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**Lower Duwamish Waterway Superfund Site**  
*Terminal 117 Early Action Area*

**THIRD QUARTER 2008 INTERIM GROUNDWATER  
MONITORING DATA RESULTS –  
NON-TIME CRITICAL REMOVAL ACTION**

Prepared for

**The Port of Seattle  
and**

**The City of Seattle**

For submittal to:

**US Environmental Protection Agency, Region 10**

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# 1 Introduction

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This *Third Quarter 2008 Interim Groundwater Monitoring Data Results Report* (Report) presents the objectives, methodologies, and results of the interim groundwater monitoring activities preceding the Non-Time Critical Removal Actions (NTCRA) at the Terminal 117 (T-117) Early Action Area (EAA) of the Lower Duwamish Waterway (LDW) Superfund Site in Seattle, Washington (Figure 1). This report was prepared on behalf of the Port of Seattle (Port), and the City of Seattle (City) for submittal to the U.S. Environmental Protection Agency (EPA) in accordance with the *Statement of Work* amendment (SOW, EPA 2007) appended to the NTCRA Administrative Settlement Agreement and Order on Consent (Settlement Agreement) issued on December 22, 2005.

The investigation described herein was performed in accordance with the *Interim Groundwater Monitoring Plan* (Plan; ENSR 2008a) and the *Quality Assurance Project Plan – Non-Time Critical Removal Action – Preliminary Investigation and Interim Groundwater Monitoring Plan* (QAPP; ENSR 2008b) submitted on behalf of the Port and the City to EPA on March 4, 2008.

The Fourth Quarter 2008 Interim Groundwater monitoring event is planned for December 2008.

## 1.1 PURPOSE AND OBJECTIVES

The groundwater monitoring network at T-117 includes 11 wells, as shown on Figure 2. The monitoring wells are located to provide specific information on the T-117 Upland groundwater (Table 1 in the *Interim Groundwater Monitoring Plan*, ENSR 2008a). Monitoring wells (MW-02 through MW-08R) are located along the shoreline to assess the groundwater entering the LDW. Additionally, MW-02 and MW-06 are located downgradient of the highest historical PCB concentrations in contact with groundwater. The shoreline wells are spread out along the entire T-117 Upland shoreline border. Monitoring well MW-03 is located in the center of T-117 Upland near a historical industrial well. New monitoring wells MW-09, MW-10, MW-11 and existing monitoring well MW-01 are upgradient and assess the groundwater quality entering the site from Basin Oil. Monitoring wells MW-09 and MW-10 were installed in February 2008 to assess the groundwater quality entering the site from Basin Oil. Monitoring wells MW-04R, MW-05R, and MW-08R were re-installed in February 2008, these wells were removed during previous site activities along the riverbank. MW-11 was installed on September 2, 2008 to further assess the groundwater quality entering the site from Basin Oil.

The objectives of the *Interim Groundwater Monitoring Plan*, as stated in the SOW are to:

- ◆ Determine if groundwater migrating onto the T-117 Upland contains contaminants at levels that have the potential to recontaminate the T-117 Upland area
- ◆ Determine if groundwater at the T-117 Upland contains contaminants at levels that have the potential to cause unacceptable human exposures or cause contaminants to migrate into the LDW sediments (including any bank or sediment areas created as part of the NTCRA) at levels exceeding the Washington State Sediment Management Standards or Washington State Water Quality Standards.

In addition to the objectives listed in the SOW, this report also presents all the data associated with the installation of monitoring well MW-11.

The data collected during the Third Quarter 2008 groundwater sampling event was collected and evaluated in accordance with the SOW, the Plan, the QAPP, the Deeper Well Installation Work Plan (ENSR 2008d), and EPA Comments for the *First Quarter 2008 Interim Groundwater Monitoring Data Results Report* (ENSR 2008c).

## **1.2 REPORT ORGANIZATION**

This report is organized as follows:

- ◆ Section 1 describes the background and the purpose and objectives of the investigation
- ◆ Section 2 describes the methods and field procedures used to complete the investigation
- ◆ Section 3 provides details of the data quality assurance, management, and usability of the investigation
- ◆ Section 4 describes the field results of the interim groundwater monitoring -third event investigation
- ◆ Section 5 summarizes the soil analytical results
- ◆ Section 6 summarizes the groundwater analytical results
- ◆ Section 7 provides a summary of the next quarterly sampling event
- ◆ Section 8 provides references cited in the report
- ◆ The appendices provide the groundwater monitoring, well installation, and other field forms, and laboratory and data validation reports and corresponding lab and validation qualifier table.

