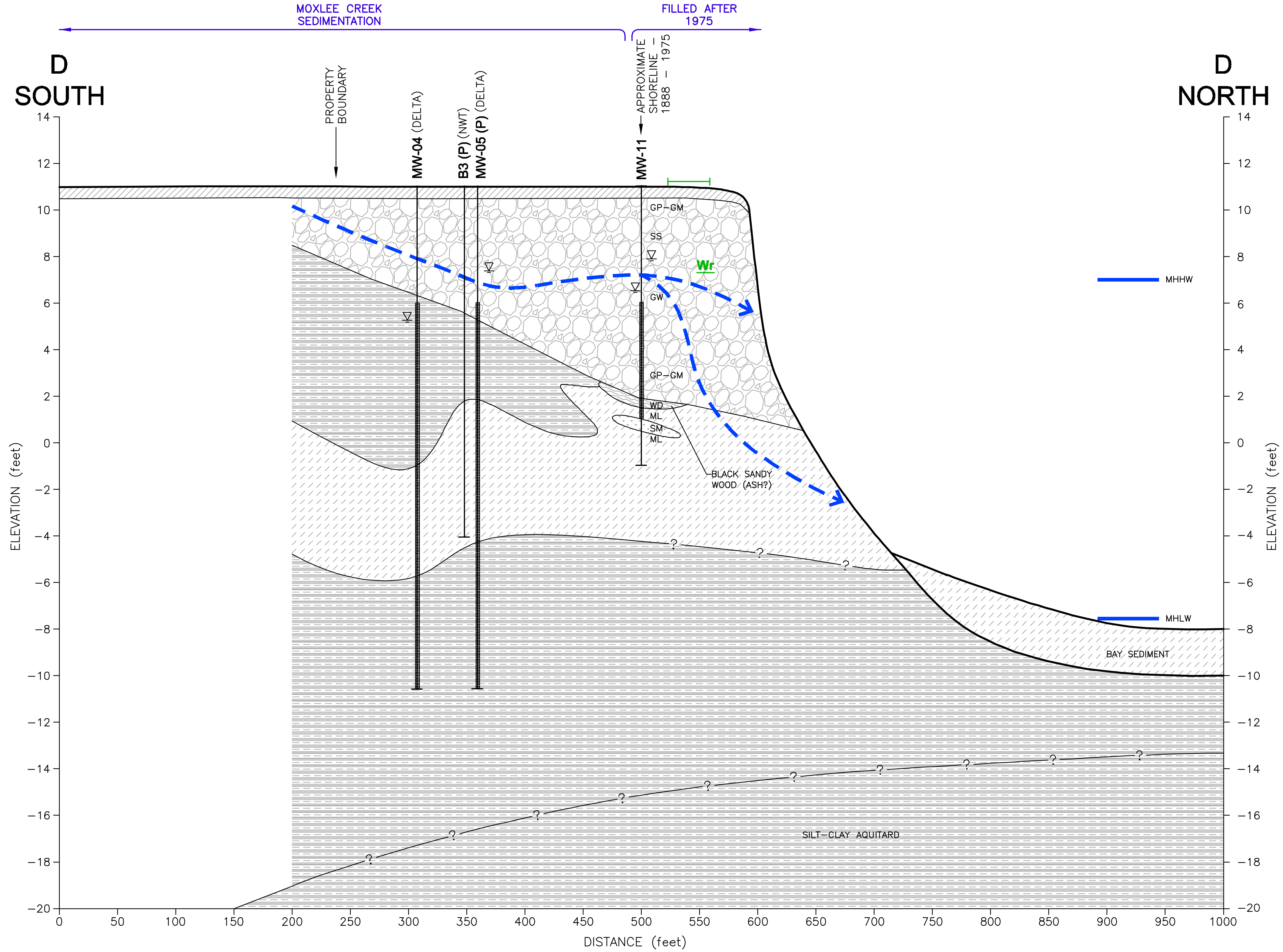
Cross Section C-C'

East Bay Redevelopment Project
Olympia, Washington

GEOENGINEERS

Figure 7C

W:\SEATTLE\PROJECTS\0\0615034\07\WORKING\RI WKPL AUG 08\FIGURES-CAD\CROSS SECTIONS-VERSION2.DWG\TAB:D MODIFIED BY LKNOWLTON ON OCT 20, 2008 - 10:58



PROPOSED UTILITY LINES

= Approximate Location of Infrastructure Corridor
Wr = Water (Reclaimed Line)
W = Water
SS = Sanitary Sewer
St = Storm
= Approximate Depth of Proposed Utility

LEGEND

FILL
- Pavement Surface (Gravel, Asphalt, Concrete)
- Wood Debris
- Gravel

NATIVE
- Silt
- Sand (Native)
- Clay

(P) = Projected
= DTW During Drilling
= DTW (MWs) - Aug 07
= Interpreted Groundwater Table

EXPLANATION

DP18 BORING NUMBER AND APPROXIMATE LOCATION
Soil Contact
Well Screen

Tidal Elevations Provided by Port of Olympia
MHHW = Mean High High Water (El. 6.83)
MLLW = Mean Low Low Water (El. -7.73)

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. cannot 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.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

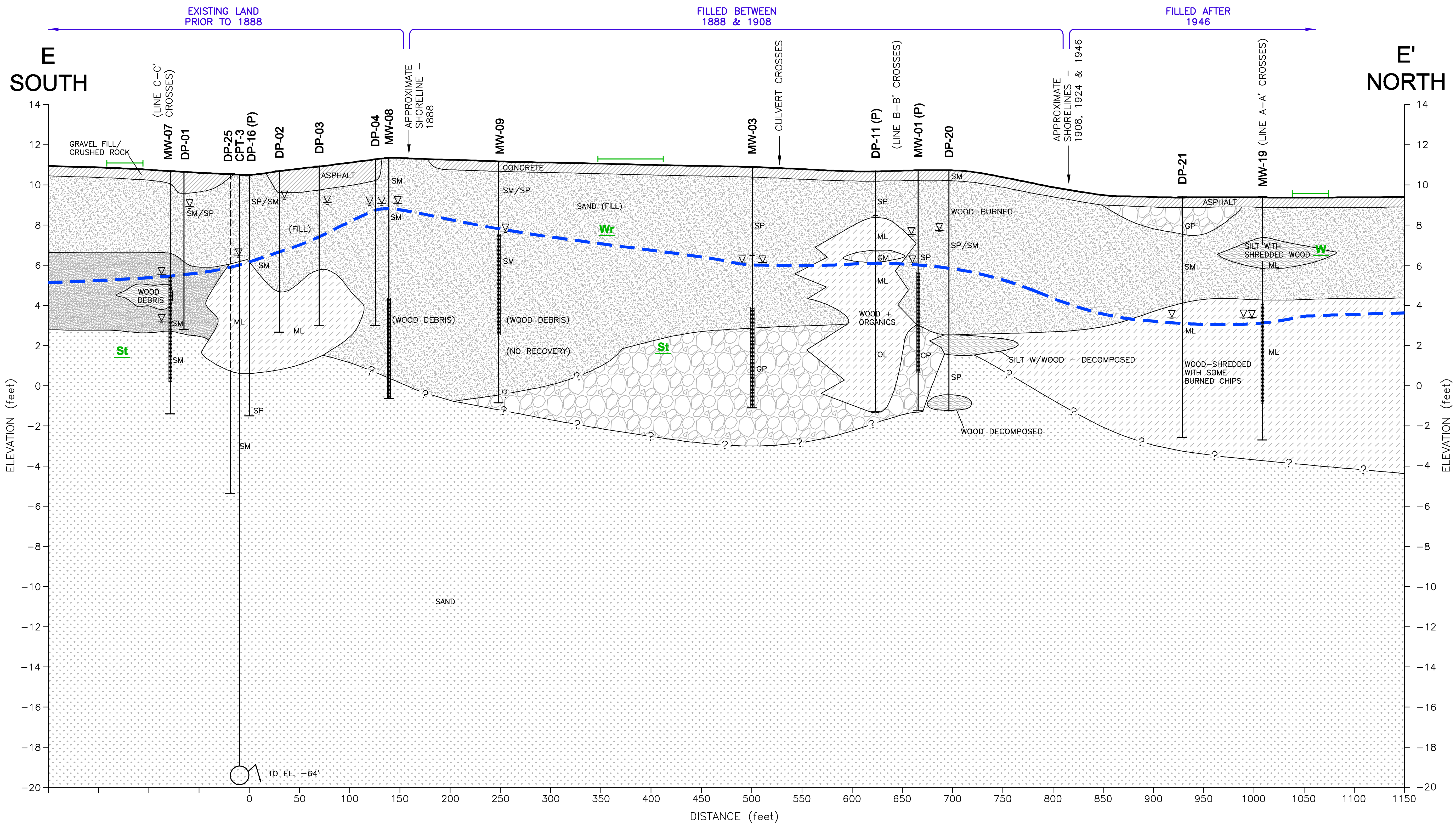
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 20X

Cross Section D-D'

East Bay Redevelopment Project
Olympia, Washington

GEOENGINEERS

Figure 7D



LEGEND

FILL:
- Pavement Surface (Gravel, Asphalt, Concrete)
- Sand (Light Colored with Construction Debris)
- Sand (Black to Dark Brown Colored with Wood Debris)
- Wood Debris
- Gravel

NATIVE:
- Silt (Disturbed Native)
- Sand (Native)
- Clay

(P) = Projected
▽ = DTW During Drilling
▽ = DTW (MWs) - Aug 07
= Interpreted Groundwater Table

EXPLANATION

DP18 — BORING NUMBER AND APPROXIMATE LOCATION
Soil Contact
Well Screen

Tidal Elevations Provided by Port of Olympia
MHHW = Mean High High Water (El. 6.83)
MLLW = Mean Low Low Water (El. -7.73)

PROPOSED UTILITY LINES

= Approximate Location of Infrastructure Corridor
Wr = Water (Reclaimed Line)
W = Water
SS = Sanitary Sewer
St = Storm
= Approximate Depth of Proposed Utility

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 20X

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. cannot 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.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

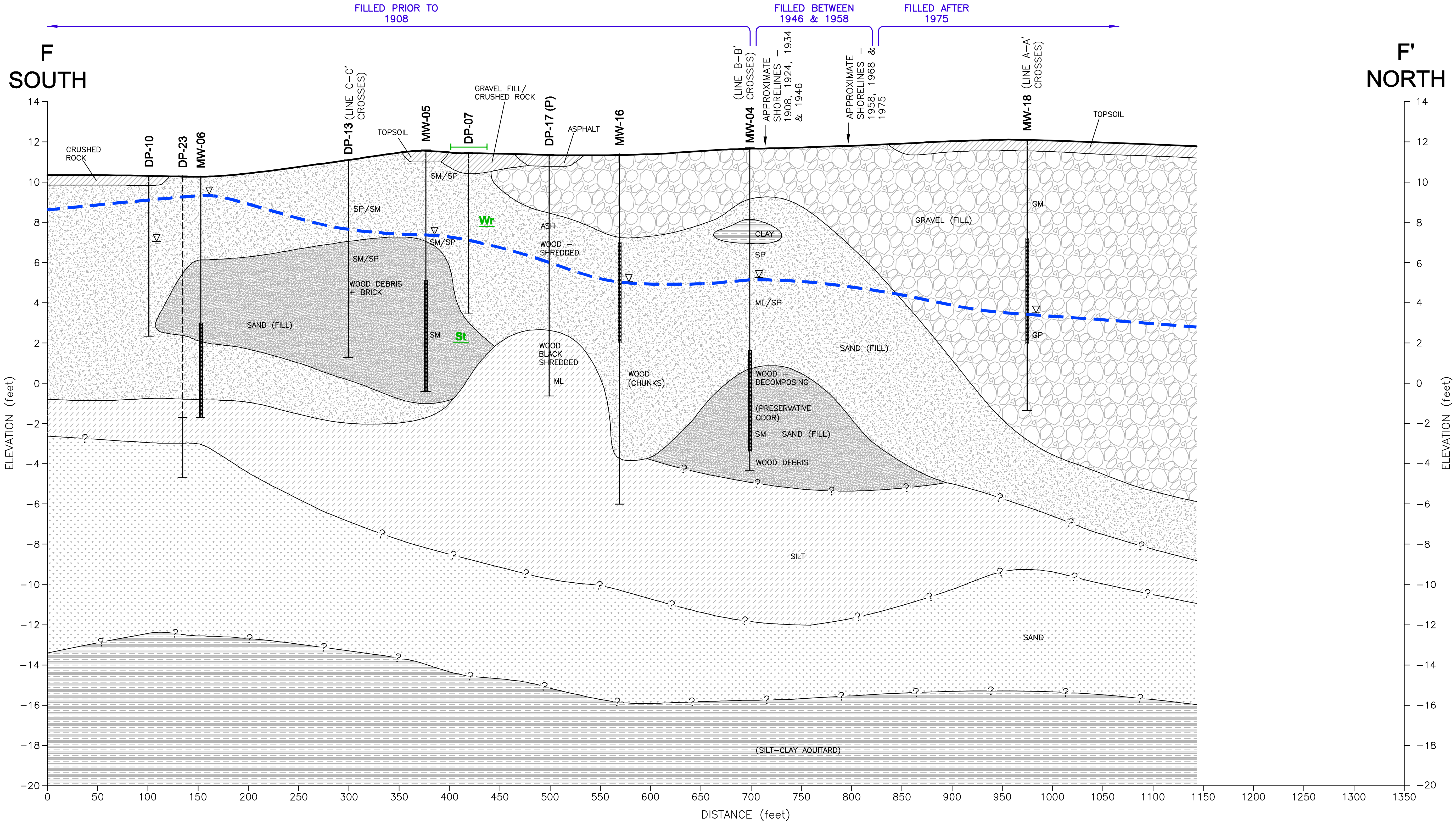
Cross Section E-E'

East Bay Redevelopment Project
Olympia, Washington

GEOENGINEERS

Figure 7E

W:\SEATTLE\PROJECTS\0\0615034\07\WORKING\RI WKPL AUG 08\FIGURES-CAD\CROSS SECTIONS-VERSION2.DWG\TAB:E MODIFIED BY LKNOWLTON ON OCT 20, 2008 - 10:59



LEGEND

FILL
- Pavement Surface (Gravel, Asphalt, Concrete)
- Sand (Light Colored with Construction Debris)
- Sand (Black to Dark Brown Colored with Wood Debris)
- Gravel

NATIVE
- Silt
- Sand (Native)
- Clay

(P) = Projected
= DTW During Drilling
= DTW (MWs) - Aug 07
= Interpreted Groundwater Table

EXPLANATION

DP18 BORING NUMBER AND APPROXIMATE LOCATION

Soil Contact

Well Screen

Tidal Elevations Provided by Port of Olympia

MHHW = Mean High High Water (El. 6.83)

MLLW = Mean Low Low Water (El. -7.73)

PROPOSED UTILITY LINES

= Approximate Location of Infrastructure Corridor

Wr = Water (Reclaimed Line)

W = Water

SS = Sanitary Sewer

St = Storm

= Approximate Depth of Proposed Utility

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 20X

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. cannot 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.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

Cross Section F-F'

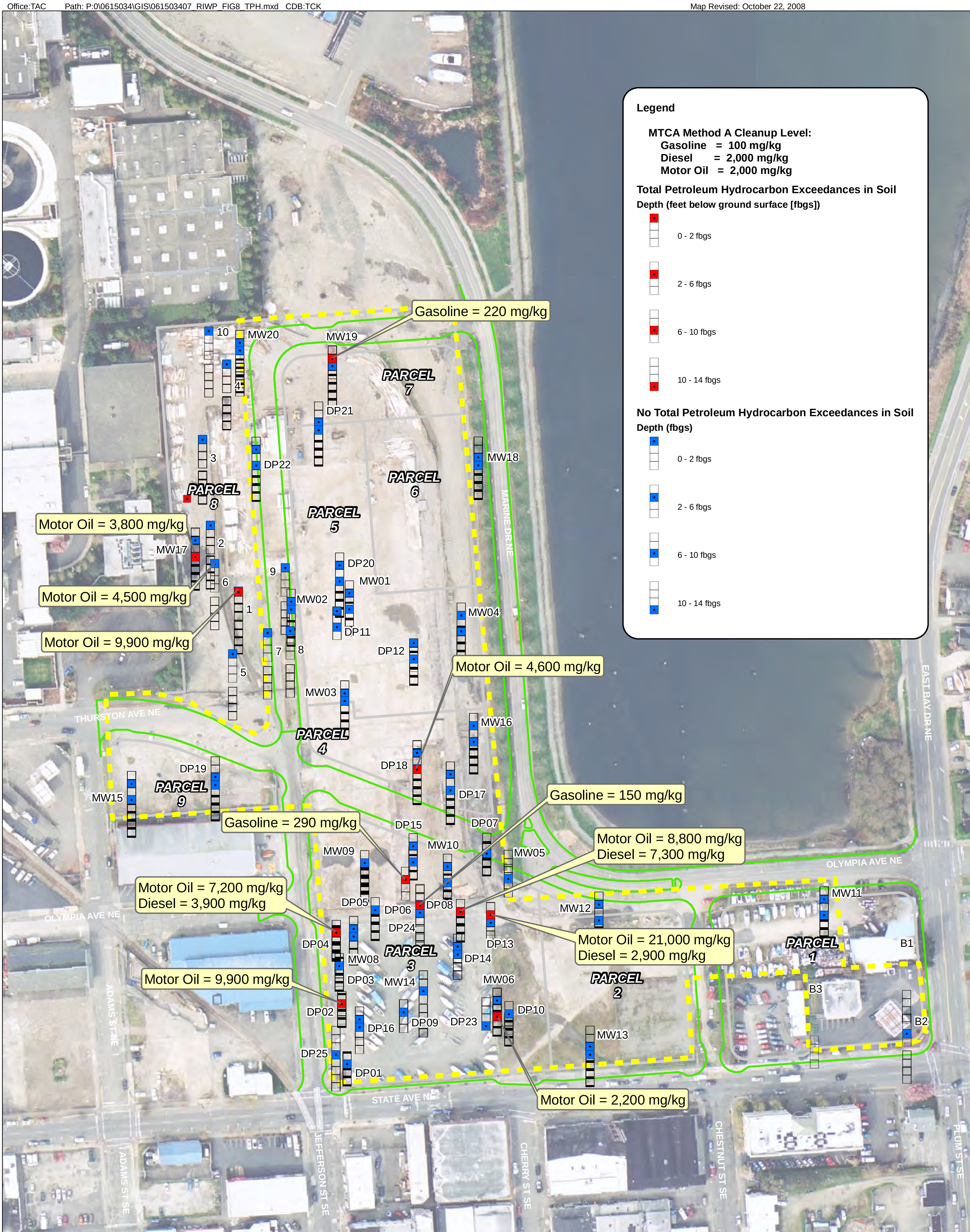
East Bay Redevelopment Project
Olympia, Washington

GEOENGINEERS

Figure 7F

W:\SEATTLE\PROJECTS\0\0615034\07\WORKING\RI WKPL AUG 08\FIGURES-CAD\CROSS SECTIONS-VERSION2.DWG\TAB:F MODIFIED BY LKNOWLTON ON OCT 20, 2008 - 11:00

Office:TAC Path: P:0\0615034\GIS\061503407_RIWP_FIG8_TPH.mxd CDB:TCK Map Revised: October 22, 2008



Blue box indicates sample was analyzed but the analyte(s) was not detected or was detected at concentrations less than applicable cleanup levels.

Red box indicates the analyte(s) was detected at a concentration greater than applicable cleanup levels.

Clear box indicates no sample tested and/or analyzed.

Approximate Infastructure Improvement Corridor

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

East Bay Redevelopment Project Area

N W E S

150 0 150

Feet

Reference: Aerial photograph (dated April 2008) from Skillings Connolly. Short plat parcel boundaries are based on information provided by the Port of Olympia. Approximate Infastructure Improvement Corridor per Skillings Connolly Drawing.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.

Extent of Petroleum Hydrocarbons in Soil

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 8

Office:TAC Path: P:\0\0615034\GIS\061503407_RIWP_FIG9_METALS.mxd CDB:TCK Map Revised: October 22, 2008

Blue box indicates sample was analyzed but the analyte(s) was not detected or was detected at concentrations less than applicable cleanup levels.

Red box indicates the analyte(s) was detected at a concentration greater than applicable cleanup levels.

Clear box indicates no sample tested and/or analyzed.

Approximate Infastructure Improvement Corridor

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

East Bay Redevelopment Project Area

N W E S

150 0 150

Feet

Reference: Aerial photograph (dated April 2008) and Approximate Infastructure Improvement Corridor from Skillings Connolly.
Short plat parcel boundaries are based on information provided by the Port of Olympia.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.

Extent of Metals in Soil

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 9

Blue box indicates sample was analyzed but the analyte(s) was not detected or was detected at concentrations less than applicable cleanup levels.

Red box indicates the analyte(s) was detected at a concentration greater than applicable cleanup levels.

Clear box indicates no sample tested and/or analyzed.

Approximate Infastructure Improvement Corridor

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

East Bay Redevelopment Project Area

TEQ = Toxicity Equivalency Quotient

Reference: Aerial photograph (dated April 2008) and Approximate Infastructure Improvement Corridor from Skillings Connolly.
Short plat parcel boundaries are based on information provided by the Port of Olympia.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.

Extent of cPAHs in Soil

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 10

Office:TAC Path: P:\0\0615034\GIS\061503407_RIWP_FIG11_DIOXIN.mxd CDB:TCK Map Revised: October 22, 2008

TP01 (Randomly Selected)	Dioxin/Furan TEQ (ng/kg)	Depth (feet bgs)
10/2007	430.3	2'
MTCA Cleanup Level	11	

TP02 (Boiler House [AOC 17])	Dioxin/Furan TEQ (ng/kg)	Depth (feet bgs)
10/2007	645.7	2'
MTCA Cleanup Level	11	

TP03 (Power House [AOC 22-24])	Dioxin/Furan TEQ (ng/kg)	Depth (feet bgs)
10/2007	57.9	3.5'
MTCA Cleanup Level	11	

TP04 (Randomly Selected)	Dioxin/Furan TEQ (ng/kg)	Depth (feet bgs)
10/2007	108.4	1.5'
MTCA Cleanup Level	11	

Test Pit (GeoEngineers, Inc.)

Approximate Infastructure Improvement Corridor

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

East Bay Redevelopment Project Area

N W E S

150 0 150

Feet

ng/kg = nanogram per kilogram
TP01 and TP04 were randomly selected locations.

Reference: Aerial photograph (dated April 2008) and Approximate Infastructure Improvement Corridor from Skillings Connolly.
Short plat parcel boundaries are based on information provided by the Port of Olympia.

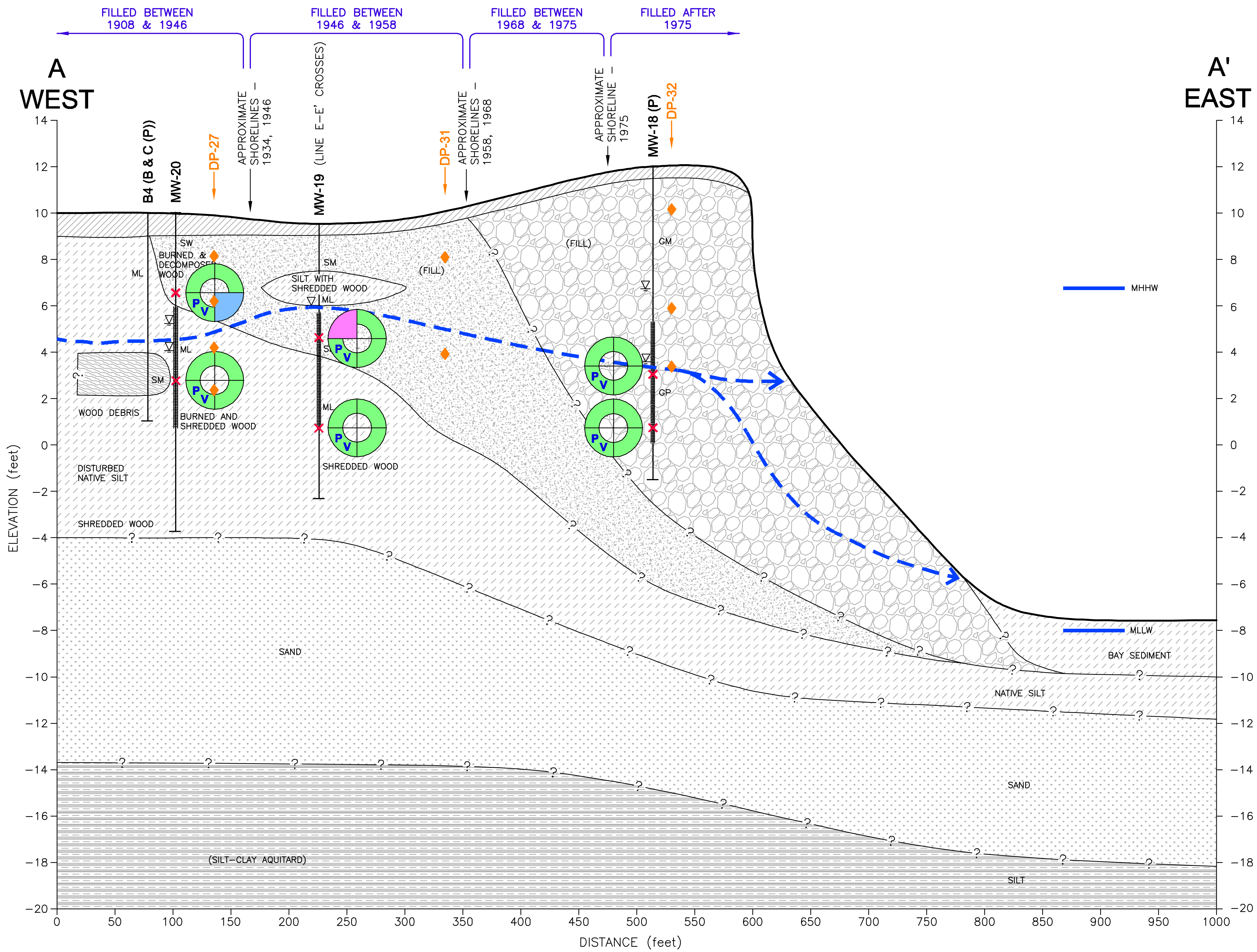
Notes:
1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Dioxin/Furan in Soil

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 11



PREVIOUS ANALYTICAL RESULTS

TPH | Metals | Other | PAHs

= No Exceedance

= Not Tested

OTHER = PCBs, VOCs, DIOXINS/FURANS

OTHER PCOCs TESTED ARE INDICATED BY AN INITIAL:

P = PCB

V = VOC

D = DIOXINS & FURANS

IF NO INITIAL, SAMPLE NOT TESTED

NO SVOC EXCEEDANCES EXCEPT AS NOTED FOR PAH TEQs

LEGEND

FILL
- Pavement Surface (Gravel, Asphalt, Concrete)
- Sand (Light Colored with Construction Debris)
- Wood Debris
- Gravel

- Silt

NATIVE
- Sand (Native)
- Clay

(P) = Projected

= DTW During Drilling

= DTW (MWs) – Aug 07

= Interpreted Groundwater Table

DP-27 = Proposed Boring Locations & Sample Depths (See Figures 16 & 17 for a site plan showing proposed boring locations.)

EXPLANATION

DP18 BORING NUMBER AND APPROXIMATE LOCATION

Soil Contact

Well Screen

Tidal Elevations Provided by Port of Olympia

MHHW = Mean High High Water (El. 6.83)

MLLW = Mean Low Low Water (El. –7.73)

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 20X

Cross Section A-A'
With Chemical Analytical Results

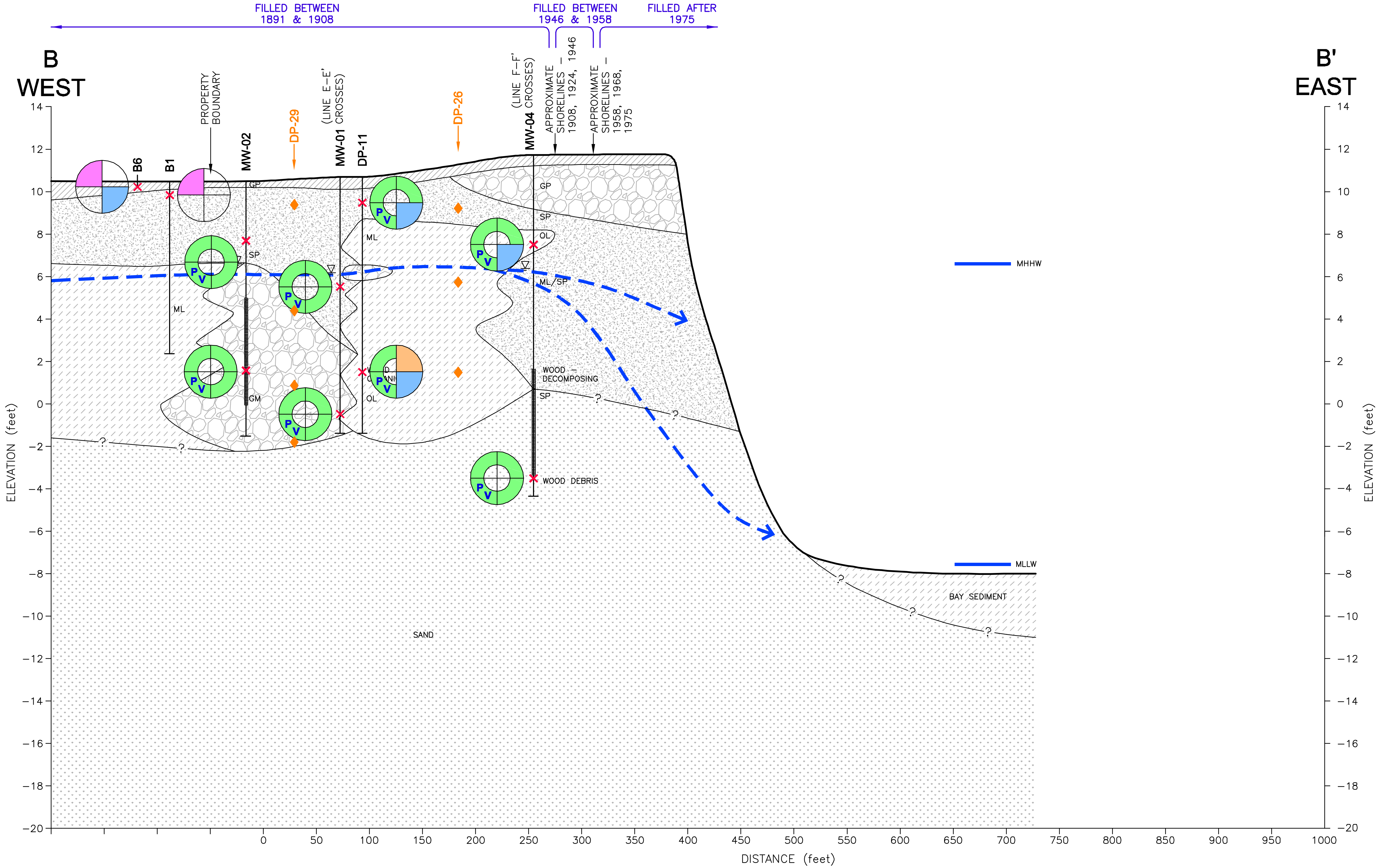
East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 12A

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. cannot 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.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.



PREVIOUS ANALYTICAL RESULTS

TPH, Metals, Other, PAHs

= No Exceedance

= Not Tested

OTHER = PCBs, VOCs, DIOXINS/FURANS

OTHER PCOCs TESTED ARE INDICATED BY AN INITIAL:

P = PCB

V = VOC

D = DIOXINS & FURANS

IF NO INITIAL, SAMPLE NOT TESTED

NO SVOC EXCEEDANCES EXCEPT AS NOTED FOR PAH TEQs

LEGEND

FILL
- Pavement Surface (Gravel, Asphalt, Concrete)
- Sand (Light Colored with Construction Debris)
- Gravel
- Silt (Disturbed)

NATIVE
- Sand (Native)
- Clay

(P) = Projected

= DTW During Drilling

= DTW (MWs) – Aug 07

= Interpreted Groundwater Table

DP-29 = Proposed Boring Locations & Sample Depths (See Figures 16 & 17 for a site plan showing proposed boring locations.)

