

Southwest Harbor Terminal 5 Groundwater Quality Monitoring Evaluation Report Seattle, Washington

Prepared for Port of Seattle

July 8, 2014 17627-00





Southwest Harbor Terminal 5 Groundwater Quality Monitoring Evaluation Report Seattle, Washington

Prepared for Port of Seattle

July 8, 2014 17627-00

Prepared by Hart Crowser, Inc.

Page missimini

**Roger McGinnis** Senior Associate Environmental Chemist

#### CONTENTS

1.0 INTRODUCTION	1
2.0 BACKGROUND	1
2.1 Remediation Area (RA) Descriptions 2.2 Monitoring Locations 2.3 Monitoring Schedule	2 4 6
3.0 SCOPE OF WORK	6
4.0 GROUNDWATER ELEVATIONS	7
<i>4.1 Site Hydrogeology 4.2 Groundwater Elevations</i>	7 7
5.0 GROUNDWATER SAMPLING AND ANALYTICAL RESULTS	8
5.1 Surface Water Quality Screening Criteria 5.2 Groundwater Concentrations Protective of Surface Water 5.3 Monitoring Well Groundwater Sampling and Analysis	8 9 10
6.0 FUTURE ESTUARINE WELL GROUNDWATER MONITORING PROGRAM	13
7.0 CONCLUSIONS	15
8.0 LIMITATIONS	15
9.0 REFERENCES	15

# TABLES

1	Summary of Monitoring Well Groundwater Elevation Data
2	Surface Water Quality Screening Criteria
3	RA-1 Groundwater Monitoring and Analytical Results - Spokane Street Area
4	RA-2 Groundwater Monitoring and Analytical Results
5	RA-3 and RA-1 Groundwater Monitoring and Analytical Results - Buckley Yard Area

6 RA-5 Groundwater Monitoring and Analytical Results - Spokane Street Area

Page

# **CONTENTS (Continued)**

Vicinity Map

Site Plan

#### FIGURES

1

2

3	Fill Aquifer Groundwater Elevation Contours, 72 Hour Mean 09-24-03	
4	Fill Aquifer Groundwater Elevation Contours, 72 Hour Mean 12-19-03	
5	Estuarine Aquifer Groundwater Elevation Contours, 72 Hour Mean 09-24-03	
6	Estuarine Aquifer Groundwater Elevation Contours, 72 Hour Mean 12-19-03	
EVA	LUATION OF GROUNDWATER CHEMICAL	
CON	ICENTRATIONS PROTECTIVE OF SURFACE WATER	
GRC	OUNDWATER CHEMICAL CONDITIONS	A-1
Iden	tification of Constituents of Potential Concern	A-1
Gro	undwater Screening Process	A-2
Gro	undwater Screening Results	A-3
Natı	Iral Attenuation of Dissolved Groundwater Chemicals	A-3
FAT	F AND TRANSPORT MODELING	A-4
Mod	lel Input Parameters	A-5
Mod	leling Results	A-6
Tida	l Mixing	A-7
SU№	IMARY AND CONCLUSIONS	A-8
501		74-0
REF	ERENCES	A-9

#### TABLES

Marine Surface Water Screening Criteria
Statistical Summary of Groundwater Quality Data
Well-by-Well Statistical Summary of Groundwater Quality Data
Summary of Input Parameters Used for Groundwater Transport Model
Summary of Groundwater Transport Modeling Results

#### FIGURE

#### A-1 Site Plan

#### **CONTENTS (Continued)**

## APPENDIX B GROUNDWATER SAMPLING PROCEDURES AND SAMPLE HANDLING METHODS

Groundwater Level Measurements	B-1
Groundwater Sampling	B-1
Sample Handling and Laboratory Analysis	B-2
Investigation-Derived Waste Storage and Disposal	B-2

APPENDIX C MONITORING WELL BORING LOGS

APPENDIX D GROUNDWATER SAMPLING FORMS

APPENDIX E CHEMICAL DATA QUALITY REVIEW AND CERTIFICATES OF ANALYSIS <u>Page</u>

# LIST OF ACRONYMS

Bis(2-ethylhexyl) phthalate
below ground surface
Burlington Northern Santa Fe Railway
chlorinated ethanes and ethenes
dichloroethene
Washington State Department of Ecology
Environmental Protection Agency
Groundwater Quality Monitoring Evaluation Report
Groundwater Confirmation Monitoring Program
Investigation-derived waste
Tetrachloroethene
Port of Seattle
Remediation Area
Southwest Harbor Project
Seattle Steel Incorporated
trichloroethene

#### SOUTHWEST HARBOR TERMINAL 5 GROUNDWATER QUALITY MONITORING EVALUATION REPORT SEATTLE, WASHINGTON

#### **1.0 INTRODUCTION**

This Groundwater Quality Monitoring Evaluation Report (GQMER) presents the results from four semiannual (twice yearly) groundwater monitoring events for the Phase II Southwest Harbor Project (SWHP) Groundwater Confirmation Monitoring Program (GWCMP) located at the Southwest Harbor Terminal 5 (Site) in Seattle, Washington (Figure 1). The purpose of the GWCMP is to confirm that soil remedial actions conducted under the individual SWHP Cleanup Action Plans are protective of surface water quality for the Site as a whole.

Phase I of the GWCMP focused on characterizing the post-remediation groundwater flow system at the Site in 2006. The resulting Hydrologic Characterization Report (Aspect 2007a) presented a detailed characterization of the post-remediation groundwater flow system, and concluded that Fill Aquifer flow conditions at the Site had equilibrated sufficiently to proceed with Phase II of the GWCMP.

This report summarizes the sampling activities and laboratory results for the four sampling events, completed by Aspect Consulting in October 2008, March/April 2009, and September 2009 and by Hart Crowser in June 2010. Sampling was performed in accordance with the Ecology-approved Water Quality Monitoring Plan (Aspect 2007 b).

Our work was completed in general accordance with our executed contract dated April 29, 2010, authorized by Mr. Brian Knight with the Port of Seattle.

#### 2.0 BACKGROUND

The SWHP is located along the base of the West Seattle highlands at the confluence of the West Waterway of the Duwamish River (West Waterway) and Elliott Bay. The Site location is shown on Figure 1. The SWHP comprises approximately 185 areas of land generally bordered by Harbor Avenue and non-Port industrial and commercial properties on the west, SW Spokane Street and non-Port commercial properties on the south, Elliott Bay and Florida Street on the north, and the original Terminal 5 on the east. Most of the SWHP overlies former tideflats that have been filled and used for various industrial purposes,

including but not limited to railroad yards, wood treatment facilities, steel scrap storage, and a municipal and wood waste landfill.

The SWHP was divided into five Remediation Areas (RAs). Figure 2 shows the SWHP area and the boundaries of each RA. To facilitate Port plans for redevelopment, the individual RAs were remediated in the mid- to late-1990s. RA-1, RA-2, RA-3 and RA-5 were redeveloped under oversight by Ecology, while RA-4 was addressed under agreement with EPA. The locations and histories of the individual RAs and specific remedial actions completed at each RA are summarized below.

#### 2.1 Remediation Area (RA) Descriptions

#### 2.1.1 Spokane Street Properties (RA-1)

RA-1 consists of two disconnected land parcels (Figure 2). The narrow northern strip of land in RA-1 is the site of the former Buckley Yard, a rail car staging area that dates from the 1920s. The portion of RA-1 south of the former Buckley Yard is referred to as the Spokane Street Properties, which was historically occupied by an aluminum foundry, a chemical distribution warehouse, automotive repair areas, a fuel oil distribution facility and retail food stores. Soil contamination associated with the Spokane Street Properties was remediated between 1994 and 1998. Low-level soil contamination associated with the Buckley Yard was left in place. Asphalt and concrete covers were placed over the Buckley Yard, except in the northern portion of the area east of RA-3, where 24 inches of ballast cover was placed under the railroad tracks. Presently, RA-1 is occupied by Burlington Northern Santa Fe (BNSF) rail spurs, the main access road into the intermodal yard facility, and office buildings.

### 2.1.2 Former Salmon Bay Steel Property (RA-2)

RA-2 is the former Salmon Bay Steel property, located north of Spokane Street (Figure 2), and was used to store slag and scrap for the steel mill south of Spokane Street from the early 1900s until the 1970s. The area also included two large warehouses, a scale, and railroad spurs. Beginning in the late 1800s, the tideflats on the property were gradually filled with dredge sediment, slag, and steel mill debris. This fill material is predominantly slag, and reaches depths of 25 feet in places. Between 1996 and 1998, a cleanup measure was implemented that involved covering a quarter of the RA with a gravel ballast cap and the remainder of the RA with an impermeable asphalt pavement cap. Prior to this effort, the contaminated soil from areas where the gravel ballast cover was to be placed was moved to areas where asphalt cover would be placed. Presently, the western portion of RA-2 is occupied by the BNSF Rail Yard, and

the eastern portion is occupied by the main entrance and south end of the intermodal yard.

# 2.1.3 Former West Seattle Landfill and Purdy Scrap/Former Seattle Steel Inc. Property (RA-3)

RA-3 was the location of both the West Seattle Landfill and the former Seattle Steel Incorporated (SSI) property (Figure 2), a scrap metal processing company. The West Seattle Landfill occupied 30 acres (approximately three-guarters of this RA) and was in operation from 1939 to 1966. The former landfill was almost entirely covered with slag, construction debris, steel mill debris, and an unengineered soil cover. In the spring of 1995, near-surface refuse from the eastern portion of the landfill was relocated to a consolidation landfill area on the western portion of the RA. An interim cover consisting of processed solid landfill material was placed over the property. Since this time, an engineered cover consisting of clean fill and a low-permeability geomembrane has been placed over the former landfill, and an asphalt cover has been placed over the former SSI property south of the landfill. The Port operates a landfill gas collection and treatment system in the former landfill area. Presently, the asphalt-paved area on the consolidated landfill portion of RA-3 is used for tenantlease activities including truck and vehicle parking, container chassis storage, and temporary construction laydown and component assembly for Sound Transit's light rail project.

### 2.1.4 Pacific Sound Resources Superfund Site (RA-4)

RA-4, a former wood treating facility referred to as the Pacific Sound Resources Superfund site, is being addressed separately under the Superfund process by EPA (Figure 2). Monitoring of groundwater downgradient of RA-4, for the purpose of verifying RA-4 cleanup action protection, is not included in the scope of the GWCMP. However, the portion of RA-4 south of Florida Street is being considered under this GWCMP in order to evaluate groundwater flow from RA-4 into the adjacent remediation areas.

Until 1994, when remediation activity began, the north portion of RA-4 (north of the Florida Street alignment) was occupied by wood treating operations, and the south portion was the location of a kiln building, laboratory area, sawmill, office building and storage areas for treated and untreated stock (Retec 1994). Remediation involved limited removal of contaminated soils and the placement of a specially-designed, low-permeability asphalt concrete cap over the entire RA. Woodwaste from an area at the west side of the RA was recycled off site and the resulting excavation pit was backfilled with fill. A geotextile identifier layer was installed throughout the RA between clean import fill and underlying

contaminated soils. In addition, a groundwater containment slurry wall was built in the northern portion of the property to reduce tidal influence on groundwater in the RA interior and limit migration of contaminants into Puget Sound. RA-4 is presently occupied by the northern end of the Terminal 5 intermodal yard, the BNSF Storage Track Yard, and the Jack Block Public Shoreline Access and Park area.

#### 2.1.5 Former Lockheed Shipyard 2 (RA-5)

RA-5 was originally a tideflat zone that has since been filled with dredge sediment, slag, and construction debris. The western portion of the remediation area (Figure 2), filled prior to 1936, was the site of Nettleton Lumber until the late 1960s. The eastern portion of the RA was filled in the late 1950s, becoming the location of Lockheed Shipyard 2, which operated from 1956 to 1987 as a ship maintenance and refitting yard. In 1994, the area used for shipbuilding operations underwent excavation and treatment of contaminated soils. Pursuant to this cleanup effort, the shipyard-era storm drain system was removed or abandoned, and the associated contaminated storm drain sediments were disposed of. In addition, an asphalt concrete cap was placed over the entire site and a new stormwater drainage system was installed. Presently, RA-5 is used by the intermodal yard tenant for parking and interim container storage.

#### 2.2 Monitoring Locations

The study area addressed in the GWCMP encompasses most of the SWHP Site, including the former Buckley Yard and Spokane Street Properties (RA-1), former Salmon Bay Steel Property (RA-2), former West Seattle Landfill and SSI property (RA-3), and the former Lockheed Shipyard 2 (RA-5). Phase II of the GWCMP involves sampling of Fill and Estuarine Aquifer monitoring wells within and/or downgradient of these RAs.

Figure 2 presents the locations of 11 Fill Aquifer and 3 Estuarine Aquifer monitoring wells that are currently sampled as part of the Phase II monitoring network. These wells are used to monitor groundwater quality within and/or downgradient of the target RAs, as follows:

- Wells CMP-17 and MW-125 monitor Fill Aquifer groundwater quality downgradient of the former Spokane Street Properties (RA-1).
- Well CMP-3 monitors Fill Aquifer groundwater quality downgradient of RA-2 and the extreme southern portion of the former Buckley Yard (RA-1).

- Well CMP-4, located within the former Buckley Yard (RA-1), monitors Fill Aquifer groundwater quality within this RA, and immediately downgradient of the central portion of RA-3.
- Well MW-308N monitors Fill Aquifer groundwater quality downgradient of the northern portions of the former Buckley Yard (RA-1) and RA-3.
- Well MW-308S monitors Estuarine Aquifer groundwater quality downgradient of the northern portions of the former Buckley Yard (RA-1) and RA-3.
- Well CMP-15 monitors Fill Aquifer groundwater quality on flow paths that transect the central and/or northern portions of the former Buckley Yard (RA-1) and RA-3, the southern portion of RA-4, and the western portion of RA-5.
- Well MW-36 monitors Estuarine Aquifer groundwater quality on flow paths that transect the central and/or northern portions of the former Buckley Yard (RA-1) and RA-3, the southern portion of RA-4, and the western portion of RA-5.
- Well MW-26R monitors Fill Aquifer groundwater quality on flow paths that transect the central portions of the former Buckley Yard (RA-1) and RA-3, the southern portion of RA-4, and the eastern portion of RA-5.
- Well MW-44 monitors Estuarine Aquifer groundwater quality on flow paths that transect the central portions of the former Buckley Yard (RA-1) and RA-3, the southern portion of RA-4, and the eastern portion of RA-5.

Four Phase II GWCMP wells were sampled to monitor background water quality upgradient of the target RAs, as follows:

- Background wells FM-105 and CMP-1 are located on the southern borders of RA-1 and RA-2, respectively. These wells monitor the quality of groundwater that flows beneath the Nucor Steel facility and SW Spokane Street, and enters the SWHP from the south.
- Background well CMP-2 monitors groundwater quality entering the SWHP from commercial/industrial areas located immediately southwest of RA-2.
- Background well CMP-5, located immediately upgradient of RA-3, monitors groundwater quality along the flow path of recharge from the adjacent West Seattle highlands.

The Phase II GWCMP monitoring network comprises monitoring wells sited for the Phase I groundwater flow characterization. It is possible that one or more of the monitoring wells may not prove to be optimal for Phase II water quality monitoring. The first four rounds of groundwater monitoring during the Phase II GCWMP have been completed and are summarized within this groundwater quality monitoring evaluation report. A summary of the recommendations for the replacement or addition of wells to better meet the goals of the Phase II program are detailed in Section 6.0.

#### 2.3 Monitoring Schedule

In accordance with the Groundwater Conceptual Letter, Phase II groundwater sampling was performed semiannually (twice yearly) (Port of Seattle 1999). Aspect Consulting completed two low-level groundwater sampling events in October 2008 and September 2009 and one high-level groundwater sampling event in March/April 2009. Hart Crowser completed the second high-level groundwater sampling event in June 2010.

Figure 2 shows the spatial distribution of monitoring wells that are currently sampled as part of the Phase II monitoring network.

#### **3.0 SCOPE OF WORK**

The purpose of the Phase II Southwest Harbor Project (SWHP) Groundwater Confirmation Monitoring Program (GWCMP) is to confirm that soil remedial actions conducted under the individual SWHP Cleanup Action Plans are protective of surface water quality for the Site as a whole.

The groundwater monitoring tasks included in Phase II are described below.

- Measure depth to water in sampled monitoring wells to determine groundwater elevation contours during the high-level groundwater sampling event (Table 1).
- Sample 14 monitoring wells in the existing monitoring well network using low-flow sampling methods.
- Monitor field parameters (dissolved oxygen, pH, temperature, specific conductivity, and turbidity) using a flow-through cell during purging and sampling.

 Collect and submit one grab groundwater sample for chemical analysis, using low-flow sampling, from each monitoring well location.

## **4.0 GROUNDWATER ELEVATIONS**

#### 4.1 Site Hydrogeology

The Site is underlain by two aquifers, a shallow Fill Aquifer and a deeper Estuarine Aquifer. Eleven wells are completed in the Fill Aquifer and three wells are completed in the Estuarine Aquifer. The Fill Aquifer consists of groundwater in various fill materials between 20 to 40 feet below ground surface (bgs). Sandy Silt to silty fine Sand tideflat deposits, typically 1 to 10 feet in thickness, occur between the Fill and Estuarine Aquifer zones over most of the Site with the exception of the easternmost portion near the West Waterway, and in isolated areas near the former axis of Longfellow Creek along the eastern edge of RA-3. Where present, this low-permeability unit results in locally confined conditions in the Estuarine Aquifer zone. The Estuarine Aquifer is underlain by a lower permeability unit that occurs at depths ranging from 30 to 50 feet bgs. The Fill Aquifer/Estuarine Aquifer system is bounded to the north by Elliott Bay and to the east by the West Waterway. The aquifers thin to the south and west and terminate to the west against the West Seattle bluff, encountering deposits of the low-permeability Lawton Clay unit.

#### 4.2 Groundwater Elevations

The depth to water was measured in all the monitoring wells during the June 2 through June 4, 2010, groundwater sampling event. Monitoring well groundwater elevation data for all four groundwater sampling events (low and high levels) are summarized and presented in Table 1. Since groundwater at the Site is tidally influenced and water levels were measured over a 3-day period, meaningful groundwater contours could not be plotted. Post-redevelopment and tidally corrected groundwater elevation contours based on a 72-hour mean during dry and wet season in the Fill and Estuarine Aquifers are provided in Figures 3 through 6 (Aspect 2007a).

### 4.2.1 Fill Aquifer

The groundwater elevations during the June 2010 measurements for shallow monitoring wells in the Fill Aquifer ranged from 8.67 to 15.09 feet bgs. Groundwater elevations in all monitoring wells increased by 0.29 to 1.85 feet relative to the September 2009 monitoring event. Based on the Aspect Consulting Hydrologic Characterization Report (2007a), groundwater flows in

the Fill Aquifer monitoring wells were generally toward the east-northeast of the West Seattle uplands, beneath RA-3, and then diverged toward the nearest water body, West Waterway or Elliott Bay, within the main Terminal 5 area. The most recent groundwater elevation contours based on a 72-hour mean during dry and wet seasons in the Fill Aquifer are provided in Figure 3 and 4, respectively. In general, Fill Aquifer groundwater flows measured during the June 2010 sampling event showed a similar trend to what was observed during the long-term study conducted by Aspect Consulting.

#### 4.2.2 Estuarine Aquifer

The groundwater elevations in the deep monitoring wells completed in the Estuarine Aquifer ranged from 8.29 to 9.44 feet bgs. Groundwater elevations in monitoring wells MW-308A(S) and MW-36 were 0.27 to 0.38 feet lower than nearby shallow monitoring wells screened in the Fill Aquifer, indicating that a downward gradient exists between the Fill Aquifer and the Estuarine Aquifer. A downward gradient was not observed at the shallow and deep monitoring well cluster, MW-26R and MW-44. This is likely due the absence of a lowpermeability confining unit on the easternmost portion of the Site near the West Waterway. However, based on the Aspect Consulting Hydrologic Characterization Report (2007a), groundwater flows in the Estuarine Aquifer monitoring wells were generally from the southwest toward the northeast, with discharge to Elliott Bay and the West Waterway. The most recent groundwater elevation contours based on a 72-hour mean during dry and wet season in the Estuarine Aquifer are provided in Figure 5 and 6, respectively. During the June 2010 sampling event, only three deep monitoring wells (MW-308S, MW-36, and MW-44) were measured, providing inadequate data for field verification of groundwater flows observed during the long-term study conducted by Aspect Consulting.

### 5.0 GROUNDWATER SAMPLING AND ANALYTICAL RESULTS

#### 5.1 Surface Water Quality Screening Criteria

As noted in the Groundwater Conceptual Letter (Port of Seattle 1999), the remediation activities completed at each of the RAs are believed to be protective of groundwater quality whose highest beneficial use is discharge to surface water. Since surface water is the assumed final receptor of groundwater, surface water quality screening criteria were included in this report for preliminary comparison purposes only. Potential surface water quality screening criteria for each analyte are summarized in Table 2. Note that the most stringent surface water criterion for arsenic is 0.14 ug/L. However, since Ecology has established the natural background concentration of arsenic in groundwater at 5 ug/L (MTCA Method A), arsenic concentrations were screened against the established background concentration of 5 ug/L. It should also be noted that surface water quality criteria are based on dissolved metals concentrations. Since the work plan for the SWHP GWCMP specified analysis of total metals, depending upon turbidity and suspended solids concentrations, reported groundwater metal concentrations may have an artificially high bias relative to the dissolved metals criteria they are being screened against.

#### 5.2 Groundwater Concentrations Protective of Surface Water

As part of this Groundwater Quality Monitoring Evaluation Report, a memorandum was developed to identify the appropriate groundwater chemical concentrations that are protective of surface water, against which the GWCMP data should be compared (Appendix A).

The protectiveness of current groundwater chemical concentrations was assessed by modeling natural attenuation of chemical constituents within the groundwater aquifer to determine if chemicals detected in groundwater are naturally attenuated to concentrations below surface water quality criteria prior to discharge to Puget Sound marine water.

Fate and transport modeling using BIOSCREEN was conducted to predict contaminant concentrations at the shoreline. The natural attenuation processes simulated in the modeling include dispersion and sorption. Biodegradation and tidal mixing processes were not included in the model.

The model results show that even under the conservative conditions, predicted concentrations of most constituents of potential concern (COPCs), including bis(2-ethylhexyl)phthalate, PAHs and PCBs detected in groundwater will not exceed the screening level concentrations at the shoreline within 100 years. For organic compounds, groundwater concentrations as high as the solubility limit would not result in an exceedance of surface water quality criteria at the shoreline.

Tidal dilution factors ranging from 4 to 10,000 have been reported from groundwater modeling at the Terminal 5 and adjacent sites (Aspect 2007; Retec 1998). Use of the lowest tidal dilution estimate of four would further reduce the calculated chemical concentrations at the shoreline after 100 years by an additional factor of four. Incorporation of chemical degradation rates would result in even lower chemical concentrations at the groundwater to surface water interface.

#### 5.3 Monitoring Well Groundwater Sampling and Analysis

Groundwater samples were collected from the 11 shallow Fill Aquifer monitoring wells (CMP-1, CMP-2, CMP-3, CMP-4, CMP-5, CMP-15, CMP-17, MW-26R, MW-125, MW-308N, and FM-105) and the deep Estuarine Aquifer monitoring wells (MW-36, MW-44, and MW-308S) to evaluate water quality in the Fill and Estuarine Aquifers.

All groundwater samples were submitted for chemical analysis of:

- cPAHs by EPA Method 8270C-SIM;
- PCBs by EPA Method 8082;
- TPH-Dx by NWTPH-Dx with silica gel cleanup; and
- Bis(2-ethylhexyl) phthalate (BEHP) by EPA Method 8270C.