## **2 Sampling Process, Methods and Field Procedures**

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The installation and development of monitoring well MW-11 was performed September 2-3, 2008. Interim groundwater monitoring activities were performed September 10-12, 2008. All groundwater monitoring activities were conducted in accordance with the Plan (ENSR 2008a), the QAPP (ENSR 2008b), and the *Deeper Well Installation Work Plan* (ENSR 2008d).

### **2.1 WELL INSTALLATION**

One monitoring well, MW-11, was installed in the T-117 Uplands on September 2, 2008. MW-11 was installed in the Dallas Avenue right-of-way, approximately five feet north of MW-10 (Figure 2). The purpose of this well is to further assess the groundwater quality entering the site from Basin Oil. The well location was selected based on the presence of select low level chlorinated volatile organic compounds (VOC) detections in the upper few feet of the aquifer at both MW-9 and MW-10 during the 1Q08 and 2Q08 interim groundwater sampling events. The location of, and the approach to, installation of this well were discussed with Ecology on July 17, 2008, and detailed in the *Deeper Well Installation Work Plan* (ENSR, 2008d).

MW-11 was drilled to a total depth of 23 feet below ground surface (ft-bgs), where the on-site geologist first observed a low-permeability silt layer. This silt layer indicates the stratigraphic transition from alluvium to a post-glacial and glacial stratigraphic unit. This silt is a regionally significant aquitard, allowing very little movement of groundwater. Appendix A contains the boring log for MW-11. A sample of soil was collected using EPA Method 5035A from immediately above the silt and was analyzed for chlorinated VOCs by EPA Method 8260B (see Section 5). Soil analytical results are provided in Table 5.

New well MW-11 was developed on September 3, 2008, approximately 24 hours after installation, in accordance with the QAPP. There were no deviations from the procedure outlined for well development in the QAPP during this activity.

### **2.2 GROUNDWATER SAMPLING**

On September 10 through September 12, 2008 groundwater samples were collected from the five existing, three replacement wells, and one newly-installed monitoring well on the T-117 Upland and streets portion of the EAA. MW-09 and MW-10 were not sampled due to insufficient water in the wells to collect a representative sample (approximately 0.27 feet and 0.24 feet of water respectively; see field forms in Appendix A).

All groundwater samples were collected in accordance with EPA-approved low-flow groundwater sampling techniques via peristaltic pump as described in the QAPP. All groundwater monitoring wells were purged until the aquifer stabilized according to the QAPP before groundwater samples were collected. See Section 4.4 for well

stabilization details. Field notes detailing aquifer stabilization parameters can be found in Appendix A. All groundwater sample collection equipment was decontaminated between sample locations in accordance with the QAPP.

Monitoring wells located on the T-117 Upland are affected by the tidal cycles of the Lower Duwamish Waterway (LDW). Due to this, optimal timing for the collection of groundwater samples is governed by the tides. A tidal study was conducted in 2003 by Windward and a second tidal study was conducted by ENSR in March 2008. The results of the March 2008 tidal study and the results of the first two groundwater sampling events of 2008 were used to determine the timing of groundwater sampling in monitoring wells MW-02 through MW-08R for the 3Q08 sampling event.

Two monitoring wells went dry during the groundwater sampling event: MW-09 and MW-10. Monitoring wells MW-09 and MW-10 went dry immediately after purging and did not recharge with a sufficient amount of water for further groundwater sampling. Both MW-09 and MW-10 were gauged each day to measure recharge. During all the gauging events sufficient recharge was not observed. Because of the lack of sufficient groundwater recharge samples were not collected during this sampling event from MW-09 or MW-10.

There were no deviations from the procedures outlined for collecting groundwater samples in the QAPP during this field activity.

### **2.3 ADDITIONAL FIELD PROCEDURES**

Additional field procedures were conducted in accordance with all methods and procedures listed in the QAPP. These included: instrument/equipment calibration and maintenance; decontamination; sample handling and custody; sample packing and labeling; sample log-in; and inspection/acceptance of supplies and consumables.

### 3 Data Quality Assurance, Management, and Usability

This section discusses the quality assurance (QA) and management process for the analytical data collected during the interim groundwater monitoring. In addition to the discussion of the data QA process (which includes the analytical methodology and data validation), this section describes the content and usability of the data.