EXPLANATION

DP18 BORING NUMBER AND APPROXIMATE LOCATION

Soil Contact

Well Screen

Tidal Elevations Provided by Port of Olympia

MHHW = Mean High High Water (El. 6.83)

MLLW = Mean Low Low Water (El. −7.73)

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. cannot 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.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

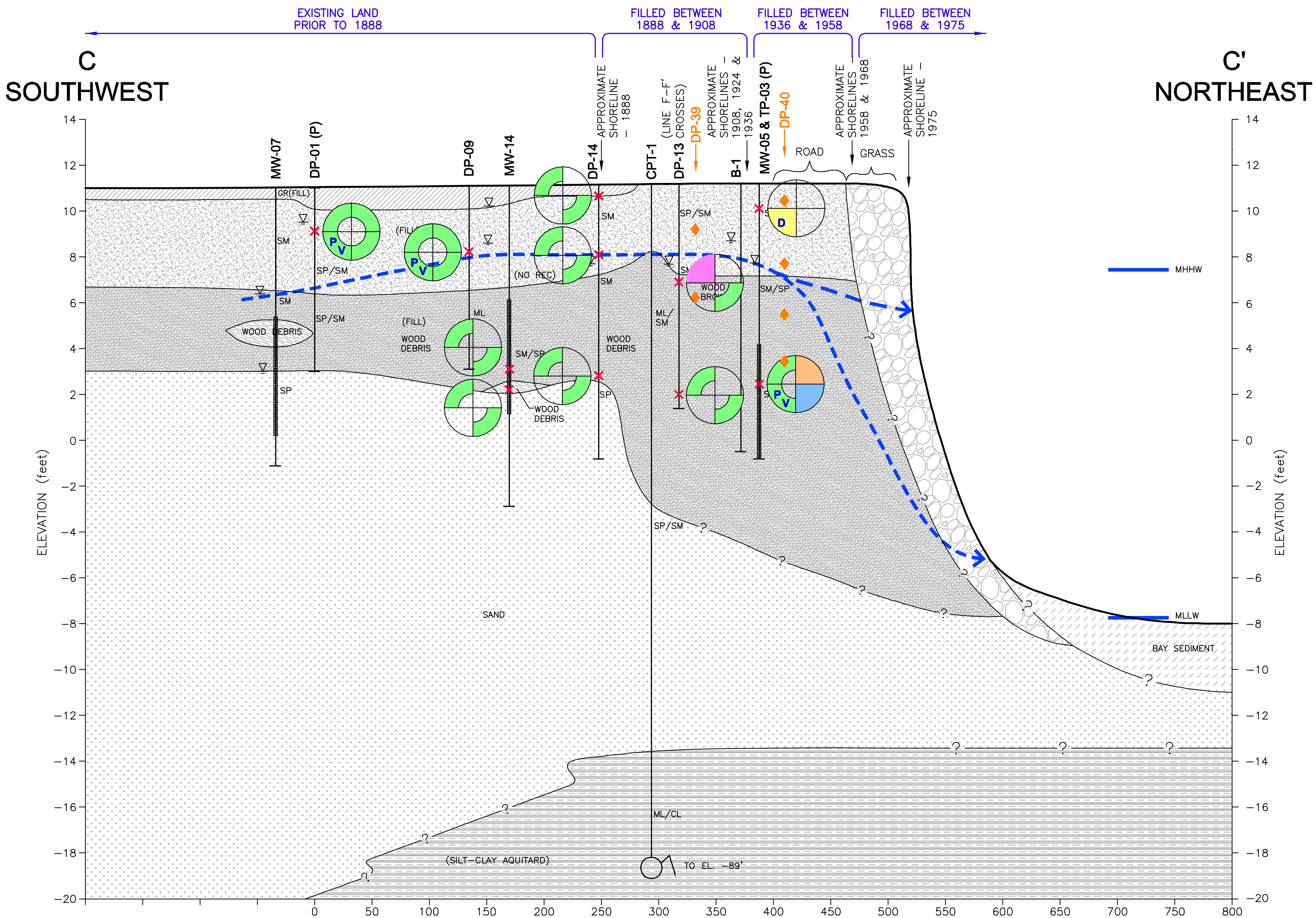
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 20X

Cross Section B-B'
With Chemical Analytical Results

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 12B



PREVIOUS ANALYTICAL RESULTS

TPH — Metals — Other — PAHs

= No Exceedance

= Not Tested

OTHER = PCBs, VOCs, DIOXINS/FURANS

OTHER PCOCs TESTED ARE INDICATED BY AN INITIAL:

P = PCB

V = VOC

D = DIOXINS & FURANS

IF NO INITIAL, SAMPLE NOT TESTED

NO SVOC EXCEEDANCES EXCEPT AS NOTED FOR PAH TEQs

LEGEND

FILL
- Pavement Surface (Gravel, Asphalt, Concrete)
- Sand (Light Colored with Construction Debris)
- Sand (Black to Dark Brown Colored with Wood Debris)
- Wood Debris
- Gravel

NATIVE
- Silt
- Sand (Native)
- Clay

(P) = Projected

= DTW During Drilling

= DTW (MWs) – Aug 07

= Interpreted Groundwater Table

DP-38 = Proposed Boring Locations & Sample Depths (See Figures 16 & 17 for a site plan showing proposed boring locations.)

EXPLANATION

DP18 — BORING NUMBER AND APPROXIMATE LOCATION

Soil Contact

Well Screen

Tidal Elevations Provided by Port of Olympia

MHHW = Mean High High Water (El. 6.83)

MLLW = Mean Low Low Water (El. -7.73)

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 20X

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. cannot 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.

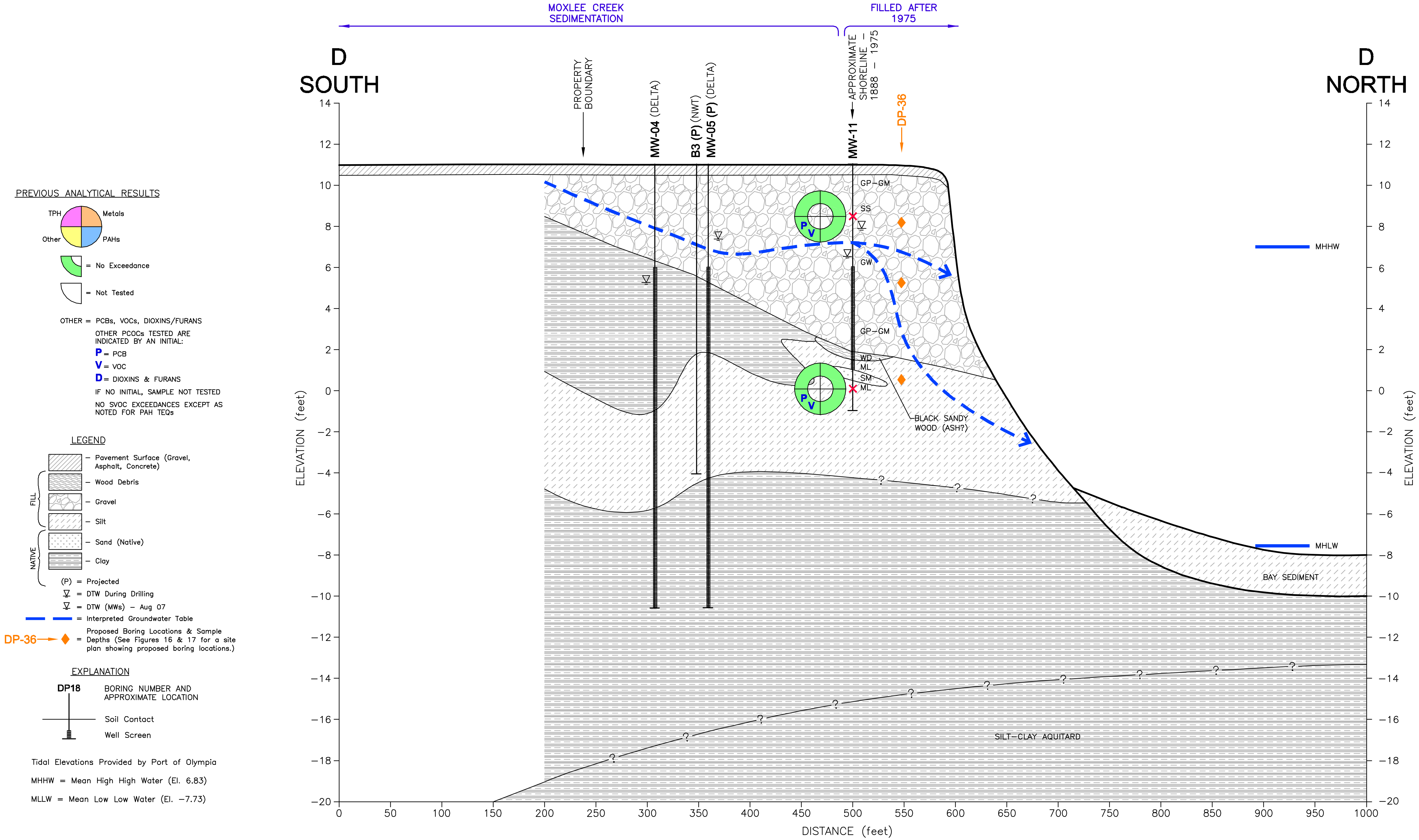
Reference: Drawing created from sketch provided by GeoEngineers' personnel.

Cross Section C-C'
With Chemical Analytical Results

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 12C



W:\SEATTLE\PROJECTS\0\0615034\07\WORKING\RI WKPL AUG 08\FIGURES-CAD\CHEM CIRCLES-VERSION2.DWG\TAB:D MODIFIED BY LKNOWLTON ON OCT 20, 2008 - 10:45

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. cannot 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.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

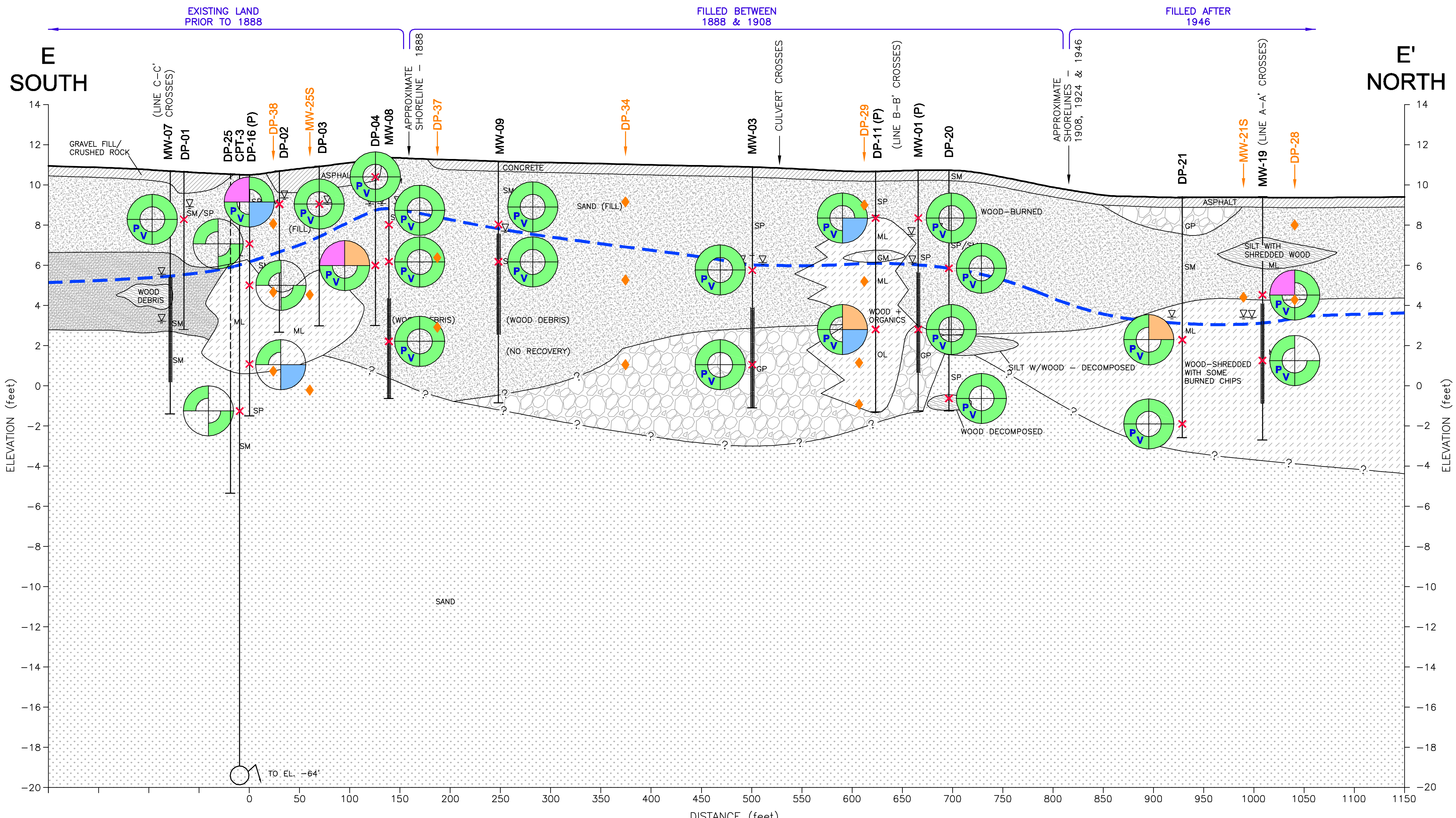
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 20X

Cross Section D-D'
With Chemical Analytical Results

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 12D



LEGEND

FILL
- Pavement Surface (Gravel, Asphalt, Concrete)
- Sand (Light Colored with Construction Debris)
- Sand (Black to Dark Brown Colored with Wood Debris)
- Wood Debris
- Gravel

NATIVE
- Silt (Disturbed Native)
- Sand (Native)
- Clay

(P) = Projected
∇ = DTW During Drilling
∇ = DTW (MWs) – Aug 07
= Interpreted Groundwater Table
DP-38 = Proposed Boring Locations & Sample Depths (See Figures 16 & 17 for a site plan showing proposed boring locations.)

EXPLANATION

DP18 BORING NUMBER AND APPROXIMATE LOCATION
Soil Contact
Well Screen

Tidal Elevations Provided by Port of Olympia
MHHW = Mean High High Water (El. 6.83)
MLLW = Mean Low Low Water (El. –7.73)

PREVIOUS ANALYTICAL RESULTS

TPH, Metals, Other, PAHs
= No Exceedance
= Not Tested

OTHER = PCBs, VOCs, DIOXINS/FURANS
OTHER PCOCs TESTED ARE INDICATED BY AN INITIAL:
P = PCB
V = VOC
D = DIOXINS & FURANS
IF NO INITIAL, SAMPLE NOT TESTED
NO SVOC EXCEEDANCES EXCEPT AS NOTED FOR PAH TEQs

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 20X

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. cannot 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.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

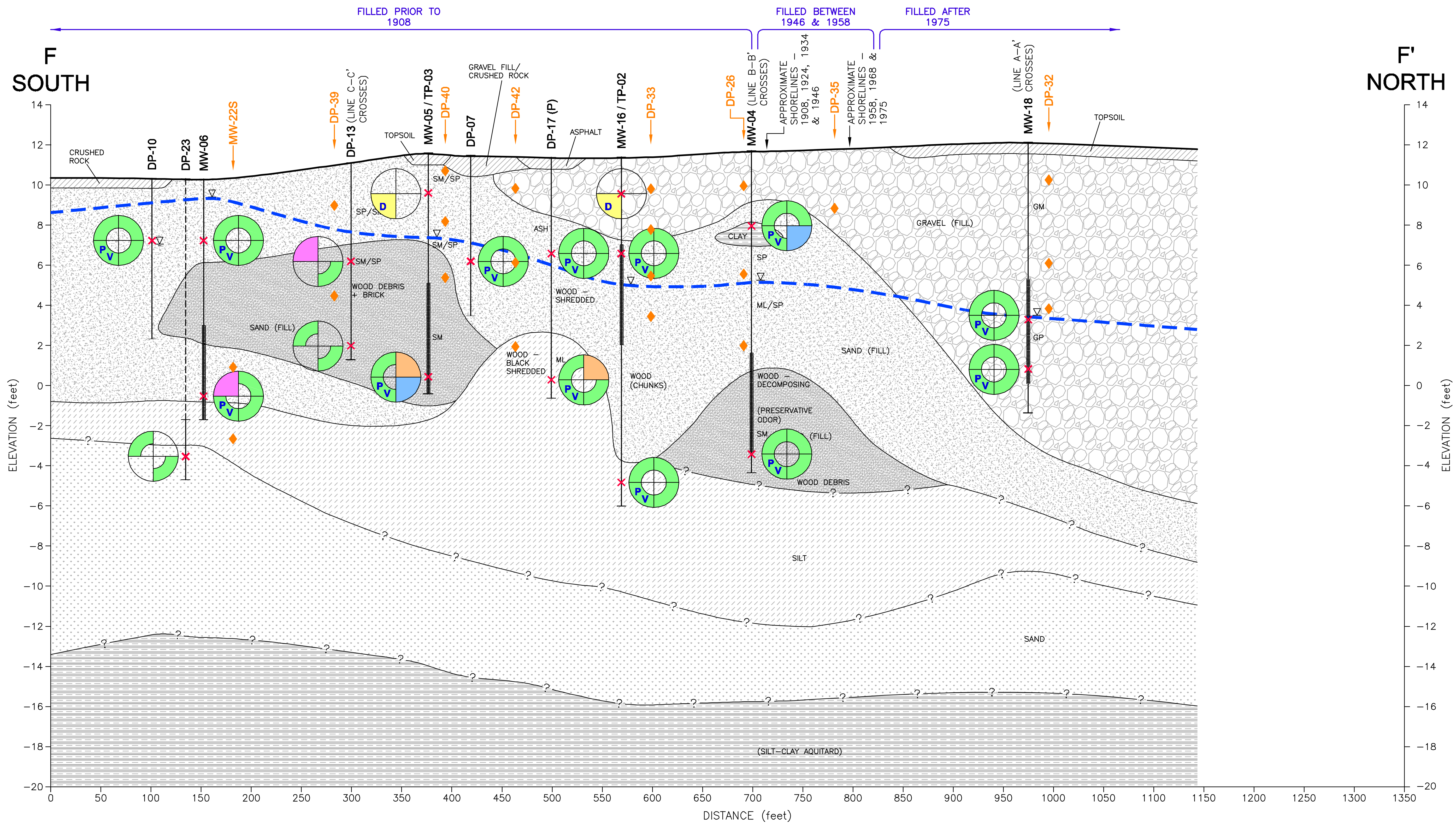
Cross Section E-E' With Chemical Analytical Results

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 12E

W:\SEATTLE\PROJECTS\0\0615034\07\WORKING\RI WKPL AUG 08\FIGURES-CAD\CHEM CIRCLES-VERSION2.DWG\TAB:E MODIFIED BY LKNOWLTON ON OCT 20, 2008 - 10:47



LEGEND

FILL
- Pavement Surface (Gravel, Asphalt, Concrete)
- Sand (Light Colored with Construction Debris)
- Sand (Black to Dark Brown Colored with Wood Debris)
- Gravel

NATIVE
- Silt
- Sand (Native)
- Clay

(P) = Projected
DTW During Drilling
DTW (MWs) – Aug 07
Interpreted Groundwater Table
DP-39 = Proposed Boring Locations & Sample Depths (See Figures 16 & 17 for a site plan showing proposed boring locations.)

EXPLANATION

DP18 BORING NUMBER AND APPROXIMATE LOCATION
Soil Contact
Well Screen

Tidal Elevations Provided by Port of Olympia
MHHW = Mean High High Water (El. 6.83)
MLLW = Mean Low Low Water (El. –7.73)

PREVIOUS ANALYTICAL RESULTS

TPH, Metals, Other, PAHs
= No Exceedance
= Not Tested

OTHER = PCBs, VOCs, DIOXINS/FURANS
OTHER PCOCs TESTED ARE INDICATED BY AN INITIAL:
P = PCB
V = VOC
D = DIOXINS & FURANS
IF NO INITIAL, SAMPLE NOT TESTED
NO SVOC EXCEEDANCES EXCEPT AS NOTED FOR PAH TEQs

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 20X

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. cannot 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.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

W:\SEATTLE\PROJECTS\0\0615034\07\WORKING\RI WKPL AUG 08\FIGURES-CAD\CHEM CIRCLES-VERSION2.DWG\TAB:F MODIFIED BY LKNOWLTON ON OCT 20, 2008 - 10:48

Cross Section F-F'
With Chemical Analytical Results

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 12F

Office:TAC Path: P:\0\0615034\GIS\061503407_RIWP_FIG12_GW.mxd CDB:TCK Map Revised: October 22, 2008

Monitoring Well (GeoEngineers, Inc.)	Discrete Water Sample Obtained from Direct-Push Boring for Screening Purposes (See Appendix B)
Direct-Push Boring (GeoEngineers,Inc.)	Groundwater Exceedances (See Note 2)
Direct-Push Boring (Brown and Caldwell)	Groundwater Elevation Contour (See Note 1)
Monitoring Well (Delta Environmental)	East Bay Redevelopment Proposed Short Plat Parcel Boundaries
Boring (Northwest Testing Company)	East Bay Redevelopment Project Area
Test Pit (GeoEngineers, Inc.)	
Approximate Infastructure Improvement Corridor	

150 0 150
Feet

Reference: Reference: Aerial photograph (dated April 2008) and Approximate Infastructure Improvement Corridor from Skillings Connolly.
Short plat parcel boundaries are based on information provided by the Port of Olympia.

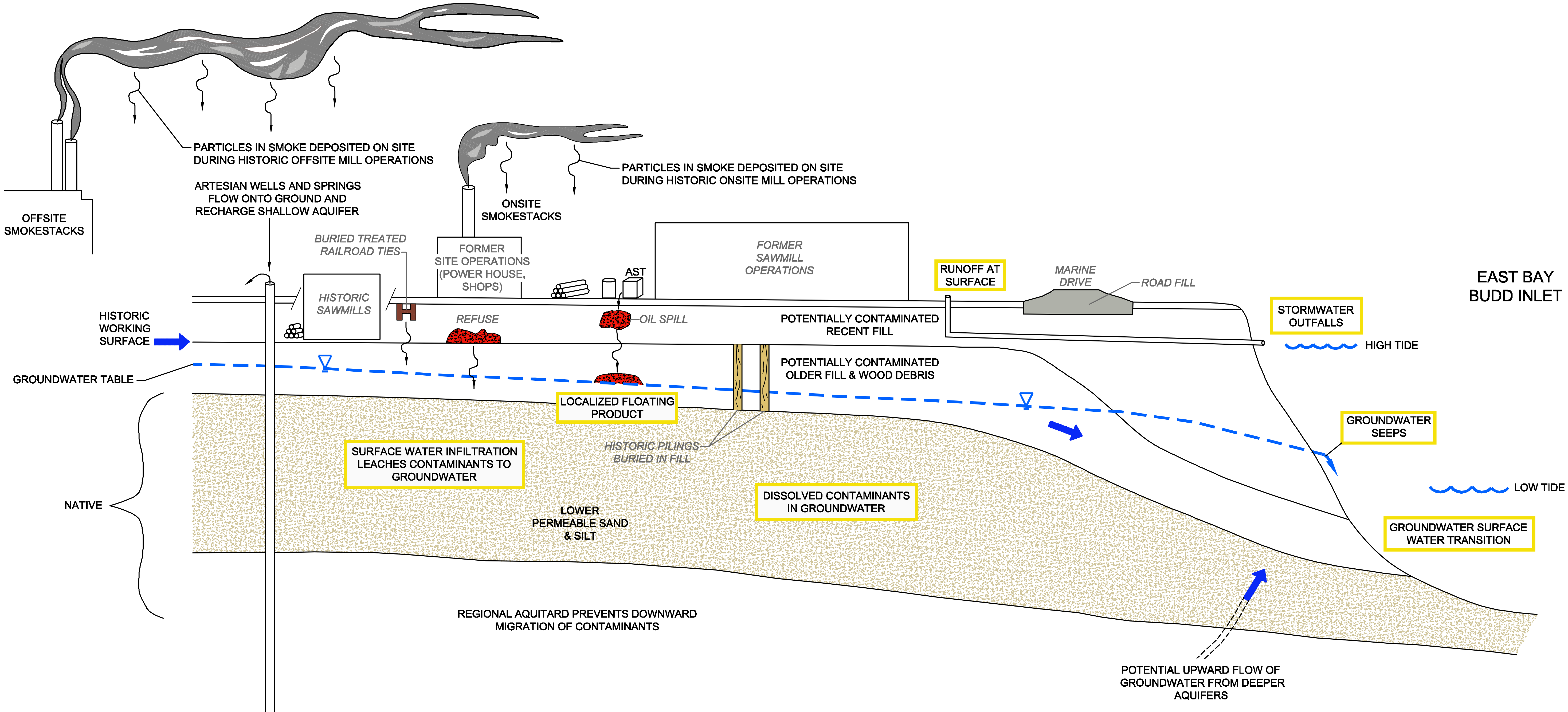
Notes:
1. Groundwater elevation data collected August 28, 2007 from approximately 8:30 am to 9:30 am in feet NGVD29.
2. BEP detected on 1/18/07 in MW06, MW08 and MW10 was likely the result of lab or sampling error.
3. The locations of all features shown are approximate.
4. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.

Groundwater Chemical Analytical Results

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 13



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. cannot 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.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

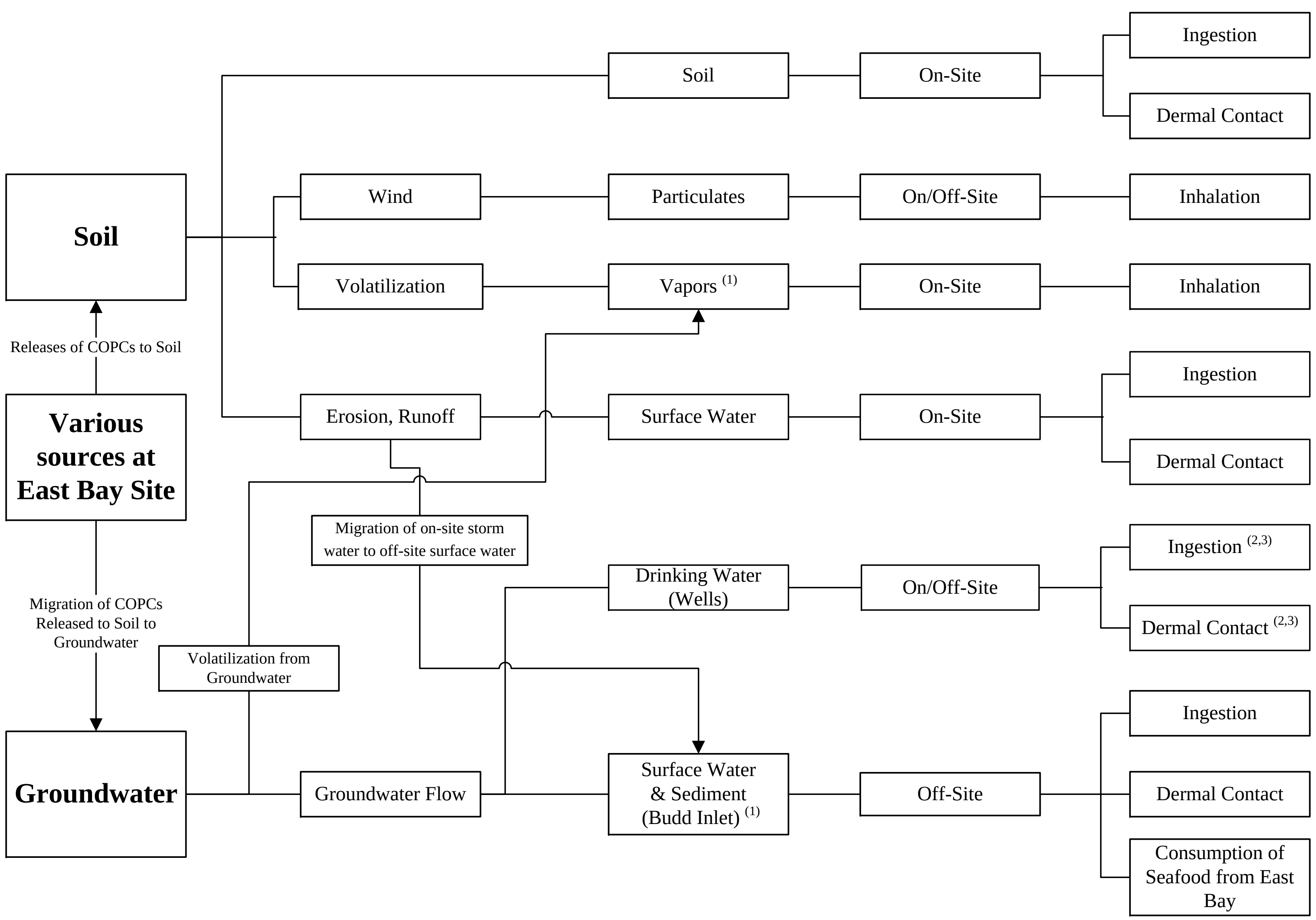
Conceptual Site Model
Potential Contaminant Pathways

East Bay Redevelopment Project
Olympia, Washington

GEOENGINEERS

Figure 14

Primary and Secondary Sources	Transport Mechanism	Exposure Medium	Exposure Point	Exposure Route	Complete Pathway?



Exposure Medium	Exposure Point	Exposure Route	Current Land Use: Residents	Current Land Use: Commercial / Industrial Workers	Current Land Use: Trespassers (4)	Current Land Use: Recreators (4)	Construction Phase: Utility Workers (4)	Construction Phase: Construction Workers (4)	Construction Phase: Trespassers (5)	Future Land Use: Urban Residents (4,6)	Future Land Use: Commercial Workers (6)	Future Land Use: Utility Workers (4)	Future Land Use: Recreators (6)	Ecological: Terrestrial Organisms	Ecological: Aquatic Organisms
Soil	On-Site	Ingestion	○	○	◆	○	●	●	●	◆	◆	●	◆	◆	○
Soil	On-Site	Dermal Contact	○	○	◆	○	●	●	●	◆	◆	●	◆	◆	○
Particulates	On/Off-Site	Inhalation	○	○	○	○	●	●	●	◆	◆	●	◆	◆	○
Vapors (1)	On-Site	Inhalation	○	○	◆	○	◆	◆	◆	◆	◆	◆	◆	◆	○
Surface Water	On-Site	Ingestion	○	○	○	○	○	○	○	○	○	○	○	○	○
Surface Water	On-Site	Dermal Contact	○	○	○	○	○	○	○	○	○	○	○	○	○
Drinking Water (Wells)	On/Off-Site	Ingestion (2,3)	○	○	○	○	○	○	○	◆	◆	◆	◆	◆	○
Drinking Water (Wells)	On/Off-Site	Dermal Contact (2,3)	○	○	◆	○	◆	○	◆	◆	◆	◆	○	◆	○
Surface Water & Sediment (Budd Inlet) (1)	Off-Site	Ingestion	○	○	○	◆	○	○	○	○	○	○	◆	○	◆
Surface Water & Sediment (Budd Inlet) (1)	Off-Site	Dermal Contact	○	○	○	◆	○	○	○	○	○	○	◆	○	◆
Surface Water & Sediment (Budd Inlet) (1)	Off-Site	Consumption of Seafood from East Bay	○	○	○	◆	○	○	○	○	○	○	◆	○	◆

Figure 15

Conceptual Site Exposure Model

Port of Olympia East Bay Site

PIONEER TECHNOLOGIES CORPORATION

File: CSE<_Fig 15 for Final RIWP.vsd

Key

● Complete Exposure Pathway

◆ Potentially Complete Exposure Pathway (pending further evaluation)

○ Incomplete Exposure Pathway

(1) Although this pathway is likely not complete based on existing data, it is considered potentially complete for all relevant receptors pending further evaluation.

(2) Even though there are no current drinking water wells that are impacted by releases to site soil and it is unlikely that a suitable future water well could be installed in the shallow groundwater at the site, use of shallow groundwater as a future drinking water source is considered potentially complete for all relevant receptors pending further evaluation.

(3) Also applies to suspected ponded groundwater during current land use and shallow groundwater in a utility excavation during the construction phase and/or future land use.

(4) This exposure scenario is a reasonable maximum exposure scenario and is more conservative and therefore protective of other similar exposure scenarios. For instance, the exposure assumptions for current trespassers are more conservative than other current exposure scenarios, such as a scenario for people who access boats stored on-site. Likewise, the current off-site recreator scenario is more conservative than other current off-site human exposure scenarios; the construction phase utility worker scenario is more conservative than other adult exposure scenarios during the utility infrastructure portion of the construction phase; the construction phase construction worker scenario is more conservative than other adult exposure scenarios during the general earthwork portion of the construction phase; the future urban residential scenario is more conservative than the hotel guest exposure scenario; the future utility worker exposure scenario is more conservative than other human exposure scenarios for future subsurface work; the future off-site recreator scenario is more conservative than the construction phase off-site recreator scenario as well as other future off-site human exposure scenarios.

(5) On-site recreators are not considered since access will be restricted during the construction phase.

(6) Although future soil-based exposures would be incomplete if exposure barriers were installed as necessary in accordance with current development plans, the pathway is considered potentially complete for all relevant receptors pending further evaluation.

- Proposed Direct-Push Boring Location
- Phase 1 Explorations
- Test Pit (GeoEngineers, Inc. - Oct. 2007)
- Direct-Push Boring (GeoEngineers, Inc. - Sept. 2006, Jan. & July 2007)
- Direct-Push Boring (Brown and Caldwell - Nov. 2006, Jan. & Feb. 2007)
- Approximate Infastructure Improvement Corridor
- East Bay Redevelopment Proposed Short Plat Parcel Boundaries
- East Bay Redevelopment Project Area
- Direct-Push Boring (Northwest Testing Company, Oct. 2006)
- Cone Penotrometer Test (Landau - May 2007)
- Boring (Landau - May 2007)

N W E S

150 0 150

Feet

Reference: Aerial photograph (dated April 2008) and Approximate Infastructure Improvement Corridor from Skillings Connolly.
Short plat parcel boundaries are based on information provided by the Port of Olympia.

Notes: 1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.

Site Plan and Exploration Locations

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 16

Office:TAC Path: P:\0\0615034\GIS\061503407_RIWP_FIG17_MW_LOCS.mxd CDB:TCK Map Revised: October 21, 2008

Proposed Monitoring Well Location

Monitoring Well (GeoEngineers, Inc. - Jan. & July 2007)

Monitoring Well (Delta Environmental - June 2003)

Artesian Well

Potential Location of Artesian Wells as reported by others

Approximate Area Where Artesian Well May Be Located

Approximate Infastructure Improvement Corridor

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

East Bay Redevelopment Project Area

N W E S

150 0 150

Feet

Site Plan and Monitoring Well Locations

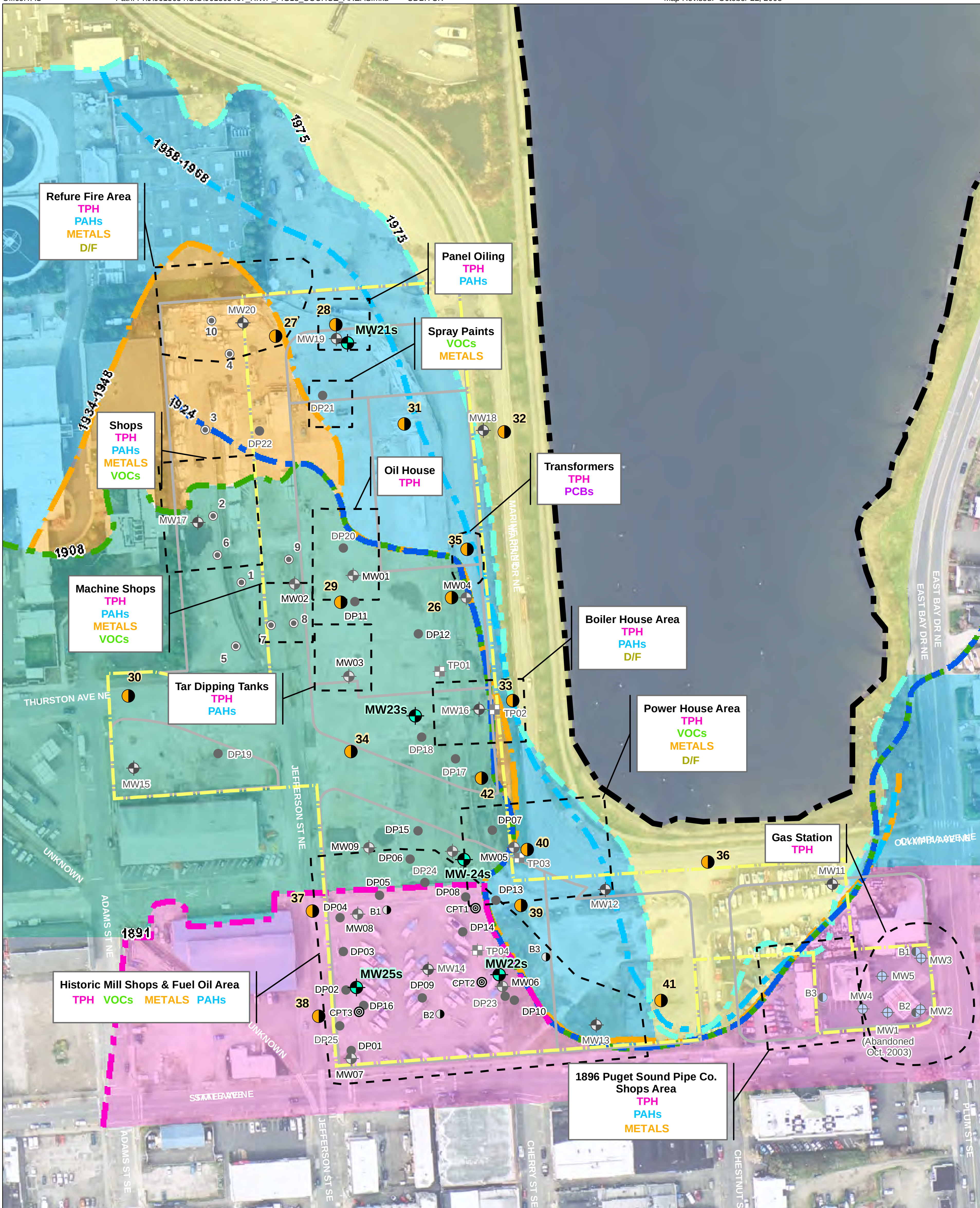
East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 17

Reference: Aerial photograph (dated April 2008) from Skillings Connolly. Short plat parcel boundaries are based on information provided by the Port of Olympia.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.