Additionally, selected groundwater samples were submitted for chemical analysis of:

- VOCs, chlorinated ethanes and ethenes (CEE's) by EPA Method 8260B for monitoring wells FM-105, MW-125, and CMP-17;
- Total metals by EPA Method 6010B/6020 for antimony, arsenic, chromium, copper, lead, and nickel for monitoring wells CMP-15, MW-26R, MW-36, and MW-44; and
- Total metals by EPA Method 6010B/6020 for arsenic and lead for monitoring wells CMP-1, CMP-2, CMP-3, CMP-4, CMP-5, CMP-17, MW-125, MW-308N, MW-308S, and FM-105.

Details of the low-flow sampling procedures are presented in Appendix A. The monitoring well boring logs for the Phase II GWCMP monitoring network are presented in Appendix B. Field water quality parameters including pH, temperature, conductivity, dissolved oxygen, and turbidity were monitored during groundwater sampling of the Fill and Estuarine Aquifer monitoring wells. Field water quality monitoring results are provided on the groundwater sampling forms presented in Appendix C. The review of chemical data quality and laboratory certificates is included in Appendix D.

Tables 3 through 6 present the tabulated field monitoring and analytical results for the RA-1 and RA-3, RA-2, and RA-5, respectively, for the four groundwater monitoring events (October 2008, March/April 2009, September 2009, and

June 2010). Groundwater quality data are organized by RA, background/ confirmation monitoring location, aquifer designation, and sampling date.

#### 5.3.1 Spokane Street Properties (RA-1)

Groundwater samples were collected from within the Fill Aquifer from one upgradient background monitoring well (FM-105) and two confirmation monitoring wells (MW-125 and CMP-17) to evaluate water quality within RA-1. Groundwater monitoring and analytical results for the Phase II GWCMP are summarized in Table 3. Additional information or clarification for selected analytes and monitoring wells is provided below.

Total arsenic was detected in all background and confirmation monitoring wells. Concentrations were comparable in the background monitoring well, FM-105, and the confirmation monitoring well, MW-125. Concentrations in confirmation monitoring well, CMP-17, were somewhat higher and may be indicative of the more reducing conditions (lower dissolved oxygen) in CMP-17.

Bis(2-ethylhexyl) phthalate (BEHP) was detected in the duplicate groundwater sample but not the primary groundwater sample collected from background monitoring well, FM-105, in March 2009. BEHP was not detected in groundwater samples from the two downgradient confirmation monitoring wells, MW-125 and CMP-17.

Tetrachloroethene (PCE) and its degradation products, trichloroethene (TCE) and dichloroethene (DCE) were detected in the upgradient background monitoring well FM-105 and confirmation monitoring wells, MW-125 and CMP-17 indicating that contamination is from an off-site source not associated with the RA-1 area. Concentrations of the more mobile degradation compounds TCE and DCE are slightly higher in downgradient confirmation monitoring well CMP-17 than in background well MW-125.

### 5.3.2 Former Salmon Bay Steel Property (RA-2)

Groundwater samples were collected from within the Fill Aquifer from two upgradient background monitoring wells (CMP-1 and CMP-2) and one confirmation monitoring well (CMP-3) to evaluate water quality within RA-2. Groundwater monitoring and analytical results for the Phase II GWCMP are summarized in Table 4. Additional information or clarification for selected analytes and monitoring wells is provided below.

Total arsenic concentrations ranged from 2.6 to 3.1 ug/L in background monitoring well CMP-1, from 20.8 to 23.2 ug/L in background monitoring well

CMP-2, and from 6.6 to 11.6 ug/L in confirmation monitoring well CMP-3 indicating that contamination is from an off-site source not associated with the RA-2 area.

Total lead concentrations ranged from 1 to 15 ug/L in background monitoring well CMP-2 and from non-detected to 4 ug/L in confirmation monitoring well CMP-3 indicating that contamination is from an off-site source not associated with the RA-2 area.

#### 5.3.3 Former West Seattle Landfill and Purdy Scrap/Former Seattle Steel Inc. Property (RA-3), Former Buckley Yard (RA-1)

Groundwater samples were collected from within the Fill Aquifer from one upgradient background monitoring well (CMP-5) and two confirmation monitoring wells (CMP-4 and MW-308N) within RA-3 and RA-1, and one monitoring well (MW-308S) within the Estuarine Aquifer to evaluate water quality within RA-3 and RA-1. Groundwater monitoring and analytical results for the Phase II GWCMP are summarized in Table 5. Additional information or clarification for selected analytes and monitoring wells is provided below.

BEHP was detected in background well CMP-5 and confirmation monitoring well CMP-4. Background concentrations were higher than the confirmation well concentrations suggesting that contamination is from an off-site source.

# 5.3.4 Former Lockheed Shipyard 2 (RA-5)

Groundwater samples were collected from within the Fill Aquifer from one upgradient background monitoring well (CMP-5) and two confirmation monitoring wells (CMP-15 and MW-26R) and two monitoring wells (MW-36 and MW-44) within the Estuarine Aquifer to evaluate water quality within RA-5. Groundwater monitoring and analytical results for the Phase II GWCMP are summarized in Table 6. Additional information or clarification for selected analytes and monitoring wells is provided below.

Diesel- and motor oil-range petroleum hydrocarbons were not detected with the exception of Estuarine Aquifer well MW-44, which had a concentration of 530 ug/L. This single result may be questionable. Monitoring well MW-44 is located in a container storage area with heavy truck traffic and, therefore, is susceptible to small oil drips on the pavement. In addition, the flush-mount well monument was full of water, presumably runoff from the pavement, which had to be removed before the well could be sampled.

Concentrations of BEHP detected in background well CMP-5 were higher than the confirmation and Estuarine Aquifer well concentrations suggesting that contamination is from an off-site source not associated with RA-5.

#### 6.0 FUTURE ESTUARINE WELL GROUNDWATER MONITORING PROGRAM

As noted in the Ecology-approved Water Quality Monitoring Plan (Aspect 2008), the remediation activities completed at each of the RAs are believed to be protective of groundwater quality whose highest beneficial use is discharge to surface water. As such, the Phase II GWCMP is not expected to continue indefinitely. Groundwater monitoring will continue for one additional year (one high water and one low water event) after the submittal of this Groundwater Quality Monitoring Evaluation Report. Groundwater monitoring may be continued after that time in select monitoring wells for select analytes, if Ecology and the Port are in mutual agreement that additional groundwater monitoring is warranted to meet the GWCMP program's objectives. Once the goal of demonstrating that surface water protection is met, groundwater monitoring will be discontinued.

In addition, as specified in the Ecology-approved work plan and in accordance with the Groundwater Conceptual Letter (Port of Seattle 1999):

"Assessment of whether modifications to the monitoring network are warranted will occur on an ongoing basis as the program progresses. The Port will evaluate the initial findings after completion of the first year of groundwater monitoring, and may propose modifications to the monitoring network at that time. Water quality in the monitored Estuarine Aquifer wells will be evaluated after 1 year of monitoring. If no inorganic or organic constituents are detected in the Estuarine Aquifer wells above background levels during the first year, these wells will be dropped from the program and the assessment of the Estuarine Aquifer will be considered complete."

The Port has continued monitoring estuarine wells for an additional year beyond the time required by the work plan. The following changes to groundwater monitoring for Estuarine Aquifer wells will be implemented based on the fact that the analytes have not been detected in estuarine wells during four rounds of semiannual groundwater monitoring conducted over a 2-year period, between October 2008 and June 2010 or chemical concentrations in estuarine wells are less than background levels.

#### Estuarine Well MW-308S

- TPH monitoring in Estuarine Aquifer well MW-308S will be discontinued since TPH has not been detected in this monitoring well.
- Lead monitoring in Estuarine Aquifer well MW-308S will be discontinued since lead has not been detected in this monitoring well.
- cPAH monitoring in Estuarine Aquifer well MW-308S will be discontinued since cPAHs have not been detected in this monitoring well.
- PCB monitoring in Estuarine Aquifer well MW-308S will be discontinued since PCBs have not been detected in this monitoring well.

#### **Estuarine Well MW-36**

- TPH monitoring in Estuarine Aquifer well MW-36 will be discontinued since TPH has not been detected in this monitoring well.
- Antimony, chromium, copper, and lead monitoring in Estuarine Aquifer well MW-36 will be discontinued since these analytes have not been detected in this monitoring well.
- cPAH monitoring in Estuarine Aquifer well MW-36 will be discontinued since cPAHs have not been detected in this monitoring well.
- PCB monitoring in Estuarine Aquifer well MW-36 will be discontinued since PCBs have not been detected in this monitoring well.

#### Estuarine Well MW-44

- PCB monitoring in Estuarine Aquifer well MW-44 will be discontinued since PCBs have not been detected in this monitoring well.
- Estuarine Aquifer well, MW44, which had a questionable detection of TPH will be redeveloped prior to the next round of groundwater sampling to determine if TPH is actually present in the groundwater or if it was an artifact resulting from surface water leaking into the monitoring well casing. If TPH is not detected during the next monitoring event (October 2010), TPH monitoring will be discontinued.

#### 7.0 CONCLUSIONS

Groundwater concentrations at Terminal 5 are protective of surface water for all chemicals included in the long-term groundwater monitoring program. For semivolatile organic compounds, natural attenuation modeling demonstrates that groundwater concentrations at the shoreline would be non-detect even after 100 years. Incorporation of chemical degradation rates and tidal mixing factors would further decrease groundwater chemical concentrations and would also result in non-detect concentrations for volatile organic compounds and metals near the shore.

In accordance with the Ecology-approved work plan and the Groundwater Conceptual Letter groundwater monitoring will be discontinued in estuarine wells for chemicals that have not been detected during the past two years.

#### **8.0 LIMITATIONS**

Work for this project was performed, and this report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of Port of Seattle for specific application to the referenced property. This report is not meant to represent a legal opinion. No other warranty, express or implied, is made.

#### 9.0 REFERENCES

Aspect Consulting, LLC, 2002. Tidal Monitoring Study Report, Phase I Groundwater Confirmation Monitoring Program, Southwest Harbor Project, Bainbridge Island, Washington. Unpublished work.

Aspect Consulting, LLC, 2007a. Southwest Harbor Project, Phase I Groundwater Confirmation Monitoring Program, Hydrologic Characterization Report, Bainbridge Island, Washington. January 18, 2007.

Aspect Consulting, LLC, 2007b. Southwest Harbor Project, Phase II Groundwater Confirmation Monitoring Program, Water Quality Monitoring Plan, Bainbridge Island, Washington. March 2, 2007.

Aspect Consulting, LLC, 2009. Southwest Harbor Project, Phase II Groundwater Confirmation Monitoring Program, Groundwater Quality Monitoring Data Report, Bainbridge Island, Washington. December 21, 2009. Port of Seattle, 1999. Groundwater Conceptual Letter, submitted by the Port of Seattle to the Washington State Department of Ecology, dated March 1999.

Retec, 1994. Current Conditions Report, Pacific Sound Resources Superfund Site, Remediation Area 4, Southwest Harbor Cleanup and Redevelopment Project. Seattle, Washington. Unpublished Work.

RETEC 1998. Final Upland Groundwater Remedial Investigation and Feasibility Study Report. Pacific Sound Resources Superfund Site, Southwest Harbor Project Remediation Area 4. Prepared for the Port of Seattle, Seattle, Washington. November 13, 1998.

Retec, 2004. Upland Groundwater Remedy 2003 Annual Monitoring Report, Pacific Sound Resources Superfund Site, Terminal 5, Dated June 7, 2004.

L:\Jobs\1762700\T5 Groundwater Report 070814\Revised T5 GW Report.doc

#### Table 1 - Summary of Monitoring Well Groundwater Elevation Data

Well Name	TOC Elevation in Feet <sup>(1)</sup>	Date	DTW in Feet	Groundwater Elevation in Feet
Fill Aguifer				
CMP-1	22.71	10/13/2008 3/31/2009 9/4/2009 6/4/2010	12.92 12.21 13.10 11.83	9.79 10.50 9.61 10.88
CMP-2	22.67	10/13/2008 3/31/2009 9/2/2009 6/4/2010	12.92 12.92 13.60 11.75	9.75 9.75 9.07 10.92
CMP-3	17.40	10/14/2008 4/1/2009 9/3/2009 6/2/2010	8.40 7.90 8.45 7.60	9.00 9.50 8.95 9.80
CMP-4	19.92	10/14/2008 4/2/2009 9/3/2009 6/2/2010	11.04 10.34 11.01 10.17	8.88 9.58 8.91 9.75
CMP-5	23.80	10/13/2008 4/1/2009 9/2/2009 6/3/2010	10.09 8.48 10.12 8.71	13.71 15.32 13.68 15.09
CMP-15	18.42	10/14/2008 4/2/2009 9/3/2009 6/3/2010	10.38 9.91 10.14 9.75	8.04 8.51 8.28 8.67
CMP-17	18.43	10/13/2008 3/31/2009 9/2/2009 6/4/2010	9.47 9.05 9.50 8.81	8.96 9.38 8.93 9.62
MW-26R	18.27	10/14/2008 4/1/2009 9/3/2009 6/4/2010	9.91 9.66 9.69 9.40	8.36 8.61 8.58 8.87
MW-125	15.90	10/13/2008 3/31/2009 9/2/2009 6/3/2010	6.88 6.40 7.01 6.25	9.02 9.50 8.89 9.65
MW-308A(N)	14.86	10/13/2008 4/2/2009 9/4/2009 6/3/2010	6.53 5.86 6.50 5.73	8.33 9.00 8.36 9.13
FM-105	20.80	10/13/2008 3/31/2009 9/2/2009 6/3/2010	11.20 10.76 11.36 10.70	9.60 10.04 9.44 10.10

#### Table 1 - Summary of Monitoring Well Groundwater Elevation Data

Well Name	TOC Elevation in Feet <sup>(1)</sup>	Date	DTW in Feet	Groundwater Elevation in Feet
Estuarine Aquifer				
		10/14/2008	10.00	7.60
		4/2/2009	9.06	8.54
MW-36	17.60	9/3/2009	9.72	7.88
		6/2/2010	9.31	8.29
		10/14/2008	10.90	7.48
	18.38	4/1/2009	8.94	9.44
MW-44		9/3/2009	11.46	6.92
		6/2/2010	8.94	9.44
		10/13/2008	6.30	8.12
		4/1/2009	5.74	8.68
MW-308B(S)	14.42	9/4/2009	6.17	8.25
		6/3/2010	5.56	8.86

Notes:

TOC - Top of Casing.

DTW - Depth to Water.

Vertical datum is in Feet MLLW.

(1) Based on a professional survey completed by Aspect Consulting, LLC (December 21, 2009).

Table 2 - Surface Water Quality Screening Criteria. Screening Levels for Groundwater Based on Marine Surface Water Criteria

Port of Seattle Terminal 5 Southwest Harbor

	1			1	Cumfo og Maton	Curfees Meter		Curfess Weter			1
					Surface water	Surface water		Surface water			
	Surface Water	Surface Water	Surface Water	Surface Water	ARAR - Aquatic	ARAR - Aquatic	Surface Water	ARAR - Human	Surface Water,	Surface Water,	
	ARAR - Aquatic	ARAR - Aquatic Life	ARAR - Aquatic	ARAR - Aquatic	Life -	Life -	ARAR - Human	Health – Marine	Method B,	Method B, Non-	
	Life -	Marine/Acute -	Life - Marine/Acute	Life -	Marine/Chronic -	Marine/Chronic -	Health – Marine	<ul> <li>– National</li> </ul>	Carcinogen,	Carcinogen,	
	Marine/Acute -	Clean Water Act	- National Toxics	Marine/Chronic -	Clean Water Act	National Toxics	– Clean Water	Toxics Rule, 40	Standard	Standard	Screening
	Ch 173-2014 WAC	\$304	Rule 40 CER 131	Ch 173-201A WAC	8304	Rule 40 CER 131	Act 8304	CFR 131	Formula Value	Formula Value	l evel <sup>2, 3</sup>
Δηριντο	(ug/L)	(ua/L)	(ug/L)		(ua/L)		(ua/L)	(ug/L)			
Analyte Metale (4)	(µg/⊏)	(µg/⊏)	(P9/E)	(µg/⊏)	(P9/L)	(µ9/⊏)	(µg/⊏)	(µg/⊏)	(µg/⊏)	(µg/Ľ)	(µg/⊏)
metals (4)											
Antimony							640	4300		1000	640
											0.14
Arsenic, inorganic	69	69	69	36	36	36	0.14	0.14	0.098	18	(5 - MTCA A GW)
Chromium (VI)	1100	50	1100	50	1100	50				490	50
Copper	4.8	4.8	2.4	3.1	3.1	2.4				2,700	2.4
Lead	210	210	210	8.1	8.1	8.1					8.1
Nickel soluble salts	74	74	74	8.2	8.2	8.2	4,600	4,600		1,100	8.2
Polychlorinated Biphenyls (PCBs)											
Aroclor 1016						0.03				0.0058	0.0058
Aroclor 1221											
Aroclor 1232											
Aroclor 1242											
Aroclor 1248											
Aroclor 1254						0.03				0.0017	0.0017
Aroclor 1260						0.03					0.03
Aroclor 1262											
Aroclor 1268											
Polychlorinated biphenyls	10			0.03	0.03	0.03	0.000064	0.00017	0.00011		0.000064
Total Petroleum Hydrocarbons	•	•	•		•			•			•
											500 <sup>5</sup>
											500 <sup>5</sup>
Chloringtod Voletile Organic Compounds (VOCo)											500
Chlorinated Volatile Organic Compounds (VOCS)	1	1	1	1	1	1	1	1	1		1
1,1,1,2- I etrachloroethane											
1,1,1-Trichloroethane										930,000	420,000
1,1,2,2-Tetrachloroethane							4	11	6.5		4
1,1,2-Trichloroethane							16	42	25	2,300	16
1,1-Dichloroethane											
1,1-Dichloroethene							7100	3.2		23,000	3.2
1,2-Dichloroethane							37	99	59	43,000	37
Chloroethane											
cis-1,2-Dichloroethene											
Tetrachloroethene							3.3	8.9	0.39	840	0.39
trans-1,2-Dichloroethene							10,000			33,000	10,000
Trichloroetlene							30	81	6.7	71	6.7
Vinyl chloride							2.4	530	3.7	6,600	2.4
Semivolatile Organic Compounds (SVOCs)											
bis(2-Ethylhexyl) phthalate							2.2	5.9	3.6	400	2.2
Carcinogenic Polycyclic Aromatic Hydrocarbons (CP	AHs)		•	•			•	•		•	•
Benzolalanthracene							0.018	0.031			0.018
Benzo[a]pvrene							0.018	0.031	0.03		0.018
Benzo[b]fluoranthene							0.018	0.031			0.018
Benzo[k]fluoranthene							0.018	0.031			0.018
Chrysene							0.018	0.031			0.018
Dibenzola hlanthracene							0.018	0.031		+	0.010
							0.018	0.031			0.010
							0.010	0.001			0.010

#### Notes

1. -- = Not established.

Screening levels may be adjusted depending on lab PQLs.
 Screening levels may be adjusted based on background data results
 Surface water quality criteria screening levels are based on dissolved metal concentrations.
 Screening levels based on MTCA Method A Cleanup levels for groundwater.

Abbreviations

 $\mu g/L$  = micrograms per liter. ARAR = applicable or relevant and appropriate requirements CFR = code of federal regulations

WAC = Washington Administrative Code

#### Table 3 - RA-1 Groundwater Monitoring and Analytical Results

POS Terminal 5 Southwest Harbor

Phase II GWCMP SWHP	Remediation Area 1 (former Spokane Street Properties)															
	Background								Confirmation Monitoring							
				U			Fill Aa	uifer				Ŭ				
Sample Name	FM105-	FM105-	FM105-	FM105-	FM105-	FM105-	EM105	MW125-	MW125-	MW125-	MW125	CMP17-	CMP17-	CMP17-	CMP17	
	081013	081013D	090331	090331D	090902	090902D		081013	090331	090902		081013	090331	090902	0	
Sampling Date	10/13/08	10/13/08	3/31/09	3/31/09	9/2/09	9/2/09	6/3/10	10/13/08	3/31/09	9/2/09	6/3/10	10/13/08	3/31/09	9/2/09	6/4/10	
Groundwater Level Measurements	10,10,00	10,10,00	0,01,00		0,2,00	0,2,00	0/0/10	10,10,00	0/01/00	0,2,00	0/0/10	10/10/00	0,01,00	0,2,00	0/ 1/ 10	
Reference Elevation in feet MLLW	20	80	20.8	30	20	80	20.80	15.90	15.90	15.90	15.90	18.43	18.43	18.43	18.43	
Depth To Water in feet		20	10.5	76	11	36	10.70	6.88	6.40	7.01	6.25	9.47	9.05	9.50	8.81	
Water Level Elevation in feet MLLW	0.6	20	10.1	10 M	9/	<u>л</u>	10.70	0.00	0.40	8.80	0.25	8.96	9.00	8.03	0.01	
Water Quality Field Parameters	5.0		10.0	J4 <u>i</u>	5.4		10.10	9.02	9.50	0.03	9.00	0.90	9.50	0.95	5.02	
Temperature in degrees Celsius	14	8	11	5	14	5	12 1	18.6	11.4	10.3	15.1	17.6	12.3	17.5	13.8	
nH	7 (	.0 13	62	6	50	15	6.45	6.61	6 18	5.94	6.42	6.61	6.05	5.83	6 10	
Conductivity in uS/cm	1.0	0	0.2	6	51	o 0	200	412	580	475	297	560	679	507	492	
Dissolved Oxygon in mg/l	44	27	47	6	0.6	0	0.07	412	1 74	475	2.47	0.1	0.30	0.32	403	
Dissolved Oxygen in hig/L	0.0	4	0.9		0.0		0.97	0.32	1.74	0.03	2.47	0.1	0.39	0.32	0.02	
Turbidity in NTOS		1	0.5	3	3.0	94	0	0.9	0.74	2.34	0	1.74	2	4.07	135	
Discol Ronge in ug/	250 U	250 11	250 11	250 11	250 11	250 11	100 11	250 11	250 11	250 11	100 11	250 11	250 11	250 11	100 11	
Dieser Range in µg/L	250 0	250 0	250 0	250 0	250 0	250 U	100 0	250 0	250 U	250 0	100 0	250 0	250 0	250 0	100 0	
Notor Oli Range in µg/L	500 0	500 U	500 U	500 0	500 U	500 U	200 0	500 0	500 U	500 U	200 0	500 0	500 U	500 0	200 0	
Total Metals by EPA Method 200.8											<u> </u>					
I otal arsenic, inorganic in µg/L	0.4	0.4	0.5	0.5	0.5	0.5	2 0	0.4	0.4	0.6	20	2.6	2.6	2.9	8.1	
I otal lead in µg/L	1 0	1 U	1 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	10 U	1 U	1 U	1 U	1 U	
Carcinogenic Polycyclic Aromatic Hydroc	arbons (cPAF	ls) by Method	8270D-SIM													
Benz(a)anthracene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.097	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	
Benzo(a)pyrene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.140	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	
Benzo(b)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.100	0.011	0.010 U	0.010 U	0.010 U	0.010 U	
Benzo(k)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.120	0.011	0.010 U	0.010 U	0.010 U	0.010 U	
Chrysene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.084	0.011	0.010 U	0.010 U	0.010 U	0.010 U	
Dibenzo(a,h)anthracene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.028	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	
Indeno(1,2,3-cd)pyrene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.051	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	
Semi-Volatile Organics by EPA Method 82	270D															
bis(2-ethylhexyl) phthalate in µg/L	1.0 U	1.0 U	1.0 UJ	5.8 J	1.0 U	1.0 U	1.4	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	
Polychlorinated Biphenyls (PCBs) by EPA	Method 8082															
Aroclor 1016 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	
Aroclor 1221 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	
Aroclor 1232 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	
Aroclor 1242 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	
Aroclor 1248 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	
Aroclor 1254 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	
Aroclor 1260 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	
Total PCBs in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	
Volatile Organic Compounds by EPA Met	hod 8260B				-	-			· · ·			· ·		-		
tetrachloroethane:1.1.1.2- in ug/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	
tetrachloroethane:1.1.2.2- in ug/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	
trichloroethane:1.1.1- in ug/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2	0.2 U	0.2 U	0.2	0.2 U	0.2 U	0.2 U	0.2 U	
trichloroethane;1,1,2- in µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	
dichloroethane;1,1- in µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.4	0.2	0.3	0.3	0.2 U	0.2 U	0.2 U	0.2 U	
dichloroethane;1,2- in ug/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	
ethyl chloride in µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	
tetrachloroethene in ua/L	6.1	6.2	3.4	3.7	5.2	5	5.7	6.7	4.1	5.1	5.4	0.3	0.2	0.3	0.2 IJ	
trichloroethene in ua/L	0.9	0.9	0.6	0.6	0.6	0.5	0.8	2.8	1.0	1.8	1.4	0.2 U	0.2 U	0.2 U	0.2 IJ	
dichloroethene:1.1- in ua/l	0.2 []	0.2 11	0.2 []	0.2 U	0.2 U	0.2 U	0.2 11	0.2 11	0.2 []	0.2 U	0.2 U	0.2 []	0.2 U	0.2 U	0.2 11	
dichloroethene;1,2cis in ua/L	0.7	0.7	0.4	0.5	0.2	0.2	2.5	2.1	0.4	1	1.5	0.2 U	0.2 U	0.2 U	0.2 U	
dichloroethene:1,2trans in ug/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	
vinyl chloride in µg/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	

U - Analyte was not detected at or above the reported result.