#### 3.1 ANALYTICAL METHODS

##### 3.1.1 Soil Analytical Methods

One soil sample was collected during the installation of monitoring well MW-11 from 22.75- 23.0 feet below ground surface. This soil sample was submitted for analysis to ARI. The soil analysis requested was for volatile organic compounds (VOCs) via EPA Method 8260B. The method reporting limit for this analyte is from 0.005 to 9 mg/kg, depending on the analyte.

##### 3.1.2 Groundwater Analytical Methods

Groundwater samples were collected and analyzed from nine monitoring wells in accordance with the QAPP and the Plan. All groundwater samples were submitted for analysis to ARI. Requested groundwater analysis is summarized below.

**Table 1 Summary of Groundwater Analytical Methods**

ANALYTE	METHOD	METHOD REPORTING LIMIT
PCBs	EPA 8082 Low Level	0.01 µg/L
Diesel Range Hydrocarbons	NWTPH-Dx	0.25 mg/L
Lube Oil Range Hydrocarbons	NWTPH-Dx	0.50 mg/L
Gasoline Range Hydrocarbons	NWTPH-Gx	0.25 mg/L
Total Suspended Solids	EPA 160.2	1 mg/L
Semi-Volatile Organic Compounds (SVOCs) including Polycyclic Aromatic Hydrocarbons (PAHs)	EPA 8270D and EPA 8270D SIM	0.1 µg/L for PAHs, 0.1 to 10 µg/L for other SVOCs
Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX)	NWTPH-Gx/EPA 8021	1,000 µg/L
Volatile Organic Compounds (VOCs)	EPA 8260B	0.2 to 5 µg/L (depending on analyte)
Metals	6010B – Ag, Be, Cd, Cr, Cu, Ni, Pd, Se, Sb, Ti, Zn; 7470 – Hg 7060A – As	0.0001 to 0.05 mg/L (depending on metal)

**Notes:**

PCB – Polychlorinated Biphenyls

EPA – Environmental Protection Agency



NWTPH-Dx – Northwest analytical method for diesel and heavy oil range hydrocarbons

NWTPH-Gx – Northwest analytical method for gasoline range hydrocarbons

µg/L – microgram per Liter

mg/L – milligrams per Liter

Ag – Silver; As – Arsenic; Be – Beryllium; Cd – Cadmium; Cr – Chromium; Cu-Copper; Ni – Nickel;

Pd – Palladium; Se – Selenium; Sb – Antimony; Ti – Thallium; Zn – Zinc; Hg – Mercury

### 3.2 DATA VALIDATION

All data validation followed the guidelines provided in US EPA's *Contract Laboratory Program (CLP) National Functional Guidelines for Organic/Inorganic Data Review*, document numbers EPA540/R-99/008 and EPA540/R-04/004 of October 1999 (Organic) and October 2004 (Inorganic), and the US EPA's *Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review*, document number USEPA-540-R-07-003, July 2007 (EPA 2007b), as they applied to the reported methodology.

A Level 4 CLP-like fully validated data package (EPA 1991) was generated and the data was validated and qualified using the control limits specified in Table 1-1 of the QAPP. Data validation reports for the investigation, including a summary table of the laboratory assigned qualifiers and the validation assigned qualifiers, are included in Appendix B. In these reports, conclusions regarding data validation criteria (accuracy, precision, completeness, and method compliance) are provided.

#### Groundwater and Soil Data Validation Results

Precision, accuracy, method compliance, and completeness of the data set have been determined to be acceptable, based on the data submitted. Generally, all analytical data was within acceptable QAQC standards with the exception of two analytes from MW-01. 2-chloroethylvinylether (Method 8260B) and 3,3'-dichlorobenzidine (Method 8270D) were rejected based on non-recovery of the matrix spike. The *Data Validation Report for Groundwater* can be found in Appendix B. A table summarizing the laboratory applied qualifiers and the validation applied qualifiers is included in Appendix B.

The QA Officer reviewed field notebooks, laboratory report, and results of the data validation to determine if the Data Quality Objectives (DQO) had been met. The usability of the data depends on the magnitude of the DQO exceedance; data that has been rejected has been flagged as "R" and maintained in the database, but will not be used in any decision making. All of the data collected for the Investigation Report are considered usable except where noted above.

## 4 Field Results

### 4.1 WELL INSTALLATION

One new monitoring well, MW-11, was installed on September 2, 2008. Well locations are shown in Figure 2. The completion details of all monitoring wells are summarized below. Copies of field forms, and the boring log for MW-11, are included in Appendix A.