◐	Proposed Direct-Push Boring Location
⊕	Proposed Monitoring Well Location
⌐ ¬	Historic Operation Areas
⌐ ¬	East Bay Redevelopment Project Area
—	East Bay Redevelopment Proposed Short Plat Parcel Boundaries

Previous Exploration Location

- Direct-Push Boring (GeoEngineers, Inc.)
- Cone Penotrometer Test (Landau)
- Test Pit (GeoEngineers, Inc.)
- Direct-Push Boring (Brown and Caldwell)
- Boring (Landau)
- Direct-Push Boring (Northwest Testing Company)

Previous Monitoring Well Location

- Monitoring Well (GeoEngineers, Inc.)
- Monitoring Well (Delta Environmental)

TPH = Total Petroleum Hydrocarbons
PAHs - Polycyclic Aromatic Hydrocarbons
METALS = Total or Dissolved Metals
VOCs = Volatile Organic Compounds
PCBs = Polychlorinated Biphenyls
D/F = Dioxins/Furans

150 0 150
Feet

Reference: Historic features were identified from Sanborn maps (dates ranging from 1888 to 1968) and air photos (dates ranging from 1934 to 1996). Aerial photograph (dated April 2008) from Skillings Connolly. Short plat parcel boundaries are based on information provided by the Port of Olympia.

Notes:1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.

Proposed Exploration Locations, Potential Historic Source Areas, COPCs and Historic Shorelines

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 18

Proposed Direct-Push Boring Location

Phase 1 Explorations

Approximate Excavation Depths - Proposed Utilities

Approximate Excavation Depths - 10ft bgs (Sanitary Sewer)

Approximate Excavation Depths - 9ft bgs (Storm Drain)

Approximate Excavation Depths - 3ft bgs (Reclaimed Water Line)

Approximate Infastructure Improvement Corridor

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

East Bay Redevelopment Project Area

150 0 150

Feet

N W E S

Approximate Maximum Depth of Excavation Proposed Utilities

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 19

Reference: Proposed improvement corridor (May 2008), Utility Plan (February 2008), and short plat parcel boundaries from Skillings Connolly Port of Olympia East Bay Short Plat Plan Set.

Notes:1. bgs = below ground surface
2. See geologic cross-sections (Figures 7a-7f) for specific utility depths.
3.The locations of all features shown are approximate.
4. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.

Office:TAC Path: P:\0\0615032\GIS\07 GIS\061503407_RIWP_FIG-20_ARTESIAN_WELLS.mxd CDB:TCK Map Revised: October 21, 2008

Proposed Monitoring Well Location

Monitoring Well (GeoEngineers, Inc.)

Monitoring Well (Delta Environmental - June 2003)

Groundwater Elevation Contour *(data collected August 28, 2007 between approximately 8:30 am and 9:30 am)*

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

East Bay Redevelopment Project Area

Potential Location of Artesian Wells as reported by others

Approximate Area Where Geophysical Surveys to be conducted

St. Paul and Tacoma Lumber Co. (1942 - 1968)

Springer Sawmill (1924-1947)

Olympia Door Co. Sawmill (1908)

Olympia Door Co. Sash and Door Factory (1908-1924)

Hyak Lumber Co. Millwork (1946-1968)

H.G. Richardson's Shingle Mill (1908)

Olympia Veneer Co. (1924)

Planing Mill & Sawmill (1888-1896)

150 0 150

Feet

Reference: Historic features were identified from Sanborn maps (dates ranging from 1888 to 1968) and air photos (dates ranging from 1934 to 1996). Aerial photograph (dated April 2008) from Skillings Connolly. East Bay Redevelopment Site and Parcel Boundaries are provided by Port of Olympia.

Notes: 1. Only primary mill facilities are shown. Lumber sheds, outbuildings and lumber storage areas are not shown.
2. The locations of all features shown are approximate.
3. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.

Artesian Well Locations

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 20

APPENDIX A
GREYLOCK CONSULTING GROUNDWATER STUDY

GREYLOCK CONSULTING LLC
Water Resources & Environmental Services

August 21, 2008

Ms. Joanne Snarski
Port of Olympia
915 Washington St. NE
Olympia, WA 98501

Re: **Groundwater Flow During High and Low Tides**
Port of Olympia East Bay Site
Olympia, Washington

Dear Ms. Snarski:

This letter documents the results of our evaluation of groundwater elevation data obtained from the East Bay Site in Olympia, Washington.

Background

The Port of Olympia (Port) is in the process of negotiating an Agreed Order with the Department of Ecology (Ecology) for an interim action at the East Bay Site (Figure 1). Various environmental studies have previously been performed at this Site (GeoEngineers, 2007a,b). Ecology has requested that the Port identify a hydrogeologic conceptual model for the site. A key component in understanding the hydrogeology of the site is to identify flow directions and gradients at varying tidal stages. This study evaluates groundwater flow directions and gradients at the site during a low and high tide on July 16, 2008.

Site

The East Bay Site (Site) is located on the south end of the Port Peninsula adjacent to the East Bay of Budd Inlet in Olympia, Washington (Figure 1).

The site consists of approximately 13.6 acres of mixed use and commercial properties. The project area is generally flat. The northern and western portions of the site are paved with asphalt, and the southern and eastern portions of the site are covered with crushed rock and bare land.

Most of the site has historically been used for commercial and light industrial purposes, including wood process and milling operations and warehousing. For a detailed discussion of the history of the Site, please see GeoEngineers' Draft Remedial Investigation/Feasibility Study (GeoEngineers, 2007b).

P.O. Box 23254, Federal Way, WA 98093 • Office: (253) 941-0654 • Cel: (253) 266-2838 • Fax: (253) 941-2705

Subsurface Soils

Predominant subsurface soils (0 to 15 ft bgs) at this site consist of coarse sand and gravel with occasional silt. Thin silt lenses and wood layers have also been observed in near surface soils. Significant filling has occurred at this site, therefore much of the shallow subsurface soils are non-native.

Monitoring Wells

Twenty shallow monitoring wells were previously constructed on and adjacent to the site by others. The monitoring wells vary in diameter from 1- to 2-inches, and vary in depth from 8 to 15 ft bgs. The effective depths of wells were measured on July 16, 2008 and are provided in Tables 1 and 2.

Groundwater

Water levels were collected at the site on July 16, 2008 by Greylock and its subconsultant Stemen Environmental Inc. (Stemen). Water levels were collected within 1 hour and 19 minutes of a low tide of – 1.4 ft Mean Low Low Water (MLLW), and within 1 hour of a high tide of +14.4 ft MLLW. Water level measurements collected during a low tide are provided in Table 1. Water level measurements collected during a high tide are provided in Table 2. Shallow groundwater at the site occurs at depths ranging from 1.05 ft to 9.40 ft below the top of casing (TOC) of monitoring wells. Ponded water was also observed on the surface of the ground in the vicinity of monitoring well MW-06. Based on a conversation with Al Kulp of the Port, we understand that artesian flow is directed toward MW-6 via a pipe. It is not known where the artesian flow originates.

July 16, 2008 Low Tide Monitoring Event

On July 16, 2008 water levels were collected at the site between 11:35 AM and 12:42 PM. A low tide of -1.4 ft MLLW was recorded at 11:25 AM. As shown on Figure 2, groundwater flow direction varies across the site. The majority of groundwater flow across the site is directed toward Budd Inlet. However, at the southwestern end of the site, a groundwater mound was measured in the vicinity of MW-14 and MW-06. At this location, groundwater flows in all directions from the southwest corner of the site outward, as shown in Figure 2. At the northwestern end of the site a groundwater high exists near MW-17. Groundwater flow is generally directed from the area of MW-17 toward the north, east and south across the site.

Groundwater gradients vary significantly across the site during a low tide. Gradients range from approximately 0.003 ft per ft near the center of the site to approximately 0.08 ft per ft toward the shoreline, near MW-12.

July 16, 2008 High Tide Monitoring Event

On July 16, 2008 water levels were collected at the Site between 7:20 and 8:19 PM. A high tide of +14.4 ft MLLW was recorded at 7:21 PM. As shown on Figure 3, groundwater flow direction varies across the site. In general, groundwater flow directions are similar to those measured during the low tide event earlier in the day. The majority of groundwater flow is directed toward Budd Inlet. At the southwestern end of the site, a groundwater mound is present in the vicinity of MW-14 and MW-06. Also, a groundwater high is present in the vicinity of MW-17.

Groundwater gradients vary significantly across the site during a high tide. Gradients range from approximately 0.003 ft per ft near the northern part the site to approximately 0.04 ft per ft at the southern part of the site, near MW-06.

Tidal Effect

Table 3 provides a summary of the change in groundwater elevation from low to high tide on July 16, 2008. Only two of twenty wells (MW-12 and MW-18) showed greater than one foot of change in elevation between the measuring periods. MW-12 and MW-18 are screened in coarse fill and are within approximately 110 ft of Budd Inlet.

Water levels in the majority of wells showed minimal elevation change with change in tide. With the exception of an area of coarse fill within 110 ft of the shoreline, tidal fluctuation does not significantly affect groundwater flow patterns at the site.

Discussion

Based on two groundwater monitoring events collected during a low and high tide event on July 16, 2008, the majority of groundwater flow across the site is directed toward Budd Inlet. Two groundwater highs were observed during both monitoring events: At the southwestern end of the site and at the northwestern end of the site. These groundwater highs are likely caused by leakage from artesian wells. Also, at the southwestern end of the site, recharge from ponded water likely contributes to the groundwater high in this area.

Limitations

This report is based upon the application of scientific principles and professional judgment to certain facts with resulting subjective interpretations. Professional judgments expressed herein are based upon the facts currently available within the limits of the existing data, scope of work, budget, and schedule. We make no warranties, expressed or implied, including, without limitation, warranties are to the fitness of the site for a particular purpose.

If you have any questions regarding this report, please call me at (253) 941-0654.

Sincerely,

GREYLOCK CONSULTING LLC

State of Washington
Hydrogeologist
747
Licensed Geologist
Suzanne Dudziak

8-21-08

Suzanne Dudziak
Principal Hydrogeologist

Attachments:
- 1 References
- 3 Tables
- 3 Figures

P.O. Box 23254, Federal Way, WA 98093 • Office: (253) 941-0654 • Cel: (253) 266-2838 • Fax: (253) 941-2705

References

GeoEngineers Inc., 2007 a. *Remedial Investigation/Feasibility Study and Cleanup Action Plan, Potential City of Olympia City Hall, The Rants Group, Olympia, Washington.* April 24, 2007.

GeoEngineers Inc., 2007 b. *Draft Remedial Investigation/Feasibility Study and Conceptual Cleanup Action Plan Port of Olympia, Olympia, Washington.* December 20, 2007.

Table 1. East Bay Groundwater Elevations, Port of Olympia
July 16, 2008 (Low Tide of -1.4 ft MLLW @ 11:25 AM)

Station	Time	MW Elevation (1) (ft)	Depth to Water from TOC (ft)	Groundwater Elevation (ft)	Depth to Bottom of Well (ft)	Measurer
MW-1	1222	10.78	4.40	6.38	8.55	PS
MW-2	1200	10.41	3.65	6.76	10.03	PS
MW-3	1206	11.05	4.79	6.26	11.35	PS
MW-4	1141	11.7	5.69	6.01	14.55	PS
MW-5	1244	11.69	4.19	7.50	11.39	PS
MW-6	1157	10.26	1.14	9.12	11.78	SD
MW-7	1213	10.99	5.03	5.96	10.50	SD
MW-8	1205	11.32	2.62	8.7	11.91	SD
MW-9	1231	10.78	2.65	8.13	7.94	PS
MW-10	1235	11.39	3.55	7.84	10.90	PS
MW-11	1145	11.07	3.42	7.65	9.45	SD
MW-12	1135	10.37	9.40	0.97	11.30	SD
MW-13	1151	9.91	4.26	5.65	9.40	SD
MW-14	1221	10.74	1.59	9.15	9.33	SD
MW-15	1242	9.86	4.09	5.77	7.79	SD
MW-16	1212	11.4	5.32	6.08	15.00	PS
MW-17	1158	10.28	2.85	7.43	6.74	PS
MW-18	1134	12.21	No water, but wet @ bottom	0.73 (2)	11.40	PS
MW-19	1150	9.38	3.78	5.6	8.45	PS
MW-20	1154	10.06	5.70	4.36	8.90	PS

TOC = Top of Casing
PS = Paul Stemen, Stemen Environmental
SD = Suzanne Dudziak, Greylock Consulting LLC

(1) Elevations surveyed by Skillings Connelly
(2) Estimated assuming groundwater elevation is at bottom of well

Table 2. East Bay Groundwater Elevations, Port of Olympia
July 16, 2008 (High Tide of 14.4 ft MLLW @ 7:21 PM)

Station	Time	MW Elevation (1) (ft)	Depth to Water from TOC (ft)	Groundwater Elevation (ft)	Depth to Bottom of Well (ft)	Measurer
MW-1	1948	10.78	4.39	6.39	8.55	PS
MW-2	1945	10.41	3.70	6.71	10.03	PS
MW-3	1935	11.05	5.78	5.27	11.35	PS
MW-4	2006	11.7	5.65	6.05	14.55	PS
MW-5	2015	11.69	4.21	7.48	11.39	PS
MW-6	2015	10.26	1.05	9.21	11.78	SD
MW-7	1942	10.99	5.00	5.99	10.50	SD
MW-8	1930	11.32	2.55	8.77	11.91	SD
MW-9	2019	10.78	2.60	8.18	7.94	PS
MW-10	1928	11.39	3.48	7.91	10.90	PS
MW-11	--	11.07	NM	--	9.45	--
MW-12	1920	10.37	7.11	3.26	11.30	SD
MW-13	2010	9.91	4.23	5.68	9.40	SD
MW-14	1936	10.74	1.48	9.26	9.33	SD
MW-15	1953	9.86	4.09	5.77	7.79	SD
MW-16	2010	11.4	5.41	5.99	15.00	PS
MW-17	1958	10.28	2.93	7.35	6.74	PS
MW-18	2001	12.21	6.56	5.65	11.40	PS
MW-19	1951	9.38	3.68	5.7	8.45	PS
MW-20	1954	10.06	5.70	4.36	8.90	PS

TOC = Top of Casing
PS = Paul Stemen, Stemen Environmental
SD = Suzanne Dudziak, Greylock Consulting LLC
NM = Not measured; well inaccessible

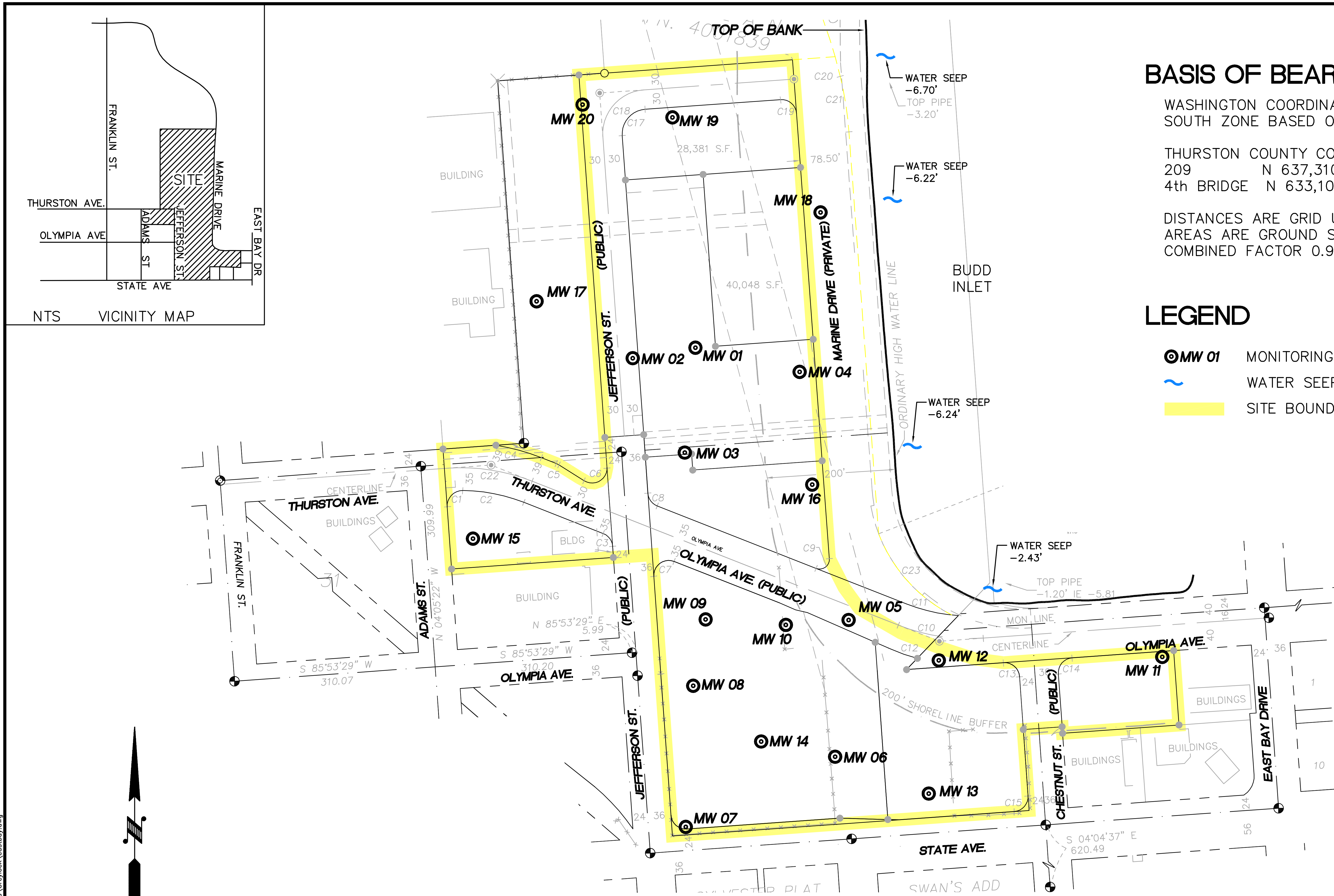
(1) Elevations surveyed by Skillings Connelly

Table 3. Change in Water Level from Low to High Tide, July 16, 2008
East Bay Site, Port of Olympia

Station	Change in Water Level (ft)
MW-1	0.01
MW-2	-0.05
MW-3	-0.99
MW-4	0.04
MW-5	-0.02
MW-6	0.09
MW-7	0.03
MW-8	0.07
MW-9	0.05
MW-10	0.07
MW-12	2.29
MW-13	0.03
MW-14	0.11
MW-15	0.00
MW-16	-0.09
MW-17	-0.08
MW-18	4.84
MW-19	0.10
MW-20	0.00

Low tide of -1.4 ft MLLW @ 11:25 AM

High tide of +14.4 ft MLLW @ 7:21 PM



SCALE: 1"=150 FEET

0 75 150 300

BASIS OF BEARINGS

WASHINGTON COORDINATE SYSTEM NAD83/91, SOUTH ZONE BASED ON GPS RTK TIES TO:

THURSTON COUNTY CONTROL POINTS:
209 N 637,310.40, E 1,043,912.62
4th BRIDGE N 633,108.13, E 1,040,037.40

DISTANCES ARE GRID US SURVEY FEET
AREAS ARE GROUND SCALE
COMBINED FACTOR 0.99996

LEGEND

⊙ MW 01	MONITORING WELL
~	WATER SEEP
(yellow band)	SITE BOUNDARY

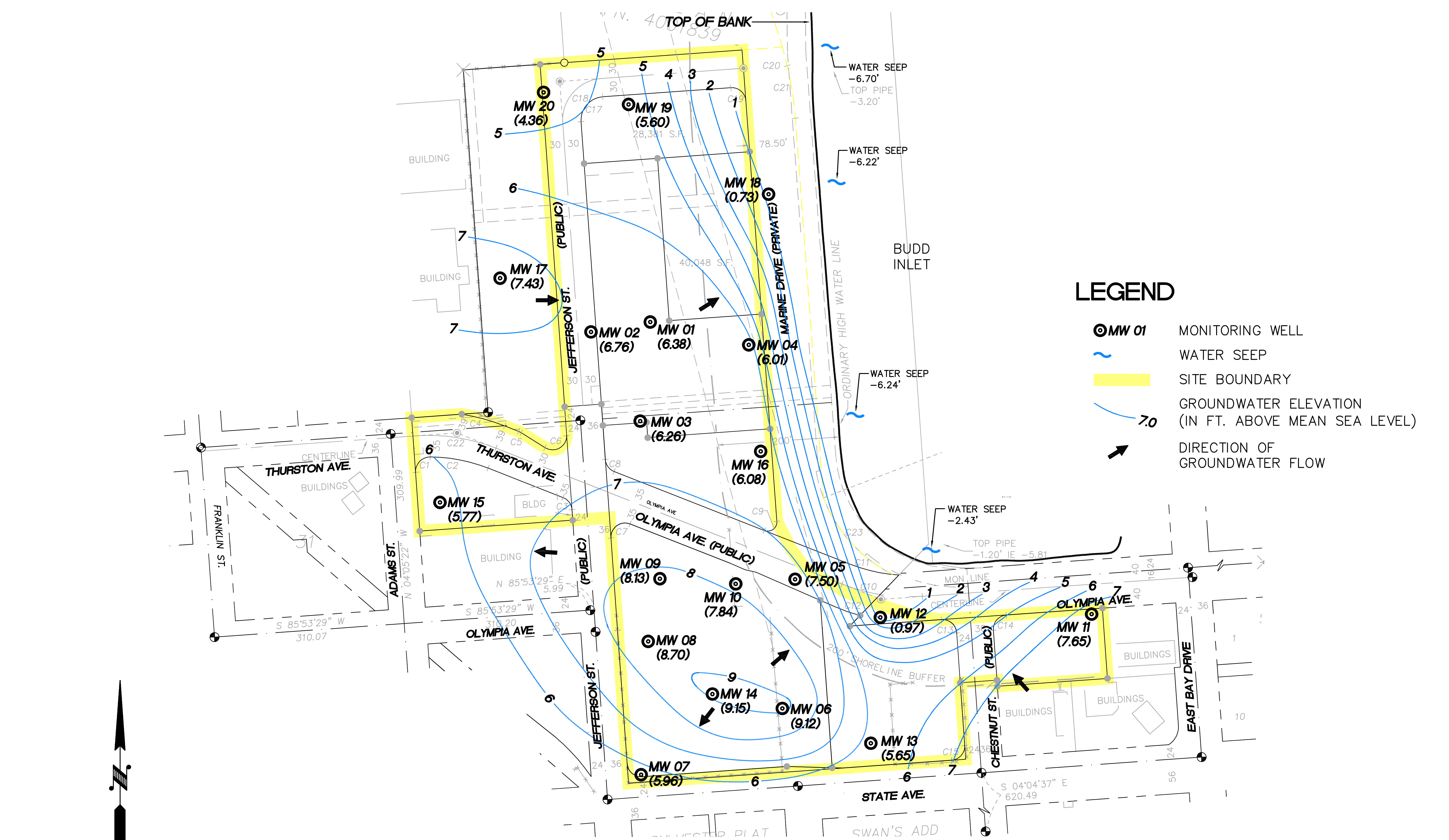
GREYLOCK CONSULTING LLC
Water Resources & Environmental Services
P.O. Box 23254
Federal Way, WA 98093
Office: (253) 941-0654
greylockllc@comcast.net

TITLE: FIGURE 1
SITE PLAN

East Bay Site, Port of Olympia
Modified from Skillings Connolly July, 2008

DRAWN BY: CPS
DATE: 08/19/08
SHEET NO: 1

CPS August 19, 2008 - C:\clients\Greylock\eastbay.dwg



SCALE: 1"=150 FEET

0 75 150 300

P.O. Box 23254
Federal Way, WA 98093
Office: (253) 941-0654
greylockllc@comcast.net

GREYLOCK CONSULTING LLC
Water Resources & Environmental Services

TITLE:

INFERRED & GENERALIZED GROUNDWATER CONTOURS

Groundwater Elevations Date: July 16, 2008 – LOW TIDE (–1.4 ft MLLW @ 11:25 AM)

East Bay Site, Port of Olympia
Modified from Skillings Connolly July, 2008

DRAWN BY: CPS

DATE: 08/19/08

SHEET NO: 2

CPS August 19, 2008 – C:\clients\Greylock\eastbay.dwg

APPENDIX B

ARTESIAN WELL LOCATING

October 22, 2008

Port of Olympia
915 Washington Street NE
Olympia, Washington 98501

Attention: Joanne Snarski

Subject: Artesian Wells
Port of Olympia
East Bay Redevelopment Project
Olympia, Washington
File No. 0615-034-07

INTRODUCTION

This letter responds to the Washington State Department of Ecology's (Ecology) request that the Port of Olympia (Port) locate and decommission artesian wells suspected to be located on the East Bay Redevelopment Site (Site). Ecology made this request in their September 22, 2008 comment letter on the draft Remedial Investigation Work Plan. Ecology wants the artesian wells decommissioned because it is speculated that leakage from these wells may be influencing groundwater in the shallow aquifer. However, this is complicated by the fact that very little is known about the condition or location of the wells. This letter summarizes what we know about these wells and provides procedures to try to locate them.

The objectives of the study described in this letter are: (1) verify what wells exist on the Site; (2) identify the location of the wells; (3) identify the size and condition of the top of the well casings; and (4) collect data necessary to evaluate the feasibility and cost of decommissioning the wells. There is uncertainty as to the number and location of these wells because most are buried, and existing data provide conflicting information regarding their locations and whether they have already been destroyed.

The information to be collected in this study is needed to determine the feasibility, methods, and costs of decommissioning the artesian wells. This letter does not include procedures to decommission wells.

SUMMARY OF WHAT IS KNOWN ABOUT THE ARTESIAN WELLS

Based on the information we reviewed there are potentially six artesian wells located on the Site. Information about these artesian wells is summarized in the table below and Figure 1, attached. Information sources and descriptions of the wells are discussed below.

Table 1. Summary of Artesian Well Information

Reported Status	Field Book 17 Well Number	1994 Survey Well Number	Flow (gpm)	Diameter (inches)	Depth (feet)	Location
Destroyed	47A	74		4	250	Parcel 3
Destroyed	47B	75	30	3	115	Parcel 3
Destroyed	47C	76	30	3	115	Parcel 3
Unknown	41	77	1.5	1.5	25	Parcel 3
Unknown	70	84	10	3-4	>150	Jefferson Street
Unknown	73	73	3	3	Unknown	Parcel 9

Notes:
Source: Table excerpted from March 26, 1999 Robinson & Noble, Inc. LOTT Technical Memorandum 1204, Thurston County Health Department 1994 Artesian Well Survey, information from Field Book 17, information from Port personnel, and/or information obtained during GeoEngineers' 2008 study.
gpm - gallons per minute

Artesian wells in the vicinity of the Site were identified in a 1994 survey of the City of Olympia map compiled by Thurston County Health Department (Attachment A). This map shows artesian wells currently present in the city of Olympia area. A study conducted in 1999 (Robinson and Noble, 1999) also investigated flowing artesian wells in downtown Olympia, but did not identify artesian wells on the Site. The 1999 report includes information (copies of pages) from "Field Book 17" that shows the location and diameter of some wells. The date of the field book and accompanying sketch is unknown. Based on these three information sources, there were potentially six wells located on the Site; 74, 75, 76, and 77 on Parcel 3, 84 on Parcel 5, and 73 on Parcel 9.

According to the 1994 survey, six artesian wells (numbered 73 and 74 through 77, and 84) formerly were located on the Site. According to the 1999 report, three (wells 74 through 76) of the six artesian wells located on the Site were destroyed during demolition of the former Olympia saw mill. The "destroyed" wells (74 through 76) appear to be in the approximate locations of three wells identified in Field Book 17 (wells A, B, C at location number 47) that were associated with former Olympic Veneer (1924) operations at the Site. The 1999 report does not describe how the wells were destroyed. Little information was presented in the 1999 report regarding the three remaining on-site wells, 73, 77 and 84. Well 77 apparently was identified at the northeast corner of State Avenue and Jefferson Street. This well was also associated with the former Olympic Veneer facility that was number 41 in Field Book 17. No information was identified regarding well 84, except for the approximate location at the east side of Jefferson Street and Thurston Avenue. Well 84 was not located or discussed in the 1999 report. Well 84 is in the approximate location of a well identified in the site sketch from Field Book 17 as Number 70 (see approximate location in Figure 1). The "Field Book 17" sketch indicates Well 73 is a 3-inch-diameter, 2-gallon-per-minute well located between Adams and Jefferson Streets.

According to Port personnel, one of the artesian wells located on Parcel 3 may be present on the Site in the southeast corner of the dry boat storage yard. There is a 2 foot by 2 foot section in the City sidewalk that is thought to be the location of a well that is capped but not decommissioned. The well casing may be one inch or less and the depth is unknown. In addition, a surface pipe has been described in the center of Parcel 3 with water flowing out. Information from Port personnel indicates this pipe is connected to a drain field installed by the Port under the gravel lot, rather than to a well. Evidence for suspected locations of artesian wells is the presence of a groundwater mound on Parcel 3 that coincides with the reported locations of artesian wells in the 1994 and 1999 studies (see Figure 1).

PROPOSED PROCEDURES TO LOCATE ARTESIAN WELLS

Geophysical methods followed by test pit explorations will be used to locate the six suspected wells at the site. Because the locations, conditions, depths and casing sizes are not known, the geophysical methods will include various methodologies to attempt to locate the wells. Geophysical methods will include ground penetrating radar (GPR), magnetometers and/or electromagnetics (time domain). Geophysical anomalies will be ground-proofed with shallow test pits to verify the presence or absence of well materials. The areas targeted for geophysics are shown as the hatched orange areas in Figure 1.

1. Subsurface utilities will be identified in the target areas using one-call service and a private locating company. It is important to identify buried utilities because they can affect interpretation of the geophysical data, in addition to the requirement to identify utilities prior to digging. The utility locating service company will also try to locate/trace the pipe visible on Parcel 3 that may be associated with an artesian well.

2. A geophysical survey will be conducted in target areas. Potential methods employed will include GPR, magnetometer and electromagnetic methods (specific details of the methods are included as Attachment B). The survey will be conducted on a close-grid spacing in the vicinity of the former well locations on Parcel 3, Parcel 5 and Parcel 9 as shown on Figure 1.

3. Test pits will be completed by a combination of hand digging and backhoe in the vicinity of identified geophysical anomalies to verify the presence or absence of buried objects. It is anticipated that the wellheads / well caps are buried between ground surface and approximately 4 feet below ground surface (bgs). Excavation of the test pits has the risk of causing uncontrolled flow of water by damaging well casings or removing overburden that may be currently controlling flow from a well. To reduce this risk, digging will be conducted slowly with constant monitoring for evidence of a well. If water does start flowing onto the ground surface digging will stop and the test pit will be backfilled (see item 5 below). If the source of water can be identified as a well casing an attempt will be made to cap the casing.

  a. Excavated soil will be temporally stockpiled on plastic. Stockpiles will be covered with plastic if left overnight and drainage from the stockpiles will be directed into the associated test pit.

  b. Test pits will be backfilled with excavated material. The back-hoe bucket will be decontaminated in-between locations to prevent cross-contamination.

  c. Field screening will be conducted on excavated soil for evidence of petroleum contamination. GeoEngineers' field geologist will also document the type of soil and fill encountered.

4. If a well casing is identified we will try and document its size, type of construction material, general condition, presence or absence of a cap, presence or absence of water leakage from around the casing or from the casing. Assuming water leaking from a well can be controlled so it does not flow uncontrolled onto the ground surface, the well casing will be left exposed to allow well drilling abandonment contractor(s) to come to the site and gather information they need to assess the feasibility of abandoning the well.

  a. The locations of all suspected well casings identified in this study will be surveyed.

  b. Well casings identified below the ground surface will be protected by placing a larger diameter conductor casing or drain pipe around the casing and extend this casing to the ground surface. The test pit will be backfilled around this protective casing. Other protective measures might be used instead of the protective casing depending on input from well abandonment contractors. The objective is to protect the well casing in a manner that facilitates further assessment.

c. Surplus excavated material will be temporarily stockpiled onsite until an appropriate disposal facility is designated or it is determined the material can be reused onsite.

5. A second field event will be needed for wells/test pits where water flowed uncontrolled onto the ground surface. Prior to re-exposing the well arrangements will be made to manage the water, based on flow estimates and other information obtained during the initial test pit investigation. The specific method for managing water will depend on the flow. Potential water management methods being considered include using vacuum trucks, pumping water into temporary storage tanks, or routing of water from the trench to another portion of same parcel for infiltration.