J - The analyte was detected above the reported quantitation limit, and the reported concentrations was an estimated value.

UJ - The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Detected concentrations are bolded.

#### Table 4 - RA-2 Groundwater Monitoring and Analytical Results

POS Terminal 5 Southwest Harbor

Phase II GWCMP SWHP

	Remediation Area 2 (former Salmon Bay Steel Property)											
		Background Confirmation Monitoring										
		Fill Aquifer										
Sample Name	CMP1-	CMP1-	CMP1-	CMP1	CMP2-	CMP2-	CMP2-	CMP2	CMP3-	CMP3-	CMP3-	CMP3
	081013	090331	090904		081013	090331	090902		081014	090401	090903	
Sampling Date	10/13/08	3/31/09	9/4/09	6/4/10	10/13/08	3/31/09	9/2/09	6/4/10	10/14/08	4/1/09	9/3/09	6/2/10
Groundwater Level Measurements												
Reference Elevation in feet MLLW	22.71	22.71	22.71	22.71	22.67	22.67	22.67	22.67	17.40	17.40	17.40	17.40
Depth To Water in feet	12.92	12.21	13.10	11.83	12.92	12.92	13.60	11.75	8.40	7.90	8.45	7.60
Water Level Elevation in feet MLLW	9.79	10.50	9.61	10.88	9.75	9.75	9.07	10.92	9.00	9.50	8.95	9.80
Water Quality Field Parameters												
Temperature in degrees Celsius	14.4	12.7	13.1	13.1	16.9	14.96	16.2	14.1	19.5	12.9	19.8	15.5
рН	6.9	6.23	6.36	6.61	9.38	9.08	8.42	9.01	10.96	8.68	10.01	9.55
Conductivity in µS/cm	563	506	511	482	1272	1402	1669	920	613	726	703	403
Dissolved Oxygen in mg/L	0.3	0.19	0.55	0.2	0.09	0.26	0.24	0.12	0.19	0.26	0.4	0.08
Turbidity in NTUs	1.76	1.17	0.78	38	0.86	1.58	1.31	4	1.09	1.8	5.3	4
Total Petroleum Hydrocarbons												
Diesel Range in µg/L	250 U	250 U	250 U	100 U	250 U	250 U	250 U	100 U	250 U	250 U	250 U	100 U
Motor Oil Range in µg/L	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U
Total Metals by EPA Method 200.8												
Total arsenic, inorganic in µg/L	2.8	2.7	3.1	2.6	22.7	23.2	20.8	23	11.6	6.6	8.3	7.4
Total lead in μg/L	1 U	1 U	1 U	1 U	15	1	1 U	2	1 U	4	1 U	1 U
Carcinogenic Polycyclic Aromatic Hydroc	arbons (cPAHs	s) by Method 8	3270D-SIM									
Benz(a)anthracene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010	0.010 U	0.010 U	0.010 U
Benzo(a)pyrene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.011	0.010 U	0.010 U
Benzo(b)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.019	0.010 U	0.010 U
Benzo(k)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.011	0.010 U	0.010 U
Chrysene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.013	0.015	0.010	0.010 U
Dibenzo(a,h)anthracene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Indeno(1,2,3-cd)pyrene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Semi-Volatile Organics by EPA Method 82	270D											
bis(2-ethylhexyl) phthalate in µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Polychlorinated Biphenyls (PCBs) by EPA	Method 8082											
Aroclor 1016 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.100 U	0.100 U
Aroclor 1221 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.100 U	0.100 U
Aroclor 1232 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.015 Y	0.010 U	0.010 U	0.010 U	0.010 U	0.100 U	0.100 U
Aroclor 1242 In µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.012 Y	0.010 U	0.010 U	0.010 0	0.200 Y	0.400 Y	0.100 U	0.100 U
Aroclor 1248 In µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.015	0.020	0.010 U	0.010 U	1.2 PJ	2.5
Arodor 1254 In µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010	0.010 U	0.150 Y	0.400 Y	0.100 Y	1.5
Total PCRs in ug/				0.010 U		0.010 0	0.010 0	0.010 0	0.000 Y			0.100 U
TUTAL FODS III µy/L	0.010 0	$0.010 \ 0$	0.010 0	0.010 0	0.012 1	U.UIS Y	0.031	0.02	0.200 Y	0.400 1	1.2 PJ	4

#### Notes

U - Analyte was not detected at or above the reported result.

Y - The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

P - The analyte was detected on both chromatographic columns but the quantified values differ by >=40% RPD with no obvious chromatographic interference.

J - The analyte was detected above the reported quantitation limit, and the reported concentrations was an estimated value.

Detected concentrations are bolded.

Hart Crowser 7/8/2014 1762700\Tables 1 and 3 through 6.xls

#### Table 5 - RA-3 and RA-1 Groundwater Monitoring and Analytical Results

POS Terminal 5 Southwest Harbor

Phase II GWCMP SWHP

		Remediation Area 3 (former West Seattle Landfill and SSI Property), Remediation Area 1 (Former Buckley Yard)														
	Background Confirmation Monitoring															
	Fill Aquifer								Estuarine Aquifer							
Sample Name	CMP5-	CMP5-	CMP5-	CMP5	CMP4-	CMP4-	CMP4-	CMP4	MW308N-	MW308N-	MW308N-	MW308N	MW308S-	MW308S-	MW308S-	MW308S
	081013	090401	090902		081014	090402	090903		081013	090402	090904		081013	090401	090904	
Sampling Date	10/13/08	4/1/09	9/2/09	6/3/10	10/14/08	4/2/09	9/3/09	6/2/10	10/13/08	4/2/09	9/4/09	6/3/10	10/13/08	4/1/09	9/4/09	6/3/10
Groundwater Level Measurements																
Reference Elevation in feet MLLW	23.80	23.80	23.80	23.80	19.92	19.92	19.92	19.92	14.86	14.86	14.86	14.86	14.42	14.42	14.42	14.42
Depth To Water in feet	10.09	8.48	10.12	8.71	11.04	10.34	11.01	10.17	6.53	5.86	6.50	5.73	6.30	5.74	6.17	5.56
Water Level Elevation in feet MLLW	13.71	15.32	13.68	15.09	8.88	9.58	8.91	9.75	8.33	9.00	8.36	9.13	8.12	8.68	8.25	8.86
Water Quality Field Parameters																
Temperature in degrees Celsius	16	11.2	16.8	13.4	17.1	12.6	17	14.2	16.8	12.3	16.3	13.8	15	12.9	14.5	13.7
рН	6.73	6.05	6.05	6.4	7.7	6.14	8.13	6.47	7.59	6.45	6.55	7.08	8.11	7.13	7.08	7.79
Conductivity in µS/cm	358	480	509	228	440	619	771	472	1586	1712	2509	959	15230	1565	1541	13000
Dissolved Oxygen in mg/L	0.07	0.32	0.44	0.15	0.25	0.74	0.19	0.73	0.02	0.05	0.23	0.03	0.03	0.08	0.11	0.03
Turbidity in NTUs	0.81	4.11	6.98	0	0.98	0.83	2.75	23	12.7	8.62	11.2	0	2.13	1.1	1.51	0
Total Petroleum Hydrocarbons		_	_											-	-	-
Diesel Range in µg/L	250 U	250 U	250 U	100 U	250 U	250 U	250 U	100 U	250 U	250 U	250 U	100 U	250 U	250 U	250 U	100 U
Motor Oil Range in µg/L	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U	500 U	500 U	500 U	200 U
Total Metals by EPA Method 200.8			-		-	-	<u> </u>							-	-	-
Total arsenic, inorganic in µg/L	14.2	1.9	12.9	3.6	2.8	1.1	3.8	1.4	25.4	16.8	15.3	16.2	8	3	3	2 U
Total lead in μg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	5 U	5 U	5 U	5 U
Carcinogenic Polycyclic Aromatic Hydroc	carbons (cPAH	s) by Method	8270D-SIM												-	
Benz(a)anthracene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(a)pyrene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(b)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(k)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Chrysene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Dibenzo(a,n)anthracene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 0	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 0	0.010 U
Indeno(1,2,3-cd)pyrene in µg/L		0.010 0	0.010 0	0.010 0	0.010 U	0.010 0	0.010 0	0.010 0	0.010 0	0.010 0	0.010 0	0.010 0	0.010 0	0.010 0	0.010 0	0.010 0
bio(2 othylboxyl) phtholoto in ug/l		<b></b>	1 11	10.11	10 11	10 11	1 11	2.4	10.1	11	10 11	10.11	1.5	E .	10.11	10.11
Dis(2-ethymexyl) phinalate in µg/L	1.0 0	23		1.0 0	1.0 0	1.0 0	1 0	2.4	1.0 0	1.1	1.0 0	1.0 0	1.5	5	1.0 0	1.0 0
Aroclor 1016 in ug/l		0.010 []	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11
Aroclor 1221 in ug/l	0.010 U	0.010 U	0.010	0.010 U	0.010	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1222 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1232 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010	0.010 U	0.010 U	0.010 U	0.010 U	0.010 1	0.010	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1248 in µg/L	0.010	0.010 U	0.010 U	0.010 11	0.010	0.010 11	0.017	0.025	0.014	0.010	0.010	0.020	0.010 U	0.010 U	0.010 U	
Aroclor 1254 in µg/L	0.010	0.010 11	0.010	0.010 U	0.010	0.010	0.010 11	0.02	0.010	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11	0.010 11
Aroclor 1260 in µg/l	0.010	0.010 11	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010	0.010	0.010 U	0.010 11	0.010 U	0.010 U	0.010 U	0.010 U
Total PCBs in ug/L	0.010 U	0.010 U	0.010 U	0.010 U	0.013	0.010 U	0.017	0.045	0.014	0.015 Y	0.01	0.02	0.010 11	0.010 11	0.010 1	0.010 11
Aroclor 1221 in µg/L Aroclor 1232 in µg/L Aroclor 1232 in µg/L Aroclor 1242 in µg/L Aroclor 1248 in µg/L Aroclor 1254 in µg/L Total PCBs in µg/L	0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U	0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U	0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U	0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U	0.010 U 0.010 U 0.013 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.013	0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U	0.010 U 0.010 U 0.010 U 0.017 U 0.010 U 0.010 U 0.010 U 0.017	0.010 U 0.010 U 0.010 U 0.025 0.02 0.010 U 0.045	0.010 U 0.010 U 0.010 U 0.014 0.010 U 0.010 U 0.010 U 0.014	0.010 U 0.015 Y 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.015 Y	0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.01	0.010 U 0.010 U 0.010 U 0.020 0.010 U 0.010 U 0.010 U 0.02	0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U	0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U	0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U 0.010 U	0.010 L 0.010 L 0.010 L 0.010 L 0.010 L 0.010 L 0.010 L 0.010 L

#### Notes

U - Analyte was not detected at or above the reported result.

Y - The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit. Detected concentrations are bolded.

#### Table 6 - RA-5 Groundwater Monitoring and Analytical Results

POS Terminal 5 Southwest Harbor

Phase II GWCMP SWHP	Remediation Area 5 (former Lockheed Shipyard 2)															
		Backg	round					•		Confirmatio	n Monitoring	1				
					Fill Aquifer											
Sample Name	CMP5- 081013	CMP5- 090401	CMP5- 090902	CMP5	CMP15- 081014	CMP15- 090402	CMP15- 090903	CMP15	MW26R- 081014	MW26R- 081014D	MW26R- 090401	MW26R- 090401D	MW26R- 090903	MW26R- 090903D	MW26R	MW26RD
Sampling Date	10/13/08	4/1/09	9/2/09	6/3/10	10/14/08	4/2/09	9/3/09	6/3/10	10/14/08	10/14/08	4/1/09	4/1/09	9/3/09	9/3/09	6/4/10	6/4/10
Groundwater Level Measurements		<u> </u>			·		<u>=</u>				=	•	<u></u>			<u>i</u>
Reference Elevation in feet MLLW	23.80	23.80	23.80	23.80	18.42	18.42	18.42	18.42	18.	27	18	.27	18	.27	18	.27
Depth To Water in feet	10.09	8.48	10.12	8.71	10.38	9.91	10.14	9.75	9.9	91	9.	66	9.	69	9.	40
Water Level Elevation in feet MLLW	13.71	15.32	13.68	15.09	8.04	8.51	8.28	8.67	8.36		8.61		8.58		8.87	
Water Quality Field Parameters											-				-	
Temperature in degrees Celsius	16	11.2	16.8	13.4	17.7	13.2	15.9	14.2	16	.9	1:	2.3	15	5.4	14	1.2
рН	6.73	6.05	6.05	6.4	6.88	6.69	6.39	6.64	7.:	29	6	43	7.	14	6.	86
Conductivity in µS/cm	358	480	509	228	2336	7059	3547	6920	101	90	11	98	10	)43	96	000
Dissolved Oxygen in mg/L	0.07	0.32	0.44	0.15	0.008	0.1	0.36	0.05	0.	11	0.	22	0.	15	0.	05
Turbidity in NTUs	0.81	4.11	6.98	0	1.12	0.73	1.78	0	0.9	94	0.	93	1.	91	1	1
Total Petroleum Hydrocarbons		<u> </u>	-			-	<u>.</u>				-	-				
Diesel Range in µg/L	250 U	250 U	250 U	250 U	250 U	250 U	250 U	100 U	250 U	250 U	250 U	250 U	250 U	250 U	100 U	100 U
Motor Oil Range in µg/L	500 U	500 U	500 U	500 U	500 U	500 U	500 U	200 U	500 U	500 U	500 U	500 U	500 U	500 U	200 U	200 U
Total Metals by EPA Method 200.8											-	-		-		
Total antimony in µg/L	14.2	1.9	12.9	3.6	0.2 U	0.5 U	0.2 U	0.2 U	0.2 U	0.2 U	1 U	1 U	<u> </u>	1 U	<u> </u>	1 U
Total arsenic, inorganic in μg/L					1	1	0.9	0.5 U	2 U	3	2 U	2 U	2 U	2 U	2 U	2 U
Total chromium (total) in μg/L					1 U	1 U	2 U	0.5 U	2 U	3	3	3	3	3	3	4
Total copper in μg/L					0.8	1 U	0.5 U	0.7	2 U	2 U	1 <u>2</u> U	2 U	3	3	2 U	3
Total lead in μg/L	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Total nickel soluble salts in µg/L					1	4	2	5.6	6	7	6	7	7	6	6	6
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) by Method 8270D-SIM																
Benz(a)anthracene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.025	0.024	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(a)pyrene in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.011	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(b)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.018	0.010 U	0.010 U	0.010 U	0.010 U
Benzo(k)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.016	0.010 U	0.010 U	0.010 U	0.010 U
Chrysene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.027	0.026	0.011	0.022	0.013	0.013	0.014	0.014
Dibenzo(a,h)anthracene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Indeno(1,2,3-cd)pyrene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Semi-Volatile Organics by EPA Method 8270D	=	=	=								8					=
bis(2-ethylhexyl) phthalate in µg/L	1.0 U	23	1.0 U	1.0 U	1.0 U	1 U	1.6	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Method 8082	•										=	E		=		=
Aroclor 1016 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1221 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1232 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1242 in μg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1248 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1254 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.018 Y	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Arocior 1260 in µg/L	0.010 U	0.010 U		0.010 U		0.010 U	0.010 U	0.010 U	0.010 U	0.010 U		0.010 U		0.010 U	0.010 U	0.010 U
I UTAL FODS III µY/L	0.010 0	0.010 0	0.010 0	0.010 0	0.010 U	0.010 0	0.010 0	0.010 0	0.010 0	0.010 0	0.010 0	0.010 0	0.010 0	0.010 U	0.010 0	0.010 0

U - Analyte was not detected at or above the reported result.

Y - The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

NA = Not available.

Detected concentrations are bolded.

Sheet 1	of	2
---------	----	---

#### Table 6 - RA-5 Groundwater Monitoring and Analytical Results

POS Terminal 5 Southwest Harbor

Phase II GWCMP SWHP	Remediation Area 5 (former Lockheed Shipyard 2)										
			C	Confirmation	n Monitoring		*				
				Estuarine	e Aquifer						
Sample Name	MW36- 081014	MW36- 090402	MW36- 090903	MW36	MW44- 081014	MW44- 090401	MW44- 090903	MW44			
Sampling Date	10/14/08	4/2/09	9/3/09	6/2/10	10/14/08	4/1/09	9/3/09	6/2/10			
Groundwater Level Measurements	-	-	-		-		-				
Reference Elevation in feet MLLW	17.60	17.60	17.60	17.60	18.38	18.38	18.38	18.38			
Depth To Water in feet	10.00	9.06	9.72	9.31	10.90	8.94	11.46	8.94			
Water Level Elevation in feet MLLW	7.60	8.54	7.88	8.29	7.48	9.44	6.92	9.44			
Water Quality Field Parameters	-		-			-					
Temperature in degrees Celsius	14.6	12.4	13.9	14.7	15.3	11.5	14	14.9			
рН	7.47	6.48	8.78	7.43	7.23	6.42	5.84	5.94			
Conductivity in µS/cm	36200	3734	3812	40000	41	46	37	11			
Dissolved Oxygen in mg/L	0.06	0.11	0.13	0.08	1.59	7.25	3.84	6.88			
Turbidity in NTUs	1.02	0.84	1.83	5	3.21	7.33	3.26	NA			
Total Petroleum Hydrocarbons											
Diesel Range in µg/L	250 U	250 U	250 U	100 U	250 U	250 U	250 U	100 U			
Motor Oil Range in µg/L	500 U	500 U	500 U	200 U	500 U	500 U	500 U	530			
Total Metals by EPA Method 200.8											
Total antimony in µg/L	5 U	2 U	2 U	2 U	0.2 U	0.6	0.3	0.4			
Total arsenic, inorganic in µg/L	6	7	6	5 U	0.5	0.8	0.3	0.8			
Total chromium (total) in µg/L	10 U	5 U	5 U	5 U	1 U	11	3.4	7.8			
Total copper in µg/L	10 U	5 U	5 U	5 U	7	18	6.4	15.5			
Total lead in µg/L	20 U	10 U	10 U	10 U	4	33	4	21			
Total nickel soluble salts in µg/L	10 U	9	12	12	2	4.3	1.4	3.8			
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) by Method 8270D-SIM					<u> </u>						
Benz(a)anthracene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.059	0.010 U	0.033			
Benzo(a)pyrene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.11	0.010 U	0.054			
Benzo(b)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.27	0.010	0.079			
Benzo(k)fluoranthene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.14	0.010 U	0.079			
Chrysene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.19	0.010 U	0.13			
Dibenzo(a,h)anthracene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.035	0.010 U	0.023			
Indeno(1,2,3-cd)pyrene in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.11	0.010 U	0.063			
Semi-Volatile Organics by EPA Method 8270D											
bis(2-ethylhexyl) phthalate in µg/L	1.0 U	1.0 U	1.0 U	1.5	1.0	2.2	1.0 U	2.4			
Polychlorinated Biphenyls (PCBs) by EPA Method 8082											
Aroclor 1016 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U			
Aroclor 1221 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U			
Aroclor 1232 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.015 Y	0.010 U	0.010 U			
Aroclor 1242 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U			
Aroclor 1248 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U			
Aroclor 1254 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U			
Aroclor 1260 in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U			
Total PCBs in µg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U			

U - Analyte was not detected at or above the reported result.

Y - The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.

NA = Not available.

Detected concentrations are bolded.

#### Sheet 2 of 2



EAL 08/17/10 1762700-001 dwg









//	<del>-</del> N	
	င္ 4၃၀	800
e la companya de la c	Feet	
ELLIOTT		


# APPENDIX A EVALUATION OF GROUNDWATER CHEMICAL CONCENTRATIONS PROTECTIVE OF SURFACE WATER

## APPENDIX A EVALUATION OF GROUNDWATER CHEMICAL CONCENTRATIONS PROTECTIVE OF SURFACE WATER

This Appendix presents our evaluation to determine groundwater chemical concentrations that would be protective of surface water for the Phase II Southwest Harbor Project (SWHP) located at the Southwest Harbor Terminal 5 (Terminal 5) in Seattle, Washington. The protectiveness of current groundwater chemical concentrations was assessed by modeling natural attenuation of chemical constituents. The purpose of modeling natural attenuation is to supplement the Groundwater Confirmation Monitoring Program and to determine if chemicals detected in groundwater are naturally attenuated to concentrations below surface water quality criteria prior to discharge to Puget Sound marine water.

### **GROUNDWATER CHEMICAL CONDITIONS**

Groundwater quality data was obtained from four rounds of groundwater data collected from 14 wells between 2008 and 2010 as part of the confirmational groundwater monitoring program. Monitoring well locations for the program are presented on Figure 1 and are summarized below:

- Four background monitoring wells are screened in the Fill Aquifer (FM-105, CMP-1, CMP-2, and CMP-5);
- Seven downgradient monitoring wells are screened in the Fill Aquifer (CMP-3, CMP-4, CMP-15, CM-17, MW-26R and MW-125, and MW-308N); and
- Three downgradient monitoring wells are screened in the Estuarine Aquifer (MW-36, MW-44, and MW-308S).

### Identification of Constituents of Potential Concern

A compilation of Terminal 5 groundwater quality data was reviewed to identify constituents of potential concern (COPCs). COPCs for groundwater were identified using a three-step procedure summarized below:

- Step 1 Screening levels were developed for chemicals analyzed as part of the Terminal 5 Long-Term Monitoring Program. Screening levels for individual chemicals were defined as the most conservative of the marine surface water quality criteria taken from Washington State Department of Ecology's Cleanup Levels and Risk Calculation (CLARC) database. Groundwater quality criteria were not evaluated since the highest beneficial use for groundwater at the site is discharge to surface water. The screening levels were intended to identify COPCs and should not be considered cleanup levels or standards. The screening levels for Terminal 5 are presented in Table 1.
- Step 2 Terminal 5 groundwater quality data collected as part of the groundwater confirmation monitoring program were reviewed to identify the chemicals detected in groundwater samples. Table 2 presents a general statistical summary of groundwater analytes and results from the Terminal 5 groundwater confirmation monitoring program compared to potentially applicable surface water quality criteria.
- Step 3 Groundwater quality data was compared to the screening levels. A well-by-well comparison of groundwater concentrations with the screening criteria is presented in Table 3.