**Table 2 Monitoring Well Details**

WELL ID	NORTHING	EASTING	TOC ELEVATION MLLW	SURFACE ELEVATION MLLW	SCREENED INTERVAL FT-BGS
MW-01	195296.3657	1275296.941	21.87	22.09	5-15
MW-02	195347.51	1275518.55	15.48	15.855	4.25-14.25
MW-03	195477.519	1275394.665	16.45	16.741	1.5-11.5
MW-04R	195661.809	1275342.79	18.86	19.19	4-14
MW-05R	195541.824	1275433.99	17.33	17.68	5-15
MW-06	195425.761	1275502.07	16.32	16.518	5-15
MW-07	195734.1446	1275130.851	19.85	20.247	10-20
MW-08R	195713.021	1275271.02	19.4	19.69	9-19
MW-09	195472.421	1275223.403	23.4	23.85	5-15
MW-10	195387.319	1275270.011	22.83	23.17	5-15
MW-11	195393.337	1275267.281	23.07	23.31	13-23

Notes:

- 1) MW-1, MW-4R, MW-5R, MW-8R, MW-9, and MW-10 were surveyed in March 2008, elevations in MLLW
- 2) MW-2, MW-3, MW-6, MW-7 were converted from NAVD88 to MLLW using the LDW conversion (by adding 2.42 ft)

<http://www.nws.usace.army.mil/PublicMenu/Documents/Reg/applications/tides/np/np92.cfm>

- 3) MW-11 was surveyed in September 2008, elevation in MLLW

TOC – Top of Casing

MLLW – Mean Low Low Water Datum

ft-bgs – feet below ground surface

### 4.2 WELL DEVELOPMENT

New monitoring well MW-11 was developed on September 3, 2008, approximately 24 hours after installation and in accordance with the QAPP.

### 4.3 GROUNDWATER SAMPLING TIMES

A 48-hour tidal study was conducted March 4-6, 2008 (ENSR, 2008c). The primary purpose of this tidal study was to determine the effect of tidal variations from the LDW on groundwater and to determine the prevailing groundwater flow direction

and gradient across the EAA. The results of the tidal study were used to determine the most accurate times to collect groundwater samples to: a) ensure samples are representative of the aquifer and not river water from the LDW; and b) provide consistency from sampling event to sampling event.

Table 3 (below) provides a summary of the recommended groundwater sample times for each well at the site based on the results of the tidal study conducted in March 2008. The sample times were chosen during the lowest tide, at the point of maximum drawdown in a given well, to allow for sampling when the groundwater gradient is toward the LDW. This approach is consistent with previous groundwater sampling events and designed to ensure the capture of water flowing from the surrounding aquifer to the LDW (Windward, DOF, Onsite 2003; Windward, DOF, Onsite 2005; RETEC 2006). The tidal study also indicated that the upgradient monitoring wells—MW-01, MW-09, MW-10, and MW-11— are not tidally influenced (ENSR, 2008c).

**Table 3 Recommended Groundwater Sample Times for 3Q08**

WELL ID	LAG TIME	SAMPLE TIME FOR 9/10/2008	SAMPLE TIME FOR 9/11/2008	SAMPLE TIME FOR 9/12/2008	DRY WELLS*	FINAL SAMPLE TIMES FOR 9/10/2008	FINAL SAMPLE TIMES FOR 9/11/2008	FINAL SAMPLE TIMES FOR 9/12/2008
MW-01	Sample Any Time							
MW-02	2:15	10:07	11:02	11:47		10:07	11:02	11:47
MW-03	0:45	8:37	9:32	10:17	2:41	5:56	6:51	7:36
MW-04R	-1:45	6:07	7:02	7:47		6:07	7:02	7:47
MW-05R	2:25	10:17	11:12	11:57		10:17	11:12	11:57
MW-06	1:05	8:57	9:52	10:37	3:43	5:14	6:09	6:54
MW-07	0:30	8:22	9:17	10:02		8:22	9:17	10:02
MW-08R	0:40	8:32	9:27	10:12		8:32	9:27	10:12
MW-09	Sample Any Time							
MW-10	Sample Any Time							
MW-11	Sample Any Time							

\*Difference calculated between suggested and actual samples time from June 2008 GW sampling event

#### 4.4 GROUNDWATER MONITORING FIELD PARAMETERS

Stabilized field parameters measured during the Second Quarter 2008 groundwater sampling event are summarized below. This section discusses the results of each field parameter in detail below.