REFERENCES

March 26, 1999. Robinson & Noble, Inc. and Brown and Caldwell. Technical Memorandum 1204 LOTT Wastewater Resource Management Plan.

Field Book 17. Field notes listing wells and well information, includes hand-drawn site plan showing wells. Date unknown.

1994 Thurston County Health Department, City of Olympia Artesian Well survey figure (also included in 3/26/99 LOTT report).

LIMITATIONS

We have prepared this letter for the exclusive use of the Port of Olympia, their authorized agents and regulatory agencies. This letter is not intended for use by others and the information contained herein is not applicable to other sites. No other party may rely on the product of our services unless we agree in advance, and in writing, to such reliance. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions.

It is always possible that contaminants remain in areas that were not observed, sampled or tested.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with our general agreement with the Port of Olympia and generally accepted environmental science practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Any electronic form of this document (email, text, table, and/or figure), if provided, and any attachments are only a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Please contact us if you have questions.

Sincerely,

GeoEngineers, Inc.

Jay Lucas, LG
Senior Project Manager

David A. Cook, LG, RBP
Principal

JCL:DAC:bmw
SEAT:\0\0615034\07\Finals\Revised RI Workplan Oct 08\061503407Artesian Wells Ltr 102008.doc

Attachments: Figure 1. Approximate Artesian Well Locations
Attachment A - 1994 Thurston County Health Department, City of Olympia Artesian Well survey figure and Field Book 17 pages
Attachment B - Geophysical Methods (Source: Global Geophysics)

Office:TAC Path: P:\0\0615032\GIS\07 GIS\061503407_LETTER_FIG-1_ARTESIAN_WELLS.mxd CDB:TCK Map Revised: October 21, 2008

Monitoring Well (GeoEngineers, Inc.)

Monitoring Well (Delta Environmental - June 2003)

Groundwater Elevation Contour *(data collected August 28, 2007 between approximately 8:30 am and 9:30 am)*

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

East Bay Redevelopment Project Area

Potential Location of Artesian Wells as reported by others

Approximate Area Where Geophysical Surveys to be conducted

St. Paul and Tacoma Lumber Co. (1942 - 1968)

Springer Sawmill (1924-1947)

Olympia Door Co. Sawmill (1908)

Olympia Door Co. Sash and Door Factory (1908-1924)

Hyak Lumber Co. Millwork (1946-1968)

H.G. Richardson's Shingle Mill (1908)

Olympia Veneer Co. (1924)

Planing Mill & Sawmill (1888-1896)

150 0 150

Feet

N W E S

Artesian Well Locations

East Bay Redevelopment Project Area
Olympia, Washington

GeoEngineers

Figure 1

Reference: Historic features were identified from Sanborn maps (dates ranging from 1888 to 1968) and air photos (dates ranging from 1934 to 1996). Aerial photograph (dated April 2008) from Skillings Connolly. East Bay Redevelopment Site and Parcel Boundaries are provided by Port of Olympia.

Notes: 1. Only primary mill facilities are shown. Lumber sheds, outbuildings and lumber storage areas are not shown.

2. The locations of all features shown are approximate.

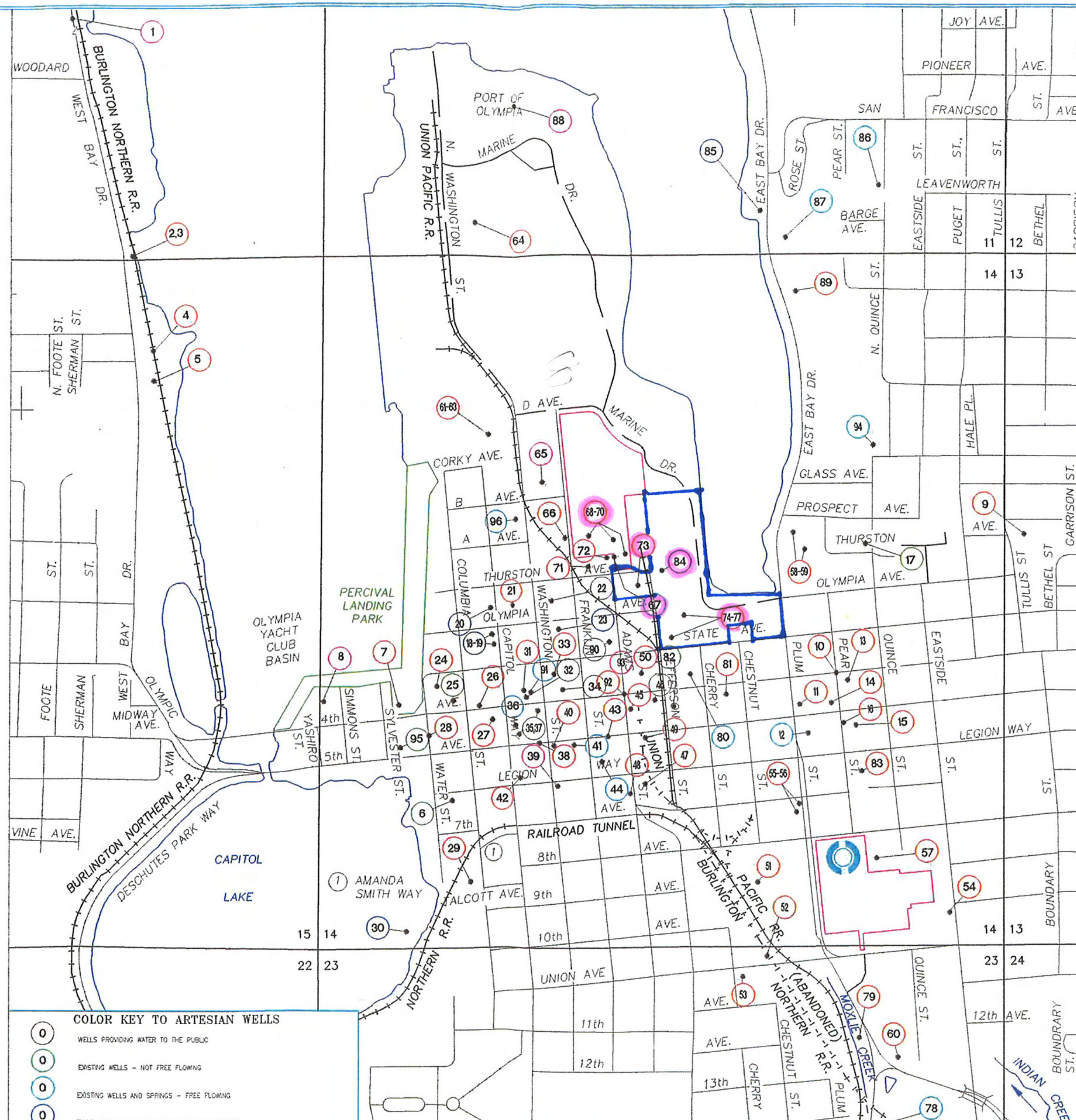
3. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

GeoEngineers

Attachment A

1994 Thurston County Health Department, City of Olympia Artesian Well survey figure and Field Book 17 pages

WELL NO.	LOCATION	REFERENCE
1)	BUCHANAN LUMBER SITE 2000 WEST BAY DR.	FIELD BOOK 317, #55 PG. 20
2)	OLD PANAMA SHINGLE SITE 1110 W. BAY DR.	FIELD BOOK 317, #54 PG. 20
3)	OLD PANAMA SHINGLE SITE 1110 W. BAY DR.	FIELD BOOK 317, #54 PG. 20
4)	TUMWATER LUMBER SITE 902 W. BAY DR.	FIELD BOOK 317, #53 PG. 20
5)	TUMWATER LUMBER SITE 902 W. BAY DR.	FIELD BOOK 317, #53 PG. 20
6)	AMERICAN LEGION BUILDING 219 W. LEGION	FIELD BOOK 317, #16 PG. 16
7)	4TH & SYLVESTER TIDELANDS	FIELD BOOK 317, #26 PG. 17
8)	BAYVIEW THRIFTWAY MARKET 516 W. 4TH	FIELD BOOK 317, #27 PG. 17
9)	EAST OF TULLIS OFF THURSTON	NONE
10)	4TH & PEAR OLD LAUNDRY	FIELD BOOK 317, #11 PG. 16
11)	SALVATION ARMY [illegible] 5TH SE	FIELD BOOK 317, #19 PG. 16
12)	510 PLUM	FIELD BOOK 317, #19A PG. 16
13)	412 SOUTH PEAR	FIELD BOOK 317, #19B PG. 17
14)	COMMUNITY YOUTH SERVICES 824 E. 5TH	FIELD BOOK 317, #19C PG. 17
15)	909 5TH AVE	FIELD BOOK 317, #20 PG. 17
16)	504 SOUTH PEAR	FIELD BOOK 317, #20A PG. 17
17)	405 QUINCE	FIELD BOOK 317, #59 PG. 20
18)	SENIOR CENTER 222 COLUMBIA NW	FIELD BOOK 317, #45A PG. 19
19)	SENIOR CENTER 222 COLUMBIA NW	FIELD BOOK 317, #45B PG. 19
20)	LASSEN ELECTRIC SERVICE 301 N. CAPITOL WAY	FIELD BOOK 317, #46 PG. 17
21)	BLOCK 12 SYLVESTER'S ADD'N	FIELD BOOK 317 #44 PG. 19
22)	206 OLYMPIA (CITY PARKING LOT)	FIELD BOOK 317, #51 PG. 19
23)	TRANSIT CENTER BLOCK 22 SYLVESTER'S ADD'N	FIELD BOOK 317, #51A PG. 19
24)	OLD OLYMPIA CREAMERY SITE 114 N. WATER	FIELD BOOK 317, #28 PG. 18
25)	SEAGULL BOOKS & CRAFTS 212 W. 4TH	FIELD BOOK 317, #29 PG. 18
26)	MINH'S GROCERY 116 4TH AVE W	FIELD BOOK 317, #30 PG. 18
27)	SCHOENFELD'S FURNITURE 4TH AND CAPITOL WAY	FIELD BOOK 317, #25 PG. 17
28)	WATER STREET BETWEEN 4TH & 5TH	NONE
29)	OLD NORTHERN PACIFIC RAILWAY DEPOT 721 COLUMBIA SW	FIELD BOOK 317, #58 PG. 20
30)	CAPITOL LAKE	FIELD BOOK 317, #8 PG. 15
31)	114 E 4TH (BEHIND THE SPAR)	FIELD BOOK 317, #31 PG. 18
32)	THE SPAR 114 E. 4TH	FIELD BOOK 317, #32 PG. 18
33)	OLD KNOX HOTEL 114 OR 117 N. WASHINGTON	FIELD BOOK 317, #33 PG. 18
34)	KING SOLOMONS REEF RESTAURANT 212 E. 4TH	FIELD BOOK 317, #34 PG. 18
35)	FOUNTAIN ON SIDEWALK SW CORNER 4TH & WASHINGTON	FIELD BOOK 317, #22 PG. 17
36)	WEST I BANK 402 S. CAPITOL	FIELD BOOK 317, #23 PG. 17
37)	REAR OF TALCOTT JEWLERS 420 CAPITOL WAY	FIELD BOOK 317, #24 PG. 17
38)	ON 5TH & WASHINGTON	NONE
39)	OLD CAPITOL BUILDING 600 S. WASHINGTON	FIELD BOOK 317, #15 PG. 16
40)	STATE OF THE ARTS 500 S. WASHINGTON	FIELD BOOK 317, #17 PG. 16
41)	CATTERY DOWN 209 5TH SE	FIELD BOOK 317, #18 PG. 16
42)	MILLER'S STORE, NE. CORNER LEGION & CAPITOL	NONE
43)	ON 5TH BETWEEN FRANKLIN & ADAMS	NONE
44)	Y.M.C.A. 510 FRANKLIN SE	NONE
45)	OLYMPIC OUTFITTERS 407 4TH AVE E	FIELD BOOK 317, #12 PG. 15
46)	DIAMOND A PARKING LOT 400 BLOCK OF LEGION	FIELD BOOK 317, #12A PG. 16
47)	SOUTH EAST CORNER ADAMS & LEGION	FIELD BOOK 317, #13 PG. 16
48)	613 SOUTH ADAMS	FIELD BOOK 317, #14 PG. 16
49)	415 1/2 5TH AVE	FIELD BOOK 317, #13A PG. 16



COLOR KEY TO ARTESIAN WELLS

- WELLS PROVIDING WATER TO THE PUBLIC
- EXISTING WELLS – NOT FREE FLOWING
- EXISTING WELLS AND SPRINGS – FREE FLOWING
- EXISTING WELLS REPORTEDLY CAPPED AND BURIED
- EXISTING WELLS – CAPPED OR FREE FLOWING UNABLE TO CONFIRM
- DOCUMENTED WELLS WHICH COULD NOT BE LOCATED

WELL NO.	LOCATION	REFERENCE
50)	IN ALLEY NORTH OF 4TH BETWEEN ADAMS & JEFFERSON	FIELD BOOK 317, #37 PG. 18
51)	619 9TH AVE	FIELD BOOK 317, #6 PG. 15
52)	604 UNION AVE (NEAR OLYMPIA CLEANERS)	FIELD BOOK 317, #5 PG. 15
53)	609 UNION	FIELD BOOK 317, #4 PG. 15
54)	OLD EASTSIDE STREET GROCERY 1001 EASTSIDE	FIELD BOOK 317, #7 PG. 15
55)	MCDONALD'S RESTAURANT 715 PLUM S.E.	FIELD BOOK 317, #9A PG. 15
56)	MCDONALD'S RESTAURANT 715 PLUM S.E.	FIELD BOOK 317, #9B PG. 16
57)	OLYMPIA CITY HALL 905 E. 8TH	FIELD BOOK 317, #9 PG. 15
58)	AT WOOD YARD PROSPECT AND E. BAY DR	FIELD BOOK 317, #40 PG. 19
59)	HOLIDAY SHORES APARTMENTS 422 E. BAY DR.	FIELD BOOK 317, #40A PG. 19
60)	AT REAR OF 1201 QUINCE	FIELD BOOK 317, #2 PG. 15
61)	PORT OF OLYMPIA	FIELD BOOK 317, #52A PG. 20
62)	PORT OF OLYMPIA	FIELD BOOK 317, #52B PG. 20
63)	PORT OF OLYMPIA	FIELD BOOK 317, #52C PG. 20
64)	PORT OF OLYMPIA, AT THE FOOT OF N. WASHINGTON	FIELD BOOK 317, #52 PG. 20
65)	WA DEPT. OF WILDLIFE NE CORNER WASINGTON & B AVE	FIELD BOOK 317, #50 PG. 19
66)	AT A AVE & FRANKLIN	FIELD BOOK 317, #49 PG. 19
67)	LOTT TREATMENT FACILITY 500 N ADAMS	FIELD BOOK 317, #48 PG. 19
68)	LOTT TREATMENT FACILITY	FIELD BOOK 317, #48 PG. 19
69)	LOTT TREATMENT FACILITY	FIELD BOOK 317, #48 PG. 19
70)	LOTT TREATMENT FACILITY	FIELD BOOK 317, #48 PG. 19
71)	POWER SUBSTATION NE CORNER FRANKLIN & THURSTON	FIELD BOOK 317, #48 PG. 19
72)	CITY OF OLYMPIA 320 THURSTON NE	FIELD BOOK 317, #48 PG. 19
73)	THURSTON STREET BETWEEN JEFFERSON & ADAMS	FIELD BOOK 317, #48 PG. 19
74)	PORT OF OLYMPIA NE CORNER STATE & JEFFERSON	FIELD BOOK 317, #47A PG. 19
75)	PORT OF OLYMPIA	FIELD BOOK 317, #47B PG. 19
76)	PORT OF OLYMPIA	FIELD BOOK 317, #47C PG. 19
77)	PORT OF OLYMPIA	FIELD BOOK 317, #41 PG. 19
78)	INTERSECTION BOULEVARD & I-5 OFF RAMP, FOUNTAIN (NW CORNER OF BLOCK 60 OF SWAN'S ADDITION)	NONE
79)	LOT 5, BLOCK 58, SWAN'S ADDITION	FIELD BOOK 317, #3 PG. 15
80)	OLYMPIA FIREPLACE SUPPLY WAREHOUSE 516 4TH AVE E.	FIELD BOOK 317, #38 PG. 18
81)	SAFEWAY 609 4TH AVE E.	FIELD BOOK 317, #21A PG. 17
82)	IN ALLEY BESIDE, 412 JEFFERSON S.E.	NONE
83)	606 PEAR	FIELD BOOK 317, #10 PG. 16
84)	PORT OF OLYMPIA E. SIDE JEFFERSON & THURSTON	FIELD BOOK 317, #39 PG. 18
85)	1221 EAST BAY DRIVE	FIELD BOOK 317, #65A PG. 51
86)	150' SOUTH OF 1311 QUINCE	FIELD BOOK 317, #65 PG. 51
87)	HARBINGER INN 1136 E. BAY DR	FIELD BOOK 317, #64 PG. 52
88)	CASCADE POLE SITE EAST OF N. WASHINGTON	NONE
89)	OLD BREWERY SITE E. BAY DR. & OAK AVE. EAST BAY HARBOR CONDOMINIUMS	FIELD BOOK 317, #63 PG. 52
90)	WA STATE DEPT OF TRANSPORTATION 318 STATE ST.	FIELD BOOK 317, #43 PG. 19
91)	BULLDOG NEWS 116 4TH AVE E	FIELD BOOK 317, #64A NONE
92)	BETTMAN BLOCK CORNER OF 4TH AND ADAMS	FIELD BOOK 317, #36 PG. 18
93)	EASTSIDE CLUB 410 4TH AVE E.	NONE
94)	N. SIDE QUINCE & BIGELOW ST.	NONE
95)	BPOE #186	USGS WATER SUPPLY BULLETIN #10 VOL 1 PG. 221
96)	YARDBIRDS SHOPPING CENTER 506 CAPITOL WAY N.	USGS WATER SUPPLY BULLETIN VOL 1 PG. 97

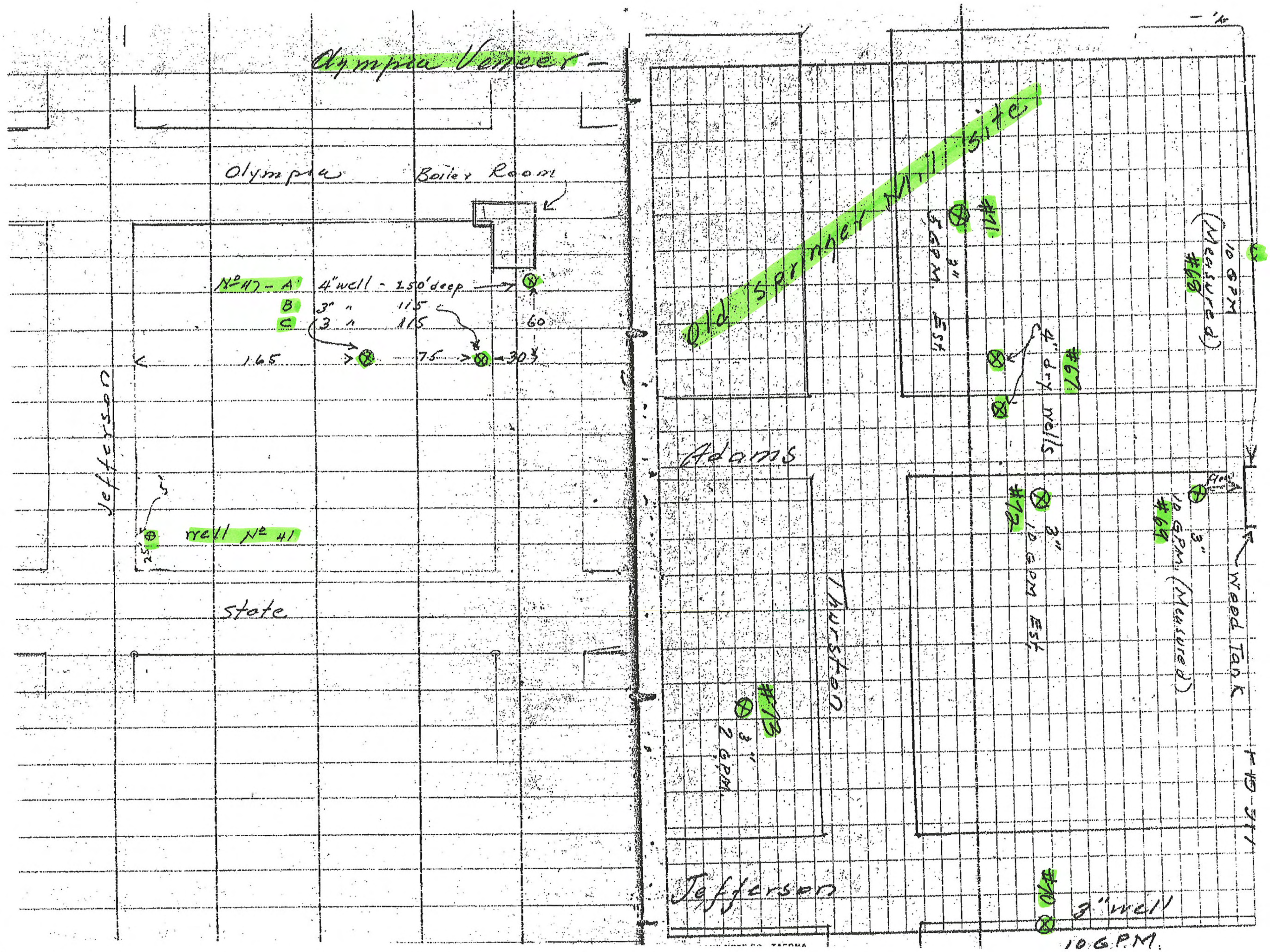
NO.	REVISIONS	BY	APPR.	DATE
1	Well Locations and Status of Well	TAT		06/94

DESIGNED		SCALE	JOB NUMBER
DRAWN	EM	HOR. VERT. 1"=400'	
CHECKED			DATE
APPROVED	GB	FIELD BOOK 317	JULY 13, 1992

CITY OF OLYMPIA
ARTESIAN WELLS

DRAWING NAME: ARTESIAN.DWG

SHEET OF



Olympia Veneer
Olympia
Boiler Room
No 47 - A 4" well - 250' deep
B 3" " 115
C 3 " 115
60
165
75
30
Jefferson
well No 41
State
Old Springer Mill site
#71
5 GPM Est
#68
10 GPM (Measured)
#67
wells
Adams
#72
3"
10 GPM Est
#69
3"
10 GPM (Measured)
Weed Tank
Thurston
#73
3"
2 GPM
Jefferson
#70
3" well
10 G.P.M.

	Location	Size	Depth	Flow	Remarks
28	Corner State & Water (Creamery)	2"	—	1.0 G.M.	This well is pumped flow given by Mgr. of Creamery
29	4th Ave between Columbia & Water - (Shoe Store) is piped to Creamery	2"	240'	17 G.M.	This well is piped to Creamery
30	Curley's place (at Rear)	2"	—	3.5 G.M.	½" faucet.
31	Behind the Spar				
32	Barcheb Bldg.			(Storage under floor)	2" upright pipe
33	Knox Hotel at rear of Lot			2.0 G.M. Est.	flows into tank and used by Hotel - Could not measure)
34	Across from [illegible]				
35	[illegible]ewski			N.G.	
36	Bettman Block -	2"	—	10 G.M. (From Bob [illegible] the Plumber)	Cannot Measure
37	in Alley N of 4th between Adams & Jefferson	2"		1.0 G.M. - Est.	
38	Capital Laundry	2"		3.5 G.M. (From Mgr. of Capital Laundry)	Cannot Measure -
✓ 39	Old pipe Factory Jefferson & Thurston				Could not find well

38.50 = Total this sheet, in 7 wells

		Location	Size	depth	Flow	Remarks
	40	At Wood yard-				
	40A	473 East Bay Drive	4"	—	N.G.	Well covered - not operating
6	41	Olympia Veneer at Corner of State & Jefferson	1½"		.5 G.M. (at Hi Tide only)	several years ago this was a good well.
r	42	Testing Lab			1.5 G.M. This used to	be a strong well.
v	43	[illegible] Franklin - at Center of Block (5' from walk)	1½"		Does not flow - Testing	Lab. plan to drill new well soon - 3" - to supply Cooling water.
6	44	Capitol Way & Olympia Center of Block 12	2"		10 G.M.	
6	45 / 45A / 45B	[illegible] Cleaners [illegible] Olympia & Capitol [illegible]	2" / 2" / 2"	155 / 132 / 210	6.0 G.M. / 3.0 G.M.	is flow of 2 wells (45 & 45A) / have Concrete Tank (10x26x15)
6	46	[illegible] Laundry - N.W. Cor Olympia & Capitol	3"	100	12.0 G.M.	Pumped by air jet
1	47	Olympia Veneer A, B, C well	4" / 3" / 3"	250 / 115 / 115	Flow sufficient for [illegible] 30.0 Est.	have Concrete Tank (15x20x6) / " Elevated wood " (20' dia x 8') / could not measure all in use
6	48	Old Sawmill Mill (see pp 21) [illegible] 2	3"		60 GM (Computed by taking flow of 2 wells) The 2 4" well are not flowing	5 flowing wells - 3" / 2 not flowing - 4" / measured 2 wells = 20 G.M. / Couldn't measure others
v	49	at A Ave & Franklin at Old water Tank			N.G.	Could not find
6	50	(Block C Olympia [illegible] Capitol [illegible] Mill)	3"		25 G.M.	This well is pumped 25 GM! (Flow used to be good about 15 GM.)
	51	206 Olympia	1½"		1 G.M.	In Garage
	51/A	207	1"		15 G.M.	Rear of Lot.

150.50 - Total this sheet in 19 wells.

ATTACHMENT B

GEOPHYSICAL METHODS (SOURCE: GLOBAL GEOPHYSICS)

GEOPHYSICAL METHODS

GROUND PENETRATING RADAR

The GPR method uses electromagnetic pulses, emitted at regular intervals by an antenna to map subsurface features. The electromagnetic pulses are reflected where changes in electrical properties of materials occur such as changes in lithology or where underground utilities are present. The reflected electromagnetic energy is received by an antenna, converted into an electrical signal, and recorded on the GPR unit. The data is recorded and viewed in real time on a graphical display that depicts a continuous profile or cross-section image of the subsurface directly beneath the path of the antenna.

The depth of penetration of the GPR signal varies according to antenna frequency and the conductivity of the subsurface material. The depth of subsurface penetration with GPR decreases with an increase in the frequency of the antenna and an increase in soil conductivity. Low frequency antennas (50 to 500 MHz) provide the best compromise between obtaining good subsurface penetration and resolution.

The data at this site will be collected using Geophysical Survey Systems, Inc. (GSSI) SIR 2000 GPR system with an antenna having a center frequency of 200-500 MHz. The data will be digitally recorded for post processing.

MAGNETOMETER

This instrument is used to measure variations in the magnetic field of the Earth, including local distortions or anomalies of the field caused by ferrous objects or minerals. In general, the magnitude of the magnetometer response is proportional to the mass of the ferrous object. A single drum can be detected to a depth of approximately 15 to 20 feet, and a 4-inch-diameter steel pipeline can be detected to a depth of approximately 10 feet. Non-ferrous metals, such as copper and aluminum cannot be located with a magnetometer.

A Geometrics Cesium G858G magnetometer will be used.

TIME-DOMAIN ELECTROMAGNETICS (EM61)

The EM61 is a time-domain electromagnetic metal detector capable of detecting buried metal objects. Ground control is established on site as a local grid system. The geophysical data are collected along regular grid lines and stations at a density that is appropriate for the size of the potential target.

APPENDIX C
MW16 ANALYTICAL REPORT

19408 Park Row Suite 320 Houston, TX 77084 (713) 266-1599 (713) 266-0130 fax

Columbia Analytical Services INC.
An Employee - Owned Company

August 19, 2008

Service Request No: E0800739

Jay Lucas
Geo Engineers Inc
1101 S. Fawcett Ave, Suite 200
Tacoma, WA 98401

Laboratory Results for: Method 1613B/0615-034-02

Dear Jay:

Enclosed are the results of the sample(s) submitted to our laboratory on July 30, 2008. For your reference, these analyses have been assigned our service request number **E0800739**.

All analyses were performed according to our laboratory's quality assurance program. The test results meet requirements of the NELAP standards except as noted in the case narrative report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report. In accordance to the NELAC 2003 Standard, a statement on the estimated uncertainty of measurement of any quantitative analysis will be supplied upon request.

Please contact me if you have any questions. My extension is 2957. You may also contact me via email at JFreemyer@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Jane Freemyer
Project Manager; GC/HRMS

Page 1 of __________

Columbia Analytical Services INC

Certificate of Analysis

19408 Park Row, Suite 320, Houston, TX 77084
Phone (713)266-1599 Fax (713)266-0130
www.caslab.com
An Employee Owned Company

COLUMBIA ANALYTICAL SERVICES, INC

Client:	Geo Engineers, Inc	**Service Request No.:**	E0800739
Project:	0615-034-02	**Date Received:**	07/30/08
Sample Matrix:	Water		

CASE NARRATIVE

All analyses were performed in adherence to the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for samples designated for Tier II. When appropriate to the method, method blank results have been reported with each analytical test.

Sample Receipt

Two water samples were received for analysis at Columbia Analytical Services on 07/30/08. One sample was put on Hold status, as requested.

The following discrepancies were noted upon initial sample inspection: no custody seals on cooler(s). The exceptions are also noted on the cooler receipt and preservation form included in this data package.

The samples were received at 2°C in good condition and are consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4°C upon receipt at the laboratory.

Data Validation Notes and Discussion

B flags – Method Blanks

The Method Blank EQ0800341-01/U129371 contained low levels of 123478-HcCDF at or below the Method Reporting Limit (MRL).

The associated compounds in the samples are flagged with 'B' flags.

Y flags – Labeled Standards

Samples that had recoveries of labeled standards outside the acceptance limits are flagged with 'Y' flags on the Labeled Compound summary pages. In all cases, the signal-to-noise ratios are greater than 10:1, making these data acceptable.

Approved by *Xiangqiu Liang* Date 8/19/08

Xiangqiu Liang, Laboratory Director

The sample extracted originally had recoveries of labeled standards outside the acceptance criteria. The sample was re-extracted, met the acceptance criteria and was reported.

MS/DMS

EQ0800341: Laboratory Control Spike/Duplicate Laboratory Control Spike (LCS/DLCS) samples were analyzed and reported in lieu of an MS/DMS for this extraction batch.

Detection Limits

Detection limits are calculated for each congener in each sample by measuring the height of the noise level for each quantitation ion for the associated labeled standard. The concentration equivalent to 2.5 times the height of the noise is then calculated using the appropriate response factor and the weight of the sample. The calculated concentration equals the detection limit.

The TEQ Summary results for each sample have been calculated by CAS/Houston to include:

- The 2005 World Health Organization Reevaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-Like Compounds (M. Van den Berg et al., Toxicological Sciences 93(2):223-241, 2006)
- Non-detected compounds are not included in the 'Total'

Approved by Xiangqiu Liang **Date** 8/19/08

Xiangqiu Liang, Laboratory Director

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
E0800739-001	MW-16-072908-W	07/29/08	10:15
E0800739-002	MW16-F-072908-W	07/29/08	10:18

Abbreviations, Acronyms & Definitions

Cal	Calibration
Conc	CONCentration
Dioxin(s)	Polychlorinated dibenzo-p-dioxin(s)
EDL	Estimated Detection Limit
EMPC	Estimated Maximum Possible Concentration
Flags	Data qualifiers
Furan(s)	Polychlorinated dibenzofuran(s)
g	Grams
ICAL	Initial CALibration
ID	IDentifier
Ions	Masses monitored for the analyte during data acquisition
L	Liter (s)
LCS	Laboratory Control Sample
DLCS	Duplicate Laboratory Control Sample
MB	Method Blank
MCL	Method Calibration Limit
MDL	Method Detection Limit
mL	Milliliters
MS	Matrix Spiked sample
DMS	Duplicate Matrix Spiked sample
NO	Number of peaks meeting all identification criteria
PCDD(s)	Polychlorinated dibenzo-p-dioxin(s)
PCDF(s)	Polychlorinated dibenzofuran(s)
ppb	Parts per billion
ppm	Parts per million
ppq	Parts per quadrillion
ppt	Parts per trillion
QA	Quality Assurance
QC	Quality Control
Ratio	Ratio of areas from monitored ions for an analyte
% Rec.	Percent recovery
RPD	Relative Percent Difference
RRF	Relative Response Factor
RT	Retention Time
SDG	Sample Delivery Group
S/N	Signal-to-noise ratio
TEF	Toxicity Equivalence Factor
TEQ	Toxicity Equivalence Quotient

Data Qualifier Flags – Dioxin/Furans

- **B** Indicates the associated analyte is found in the method blank, as well as in the sample

- **C** Confirmation of the TCDF compound: When 2378-TCDF is detected on the DB-5 column, confirmation analyses are performed on a second column (DB-225). The results from both the DB-5 column and the DB-225 column are included in this data package. The results from the DB-225 analyses should be used to evaluate the 2378-TCDF in the samples. The confirmed result should be used in determining the TEQ value for TCDF.

- **E** Indicates an estimated value – used when the analyte concentration exceeds the upper end of the linear calibration range

- **J** Indicates an estimated value – used when the analyte concentration is below the method reporting limit (MRL) and above the estimated detection limit (EDL)

- **K** EMPC - When the ion abundance ratios associated with a particular compound are outside the QC limits, samples are flagged with a 'K' flag. A 'K' flag indicates an estimated maximum possible concentration for the associated compound.

- **U** Indicates the compound was analyzed and not detected

- **Y** Samples that had recoveries of labeled standards outside the acceptance limits are flagged with 'Y'. In all cases, the signal-to-noise ratios are greater than 10:1, making these data acceptable.