### Groundwater Screening Process

Validated groundwater sample analytical results were compared to the most conservative surface water quality criteria to identify COPCs in groundwater at Terminal 5. Migration of upland groundwater has been identified as a potential pathway for dissolved chemicals to reach surface water. Surface water quality criteria used to screen the Terminal 5 groundwater chemical concentrations include:

- Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC);
- Clean Water Act 304 for Human Health and Chronic Aquatic Life;
- National Toxics Rule (40 CFR Part 131) for Human Health and Chronic Aquatic Life; and

 MTCA Method B carcinogen and non-carcinogen cleanup levels for surface water (WAC 173-340-730).

The published marine surface water criteria used to establish the surface water screening levels are presented in Table 1. The most conservative of these criteria for each constituent were established as the preliminary screening levels for groundwater modeling.

### Groundwater Screening Results

Tables 2 and 3 present a summary of the results of groundwater comparing concentrations against the screening levels for COPCs at Terminal 5. Relatively few of the detected constituents exceed the screening levels. The analytes with one or more detections in monitoring wells, which exceed the screening levels include:

- Heavy oil-range petroleum hydrocarbons;
- Polychlorinated biphenyls (PCBs);
- Metals (arsenic, copper, lead, and nickel);
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs);
- Bis(2-ethylhexyl) phthalate; and
- Tetrachlorethene (PCE).

### Natural Attenuation of Dissolved Groundwater Chemicals

Natural attenuation refers to the reliance on natural processes to achieve sitespecific cleanup goals (EPA, 1997). Natural attenuation occurs using the physical, chemical, and biological processes inherent within the aquifer that act to reduce the mass, toxicity, mobility, volume or concentration of contaminants in soil or groundwater. These processes can include biodegradation, dispersion, dilution, sorption, transformation, stabilization, and volatilization of the unwanted contaminants.

Biodegradation is degradation of chemicals by microbes within the soil matrix. The rate of and extent of microbial degradation of chemicals are complex and regulated by the chemical properties of the contaminant, soil and groundwater chemistry, and the microbial population present. Degradation rates are typically measured in terms of half-life. The half-life is the amount of time needed for onehalf of the original contaminant mass to be degraded. The half life of the COPCs are presented in Table 4. Dispersion refers to the process whereby a plume will spread out in a longitudinal direction (along the direction of groundwater flow), transversely (perpendicular to groundwater flow), and vertically downwards due to mechanical mixing in the aquifer and chemical diffusion. Dispersion is usually estimated rather than measured, given the impracticability of measuring dispersion in the field. Dispersion is usually estimated based on the length of the plume or distance to the measurement point. Researchers indicate that dispersion values can range over two to three orders of magnitude for a given value of plume length or distance to a measurement point (Gelhar et al., 1992).

Tidal dilution is mixing of chemicals in groundwater that occurs as the result of changes in gradient during tidal changes. Groundwater will mix with tidal inflows during rising tides. The outflow during a falling tide consists of a mixture of tidal inflow and groundwater. The amount of tidal dilution is a function of the relative range in tidal stage and the aquifer properties. Tidal dilution factors ranging from 4 to 10,000 have been reported from groundwater modeling at Terminal 5 and adjacent sites (Aspect 2007; S. S. Papadopulos & Associates 1997).

Most organic chemicals are removed from solution by sorption onto soil particles. Sorption of dissolved contamination onto the aquifer matrix results in slowing or retardation of the contaminant relative to advective groundwater flow velocity and a reduction in dissolved contaminant concentrations. Sorption is generally represented in fate and transport models using a retardation factor. The retardation factor is the rate at which dissolved contaminants moving through an aquifer are reduced by sorption of contaminants to the solid aquifer matrix. The degree of retardation depends on both aquifer and constituent properties. The retardation factor is the ratio of the groundwater seepage velocity to the rate that organic chemicals migrate in the groundwater. A retardation value of two indicates that if the groundwater seepage velocity is 100 feet/year, then the organic chemicals migrate at approximately 50 feet/yr.

### FATE AND TRANSPORT MODELING

A fate and transport model was implemented to evaluate the potential for existing upland groundwater to exceed the screening criteria at the point of compliance (surface water). The selected fate and transport model, BIOSCREEN (EPA 1996), is based on the Domenico analytical solution (Domenico 1987), and was used to estimate the natural attenuation of COPCs between downgradient monitoring wells and the surface water/sediment interface. BIOSCREEN uses the following assumptions:

- Uniform and constant aquifer properties;
- One-dimensional groundwater flow;
- First-order decay, degradation, or transformation of contaminants; and
- Constant source area and concentrations.

The model predicts maximum groundwater concentrations in the centerline of the groundwater chemical plume to the receptor (Elliott Bay and Duwamish Waterway). The model was evaluated using the following conditions:

- Steady-state conditions without biodegradation;
- Assumed dispersion in the longitudinal, transverse, and vertical directions,
- Equilibrium partitioning and adsorption of COPCs to the aquifer soil matrix; and
- The minimum distance from the monitoring well to the surface water was used for the distance to the receptor.

### Model Input Parameters

Model input parameters are summarized in Table 4.

Arsenic attenuation was not modeled since it is ubiquitous throughout the region. Background monitoring wells have arsenic concentrations ranging from 0.4 to 23.2 micrograms per liter (ug/L) and the downgradient wells have arsenic concentrations ranging from 0.3 to 25.4 ug/L.

The model represents the contaminant source as a vertical plane, perpendicular to groundwater flow, releasing dissolved constituents into groundwater passing through this plane. The source is assumed to have existed for a period of 100 years, with source zone concentrations set to equal measured chemical concentrations in the groundwater wells. Concentrations used for modeling were conservatively set to equal the maximum measured concentration at each well location.

The groundwater flow and velocity are defined by the hydraulic conductivity, hydraulic gradient, and porosity. Hydrogeologic and aquifer characteristics were obtained from the fate and transport analysis in the Upland Remedial Investigation and Feasibility Study report (RETEC 1997) and Marine Sediments Remedial Investigation and Marine Sediments Feasibility Study (Weston 1998a and 1998b, respectively).

Biodegradation was not used in modeling. For references purposes, biodegradation half life values presented in Table 4 were taken from Howard, 1991.

The soil bulk density, in kg/L, of the aquifer matrix is related to porosity and pure solids density. Although this value can be measured in the lab, in most cases estimated values are used. A default value of 1.7 kg/L was used.

Fraction organic carbon (foc) is the fraction of the aquifer soil matrix comprised of natural organic carbon. More natural organic carbon typically means higher adsorption of organic constituents on the aquifer matrix. Typical values of foc are 0.002 to 0.02. A value of 0.01 was used for this study as this is a representative value for site soil based on RETEC (1997) and WESTON (1998a and 1998b). Other chemical properties (e.g., organic carbon partition coefficient) were obtained through Ecology's CLARC database.

The model was used to predict the chemical concentration at the receptor which was considered to be at the groundwater/surface water interface. The distance to the receptor was measured on the site map from the well to the closest shoreline following the groundwater flow path based on the groundwater contour maps provided in Aspect (2007). A simulation time of 100 years was considered a sufficient amount of time for the COPCs to potentially reach the surface water.

Two modeling runs were performed using: (1) a maximum concentration of the COPCs for each well from groundwater quality database (Hart Crowser 2010) as a baseline case; and (2) solubility concentrations for the COPCs for each well (solubility case). The solubility case is considered to be the worst-case scenario assuming that NAPL phase was present. There is no evidence that NAPL phase is present at Terminal 5.

### **Modeling Results**

The model results are summarized in Table 5. The model results predict that for the baseline case using the maximum chemical concentrations detected in each well, the COPC concentrations will not reach marine surface water after 100

years except for tetrachloroethene (PCE) from MW-125 and copper from MW-26R and MW-44.

The model predicts the PCE from MW-125 will reach the shoreline at a concentration in the Fill Aquifer of 1.9 ug/L (0.0019 mg/L), which is slightly above the screening criteria of 0.39 ug/L (0.00039 mg/L). If PCE degradation is incorporated into the model, concentrations at the shoreline after 100 years would be non-detect.

The model also predicts that copper from MW-26R and MW-44 will reach the shoreline at concentrations less than 0.1 ug/L (0.0001 mg/L), which is below the screening criteria of 2.4 ug/L (0.0024 mg/L).

For organic compounds, using the solubility limit as a worst-case scenario, the model results predict the COPC concentrations will be non-detect at the surface water after 100 years, except for PCE. Given that the aqueous solubility of PCE is relatively high (200 mg/L), the predicted concentration using the solubility limit model is well above surface water criteria. This scenario assumes that PCE in the form of dense non-aqueous phase liquid (DNAPL) is present. However, the relatively low dissolved PCE concentrations observed in both upgradient and site wells do not indicate the presence of DNAPL at Terminal 5 making the solubility scenario unrealistic. If PCE degradation is incorporated into the model, concentrations at the shoreline after 100 years would be non-detect.

Solubility values for metals were not provided in the CLARC database; therefore, the metals were not modeled for the solubility case.

### Tidal Mixing

Tidal mixing, while not incorporated into the model, would further reduce chemical concentrations in groundwater prior to discharge to surface water. As discussed earlier, groundwater will mix with tidal inflows during rising tides. The outflow during a falling tide consists of a mixture of tidal inflow and groundwater. The amount of tidal mixing is a function of the relative range in tidal stage and the aquifer properties. Tidal dilution factors ranging from 4 to 10,000 have been reported from groundwater modeling at the Terminal 5 and adjacent sites (Aspect 2007; S. S. Papadopulos & Associates 1997). Use of the lowest tidal dilution estimate of four would further reduce the calculated chemical concentrations at the shoreline after 100 years by an additional factor of four times less than concentrations presented in Table 5.

### SUMMARY AND CONCLUSIONS

- An evaluation was completed to determine if chemicals detected in groundwater at Terminal 5 are naturally attenuated to concentrations below marine surface water quality criteria prior to discharge to Puget Sound.
- Screening criteria based on marine surface water criteria were developed to compare against the groundwater quality data collected from Terminal 5. The screening criteria are presented in Table 1. The statistical summary of groundwater quality database and a comparison with the screening criteria are presented in Tables 2 and 3.
- Fate and transport modeling using BIOSCREEN was conducted to predict contaminant concentrations at the shoreline. The natural attenuation processes simulated in the modeling include dispersion and sorption. Processes not modeled included biodegradation and tidal mixing.
- The model results show that even under conservative conditions, predicted concentrations of most COPCs, including bis(2-ethylhexyl)phthalate, PAHs and PCBs detected in groundwater will not exceed the screening level concentrations at the shoreline within 100 years. For organic compounds, concentrations as high as the solubility limit would not result in an exceedance of surface water quality criteria at the shoreline.
- The model results show that even under the conservative conditions, predicted concentrations of copper and lead detected in groundwater will not exceed the screening level concentrations at the shoreline within 100 years. If tidal mixing is incorporated into the model, copper and lead concentrations four times higher than the maximum detected concentrations will not exceed the screening level concentrations at the shoreline within 100 years.
- PCE in monitoring well MW-125 is calculated to exceed surface water quality criteria within 100 years based on retardation modeling. If degradation half-life and tidal mixing are incorporated into the model, PCE concentrations will be non-detect at the shoreline after 100 years. Furthermore, the source of PCE is from off-site of Terminal 5. PCE is present in off-site, upgradient monitoring well FM-105 at concentrations comparable to those found in MW-125.

 Although not simulated during modeling, tidal mixing and biodegradation are important natural attenuation processes that would further reduce groundwater chemical concentrations at Terminal 5.

### REFERENCES

Aspect 2007. Southwest Harbor Project Phase I Groundwater Confirmation Monitoring Program Hydrologic Characterization Report. Prepared for the Port of Seattle, Seattle, Washington. January 18, 2007.

Domenico, P. A. 1987. An Analytical Model for Multidimensional Transport of Decaying Contaminant Species. Journal of Hydrology 91:49-58.

EPA 1996. BIOSCREEN Natural Attenuation Decision Support System User's Manual Version 1.3.

Hart Crowser 2010. Southwest Harbor Terminal 5 Groundwater Quality Monitoring Evaluation Report. Prepared for the Port of Seattle, Seattle, Washington. August 2010.

Howard 1991. Handbook of Environmental Degradation Rates. Lewis Publishers. 1991.

RETEC 1997. Upland Remedial Investigation and Feasibility Study Report. Pacific Sound Resources Superfund Site, Southwest Harbor Project Remediation Area 4. Prepared for the Port of Seattle, Seattle, Washington. February 24, 1997.

RETEC 1998. Final Upland Groundwater Remedial Investigation and Feasibility Study Report. Pacific Sound Resources Superfund Site, Southwest Harbor Project Remediation Area 4. Prepared for the Port of Seattle, Seattle, Washington. November 13, 1998.

S. S. Papadopulos & Associates. 1997. Groundwater Model of Hanging Wall Slurry Wall under Tidal Conditions. Prepared for RETEC, Inc. and Port of Seattle. February 1997. Weston 1998a. Remedial Investigation Report. Pacific Sound Resources Marine Sediments Unit. Prepared for the U.S. Environmental Protection Agency, Seattle, Washington. April 1998.

Weston 1998b. Feasibility Study Report. Pacific Sound Resources Marine Sediments Unit. Prepared for the U.S. Environmental Protection Agency, Seattle, Washington. November 1998.

L:\Jobs\1762700\T5 Groundwater Report 070814\Revised T5 GW Report.doc

# Table A-1 - Marine Surface Water Screening CriteriaPort of Seattle Terminal 5

					Surface Water	Surface Water		Surface Water			
	Surface Water	Surface Water	Surface Water	Surface Water	ARAR - Aquatic	ARAR - Aquatic	Surface Water	ARAR - Human	Surface Water,	Surface Water,	
	ARAR - Aquatic	ARAR - Aquatic Life	ARAR - Aquatic	ARAR - Aquatic	Life -	Life -	ARAR - Human	Health – Marine	Method B,	Method B, Non-	
	Life -	- Marine/Acute -	Life - Marine/Acute	Life -	Marine/Chronic -	Marine/Chronic -	Health – Marine	– National	Carcinogen.	Carcinogen.	
	Marine/Acute -	Clean Water Act	- National Toxics	Marine/Chronic -	Clean Water Act	National Toxics	– Clean Water	Toxics Rule, 40	Standard	Standard	Screening
	Ch. 173-201A WAC	\$304	Rule, 40 CFR 131	Ch. 173-201A WAC	\$304	Rule, 40 CFR 131	Act §304	CFR 131	Formula Value	Formula Value	Level <sup>2,3</sup>
Analyte	(ua/L)	(ua/L)	(ua/L)	(ug/L)	(ua/L)	(ua/L)	(ua/L)	(ua/L)	(ua/L)	(ua/L)	(ua/L)
Metals	(1-3/	(1-3/	(F <b>3</b> -7	(F* <b>3</b> · =/	(F <b>3</b> -7	(1-3/	( <b>#3</b> , <b>-</b> /	(r- <b>3</b> -7	(⊪3)	(F <b>3</b> -7	(F <b>3</b> -7
Antimony							640	4300		1 000	640
Anumony							0+0	+300		1,000	040
											0 14
Arsenic inorganic	69	69	69	36	36	36	0 14	0 14	0.098	18	(5 - MTCA A GW)
Chromium (VI)	1100	50	1100	50	1100	50				490	50
Copper	4.8	4.8	2.4	3.1	3.1	2.4				2,700	2.4
Lead	210	210	210	8.1	8.1	8.1					8.1
Nickel soluble salts	74	74	74	8.2	8.2	8.2	4,600	4,600		1,100	8.2
Polychlorinated Biphenyls (PCBs)	•	•		•	•		•	•	•	•	•
Aroclor 1016						0.03				0.0058	0.0058
Aroclor 1221											
Aroclor 1232											
Aroclor 1242											
Aroclor 1248											
Aroclor 1254						0.03				0.0017	0.0017
Aroclor 1260						0.03					0.03
Aroclor 1262											
Aroclor 1268											
Polychlorinated biphenyls	10			0.03	0.03	0.03	0.000064	0.00017	0.00011		0.000064
Total Petroleum Hydrocarbons											
TPH. diesel range organics											500 <sup>5</sup>
TPH, heavy oils											500 <sup>5</sup>
Volatile Organic Compounds (VOCs)											
1 1 1 2-Tetrachloroethane											
1.1.1-Trichloroethane										930.000	420.000
1.1.2.2-Tetrachloroethane							4	11	6.5		4
1.1.2-Trichloroethane							16	42	25	2.300	16
1.1-Dichloroethane											
1,1-Dichloroethene							7100	3.2		23,000	3.2
1,2-Dichloroethane							37	99	59	43,000	37
Chloroethane											
cis-1,2-Dichloroethene											
Tetrachloroethene							3.3	8.9	0.39	840	0.39
trans-1,2-Dichloroethene							10,000			33,000	10,000
Trichloroetlene							30	81	6.7	71	6.7
Vinyl chloride							2.4	530	3.7	6,600	2.4

# Table A-1 - Marine Surface Water Screening CriteriaPort of Seattle Terminal 5

	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	
	ARAR - Aquatic	ARAR - Aquatic Life	ARAR - Aquatic	ARAR - Aquatic	Life -	Life -	ARAR - Human	Health – Marine	Method B,	Method B, Non-	
	Life -	- Marine/Acute -	Life - Marine/Acute	Life -	Marine/Chronic -	Marine/Chronic -	Health – Marine	<ul> <li>National</li> </ul>	Carcinogen,	Carcinogen,	
	Marine/Acute -	Clean Water Act	- National Toxics	Marine/Chronic -	Clean Water Act	National Toxics	<ul> <li>Clean Water</li> </ul>	Toxics Rule, 40	Standard	Standard	Screening
	Ch. 173-201A WAC	§304	Rule, 40 CFR 131	Ch. 173-201A WAC	§304	Rule, 40 CFR 131	Act §304	CFR 131	Formula Value	Formula Value	Level <sup>2, 3</sup>
Analyte	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Semivolatile Organic Compounds (SVOCs)											
bis(2-Ethylhexyl) phthalate							2.2	5.9	3.6	400	2.2
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPA	\Hs)										
Benzo[a]anthracene							0.018	0.031			0.018
Benzo[a]pyrene							0.018	0.031	0.03		0.018
Benzo[b]fluoranthene							0.018	0.031			0.018
Benzo[k]fluoranthene							0.018	0.031			0.018
Chrysene							0.018	0.031			0.018
Dibenzo[a,h]anthracene							0.018	0.031			0.018
Indeno[1,2,3-cd]pyrene							0.018	0.031			0.018

Notes

1. -- = Not established.

2. Screening levels may be adjusted depending on lab PQLs.

3. Screening levels may be adjusted based on background data results.

4. Surface water quality criteria are based on dissolved metal concentrations.

Abbreviations

µg/L = micrograms per liter.

ARAR = applicable or relevant and appropriate requirements

CFR = code of federal regulations

WAC = Washington Administrative Code

# Table A-2 - Statistical Summary of Groundwater Quality DataPort of Seattle Terminal 5

	Potential		Number o	of Samples		Of th	ne Samples Dete	cted
Chemical	Screening Level	Analyzed	Non- Detect	Detected	Exceeding Screening Levels	Minimum Concentration	Maximum Concentration	Average Concentration
ТРН								
Diesel range in µg/L	500	56	56	0	0	0	0	
Motor oil range in µg/L	500	56	55	1	1	530	530	530
Total Metals								
Total antimony in μg/L	640	16	13	3	0	0.3	0.6	0.4
Total arsenic, inorganic in μg/L	0.14/5 (1)	56	9	47	19	0.3	25.4	6.5
Total chromium in µg/L	50	16	10	6	0	3	11	5.2
Total copper in μg/L	2.4	16	9	7	5	0.7	18	7.3
Total lead in μg/L	8.1	56	47	9	3	1	33	9.4
Total nickel soluble salts in $\mu$ g/L	8.2	16	1	15	3	1	12	5.5
cPAHs								
Benzo(a)anthracene in µg/L	0.018	56	51	5	4	0.01	0.097	0.045
Benzo(a)pyrene in µg/L	0.018	56	52	4	3	0.011	0.14	0.079
Benzo(b)fluoranthene in µg/L	0.018	56	50	6	4	0.01	0.27	0.082
Benzo(k)fluoranthene in µg/L	0.018	56	51	5	3	0.011	0.14	0.072
Chrysene in µg/L	0.018	56	45	11	4	0.01	0.19	0.047
Dibenzo(a,h)anthracene in µg/L	0.018	56	53	3	3	0.023	0.035	0.029
Indeno(1,2,3-cd)pyrene in µg/L	0.018	56	53	3	3	0.051	0.11	0.075
sVOCs								
bis(2-ethylhexyl) phthalate in μg/L	2.2	56	45	11	4	1	23	3.9
PCBs								
Aroclor 1016 in μg/L	0.0058	56	56	0	0	0	0	
Aroclor 1221 in μg/L		56	56	0		0	0	
Aroclor 1232 in μg/L		56	56	0		0	0	
Aroclor 1242 in μg/L		56	54	2		0.01	0.013	0.012
Aroclor 1248 in μg/L		56	48	8		0.014	2.5	0.476
Aroclor 1254 in μg/L	0.0017	56	53	3	3	0.016	1.5	0.512
Aroclor 1260 in μg/L	0.03	56	56	0	0	0	0	
Total PCBs in μg/L	0.000064	56	46	10	10	0.01	4	0.537

# Table A-2 - Statistical Summary of Groundwater Quality DataPort of Seattle Terminal 5

	Potential		Number o	of Samples		Of t	he Samples Dete	ected
Chemical	Screening Level	Analyzed	Non- Detect	Detected	Exceeding Screening Levels	Minimum Concentration	Maximum Concentration	Average Concentration
VOCs								
Tetrachloroethane;1,1,1,2- in μg/L		13	13	0		0	0	
Tetrachloroethane;1,1,2,2- in μg/L	4	13	13	0	0	0	0	
Trichloroethane;1,1,1- in µg/L	420,000	13	11	2	0	0.2	0.2	0.2
Trichloroethane;1,1,2- in μg/L	16	13	13	0	0	0	0	
Dichloroethane;1,1- in µg/L		13	9	4		0.2	0.4	0.3
Dichloroethane;1,2- in µg/L	37	13	13	0	0	0	0	
Ethyl chloride in µg/L		13	13	0		0	0	
Tetrachloroethene in µg/L	0.39	12	1	11	8	0.2	6.7	3.9
Trichloroethene in µg/L	6.7	12	4	8	0	0.6	2.8	1.2
Dichloroethene;1,1- in µg/L	3.2	12	12	0	0	0	0	
Dichloroethene;1,2-,cis in µg/L		12	4	8		0.2	2.5	1.1
Dichloroethene;1,2-,trans in µg/L	10,000	12	12	0	0	0	0	
Vinyl chloride in µg/L	2.4	12	12	0	0	0	0	

Notes:

TPH = Total Petroleum Hydrocarbons

cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons

sVOCs = Semivolatile Organic Compounds

PCBs = Polychlorinated Biphenyls

VOCs = Volatile Organic Compounds

(1) 0.14 is based on Surface Water screening criteria and 5 is based on MTCA Method A groundwater cleanup level.