**Table 4 Stabilized Field Parameters**

WELL	SAMPLE DATE	FIELD PARAMETERS						
		TIME	TEMPERATURE	PH	CONDUCTIVITY	DISSOLVED OXYGEN	ORP	TURBIDITY
			(°C)	PH UNITS	(µS/CM)	(MG/L)	(MV)	(NTU)
MW-1	9/11/2008	8:40	15.2	5.94	0.758	1.55	48.5	0.75
MW-2	9/10/2008	10:00	18.01	6.6	0.577	0.24	-78.7	1.77
MW-3	9/10/2008	6:20	16.86	6.33	0.432	0.14	-60.2	7.31
MW-4R	9/11/2008	6:53	16.03	6.94	21.9	3.8	-165.2	1.14
MW-5R	9/10/2008	10:30	16.47	6.97	15.03	5.74	177.5	0.2
MW-6	9/11/2008	7:15	15.41	6.7	3.48	3.35	112.9	6.12
MW-7	9/10/2008	8:20	15.89	5.8	0.19	2.45	24.4	1.11
MW-8R	9/10/2008	8:50	15.31	7.21	24.5	3.64	233.3	0.26
MW-9	Not Sampled - Dry Well							
MW-10	Not Sampled - Dry Well							
MW-11	9/11/2008	9:17	13.81	6.55	0.674	0.36	-238.4	1
<b>Sitewide Minimum</b>			13.81	5.8	0.19	0.14	-238.4	0.2
<b>Sitewide Maximum</b>			18.01	7.21	24.5	5.74	233.3	7.31
<b>Sitewide Mean</b>			15.89	6.56	7.50	2.36	6.01	2.10

**Notes:**

Stabilized field parameters are the last measured values before collecting groundwater samples.

°C – degrees Celsius

µS/cm – microSiemens per centimeter

mg/L – milligrams per Liter

mV – millivolts

NTU – Nephelometric Turbidity Units

NC – Not collected

**4.4.1 pH**

The mean pH of groundwater across the monitoring well network during the reporting period was 6.56, with a minimum value of 5.80, and a maximum value of 7.21. The minimum value was detected in MW-07 and the maximum value was detected in MW-08R. These results are consistent with the First and Second Quarter 2008 results.

**4.4.2 Conductivity**

The mean conductivity (µS/cm) of groundwater during the reporting period was 7.50, with a minimum value of 0.19, and a maximum value of 24.5. The maximum value was detected in MW-08R; the minimum value was detected in MW-07. The maximum value result is much higher than the Second Quarter 2008 result, and approximately twice as high as the First Quarter 2008 result. The minimum values are consistent with the First and Second Quarter 2008 results. The higher conductivity results are overall more consistent with the First Quarter 2008 results than the Second Quarter results.

#### **4.4.3 Temperature**

The mean temperature (°C) of groundwater during the reporting period was 15.89 with a minimum value of 13.81 and a maximum value of 18.01. The temperature fluctuation of groundwater varies seasonally. The maximum value was detected in MW-02 and the minimum value was detected in MW-11. These results are slightly higher than last quarter.

#### **4.4.4 Dissolved Oxygen**

The typical dissolved oxygen (DO) concentration in groundwater is between 0 mg/L and 10 mg/L, which is equal to the saturation index of dissolved oxygen in water. The mean DO concentration in groundwater during the sampling event was 2.36 mg/L, with a minimum value of 0.14 mg/L (MW-03), and a maximum value of 5.74 mg/L (MW-05R). This is consistent with the First and Second Quarter 2008 results. The maximum value has slightly decreased from the Second Quarter results.

#### **4.4.5 Oxidation-Reduction Potential**

The mean oxidation-reduction potential (ORP) in groundwater during the reporting period was 6.01 mV, with a minimum value of -238.4, and a maximum value of 233.3 mV. Negative ORP values indicate reducing conditions. Three wells (MW-02, MW-03, and MW-04R) had negative ORP values during aquifer stabilization prior to groundwater sampling. The maximum value was detected in MW-08R. Only MW-03 has been consistently reading negative results during the First and Second Quarter sampling events. The addition of MW-02 and MW-04R having negative results could be due to instrument error.

#### **4.4.6 Turbidity**

The mean turbidity in groundwater during the reporting period was 2.10 NTU with a minimum value of 0.20 in MW-05R and a maximum value of 7.31 in MW-03. These results are slightly higher than last quarter, but overall consistent.

## 5 Well Installation Soil Analytical Results

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This section presents the soil analytical results from the installation of MW-11 prior to the Third Quarter 2008 groundwater sampling event.