- **ND** Indicates concentration is reported as 'Not Detected'

- **S** Peak is saturated; data not reportable

- **Q** Lock-mass interference by ether compounds

CAS/HOU - Form Production, Peer Review & Project Review Signatures

SR# Unique ID E0800739

First Level - Data Processing - to be filled by person generating the forms			
Date	08/18/08	Person 1	MC
Date		Person 2	

Second Level - Data Review – to be filled by person doing peer review			
Date	8/19/08	Primary Data Reviewer	QC
Date		Secondary Data Reviewer	

Project Level - Review - to be filled by person doing project compliance review			
Date	8/19/8	Reviewer	OF

DATA_REV_SIG1 (8/18/2008)

Columbia Analytical Services INC

Analytical Results

19408 Park Row, Suite 320, Houston, TX 77084
Phone (713)266-1599 Fax (713)266-0130
www.caslab.com
An Employee Owned Company

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geo Engineers	**Service Request:**	E0800739
Project:	Method 1613B/0615-034-02	**Date Collected:**	07/29/2008
Sample Matrix:	Water	**Date Received:**	07/30/2008
Sample Name:	MW-16-072908-W	**Units:**	pg/L
Lab Code:	E0800739-001	**Basis:**	NA

Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans by HRGC/HRMS

Analytical Method:	1613B	**Date Analyzed:**	8/14/08 00:28:0(
Prep Method:	Method	**Date Extracted:**	8/11/08
Sample Amount:	1043mL	**Instrument Name:**	E-HRMS-01
		GC Column:	DB-5
Data File Name:	U129386	**Blank File Name:**	U129371
ICAL Name:	05/02/08	**Cal Ver. File Name:**	U129378

Analyte Name	Result	Q	EDL	MRL	Ion Ratio	RRT	Dilution Factor
2,3,7,8-TCDD	ND	U	0.702	9.59			1
1,2,3,7,8-PeCDD	ND	U	0.585	47.9			1
1,2,3,4,7,8-HxCDD	ND	U	0.756	47.9			1
1,2,3,6,7,8-HxCDD	ND	U	0.912	47.9			1
1,2,3,7,8,9-HxCDD	ND	U	0.785	47.9			1
1,2,3,4,6,7,8-HpCDD	ND	U	0.558	47.9			1
OCDD	**12.7**	J	1.56	95.9	0.87	1.000	1
2,3,7,8-TCDF	ND	U	0.675	9.59			1
1,2,3,7,8-PeCDF	ND	U	0.336	47.9			1
2,3,4,7,8-PeCDF	ND	U	0.307	47.9			1
1,2,3,4,7,8-HxCDF	ND	U	0.643	47.9			1
1,2,3,6,7,8-HxCDF	ND	U	0.710	47.9			1
1,2,3,7,8,9-HxCDF	ND	U	0.733	47.9			1
2,3,4,6,7,8-HxCDF	ND	U	0.644	47.9			1
1,2,3,4,6,7,8-HpCDF	ND	U	0.731	47.9			1
1,2,3,4,7,8,9-HpCDF	ND	U	0.669	47.9			1
OCDF	ND	U	1.62	95.9			1
Total Tetra-Dioxins	ND	U	0.702	9.59			1
Total Penta-Dioxins	ND	U	0.585	47.9			1
Total Hexa-Dioxins	ND	U	0.756	47.9			1
Total Hepta-Dioxins	**2.57**	J	0.558	47.9	1.00		1
Total Tetra-Furans	ND	U	0.675	9.59			1
Total Penta-Furans	ND	U	0.307	47.9			1
Total Hexa-Furans	ND	U	0.643	47.9			1
Total Hepta-Furans	ND	U	0.731	47.9			1

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geo Engineers	**Service Request:**	E0800739
Project:	Method 1613B/0615-034-02	**Date Collected:**	07/29/2008
Sample Matrix:	Water	**Date Received:**	07/30/2008
Sample Name:	MW-16-072908-W	**Units:**	Percent
Lab Code:	E0800739-001	**Basis:**	NA

Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans by HRGC/HRMS

Analytical Method:	1613B	**Date Analyzed:**	8/14/08 00:28:0(
Prep Method:	Method	**Date Extracted:**	8/11/08
Sample Amount:	1043mL	**Instrument Name:**	E-HRMS-01
		GC Column:	DB-5
Data File Name:	U129386	**Blank File Name:**	U129371
ICAL Name:	05/02/08	**Cal Ver. File Name:**	U129378

Labeled Compounds	Spike Conc.(pg)	Conc. Found (pg)	%Rec	Q	Control Limits	Ion Ratio	RRT
13C-2,3,7,8-TCDD	2000	1278.111	64		25-164	0.78	1.008
13C-1,2,3,7,8-PeCDD	2000	1567.553	78		25-181	1.51	1.169
13C-1,2,3,4,7,8-HxCDD	2000	1601.613	80		32-141	1.29	0.990
13C-1,2,3,6,7,8-HxCDD	2000	1450.948	73		28-130	1.27	0.993
13C-1,2,3,4,6,7,8-HpCDD	2000	1192.920	60		23-140	1.05	1.066
13C-OCDD	4000	1797.084	45		17-157	0.91	1.144
13C-2,3,7,8-TCDF	2000	1140.374	57		24-169	0.78	0.979
13C-1,2,3,7,8-PeCDF	2000	1488.457	74		24-185	1.59	1.131
13C-2,3,4,7,8-PeCDF	2000	1455.204	73		21-178	1.58	1.157
13C-1,2,3,4,7,8-HxCDF	2000	1411.797	71		26-152	0.52	0.972
13C-1,2,3,6,7,8-HxCDF	2000	1244.591	62		26-123	0.52	0.974
13C-1,2,3,7,8,9-HxCDF	2000	1507.962	75		29-147	0.53	1.006
13C-2,3,4,6,7,8-HxCDF	2000	1474.253	74		28-136	0.53	0.987
13C-1,2,3,4,6,7,8-HpCDF	2000	1074.503	54		28-143	0.45	1.043
13C-1,2,3,4,7,8,9-HpCDF	2000	1627.983	81		26-138	0.45	1.077
37Cl-2,3,7,8-TCDD	800	614.506	77		35-197	NA	1.008

Comments:

Client:	Geo Engineers	**Service Request:**	E0800739
Project:	Method 1613B/0615-034-02	**Date Collected:**	07/29/2008
Sample Matrix:	Water	**Date Received:**	07/30/2008
Sample Name:	MW-16-072908-W	**Units:**	pg/L
Lab Code:	E0800739-001	**Basis:**	NA

Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans by HRGC/HRMS

Analytical Method: 1613B
Prep Method: Method

Analyte Name	Result	DL	Dilution Factor	TEF	TEF - Adjusted Concentration
2,3,7,8-TCDD	ND	0.702	1	1	
1,2,3,7,8-PeCDD	ND	0.585	1	1	
1,2,3,4,7,8-HxCDD	ND	0.756	1	0.1	
1,2,3,6,7,8-HxCDD	ND	0.912	1	0.1	
1,2,3,7,8,9-HxCDD	ND	0.785	1	0.1	
1,2,3,4,6,7,8-HpCDD	ND	0.558	1	0.01	
OCDD	**12.7**	1.56	1	0.0003	0.00381
2,3,7,8-TCDF	ND	0.675	1	0.1	
1,2,3,7,8-PeCDF	ND	0.336	1	0.03	
2,3,4,7,8-PeCDF	ND	0.307	1	0.3	
1,2,3,4,7,8-HxCDF	ND	0.643	1	0.1	
1,2,3,6,7,8-HxCDF	ND	0.710	1	0.1	
1,2,3,7,8,9-HxCDF	ND	0.733	1	0.1	
2,3,4,6,7,8-HxCDF	ND	0.644	1	0.1	
1,2,3,4,6,7,8-HpCDF	ND	0.731	1	0.01	
1,2,3,4,7,8,9-HpCDF	ND	0.669	1	0.01	
OCDF	ND	1.62	1	0.0003	
		Total TEQ			0.00381

2005 WHO TEFs, ND = 0

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Geo Engineers
Project: Method 1613B/0615-034-02
Sample Matrix: Water

Sample Name: Method Blank
Lab Code: EQ0800341-01

Service Request: E0800739
Date Collected: NA
Date Received: NA

Units: pg/L
Basis: NA

Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans by HRGC/HRMS

Analytical Method: 1613B
Prep Method: Method
Sample Amount: 1000mL

Data File Name: U129371
ICAL Name: 05/02/08

Date Analyzed: 8/13/08 11:59:0(
Date Extracted: 8/11/08
Instrument Name: E-HRMS-01
GC Column: DB-5
Blank File Name: U129371
Cal Ver. File Name: U129370

Analyte Name	Result	Q	EDL	MRL	Ion Ratio	RRT	Dilution Factor
2,3,7,8-TCDD	ND	U	1.47	10.0			1
1,2,3,7,8-PeCDD	ND	U	0.828	50.0			1
1,2,3,4,7,8-HxCDD	ND	U	1.24	50.0			1
1,2,3,6,7,8-HxCDD	ND	U	1.43	50.0			1
1,2,3,7,8,9-HxCDD	ND	U	1.26	50.0			1
1,2,3,4,6,7,8-HpCDD	ND	U	1.37	50.0			1
OCDD	ND	U	2.18	100			1
2,3,7,8-TCDF	ND	U	1.05	10.0			1
1,2,3,7,8-PeCDF	ND	U	0.908	50.0			1
2,3,4,7,8-PeCDF	ND	U	0.849	50.0			1
1,2,3,4,7,8-HxCDF	**5.35**	J	0.919	50.0	1.14	0.999	1
1,2,3,6,7,8-HxCDF	ND	U	1.01	50.0			1
1,2,3,7,8,9-HxCDF	ND	U	1.25	50.0			1
2,3,4,6,7,8-HxCDF	ND	U	0.973	50.0			1
1,2,3,4,6,7,8-HpCDF	ND	U	1.38	50.0			1
1,2,3,4,7,8,9-HpCDF	ND	U	1.30	50.0			1
OCDF	ND	U	3.06	100			1
Total Tetra-Dioxins	ND	U	1.47	10.0			1
Total Penta-Dioxins	ND	U	0.828	50.0			1
Total Hexa-Dioxins	ND	U	1.24	50.0			1
Total Hepta-Dioxins	**36.7**	J	1.37	50.0	1.11		1
Total Tetra-Furans	ND	U	1.05	10.0			1
Total Penta-Furans	ND	U	0.849	50.0			1
Total Hexa-Furans	**14.4**	J	0.919	50.0	1.22		1
Total Hepta-Furans	**23.9**	J	1.38	50.0	1.00		1

Comments:

Client:	Geo Engineers	**Service Request:**	E0800739
Project:	Method 1613B/0615-034-02	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
Sample Name:	Method Blank	**Units:**	Percent
Lab Code:	EQ0800341-01	**Basis:**	NA

Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans by HRGC/HRMS

Analytical Method:	1613B	**Date Analyzed:**	8/13/08 11:59:0(
Prep Method:	Method	**Date Extracted:**	8/11/08
Sample Amount:	1000mL	**Instrument Name:**	E-HRMS-01
		GC Column:	DB-5
Data File Name:	U129371	**Blank File Name:**	U129371
ICAL Name:	05/02/08	**Cal Ver. File Name:**	U129370

Labeled Compounds	Spike Conc.(pg)	Conc. Found (pg)	%Rec	Q	Control Limits	Ion Ratio	RRT
13C-2,3,7,8-TCDD	2000	1187.764	59		25-164	0.75	1.008
13C-1,2,3,7,8-PeCDD	2000	1426.579	71		25-181	1.57	1.168
13C-1,2,3,4,7,8-HxCDD	2000	1555.369	78		32-141	1.25	0.991
13C-1,2,3,6,7,8-HxCDD	2000	1393.665	70		28-130	1.26	0.993
13C-1,2,3,4,6,7,8-HpCDD	2000	1145.372	57		23-140	1.06	1.067
13C-OCDD	4000	1554.511	39		17-157	0.91	1.145
13C-2,3,7,8-TCDF	2000	1109.884	55		24-169	0.78	0.979
13C-1,2,3,7,8-PeCDF	2000	1305.361	65		24-185	1.55	1.130
13C-2,3,4,7,8-PeCDF	2000	1289.956	64		21-178	1.58	1.155
13C-1,2,3,4,7,8-HxCDF	2000	1369.987	68		26-152	0.51	0.972
13C-1,2,3,6,7,8-HxCDF	2000	1187.453	59		26-123	0.51	0.975
13C-1,2,3,7,8,9-HxCDF	2000	1259.727	63		29-147	0.54	1.006
13C-2,3,4,6,7,8-HxCDF	2000	1377.310	69		28-136	0.53	0.988
13C-1,2,3,4,6,7,8-HpCDF	2000	1034.307	52		28-143	0.44	1.044
13C-1,2,3,4,7,8,9-HpCDF	2000	1517.927	76		26-138	0.44	1.078
37Cl-2,3,7,8-TCDD	800	587.218	73		35-197	NA	1.008

Comments:

Columbia
Analytical Services INC

Accuracy and Precision

19408 Park Row, Suite 320, Houston, TX 77084
Phone (713)266-1599 Fax (713)266-0130
www.caslab.com
An Employee Owned Company

Client: Geo Engineers
Project: Method 1613B/0615-034-02
Sample Matrix: Water

Service Request: E0800739
Date Analyzed: 08/13/2008

Lab Control Sample Summary
Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans by HRGC/HRMS

Sample Name: Lab Control Sample
Lab Code: EQ0800341-02

Units: pg/L
Basis: NA

Analytical Method: 1613B
Prep Method: Method

Extraction Lot: 71538

	Lab Control Sample			Duplicate Lab Control Sample			% Rec		RPD
Analyte Name	**Result**	**Expected**	**% Rec**	**Result**	**Expected**	**% Rec**	**Limits**	**RPD**	**Limit**
2,3,7,8-TCDD	259	200	129	267	200	134	67 - 158	4	50
1,2,3,7,8-PeCDD	999	1000	100	1030	1000	103	70 - 142	3	50
1,2,3,4,7,8-HxCDD	934	1000	93	957	1000	96	70 - 164	3	50
1,2,3,6,7,8-HxCDD	1120	1000	112	1050	1000	105	76 - 134	6	50
1,2,3,7,8,9-HxCDD	946	1000	95	939	1000	94	64 - 162	1	50
1,2,3,4,6,7,8-HpCDD	978	1000	98	991	1000	99	70 - 140	1	50
OCDD	1810	2000	90	1870	2000	94	78 - 144	4	50
2,3,7,8-TCDF	192	200	96	191	200	96	75 - 158	0	50
1,2,3,7,8-PeCDF	922	1000	92	947	1000	95	80 - 134	3	50
2,3,4,7,8-PeCDF	953	1000	95	986	1000	99	68 - 160	4	50
1,2,3,4,7,8-HxCDF	1000	1000	100	1080	1000	108	72 - 134	8	50
1,2,3,6,7,8-HxCDF	1140	1000	114	1140	1000	114	84 - 130	0	50
1,2,3,7,8,9-HxCDF	848	1000	85	885	1000	89	78 - 130	5	50
2,3,4,6,7,8-HxCDF	972	1000	97	1010	1000	101	70 - 156	4	50
1,2,3,4,6,7,8-HpCDF	966	1000	97	991	1000	99	82 - 132	2	50
1,2,3,4,7,8,9-HpCDF	834	1000	83	850	1000	85	78 - 138	2	50
OCDF	2000	2000	100	2350	2000	118	63 - 170	17	50

Comments: ______

Analytical Report

Client:	Geo Engineers	**Service Request:**	E0800739
Project:	Method 1613B/0615-034-02	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
Sample Name:	Lab Control Sample	**Units:**	pg/L
Lab Code:	EQ0800341-02	**Basis:**	NA

Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans by HRGC/HRMS

Analytical Method:	1613B	**Date Analyzed:**	8/13/08 15:10:0(
Prep Method:	Method	**Date Extracted:**	8/11/08
Sample Amount:	1000mL	**Instrument Name:**	E-HRMS-01
		GC Column:	DB-5
Data File Name:	U129375	**Blank File Name:**	U129371
ICAL Name:	05/02/08	**Cal Ver. File Name:**	U129370

Analyte Name	Result	Q	EDL	MRL	Ion Ratio	RRT	Dilution Factor
2,3,7,8-TCDD	**259**		0.880	10.0	0.77	1.001	1
1,2,3,7,8-PeCDD	**999**		0.619	50.0	1.56	1.000	1
1,2,3,4,7,8-HxCDD	**934**		0.634	50.0	1.28	1.000	1
1,2,3,6,7,8-HxCDD	**1120**		0.786	50.0	1.23	1.000	1
1,2,3,7,8,9-HxCDD	**946**		0.668	50.0	1.22	1.008	1
1,2,3,4,6,7,8-HpCDD	**978**		0.554	50.0	1.01	1.000	1
OCDD	**1810**		1.12	100	0.89	1.000	1
2,3,7,8-TCDF	**192**		0.955	10.0	0.82	1.001	1
1,2,3,7,8-PeCDF	**922**		0.438	50.0	1.54	1.000	1
2,3,4,7,8-PeCDF	**953**		0.413	50.0	1.50	1.000	1
1,2,3,4,7,8-HxCDF	**1000**		0.455	50.0	1.25	1.000	1
1,2,3,6,7,8-HxCDF	**1140**		0.523	50.0	1.18	1.000	1
1,2,3,7,8,9-HxCDF	**848**		0.575	50.0	1.26	1.000	1
2,3,4,6,7,8-HxCDF	**972**		0.472	50.0	1.18	1.000	1
1,2,3,4,6,7,8-HpCDF	**966**		0.894	50.0	1.05	1.000	1
1,2,3,4,7,8,9-HpCDF	**834**		0.847	50.0	1.02	1.000	1
OCDF	**2000**		1.05	100	0.92	1.004	1
Total Tetra-Dioxins	**259**		0.880	10.0	0.77		1
Total Penta-Dioxins	**999**		0.619	50.0	1.56		1
Total Hexa-Dioxins	**3000**		0.634	50.0	1.28		1
Total Hepta-Dioxins	**978**		0.554	50.0	1.01		1
Total Tetra-Furans	**192**		0.955	10.0	0.82		1
Total Penta-Furans	**1890**		0.413	50.0	1.63		1
Total Hexa-Furans	**3960**		0.455	50.0	1.25		1
Total Hepta-Furans	**1800**		0.894	50.0	1.05		1

Comments:

Client:	Geo Engineers	**Service Request:**	E0800739
Project:	Method 1613B/0615-034-02	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
Sample Name:	Lab Control Sample	**Units:**	Percent
Lab Code:	EQ0800341-02	**Basis:**	NA

Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans by HRGC/HRMS

Analytical Method:	1613B	**Date Analyzed:**	8/13/08 15:10:0(
Prep Method:	Method	**Date Extracted:**	8/11/08
Sample Amount:	1000mL	**Instrument Name:**	E-HRMS-01
		GC Column:	DB-5
Data File Name:	U129375	**Blank File Name:**	U129371
ICAL Name:	05/02/08	**Cal Ver. File Name:**	U129370

Labeled Compounds	Spike Conc.(pg)	Conc. Found (pg)	%Rec	Q	Control Limits	Ion Ratio	RRT
13C-2,3,7,8-TCDD	2000	1279.106	64		25-164	0.76	1.008
13C-1,2,3,7,8-PeCDD	2000	1560.908	78		25-181	1.56	1.167
13C-1,2,3,4,7,8-HxCDD	2000	1533.696	77		32-141	1.24	0.990
13C-1,2,3,6,7,8-HxCDD	2000	1323.782	66		28-130	1.24	0.993
13C-1,2,3,4,6,7,8-HpCDD	2000	1323.195	66		23-140	1.04	1.067
13C-OCDD	4000	2420.620	61		17-157	0.90	1.144
13C-2,3,7,8-TCDF	2000	1153.621	58		24-169	0.79	0.979
13C-1,2,3,7,8-PeCDF	2000	1404.463	70		24-185	1.55	1.130
13C-2,3,4,7,8-PeCDF	2000	1401.870	70		21-178	1.55	1.155
13C-1,2,3,4,7,8-HxCDF	2000	1358.501	68		26-152	0.51	0.972
13C-1,2,3,6,7,8-HxCDF	2000	1174.684	59		26-123	0.52	0.974
13C-1,2,3,7,8,9-HxCDF	2000	1316.726	66		29-147	0.51	1.006
13C-2,3,4,6,7,8-HxCDF	2000	1396.278	70		28-136	0.51	0.987
13C-1,2,3,4,6,7,8-HpCDF	2000	1172.725	59		28-143	0.44	1.043
13C-1,2,3,4,7,8,9-HpCDF	2000	1752.880	88		26-138	0.45	1.077
37Cl-2,3,7,8-TCDD	800	644.104	81		35-197	NA	1.008

Comments:

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Geo Engineers
Project: Method 1613B/0615-034-02
Sample Matrix: Water

Sample Name: Lab Control Sample Dup
Lab Code: EQ0800341-03

Service Request: E0800739
Date Collected: NA
Date Received: NA

Units: pg/L
Basis: NA

Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans by HRGC/HRMS

Analytical Method: 1613B
Prep Method: Method
Sample Amount: 1000mL

Data File Name: U129376
ICAL Name: 05/02/08

Date Analyzed: 8/13/08 15:59:0(
Date Extracted: 8/11/08
Instrument Name: E-HRMS-01
GC Column: DB-5
Blank File Name: U129371
Cal Ver. File Name: U129370

Analyte Name	Result	Q	EDL	MRL	Ion Ratio	RRT	Dilution Factor
2,3,7,8-TCDD	**267**		1.00	10.0	0.77	1.001	1
1,2,3,7,8-PeCDD	**1030**		0.665	50.0	1.56	1.000	1
1,2,3,4,7,8-HxCDD	**957**		0.710	50.0	1.22	1.000	1
1,2,3,6,7,8-HxCDD	**1050**		0.834	50.0	1.22	1.000	1
1,2,3,7,8,9-HxCDD	**939**		0.728	50.0	1.22	1.008	1
1,2,3,4,6,7,8-HpCDD	**991**		0.736	50.0	1.06	1.000	1
OCDD	**1870**		1.56	100	0.90	1.000	1
2,3,7,8-TCDF	**191**		1.07	10.0	0.83	1.001	1
1,2,3,7,8-PeCDF	**947**		0.438	50.0	1.52	1.000	1
2,3,4,7,8-PeCDF	**986**		0.418	50.0	1.53	1.000	1
1,2,3,4,7,8-HxCDF	**1080**		0.436	50.0	1.27	1.000	1
1,2,3,6,7,8-HxCDF	**1140**		0.484	50.0	1.26	1.000	1
1,2,3,7,8,9-HxCDF	**885**		0.535	50.0	1.31	1.000	1
2,3,4,6,7,8-HxCDF	**1010**		0.467	50.0	1.25	1.000	1
1,2,3,4,6,7,8-HpCDF	**991**		1.16	50.0	1.05	1.000	1
1,2,3,4,7,8,9-HpCDF	**850**		1.04	50.0	1.02	1.000	1
OCDF	**2350**		1.99	100	0.88	1.004	1
Total Tetra-Dioxins	**267**		1.00	10.0	0.77		1
Total Penta-Dioxins	**1030**		0.665	50.0	1.56		1
Total Hexa-Dioxins	**2950**		0.710	50.0	1.22		1
Total Hepta-Dioxins	**991**		0.736	50.0	1.06		1
Total Tetra-Furans	**191**		1.07	10.0	0.83		1
Total Penta-Furans	**1950**		0.418	50.0	1.52		1
Total Hexa-Furans	**4110**		0.436	50.0	1.27		1
Total Hepta-Furans	**1840**		1.16	50.0	1.05		1

Comments:

Client:	Geo Engineers	**Service Request:**	E0800739
Project:	Method 1613B/0615-034-02	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA
Sample Name:	Lab Control Sample Dup	**Units:**	Percent
Lab Code:	EQ0800341-03	**Basis:**	NA

Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans by HRGC/HRMS

Analytical Method:	1613B	**Date Analyzed:**	8/13/08 15:59:0(
Prep Method:	Method	**Date Extracted:**	8/11/08
Sample Amount:	1000mL	**Instrument Name:**	E-HRMS-01
		GC Column:	DB-5
Data File Name:	U129376	**Blank File Name:**	U129371
ICAL Name:	05/02/08	**Cal Ver. File Name:**	U129370

Labeled Compounds	Spike Conc.(pg)	Conc. Found (pg)	%Rec	Q	Control Limits	Ion Ratio	RRT
13C-2,3,7,8-TCDD	2000	1284.753	64		25-164	0.76	1.008
13C-1,2,3,7,8-PeCDD	2000	1496.503	75		25-181	1.55	1.168
13C-1,2,3,4,7,8-HxCDD	2000	1546.083	77		32-141	1.25	0.990
13C-1,2,3,6,7,8-HxCDD	2000	1375.398	69		28-130	1.25	0.993
13C-1,2,3,4,6,7,8-HpCDD	2000	1122.480	56		23-140	1.06	1.067
13C-OCDD	4000	1582.160	40		17-157	0.90	1.145
13C-2,3,7,8-TCDF	2000	1188.272	59		24-169	0.78	0.979
13C-1,2,3,7,8-PeCDF	2000	1389.024	69		24-185	1.57	1.130
13C-2,3,4,7,8-PeCDF	2000	1339.852	67		21-178	1.57	1.156
13C-1,2,3,4,7,8-HxCDF	2000	1327.350	66		26-152	0.54	0.972
13C-1,2,3,6,7,8-HxCDF	2000	1147.159	57		26-123	0.51	0.975
13C-1,2,3,7,8,9-HxCDF	2000	1379.013	69		29-147	0.51	1.006
13C-2,3,4,6,7,8-HxCDF	2000	1340.763	67		28-136	0.55	0.988
13C-1,2,3,4,6,7,8-HpCDF	2000	1015.145	51		28-143	0.43	1.044
13C-1,2,3,4,7,8,9-HpCDF	2000	1539.706	77		26-138	0.45	1.078
37Cl-2,3,7,8-TCDD	800	647.741	81		35-197	NA	1.008

Comments:

Columbia Analytical Services INC

Chain of Custody

19408 Park Row, Suite 320, Houston, TX 77084
Phone (713)266-1599 Fax (713)266-0130
www.caslab.com
An Employee Owned Company

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Tacoma
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.testamericainc.com

Columbia Analytical Services
19408 Park Road
Suite 320
Houston, Texas 77084

Chain of Custody Record

Client: GeoEngineers Inc.	Project Manager: Jay Lucas	Date: 07/29/08	Chain of Custody Number: 2523
Address: 1101 S. Fawcett Ave Suite 200	Telephone Number (Area Code)/Fax Number: 206-239-3221	Lab Number:	Page ___ of ___
City: Tacoma; State: WA; Zip Code: 98401	Site Contact: ; Lab Contact:		
Project Name and Location (State): Port of Olympia East Bay	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.: Project # ~~0416-595-08~~ 0615-034-02			

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sed.	Soil	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Dioxins/furans EPA 1613	Hold	Special Instructions/ Conditions of Receipt
MW16-072908-W	07/29/08	1015		X			2						X		Std TAT
MW16-F-072908-W	07/29/08	1018		X			2						~~X~~ (DF)	X	(DF) 7/30/08

Cooler: ☒ Yes ☐ No Cooler Temp: ______

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days): ☒ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☐ Other ______

QC Requirements (Specify):

	Date	Time		Date	Time
1. Relinquished By: Chad C. Opatz	07/29/08	1305	1. Received By:		
2. Relinquished By:			2. Received By:		
3. Relinquished By:			3. Received By: [signature]	7/30/08	10:00

Comments: 2° C

DISTRIBUTION: WHITE – Stays with the Samples; CANARY – Returned to Client with Report; PINK – Field Copy

TAL-8274-580 (0508)

Reset Form | Print Form

Columbia Analytical Services, Inc.
Cooler Receipt Form

Client/Project: Geo Engineers   Service Request: E0800739

Received: 7/30/08   Opened (Date/Time): 10:00   By: AE

1. Samples were received via? ☐ *US Mail* ☐ *Fedex* ☑ *UPS* ☐ *DHL* ☐ *Courier* ☐ *Hand Delivered*
2. Samples were received in: (circle) ☑ *Cooler* ☐ *Box* ☐ *Other* ______ ☐ *NA*
3. Were custody seals present on coolers? ☐ Y ☑ N   If yes, how many and where? ______

   If present, were custody seals intact? ☐ Y ☐ N   If present, were they signed and dated? ☐ Y ☐ N
4. Is shipper's air-bill filed? ☐ NA ☑ Y ☐ N   If not, record air bill number: ______
5. Temperature of cooler(s) upon receipt (°C): 2
6. If applicable, list Chain of Custody numbers: ______
7. Were custody papers properly filled our (ink, signed, etc.)? ☐ NA ☑ Y ☐ N
8. Packing material used: ☐ *Inserts* ☑ *Bubble Wrap* ☐ *Blue Ice* ☑ *Wet Ice* ☐ *Sleeves* ☐ *Other* ______
9. Were the correct types of bottles used for the tests indicated? ☑ Y ☐ N

   Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* ☑ Y ☐ N

Sample ID	Bottle Count	Bottle Type	Out of Temp	Broken	Initials
			☐	☐	
			☐	☐	
			☐	☐	
			☐	☐	
			☐	☐	
			☐	☐	
			☐	☐	

10. Were all bottle labels complete (i.e. analysis, ID, etc.)? ☑ Y ☐ N

    Did all bottle labels and tags agree with custody papers? *Indicate in the table below.* ☑ Y ☐ N

Sample ID on Bottle	Sample ID on COC		Sample ID on Bottle	Sample ID on COC

11. Additional notes, discrepancies, and resolutions:

______

Page 1 of: ☑ 1 ☐ 2

Sample Acceptance Policy

Custody Seals (desirable, mandatory if specified in SAP):

- ✓ On outside of cooler
- ✓ Seals intact, signed and dated

Chain-of-Custody documentation (mandatory):

- ✓ Properly filled out in ink & signed by the client
- ✓ Sign and date the coc for CAS/HOU upon cooler receipt
- ✓ Coc must list method number
- ✓ If no coc was submitted with the samples, complete a CAS/HOU coc for the client

Sample Integrity (mandatory):

- ✓ Sample containers must arrive in good condition (not broken or leaking)
- ✓ Sample IDs on the bottles must match the sample IDs on the coc
- ✓ The correct type of sample bottle must be used for the method requested
- ✓ The correct number of sample containers received must agree with the documentation on the coc
- ✓ The correct sample matrix must appear on the coc
- ✓ An appropriate sample volume or weight must be received

Temperature Preservatives (varies by sample matrix):

- ✓ Aqueous and Non-aqueous samples must be shipped and stored cold, at 0 to 6°C
- ✓ Tissue samples must be shipped and stored frozen, at -20 to -10°C
- ✓ Air samples can be shipped and stored at ambient temperature, ~23°C
- ✓ The sample temperature must be recorded on the coc
- ✓ Notify a Project Chemist if any samples are outside the acceptance temperature or have compromised sample integrity – the client must decide re: replacement sample submittal or continue with the analysis

Cooler Receipt Form, CRF (mandatory):

- ✓ Cooler receipt forms must be completed for each coc & SR#
- ✓ Sample integrity issues must be documented on the CRF
- ✓ A scan of the carrier and the airbill number must be recorded in CAS LIMS

Sample Integrity Issues/Resolutions (mandatory):

- ✓ Sample integrity issues are documented on the CRF and given to the Project Chemist for resolution with the client
- ✓ Client resolution is documented in writing (typically email or on the CRF) and filed in the project folder(s)

Service Request Summary

Folder #: **E0800739**
Client Name: Geo Engineers
Project Name: Method 1613B
Project Number: 0615-034-02

Report To: Jay Lucas
Geo Engineers Inc
1101 S. Fawcett Ave, Suite 200
Tacoma, WA 98401

Phone Number:
Cell Number:
Fax Number:
E-mail: jlucas@geoengineers.com

Project Chemist: Jane Freemyer
Originating Lab: HOUSTON
Logged By: AENNIS
Date Received: 07/30/2008
Internal Due Date: 08/13/2008
QAPP: LAB QAP
Qualifier Set: CAS Standard
Formset: CAS Standard
Merged?: N
Report to MDL?: Y
P.O. Number: 0615-034-02
EDD: BASIC_WQC_CASNo

4 - 1000 ml-Glass Bottle NM AMBER Teflon Liner Unpreserv

Location: E-WIC01

CAS Samp No.	Client Samp No.	Matrix	Collected	SVM Dioxins Furans/ 1613B
E0800739-001	MW-16-072908-W	Water	7/29/08 1015	IV
E0800739-002	MW16-F-072908-W	Water	7/29/08 1018	IV(H)

Preparation Information Benchsheet

Prep Run#: 71538
Team: Semivoa GCMS/SMALHOTRA

Prep WorkFlow: OrgExtAq(365)
Prep Method: Method

Status: Prepped
Prep Date/Time: 08/11/2008 03:00 PM

#	Lab Code	Client ID	B#	Method /Test	pH	Matrix	Amt. Ext.	Sample Description
1	EQ0800341-01	MB		1613B/Dioxins Furans		Liquid	1000mL	
2	EQ0800341-02	LCS		1613B/Dioxins Furans		Liquid	1000mL	
3	EQ0800341-03	DLCS		1613B/Dioxins Furans		Liquid	1000mL	
4	E0800735-001RE	2008-07-23-I	.01	1613B/Dioxins Furans	3	Water	1010mL	Yellow clear liquid
5	E0800735-002RE	2008-07-25-G	.01	1613B/Dioxins Furans	4	Water	1017mL	Yellow clear liquid
6	E0800739-001RE	MW-16-072908-W	.01	1613B/Dioxins Furans	8	Water	1043mL	Very pale yellow clear liquid
7	E0800742-001RE	01F	.01	1613B/Dioxins Furans	7	Water	898mL	Colorless clear liquid
8	E0800742-002RE	02F	.01	1613B/Dioxins Furans	7	Water	945mL	Colorless clear liquid
9	E0800762-001	A-Line Bl. Plant	.01	1613B/Dioxins Furans	2	Water	1080mL	Yellow, cloudy liquid
10	E0800762-002	B-Line Bl. Plant	.01	1613B/Dioxins Furans	4	Water	973mL	Yellow, cloudy liquid
11	E0800763-001	01I	.01	1613B/Dioxins Furans	7	Water	983mL	Clear, colorless liquid
12	E0800769-014	08A-0067-C3FR	.01	1613B/Dioxins Furans	5	Misc. Aqueous	0mL	Hexane, clear
13	E0800770-001	18H 0018-01 WW effluent	.01	1613B/Dioxins Furans	7	Water	940mL	Very light yellow clear liquid
14	E0800772-001	OUTFALL 004	.01	1613B/Dioxins Furans	4	Wastewater	983mL	Orange, cloudy liquid
15	E0800772-002	OUTFALL 005	.01	1613B/Dioxins Furans	7	Wastewater	945mL	Orange, cloudy liquid
16	E0800774-001	08080726	.01	1613B/Dioxins Furans	8	Water	1023mL	White, slightly cloudy liquid
17	E0800776-001	01H	.01	1613B/Dioxins Furans	7	Water	998mL	Clear, colorless liquid
18	E0800777-001	01H	.01	1613B/Dioxins Furans	7	Water	998mL	Clear, colorless liquid
19	J0803766-002	Dioxins/21-2	.01	1613B/Dioxins Furans	3	Water	983mL	Yellow, cloudy liquid
20	J0803766-004	Dioxins/13-3	.01	1613B/Dioxins Furans	3	Water	967mL	Yellow, cloudy liquid
21	J0803766-006	Dioxins/13-4	.01	1613B/Dioxins Furans	3	Water	986mL	Yellow, cloudy liquid
22	K0806915-001RE	Bogue Losa	.05	1613B/Dioxins Furans	6	Drinking Water	980mL	Colorless clear liquid
23	P0802464-001	1133924	.01	1613B/Dioxins Furans	7	Water	973mL	Tan, cloudy liquid

Preparation Information Benchsheet

Prep Run#: 71538
Team: Semivoa GCMS/SMALHOTRA
Prep WorkFlow: OrgExtAq(365)
Prep Method: Method
Status: Prepped
Prep Date/Time: 08/11/2008 03:00 PM

Spiking Solutions

Name: 1613B Matrix Working Standard | Inventory ID 4296 | Logbook Ref: D9-65-2B | Expires On: 06/13/2018

EQ0800341-02	100.00uL	EQ0800341-03	100.00uL

Name: 8290/1613B Cleanup Working Standard | Inventory ID 4863 | Logbook Ref: D9-73-5A/B | Expires On: 08/11/2018

E0800735-001	100.00uL	E0800735-002	100.00uL	E0800739-001	100.00uL	E0800742-001	100.00uL	E0800742-002	100.00uL	E0800762-001	100.00uL
E0800762-002	100.00uL	E0800763-001	100.00uL	E0800769-014	100.00uL	E0800770-001	100.00uL	E0800772-001	100.00uL	E0800772-002	100.00uL
E0800774-001	100.00uL	E0800776-001	100.00uL	E0800777-001	100.00uL	EQ0800341-01	100.00uL	EQ0800341-02	100.00uL	EQ0800341-03	100.00uL
J0803766-002	100.00uL	J0803766-004	100.00uL	J0803766-006	100.00uL	K0806915-001	100.00uL	P0802464-001	100.00uL		

Name: 1613B Labeled Working Standard | Inventory ID 4911 | Logbook Ref: D9-73-4B | Expires On: 02/09/2009

E0800735-001	1,000.00uL	E0800735-002	1,000.00uL	E0800739-001	1,000.00uL	E0800742-001	1,000.00uL	E0800742-002	1,000.00uL	E0800762-001	1,000.00uL
E0800762-002	1,000.00uL	E0800763-001	1,000.00uL	E0800769-014	1,000.00uL	E0800770-001	1,000.00uL	E0800772-001	1,000.00uL	E0800772-002	1,000.00uL
E0800774-001	1,000.00uL	E0800776-001	1,000.00uL	E0800777-001	1,000.00uL	EQ0800341-01	1,000.00uL	EQ0800341-02	1,000.00uL	EQ0800341-03	1,000.00uL
J0803766-002	1,000.00uL	J0803766-004	1,000.00uL	J0803766-006	1,000.00uL	K0806915-001	1,000.00uL	P0802464-001	1,000.00uL		

Preparation Materials

Silica Gel Reagent Grade	C2-6-004 (3305)	Carbon, High Purity	C2-9-004 (3628)	Glass Wool	C2-1-004 (3060)
Acetone 99.5% Minimum	C1-124-004 (3063)	Nonane (n-Nonane) 99%	C2-4-003 (3304)	Sodium Chloride Reagent Grade I	C1-104-2 (3306)
Sodium Sulfate Anhydrous Reage	C2-10-001 (3635)	Dichloromethane (Methylene Chl	C2-9-007 (3629)	Toluene 99.9% Minimum	C2-9-005 (3634)
Ethyl Acetate 99.9% Minimum Et	C2-1-005 (3059)	Hexane (n-Hexane) 98.5% Minim	C2-9-006 (3631)	Tridecane (n-Tridecane)	C2-7-002 (3360)
Sulfuric Acid Reagent Grade H2S	C2-7-005 (3357)	pH Paper 0-14	(1008)		

Preparation Steps

Step:	Extraction	Step:	Acid Clean	Step:	Silica Gel Clean	Step:	Final Volume
Started:	8/11/08 15:00	Started:	8/12/08 08:00	Started:	8/12/08 15:00	Started:	8/13/08 08:00
Finished:	8/11/08 18:00	Finished:	8/12/08 08:00	Finished:	8/12/08 18:00	Finished:	8/13/08 12:00
By:	NBROWN	By:	NBROWN	By:	NBROWN	By:	NBROWN

Comments: ______________________________

Reviewed By: ____________________ Date: ____________

Chain of Custody

Relinquished By: ____________________ Date: ____________

Received By: ____________________ Date: ____________

Extracts Examined
Yes No

Columbia Analytical Services, Inc.