# Table A-3 - Well-by-Well Statistical Summary of Groundwater Quality Data Port of Seattle Terminal 5

Sample Name			CMP-15			MW	26R			MM	V-36			MV	V44			CN	1P-5	
		#	# Above	Max	#		# Above	Max	#		# Above	Max	#		# Above	Max	#		# Above	Max
Sampling Date	Screen Level	Samples # Dete	cts CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.
Total Petroleum Hydrocarbons																				
Diesel Range in µg/L	500	4	0 0	)	4	0	0		4	0	0		4	4	0		0	0	0	
Motor Oil Range in µg/L	500	4	0 (	)	- 4	0	0		4	0	0		4	1	1	530	0	0	0	
Total Metals	0.40	<u> </u>									I						1	1	r	
I otal antimony in μg/L	640	4	0 (	)	4	0	0		4	0	0		4	3	0	0.6				 
Total arsenic, inorganic in µg/L	0.14/5 (1)	4	3 3	1	4	0	0		4	3	3	7	4	4	0	0.8	4	4	3	14.2
Total chromium (total) in µg/L	50	4	0 (	)	4	3	0	3	4	0	0		4	3	0	11				
Total copper in µg/L	2.4	4	3 (	0.8	4	1	1	3	4	0	0		4	4	4	18				
Total lead in µg/L	8.1	4	0 0	)	- 4	0	0		4	0	0		4	4	2	33	4	0	0	
Total nickel soluble salts in µg/L	8.2	4	4 (	5.6	6 4	4	0	7	4	3	3	12	4	4	0	4.3				L
Carcinogenic Polycyclic Aromatic																				
	0.019		0 1		4	4	4	0.005		^			ا ہ	~	<u>^</u>	0.000				r
Benzo(a)anthracene in µg/L	0.018	4	0 (		4	1	1	0.025	4	0	0		4	2	2	0.060	4	0	0	
Benzo(a)pyrene in µg/L	0.018	4	0 (	)	4	0	0		4	0	0		4	2	2	0.110	4	0	0	
Benzo(b)fluoranthene in µg/L	0.018	4	0 (	)	4	0	0		4	0	0		4	3	2	0.270	4	0	0	
Benzo(k)fluoranthene in µg/L	0.018	4	0 (	)	4	0	0		4	0	0		4	2	2	0.140	4	0	0	
Chrysene in µg/L	0.018	4	0 (	)	. 4	4	1	0.027	4	0	0		4	2	2	0.190	4	0	0	
Dibenzo(a,h)anthracene in μg/L	0.018	4	0 (	)	- 4	0	0		4	0	0		4	2	2	0.040	4	0	0	
Indeno(1,2,3-cd)pyrene in µg/L	0.018	4	0 (	)	- 4	0	0		4	0	0		4	2	2	0.110	4	0	0	
	0.0	<u>г</u>															r .	<b>.</b> .	<u> </u>	
bis(2-ethylhexyl) phthalate in µg/L	2.2	4	1 (	1.6	i 4	0	0	NA	4.0	1.0	0.0	1.5	4	3	1	2.4	4	1	1	23
	0.0059		0				0		4	0			4	0	0	1	1			
Aroclor 1016 in µg/L	0.0056	4	0 (		4	0	0		4	0	0		4	0	0		4	0	0	
Arocior 1221 in µg/L		4	0 (		4	0	0		4	0	0		4	0	0		4	0	0	
Arocior 1232 in µg/L		4	0 (		4	0	0		4	0	0		4	0	0		4	0	0	
Arocior 1242 in µg/L		4	0 (		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1248 In µg/L		4	0 0		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1254 In µg/L	0.0017	4	0 0		4	0	0		4	0	0		4	0	0		4	0	0	
Total PCBs in ug/l	0.03	4	0 0	·	4 . 4	0	0		4	0	0		4 4	0	0		4 	0	0	
Volatile Organic Compounds	0.000004	т	0	,	-	0	0			0	U		т	0	0				0	<u> </u>
Tetrachloroethane:1 1 1 2- in ug/l																				
Tetrachloroethane:1,1,2,2 in µg/l	4																			
Trichloroethane: 1 1 1- in ug/l	420,000																			
Trichloroethane: 1 1 2- in ug/l	16																			
Dichloroethane:1.1- in ug/l																				
Dichloroethane:1,2- in ug/l	.37																			
Ethyl Chloride in ug/l																				
Tetrachloroethene in ug/l	0.30																			
Trichloroethene in $\mu g/L$	67																			
	3.0	+																		
	5.2	+																		
Dichloroothono:1.2 trops in ug/	10.000	+																		
Vipul Chlorido in $ua/l$	2 /	+																		
vinyi Chionae in µg/L	2.4				·												<u> </u>			

### Sheet 1 of 3

# Table A-3 - Well-by-Well Statistical Summary of Groundwater Quality Data Port of Seattle Terminal 5

Sample Name			CM	IP-4			MW-	308N			MW	308S			MW3	308S			CM	IP2	
							1														·
Sampling Date	Screen Level	# Samples #	t Detects	# Above	Max	# Samples	# Detects	# Above	Max	# Samples	# Detects	# Above	Max	# Samples	# Detects	# Above	Max	# Samples	# Detects	# Above	Max
Total Petroleum Hydrocarbons	Corcert Level	Campico "	Deleoio	OOL	Concern.	Campico	# Deteoto	OOL	Contoern.	Campico	# Deteoto	001	Concern.	Campico	I Deteoto	001	Contoon.	Campico	# Deteoto	OOL	Concern.
Diesel Range in µg/L	500	0	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Motor Oil Range in µg/L	500	0	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Total Metals							-														
Total antimony in μg/L	640																				<u> </u>
Total arsenic, inorganic in µg/L	0.14/5 (1)	4	4	0	3.8	4	4	4	25.4	4	3	1	8	4	4	0	3.1	4	4	4	23.2
Total chromium (total) in μg/L	50	0				0				0											1
Total copper in μg/L	2.4	0				0				0											
Total lead in µg/L	8.1	4	1	0	1	4	0	0		4	0	0		4	0	0		4	3	1	15
Total nickel soluble salts in µg/L	8.2																				
Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)																					
Benzo(a)anthracene in µg/L	0.018	4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Benzo(a)pyrene in µg/L	0.018	4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Benzo(b)fluoranthene in µg/L	0.018	4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Benzo(k)fluoranthene in µg/L	0.018	4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Chrysene in µg/L	0.018	4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Dibenzo(a,h)anthracene in µg/L	0.018	4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Indeno(1,2,3-cd)pyrene in µg/L	0.018	4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Semivolatile Organic																					
bis(2-ethylhexyl) phthalate in µg/L	2.2	4.0	1.0	1.0	2.4	4	0	0		4.0	2.0	1.0	5.0	4	0	0		4	0	0	
Polychlorinated Biphenyls (PCBs)							-			-							-				
Aroclor 1016 in μg/L	0.0058	4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1221 in μg/L		4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1232 in μg/L		4	0	0		4	0	0		4	0	0		4	0	0		4	0	0	
Aroclor 1242 in μg/L		4	1	0	0.013	4	1	0		4	0	0		4	0	0		4	0	0	
Aroclor 1248 in μg/L		4	2	0	0.025	4	2	0		4	0	0		4	0	0		4	2	0	0.020
Aroclor 1254 in μg/L	0.0017	4	1	1	0.020	4	0	0		4	0	0		4	0	0		4	1	1	0.016
Aroclor 1260 in μg/L	0.03	4	0	0	NA	4	0	0		4	0	0		4	0	0		4	0	0	
Total PCBs in μg/L	0.000064	4	3	3	0.045	4	3	3	0.020	4	0	0		4	0	0		4	2	2	0.031
Volatile Organic Compounds		<b></b>					1	1	1		1			1				1	1		
Tetrachloroethane;1,1,1,2- in μg/L																					
Tetrachloroethane;1,1,2,2- in µg/L	4																				
Trichloroethane;1,1,1- in μg/L	420,000																				
Trichloroethane;1,1,2- in μg/L	16																				
Dichloroethane;1,1- in µg/L																					
Dichloroethane;1,2- in µg/L	37																				
Ethyl Chloride in µg/L																					
Tetrachloroethene in µg/L	0.39																				
Trichloroethene in µg/L+A22	6.7																				
Dichloroethene;1,1- in µg/L	3.2																				
Dichloroethene;1,2-,cis in µg/L																					
Dichloroethene;1,2-,trans in µg/L	10,000																				
Vinyl Chloride in µg/L	2.4																				

### Sheet 2 of 3

# Table A-3 - Well-by-Well Statistical Summary of Groundwater Quality Data Port of Seattle Terminal 5

Sample Name			CM	1P-3			FM	105			MW	-125			CM	P-17	
			-	•			-					-	-		1		-
		#		# Above	Max	#		# Above	Max	#		# Above	Max	#		# Above	Max
Sampling Date	Screen Level	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen.	Samples	# Detects	CUL	Concen
Total Petroleum Hydrocarbons	500	<u> </u>			1				1								1
Diesel Range in µg/L	500	4	0	0		4	0	0		4	0	0		4	0	0	
	500	4	0	0		4	0	0		4	0	0		4	0	0	<u> </u>
Total antimony in ug/l	640		ſ				ſ					1	ſ				1
	0.14/5(1)	1	1	1	11.6	1	3	0	0.5	1	3	0	0.6	1	1	0	8
Total chromium (total) in ug/l	50	4	4	4	11.0	4	5	0	0.5	4	5	0	0.0	4	4	0	0.
	24									0				0			
Total copper in µg/L	2.4	4	1	0	4	4	0			0	0	0		0	0	0	
	0.1	4		0	4	4	0	0		4	0	0		4	0	0	
	0.2													0			
Hydrocarbons (cPAHs)																	
Benzo(a)anthracene in µg/L	0.018	4	1	0		4	0	0		4	1	1	0.097	4	0	0	-
Benzo(a)pyrene in µg/L	0.018	4	1	0	0.011	4	0	0		4	1	1	0.140	4	0	0	
Benzo(b)fluoranthene in µg/L	0.018	4	1	1	0.019	4	0	0		4	2	1	0.100	4	0	0	· · ·
Benzo(k)fluoranthene in µg/L	0.018	4	1	0	0.011	4	0	0		4	2	1	0.120	4	0	0	-
Chrysene in µa/L	0.018	4	3	0	0.015	4	0	0		4	2	1	0.084	4	0	0	-
Dibenzo(a,h)anthracene in µg/L	0.018	4	0	0		4	0	0		4	1	1	0.028	4	0	0	
Indeno(1.2.3-cd)pyrene in ug/L	0.018	4	0	0		4	0	0		4	1	1	0.051	4	0	0	· .
Semivolatile Organic				-													L
bis(2-ethylhexyl) phthalate in µg/L	2.2	4	0	0		4.0	1.0	0.0	1.4	4	0	0		4	0	0	
Polychlorinated Biphenyls (PCBs)																	
Aroclor 1016 in µg/L	0.0058	4	0	0		4	0	0		4	0	0		4	0	0	-
Aroclor 1221 in µg/L		4	0	0		4	0	0		4	0	0		4	0	0	-
Aroclor 1232 in µg/L		4	0	0		4	0	0		4	0	0		4	0	0	-
Aroclor 1242 in µg/L		4	0	0		4	0	0		4	0	0		4	0	0	-
Aroclor 1248 in µg/L		4	2	0	2.5	4	0	0		4	0	0		4	0	0	-
Aroclor 1254 in μg/L	0.0017	4	1	1	1.5	4	0	0		4	0	0		4	0	0	-
Aroclor 1260 in µg/L	0.03	4	0	0		4	0	0		4	0	0		4	0	0	-
Total PCBs in µg/L	0.000064	4	2	2	4.0	4	0	0		4	0	0		4	0	0	-
Volatile Organic Compounds		1	1	1	1	1	1		1	1	1	1	1	•	1	1	τ
Tetrachloroethane;1,1,1,2- in µg/L						4	0	0		4	0	0		4	0	0	
Tetrachloroethane;1,1,2,2- in µg/L	4					4	0	0		4	0	0		4	0	0	-
Trichloroethane;1,1,1- in µg/L	420,000					4	0	0		4	2	0	0.2	4	0	0	
Trichloroethane;1,1,2- in µg/L	16					4	0	0		4	0	0		4	0	0	-
Dichloroethane;1,1- in µg/L						4	0	0		4	4	0	0.4	4	0	0	-
Dichloroethane;1,2- in µg/L	37					4	0	0		4	0	0		4	0	0	-
Ethyl Chloride in µg/L						4	0	0		4	0	0		4	0	0	-
Tetrachloroethene in µg/L	0.39					4	4	4	6.1	4	4	4	6.7	4	3	0	0.
Trichloroethene in µg/L+A22	6.7					4	4	0	0.8	4	4	0	2.8	4	0	0	<u> </u>
Dichloroethene;1,1- in µg/L	3.2					4	0	0		4	0	0		4	0	0	<u> </u>
Dichloroethene;1,2-,cis in µg/L						4	4	0	2.5	4	4	0	2.1	4	0	0	-
Dichloroethene;1,2-,trans in µg/L	10,000					4	0	0		4	0	0		4	0	0	
Vinyl Chloride in µg/L	2.4					4	0	0		4	0	0		4	0	0	-

Sheet 3 of 3

#### Table A-4 - Summary of Input Parameters Used for Groundwater Transport Model Port of Seattle Terminal 5

					Source Values			Н	ydrogeology			Dispersion			Ads	orption		Pio
Class	Chemical	Potential Screening Level in mg/L	Well ID	Distance to Receptor in Feet	Source Concentration in mg/L	Source Width in Feet	Source Thickness in Feet	Hydraulic Conductivity in cm/sec	Hydraulic Gradient in Feet/Feet	Porosity	Longitudinal in Feet	Transverse in Feet	Vertical in Feet	Soil Bulk Density in kg/L	Koc in L/kg	Kd in L/kg	Fraction of Organic Carbon	degradation half-life range in Years
	Lead	0.0081	CMP-2	940	1.5E-02	100	10	0.024	0.0007	0.45	5.5	2	1	1.7		1.00E+04	0.01	
	Polychlorinated biphenyls	0.00000064	CMP-2	940	3.1E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.10E+05	3.10E+03	0.01	
Background	Tetrachloroethene	0.00039	FM-105	355	6.2E-03	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	2.70E+02	2.70E+00	0.01	1 - 2
	bis(2-Ethylhexyl) phthalate	0.0022	FM-105	355	5.8E-03	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.10E+05	1.10E+03	0.01	0.027 - 1
	bis(2-Ethylhexyl) phthalate	0.0022	CMP-5	1160	2.3E-02	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.10E+05	1.10E+03	0.01	0.027 - 1
	Copper	0.0024	MW-26R	105	3.0E-03	100	10	0.024	0.0007	0.45	5.5	2	1	1.7		2.20E+01	0.01	
	Polychlorinated biphenyls	0.00000064	CMP-3	490	1.2E-03	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.10E+05	3.10E+03	0.01	
	Polychlorinated biphenyls	0.00000064	CMP-4	760	1.7E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.10E+05	3.10E+03	0.01	
	Polychlorinated biphenyls	0.00000064	MW-308N	185	1.4E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.10E+05	3.10E+03	0.01	
	Tetrachloroethene	0.00039	MW-125	250	6.7E-03	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	2.70E+02	2.70E+00	0.01	1 - 2
	bis(2-Ethylhexyl) phthalate	0.0022	CMP-4	760	2.4E-03	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.10E+05	1.10E+03	0.01	0.027 - 1
	Benzo[a]anthracene	0.000018	MW-125	250	9.7E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.60E+05	3.60E+03	0.01	0.56 - 2.73
	Benzo[a]anthracene	0.000018	MW-26R	105	2.5E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.60E+05	3.60E+03	0.01	0.56 - 2.73
Fill Aquiter	Benzo[a]pyrene	0.000018	MW-125	250	1.4E-04	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	9.70E+05	9.70E+03	0.01	0.31 - 2.9
	Benzo[b]fluoranthene	0.000018	MW-125	250	1.0E-04	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.20E+06	1.20E+04	0.01	1.97 - 3.34
	Benzo[b]fluoranthene	0.000018	CMP-3	490	1.9E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.20E+06	1.20E+04	0.01	1.97 - 3.34
	Benzo[k]fluoranthene	0.000018	MW-125	250	1.2E-04	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.20E+06	1.20E+04	0.01	4.99 - 11.7
	Chrysene	0.000018	MW-125	250	8.4E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	4.00E+05	4.00E+03	0.01	2.04 - 5.48
	Chrysene	0.000018	MW-26R	105	2.7E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	4.00E+05	4.00E+03	0.01	2.04 - 5.48
	Dibenzo[a,h]anthracene	0.000018	MW-125	250	2.8E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	1.80E+06	1.80E+04	0.01	1.98 - 5.15
	Indeno[1,2,3-cd]pyrene	0.000018	MW-125	250	5.1E-05	100	10	0.024	0.0007	0.45	5.5	2	1	1.7	3.50E+06	3.50E+04	0.01	3.89 - 4
	Copper	0.0024	MW-44	100	1.8E-02	100	10	0.014	0.0008	0.45	5.5	2	1	1.7		2.20E+01	0.01	
	Lead	0.0081	MW-44	100	3.3E-02	100	10	0.014	0.0008	0.45	5.5	2	1	1.7		1.00E+04	0.01	
	Nickel soluble salts	0.0082	MW-36	360	1.2E-02	100	10	0.014	0.0008	0.45	5.5	2	1	1.7		6.50E+01	0.01	
	TPH, heavy oils	0.5	MW-44	100	5.3E-01	100	10	0.014	0.0008	0.45	5.5	2	1	1.7			0.01	
	bis(2-Ethylhexyl) phthalate	0.0022	MW-308S	190	5.0E-03	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	1.10E+05	1.10E+03	0.01	0.027 - 1
	bis(2-Ethylhexyl) phthalate	0.0022	MW-44	100	2.4E-03	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	1.10E+05	1.10E+03	0.01	0.027 - 1
Estuarine	Benzo[a]anthracene	0.000018	MW-44	100	5.9E-05	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	3.60E+05	3.60E+03	0.01	0.56 - 2.73
Aquiter	Benzo[a]pyrene	0.000018	MW-44	100	1.1E-04	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	9.70E+05	9.70E+03	0.01	0.31 - 2.9
	Benzo[b]fluoranthene	0.000018	MW-44	100	2.7E-04	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	1.20E+06	1.20E+04	0.01	1.97 - 3.34
	Benzo[k]fluoranthene	0.000018	MW-44	100	1.4E-04	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	1.20E+06	1.20E+04	0.01	4.99 - 11.7
	Chrysene	0.000018	MW-44	100	1.9E-04	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	4.00E+05	4.00E+03	0.01	2.04 - 5.48
	Dibenzo[a,h]anthracene	0.000018	MW-44	100	3.5E-05	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	1.80E+06	1.80E+04	0.01	1.98 - 5.15
	Indeno[1,2,3-cd]pyrene	0.000018	MW-44	100	1.1E-04	100	10	0.014	0.0008	0.45	5.5	2	1	1.7	3.50E+06	3.50E+04	0.01	3.89 - 4

Notes:

Potential screening levels are obtained from GQMER (Hart Crowser 2010).

Source concentrations values are maximum concentrations for individual wells.

Source width, source thickness, hydraulic conductivity, longitudinal dispersion, transverse dispersion, vertical dispersion, and fraction of organic carbon values are referenced from the RI - PSR Marine Sediments Unit (Weston 1998b). Hydraulic gradients are calculated from the 72-hour mean groundwater elevations provided in the Hydrologic Characterization Report (Aspect 2007).

Koc = soil adsorption coefficient.

Kd = soil distribution coefficient.

Kd = Koc x fraction of organic carbon.

-- = not applicable.

ND = not detected.

Biodegradation half-life provided for reference; not used in modeling

# Table A-5 - Summary of Groundwater Transport Modeling Results Port of Seattle Terminal 5

				Baselin	e Case	Solubilit	y Case
Class	Chemical	Well ID	Potential Screening Level in mg/L (1)	Source Concentration in mg/L (2)	Concentration After 100 Years at Receptor in mg/L	Solubility Concentration (3) in mg/L	Concentration After 100 Years at Receptor in mg/L
	Lead	CMP-2	8.1E-03	1.5E-02			
	Polychlorinated biphenyls	CMP-2	6.4E-08	3.1E-05		7.0E-01	
Background	Tetrachloroethene	FM-105	3.9E-04	6.2E-03		2.0E+02	
_	bis(2-Ethylhexyl) phthalate	FM-105	2.2E-03	5.8E-03		3.4E-01	
	bis(2-Ethylhexyl) phthalate	CMP-5	2.2E-03	2.3E-02		3.4E-01	
	Copper	MW-26R	2.4E-03	3.0E-03	6.5E-06		
	Polychlorinated biphenyls	CMP-3	6.4E-08	1.2E-03	ND	7.0E-01	ND
	Polychlorinated biphenyls	CMP-4	6.4E-08	1.7E-05	ND	7.0E-01	ND
	Polychlorinated biphenyls	MW-308N	6.4E-08	1.4E-05	ND	7.0E-01	ND
	Tetrachloroethene	MW-125	3.9E-04	6.7E-03	0.0019 <sup>a</sup>	2.0E+02	57 <sup>a</sup>
	bis(2-Ethylhexyl) phthalate	CMP-4	2.2E-03	2.4E-03	ND	3.4E-01	ND
	Benzolalanthracene	MW-125	1.8E-05	9.7E-05	ND	9.4E-03	ND
	Benzolalanthracene	MW-26R	1.8E-05	2.5E-05	ND	9.4E-03	ND
Fill Aquiter	Benzolalpyrene	MW-125	1.8E-05	1.4E-04	ND	1.6E-03	ND
	Benzo[b]fluoranthene	MW-125	1.8E-05	1.0E-04	ND	1.5E-03	ND
	Benzolblfluoranthene	CMP-3	1.8E-05	1.9E-05	ND	1.5E-03	ND
	Benzolklfluoranthene	MW-125	1.8E-05	1.2E-04	ND	8.0E-04	ND
	Chrysene	MW-125	1.8E-05	8.4E-05	ND	1.6E-03	ND
	Chrysene	MW-26R	1.8E-05	2.7E-05	ND	1.6E-03	ND
	Dibenzola.hlanthracene	MW-125	1.8E-05	2.8E-05	ND	2.5E-03	ND
	Indeno[1,2,3-cd]pyrene	MW-125	1.8E-05	5.1E-05	ND	2.2E-05	ND
	Copper	MW-44	2.4E-03	1.8E-02	7.2E-07		
	Lead	MW-44	8.1E-03	3.3E-02	ND		
	Nickel soluble salts	MW-36	8.2E-03	1.2E-02	ND		
	TPH, heavy oils	MW-44	5.0E-01	5.3E-01			
	bis(2-Ethylhexyl) phthalate	MW-308S	2.2E-03	5.0E-03	ND	3.4E-01	ND
	bis(2-Ethylhexyl) phthalate	MW-44	2.2E-03	2.4E-03	ND	3.4E-01	ND
Estuarine	Benzo[a]anthracene	MW-44	1.8E-05	5.9E-05	ND	9.4E-03	ND
Aquiter	Benzo[a]pyrene	MW-44	1.8E-05	1.1E-04	ND	1.6E-03	ND
	Benzolblfluoranthene	MW-44	1.8E-05	2.7E-04	ND	1.5E-03	ND
	Benzo[k]fluoranthene	MW-44	1.8E-05	1.4E-04	ND	8.0E-04	ND
	Chrysene	MW-44	1.8E-05	1.9E-04	ND	1.6E-03	ND
	Dibenzo[a,h]anthracene	MW-44	1.8E-05	3.5E-05	ND	2.5E-03	ND
	Indeno[1,2,3-cd]pyrene	MW-44	1.8E-05	1.1E-04	ND	2.2E-05	ND

Notes:

1. Potential screening levels are obtained from GQMER (Hart Crowser 2010).

2. Source concentrations values are maximum concentrations for individual wells.

3. Solubility concentration values are obtained from CLARC database.

<sup>a</sup> Predicted concentrations of PCE with biodegradation (1 to 2 half life) were less than 0.0001 mg/L

Background groundwater data was not modeled.