One soil sample was collected from MW-11 during installation from 22.75– 23.0 feet below ground surface, immediately above the silt layer. The soil sample was collected via EPA Method 5035 and analyzed for VOCs by EPA Method 8260B. Soil analytical results were compared to MTCA Method A Cleanup Levels for unrestricted land use.

The soil sample from MW-11 had a detection of acetone at a concentration of 0.0033 mg/kg. There is no established MCTA Method A Cleanup Level for acetone. All other analytes were not detected.

The soil analytical results are presented in Table 5.

## 6 Groundwater Analytical Results

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This section presents the results from the Third Quarter 2008 groundwater sampling event conducted between September 10 and September 12, 2008. Groundwater samples were collected from nine of the eleven groundwater monitoring wells (MW-09 and MW-10 were not sampled due to insufficient groundwater). Groundwater samples were analyzed for PCBs, TPH, PAHs and SVOCs, VOCs, BTEX, total and dissolved metals. Groundwater results were compared to the following screening levels:

- ◆ TPH/NWTPH screening levels obtained from the MTCA Method A Cleanup Level for unrestricted land use (Ecology 2007)
- ◆ PCBs screening levels are obtained from the Surface Water ARAR – Aquatic Life – Marine/Chronic – National Toxics Rule, 40 CFR 131 (EPA 1993)
- ◆ Cadmium, copper, lead, and silver screening levels are obtained from the WAC Chapter 173-201A-Aquatic Life – Marine/ Acute Water Quality Standards for Surface Waters of the State of Washington (WAC 2006)
- ◆ All other groundwater screening levels were obtained from the Surface Water ARAR – Human Health – Marine – Clean Water Act §304 (EPA 1988).

Table 6 presents the analytical results from the September 2008 groundwater sampling event. Table 7 summarizes the detected constituents in groundwater samples collected since 2003. Appendix B contains the laboratory and data validation reports.

## 6.1 POLYCHLORINATED BIPHENYLS (PCBs)

Aroclor® 1260 was the only PCB detected in groundwater during this sampling event. Aroclor® 1260 was detected in the groundwater from MW-01 (0.088 µg/L), and MW-03 (0.52 µg/L) each at a concentration above the PCB screening level of 0.03 µg/L (WAC Chapter 173-201 Water Quality Standards for Surface Waters of the State of Washington). Aroclor® 1260 was also detected in MW-05R and MW-06; both detections were below screening level values. All four detections for Aroclor® 1260 have been flagged and qualified by the ENSR data validator as likely being an indistinguishable combination of both Aroclor® 1254 and Aroclor® 1260 (see Data Validation Report in Appendix B). Groundwater results for PCBs are below the laboratory detection limit for the remaining wells. Detections of PCBs are consistent or lower than previous sampling results (see Table 7).

Groundwater from MW-01 had a detection of Aroclor® 1260 (0.088 µg/L) during the September 2008 sampling event. This is the first time MW-01 has had a detected result for PCBs this year. MW-01 will continue to be monitored for PCBs during the next quarterly sampling event to determine trends.

MW-03 had a detection of Aroclor® 1260 (0.52 µg/L) during the September 2008 sampling event. During the March 2008 sampling event MW-03 had a detection of Aroclor® 1260 at a concentration of 2 µg/L. MW-03 will continue to be monitored for PCBs during the next quarterly sampling event.

MW-05R had a detection of Aroclor® 1260 (0.014 µg/L) during the September 2008 sampling event. Historically, MW-05R has had PCB results above the screening level of 0.03 µg/L. The results of the first quarter 2008 sampling event was 0.057 µg/L, and the second quarter 2008 event had an Aroclor® 1260 of 0.039J for MW-05R. The third quarter 2008 sampling event result has decreased from the first and second quarter sampling events showing consistently decreasing values of PCBs over time.

MW-06 had a detection of Aroclor® 1260 (0.026 µg/L) during the September 2008 sampling event. This result has decreased from the first and second quarter 2008 events. This is the fourth time the well has been sampled for total PCBs since the 1999 soil removal, and the first time PCBs have been below the screening level. Aroclor® 1260 was detected during the August 2006 event at a concentrations of 0.02 µg/L, in March 2008 at 0.082 µg/L, and in June 2008 at 0.76J µg/L. Detections of total PCB will be monitored at this well during the next quarterly sampling event to determine trends.