Nonconformity and Corrective Action Report

NONCONFORMITY

PROCEDURE (SOP or METHOD): 1613

EVENT:
- ☐ Missed Holding Time
- ☐ Method Blank Contamination
- ☐ Equipment Failure
- ☐ SOP Deviation
- ☒ QC Failure
- ☐ Login Error
- ☐ Unacceptable PT Sample Result
- ☐ Other (describe):
- ☐ Lab Error (spilled sample, spiking error, etc.)
- ☐ Project Management Error

SAMPLES / PROJECTS / CUSTOMERS / SYSTEMS AFFECTED

EQ0800332-01 MB E0800735 E0800738 E0800739 E0800742 E08007347 E0800748 E0800749 J0803628 K0806915

DETAILED DESCRIPTION

Low internal standard recovery.

ORIGINATOR: Rolando Diaz DATE: *08/08/08*

CORRECTIVE ACTION AND OUTCOME

Re-establishment of conformity must be demonstrated and documented. Describe the steps that were taken, or are planned to be taken, to correct the particular Nonconformity and prevent its reoccurrence. Include any Project Manager instructions here.

Re-extract ½ original sample size.

Is the data to be flagged in the Analytical Report with an appropriate qualifier? ☐ **No** ☒ **Yes**

APPROVAL AND NOTIFICATION

Supervisor Verification and Approval of Corrective Action [signature] Date: 8/19/08

Comments:

QA PM Verification and Approval of Corrective Action Andrew Biddle Date: 08/08/08

Comments:

Customer Notified by ☐ Telephone ☐ Fax ☑ E-mail ☑ Narrative ☐ Not notified

Project Manager Verification and Approval of Corrective Action [signature] Date: 8/19/8

Comments:

(Attach record or cite reference where record is located.) Project folder archives

GeoEngineers

APPENDIX D
SAMPLING AND ANALYSIS PLAN AND QUALITY ASSURANCE PROJECT PLAN

SAMPLING AND ANALYSIS PLAN AND QUALITY ASSURANCE PROJECT PLAN REMEDIAL INVESTIGATION WORK PLAN EAST BAY REDEVELOPMENT PORT OF OLYMPIA OLYMPIA, WASHINGTON

OCTOBER 22, 2008

FOR PORT OF OLYMPIA

GEOENGINEERS

Sampling and Analysis Plan and Quality Assurance Project Plan

File No. 0615-034-07

October 22, 2008

Prepared for:

Port of Olympia
915 Washington Street NE
Olympia, Washington 98501-6931

Attention: Joanne Snarski,

Prepared by:

GeoEngineers, Inc.
600 Stewart Street, Suite 1700
Seattle, Washington 98101
(206) 728-2674

GeoEngineers, Inc.

Jay C. Lucas, LG
Senior Geologist

Cindy Bartlett, LG
Environmental Geologist

David A. Cook, LG, RBP
Principal

DAC:JCL:bmw
SEAT:\0\0615034\07\Finals\Revised RI Workplan Oct 08\061503407RI WP Apdx D SAP & QAPP Revised Oct 08.doc

TABLE OF CONTENTS

Page No.

TABLE OF CONTENTS (CONTINUED)

Page No.

List of Tables

List of Figures

SAMPLING AND ANALYSIS PLAN AND
QUALITY ASSURANCE PROJECT PLAN
REMEDIAL INVESTIGATION WORK PLAN
EAST BAY REDEVELOPMENT, PORT OF OLYMPIA
OLYMPIA, WASHINGTON
FOR
PORT OF OLYMPIA

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) describe sample collection, handling and analysis procedures associated with the Remedial Investigation Work Plan (RIWP) for the Port of Olympia's (Port) 13-acre East Bay Redevelopment Site (Site). The Site is located in Olympia, Washington, as shown in Figure 1. This SAP must be used in conjunction with the RIWP and the project-specific Health and Safety Plan (HASP).

Detailed descriptions of the field sampling procedures are provided in this document. Site conditions may make it necessary to modify these procedures. Any variations or modifications that become necessary during the investigation will be coordinated with Port personnel, the Washington State Department of Ecology (Ecology) and other involved parties, as appropriate. Variations or modifications implemented during the investigation and the reason for the modification will be documented in field records.

This SAP describes field activities, sampling equipment, sampling locations and procedures that will be used during investigations at the Site. This SAP also includes a QAPP (Section 11), which identifies quality assurance/quality control (QA/QC) procedures that will be implemented during field sampling activities and laboratory analyses.

2.0 PURPOSE AND SCOPE

The purpose of this SAP is to present the detailed procedures that will be used to obtain samples during the supplemental remedial investigation (RI). The objective of this sampling is to provide information to:

- Characterize the nature and extent of contamination at the Site;
- Assess the potential risk to human and ecological receptors; and
- Provide the information that will allow selection of cleanup action alternatives.

Rationale for sample locations and depths and monitoring wells are described in Tables 1 through 3.

Activities to be performed by GeoEngineers during the RI include the following:

1. Update the Project HASP and SAP for use by GeoEngineers' personnel during the RI.
2. Retain public and private utility locating services to identify and locate underground utilities in the exploration areas in coordination with the Port.
3. Retain a concrete coring contractor to core through paved surfaces, as necessary.
4. Monitor the advancement of soil explorations using direct-push and/or hollow-stem auger techniques to depths specific to proposed sample locations. If field screening indicates

contamination is present at the target total depth for a boring, the boring will be advanced until field screening indicates contamination is not present.

a. Soil borings will be located by measuring from known previously surveyed features (roads, existing monitoring wells, etc) and GPS readings.

b. Samples of soil will be collected continuously for the total depth of each boring. Samples for potential chemical analyses will be collected approximately every two feet. Soil will be visually classified in the field according to the Unified Soil Classification System. Contacts between soil lithologies and fill episodes, if feasible, will also be described.

c. Groundwater monitoring wells may be constructed in five borings as described in Table 2.

5. Obtain soil samples as specified in this SAP and the RIWP. Field screening will be performed on each sample using visual, water sheen and headspace vapor screening methods. The field screening results will be used as a general guideline to approximate the vertical extent of petroleum-related contamination in the soil samples. In addition, screening results will be used to aid in the selection of soil samples to be submitted for chemical analysis.

6. Explore the locations and nature of water seeps along the shoreline embankment and collect data to determine if the seeps represent groundwater.

7. Obtain groundwater samples from existing and new monitoring wells for chemical analytical testing using low-flow sampling methodology. Measure depth to water using an electric water level indicator.

a. Collect water samples from seeps if the seeps represent groundwater.

8. Contain soil cuttings, purge water and decontamination water in steel drums and store the drums in a secure location designated by the Port to await off-site transport and disposal. The drums will be labeled according to standard GeoEngineers' practice.

9. Submit soil and groundwater samples to a subcontracted chemical analytical laboratory for chemical analysis. The chemical constituents for each sample have been determined based on existing data and assumptions of the chemicals of potential concern (COPCs) present. Sample locations, depth intervals, and COPCs are described in Tables 1 through 3. The chemical analysis may include one or more of the following:

a. Gasoline-, diesel- and motor oil-range petroleum hydrocarbons by Ecology Methods NWTPH-Gx and NWTPH-Dx,

b. Metals by U.S. Environmental Protection Agency (EPA) Method 6000/7000 series,

c. Volatile organic compounds (VOCs) by EPA Method 8260B,

d. Semivolatile organic compounds (SVOCs) including carcinogenic polycyclic aromatic hydrocarbons (cPAHs) by EPA Method 8270 SIM,

e. Polychlorinated biphenyls (PCBs) by EPA Method 8082, and

f. Dioxins/furans by EPA Method 1613B or Method 8290.

Tables 4 and 5 summarizes the target analytical reporting limits and analytical methods that will be used for soil and groundwater.

10. Document sample methodology and sample locations using detailed field logs.

11. Use database and geographic information system (GIS) technologies to manage chemical analytical data and sample locations.

3.0 PROJECT SCHEDULE

Field work for the supplemental RI will be conducted in phases. The initial phase of the RI will be completed in Fall 2008 in order to provide data critical to the planning of the infrastructure improvement project. The initial phase includes completing eight explorations located in or near the infrastructure corridor. The initial eight exploration locations include borings DP27, DP30, DP32, DP33, DP34, DP36, DP38, and DP40, which are also highlighted on Table 1. The initial phase will also include locating suspected artesian wells, as described in Appendix B of the RI Workplan. Subsequent phase of field work will be completed after data from the first phase has been evaluated and after decommissioning of the artesian wells.

4.0 ROLES AND RESPONSIBILITIES

This section outlines the individuals directly involved with the RI. Work performed under this SAP will be in cooperation with the Port.

Key personnel for this project are as follows:

Position	Name	Affiliation	Telephone Number
Ecology Project Coordinator	Steve Teel	Washington State Department of Ecology	360-407-6247
Port Project Coordinator	Joanne Snarski	Port of Olympia	360-528-8061
Principal-in-Charge	David Cook	GeoEngineers, Inc.	206-728-2674
Project Manager	Jay Lucas	GeoEngineers, Inc.	206-239-3221

- The **Ecology Project Coordinator** is responsible for providing timely technical review and guidance regarding compliance with the Agreed Order (AO) and is responsible for overseeing implementation of the AO for Ecology.
- The **Port Project Coordinator** is responsible for administering the contract with the consultant and is responsible under the AO for overseeing implementation of the AO for the Port.
- The **Principal-in-Charge** works with the Project Manager and is responsible for project document QA/QC review.
- The **Project Manager** reports directly to the Port Project Coordinator and the Principal-in-Charge. The Project Manager is responsible for coordinating project activities and submitting deliverables to the Port. The Project Manager's duties consist of providing concise technical work statements for project tasks, selecting project team members, determining the degree of subcontractor participation, establishing and adhering to budget and schedule, providing technical oversight and providing review of all work.

5.0 FIELD PROCEDURES

The rationale, depths and chemical program for soil and groundwater samples are presented in Tables 1 through 6 of this SAP and are described in the RIWP. The soil and groundwater samples will be obtained and submitted to a Washington State accredited laboratory for chemical analysis.

Note that Sampling and Testing associated with the RI, as outlined in this SAP, includes a phased approach to facilitate early decisions regarding the infrastructure improvements and associated excavation. The phased explorations and testing approach are highlighted in Table 1 of this SAP.

5.1 UNDERGROUND UTILITY LOCATE

Prior to sampling activities, an underground utility locate will be conducted in the area of the proposed sample locations to identify any subsurface utilities and/or potential underground physical hazards.

5.2 SUBSURFACE SOIL SAMPLING

5.2.1 Sample Collection Method

Subsurface soil sampling will be conducted using a direct-push drilling rig equipped with a core barrel lined with disposable acetate sleeves. Soil samples will be obtained every two feet for potential chemical analytical testing and field screening, as described in Table 1. Samples obtained for chemical analytical testing will consist of approximately four- to six-inches of the soil core. The depth of each sample will be measured from the bottom of the sample interval. The depth to the groundwater table, if present, may also be measured at each sample location, using an electric water level indicator.

Samples to be analyzed for gasoline-range petroleum hydrocarbons and VOC analysis following EPA Method 5035A (Ecology 2004) will be obtained first. Samples obtained for non-volatile analyses will be obtained from the same general intervals as the volatile samples. Planned sample depths are based on results from earlier studies and are outlined in Table 1. Sample containers will be labeled in the field and stored in an iced cooler prior to and during shipment to the chemical analytical laboratory.

Sampling activities will be conducted by a GeoEngineers representative, and soil will be visually classified in the field according to the Unified Soil Classification System (USCS) and American Society for Testing and Materials (ASTM) Standard 2488.

Field personnel will record the sample locations using hand-held Trimble GeoXT global positioning system (GPS) units with sub-meter accuracy during sampling activities. Sub-meter accuracy standards will be used during data collection to record latitude and longitudinal data. A minimum of four satellites will be required for a position dilution of precision (PDOP) value of less than 6. Satellite elevation must be at least 15 degrees above the horizon, with a minimum signal-to-noise ratio (SNR) of 39 bBHz. GPS data collected in the field will be subsequently processed in the office using measurements from the nearest reference station to each collection point.

5.2.2 Sample Locations

Twenty-two new boring locations are planned and shown in Figures 2 and 3. The borings are placed in areas to further evaluate the lateral and/or vertical extent of contamination that has been identified in previous studies. The rationale for sample locations and depth intervals are described in Table 1.

5.2.3 Phase 1: Infrastructure Construction Corridor Sample Locations

Locations of eight borings are within utility corridors associated with the infrastructure improvements. These borings may be completed during an initial phase of exploration to accommodate the construction schedule. These borings are highlighted in Table 1 and Figure 2. Sampling in the infrastructure corridor will provide data to characterize soil that will be removed during excavation activities.

5.3 FIELD SCREENING

Field screening for evidence of possible contamination will be performed on soil samples obtained from the explorations. Field screening results will be recorded on the field logs, and the results will be used as a general guideline to delineate areas of possible contamination. Screening results will be used to aid in the selection of soil samples to be submitted for chemical analysis. The following screening methods will be used: (1) visual screening, (2) water sheen screening and (3) headspace vapor screening. Visual screening and water sheen screening are qualitative methods; therefore, precision, accuracy and detection limits are not quantified for these methods. Headspace vapor screening is a semi-quantitative method; however, precision and accuracy will not be quantified for this method. Instrument accuracy and detection limits are described below. Field screening results are site- and location-specific. The results may vary with temperature, moisture content, soil type and chemical constituent.

5.3.1 Visual Screening

The soil will be observed for unusual color and stains and/or odor indicative of possible contamination.

5.3.2 Water Sheen Screening

A portion of the soil sample will be placed in a pan containing distilled water. The water surface will be observed for signs of sheen. The following sheen classifications will be used:

Classification	Identifier	Description
No Sheen	(NS)	No visible sheen on the water surface
Slight Sheen	(SS)	Light, colorless, dull sheen; spread is irregular, not rapid; sheen dissipates rapidly
Moderate Sheen	(MS)	Light to heavy sheen; may have some color/iridescence; spread is irregular to flowing, may be rapid; few remaining areas of no sheen on the water surface
Heavy Sheen	(HS)	Heavy sheen with color/iridescence; spread is rapid; entire water surface may be covered with sheen

5.3.3 Headspace Vapor Screening

Headspace vapor screening will be performed on a portion of the soil sample placed into a resealable plastic bag. Ambient air will be captured in the bag; the bag will be sealed and then shaken gently to expose the soil to the air trapped in the bag. The bag will remain closed for approximately 5 minutes at ambient temperature before the headspace vapors are measured. Vapors present within the sample bag's headspace will be measured by inserting the probe of a photoionization detector (PID) through a small opening in the bag. A PID measures the concentration of organic vapors ionizable by a 10.6 electron volt (eV) lamp in parts per million (ppm) and quantifies organic vapor concentrations in the range between 0.1 ppm and 2,000 ppm (isobutylene equivalent) with an accuracy of 1 ppm between 0 ppm and 100 ppm. The maximum value on the instrument and the ambient air temperature will be recorded on the field log for each sample. The PID will be calibrated to 100 ppm isobutylene.

5.4 GROUNDWATER SAMPLING

5.4.1 Monitoring wells

Groundwater will be sampled from 17 existing and new monitoring wells for chemical analytical testing as shown in Table 3. Monitoring wells will be sampled using low-flow sampling methodologies, as described below.

- Prior to sampling, measure depth to water with an electric water level indicator.
- Purge groundwater from the monitoring wells using dedicated tubing, a peristaltic pump (or equivalent), a flow-through cell and water parameter analyzer (Horiba U-20). Purge monitoring wells using a flow rate between 100 and 500 milliliters per minute (mL/min) that does not create significant drawdown in the well. When field parameters have stabilized or at least three well volumes of water have been purged from the well, disconnect the flow-through cell and sample groundwater directly from down-well tubing, maintaining a low-flow pumping rate. Water quality parameters to be monitored during purging include: conductivity, dissolved oxygen, pH, salinity, total dissolved solids, turbidity, oxidation-reduction potential and temperature.
- Place each groundwater sample directly into a laboratory-prepared sample container, label the container, log the sample on the chain-of-custody and sample collection form, and place the container into a cooler with ice.

5.4.2 Groundwater Seeps

Greylock Consulting identified four seep locations along the shoreline during a low tide on July 16, 2008. These locations, as well as other seep locations that may be identified during site visits, will be evaluated to determine if they represent groundwater rather than surface water, irrigation water or discharge from buried pipes.

The evaluation will be based on several lines of evidence that will include:

- Physical observations of the proximity of the seeps to known utilities that could represent areas where water leaks from stormwater drains or from the fill around buried utilities.
- Explore the soil above the seeps to determine if the soil is saturated above the seepage point, and follow the saturation to its point of origin. This exploration will be conducted with hand digging equipment.
- Measure the temperature, salinity and conductivity of the water discharging from the seeps and compare these values to that representative of groundwater and of marine water. This will help determine if the seeps represent delayed drainage of sea water, rather than groundwater.
- Determine if the seeps originate at a higher elevation that the groundwater table. If a seep originates above the elevation of the groundwater table or high tide elevation that day, it is evidence that the seep does not represent groundwater. The elevation of the groundwater table will be based on water levels measured in the nearest monitoring well during the high tide and the low tide of that day’s tidal cycle.

If water from an area of seepage is identified as groundwater, a representative sample will be collected for chemical testing as identified in Table 3. The sample will be collected by pushing a short PVC pipe into the seep so the water drains from the end of the pipe. Following insertion of the PVC pipe, a sample of the water will be collected after turbidity caused by the initial disturbance has descreased. Conductivity, temperature, and salinity water quality parameters will be measured as described above for the monitoring well samples. Up to four samples representative of groundwater seeps will be collected. The PVC pipe will be decontaminated prior to collection of each sample.

5.5 Field Equipment Calibration Procedures

Field equipment requiring calibration will be calibrated to known standards in accordance with manufacturers' recommended schedules and procedures for each instrument. If field equipment becomes inoperable, it will be replaced with a properly calibrated instrument.

6.0 CHEMICAL ANALYTICAL PROGRAM

All samples will be submitted to a Washington State accredited laboratory. Tables 1 and 3 summarize the chemical analyses for soil and groundwater samples from monitoring wells, respectively. Tables 4 and 5 summarize the target analytical reporting limits.

7.0 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

The following procedures will be used when obtaining soil and/or groundwater samples during the investigation activities.

- Dedicated nitrile gloves will be worn when obtaining each sample, including quality control (QC) samples.
- Soil samples obtained for chemical analysis of gasoline-range petroleum hydrocarbons and VOCs will be obtained using EPA Method 5035A.
- Samples obtained for chemical analysis will be transferred into clean sample containers supplied by the analytical laboratory. Table 6 lists the sample containers to be used.
- Sufficient sample volume will be obtained for the laboratory to complete the method-specific QC analyses on a laboratory-batch basis.
- Sample labels will be completed for each sample following the procedures provided in this section. Immediately after the samples are obtained, they will be stored in a cooler with ice until they are delivered to the analytical laboratory.
- Standard chain-of-custody procedures will be followed for all samples obtained.

7.1 Custody Seals

Custody seals are signed and dated seals that are affixed to the lid of a shipping container (for example, cooler) and are used to indicate if the container has been opened before it reaches the intended recipient. Custody seals will be attached to containers by GeoEngineers personnel before they are transferred to the chemical analytical laboratory.

7.2 Custody Procedures

Chain-of-custody procedures will be used to track the possession of the samples from the time they are obtained in the field through analysis and final disposition. Each time the samples change hands, both the sender and receiver will sign and date the chain-of-custody record form. A chain-of-custody record form will be used to track possession of the samples and to document the analyses requested. The form will be completed at the end of each sampling day prior to transfer of samples off-site and will accompany the samples during transfer to the laboratory.

When the samples are shipped to the laboratory via common carrier, one copy of the chain-of-custody record form will be retained for project files, and the remaining copies will be enclosed in a plastic bag and secured to the inside of the cooler prior to shipment.

Upon receipt of the samples at the laboratory, the custody seals will be broken, the chain-of-custody form will be signed as received by the laboratory, and the conditions of the samples will be recorded on the form. The original chain-of-custody form will remain with the laboratory, and copies will be returned to the relinquishing party.

8.0 DOCUMENTATION OF FIELD ACTIVITIES

Daily field activities, including observations and field procedures, will be recorded on appropriate forms. The original field forms will be maintained in GeoEngineers' office files. Copies of the completed forms will be maintained in a sequentially numbered field file for reference during field activities. Photographic documentation of field activities will be performed as appropriate.

8.1 SAMPLE DESIGNATION

Each sample obtained during field activities will be identified by a unique sample designation. The sample designation will be included on the sample label. For soil samples, the designation also will be included with the corresponding sample information on the appropriate field log. For groundwater sampling from monitoring wells, the corresponding sample information will be recorded on the monitoring well sampling field sheet. The following sample designation system will be used for this project.

All samples will be assigned a unique identification code based on a consistent sample designation scheme. The sample designation scheme is designed to suit the needs of the field staff, data management and data users. All samples will consist of three components separated by a dash. These components are station code, date and sample interval. The sample designation scheme is as follows:

Station Code	Date	Sample Interval
SSnn	YYMMDD	XXX
MWnn	YYMMDD	W

The three components are described below.

8.1.1 Station Code

The station code component is a four-character code that uniquely identifies each sampling station. The station code component has two parts: a two-letter station designation ("SS" or "MW") followed by a sequential two-digit number component "nn." The two-letter "SS" designation will be determined by how the soil sample was obtained (for example, drilling method, grab) as described below. The sequential "nn" component will begin at 26 (that is, 26, 27, 28) to accommodate samples previously obtained at the Site during previous studies. For groundwater samples, the "MWnn" designation will correspond to the monitoring well number (for example, MW25S).

The station designations are:

- DP – Direct-Push
- SB – Soil Boring using Hollow-Stem Auger (HSA) Drilling Techniques
- TP – Test Pit
- GB – Grab Sample

8.1.2 Date

The date component is a six-character code that presents the date that the sample was obtained in the following format: year, month, day (YYMMDD).

8.1.3 Sample Interval

The sample interval component corresponds to sample depth for soil samples, and is a three-character code that identifies each sampling interval. Soil sample depth determinations will be made to the nearest 0.5 foot, with the depth determination representing *either* the sample collection point (for VOC) *or* the beginning of the sampling interval (that is, 050 will represent the 5- to 5.5-foot interval). For groundwater, a "W" will be used for the sample interval component.

8.1.3.1 Field Quality Control (QC) Samples

Field QC samples will be identified by adding characters to the end of the sample interval field. The following characters are associated with the following field QC sample types:

- TB – VOC trip blank
- DUP – duplicate sample

8.1.4 Examples

Examples of complete sample numbers with descriptions are as follows:

- DP30-080825-020 — A field sample collected at station DP30 on August 25, 2008, from 2 to 2.5 feet bgs.
- MW04-080825-W — A groundwater sample collected at monitoring well MW04 on August 25, 2008.

Under the sample designation method described above, the identifier will be unique (that is, no two samples will have the same identifier) and informative (that is, location, date and sample interval). This designation scheme will facilitate overall data management and submittal into Ecology's Environmental Information Management (EIM) database.

8.2 SAMPLE LABELING

Sample information will be printed legibly onto the sample labels in indelible ink. Field identification will be sufficient to enable cross-reference with the project logbook.

To minimize handling of sample containers, labels will be completed before sample collection to the extent possible. The label will be filled out completely in the field and attached firmly to the sample container. The sample label will provide the following information:

- GeoEngineers' job number
- Sample designation
- Date of sample collection (month/day/year)
- Time of sample collection (hours: minutes)
- Chemical analyses to be conducted

- Sample preservation, if applicable
- Initials of sampler

8.3 FIELD LOGBOOKS AND DATA FORMS

Field logbooks (or daily logs) and data forms are necessary to document daily activities and observations. Documentation will be sufficient to enable participants to reconstruct events that occurred during the project accurately and objectively at a later time. All entries will be written in ink, dated and signed daily. No pages will be removed from logbooks for any reason. If corrections are necessary, these corrections will be made by drawing a single line through the original entry (so that the original entry is legible) and writing the corrected entry alongside. The correction will be initialed and dated. Corrected errors may require a footnote explaining the correction.

8.4 PHOTOGRAPHS

Documentation of a photograph is crucial to its validity as a representation of an existing situation. The following information will be noted in the field logbook or data forms concerning photographs:

- Date, time and location where photograph was taken
- Photographer
- Description of photograph taken
- Sequential number of the photograph and the film roll number, or sequence in the digital log
- Compass direction

9.0 DECONTAMINATION PROCEDURES

The objectives of decontamination procedures are to minimize the potential for cross-contamination between individual samples, to prevent contamination from leaving the sampling site by way of equipment or personnel and to prevent exposure of field personnel to contaminated materials. This section discusses general decontamination procedures.

9.1 PERSONNEL

Personnel decontamination procedures depend on the level of protection specified for a given activity. The HASP identifies the appropriate level of protection for each type of fieldwork involved in this project, as well as appropriate decontamination procedures.

9.2 SAMPLING EQUIPMENT

Decontamination procedures are designed to remove trace-level contaminants from sampling equipment to prevent cross-contamination of samples. Non-dedicated sampling or measurement equipment, including stainless steel sampling tools, soil sampling equipment and water level measurement instruments, will be decontaminated prior to and after each sampling attempt or measurement by washing with a nonphosphate detergent solution (for example, LiquiNox® and distilled water) and rinsing with distilled water.

10.0 INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) generated from the subsurface investigations will be contained in 55-gallon steel drums and temporarily stored in a secured location as designated by the Port. The IDW is anticipated to consist of soil cuttings, decontamination water, monitoring well development and purge water. The IDW will be separated by media (that is, soil and water) and labeled appropriately. Chemical analytical results from soil and groundwater sample analyses may be used to profile IDW for disposal at an appropriate off-site disposal facility. Solid waste from sampling activities (used gloves, tubing, etc.) will be contained in plastic trash bags and disposed as solid waste.

11.0 QUALITY ASSURANCE PROJECT PLAN

11.1 QUALITY ASSURANCE OBJECTIVES

The general quality assurance (QA) objectives for this project are to develop and implement procedures for obtaining and evaluating data of a specified quality that can be used to assess site conditions and risks. Field QA procedures to be followed include completing all appropriate sample documentation. Measurement data should have an appropriate degree of accuracy and reproducibility; samples obtained should be representative of actual field conditions, and samples should be obtained and analyzed using proper chain-of-custody procedures.

11.2 FIELD QA/QC PROCEDURES

Field QA/QC procedures to be followed include completing all appropriate sample documentation and preservation. One trip blank will be placed in each sample shipping container (for example, cooler) and analyzed for VOCs.

11.2.1 Trip Blanks

The analytical results of field trip blanks will be reviewed to evaluate the possibility for contamination resulting from the laboratory-prepared sample containers or the sample transport containers. Trip blanks will be analyzed at a frequency of one for each shipment of samples containing field samples for chemical analysis of VOCs. The trip blanks will be labeled with a "TB" sample identifier as described earlier in the "Sample Designation" section (Section 8.1) and delivered to the laboratory with the normal shipment of samples.

11.2.2 Sample Preservation and Containers

Samples will be kept in a cooler with ice before and during transport to the laboratory. The sampling extraction and analysis dates will be reviewed to confirm that extraction and analyses were completed within the recommended holding times, as specified by EPA protocol. Appropriate laboratory-assigned data qualifiers will be noted if holding times are exceeded or containers do not contain the appropriate sample preservation. Table 6 summarizes sample preservation and containers.

11.3 LABORATORY QA/QC PROCEDURES

The data quality objectives will be met in the laboratory by using established instrument calibration and sample handling procedures, analysis according to standard analytical methods and analysis of quality control samples. Laboratory quality control will consist of analysis of surrogate spikes, method blanks, duplicates, matrix spikes and matrix spike duplicates and reporting of all data including holding times.

11.3.1 Equipment Calibration Procedures and Frequency

All instruments and equipment used by the laboratory will be operated, calibrated and maintained according to manufacturer's guidelines and recommendations. Operation, calibration and maintenance will be performed by personnel who have been properly trained in these procedures. A routine schedule and record of instrument calibration and maintenance will be kept on file at the laboratory.

11.3.2 Analytical Procedures

Samples will be analyzed according to analytical methods listed in Tables 1, 3, 4 and 5. EPA standard analytical methods are specified in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW-846* (through update III), dated December 1996. Washington analytical methods for petroleum hydrocarbons are specified in the Model Toxics Control Act (MTCA) regulations, as outlined in Washington Administrative Code (WAC) 173-340.

11.3.3 Laboratory QA/QC Samples

Laboratory QC samples will be analyzed at a frequency of 5 percent (1 in 20) on a laboratory batch basis. Laboratory QC samples will consist of duplicates, method blanks, matrix spikes and matrix spike duplicates. In addition, each organic analysis will include addition of surrogate compounds to the sample for surrogate spike analysis.

11.3.4 Laboratory Deliverables

The following information will be provided in the laboratory reports submitted for this project:

- Transmittal letter, including information about the receipt of samples, the testing methodology performed, any deviations from the required procedures, any problems encountered in the analysis of the samples, any problems meeting the method holding times or laboratory control limits, and any corrective actions taken by the laboratory relative to the quality of the data contained in the report.
- Sample analytical results, including sampling date, date of sample extraction or preparation, date of sample analysis, dilution factors and test method identification; soil sample results in milligrams per kilogram (mg/kg), micrograms per kilogram (µg/kg) or nanograms per kilogram (ng/kg); and detection limits for undetected analytes. Results will be reported for all field samples, including field duplicates and blanks submitted for analysis.
- Method blank results, including reporting limits for undetected analytes.
- Surrogate recovery results and corresponding control limits for samples and method blanks (organic analyses only).
- Matrix spike/matrix spike duplicate and/or blank spike/blank spike duplicate spike concentrations, percent recoveries, relative percent differences and corresponding control limits.
- Laboratory duplicate results for inorganic analyses, including relative percent differences and corresponding control limits.
- Sample chain-of-custody documentation.