Receptor is the surface water (Elliott Bay and/or Duwamish Waterway).



AL 09/23/10 1762700-005 dw

APPENDIX B GROUNDWATER SAMPLING PROCEDURES AND SAMPLE HANDLING METHODS

### APPENDIX B GROUNDWATER SAMPLING PROCEDURES AND SAMPLE HANDLING METHODS

This appendix summarizes the groundwater sampling and handling procedures used by Hart Crowser to conduct its fieldwork.

#### Groundwater Level Measurements

Groundwater level measurements were made during the groundwater sampling event from June 2 through June 4, 2010. Groundwater elevation data are summarized in Table 1. Depths to water measurements were made using a water level indicator. The probe was cleaned with deionized water between measurements to prevent cross-contamination of monitoring wells.

### Groundwater Sampling

Groundwater samples were collected from monitoring wells CMP-1, CMP-2, CMP-3, CMP-4, CMP-5, CMP-15, CMP-17, MW-26R, MW-36, MW-44, MW-125, MW-308A(N), MW-308B(S), and FM-105 from June 2 through June 4, 2010 for chemical analysis. One duplicate sample was collected for each analyte during the sampling event. Equipment used for groundwater sample collection of groundwater samples included:

- Multiparameter water quality meter;
- Water level indicator;
- Peristaltic pump with disposable polyethylene tubing;
- Laboratory-supplied, pre-cleaned and preserved, 500 mL and 1 L HPDE and amber bottles;
- Coolers with ice; and
- Hart Crowser Sample Custody Record and Groundwater Sampling Data forms.

Upon arrival at the wellhead, field personnel recorded well conditions, depth to water, and depth to sediment in the well using a water level indicator. Purging and sampling was conducted at a depth representing the middle of the screened interval of each well. Groundwater samples were collected using low-flow sampling techniques. The wells were purged and sampled with a peristaltic pump. Clean sample tubing was used for each well and disposed of after use.

The field parameters pH, temperature, specific conductivity, dissolved oxygen, turbidity, and oxygen redox potential were measured and recorded periodically during well purging. Once the field parameters remained stable between

measurements, the groundwater sample was collected. The final stabilized readings measured just before sampling were recorded on the Groundwater Sampling Data form. Copies of the Groundwater Sampling Data forms are presented in Appendix C.

#### Sample Handling and Laboratory Analysis

Groundwater samples collected during the monitoring event were submitted to Analytical Resources Inc. of Tukwila, Washington. Samples were delivered by courier to the laboratory under chain of custody protocols.

One field duplicate and two trip blank samples were collected for the groundwater samples and submitted to the laboratory to assess combined field and laboratory variability. The one field duplicate sample was assigned the same exploration label with the letter "D" at the end of the number. The two trip blank samples were assigned the label "Trip Blank."

All groundwater samples were submitted for chemical analysis of cPAHs by EPA Method 8270C-SIM, PCBs by EPA Method 8082, TPH-Dx by NWTPH-Dx with silica gel cleanup, and bis(2-ethylhexyl)phthalate (BEHP) by EPA Method 8270C. Selected groundwater samples (FM-105, MW-125, and CMP-17) were submitted for chemical analysis of VOCs chlorinated ethanes and ethenes (CEEs) by EPA Method 8260B. Selected groundwater samples (CMP-15, MW-26R, MW-36, and MW-44) were submitted for chemical analysis of total metals by EPA Method 6010B/6020 for As, Pb, Sb, Cr, Cu, and Ni. Selected groundwater samples (CMP-1, CMP-2, CMP-3, CMP-4, CMP-5, CMP-17, MW-125, MW-308N, MW-308S, and FM-105) were submitted for chemical analysis of total metals by EPA Method 6010B/6020 for As and Pb.

### Investigation-Derived Waste Storage and Disposal

Investigation-derived waste (IDW) generated from purging groundwater for sampling by Hart Crowser will be transported and transferred to a 1,100-gallon poly tank stored on site within a locked fence area at Pier 2-East (adjacent to SW Florida Street). Wastewater will periodically be picked up via tanker truck and transported to the Phillip Services facility in Kent, Washington for treatment. Wastewater disposal will be managed under an existing Phillip Services waste profile developed for wastewater during the Phase I Groundwater Confirmation Monitoring Program (GWCMP). Dedicated disposable sampling equipment such as gloves, tubing, and Tyvek will be disposed of as solid waste.

L:\Jobs\1762700\T5 Groundwater Report 070814\Revised T5 GW Report.doc

APPENDIX C MONITORING WELL BORING LOGS

# List of Well Completion Reports

CMP-1

CMP-2

CMP-3

CMP-4

CMP-5

CMP-15

CMP-17

MW-26R

MW-36

MW-44

MW-125

MW-308A(N)

MW-308B(S)

FM-105

			10.0.	u		1					
	ы		D		Well-graded gravel and	Terms D	escri	bing R	elative Densit	y and Consi	stency
	acti	s 12 12	စို့စို	GW	gravel with sand, little to		Den	sity	SPT <sup>(2)</sup> blows/foot		
	Ъ	Line		3	no lines	Coarse-	Very	Loose	0 to 4		
ě	arse	1%2		í l	Poorly-graded gravel	Grained Soils	Loose	) Im Donco	4 to 10		
Sie	ပိုးပို	Ňí		GP	and gravel with sand,		Dens	am Dense	30 to 50	Test S	Symbols
°C	0. d		00000		little to no fines		Verv	Dense	>50	G = Grair	n Size
	)% Z			<u>`</u>		4	Conoio	topov	SDT <sup>(2)</sup> blowe/feet	M = Mois	ture Content
ž	d or				Silty gravel and silty		Vorv	Soft		A = Attern	perg Limits
on	nec	s (5	8.8.	GM	gravel with sand	Fine-	Soft	5011	2 to 4	DD = Drv	Density
per	ore	l i	600			Grained Soils	Mediu	um Stiff	4 to 8	K = Perm	eability
etaii	≚ œ	8		\$	Clayov gravel and	-	Stiff		8 to 15		
, Re	<u>s</u>	12			clayey gravel with sand		Very	Stiff	15 to 30		
%(1	rave		1 A K	GC	clayey graver with sand		Hard		>30		
50	G		45157	1				Com	ponent Definit	ions	
าลท	L L				Well-graded sand and	Descriptive T	erm	<u>Size Ra</u>	ange and Sieve Nu	mber	
e th	ctic	(2)		sw	sand with gravel, little	Boulders		Larger	than 12"		
Mor	Fra	nes			to no fines	Cobbles		3" to 12	2"		
	se	Ë –		-		Gravel		3" to N	o. 4 (4.75 mm)		
soils	eve	20 N			Poorly-graded sand	Coarse Grav	/el	3" to 3/	4"		
p o	Si O			SP	little to no fines	Fine Gravel		3/4" to	No. 4 (4.75 mm)		
aine	o. 4			1		Sand		No. 4 (	4.75 mm) to No. 200 (	0.075 mm)	
G	βŽ				Silty sand and	Coarse Sand	d	No. 4 (	4.75 mm) to No. 10 (2	.00 mm)	
-se-	or	(2)		SM	silty sand with	Medium Sar	nd	NO. 10	(2.00 mm) to No. 40 (	0.425 mm) 0 (0.075 mm)	
oar	% <sup>(1</sup> Pas	les			gravel			110.40	(0.423 mm) to No. 20	0 (0.073 mm)	
0	20	Ē		<u> </u>		Silt and Clay		Smalle	r than No. 200 (0.075)	mm)	
	- st	15%			Clayey sand and	<sup>(3)</sup> Estimate	ed Pe	centa	de	Moisture	Content
	and	^		SC	clayey sand with gravel	Percentage	9 9	00.110	90	Dry - Absenc	e of moisture,
	S S					by Weight	_	Mod	fier	dusty, d	ry to the touch
					Silt, sandy silt, gravelly silt,	<5		Trace		Slightly Mois	st - Perceptible
		5		м	silt with sand or gravel						moisture
ieve		0 =			5	5 to 15		Sligh	ily (sandy, silty,	Moist - Damp	but no visible
S C	ays							claye	y, gravelly)	Water	
20	00	2020			Clay of low to medium	15 to 30		Sand	y, silty, clayey,		It free draining
9. Š	pug 1	Ľ		CL	plasticity; silty, sandy, or	30 to 49		Vorv	(sandy silty	Wat - Visible free	water usually
es	Its a				gravelly clay, lean clay	501047		claye	y, gravelly)	from below	w water table
ass	io -			1	Organic clay or silt of low	1		5	Symbols		
е			<u> </u>		plasticity		Blows	'6" or	Symbols	Ce	ement grout
Mor		-	<u> </u>			Sampler	portior	1 of 6"			
or						I lype	. /			Be Be ch	entonite
(I) (1)					Elastic silt, clayey silt, silt	2.0" OD	ZZ !!	Samp	<u>ller Type</u>	88 88	.po
50%	2	D		MH	with micaceous or diato-	Split-Spoon Sampler	20	Des	cription	(4) Be	entonite al
- s	s, s				maceous line sand or sill	(SPT)	Cont	inuous Pu	sh		tor pack with
Soil	Clay	5			Clay of high plasticity.	1	3.25"	OD Split-	Spoon Ring Sampler	(4)	ank casing
pe pe		5		СН	sandy or gravelly clay, fat	Bulk sample	3 0" (	OD Thin-W	all Tube Sampler	Į ∐ se	
ain	s ar	Ē	/////		clay with sand or gravel		(inclu	ding Shel	by tube)		Hydrotip with
ő	l Silt		444			Grab Sample	<sup>CC</sup>			[·]∃·  <sup>filt</sup>	er pack
ine		-Idc			Organic clay or silt of	l	O Porti	on not rec	overed	Er	id cap
<u>ш</u>	-			ОН	medium to high	<sup>(1)</sup> Percentage by	, drv wei	aht	<sup>(5)</sup> C	ombined USCS sv	mbols used for
1					μαδιισιτά	<sup>(2)</sup> (SPT) Standard	d Penetr	ation Test	fir	nes between 5% ar	nd 15% as
					Peat, muck and other	(ASTM D-1586	<b>b</b> )		es	stimated in Genera	I Accordance
yht (	Jani Sils			рт	highly organic soils	In General Acc	cordance	e with	W	ith Standard Practi	ce for
Hig	ы С					Standard Prac	tion of Se		ı D_2/188)	escription and Ider	nutrication of
	-			1		<sup>(4)</sup> Depth of aroun	ndwator		TD = At time of drilling	טויס (אס דידע בווט א	/
						Deptition groun	nawater	v A ▼ S	tatic water level (date)	J	
L						1		<u>+</u> °			
Classifi	cations	of	soils in t	his rep	ort are based on visual field and/or l	aboratory observation	ns, which	include der	sity/consistency, moistu	re condition, grain siz	ze, and
plasticit	ty estim	ate	es and sh	nould n	ot be construed to imply field or labo	pratory testing unless	presented	d herein. Vi	sual-manual and/or labor	ratory classification	
meuluu	13 UI AS	VIIV	-240 <i>1</i>			ande for the Onlined		Sincation 3	yotem.	DATE:	
	\en/	<u>م</u> د	+		50 S						PROJECT NO.
	vahe	30	earth	+wate	E>	ploration	Loc	l Kev		DESIGNED BY:	
	www.	.asp	ectconsu	lting.cor	n	•	<u>ر</u>	. J		DRAWN BY:	FIGURE NO.
		ə lir	nited liahilih	/comnan	/					REVISED BY:	B-1
		J 11		ssinpari	′ I						-

	C.	Acpost					Ge	olog	ic & Mo	nitoring Well Const	ruction Log
		ASPECIcons	Sulting SPECTIVE				Project	Numb	er	Well Number	Sheet 1 of 1
Project	Name	Southwest H	arhor P	roject			990	5100	I	Monument Flev (ft m	1011 Ilw) 22.90
Location	n	Seattle, Washing	aton	10,001						Water Elev. (ft mllw)	11.4
Drilling	Method	Hollow Stem Aug	per 8" OE	)/4" ID :	Ho	t Drilling	<u>з</u> .			Start Date Sept	ember 19, 2001
Samplin	ng Meth	od 2" Diameter, Spl	it Spoon	Sample	r		,			Finish Date Septe	ember 19, 2001
Depth feet	v	Vell Construction	PID (ppm)	H2S (ppm)	S T	Blows/ 6*	Sample ID	Mtl. Graphic		Description	
	ৰ প্ৰ	8" Steel Monument			++			0.00	)	CRUSHED GRAVEL S	URFACE
		1 ype L-868				×		6.6	1 1-1/4" min	ius crushed gravel	
		Concrete seal									
								<u>Å.</u> Å.		Ell I	
			0	. 0		12	S-1			1 I Austra	
- 88		Bentonite chips			Ø	15			Dense, da	amp, dark brown SAND; sand f	ine to medium
					8	17					,
-5		, · · ·							-		
-		Filter Pack, 10 X 20 & 20									
		X 40 COlorado Silica Salid									
Γ İ.	目								•		
- !:	目:	Well Screen 2" ID SCH 40	0	0		13 8	S-2		grades to	o medium dense	
	:目:1	PVC, 0.01" slot size			0	6					
-	日日				Ó						
-10 <u>:</u>	目引										
	·目:								Medium d	ense, wet, black SAND; sand	ine to medium, trace red
<b>T</b>		11.5' ATD							grains		·····, ·····
- 1	:目:1	· •							•		
	目		0.	0		3	S-3				
	:目:1		-			6					
					þ	10					•
	· E: I										
-15	:目:										
	. =										
$ \vdash \downarrow$	日日					•			Medium d	ense, wet, gray-brown SAND;	sand fine to medium
	:目:1										
	· 🐻 : 1	PVC Threaded End Cap									
			0	0	Ø	4	S-4				
		Filter Pack, 10 X 20 & 20 X 40 Colorado Silica Sand				10					
-  ÷					Ø	•			Bottom of	exploration boring at 19 feet.	
<sup>-20</sup>											
											• · · · ·
	Samp	ler Type (ST):				Lab	Fests:	~		Logged by:	KKH .
		3.25" OD D & M Split-9	Spoon Ri	ing Sam	pler	G-0 P-P	ermeahi	e litv		Approved by:	WVG
	01	No Recovery				M - N	Aoisture	Conter	nt		
		2" OD Split-Spoon Sar	npler	Ţ	Wa	ter Leve	el (ATD)	∑ St	tatic Water	Level Figure No.	

Project Number     Well Number     Sheet       990106     CMP-2     1 of 1       Project Name     Southwest Harbor Project     Monument Elev. (ft mllw)     23.04       Location     Seattle, Washington     Water Elev. (ft mllw)     10.5       Drilling Method     Hollow Stem Auger 8" OD/4" ID ; Holt Drilling     Start Date     September 18, 2001       Sampling Method     2" Diameter, Split Spoon Sampler     Finish Date     September 18, 2001       Depth     Project Mument     ID     Graphic     Description       8" Steel Monument     (ppm)     T     6"     ID     Graphic       Type L-868     South Seattle     South Sample     Froject Name     RECENT FILL       Concrete seal     Southwest Harbor Project     Southwest Harbor Project     Southwest Harbor Project     Southwest Harbor Project	
Project Name       Southwest Harbor Project       Monument Elev. (ft mllw)       23.04         Location       Seattle, Washington       Water Elev. (ft mllw)       10.5         Drilling Method       Hollow Stem Auger 8" OD/4" ID ; Holt Drilling       Start Date       September 18, 2001         Sampling Method       2" Diameter, Split Spoon Sampler       Finish Date       September 18, 2001         Depth feet       Well Construction       PID (ppm)       H2S (ppm)       S       Blows/ 1D       Sample Graphic       Mtl.         B*Steel Monument Type L-868       B*Steel Monument Concrete seal       S       Blows/ 0 0 0       Sample Graphic       Concrete seal       Concrete seal	
Location       Seattle, Washington       Water Elev. (ft mllw)       10.5         Drilling Method       Hollow Stem Auger 8" OD/4" ID ; Holt Drilling       Start Date       September 18, 2001         Sampling Method       2" Diameter, Split Spoon Sampler       Finish Date       September 18, 2001         Depth feet       Well Construction       PID (ppm)       H2S (ppm)       S       Blows/ 6"       Sample ID       Mtl. Graphic       Description         8" Steel Monument Type L-868       Fype L-868       S       South Concrete seal       South Concrete seal       South Concrete seal       Finish Sample Mtl.	
Drilling Method       Hollow Stem Auger 8" OD/4" ID ; Holt Drilling       Start Date       September 18, 2001         Sampling Method       2" Diameter, Split Spoon Sampler       Finish Date       September 18, 2001         Depth feet       Well Construction       PID (ppm)       H2S (ppm)       Sample T       Sample 6"       Mtl. ID       Description         8" Steel Monument Type L-868       Sample Concrete seal       Sample Concrete seal       Sample Concrete seal       Null       Description	
Sampling Method       2" Diameter, Split Spoon Sampler       Finish Date       September 18, 2001         Depth feet       Well Construction       PID (ppm)       H2S (ppm)       S T       Blows/ 6"       Sample ID       Mtl. Graphic       Description         8" Steel Monument Type L-868       Type L-868       T       D       O       Concrete seal       Concrete seal	
Depth feet     Well Construction     PID (ppm)     H2S (ppm)     S Blows/     Sample IID     Mtl. Graphic       8" Steel Monument     Type L-868       Concrete seal	
8" Steel Monument     RECENT FILL       Type L-868     0 0 0 0       Concrete seal     0 0 0 0   - road ballast, 1-1/4" minus gravel with sand; trace silt	
Type L-868 Concrete seal	
OLDER FILL	dium
	aium 
-5 Bentonite chips	
Filter Pack, 10 X 20 & 20       Dense, damp, dark brown SANDY GRAVEL         X 40 Colorado Silica Sand       Dense, damp, dark brown SANDY GRAVEL         X 40 Colorado Silica Sand       Dense, damp, dark brown SANDY GRAVEL         X 40 Colorado Silica Sand       Dense, damp, dark brown SANDY GRAVEL         X 40 Colorado Silica Sand       Dense, damp, dark brown SANDY GRAVEL         X 40 Colorado Silica Sand       Dense, damp, dark brown SANDY GRAVEL         X 40 Colorado Silica Sand       Dense, damp, dark brown SANDY GRAVEL	
- 10	
$\mathbf{Y}$ 12.5' ATD $0$ $0$ $\frac{12.5'}{12.5'}$ 12.5' ATD $0$ $0$ $\frac{12}{15}$ $\frac{23}{9}$ $\frac{15}{9}$ $\frac{15}{9}$ $\frac{115}{9}$ $\frac{115}$	
<ul> <li>PVC Threaded End Cap</li> <li>Filter Pack, 10 X 20 &amp; 20</li> <li>Filter Pack, 10 X 20 &amp; 20</li> <li>Filter Sand</li> /ul>	and kiln
- 20	
	-
Sampler Type (ST): Lab Tests: Logged by: RRH	
3.25" OD D & M Split-Spoon Ring Sampler G - Grain Size Approved by: WVG	
No Recovery     P - Permeability     M - Moisture Content	
2" OD Split-Spoon Sampler ▼ Motor Loval (ATD) ∇ Static Mator Loval Elsure No	

Ø	Aspectan	ulting				Ge	olog	gic & Monitoring Well Construction Log
THE STREET	IN-DEPTH PERS	SPECTIVE				Project	Numb	ber Well Number Sheet
Project Name	Southwest Ha	arhor P	roject			990	5100	Monument Elev. (ft mlw) 17.75
	Seattle Washing	aton	IUJECI					Water Elev. (ft mllw) 8.2
Drilling Method	Hollow Stem Aug	ner 8" OF	י חו "4/נ	Hol	t Drilling	т		Start Date September 19, 2001
Sampling Method	2" Diameter, Spl	it Spoon	Sample	r 1101	t Drining	1		Finish Date September 19, 2001
Depth feet Well	Construction	PID (ppm)	H2S	S T	Blows/ 6"	Sample ID	Mtl. Graphic	Description
N N 8" 5	Steel Monument		()					ASPHALT SURFACE
Тур	be L-868					,		FILL
	ncrete seal						0.0.	, cobbles in cutting
⊢ ▓ ▓								Dense, damp, brown GRAVELLY SAND; trace silt, sand fine to
Ber	ntonite chips	0	0		6	S_1		
-		0	Ŭ	0	9	0-1		
				Ø	26			
-5 Fill	er Pack, 10 X 20 & 20							
X4	0 Colorado Silica Sand							·.
								Very dense, moist, brown SANDY GRAVEL; sand fine to coarse
							0000	5 5 5 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3
							0000	
		0.	0	Ø	13 31	S-2	0000	
				0	42			
				H			000	
9.5	ATD						0000	
							000	
	Il Screen 2" ID SCH 40							L Loose, wet, dark brown GRAVELLY SAND with SILT; sand fine to
PV	C, 0.01" slot size							coarse
		0	0		.3	S-3		
				8	5			
				Ц	5			
-15							₿. ₽	Medium dense, wet brown SANDY GRAVEL with SILT
	-							
PV	C Threaded End Cap	0	0	Ø	4	S-4		
Filte	er Pack, 10 X 20 & 20			2	9 11			TIDAL MARSH DEPOSITS
×4	0 Colorado Silica Sand			Р				Bottom of exploration boring at 17.5 feet
-								Determ of exploration being at 11.6 feet.
-20								
Sampler	Type (ST):				Lab T	ests:		Logged by: RRH
3.25	5" OD D & M Split-S	spoon Rir	ng Samp	oler	G-G	rain Size	e itv	Approved by: WVG
O No I	Recovery				м - Ре М - М	loisture (	ny Conten	nt
2" 0	D Split-Spoon Sam	npler	Ţ	Wat	er Leve	I (ATD)	∑ St	Static Water Level Figure No.

			Acnoct					Ge	olog	ic & Monitoring Well Construction Log
			мэресісог IN-DEPTH PE	RSPECTIVE				Projec	t Numb	Vell Number Sheet
	Droio	ot Nom	Southwest H	Jarbor P	rojoct			99	0100	OMP-4 OT 1
	Locat	tion	Seattle Washi	naton	TUJECI					Water Elev. (R milw) 7.93
	Drillin	na Meth	nod Hollow Stem A	uger 8" Ol	)/4" ID :	Но	lt Drillin	a		Start Date September 18, 2001
	Sam	oling M	ethod 2" Diameter, S	plit Spoon	Sample	r		5		Finish Date September 18, 2001
	Depth		Woll Operation	PID	H2S	s	Blows/	Sample	Mti.	Description
	feet	ka r	8" Steel Monument		(ppm)		6"		Graphic	ASPHALT SURFACE
			Type L-868			•				FILL
	Γ		Concrete seal						0.0.	Dense, damp, brown SAND: sand fine to medium: no visible
			Bentonite chips	0	0		10 20 28	S-1		structure (fill)
	5 5		Filter Pack, 10 X 20 & 20			4				
			X 40 Colorado Silica Sand Well Screen 2" ID SCH 40 PVC, 0.01" slot size	0	0		10	S-2		
	- 10						22			
	_									A A A A A A A A A A A A A A
	-		12.32' ATD	0	0		2 3 4	S-3		-grades to loose -becomes wet
	- 15					70				Loose, wet, gray SAND; few silt, trace gravels, sand fine to mediur
				0	0	Ø	0 2	S-4		
	F		PVC Threaded End Cap				3			
	F		X 40 Colorado Silica Sand							Bottom of exploration boring at 17.5 feet.
	-									
	-20									
	F									
000										
u v	5									
cinda					-					
ці 										
С Ц С	2			· ·						
A R R				<u> </u>			l ob "	Looto.	<u> </u>	
		San	прієстуре (эт): 3 25" ОП Л & M Split	Snoon Ri	na Sami	nlor	G - G	rain Siz	е	
a C a			No Recovery	SPOORIN	ng oann	0101	P - P	ermeabi	lity	
YAH/			2" OD Split-Spoon Sc	moler	-		M - N	loisture	Conten	
Š,	51	12	z on shir-shool se	nuhiei	Ţ	vva	ter Leve	er (ATD)	⊻ St	alic water Level Figure No.