## 6.2 TOTAL PETROLEUM HYDROCARBONS (TPH)

During the September 2008 sampling event three monitoring wells, MW-02, the duplicate of MW-02, and MW-03 reported detections of diesel and motor oil range hydrocarbons. Diesel range hydrocarbons were detected at MW-02 (0.79 mg/L), the duplicate of MW-02 (0.67 J mg/L), and MW-03 (4.0 mg/L). Motor oil range

hydrocarbons were detected at MW-03 (3.8 mg/L). Gasoline range hydrocarbons were not detected in the groundwater in any of the 9 monitoring wells sampled.

Detections during the September 2008 sampling event are consistent with historic groundwater sample results. While results are consistent, they continue to exceed the MTCA Method A Cleanup Level for unrestricted land use (0.5 mg/L). TPH will be monitored in future groundwater sampling events to assess TPH levels in groundwater.

### **6.3 POLYCYCLIC AROMATIC HYDROCARBONS (PAHs) AND SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)**

PAHs were detected in MW-02, the duplicate of MW-02, and MW-03. Below is a summary of PAH detections by monitoring well:

- ◆ MW-02 and the duplicate of MW-02: 1-Methylnaphthalene (both at 0.1 µg/L)
- ◆ MW-03: Chrysene (0.25 µg/L), Fluorene (0.13 µg/L), and Pyrene (0.17µg/L).

The following PAH was detected above their respected screening level of 0.018 µg/L (Surface Water ARAR - Human Health - Marine - Clean Water Act §304):

- ◆ Chrysene - MW-03 (0.25 µg/L).

All other detected PAHs were below their respective screening levels.

Historically, PAHs were not detected above each analyte's respective reporting limit in any well with the exception of MW-03. During the May 2003 event PAHs were detected in the groundwater from MW-02, MW-03, and MW-05R. Chrysene was the only PAH detected above the screening level of 0.018 µg/L (May 2003, 0.1 µg/L). Though these compounds were detected, they were generally detected only slightly above the reporting limit (0.1 µg/L) and slightly above the screening levels (the lowest screening levels is 0.018 µg/L). PAHs will continue to be monitored during future sampling events.

SVOCs were detected in MW-02, the duplicate of MW-02, MW-04R, MW-05R, MW-06, MW-08R, and MW-11. Below is a summary of SVOC detections by analyte:

- ◆ bis(2-Ethylhexyl)phthalate - MW-02 (2.1 J µg/L), MW-04R (16 J µg/L), MW-05R (4.8 J µg/L), MW-06 (1.5 J µg/L), MW-08R (1.8 J µg/L), and MW-11 (19 J µg/L).
- ◆ Phenol: MW-02 (20 J µg/L), and the duplicate of MW-02 (9.6 J µg/L).

The following SVOC was detected above their respected screening level of 2.2 µg/L (Surface Water ARAR - Human Health - Marine - Clean Water Act §304):

- ◆ bis(2-Ethylhexyl)phthalate -MW-04R (16 J µg/L), MW-05R (4.8 J µg/L), and MW-11 (19 J µg/L).

SVOCs will continue to be monitored during future sampling events.



## 6.4 VOLATILE ORGANIC COMPOUNDS (VOCs)

Of the 71 VOCs analyzed for, 3 VOCs were detected in the groundwater from MW-02, the duplicate of MW-02, MW-03, and MW-11. All detected VOCs are below their respective screening level (Surface Water ARAR – Human Health – Marine – Clean Water Act §304). VOC detections are summarized below:

- ◆ Acetone – duplicate of MW-02 (4 J  $\mu\text{g/L}$ ), MW-03 (3.4  $\mu\text{g/L}$ ), and MW-11 (3.4  $\mu\text{g/L}$ )
- ◆ Chlorobenzene – MW-02 (0.5  $\mu\text{g/L}$ ), and the duplicate of MW-02 (0.6 J  $\mu\text{g/L}$ )
- ◆ Cis-1,2-Dichloroethene – MW-11 at a concentration of 2.9  $\mu\text{g/L}$
- ◆ VOCs will be monitored in future groundwater sampling events to assess VOC levels in groundwater across the site.

## 6.5 PRIORITY POLLUTANT METALS

Arsenic (total and dissolved), chromium (total), copper (total and dissolved), nickel (total and dissolved), silver (total and dissolved), and zinc (total) were the metals detected in groundwater samples collected during the September 2008 sampling event.

Arsenic (total and dissolved) was detected in the groundwater from MW-02 and the duplicate of MW-02. Arsenic was detected above the Surface Water ARAR – Human Health – Marine – Clean Water Act §304 screening level of 0.00014 mg/L for both wells with detections, from 0.09 mg/L (MW-02) to 0.11 mg/L (duplicate of MW-02).