The raw analytical data, including calibration curves, instrument calibration data, data calculation work sheets and other laboratory support data for samples from this project, will be compiled and kept on file at the laboratory’s office for reference.

11.4 Review of Field and Laboratory QA/QC Data

The sample data, field and laboratory QA/QC results will be evaluated for acceptability with respect to the RI data quality objectives (DQOs). Each group of samples will be compared with the DQOs and evaluated using data validation guidelines contained in the following documents: *Guidance Document for the Assessment of RCRA Environmental Data Quality*, draft dated 1988 and *National Functional Guidelines for Organic Data Review*, draft 1999. To accomplish data evaluation, the criteria listed in the following subsections will be assessed.

11.5 PRECISION, ACCURACY AND COMPLETENESS

11.5.1 Precision

Precision is a measure of data variability. Variability can be attributed to sampling activities and/or chemical analysis. Relative percent difference (RPD) is used to assess the precision of the sampling and analytical method and is calculated as follows.

RPD = 100[(Xs - Xd)/(Xs + Xd)]/2

where

RPD = relative percent difference

Xs = sample analytical result

Xd = duplicate sample analytical result

11.5.2 Accuracy

Accuracy is a measure of the error between chemical analytical results and the true sample concentrations. Accuracy is a measure of the bias in a system and will be expressed as the percent recovery of spiked samples. The accuracy will be presented as percent recovery and will be calculated as follows.

PR = 100(Xss - Xs)/T

where

PR = percent recovery

Xss = spike sample analytical result

Xs = sample analytical result

T = known spike concentration

11.5.3 Completeness

Completeness is evaluated to assess whether a sufficient amount of valid data is obtained. Completeness is described as the ratio of acceptable measurements to the total planned measurements. Completeness is calculated as follows.

C = (Number of samples having acceptable data)/
(total number of samples analyzed) x 100%

where

C = completeness

11.6 REPORTING, DOCUMENTATION, DATA REDUCTION AND CORRECTIVE ACTION

Upon receipt of each laboratory data package, data will be evaluated against the criteria outlined in the previous sections. Any deviation from the established criteria will be noted and the data will be qualified, as appropriate. A review and discussion of analytical data QA/QC will be submitted in a report to be attached to the RI report. Data validation procedures for all samples will include checking the following, when appropriate.

1. Holding times
2. Detection limits
3. Field equipment rinseate blanks
4. Laboratory blanks
5. Laboratory matrix spikes
6. Laboratory matrix spike duplicates
7. Laboratory blank spikes
8. Laboratory blank spike duplicates
9. Surrogate recoveries

If significant quality assurance problems are encountered, appropriate corrective action as determined by GeoEngineers' project manager and/or the chemical analytical laboratory will be implemented as appropriate. All corrective action will be defensible, and the corrected data will be qualified.

Spatial information collected during the field event will be analyzed and displayed using ArcGIS 9.1 and EQUIS 3 to manage the chemical analytical data.

12.0 REFERENCES

Ecology (Washington State Department of Ecology). June 2004. *Collecting and Preparing Soil Samples for VOC Analysis – Implementation Memorandum #5*. Publication 04-09-087.

Ecology. April 2003. *Guidance for Site Checks and Site Assessments for Underground Storage Tanks*. Publication 90-53.

Ecology. February 2001. *Model Toxics Control Act, Chapter 173-340*, Washington State Department of Ecology Toxics Cleanup Program, Olympia, Washington.

TABLE 1
PROPOSED NEW BORING AND MONITORING WELL RATIONALE
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Ecology Comment	Response to Ecology Comments/Sampling Rationale	Exploration: Boring (DP) Well (MW)	Sampling Depth Interval (ft bgs)[1]	Soil Analyses: NWTPH-Dx	NWTPH-G	BTEX	Total Metals (As, Cd, Pb)[2]	D/F	PAHs	PCBs	TOC[3]	Planned Utilities - Maximum Depth (feet)	Anticipated Soil Type / Lithologic Unit
1. Additional characterization is needed to define the extent of soil contamination at the site. The aerial and vertical extent of soil contamination needs to be further defined in the vicinity of DP02 and DP04 (including westward beneath Jefferson Street and on adjacent offsite parcels if necessary) and north of DP18.	TPH-D, TPH-MO, arsenic, and cadmium in the 2-6 feet interval were the only COPC exceedances at DP04. These COPCs have been delineated laterally in this interval to the northeast and south with MW08 and DP03, respectively. A new soil boring will be advanced northwest of DP04 to complete the lateral delineation of COPC screening level exceedances in the 2-6 feet interval. Soil samples will also be obtained from beneath existing railroad tracks to be removed during infrastructure construction activities. The railroad tracks are currently embedded in the asphaltic pavement along Jefferson Street and we expect that the section beneath the pavement will consist of railroad ties supporting the rail and ballast material (typically 3 feet of crushed rock) supporting the ties. Soil samples will be collected at the soil/ballast interface. We will analyze soil collected beneath the ballast material for cPAHs (using EPA Method 8270C), TPH, and metals to assess potential residual soil contamination associated with the ties.	DP37	0-2										
			2-6	x [a]	X	X	x		x	X			light sand fill
			6-10	X	X	X	x			X			dark sand fill
	TPH-MO in the 2-6 feet interval was the only significant COPC exceedance at DP02. This COPC has been delineated laterally in this interval to the north and southeast with DP03 and DP16, respectively. A new soil boring will be advanced southwest of DP02 to complete the lateral delineation of the TPH-MO screening level exceedance in the 2-6 feet interval. A sample from 10 to 14 feet from the monitoring well boring for MW25S will be tested for TPH-MO to evaluate the vertical extent of this COPC identified in previous samples from DP02. Proposed shallow screen interval for MW25S addresses Ecology Comment #9 for detected TPH in soil at DP02 and DP04. Soil samples from below the railroad tracks will also be collected and analyzed from DP38 and analyzed for PAHs. PAHs will be tested in sample from 10 to 14 foot depth interval in the boring for MW25S to evaluate the vertical extent of this COPC identified previously at DP02 and DP16. One sample from DP38 will be tested for dioxins/furans to evaluate soil within the infrastructure corridor.	DP38	1-3				x		x				
			4-6	x	X	X	x	x	x		x		light sand fill
			6-10	X	X	X	x	x	x		x	9	Silt or dark sand fill
		MW25S	0-2										
			2-6										
			6-10	x	X	X	X		X				Silt or dark sand fill
			10-14	x	X	X	X		x				Silt or dark sand fill
	TPH-MO in the 10-14 feet interval was the only significant potential COPC exceedance at DP18. This COPC has been delineated latreally in the vadose zone and saturated zone with MW03, MW16, and DP17 but has not been delineated laterally north of DP18. Soil samples from the boring for MW23S will provide this information. Proposed screen interval for MW23S addresses Ecology Comment #9 for detected TPH in soil at DP18. TPH-MO will be tested in MW-23S at the 6 to 10 and 10 to 14 foot intervals to evaluate the vertical extent of TPH-MO identified previously at DP18.	MW23S	0-2										
			2-6										
			6-10	x [a]	X	X	X		X				light sand fill
			10-14	x	X	X	X		X				light sand fill
2. Additional characterization is needed to define the extent of soil contamination at the site. The vertical extent of contamination needs to be defined in the vicinity of DP06 and DP08.	TPH-G in the 2-6 feet interval was the only significant potential COPC exceedance at DP06 and needs to be defined at depth and to the south. TPH-D and TPH-MO in the 2-6 feet interval were the only significant potential COPC exceedances at DP08. TPH-D and TPH-MO exceedance was identified in the 2-6 feet interval in DP-13. The vertical extent of gasoline, diesel and oil contaminated soil has been delineated with DP24, DP15, DP14, MW-5, MW-8 and MW-10. MW24S, along with the other proposed and existing wells, will be used to evaluate the leaching to groundwater pathway via empirical demonstration per WAC 173-340-747(9) an (10)(c). Proposed shallow screen interval for MW24S addresses Ecology Comment #9 for detected TPH in soil at DP06, DP08, DP24, and DP13.	MW24S	4-6	X	X	X	X		X				
			6-10	X	X	X	X		X				
	Evaluate lateral extent of TPH-D and MO identified previously at DP08 and DP13. Evaluate lateral extent of gasoline exceedance at DP08 and DP13.	DP39	0-2	X	X	X	X		X				
			2-6	x [a]	X	X	X		X				dark sand fill
	Lateral and vertical extent of dioxins/furans by TP03. Evaluate thickness of pre-1891 fill. Collect data to support management of soil that will be excavated as part of the infrastructure improvements. DP40 will also help evaluate the extent of diesel and oil contamination previously observed in DP13 and DP08 at 2-6 feet.	DP40	0-2	x	X	X	x	x	x				light sand fill
			2-4	x	X	X	x	x	x		x		light sand fill
			4-6	x	X	X	x	x	x		x	3.5	dark sand fill
3. Additional characterization is needed to define the extent of soil contamination at the site. The aerial extent of contamination has not been defined in the vicinity of MW19.	TPH-G in the 2-6 feet interval was the only potential COPC exceedance at MW19. Two soil borings (DP28 and the boring for MW21s) will be located near MW19 to evaluate the aerial extent of the screening level exceedance of TPH-G at MW19 in the 2-6 feet interval. The proposed screen interval (2 to 7 feet bgs) for MW21S addresses Ecology Comment #9 for detected TPH in soil at MW19. Moreover, a soil boring advanced to the west of MW19 in response to Ecology Comment #7 (i.e. DP27) will also be sampled for TPH-G in the 2-6 feet interval to provide lateral delineation to the west. To address Ecology comment 7, if evidence of burned wood or ash is observed in boring DP28, which is located on the northern edge of parcel 1 near the former Refuse Fire Area, a sample of this material will be analyzed for dioxins and furans.	DP28	0-2	X	X	X	X						
			2-6	X	x	X	X						light sand fill
		MW21S	0-2										
			2-6		x [a]								light sand fill

TABLE 1
PROPOSED NEW BORING AND MONITORING WELL RATIONALE
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Ecology Comment	Response to Ecology Comments/Sampling Rationale	Exploration: Boring (DP) Well (MW)	Sampling Depth Interval (ft bgs)[1]	Soil Analyses: NWTPH-Dx	NWTPH-G	BTEX	Total Metals (As, Cd, Pb)[2]	D/F	PAHs	PCBs	TOC[3]	Planned Utilities - Maximum Depth (feet)	Anticipated Soil Type / Lithologic Unit
4. Additional characterization is needed to define the extent of soil contamination at the site. Area of Concern (AOC) #16 (pad mounted transformer) needs to be evaluated. Soil samples should be collected from this area for petroleum hydrocarbons and PCBs. The location of well MW04 does not appear to be close enough to this AOC to be adequate.	One new boring will be advanced and sampled within AOC 16 as recommended by Ecology. The targeted depth for the soil sample collected from this boring is the elevation of the former transformer pad located in AOC 16. The sample from this boring will be analyzed for PCBs and mineral oil range petroleum hydrocarbons (NWTPH-Dx).	DP35	0-2										
			2-6	x						x			gravel fill
5. Parcel 1 needs to be assessed. AOCs #43 through 48 and #50 have not been adequately assessed. Also, the northern portion of Parcel 1 needs to be assessed.	The first sentence of this comment does not apply because the East Bay Redevelopment Project Area only includes the northwest portion of Parcel 1. A new boring (DP36) located in the right-of-way of Olympia avenue adjacent to the northwest portion of Parcel 1will address Ecology's concern regarding the northern portion of Parcel 1. However, the primary purpose of this boring is to evaluate soil conditions to assist in planning of future infrastructure improvements in this area and evaluate residual concentrations of COPCs in an area where historical sources were not located.	DP36	1-3					x					gravel fill
			2-6	x	x	X	x	X					silt
			6-10					X				9	silt
6. Additional characterization of dioxins/furans is needed. As shown in the report, concentration of dioxins/furans that exceed the MTCA Method B Soil Cleanup Level of 11 nanograms per kilogram (ng/kg) or parts per trillion (ppt), expressed as a Total Toxicity Equivalency Factor (TEF), were observed at all four locations tested for this constituent. The reported TEF values from these locations range from 57.9 to 645 ng/kg. Because the highest concentration (TP02) is near the east property line and near an adjacent public walking path and grassy area, additional samples for dioxins/furans should be collected in this adjacent area. Also, an analysis of wind direction should be performed to help predict locations that may show higher dioxin concentrations.	New boring DP33 will provide vertical profile of dioxins/furans concentrations near TP2. Selection of sample locations based on prediction of wind direction is not necessary because the proposed dioxins/furans sample locations (as outlined in this table) provide spatial coverage across the site.	DP33	0-2				x	x	x				gravel fill
			2-4				x	x	x		x		gravel fill
			4-6				x	x	x				light sand fill
			6-8					x				9	light sand fill
7. Additional characterization of dioxins/furans is needed. Parcel 7 is located adjacent to the Refuse Fire Area (Area of Concern #1), which is a potential source of dioxins/furans contamination. Additional soil samples for dioxins/furans analyses should be performed in Parcel 7. These samples will provide additional dioxins/furans data for the site and may help to determine whether AOC #1 was a source.	Additional samples which address Ecology's comment 7 will be collected and tested for dioxins/furans from a boring advanced near AOC 1 (DP27) and a boring advanced at the northern edge of Parcel 7 (DP28). In addition, DP27 will be sampled for TPH-G to address gasoline contamination identified in soil at MW-19 (see response to Ecology Comment #3). Samples from boring DP27 will also be analyzed for PAHs to evaluate the lateral and vertical extent of cPAHs identified in soil samples from MW-20, near the Refuse Fire Area. Note that Parcel 8, which is adjacent to the northwest portion of the Site, is being addressed by LOTT Alliance through Ecology's Voluntary Cleanup Program.	DP27	0-2				x	x	x				light sand fill
			2-4		x	X	x	x	x		x		light sand fill
			4-6				x	x	x		x		silt
			6-8				x	x				3	silt

TABLE 1
PROPOSED NEW BORING AND MONITORING WELL RATIONALE
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Ecology Comment	Response to Ecology Comments/Sampling Rationale	Exploration: Boring (DP) Well (MW)	Sampling Depth Interval (ft bgs)[1]	Soil Analyses: NWTPH-Dx	NWTPH-G	BTEX	Total Metals (As, Cd, Pb)[2]	D/F	PAHs	PCBs	TOC[3]	Planned Utilities - Maximum Depth (feet)	Anticipated Soil Type / Lithologic Unit
8. Additional characterization of dioxins/furans is needed. Section 4.3.1 states that "dioxin testing appears to indicate that the historical working surface (depth of about 2 feet below existing grade) is impacted." Please provide more detail on what is meant by "historical working surface" and how it is distinguished. According to the Supplemental Site Use History report, the boiler house (AOC #17) operated circa 1932 and the power house (AOC #22-24) operated from at least 1941 through 1958. Was 2.0 feet below current grade the historical grade for these facilities? If so, what evidence is there for this? Dioxin samples were collected at the 2.0 foot depth at AOC #17, at the 3.5 depth at AOC #22-24, and at the 1.5 and 2.0 foot depths at the two randomly selected locations. It is recommended that additional samples be collected at AOC #17 so that a concentration verses depth profile can be determined.	The "historical working surface" is the sometimes woody and compacted historical grade where industrial buildings were located and operations were conducted on the property prior to later filling and grading. Based on our review of historical information the working surface is located about 1 to 4 feet below existing grade, however it can be difficult to identify in borings due to similarity in lithology of fill in this depth interval. Because of Ecology's questioning of the historical working surface and difficulty in determining its exact location in borings, a more appropriate rationale for the location of explorations where vertical profiles for dioxins/furans testing is as follows:1) complete a profile (DP33) adjacent to previous sample with high dioxins concentrations (TP02) and 2) complete a profile that represents temporal fill sequences.	See DP 33 (Comment 6) and borings and "Additional Explorations" rationale below.											
9. Additional characterization of groundwater contamination, flow direction, and gradient is needed. Groundwater monitoring wells MW-1 through MW-11 and MW-14 were installed with their screened interval submerged below the water table. Wells that monitor for light non-aqueous phase liquids (LNAPL, such as petroleum hydrocarbons) should be completed so that their screen straddles the water table. Therefore, to accurately evaluate whether groundwater is contaminated from LNAPL constituents, it will be necessary to install additional groundwater monitoring wells with screens that extend above the water table at selected locations where the existing monitoring wells are not adequate. Please present your proposed new well locations to us for review and approval.	Given the general lack of dissolved-phase petroleum constituent detections in the groundwater samples collected from existing MWs (as well as the relatively low TPH soil concentrations detected in soil samples collected from areas with suspected hydrocarbon contamination), it is unlikely that the typical placement of the screened intervals straddling the water table would result in measurable LNAPL thicknesses or even a screening level TPH exceedance at any MW at this site. Nonetheless, five shallow MWs (MW21S through MW25S) with screens straddling the water table are proposed to address this comment. MW21S and MW24S are discussed in the responses to Ecology Comments #2 and #3, respectively. Proposed MW22S will be used to evaluate LNAPL thicknesses and petroleum constituent concentrations near MW06. MW23S and MW25S are discussed in the response to Ecology Comment #1. This Ecology comment is further addressed by in the Groundwater Monitoring Plan. Based on recent comments from Ecology (9/22/08 Ecology comment letter and subsequent discussion), because artesian wells at the Site may be influencing shallow groundwater, an attempt will be made to locate and decommission or otherwise mitigate leakage from the artesian wells. If the artesian wells are found and decommissioned, water levels and the need for shallow monitoring wells will be reevaluated.	MW22S	No analysis of soil samples unless field observations indicate the presence of contamination. Anticipated screened interval is 1-6 feet bgs.										
Additional Explorations													
Additional explorations to evaluate the nature and extent of contamination, including dioxins/furans. These explorations will provide data related to: a) regional area background concentrations of dioxins/furans and metals not related to a site release, b) management of soil that will be excavated as part of the infrastructure improvements, and c) evaluation of COPC distribution in different fill types and spatial coverage related to general extent of COPCs.	Evaluate extent of lead and PAHs at DP11.	DP29	0-2						x				light sand fill
			2-6				x						silt or gravel
			6-10				x						silt or gravel
			10-14						x				silt or gravel
	Evaluate dioxins/furans in fill (1891 to 1908 time interval), evaluate dioxins/furans in soil within the infrastructure corridor, and provide additional sampling data for parcel 9.	DP30	0-2				x	x					light sand fill
			2-4				x	x	x				light sand fill or silt
			6-8				x	x (if silt)				9	light sand fill or silt

TABLE 1
PROPOSED NEW BORING AND MONITORING WELL RATIONALE
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Ecology Comment	Response to Ecology Comments/Sampling Rationale	Exploration: Boring (DP) Well (MW)	Sampling Depth Interval (ft bgs)[1]	Soil Analyses: NWTPH-Dx	NWTPH-G	BTEX	Total Metals (As, Cd, Pb)[2]	D/F	PAHs	PCBs	TOC[3]	Planned Utilities - Maximum Depth (feet)	Anticipated Soil Type / Lithologic Unit
	Locations DP31 and DP41 are selected to obtain dioxins/furans data from soil not associated with any AOC source. This data will be used to evaluate dioxins/furans concentrations related to regional dioxin sources and regional background levels as it is possible that detected concentrations of dioxins/furans and metals in soil samples collected to date are attributable to an area or regional background rather than a site release. DP31 is located on parcel 6 in an area where no historical sources (AOCs) were located and the underlying fill is from the 1948 to 1975 time period. DP41 is located on parcel 2 in an area where no historical sources (AOCs) were located and the underlying fill is from the post 1975 time period.	DP31	0-2					x					light sand fill
			2-6	x			x	x					light sand fill
		DP41	0-2					x					gravel fill
			2-6				x	x					silt
	Evaluate dioxins/furans in post-1975 fill within the infrastructure corridor. These data will assist with evaluating background conditions as well as inform waste characterization and disposal associated with the excavated infrastructure corridor soils.	DP32	0-2					x			x		gravel fill
			2-6				x	x	x		x		gravel fill
			6-9					x				9	gravel fill
	Evaluate dioxins/furans in fill (1891 to 1908 time interval) near infrastructure corridor and on Parcel 4.	DP34	0-2					x					light sand fill
			2-6	X	X	X	x	x	x		x		light sand fill
			8-10	X	X	X	x	x	x			10	light sand fill or gravel
	These borings are located on Parcel 4 and the locations were selected to gather information to support soil characterization during construction activities associated with the Children's Hands on Museum.	DP26	0-2				X	x	X				light sand fill
			2-6					x	X				silt or light sand fill
			6-10				X	X					
		DP42	0-2				X	x					gravel fill
			2-6				X	x					light sand fill
			6-10				X	X					

Notes:

Blank boxes (no X) indicate that soil samples will be collected from the specified depth intervals and held for potential analyses by the analytical laboratory

Shaded cells indicate explorations and samples that will be collected in first phase of investigation

[1] Samples will be collected approximately every 2 feet in soil borings for field screening and potential chemical analyses. Discrete soil samples will be obtained from within the depth intervals shown in this column (rather than composite samples.) The depth ranges represent the intervals that a sample will be analyzed for the COPCs identified in the Soil Analyses columns. Additional samples may be analyzed if field observations indicate the presence of contamination.

[2] The metals listed; arsenic, cadmium and lead, represent metals that had concentrations exceeding screening levels in one or more locations. Some soil samples collected from the infrastructure corridor may also be analyzed for "RCRA 8" metals to provide data needed by soil disposal facilities. The RCRA metals include arsenic, barium, cadmium, chromium, lead, mercury, selenium & silver.

[3] TOC= total organic carbon. TOC and other physical soil properties such as grain size may also be analyzed at various locations for the possibility of establishing site specific Method B cleanup levels.

[a] Also analyze for EPH.
[b] Also analyze for total organic carbon
x = sample collected for analytical testing. Red X = additional analytical testing requested by Ecology in it's September 22, 2008 comment letter.
As = Arsenic, Cd = Cadmium, Pb = Lead
PCBs = Polychlorinated biphenyls
HCID = Hydrocarbon Identification test (NWTPH-HCID)
NWTPH-Dx = Diesel-range and motor oil-range total petroleum hydrocarbons
TPH-MO = motor oil-range petroleum hydrocarbons
D/F = Dioxins and furans
NWTPH-G = Gasoline-range total petroleum hydrocarbons

SEAT:\0\0615034\07\Finals\Revised RI Workplan Oct 08\061503407 RIWP Tables.xls

TABLE 2
PROPOSED NEW MONITORING WELL RATIONALE
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Well I.D.	Purpose	Installation Method/Well Diameter	Proposed Well Screen Interval (BGS-feet)[1]	Existing Well Data[2]		
				Nearest Existing well	Highest DTW	Lowest DTW
MW21s	MW21S addresses Ecology Comment #9 for detected TPH in soil at MW19.	Direct push/1-inch	2 to 7	MW19	3.47	3.78
MW22s	MW22S will be used to evaluate LNAPL thicknesses and petroleum constituent concentrations near MW06.	Direct push/1-inch	1 to 6	MW6	0.84	1.14
MW23s	MW23S addresses Ecology Comment #9 for detected TPH in soil at DP18.	Direct push/1-inch	4 to 9	MW16	5.41	6.35
MW24s	MW24S addresses Ecology Comment #9 for detected TPH in soil at DP06, DP08, DP24, and DP13.	Direct push/1-inch	2.5 to 7.5	MW10	3.48	3.8
MW25s	MW25S addresses Ecology Comment #9 for detected TPH in soil at DP02 and DP04	Direct push/1-inch	2 to 7	MW7 and MW8	5.0 & 2.55	5 & 2.62

Notes:

Based on recent comments from Ecology, because artesian wells at the Site may be influencing groundwater levels, an attempt will be made to locate and decommission the artesian wells. If the artesian wells are found and decommissioned, the need for shallow monitoring wells will be reevaluated.

[1]Across water table with one foot of screen above predicted high water table elevation and four feet of screen below this elevation, subject to approval by Ecology and issuance of well construction variance.

[2] Based on depth to water measurements collected August 2007 and July 2008 during low and high tides.

bgs=below ground surface

DTW = depth to water in feet as measured from top of well casing. Top of well casings for referenced wells is approximately at ground surface.

SEAT:\0\0615034\07\Finals\Revised RI Workplan Oct 08\061503407 RIWP Tables.xls

TABLE 3
PROPOSED GROUNDWATER MONITORING AND CHEMICAL ANALYTICAL TESTING PLAN
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

		Past Groundwater Monitoring and Sampling Events												Proposed Future Groundwater Monitoring									
		Last Sampling Events			Chemical Analytical Testing Completed									Physical Parameter Monitoring		Chemical Analytical Testing Proposed							
Well No.(3,4,5)	Associated Historic Source Area/Concern and Contaminant of Potential Concern (COPC)	Jan-07	Jun-07	Aug-07	TPH-Gasoline	TPH-Diesel	TPH-Oil	VOCs	Total PP Metals	SVOCs (and PAHs) (6)	PCBs(7)	Dioxins/Furans(8)	Previous Exceedance of Screening Level (MTCA A or B)	Depth to Water	Conductivity, pH, ORP, Turbidity, DO, Salinity, Fe^{2+} (using a Horiba U-10 flow through cell)	TPH-Gasoline	TPH-Diesel	TPH-Oil	VOCs (BETX and HVOCs)	Total RCRA Metals	PAHs(6)	PCBs(7)	Dioxins/Furans(8)
MW01	Oil House (TPH)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW02	Machine Shops (TPH, metals, PAHs, VOCs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x (1)	x	--	--
MW03	Tar Dipping Tank (TPH, PAHs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW04	Near former Transformers (PCBs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	**arsenic**	x	x	x	x	x	x	x (1)	x	x	--
MW05 (2)	Power House Area (TPH, metals, VOCs, D/F)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	x	x
MW06	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	See MW22s (if MW22s is not installed, MW06 wil be sampled for parameters planned for MW22s)							
MW07	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW08	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW09	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW10	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	See MW24s (if MW24s is not installed, MW10 wil be sampled for parameters planned for MW24s)							
MW11	None: downgradient from offsite gasoline station	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW12 (2)	Power House Area (TPH, metals, VOCs)	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW13	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	**arsenic, diesel**	x	x	x	x	x	x	x (1)	x	--	--
MW14	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)	N	N	N	N	N	N	N	N	N	N	N	N/A	x	x	x	x	x	x	x	x	--	--
MW15 (2)	None	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW16 (2)	Boiler House Area (TPH, PAHs)	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	x (tested Aug-08)
MW17	Shops (TPH, PAHs, Metals, VOCs)	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	**arsenic**	x	x	x	x	x	x	x (1)	x	--	--
MW18 (2)	None: downgradient well near Marine View Drive	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
MW19	Panel Oiling (TPH, PAHs)	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	See MW21s (if MW21s is not installed, MW19 wil be sampled for parameters planned for MW21s)							
MW20	Refuse Fire Area (TPH, metals, PAHs, D/F)	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	none	x	x	x	x	x	x	x	x	--	--
Proposed Wells and/or Sampling Locations																							
MW21s (paired with MW19)9	Panel Oiling (TPH, PAHs)													x	x	x	x	x	x	x	x	--	--
MW22s (paired with MW06)9	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)													x	x	x	x	x	x	x	x	--	--
MW23s (paired with MW16)9	Boiler House Area (TPH, PAHs)													x	x	x	x	x	--	--	--	--	--
MW24s (paired with MW10)9	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)													x	x	x	x	x	x	x	x	--	--
MW25s (no pairing)	Near Fuel and Oil Areas (TPH, metals, PAHs, VOCs)													x	x	x	x	x	x	x	x	--	--
Seep 1 10	Groundwater/surface water interface													NA	x	x	x	x	x	x	x	--	--
Seep 2 10	Groundwater/surface water interface													NA	x	x	x	x	x	x	x	--	--
Seep 3 10	Groundwater/surface water interface													NA	x	x	x	x	x	x	x	--	--
Seep 4 10	Groundwater/surface water interface													NA	x	x	x	x	x	x	x	--	--

Notes:

[1]Dissolved metals to be tested in addition to total metals at locations where metals exceedances have been measured. Also test these samples for aluminum and iron (Al and Fe^{3+}) to represent suspended clay particles. Results to potentially be used for evaluating sorption of COPCs.

[2]MW05, MW12, MW16 and MW18 are downgradient wells between the subject property and East Bay. These wells will be considered for potential future compliance wells.

[3]MW04, 05, 06, 07, 08, 10 were sampled and tested July 13, 2007 for diesel-range hydrocarbons only.

[4]MW01 through MW10 were installed in January 2007. MW11 through MW20 were installed in July and August 2007.

[5]MW14 was not sampled in 2007 because other monitoring wells surrounding MW14 were sampled and tested.

[6]Note on SVOCs. The only SVOC exceedances were cPAHs, therefore only cPAHs will be analyzed, rather than the full SVOC list.

[7]Note on PCBs. PCBs have not been detected in any of the groundwater samples obtained from MW01 through MW20 at the site; nor have they been detected above soil screening levels. Therefore PCBs will only be tested at locations where low level detections of PCBs were detected in soil on Parcel 3 and near the former transformer location (MW04).

[8]Note on Dioxins/Furans. Dioxin/Furans were not detected in a groundwater sample obtained and tested from MW16 in August 2008. Dioxin sampling and testing approach is based on obtaining samples from potential source area wells that are also downgradient compliance wells (MW05 and MW16). If dioxins/furans are detected in groundwater at MW05 or MW16, then additional testing will be conducted at the other compliance wells (MW04, MW11, MW12

[9]This well will not be installed if water levels drop sufficiently after the artesian wells are decommissioned if the existing paired monitoring well screen is not totally submerged.

[10]Water from this seep area will only be sampled if it is determined to represent groundwater (see Section 5.4.2 of Sample and Analysis Plan)

x = sample collected for analytical testing

Y = Yes; N = No; NA = not applicable; "--" = Not tested

TPH-Gasoline by Ecology Method NWTPH-Gx

TPH-Diesel and Oil by Ecology Method NWTPH-Dx

VOCs (volatile organic compounds) by EPA Method 8260B

RCRA Metals (As, Ba, Cd, Cr, Pb, Ag, Se, Hg) by EPA Methods 6000/7000

PAHs (polycyclic aromatic hydrocarbons) by EPA Method 8270sim

PCBs (polychlorinated biphenyls) by EPA Method 8082

Dioxins/Furans by EPA Method 1613B

ORP = Oxidation Reduction Potential

DO = Dissolved Oxygen

Fe = Iron

Al = Aluminum

COPCs = contaminants of potential concern

SEAT:\0\0615034\07\Finals\Revised RI Workplan Oct 08\061503407 RIWP Tables.xls

TABLE 4
SOIL ANALYTICAL TARGET REPORTING LIMITS
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Analytes	Units	Analytical Laboratory Criteria[1]	
		Target Reporting Limits	**Analytical Method**
Total Petroleum Hydrocarbons			
Gasoline-Range	mg/kg	5.0E+00	NW-TPH-Gx
Diesel-Range	mg/kg	5.0E+00	NW-TPH-Dx
Oil-Range (including Mineral O	mg/kg	1.0E+01	NW-TPH-Dx
Metals			
Arsenic	mg/kg	5.0E+00	6010B ICP
Cadmium	mg/kg	2.0E-01	6010B ICP
Lead	mg/kg	2.0E+00	6010B ICP
Volatile Organic Compounds[2]			
BTEX	mg/kg	1.0E-03	EPA 8260B
Semivolatile Organic Compounds[2]			
SVOCs	mg/kg	6.7E-02	EPA 8270
4-Chloro-3-methylphenol	mg/kg	3.3E-01	EPA 8270
Polycyclic Aromatic Hydrocarbons[2]			
PAHs	mg/kg	5.0E-03	EPA 8270D SIM
Polychlorinated Biphenyls[2]			
Total PCBs	mg/kg	4.0E-03	8082 Low Level
Dioxins and Furans			
2,3,7,8-TCDD	mg/kg	5.0E-07	1613/8290
2,3,7,8-TCDF	mg/kg	5.0E-07	1613/8290
-Penta, Hexa, Hepta	mg/kg	2.0E-06	1613/8290
-Octa	mg/kg	5.0E-06	1613/8290

Notes:

[1] These limits represent target reporting limits typically achievable by analytical laboratories. However, there may be instances where these levels cannot be achieved due to sample specific interferences.