		Asnect.com	sulting				Ge	olog	ic & Monitoring Well Construction Log
		IN-DEPTH PER	SPECTIVE				Project	Numb	Der Well Number Sheet
Droigo	tNom	Southwoot U	orbor D	roiget			990	J106	CMP-5 1 of 1
Locatio	on	Seattle Washin	aton	Tojeci					Monument Elev. (π milw)24.07
Drilling	un 1 Math	- Hollow Stem Au	gion ger 8" Of	-	Lla		~		Water Elev. (it milw)
Sampl	lina Me	thod 2" Diameter Sp	lit Spoon	<u>574 ID</u> , Somolo	п0 г 1		y		Start Date October 29, 2001
Denth					i, i <sup>.</sup>	Howa/	Cample	NA41	
feet		Well Construction	(ppm)	(ppm)	Т	6"	ID	Graphic	ic Description
		8" Steel Monument						0 6 0 0 4 0	CONCRETE ROAD BED
									FILL
		Concrete seal						0.00	Dense, damp, brown SANDY GRAVEL; trace silt, trace wood, tra glass; sand fine to medium
- 1		8 Bentonite chips						<u>ו ו</u>	Medium dense, damp, brown SAND; sand fine to medium
			0	0	Ø	16	S-1		-
- 1	585 <b>5</b> 5	8			2	12 15			
		•			0	10			
-		Filter Pack, 10 X 20 & 20							
		X 40 Colorado Silica Sand							
-5									•
ľ		. V-Wrap Well Screen	-					····	
_	· E:	2" ID SCH 40 PVC,							NATIVE DEPOSITS
ľ									Medium dense, moist, brown SAND with gray SILTY SAND
_	: : : : : : : : : : : : : : : : : : :								
		•	0	0	Ø	5	S-2		
-					.0	5			
	:目:								
-  .	:日:								
		· ·							
-10	: 目:								
								111	Loose wet gray SLIGHTLY SILTY to SILTY SAND: sand fine to
- <u>₹</u> :	: 目:	11.0' ATD							medium
ľ									
-  .	::目::								
_	: 目:		U	0	Ø	2 3	8-3		
-	::目::				2	6			
_	: 目:				0				
-									
10									•
-15	- E	PVC Threaded End Cap	0	0	Ø	4	S-4		-grades to medium dense with trace gravel
ŀ		•			Ø	7			
-  :					Ø	-			
ŀ					Å				-
-  ·									
-  -	· · · · · · · ·		0	Ω	H	1	S-5		
-  .			v	0	0	1	50		LAWTON CLAY
ŀ	· · · · · · ·				Ø	3			Soft, wet, gray CLAYEY SILT
-  -	······································	-			A			<b>µ∎∎</b>	Pottom of exploration baring at 10 fact
	Sam	pier Type (ST):	)na 5'	- 0 - · ·	.1	Lab T	ests: rain Sizo		Logged by: RRH
		3.25" UD D & M Split-S	poon Rir	ng Samp	oler	9 - 9 P - Pe	ermeabili	ty	Approved by: WVG
	р М					M - M	oisture C	ontent	.t.
		2 OD Split-Spoon San	npier	<u> </u>	Wat	er Leve	I (ATD)	⊻ Sta	atic Water Level Figure No.

								Ge Project	olog Numb	Konitoring Well Construction Log     Well Number     Sheet		
		٥	IN-DEPTH PER	SPECTIVE				99(	0106	CMP-15 1 of 1		
Projec	t Nam	е	Southwest H	arbor P	roject		<b>I</b>			Monument Elev. (ft mllw) 18.74		
Locati	on		Seattle, Washin	gton						Water Elev. (ft mllw) 6.7		
Drillin	g Meth	od	Hollow Stem Au	ger 8" Ol	)/4" ID ;	Hol	t Drillin	9		Start Date November 5, 2001		
Samp	ling Me	ethod	2" Diameter, Sp	it Spoon	Sampler	r, 14	10 lb ha	mmer		Finish Date November 5, 2001		
Depth feet		Well C	Construction	PID (ppm)	H2S	S	Blows/	Sample	Mtl. Graphic	Description		
	য় চ	🛛 8" St	eel Monument		(ppiii)	++			Bis	ASPHALT		
		Туре	C-868						0000	FILL		
-		Conc	orete seal	0	0		29 35	S-1		Very dense, damp, brown SANDY GRAVEL		
-5		Filter X 40	Pack, 10 X 20 & 20 Colorado Silica Sand				20		00,00,00,00,00,00,00,00,00,00,00,00,00,	Dense, moist, dark brown to black SANDY GRAVEL with SI trace wood and slag-like material		
-		V-Wi 2" ID 0.01'	rap Well Screen SCH 40 PVC, ' slot size	0	0	NIIIIIIVo	3 8 11	S-2				
- 10 - ¥		12.0'	ATD .	0	0	IONIIIIN	4 7 9	S-3		-wet at 12.5'		
		·.]								TIDAL MARSH DEPOSITS		
- 15 -		. PVC	Threaded End Cap	0	0	NIIIINO	4 6 16	S-4		Medium dense, wet, brown SAND; trace silt, trace organics, shell fragments; sand fine to medium; slight creosote-like od		
	100028								┝┷┷┿	Bottom of exploration boring at 17.4 feet.		
-												
				-								
	Sam	 pler T 3.25"	ype (ST): OD D & M Split-S	boon Rir	ng Samp	LL ler	Lab T G - G	'ests: rain Size	<u>                                     </u>	Logged by: RRH		
	6	No R	ecoverv		J		P - Pe	ermeabili	ity	, pp. 0.00 by., 111 b		
	$\square$						M - M	oisture C	Content			

	Aspect con	sultina				Ge	olog	C & WONITOFING Well Construction Log
	IN-DEPTH PER	SPECTIVE				99(	0106	CMP-17 1 of 1
Project Name	Southwest H	arbor P	roiect					Monument Elev. (ft mllw) 18.61
Location	Seattle, Washin	aton						Water Elev. (ft mllw) 7.3
Drilling Metho	d Hollow Stem Au	ider 8" Ol	י חו "4/ר	Hol	t Drillin	a —		Start Date November 6, 2001
Sampling Met	hod 2" Diameter, Sp	lit Spoon	Sample	r 14	10 lb ha	emmer		Finish Date November 6, 2001
Depth		PID	H2S	ls I	Blows/	Sample	Mti.	
feet	Well Construction	(ppm)	(ppm)	Т	6"	D	Graphic	Description
	8" Steel Monument Type C-868						000	FILL
	Concrete seal				,			Very dense, moist, dark brown GRAVELLY SAND; trace silt
-	Bentonite chips	0	0		15 26 28	S-1		
- 5	Filter Pack, 10 X 20 & 20 X 40 Colorado Silica Sand							
		0	0		10	S-2		Dense, moist, dark brown SAND; sand fine to medium; red sa grains visible
- 10	V-Wrap Well Screen 2" ID SCH 40 PVC, 0.01" slot size				15 19			- 1" silt lense at 8.5'
	11.3' ATD							Medium dense, wet, dark gray SAND with silt interbeds; sand to medium
		0	0		5 6 8	S-3		
- 15	PVC Threaded End Cap	0	0		5 6 6	S-4		
								Bottom of exploration boring at 16.5 feet.
_								
Samp	oler Type (ST):		·		Lab <sup>-</sup>	Tests:		Logged by: RRH
	3.25" OD D & M Split-	Spoon Ri	ng Sam	pler	G - G	Grain Size	Э	Approved by: WVG
6	No Recoverv				P - P	ermeabil	ity	·· ·
• M					i∕i - N	loisture	Jonten	

						Project	Numb	Well Number         Sheet
	)	01775				990	0106	MW-26(R) 1 of 1
Project Name	Southwest H	arbor P	roject					Monument Elev. (ft mllw) 18.59
Location	Seattle, Washin	gton						Water Elev. (ft mllw) 7.59
Drilling Method	Hollow Stem Au	iger 8" O[	D/4" ID ;	Hol	t Drillin	g		Start Date November 6, 2001
Sampling Method	2" Diameter, Sp	lit Spoon	Sample	r, 14	10 lb ha	mmer		Finish Date November 6, 2001
Depth feet Well	Construction	PID (ppm)	H2S (ppm)	S T	Blows/ 6"	Sample ID	Mtl. Graphic	Description
8"	Steel Monument			++				ASPHALT SURFACE
	ie C-868							FILL
- 	ncrete seal							Medium dense, damp, brown SANDY GRAVEL; sand fine to nedium, gravel medium to coarse
-							<u> </u>	Medium dense, damp, brown SAND; sand fine to medium
Bell	ntonite chips	0	0		5	S-1		
-	·			Ø	10			
				0	υ			
- 🅅 🕅				Р				
-5	,							
Fitt	er Pack, 10 X 20 & 20							
	u Colorado Silica Sand		,					
								trace shell fragments in cuttings
			•					
- 1:1								
		0			2	62		grades to wat at 0'
-  :==: vv	Vrap Well Screen	0		Ø	6	0-2		grades to wet at 9
2"	D SCH 40 PVC,			Ø	5			
	1" SIOT SIZE			R				
				Π				·
-10							$\left[ \begin{array}{c} \cdot & \cdot \\ \cdot & \cdot \end{array} \right]$	
		1						
- ¥日11.	D' ATD							
						e.		
								TIDAL MARSH DEPOSITS
		0	0		4	S-3		fedium dense, wet, dark gray to brown SILTY SAND with S
				Ø	7 17			nterbeds; trace organics, trace shells
				A				
- []目:				М				
		-						
-15			~	H	-			
		U	U	Ø	5 6	5-4		
				0	5			
				0				grades to loose at 16'
∵.…  PV(	C Threaded End Cap			П				
								ottom of exploration boring at 17 feet.
						8		-
-   .								-
-								
Sampler	Type (ST):				Lab 1	Tests:	<u> </u>	Logged by: RRH
3.25	" OD D & M Split-S	Spoon Rir	ng Samp	ler	G - G	rain Size	)    .	Approved by: WVG
	Recovery				P - P	ermeabili loioture (	ity Contert	
					IVI - IV	ioisture (	Jontent	


			Log	of Bo	ring	<u>MW44</u>	
Analytical Results	Blow Count	Sample Recovery (%)	, Depth (ft)	Soil Profile	USCS Symbo		PIC Rei
MW44-0.5 fL WTPH-418.1	4,6, 12	90 90	0 <u> </u>		SP	ASPHALT, 6 inches. Loose to medium dense, brown, fine SAND: laminated in places; trace silt; dry; no sign of	4.2 no c
	2,4,6	90				contamination. (Hydraulic Fill) - occasional shell fragments and charcoal.	
MW44-5 ft.	5,6,6	90	5 -			- 2 inch bed of shell fragments and stony debris (slag?); moist.	5.4
w 1111-10.1	5,4,4	90	<b>•</b>			dade mus wurt allebein berahish adar	sligt
	3,3,3	90	10:		<b>6P</b> (	- dark gray, wei, sugnuy orackish odor.	
MW44-10 ft. WTPH-418.1	2,4,5	<b>90</b> -	10 -		SP/ ML	Loose, dark gray, silly, fine SAND and SILT: laminated and bedded; minor shell fragments;	sligt
	7,6,7	90	-			plant fibers along faminae, 6" reedy bed at 10.5; wet. (Tidal Marsh soil)	sulfr
MW44-15 fl.	2,2,3	90 16	15 -		SP	Very loose, dark gray, fine SAND. (Fluvial	поо
WTPH-418.1	2,4,4	90		•	ML.	Soft, dark gray SILT: laminated; occasional	
	2,2,2	90			CL	Soft to medium stiff, dark gray, Clayey SILT:	2.7 1
•	2.2.5 .	90	20 -			laminated; wet; peaty debris on laminae; occa- sional shell fragments; sandy beds toward base.	sligh sulfu
}	2,3,3	60	4		SP	Very loose to medium dense, dark gray, fine SAND: laminated with occasional thin clayey	
· · · · · ·	3,4,5 3,5	90 90				silt interbeds; shell fragments and/or plant debris in places. (Fluvial Deltaic soils)	Backs
MW44-25 fl. WTPH-418.1	4,4,4	90	25			- 4" clayey silt interbed at 24 feet.	below no oc
	2,3,2	80	-			- 4" clayey silt interbed.	0.0 p sligh
•	1,1,1	90	30 -				sulfu
	2,1,1	60 00	ŀ		CL	Soft, green gray, Clayey SILT: laminated, with soft sediment deformation.	slight
	3,8,11	90 90	1		SP	Loose to medium dense, dark gray, fine SAND: laminated: occasional silt laminae, shells, plant	sulfu
	11,17, 22	90	35 -			debris; wet; no sign of contamination. (Fluvial Deltaic beds)	
•	13,15, 16 8,11.	90	┟			- silt laminae with soft sediment deformation.	
	14 8.11.9	90				- peaty layer	no oc
		90	40 +			- oren tragneneo	0.0 p
			4			(continues on page 2)	
en	viro	<u> </u>		I	D: Gi	ate Drilled: 6-23-92 cologist/Engineer: S.H. Evans	Ļ <u> </u>
· · · · · · · · · · · · · · · · · · ·	•				Ec	upinent: 6" i.d. Hollowstern Auger	A۰

(

Log of Boring MW44 (cont.) 15' scilles 58'-73'												
Analytical Results	Blow Count	Sample Recovery (%)	, Depth (ft)	Soil Profile		D.B.A.FT	PID/ Remarks					
	4,4,4	90	<b>6</b> 40			(continued from page 1)	0.0 ppm					
•	235	70			сг	Soft, green gray to dark gray, Clayey SILT:	no odor transitional					
•	233	60	· .			soft sediment deformation; no evidence of	sequence					
NDVAA.45 ft		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	45-			contamination. (Fluvial Deltaic soil)	0.0					
WIPH-418.1	2,2,2	100				- very dark gray bands, interval sampled.	0.0 ppm					
· · · ·	1,2,3	90				- increasing sand interpeds.	slight					
	3,2.5	90	·		SP/	green gray, fine SAND and Clayey SILT: shell	sulfur odor					
	5,6	90	50 -		CL	fragments, peary debris; wet; no sign of	no odor					
MW44-50 ft	3,2,5	90				contamination. (Fluvial Deltaic soil)	clight					
WIPH-418.1	1.2,4	90					sulfur odor					
.*	4.7.7	90				- clam shells and neaty laminae.						
	346	<b></b>	55-									
, • · · ·	5,4,0	90				Loose to medium dense, day, gray, fine SAND:	4					
	3,5,9	80			SP	occasional clayey silt laminae; peaty plant	no odor					
	5,9,9	90				debris; no sign of contamination. (Fluvial						
	3,5,5	90	60-			- 2" peary silt bed at 59.5".						
	3,4,4	70				Loose dark gray Silty fine SAND and SILT:						
	3,4,4	<i>.</i> 90	E	T i	SM	wood debris at top; clayey laminae; occasional	no odor					
	3.3.3	90	F			peaty material; no sign of contamination.	slight					
MW44-65 ft	458	90	65-			(Filivial Denaic soll) Medium dense to loose dark gray, fine SAND:	sulter odor					
Acid/Base/Nutral	-,0,0	50			SP	clean; laminated; wet; no sign of contamination.	no odor					
	7,6,8	90				(Fluvial Deltaic beds)						
8						- thin silt beds.	1					
<b>0</b>	3,3,3	0	70-				-					
2 7	1.2.3	0										
ft.			E		:							
		5	· .				no odor					
MW44-75 ft	324	5	75-			- occasional shell fragments						
WTPH-418.1		5										
					-							
						mail Davids 20 6 feet	Background					
н. :			80-			Note: sample interval at approximately 68 feet	0.0 ppm					
•						overdrilled. Sand pack on well squeezed by						
· ·						native soil after removal of auger, pushing sand						
en	viro	S		<b></b>		Date Drilled: 6-23-92 Geologist/Engineer: S.H. Evans	A					
						Fround Water Level When Drilling: 9.5 feet	<b>M-</b>					
		n	<del>nt</del> o:		Γ P	roject Name: Southwest Harbor Project	page 2 of 2					

Well Installation (Above Grado)       Project       Style RA-1       State       Zoor         and				. <u></u>	Well No MW-	-125	Page 1 of 1
et     Proied     SWH RA-1     Ste     Zoo       alken     MW-125     Wed Ownor     Port     Supervised by (company) Terra     Instanto by (company) Terra     Instanto by (company) Ramito       asknod     5-13-94     Date Completed     5-13-94     Formation of Complete     Serve Zone       Cound Surface     Date Completed     5-13-94     Formation of Complete     Instanto by (company) Terra     Instanto by (company) Bando     Instanto by (company) Terra       Cound Surface     Date Completed     5-13-94     Formation of Complete     Instanto by (company) Terra     Instanto by (company) Terra     Instanto by (company) Terra       Cound Surface     Cound Surface     To of Casing     MEASUREMENTS IN FEET     Instanto by (cound)     Instanto by (cound)       I     Total Boreholo depth     16.5     Ieet (BGS)       I     Total Boreholo depth     10     Ieet (BGS)       I     State so I daskil material     1eet (BGS)       I     Total Boreholo Biandler     10     Ieet (BGS)       I <th>Well Ins (Above</th> <th>s<b>tallati</b> e Grade)</th> <th>on</th> <th></th> <th>L</th> <th></th> <th>- URS</th>	Well Ins (Above	s <b>tallati</b> e Grade)	on		L		- URS
Number of the second system       Number of the second system       Installed by (company)       Installed by (company)         3 Garded       5-13-94       Date Completed       5-13-94       Formation of Completen       Second Surface Elevation	<u> </u>		Projuct	SWH RA-1	São	Za	no
Stand       5-13-94       Date Completed       5-13-94       Formation of Completes       Stront Zone         Ground Surface Elevation	tion MW-125	Well Owner	Port	Supervised by (company	) Insta	llod by (compan Ram10	Y)
Ground Surface Elevation	Startod 5-13-94	Dato Completed	5-13-94	Formation of Completion	S	croon Zono	
Locking Protoctive Casing (nitus) Top of Casing Elevation	<u></u>	······································		Ground Surface	Flovation		feet MSL
Locking Protective Casing				(minus) Top of	Casino Elevation		leet MSL
Ground Surtace (Datum)	Locking Protective	Casing		(equals) Well Si	lickup		feet
Ground Surface (Daturn)       MEASUREMENTS IN FEET         L1       Total Borehole depth       16.5         L2       Casing depth       15         L3       Depth to top of screen       5         L4       Depth to bland       3         L5       Depth to bland       3         L6       Depth to bland       10         L6       Depth to bland       12         L7       Screen kength       10         L8       Height of filer above screen       2         L10       Thickness of scal material       12         L12       Casing Stickup       0       inches         L13       Depth to Boat       10       inches         L14       Casing Stickup       0		write	77777777777777777777777777777777777777				
(Daum)       MESoficient of NTEEL         I1       Total Borehole depth       16.5       feet (BGS)         I2       Casing depth       15       feet (BGS)         I3       Depth to top of screen       5       feet (BGS)         I4       Depth to backfill material       3       feet (BGS)         I5       Depth to backfill material       3       feet (BGS)         I5       Depth to backfill material       10       feet (BGS)         I5       Depth to backfill material       12       feet (BGS)         I5       Depth to backfill material       12       feet (BGS)         I5       Depth to backfill material       10       feet (BGS)         I6       Depth to backfill material       12       feet (BGS)         I6       Depth to backfill material       16       feet (BGS)         I6       Depth to backfill material       10       inches <td< td=""><td>Crowed Sudam</td><td>V T</td><td>(Dalum)</td><td></td><td>ITS IN FEFT</td><td></td><td></td></td<>	Crowed Sudam	V T	(Dalum)		ITS IN FEFT		
Image: Construction of the set of t	(Datum)				holo denth	16.5	leet (BGS)
L3 Depth to top of screen 5 [feel (BGS) L4 Depth to Biter material 3 [feel (BGS) L5 Depth to backfill material 2 [feel (BGS) L5 Depth to backfill material 2 [feel (BGS) L6 Depth to backfill material 2 [feel (BGS) L9 Thickness of Star material 2 [feel L10 Thickness of Star material 2 [feel L11 Thickness of Biter material 2 [feel L12 Casing Stackpi 0 [feel L12 Casing Stackpi 0 [feel L13 Borehole Diameter 10 [feel L12 Casing Starkpi 0 [feel L12 Casing Stackpi 0 ] [feel L13 Borehole Diameter 2 [filer material ] D=20 Silica Sand A3 Scal material Bentonite Chinos A4 Annular Scal material Concrete Screen Stol Size 0.010 Depth to Water 7.6 [feel material ] [feel Chinos [feel L12 Casing Starkpi 0 ] [feel Chinos [feel L13 Scal material ] [feel L13 Scal materi				L2 Casing de	pth	15	leet (BGS)
4       Depth to Biller material       3       teet (BGS)         15       Depth to backfill material       2       teet (BGS)         16       Depth to backfill material       2       teet (BGS)         17       Screen length       10       teet         18       Height of filler material       2       teet (BGS)         17       Screen length       10       teet         18       Height of filler material       2       teet         19       Thickness of backfill material       teet       teet         10       Tickness of scalametrial       2       teet         111       Thickness of backfill material       teet       teet         112       Casing Slickup       0       teet       teet         113       Borthole Diameter       10       inches       teet         114       Casing Diametal       2       inches       Annular Seal material       2         113       Borthole Diametal       2       inches       Annular Seal material       2       inches         113       Borthole Diametal       Concrete       Screen Slot Size       0.010       0       0         114       Est       Est       Sala				L3 Depth to to	op of screen	5	leet (BGS)
LS Dépin B sza materiaitet (BGS) LG Dépin b szakil mate				L4 Depth to fi	iller material		feet (BGS)
Image: Source length					vackfill material	2	fcet (BGS)
Image: Interview of the second sec					_	10	
Image: Second				L7 Screen lei	ngth	10	leet
Image: State of the state				L8 Height of	iller above scree	" <u></u>	leet
Image: State of the second		· / ·		Ly Inickness	of seal material	2	feet
L12 Casing Sickup       0       leet         L13 Borehole Diameter       10       inches         L14 Casing Diameter       2       inches         A1 Backfill material       Native       A2         A2 Filter material       Bentonite Chips         A4 Annuar Seal material       Concrete         Surface seal material       Concrete         Screen Slot Size       0.010         Depth to Water       7.6         Sand - 6 bags       Bentonite - 1 bags         Concret - 2 bags       s/s centralizer on screen				1 11 Thickness	s of backfill materi	ial	leet
L13 Borehole Diameter2 inches L14 Casing Diameter2 inches L14 Casing Diameter2 inches L14 Casing Diameter2 inches A1 Backfill material <u>Native</u> A2 Filter material <u>10-20 Silica Sand</u> A3 Seal material <u>Bentonite Chips</u> A4 Annular Seal material <u>Concrete</u> Screen Slot Size Screen				L12 Casing SI	ickup	0	leet
Image: Single state in the				L13 Borehole	Diameter	10	inches
A1 Backfill material <u>Native</u> A2 Filter material <u>10-20 Silica Sand</u> A3 Seal material <u>Bentonite Chips</u> A4 Annular Seal material <u>Concrete</u> Screen Siot Size <u>0.010</u> Depth to Water <u>7.6</u> Sand - 6 bags Bentonite - 1 bags Concret - 2 bags S/s centralizer on screen				L14 Casing Di	iameter		Inches
Ar Beach Hardel 10-20 Silica Sand A2 File material <u>Bentonite Chips</u> A3 Seal material <u>Bentonite Chips</u> A4 Annular Seal material <u>Concrete</u> Screen Slot Size <u>0.010</u> Depth to Water <u>7.6</u> Sand - 6 bags <u>Bentonite - 1 bags</u> <u>Concret - 2 bags</u> <u>s/s centralizer on screen</u>				At Dackfill m	atonal Nativ	/e	
AS Seal material <u>Bentonite Chips</u> AA Seal material <u>Bentonite Chips</u> AA Annular Seal material <u>Concrete</u> Screen Slot Size <u>0.010</u> Depth to Water <u>7.6</u> Sand - 6 bags Bentonite - 1 bags Concret - 2 bags S/s centralizer on screen		ाईज 👘		A1 Datatin in A2 Filter mat	enial 10-20 St	lica Sa	nd
A4 Annular Seal material A5 Surface seal material Screen Slot Size D Screen Slot Size D Bemarks Sand - 6 bags Bentonite - 1 bags Concret - 2 bags  S/s centralizer on screen		<b>T</b>		A3 Seal main	erial Bentor	nite Chi	<u>ps</u>
A5 Surface seal material <u>Concrete</u> Screen Slot Size <u>0.010</u> Depth to Waler <u>7.6</u> Sand - 6 bags Bentonite - 1 bags Concret - 2 bags s/s centralizer on screen				A4 Annular S	Seal material	<u> </u>	
Screen Slot Size Depth to Water Sand - 6 bags Bentonite - 1 bags Concret - 2 bags S/s centralizer on screen				A5 Surface s	ical material <u>Co</u>	oncrete_	
Scheen out outs				Corner S	lat Size 0.01	10	
Remarks Sand - 6 bags Bentonite - 1 bags Concret - 2 bags s/s centralizer on screen				Depth to	Water 7.6		·
Remarks				00000		•	· · ·
Remarks   Sand - 6 bags   Bentonite - 1 bags   Concret - 2 bags   S/s centralizer on screen	L III						
Sand - 6 bags       Bentonite - 1 bags       Concret - 2 bags       S/s centralizer on screen				Demodul			
Sand - 6 bags Bentonite - 1 bags Concret - 2 bags s/s centralizer on screen					6 ha==		
Bentonite - 1 bags Concret - 2 bags s/s centralizer on screen				Sand -	o pags		
Concret - 2 bags S/s centralizer on screen				Bentoni	te - 1 bag:	5	•
s/s centralizer on screen	147		∃XXI	Concret	- 2 bags		
s/s centralizer on screen							
s/s centralizer on screen		_ <u> </u>	製				
	1 <del>5</del>	——※		s/s cen	tralizer of	n screen	
<u>T</u>				•			
		( <i>``</i> ``	<u></u>				
	•						
Date 7-10-94	nulaí Dr		Chockat Ry			Date	7-10-94