Chromium (total) was detected below the screening level in the groundwater from MW-03 at a concentration of 0.012 mg/L.

Copper (total and dissolved) was detected in the groundwater from MW-01 and MW-03, MW-05R, MW-06, MW-07, and MW-11. Copper detections are all below the screening level of 0.48 mg/L (WAC Chapter 173-201A-Aquatic Life – Marine/Acute Water Quality Standards); detections ranged from 0.002 mg/L (MW-01, MW-07, and MW-11 [dissolved]) to 0.024 mg/L (MW-03 [total]).

Nickel (total and dissolved) was detected in groundwater from MW-11. Both total and dissolved concentrations are 0.01 mg/L, below the Surface Water ARAR – Human Health – Marine – Clean Water Act §304 of 4.6 mg/L.

Silver (total and dissolved) was detected in groundwater from MW-04R, MW-05R, MW-06, and MW-08R. Detections ranged from 0.003 mg/L (MW-06) to 0.03 (MW-04R and MW-08R). All detections are above the screening level of 0.0019 mg/L (WAC Chapter 173-201A-Aquatic Life – Marine/Acute Water Quality Standards).

Total zinc was detected in groundwater from MW-03 at a concentration of 0.02 mg/L. This is below the Surface Water ARAR – Human Health – Marine – Clean Water Act §304 of 26 mg/L.

Metals detected in the groundwater during the third quarter are less than or consistent with the previous results. It should be noted that the reporting limit for arsenic was elevated during the first quarter 2008 sampling event, as compared to the second/third quarter sampling event. The reporting limit was 0.05 mg/L during the first quarter sampling event and 0.001 mg/L during the second quarter, the lower reporting limit was achieved by using a different laboratory analysis method.

**Table 5 T-117 MW-11 Soil Analytical Results**

**Table 6 T-117 Third Quarter 2008 Groundwater Results**



**Table 7 T-117 Groundwater Detections 2003 – Present**





















## 7 Upcoming Sampling Event – Fourth Quarter 2008

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The fourth quarter 2008 sampling event is schedule for December 9-11, 2008. This time coincides with a negative low tide of -1.1 feet (on December 9) to a maximum negative low tide of -3.5 feet <sup>1</sup> (on December 11). Sampling during the lowest negative tide, at the point of maximum drawdown, ensures sampling is performed when the groundwater gradient is toward the LDW (ENSR 2008c). The timing of sampling in each well will be consistent with the first, second and third quarter 2008 sample results.

As stated in the SOW, EPA may approve a reduction in the analyte list upon demonstration that certain analytes are not of concern at specific monitoring locations or throughout the T-117 EAA. No reduction in the analyte list is requested for the fourth quarter 2008 groundwater sampling event. Arsenic will be analyzed by graphite furnace atomic absorption (GFAA) to obtain a lower reporting limit. Groundwater samples will be submitted for the following analysis:

- ◆ PCBs by Method 8082
- ◆ TPH (gasoline and diesel) by NWTPH-DX and NWTPH-Gx
- ◆ TSS by Method 160.2
- ◆ PAHs and SVOCs by 8270D SIM
- ◆ BTEX by NWTPH-Gx/EPA 8021
- ◆ VOC by 8260
- ◆ Total and dissolved priority pollutant metals by 6010B, 7060A (arsenic) and 7470A (mercury).

In addition to the analysis above, groundwater from 3 of the site monitoring wells will also be sampled for dioxin/furans (method SW846 Method 8290). One upland monitoring well (MW-10) and two bank monitoring wells (MW-05R and MW-08R) were selected to be representative of current site conditions. These wells will be sampled in accordance with the QAPP. This event will be limited to the fourth quarter 2008 sampling event, unless screening criteria are exceeded. The results and future sampling discussion will be included in the fourth quarter 2008 groundwater report.

The fourth quarter 2008 groundwater report will be submitted to EPA within 60 days of the sampling event.

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<sup>1</sup> Tide Chart: [http://tidesandcurrents.noaa.gov/get\\_predictions.shtml?year=2008&stn=1814+Seattle](http://tidesandcurrents.noaa.gov/get_predictions.shtml?year=2008&stn=1814+Seattle)



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# Figures

## **Appendix A**

### **Field Forms and MW-11 Well Log**

## **Appendix B**

### **Third Quarter 2008 Laboratory, Data Validation Reports and Qualifier Summary Table**

**(NOTE: Provided on attached CD-ROM)**