[2] Reporting limits for VOCs, SVOCs, PAHs, and PCBs are indicated for the group of compounds. Specific compounds are listed separately if they have a different reporting limit.

mg/kg = milligrams per kilogram
SVOCs = Semivolatile Organic Compounds
TCDD = Tetrachlorinated Dibenzo-p-dioxins
TCDF = Tetrachlorinated Dibenzofurans
PCBs =Polychlorinated Biphenyls
BTEX = benzene, toluene, ethylbenzene, and xylenes
PAHs = Polycyclic Aromatic Hydrocarbons

SEAT:\0\0615034\07\Finals\Revised RI Workplan Oct 08\061503407 RIWP Tables.xls

TABLE 5
GROUNDWATER ANALYTICAL TARGET REPORTING LIMITS
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Analytes	Units	Analytical Laboratory Criteria[1] Target Reporting Limits	Analytical Method
Petroleum Hydrocarbons			
Gasoline-Range	mg/L	0.03	NWTPH-G
Diesel-Range	mg/L	0.25	NW-TPH-Dx
Oil-Range	mg/L	0.50	NW-TPH-Dx
Si/Acid Cleaned TPH-D	mg/L	0.25	NW-TPH-Dx
Si/Acid Cleaned TPH-O	mg/L	0.50	NW-TPH-Dx
Metals *(Total or Dissolved)*			
Arsenic	mg/L	0.0002	EPA 6020/200.8 ICP-MS
Barium	mg/L	0.01	EPA 6020/200.8 ICP-MS
Cadmium	mg/L	0.0002	EPA 6020/200.8 ICP-MS
Chromium	mg/L	0.0005	EPA 6020/200.8 ICP-MS
Lead	mg/L	0.001	EPA 6020/200.8 ICP-MS
Mercury	mg/L	0.00002	EPA 7470 GFAA & CVAA
Selenium	mg/L	0.1	EPA 6020/200.8 ICP-MS
Silver	mg/L	0.02	EPA 6020/200.8 ICP-MS
Volatile Organic Compounds[2]			
VOCs	µg/L	1.0	EPA 8260B (5 mL purge)
Methylene Chloride	µg/L	2.0	EPA 8260B (5 mL purge)
Acetone	µg/L	5.0	EPA 8260B (5 mL purge)
2-Butanone	µg/L	5.0	EPA 8260B (5 mL purge)
Vinyl Acetate	µg/L	5.0	EPA 8260B (5 mL purge)
4-Methyl-2-Pentanone	µg/L	5.0	EPA 8260B (5 mL purge)
2-Hexanone	µg/L	5.0	EPA 8260B (5 mL purge)
Tetrachloroethene	µg/L	0.2	EPA 8260B (20 mL purge)
1,1,2-Trichlorotrifluoroethane	µg/L	2.0	EPA 8260B (5 mL purge)
Acrolein	µg/L	50	EPA 8260B (5 mL purge)
1,2-Dibromo-3-Chloropropane	µg/L	5.0	EPA 8260B (5 mL purge)
1,2,3-Trichloropropane	µg/L	2.0	EPA 8260B (5 mL purge)
trans-1,4-Dichloro-2-Butene	µg/L	5.0	EPA 8260B (5 mL purge)
Hexachlorobutadiene	µg/L	5.0	EPA 8260B (5 mL purge)
1,2,4-Trichlorobenzene	µg/L	5.0	EPA 8260B (5 mL purge)
Naphthalene	µg/L	5.0	EPA 8260B (5 mL purge)
1,2,3-Trichlorobenzene	µg/L	5.0	EPA 8260B (5 mL purge)
Semivolatile Organic Compounds[2]			
SVOCs	µg/L	1.0	EPA 8270D
Benzyl Alcohol	µg/L	5.0	EPA 8270D
N-Nitroso-Di-N-Propylamine	µg/L	5.0	EPA 8270D
Hexachloroethane	µg/L	2.0	EPA 8270D
2-Nitrophenol	µg/L	5.0	EPA 8270D
Benzoic Acid	µg/L	10	EPA 8270D
bis(2-Chloroethoxy) Methane	µg/L	1.0	EPA 8270D
2,4-Dichlorophenol	µg/L	5.0	EPA 8270D
1,2,4-Trichlorobenzene	µg/L	1.0	EPA 8270D
Naphthalene	µg/L	1.0	EPA 8270D
4-Chloroaniline	µg/L	5.0	EPA 8270D
4-Chloro-3-methylphenol	µg/L	5.0	EPA 8270D
Hexachlorocyclopentadiene	µg/L	5.0	EPA 8270D
2,4,6-Trichlorophenol	µg/L	5.0	EPA 8270D
2,4,5-Trichlorophenol	µg/L	5.0	EPA 8270D
2-Nitroaniline	µg/L	5.0	EPA 8270D
3-Nitroaniline	µg/L	5.0	EPA 8270D
2,4-Dinitrophenol	µg/L	10	EPA 8270D
4-Nitrophenol	µg/L	5.0	EPA 8270D
2,6-Dinitrotoluene	µg/L	5.0	EPA 8270D
2,4-Dinitrotoluene	µg/L	5.0	EPA 8270D
4-Nitroaniline	µg/L	5.0	EPA 8270D
Pentachlorophenol	µg/L	5.0	EPA 8270D
3,3'-Dichlorobenzidine	µg/L	5.0	EPA 8270D
Polycyclic Aromatic Hydrocarbons[2]			
PAHs	µg/L	0.01	8270M GC/MS Low Level
Polychlorinated Biphenyls			
Total PCBs	µg/L	0.01	EPA 8082 Low Level
Dioxins and Furans			
2,3,7,8-TCDD	µg/L	0.000005	EPA 1613/8290
-Penta, Hexa, Hepta	µg/L	0.000025	EPA 1613/8290
-Octa	µg/L	0.00005	EPA 1613/8290

Notes:

[1] These limits represent target reporting limits typically achievable by analytical laboratories. However, there may be instances where these levels cannot be achieved due to sample specific interferences.

[2] Reporting limits for VOCs, SVOCs, PAHs, and PCBs are indicated for the group of compounds. Specific compounds are listed separately if they have a different reporting limit.

mg/L = milligrams per liter
µg/L = micrograms per liter
TCDD = Tetrachlorinated Dibenzo-p-dioxins
TPH-O = Oil-range Petroleum Hydrocarbons
TPH-D = Diesel-range Petroleum Hydrocarbons
SVOC = Semivolatile Organic Compound
VOCs = volatile organic compounds
PCB = Polychlorinated Biphenyls
PAHs = polycyclic aromatic hydrocarbons

SEAT:\0\0615034\07\Finals\Revised RI Workplan Oct 08\061503407 RIWP Tables.xls

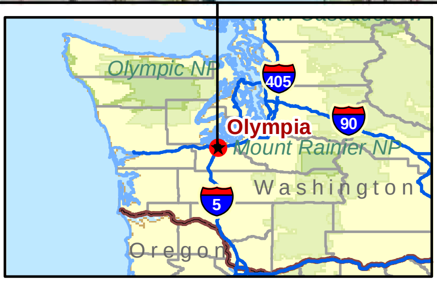
TABLE 6
SAMPLE CONTAINERS
EAST BAY REDEVELOPMENT
PORT OF OLYMPIA

Analysis	Method	Soils				Waters			
		Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times	Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times
Diesel Range Hydrocarbons	NWTPH-Dx	100 g	8 or 16 oz amber glass wide-mouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 40 days from extraction to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4 C, HCl to pH < 2	14 days to extraction 40 days from extraction to analysis
Gas Range Hydrocarbons	NWTPH-G	100 g	4 or 8 oz glass wide mouth with Teflon-lined lid	Cool 4°C	14 days	120 mL	3 - 40 mL VOA Vials	HCl - pH<2	14 days preserved 7 days unpreserved
VOC	SW-846 8260B	100 g	4 or 8 oz glass wide mouth with Teflon-lined lid	Cool 4°C	14 days	120 mL	3 - 40 mL VOA Vials	HCl - pH<2	14 days preserved 7 days unpreserved
Metals (including Mercury)	SW-846 6010/6020 SW-846 7470/7471	100 g	4 or 8 oz glass wide mouth with Teflon-lined lid	Cool 4°C	180 days/ 28 days for Mercury	500 mL	1 L poly bottle	HNO_3 - pH<2 (Dissolved metals preserved after filtration)	180 days (28 days for Mercury)
SVOCs (PAHs)	SW-846 8270C	100 g	4 or 8 oz glass wide mouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 40 days from extraction to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	7 days to extraction 40 days from extraction to analysis
PCB	SW-846 8082	100 g	4 or 8 oz glass wide mouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 40 days from extraction to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	7 days to extraction 40 days from extraction to analysis
PCDD/PCDF	SW-846 8290	100 g	4 or 8 oz glass wide mouth with Teflon-lined lid	Cool 4°C	30 days to extraction, 40 days from extraction to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	30 days to extraction 40 days from extraction to analysis

Note:
Holding Times are based on elapsed time from date of collection
VOC = Volatile Organic Compounds
SVOC = Semivolatile Organic Compound
PCDD = Polychlorinated Dibenzo-p-dioxins
PCDF = Polychlorinated Dibenzofurans
PCB =Polychlorinated Biphenyls
HCl = Hydrochloric Acid
HNO_3 = Nitric Acid
oz = ounce
mL = milliliter
L = liter
g = gram

SEAT:\0\0615034\07\Finals\Revised RI Workplan Oct 08\061503407 RIWP Tables.xls

Office: TAC   Path: P:\0\0615034\02\GIS\061503407_SAP_FIG1_VICINITYMAP.mxd   CDB:TCK   Map Revised: October 21, 2008



N
W E
S

2,000 0 2,000
Feet

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. cannot 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: Interstates, state routes, and roads from TIGER 2000. County boundaries, cities, and waterbodies from Department of Ecology. U.S. topographic map from National Geographic Society.

Lambert Conformal Conic, Washington State Plane North, North American Datum 1983

Vicinity Map

East Bay Redevelopment Project Area
Olympia, Washington

GeoEngineers

Figure 1

Office:TAC Path: P:\0\0615034\GIS\061503407_SAP_FIG2_EXPLOR_LOC.mxd CDB:TCK Map Revised: October 21, 2008

Proposed Direct-Push Boring Location

Phase 1 Explorations

Test Pit (GeoEngineers, Inc. - Oct. 2007)

Direct-Push Boring (GeoEngineers, Inc. - Sept. 2006, Jan. & July 2007)

Direct-Push Boring (Brown and Caldwell - Nov. 2006, Jan. & Feb. 2007)

Approximate Infastructure Improvement Corridor

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

East Bay Redevelopment Project Area

Direct-Push Boring (Northwest Testing Company, Oct. 2006)

Cone Penotrometer Test (Landau - May 2007)

Boring (Landau - May 2007)

N W E S

150 0 150

Feet

Reference: Aerial photograph (dated April 2008) and Approximate Infastructure Improvement Corridor from Skillings Connolly.
Short plat parcel boundaries are based on information provided by the Port of Olympia.
Notes: 1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.

Site Plan and Exploration Locations

East Bay Redevelopment Project Area
Olympia, Washington

GeoEngineers

Figure 2

Proposed Monitoring Well Location

Monitoring Well (GeoEngineers, Inc. - Jan. & July 2007)

Monitoring Well (Delta Environmental - June 2003)

Approximate Infastructure Improvement Corridor

East Bay Redevelopment Proposed Short Plat Parcel Boundaries

East Bay Redevelopment Project Area

N W E S

150 0 150

Feet

Site Plan and Monitoring Well Locations

East Bay Redevelopment Project Area
Olympia, Washington

GEOENGINEERS

Figure 3

Reference: Aerial photograph (dated April 2008) from Skillings Connolly. Short plat parcel boundaries are based on information provided by the Port of Olympia.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for infomation purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot 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.

APPENDIX E
HEALTH AND SAFETY PLAN

GEOENGINEERS, INC.
SITE HEALTH AND SAFETY PLAN CHECKLIST
PORT OF OLYMPIA EAST BAY REDEVELOPMENT
PORT OF OLYMPIA - 0615-034-07

This checklist is to be used in conjunction with the GeoEngineers' Safety program manual. Together, the program and this checklist comprise the site safety plan for this project. This plan is to be used by GeoEngineers personnel on this site. If the work entails potential exposures to other substances or unusual situations, additional safety and health information will be included and the plan will be approved by the GeoEngineers Health and Safety Manager. All plans are to be used in conjunction with current standards and policies outlined in the GeoEngineers Health and Safety Program Manual.

1. GENERAL PROJECT INFORMATION

Project Name:	Port of Olympia East Bay Redevelopment
Project Number:	0615-034-07
Type of Project:	Drilling oversight, soil and groundwater sampling
Start/Completion:	TBD (start date estimated Fall 2008)
Contractors:	TBD

Liability Clause - This Site Safety Plan is intended for use by GeoEngineers Employees only. It does not extend to the other contractors or subcontractors working on this site. If requested by subcontractors, this site safety plan may be used as a minimum guideline for those entities to develop safety plans or procedures for their own staff to work under. In this case, Form C-3 shall be signed by the subcontractor.

2. SCOPE OF WORK

The scope of work identified in this HASP is associated with remedial excavation, soil stockpiling and soil sampling.

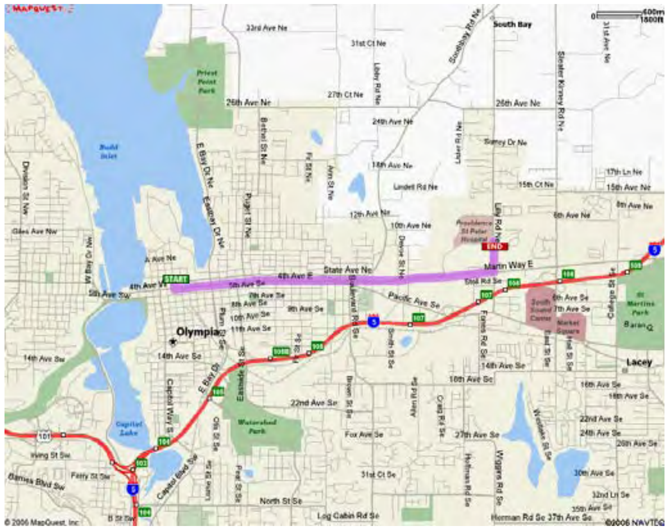
3. PERSONNEL/CONTACT INFORMATION PHONE NUMBERS

Title	Name	Telephone Numbers
Site Safety and Health Supervisor	GeoEngineers Field Staff	TBD
Project Manager	Jay Lucas	206-239-3221
Health and Safety Program Manager	Leah Alcyon, CIH	425-861-6098
Field Engineer/Geologist	GeoEngineers Field Staff	TBD
Client	Port of Olympia – Joanne Snarski	360-528-8020
Site Contact	Port of Olympia – Al Kulp	360-528-8006

Site safety and health supervisor -- The individual present at a hazardous waste site responsible to the employer and has the authority and knowledge necessary to establish the site-specific health and safety plan and verify compliance with applicable safety and health requirements.

4. Emergency Information

Providence St. Peter Hospital
413 Lilly Road NE
Olympia, Washington 98506-5166
(360) 491-9480



Hospital Name and Address:	Providence St. Peter Hospital 413 Lilly Road NE Olympia, WA 98506-5166
Phone Numbers (Hospital):	(360) 491-9480
Starting from:	Corner of Jefferson St NE and State Ave NE Olympia, WA
Arriving at:	413 Lilly Road NE Olympia, WA
Distance:	3 miles
	1. Head west from State Ave NE - go 73 ft 2. Turn left at Franklin St NE - go 0.1 mi 3. Turn left at 4th Ave E - go 1.6 mi 4. Continue on Martin Way E - go 1.0 mi 5. Turn left at Lilly Rd NE - go 0.3 mi
Ambulance:	9-1-1
Poison Control:	9-1-1
Police:	9-1-1
Fire:	9-1-1
Location of Nearest Telephone:	Cell phones are carried by field personnel.
Nearest Fire Extinguisher:	Located in the GEI vehicle on site.
Nearest First-Aid Kit:	Located in the GEI vehicle on site.

4.1 Standard Emergency Procedures

1. Get help -
   - send another worker to phone 911 (if necessary)
   - as soon as feasible, notify GeoEngineers' project manager
2. Reduce risk to injured person -
   - turn off equipment
3. Get help -
   - send another worker to phone 911 (if necessary)
   - as soon as feasible, notify GeoEngineers' project manager

4. Reduce risk to injured person -
    - turn off equipment
    - move from injury location (if possible)
    - keep warm
    - perform CPR (if necessary)
5. Transport injured person to medical treatment facility (if necessary) -
    - by ambulance (if necessary) or GeoEngineers vehicle
    - stay with person at medical facility
    - keep GeoEngineers manager apprised of situation and notify human resources manager of situation

5. PERSONNEL TRAINING RECORDS

Name of Employees	Level of Training (24/ 40 hr)	Date of Last Training	HAZWOPER Supervisor Training	First Aid/ CPR	Respirator Fit Test

6. KNOWN (OR ANTICIPATED) HAZARDS

Note: A hazard assessment will be completed at every site prior to beginning field activities. Updates will be included in the daily log. This list is a summary of hazards listed on the form.

6.1 Physical Hazards

X	Drill rigs and concrete coring/slab cutting
	Backhoe
	Trackhoe
	Crane
	Front End Loader
	Excavations/trenching (1:1 slopes for Type B soil)
	Shored/braced excavation if greater than 4 feet of depth
X	Overhead hazards/power lines
X	Tripping/puncture hazards
X	Unusual traffic hazard – Street traffic

6.2 Physical Hazard Mitigation Measures or Procedures

- Work areas will be marked with reflective cones, barricades and/or caution tape. Personnel will wear blaze orange vests for increased visibility by vehicle and equipment operators.

- Field personnel will be aware constantly of the location and motion of heavy equipment. A safe distance will be maintained between personnel and the equipment. Personnel will be visible to the operator at all times and will remain out of the swing and/or direction of the equipment apparatus. Personnel will approach operating heavy equipment only when they are certain the operator has indicated it is safe to do so.
- Heavy equipment and/or vehicles used on this site will not work within 20 feet of overhead utility lines without first ensuring that the lines are not energized. This distance may be reduced to 10 feet depending on the client and the use of a safety watch.
- Personnel entry into unshored or unsloped excavations deeper than four feet is not allowed. Any trenching and shoring requirements will follow guidelines established in WAC 296-155, the Washington State Construction standards or OSHA 1926.651 Excavation Requirements. In the event that a worker is required to enter an excavation deeper than 4 feet, a trench box or other acceptable shoring will be employed or the side walls of the excavation will be sloped according to the soil type and guidelines as outlined in OSHA/WISHA regulations. If the shoring/sloping deviates from that outlined in the WAC, it will be designed and stamped by a PE. Prior to entry, personnel will conduct air monitoring as described later in this plan. All hazardous encumbrances and excavated material will be stockpiled at least two feet from the edge of a trench or open pit. If concentrations of volatile gases accumulate within an open trench or excavation, the means of entering shall adhere to confined space entry and air monitoring procedures outlined under the air monitoring recommendations in this plan and the GeoEngineers Safety Program Manual.
- Personnel will avoid tripping hazards, steep slopes, pit and other hazardous encumbrances. If it becomes necessary to work within 6 feet of the edge of a pit, slope, pier or other potentially hazardous area, appropriate fall protection measures will be implemented by the Site Safety Officer (SSO) in accordance with OSHA/WISHA regulations and the GeoEngineers Safety Program manual.

Engineering Controls:

____________ Trench shoring (1:1 slope for Type B Soils)

____________ Location work spaces upwind/wind direction monitoring

____________ Other soil covers (as needed)

____________ Other (specify)____

____

6.3 Chemical Hazards (potentially present at site)

Petroleum Hydrocarbons:

X Naphthalenes or paraffins

X Aromatic hydrocarbons (benzene, ethylbenzene, toluene, xylenes)

X Gasoline

X Diesel fuel

____________ Waste oil

X Other petroleum fuels (list) lube oil-range hydrocarbons_

6.4 Hazards from Other Organic Compounds (present or potentially present at site)

X	Chlorinated hydrocarbons (Polychlorinated biphenyls) and PCE. Breakdown products of PCE have not been detected at the site.
X	Polycyclic aromatic hydrocarbons (PAHs)
	Pesticides/Herbicides
X	Other Dioxins/Furans

6.5 Metals (Potentially present at site)

X	Lead
X	Copper
X	Chromium
X	Zinc
X	Other metals (See known chemical characteristics in Site History)

Known chemical characteristics (maximum/ average concentrations for routine monitoring):	Soil Chemistry (mg/kg)	Water Chemistry (µg/l)
Diesel / Oil	21,000	500
Gasoline	290	ND
Dioxins/Furans	645 ng/kg	ND
Lead	2,500	ND
Arsenic	84	140
Cadmium	3.7	ND
PAHs (TEQ)	1.01	ND
PCBs	ND	ND

Summary of Petroleum Hazards

Compound/ Description	Exposure Limits/IDLHb	Exposure Routes	Toxic Characteristics
Diesel Fuel—liquid with a characteristic odor	None established by OSHA, but ACGIH has adopted 100 mg/m3 for a TWA (as total hydrocarbons)	Ingestion, inhalation, skin absorption, and skin and eye contact	Irritated eyes, skin, and mucus membrane; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; and headache, and dermatitis
Gasoline (Unleaded)—clear liquid with a characteristic odor	PEL 300 ppm TLV 300 ppm STEL 500 ppm	Ingestion, inhalation, skin absorption, skin and eye contact	Irritated eyes, skin, and mucus membrane; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; and headache, and dermatitis

Compound/ Description	Exposure Limits/IDLHb	Exposure Routes	Toxic Characteristics
Mineral Oil – As a mist	The current OSHA PEL for mineral oil mist is 5 mg/m3 of air as an 8-hr TWA	If the oil is not a mist, then route of exposure is skin and eye contact	Exposure to oil mists can cause eye, skin, and upper respiratory tract irritation
Mineral based crankcase oil – may contain metals, gas, antifreeze and PAHs	It depends on the contaminants	Ingestion, inhalation, skin absorption, skin and eye contact	It depends on the contaminants.

Notes:
IDLH = immediately dangerous to life or health
OSHA = Occupational Safety and Health Administration
mg/m^3 = milligrams per cubic meter
TWA = time-weighted average
PEL = permissible exposure limit
TLV = threshold limit value
STEL = short-term exposure limit
ppm = parts per million

6.6 Chemical Hazard Mitigation Measures or Procedures

Air monitoring will be conducted for flammable vapors and for establishing the level of respiratory protection.

- Half-face combination organic vapor/high efficiency particulate air (HEPA) or P100 cartridge respirators will be available on-site to be used as necessary. P100 cartridges are only to be used if PID measurements are below the site action limit. P100 cartridges are used for protection against dust, metals and asbestos, while the combination organic vapor/HEPA cartridges are protective against both dust and vapor. Ensure that the PID or TLV will detect the chemicals of concern on-site.
- Level D PPE will be worn at all times on-site. Potentially exposed personnel will wash gloves, hands, face, and other pertinent items to prevent hand-to-mouth contact. This will be done prior to hand-to- mouth activities including eating, smoking, etc.
- Adequate personnel and equipment decontamination will be used to decrease potential ingestion and inhalation.
- Individual PELs or action limits are not expected to be exceeded given the planned activities. If there are waste oil contaminants in the soil and conditions are damp, airborne dust is not likely to be an issue. If conditions are dry and dust is visible during site activities, personnel will use P100 cartridges on their respirator.

6.7 Biologic Hazards

________	Poison Ivy or other vegetation	________
________	Insects or snakes	________
________	Used hypodermic needs or other infectious	**Do not pick up or contact**
________	hazards	________
________	Others	________

6.8 Biologic Hazard Mitigation Measures or Procedures

Site personnel shall avoid contact with or exposures to potential biological hazards encountered.

Additional Hazards ______________________________

6.9 Additional Hazards (Update in Daily Log)

Include evaluation of:

- Physical Hazards (excavations and shoring, equipment, traffic, tripping, heat stress, cold stress and others)
- Chemical Hazards (odors, spills, free product, airborne particulates and others present)
- Biologic Hazards (snakes, spiders, other animals, discarded needles, poison ivy and others present)

7. LIST OF FIELD ACTIVITIES

Check the activities to be completed during the project

	Site reconnaissance
X	Exploratory borings
	Construction monitoring
	Surveying
	Test pit exploration
X	Monitoring well installation
X	Monitoring well development
X	Soil sample collection
X	Field screening of soil samples
X	Vapor measurements
X	Groundwater sampling
X	Groundwater depth and free product measurement
	Product sample collection
	Soil stockpile testing
	Remedial excavation
	Underground storage tank removal monitoring
	Remediation system monitoring
	Recovery of free product

8. SITE DESCRIPTION (ATTACH ANY ADDITIONAL SITE PLAN DETAILS AND CHEMICAL ANALYSES)

8.1 Site History

Address/Location:	Corner of Jefferson Street NE and State Avenue NE Olympia, Washington
Site topography:	Flat
Predominant wind direction:	South to north

Site drainage:

X Municipal drain
X Surface water drainage
X Engineered site drains
___ Other

Utility check complete: To be completed prior to drilling – see documentation Utility Checklist

Traffic or vehicle access control plans: NA

Site access control (exclusion zone) defined by:

X Fence
___ Survey tape
X Traffic cones
X Other (traffic control barriers as required by the city)

Hot zone/exclusion zone (Define): ***Within 10 feet of borings***

Fence around site perimeter, if existing and available otherwise use flagging and/or cones.

N/A

Contamination reduction zone (Define): ***Decontamination will be set up and area will be delineated***

Fence around site perimeter, if existing and available otherwise use flagging and/or cones.

N/A

8.2 Personal Protective Equipment

8.2.1 Personal Protective Equipment (PPE)

Minimum level of protective equipment for these sites is Level D. After the initial and/or daily hazard assessment has been completed, select the appropriate protective gear (PPE) to preserve worker safety. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted prior to the start of site operations.

Check applicable personal protection gear to be used:

X Hardhat (if overhead hazards, or client requests)
X Steel-toed boots (if crushing hazards are a potential or if client requests)
X Safety glasses (if dust, particles, or other hazards are present or client requests)
X Hearing protection (if it is difficult to carry on a conversation 3 feet away)
X Rubber steel-toed boots (if wet conditions)

Gloves (specify):

__X__ Nitrile
______ Latex
______ Liners
______ Leather
______ Other (specify) ______________________________

Protective clothing:

______ Tyvek (if dry conditions are encountered, Tyvek is sufficient)
______ Saranex (personnel shall use Saranex if liquids are handled or splash may be an issue)
__X__ Cotton
__X__ Rain gear (as needed)
__X__ Layered warm clothing (as needed)

Inhalation hazard protection:

__X__ Level D
______ Level C (respirators with organic vapor filters/ P100 filters)

8.2.2 Limitations of Protective Clothing

PPE clothing ensembles designated for use during site activities shall be selected to provide protection against known or anticipated hazards. However, no protective garment, glove or boot is entirely chemical-resistant, nor does any PPE provide protection against all types of hazards. To obtain optimum performance from PPE, site personnel shall be trained in the proper use and inspection of PPE. This training shall include the following:

- Inspect PPE before and during use for imperfect seams, non-uniform coatings, tears, poorly functioning closures, or other defects. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Inspect PPE during use for visible signs of chemical permeation such as swelling, discoloration, stiffness, brittleness, cracks, tears, or other signs of punctures. If the integrity of the PPE is comprised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Disposable PPE should not be reused after breaks unless it has been properly decontaminated.

8.3 Respirator Selection, Use and Maintenance

GeoEngineers has developed a written respiratory protection program in compliance with OSHA requirements contained in 29 CFR 1910.134. Site personnel shall be trained on the proper use, maintenance and limitations of respirators. Site personnel that are required to wear respiratory protection shall be medically qualified to wear respiratory protection in accordance with 29 CFR 1910.134. Site personnel that will use a tight-fitting respirator must have passed a qualitative or quantitative fit test conducted in accordance with an OSHA-accepted fit test protocol. Fit testing must be repeated annually or whenever a new type of respirator is used.

8.3.1 Respirator Cartridges

If site personnel are required to wear air-purifying respirators, the appropriate cartridges shall be selected to protect personnel from known or anticipated site contaminants. The respirator/cartridge combination shall be certified and approved by NIOSH. A cartridge change out schedule shall be developed based on known site contaminants, anticipated contaminant concentrations and data supplied by the cartridge manufacturer related to the absorption capacity of the cartridge for specific contaminants. Site personnel shall be made aware of the cartridge change out schedule prior to the initiation of site activities. Site personnel shall also be instructed to change respirator cartridges if they detect increased resistance during inhalation or detect vapor breakthrough by smell, taste or feel although breakthrough is not an acceptable method of determining the change out schedule. At a minimum, cartridges should be changed a minimum of once daily.

8.3.2 Respirator Inspection and Cleaning

The SSO shall periodically (that is, weekly) inspect respirators at the project site. Site personnel shall inspect respirators prior to each use in accordance with the manufacturer's instructions. In addition, site personnel wearing a tight-fitting respirator shall perform a positive and negative pressure user seal check each time the respirator is donned to ensure proper fit and function. User seal checks shall be performed in accordance with the GeoEngineers respiratory protection program or the respirator manufacturer's instructions.

Respirators shall be hygienically cleaned as often as necessary to maintain the equipment in a sanitary condition. At a minimum, respirators shall be cleaned at the end of each work shift. Respirator cleaning procedures shall include an initial soap/water cleaning, a water rinse, a sanitizing soaking and a final water rinse. One capful of bleach per one gallon of water can be used to create the sanitizing soak solution. When not in use, respirators shall be stored to protect against damage, hazardous chemicals, sunlight, dust, excessive temperatures and excessive moisture. In addition, respirators shall be stored to prevent deformation of the face piece and exhalation valve.

8.3.3 Facial Hair and Corrective Lenses

Site personnel with facial hair that interferes with the sealing surface of a respirator shall not be permitted to wear respiratory protection or work in areas where respiratory protection is required. Normal eyeglasses can not be worn under full-face respirators because the temple bars interfere with the sealing surface of the respirator. Site personnel requiring corrective lenses will be provided with spectacle inserts designed for use with full-face respirators. Contact lenses should not be worn with respiratory protection.

9. AIR MONITORING PLAN

Work upwind if at all possible.

Check instrumentation to be used:

______ TLV Monitor (flammability only, for methane and petroleum vapors)
__X__ Photoionization Detector (PID)
______ Other (i.e., detector tubes): ____

Check monitoring frequency/locations: and type (specify: work space, borehole, breathing zone):

______ **15 minutes - Continuous during soil disturbance activities or handling samples**
______ 15 minutes
______ 30 minutes
__X__ Hourly (in breathing zone during each excavation, drilling, sampling)

Additional personal air monitoring for specific chemical exposure:

9.1 Action Levels

- The workspace will be monitored using a PID. These instruments must be properly maintained, calibrated and charged (refer to the instrument manuals for details). Zero this meter in the same relative humidity as the area it will be used in and allow at least a 10-minute warm-up prior to zeroing. Do not zero in a contaminated area. The PID can be tuned to read chemicals specifically if there are not multiple contaminants on-site. Can tune to detect one chemical with response factor entered into equipment but PID picks up all Volatile Organic Compounds present. Ionization potential (IP) of chemical has to be less than lamp (11.7/ 10.6eV) and PID does not detect methane. The ppm readout on the instrument is relative to the IP of isobutylene (calibration gas) so conversion must be made in order to estimate ppm of chemical on site.
- An initial vapor measurement survey of the site should be conducted to detect "hot spots" if contaminated soil is exposed at the surface. Vapor measurement surveys of the workspace should be conducted at least hourly or more often if persistent petroleum-related odors are detected. Additionally, if vapor concentrations exceed 5 ppm above background continuously for a five-minute period as measured in the breathing zone, upgrade to Level C PPE or move to a non-contaminated area.
- If the workspace will be monitored using a TLV Sniffer, the TLV Sniffer is not consistently reliable in measuring vapor concentrations less than 400 ppm. Therefore the TLV Sniffer should be used only as a warning indicator of high vapor concentrations. A PID is the preferred instrument and will be used if work with gasoline-contaminated soil is conducted.
- If the TLV Sniffer indicates greater than 1,000 ppm at the borehole or 600 ppm in the breathing zone, flammability may be a problem as well as indicating a health hazard. Stop work, move to an uncontaminated area and stabilize the situation. Continue work with caution, monitoring every 15 minutes.
- Standard industrial hygiene/safety procedure is to require that action be taken to reduce worker exposure to organic vapors when vapor concentrations exceed ½ the TLV. Because of the variety of chemicals, the PID will not indicate exposure to a specific PEL and is therefore not a preferred tool for determining worker exposure to chemicals. If odors are detected then employees will upgrade to respirator with Organic Vapor cartridges and will contact the Health and Safety Program Manager for other sampling options.

10. DECONTAMINATION PROCEDURES

Decontamination consists of removing outer protective Tyvek clothing and washing soiled boots and gloves using bucket and brush provided on site in the contamination reduction zone. Inner gloves will then be removed and respirator, hands and face will be washed in either a portable wash station or a bathroom facility in the support zone. Employees will perform decontamination procedures and wash prior to eating, drinking or leaving the site.

Specify other site-specific decontamination procedures:

11. WASTE DISPOSAL OR STORAGE

PPE disposal (specify): Investigative-derived waste (soil cuttings and purge/decon water) to be stored on-site pending characterization and disposal, as necessary.

IDW disposal or storage:

X On-site, pending analysis and further action, as necessary (e.g. stockpiles)

X Secured in steel drums

X Other (describe destination, responsible parties): Trash bags for solid waste

12. DOCUMENTATION EXPECTED TO BE COMPLETED

NOTE: The Field Log is to contain the following information:

- Updates on hazard assessments, field decisions, conversations with subs, client or other parties.
- Air monitoring/calibration results; personnel, locations monitored, activity at the time of monitoring.
- Action level for upgrading PPE and rationale.
- Meteorological conditions (temperature, wind direction, speed, humidity, etc.).

Required forms:

- Field Log.
- Health and Safety Plan acknowledgment by GeoEngineers employees (Form C-2).
- Contractors Health and Safety Plan Disclaimer (Form C-3).

Conditional forms available at GeoEngineers office:

- Accident Report (Form C-4).

13. APPROVALS

1. Plan Prepared Cindy Bartlett	______________ Signature	______________ Date
2. Plan Approval Jay Lucas	______________ PM Signature	______________ Date
3. Health & Safety Officer	Leah Alcyon, CIH Health & Safety Program Manager	______________ Date

FORM C-1
HEALTH AND SAFETY MEETING
PORT OF OLYMPIA EAST BAY REDEVELOPMENT
PORT OF OLYMPIA - 0615-034-07

All personnel participating in this project must receive initial health and safety orientation. Thereafter, brief tailgate safety meetings as deemed necessary by the site Safety Officer.

The orientation and the tailgate safety meetings shall include a discussion of emergency response, site communications and site hazards.

Date	Topics	Attendee	Company Name	Employee Initials

FORM C-2
SITE SAFETY PLAN – GEOENGINEERS' EMPLOYEE ACKNOWLEDGMENT
PORT OF OLYMPIA EAST BAY REDEVELOPMENT
PORT OF OLYMPIA - 0615-034-07

(All GeoEngineers' site workers complete this form which should remain attached to the safety plan checklist and filed with other project documentation).

I, ____, do hereby verify that a copy of the current Safety Plan has been provided by GeoEngineers, Inc., for my review and personal use. I have read the document completely and acknowledge a full understanding of the safety procedures and protocol for my responsibilities on site. I agree to comply with all required, specified safety regulations and procedures. I understand that I will be informed immediately of any changes that would affect site personnel safety.

Signed ______________________________ Date ______________________

Range of Dates From: ______________________________
To: ______________________________

Signed ______________________________ Date ______________________

Range of Dates From: ______________________________
To: ______________________________

Signed ______________________________ Date ______________________

Range of Dates From: ______________________________
To: ______________________________

Signed ______________________________ Date ______________________

FORM C-3
SUBCONTRACTOR AND SITE VISITOR SITE SAFETY FORM
PORT OF OLYMPIA EAST BAY REDEVELOPMENT
PORT OF OLYMPIA - 0615-034-07

I, ____, verify that a copy of the current site Safety Plan has been provided by GeoEngineers, Inc. to inform me of the hazardous substances on site and to provide safety procedures and protocols that will be used by GeoEngineers' staff at the site. By signing below, I agree that the safety of my employees is the responsibility of the undersigned company.

Signed ____________________________ Date ______________________

Firm: ____

Signed ____________________________ Date ______________________

Firm: ____

Signed ____________________________ Date ______________________

Firm: ____

Signed ____________________________ Date ______________________

Firm: ____

Signed ____________________________ Date ______________________

Firm: ____

Signed ____________________________ Date ______________________

Firm: ____