1621/93

12100

Log of Boring MW308A(N) Froject: PORT OF SEATTLE Project Location: - SEATTLE, WA Sheet 1 of 1 FILL AR. Project Number: 9360423 Date(s) Orilled Checked By Logged By K. GOFFMAN 4/5/94 G. DAVIS Drilling Method 8"OD 4"ID HOLLOW STEM AUGER Top of PVC Elevation (feet) Total Depth Drilled (feet) 14.7 21.5 Drill Rig Type Drilled By Hammer Weight/ 140#/30" Drop (lbs/in.) MOBILE 8-61 TACOMA PUMP AND DRILLING Approx. Surface 15.4 Elevation (feet) Sampler Type Groundweter Level (ft bgs) 8 SPLIT SPOON Diameter of Hole (inches) Type of Well Casing Diameter of Well (inches) Screen Perforation 8 2 SCH 40 PVC .02" (12.5'-17.5') Type/Thickness CONCRETE / 0-2' BENTONITE / 2-10' of Seal(s) Type of Sand Pack 10/20 SILICA SAND Comments

1				SAMI	PLËS			1	Ē	SAM	PLES		
Depth.	1021	Elevation, feet	Type	Number	Blow Count	Graphic Log	MATERIAL DESCRIPTION		Well Completio Log	Recovery %			- REMARKS
	יר'	15					Asphalt						
					•		Loose medium to fine SAND (SP), little silt, black, damp, sand has white, red grains	astated in the					
	+						· · · · · · · · · · · · · · · · · · ·	-12					
5		10	X	1	19		•	toutour and		100			
												:	Initial GW contact
10-		5	X	2	13		° Few silt layers, li≏le organic material, wet			90			
1.5				3	50/3*		Stiff fine sandy SILT (SM), black, wet, some organic material; thin interbeds			90		. 1	
15-	7	0	$\left( \right)$	4	47		("2") of above sand Loose medium to fine SAND (SP), little silt, black, wet, some organic material (wood).	À		100			
	1	·	$\downarrow$				Stiff clayey to fine sandy SILT (SM), dark	A					
			XĮ.	э —	14		Loose, medium to fine SAND (SP), little sit, black, wet, with some organic debris (wood)						
20-	4	[	$\downarrow$	_	-2.		Stiff fine sandy SILT (SM), dark gray to						
		-5	4	•	51		Linese, wet, Loose medium to fine SAND (SP), little sit, black, wet, with some organic debris	Æ					
							Stiff fine sandy SILT (SM), dark grey to black, wet						
						l	Loose medium fine SAND (SP), little sit, / black, wet						
					1	ſ	Boring terminated at 21.5 ft bgs.						
25-	-	<u>ر</u>										•	
2/1/24 17	ML1 54	ART					Woodward-Clyde Consulta	ant	ts 🗲	<u>) —</u>			,



#### Project: PORT OF SEATTLE Project Location: SEATTLE, WA Project Number: 93CO423

# Log of Boring MW308B(S)

Sheet 2 of 2

	T		SAMI	PLES			_ د	Τ	SAM	PLES	
Depth, feet	Elevation, feet	Type	Number	Blow Count	Graphic Log	MATERIAL DESCRIPTION	Well Completio	Log	Recoverý %		REMARKS
20-	5					Dense to very dense fine to medium SAND (SP), trace silt, black, wet, sand					
-		M	5	50/4*		has white and red grains			100		
25-	10					Dense sitty fine SAND (SM), dark grey to black, wet, some shell fragments, trace organic material					Thin layer wood debris (1") at top of unit
-			6	35		Dense fine to medium SAND (SP), trace silt, black, wet, sand has white and red grains.			100		•
-		Д				Dense fine sandy SILT (SM), some organic material, dark, gray, wet, some shell fragments; lenses of fine sand, clayey silt					
30—	15	X	7	47		Dense silty fine SAND (SM), dark gray, wet, with occasional shells, sandy silt			100		
-		X	8	68					100		
35-	20		9	94		- -			100		• •
		$\square$	10	109					100		
-  -  -		Ą									
40	25					Boring terminated at 40 ft bgs.	366				
45-			1			· · ·					
1	30					-Woodward-Clyde Consultar	hts :	•		 	

V		. ]	92-3	35175	:	FM-105 Sheet 1 of 1
Proje	et ALF	<u>CLCSÓ</u>				Location SW Spokane St
Eleva	tion (Top	of Well Casing)		06		Start Data September 28 1002
Drilli	ng Method	Hollow Stem Au	ger			Finish Date September 29, 1992
amp	ler/Drivin	g Weight SPT 1401b./	R 3001b			
epth feet	1	Well Construction	Other Tests	SBlows, I 12"	Moisture/ Density	Description
		flush mount stæl monument			•	FILL SAND; mottled gray-brown, fine to medium, little gravel, claye silt lumps with few gravel clasts; medium dense, slightly moist
		concrete surface seal		22		
•		bentonite chip seal				
5		2" ID schedule 40 PVC riser		9		GRAVEL; olive-brown, with fine sand matrix, scattered clay lumps; loose, slightly moist
				9		SILT; olive-gray, few fine sand, few gravel, wood fragments; st slightly moist
		10/20 silica send		5		SAND; dark brown, fine to medium, faw conrse; very loose, we
-		12/23/92				
.0			G	2	21 / 95	wood fragments, gray mottled clay lumps gray, few fine to coarse gravel clasts
		2" ID 0.010" slot, schedu 40 PYC	lie	_ 2		dark gray to black, little silt, few wood fragments
5						SILT; dark gray to black, little fine sand, wood fragments; ver loose, wet
		PVC bottom cap native backfill	FM-105-	5 2		drive shoe has pitch black silt with medium strong petroleum/ edor (Oppm) with charcoal lump
0						Bottom of boring at depth 19 feet. Piezometer installed to de 17 feet. Composite soil sample (FM-105-C) collected from 0-10 feet. Less than 1 ppm total organic vapors detected by OVM field screening of each soil sample.
					_	
		;				
					<u> </u>	Lagad hus CID
	ST - SL	mpler Type:		Lab '	Tests:	Folder ph: C1L

Ĩ

The second s

Contraction .

Non and

牏

I

APPENDIX D GROUNDWATER SAMPLING FORMS

GROUNDWATER SAMPLING FORMS HART CROWSER, INC.

	Grou	undwa	ater S	amp	ling Da	ata - We	ell I.D.				CMP-	1			×
	Project Job No Project	Manager	2	Port of 17627- Roger	Seattle - T 00 McGinnis	erminal 5		-	Date Tida Wel	e/Time Illy Infl I Deptl	e Sampled uenced h in Feet	6141	/b /es X 17	104	D No
	1) Du	eps. raina D	ata/Eid	UC MO		nto, All A	10000	-	Scre	ened	Interval in F	eet	7-17		
	i) Pui	'ging D		ela Me	asureme	ents: All IV	leasure	ement	's Re	elative	e to Top oi	t Casing	(TOC)		
	Well De	epth in Fe	et		/	1		_	Cas	ing Vo	lume in Gall	ons	(	0,79	
	Depth c	of Water (	DTW) in	Feet	/	11.83		-	Purc	iamete ie Voli	r = x .041 gal/ ume in Gallo	n, 2" d. = x	163 gal/ft	,>4" d. = x	.653 gal/ft]
	(DTS -	DTW)				4.88	-	Actual Purge in Gallons / ^5L							
	Time	No. of Gallons Purged	pH	Temp in °C	Conduct in mS/cm	Turbidity NTU	DO MIL Commen	OR M ts Qua	P V lity, R	ecover	y Color, Odor,	Sheen, Acc	umulated	Silt/Sand	
	10/21	11	10.62	12.3	0,400	63	0,20		8	UV	bid, Ora	nge Color	<u>, no</u>	ndor 19	shaen
	10.30	21	6.46	1213	0.484	- 68-	0,2		0			1			-
	1025	2	6.62	121	0.902	11	0.19		7		- Ye	llow that	ć		
	10.00	4L GI	6.02	121	0,482	17	0.20	$\frac{1}{1}$	5						
MPL	145	JL	0.01	1511	0,482	38	0.20	$\frac{1}{1}$	L		V	Clear		-x	
S	1040		-											Ŷ	
	Comm	ents				<del></del>						·····			
					11 - Frank - Alfred								······		
2		Meti	hod	Purgin	ig Rate in /min	Depth of Equ Fee	ipment in t		Bails	dry?		Y	es	]	No
F	urge	Penis	altic	0,3	3 4mir	MZ			At no	o. of C	asing Volum	ies		$\sim  $	
~		L	/	1.	4	1/	i.	1		1	3			'	
5	ample [					V		l	Purg (Stor	e Wat ed in	er Disposal I 1.000 gallon	Method/Vo temporary	ume onsite st	ON orage tai	ISITE
	2) San	npling	Data						1						,
Bot	tle Type	No of Co	ntainers		Analyse	s	Perserv.	Filter			Total Nur	nber of Bo	ottles	3	9
Am	ber	2 - 500n	nL	cPAHs	etais - As, Pl	)	None	N			Duplicate	Sample I	D.		
Am Am	ber ber	2 - 1L 2 - 500m	nl	PCBs	w/ silica del	deanun	None	N			Field Blor				
Am	ber	2 - 500m	nL	Bis(2-eth	vy/ since get iylhexyl)phtl	nalate	None	N				IK I.D.			
				-							Rinseate	Sample I.	D.		
	3) Fiel	ld Equij	oment						Тур	e/Bra	and/Seria	l No./Ma	terial/U	nits	
	Pump 1	Type/Tub	oing Typ	e .	Peristaltic	Pump dec	licated to	ubing	1/4'	"PE	_Temp/pH	/E.C./D.O	Horib	a U-22	.10
	Bailer T	Гуре			N/A						Water Lev	vel Probe	Wate	rline/So	linst/Heron
	Filter T	уре		2	None						Other	OR	P Pen		
	4) Wel	ll Cond	itions		ок [	X	Not OK		Ex	plain	4 BOLTS	HC Standar	As per	+ Lac	K Well ID

IC	Standards/Field	Forms/GW-Well	ID

	Gro	undwa	ater S	Samp	ling D	ata - We	ell I.D.				CMP	2-2					
	Project			Port of	Seattle - 1	erminal 5			Date	e/Time	e Sampled	6	1411	0	A	115	,
	Job No			17627-	00			-	Tida	llv Infl	luenced		Ye		T	Nol	
	Project	Manager	• •	Roger	McGinnis			_	Well	Dept	h in Feet			17			
	Field R	eps.	(	CFR/K	MR/AJG)			_	Scre	ened	Interval in	Feet		7-17			
	1) Pu	rging D	ata/Fie	eld Me	asureme	ents: All N	leasure	eme	nts Re	lative	e to Top	of Casi	ng (7	TOC)			
	Well De	epth in Fe	et			17'			Casi	na Va	olume in G	allons		$\wedge$	01		
	Depth of	of Sedime	ent (DTS	) in Feet	t ,	6.7'			[1" di	amete	r = x .041 a	al/ft. 2" d.	= x .1	63 gal/ft	4" d =	x 653 gal	
	Depth of	of Water (	DTW) in	Feet	tere and another	11.75'			Purg	e Vol	ume in Ga	llons	ine light of the second			gui	,,,,
	(DTS -	DTW)				4.95		-	Actu	al Pur	ge in Galle	ons L		~	51		
		No. of		Tomp			DD		ORP	1				- <u> </u>	1997		
	Time	Purged	pН	in °C	mS/cm	Turbidity NTU	Commen	ts Q	mV uality, Re	ecover	v Color, Od	or. Sheen.	Accur	nulated :	Silt/Sand		
	0932	IL	8.92	14.0	1.94	12	0.15		1		1010 00	tolog	101	n ad		10000	
	1925	21	894	14.0	1.930	11	0.14	1-	1	1 ch	Lear , The	<u>[0104</u>	<u>, 10</u>	0 0(A	ov je	meen	
	1928	21	Ran	140	1 97 8	1		+	<u> </u>								
	LAAI	41	Raa	110	A MA	1	0.11	+	11								
	0991	TL	0.99	14.0	0.910	5	0.09	-	16								401 17
님	0444	2L	9.01	141	0,920	4	0112	4-	24		V			2	V	i)	
SM	0945										-						
	Comm	ents			*												
)																	
								1							7		7
		Meth	nod	Purgin	g Rate in /min	Depth of Equ Fee	uipment in It		Bails	dry?			Ye	s		No	$\checkmark$
F	Purge	Perist	altic	~0.3	4min	~ 12	2		At no	o. of C	asing Volu	imes			$\sim$		
		J					,	1									
S	ample	N			V	V			Purge	e Wat	er Disposa	al Methoo	l/Volu	me	On	SITE	
	-								(Store	ed in	1,000 gallo	on tempo	rary o	nsite ste	orage ta	ınk.)	
	2) Sar	npling l	Data		5												
Bot	tle Type	No of Cor	ntainers		Analyse	s	Perserv.	Filte	r		Total N	umber o	f Rott	امد		0	
HP	DE	1 - 500m	۱L	Total Me	lals - As, P	b	HNO3	N					000	100		<u> </u>	
Am Am	ber	2 - 500m	nL	cPAHs			None	N			Duplica	te Samp	le I.D	).	-		
Am	ber	2 - 500m	۱L	TPH-Dx	w/ silica ael	cleanup	None	N	-		Field Bl	ank I D			-		
Am	ber	2 - 500m	۱L	Bis(2-eth	ylhexyl)pht	nalate	None	N			T TOTA DI	ann n.D.					
		<u> </u>							_		Rinseat	e Samp	e I.D.				
	3) Fiel	ld Equij	oment						Тур	e/Bra	and/Seri	al No./	Mate	rial/U	nits		
	Pump ]	Tvpe/Tub	oina Tvr	ne.	Peristaltic	Pump dec	licated t	ihini	1/4	"OF	Tomp/p			Llorib	- LL 00	-10	
	Bailer 7	Type			N/A				<u>,     </u>	10	- Water I		b.O	Moto	d U-LL		
	Filter T	vpe		÷	None			-11				ever PIC		wate	mine/80	JIIISI/HE	ron
		, F -		<u>-</u>		>/					ottler	C	IRI	ren			
	4) Wel	ll Condi	itions		ок [	X	Not OK	<u> </u>	] Exp	olain	4 Bc	HC Star	ndards	A AS	ped	well ID	

	1	1-1-2	
HC	Standarda/Elald	Edrmalain	114/-1115
110	Stanuarus/Fielu	FOILIS/GV	v-vveli iD

#### Groundwater Sampling Data - Well I.D. CMP-3 Project 6/2/10 305 Port of Seattle - Terminal 5 Date/Time Sampled Job No. 17627-00 **Tidally Influenced** Yes No **Project Manager Roger McGinnis** Well Depth in Feet 16 CFR/KMR/AJG Field Reps. Screened Interval in Feet 6-16 1) Purging Data/Field Measurements: All Measurements Relative to Top of Casing (TOC) Well Depth in Feet Casing Volume in Gallons 15.71 Depth of Sediment (DTS) in Feet 66 [1" diameter = x .041 gal/ft, 2" d. = x .163 gal/ft, 4" d. = x .653 gal/ft] Depth of Water (DTW) in Feet 7.60 Purge Volume in Gallons (DTS - DTW) Actual Purge in Gallons No. of ORP DO Temp Turbidity Gallons Conduct in mv Comments Quality Recovery Color, Odor, Sheen, Accumulated Silt/Sand in °C Time Purged pH mS/cm NTU 15.4 402 92 IL 00 240 0 0.19 Clear, no odor nosheen Wellow that 151 60 2 5,1 -107 AIC 58 25 3 105 N/ 6,16 5 E 03 0.0915.5 03 0.08 NO LOLOV SMPL 2" Inch bolk. Comments Well Cap Purging Rate in Depth of Equipment in Method L/min Feet Bails dry? Yes

0.25 -/min

Total Metals - As, Pb

cPAHs

PCBs

Analyses

TPH-Dx w/ silica gel cleanup

Bis(2-ethylhexyl)phthalate

pristaltic

No of Containers

1 - 500mL

2 - 500mL

2 - 500mL

2 - 500mL

3) Field Equipment

2 - 1L

2) Sampling Data

Purge

Sample

Bottle Type

HPDE

Amber

Amber

Amber

Amber

r

Perserv.

HNO3

None

None

None

None

Filter

N

N

N

N

N

At no. of Casing Volumes

Purge Water Disposal Method/Volume ONSITE (Stored in 1,000 gallon temporary onsite storage tank.)

# **Total Number of Bottles** 9 Duplicate Sample I.D. Field Blank I.D. Rinseate Sample I.D.

#### Type/Brand/Serial No./Material/Units

Pump Type/Tubing Type	Peristaltic Pump dedicated tubing	1/4 PE	_Temp/pH	/E.C./D.O	Horiba U-22 U-10
Bailer Type	N/A		Water Le	vel Probe	Waterline/Solinst/Heron
Filter Type	None		Other	ORP	Pen
4) Well Conditions	OK Not OK	Explain	<u>3 boHs</u>	Perover HC Standard	1 Aspect Lock

# Groundwater Sampling Data - Well I.D.

CMP-4

0,0	ananc		amp	ing D				0111 -4	
Project	t		Port of	Seattle - T	erminal 5		D	Date/Time Sampled	
Job No	).		17627-	.00	3	1. <u></u>	- т		1
Project	t Manager		Roger	McGinnis			- ·	Well Depth in East 17	J
Field R	lens		CERIK	MR/AIG	<u></u>		- '	Screened Interval in East 7.17	
() =			<u> </u>				- 0		
1) Pu	rging D	ata/Fie	eld Me	asureme	ents: All N	leasure	ments	Relative to Top of Casing (TOC)	
Well D	epth in Fe	et		1	7.0		C	Casing Volume in Gallons /.68	
Depth	of Sedime	nt (DTS	) in Feet	t(e	.30		_ [1	[1" diameter = x .041 gal/ft (2" d. = x .163 gal/ft) 4" d. = x .653 gal/ft	- ]
Depth	of Water (	DTW) in	Feet	10.	17		_ P	Purge Volume in Gallons	
(DTS -	DTW)			6.	63		A	Actual Purge in Gallons	
<b></b>	No. of	<u> </u>					~~~~~		
Time	Gallons Purged	рН	Temp	Conduct in mS/cm	Turbidity NTU	Mall	MV MV	Recovery Color Oder Shoen Accumulated Sill/Send	
1500		1. Go	141	A Con	1210	h CD	13. Quality	Turling Recovery Color, Oddr, Sheen, Accumulated SilvSand	
1500	21	1 10	11.2	0.500	100	0.50	110	I Which, IT. prown (blor, VID octor I Sheer	1
1305	LL	10.49	14.5	0,419	24	0.65	10	Clear.	
1506	SL	4.40	143	0,40	22	D. TO	167	no color	
1509	4L	1,41	14.2	0,472	23	0,73	1.3		
							1 -		
AN IND			- 23				1		
SUDIO							1	1	
Comm	ients						M 15 10-		
		·							
	Mett	nod	Purgir	ng Rate in /min	Depth of Equ	uipment in	] <sub>в</sub>		]
	DUA	2.11	171	1	1/	/			1
Purge	terist	att	UDL/	MM	16		A	At no. of Casing Volumes	
Comula	V		١	b	V				
Sample					V		] P	Purge Water Disposal Method/Volume	
							(3	Stored in 1,000 gallon temporary onsite storage tank.)	
2) Sal	mpling	Data							
Delle True	Next								
HPDF	1 - 500m	ntainers	Total Me	Analyse	es	HNO3	Filter	I otal Number of Bottles 9	
Amber	2 - 500m	nL	cPAHs	1010 - Ma, F		None	N	Duplicate Sample I.D.	
Amber	2 - 1L		PCBs			None	N		
Amber	2 - 500m	nL	TPH-Dx	w/ silica gel	l cleanup	None	N	Field Blank I.D.	
Amber	2 - 500m		Bis(2-eth	nylhexyl)pht	halate	None	N -	Pinconto Comple I D	
								Rinseate Sample I.D.	<u> </u>
					- 11 - K				
3) Fie	ld Equij	oment					τ	Type/Brand/Serial No./Material/Units	
							1	1/11/1 0	
Pump Type/Tubing Type Peristaltic Pump d					c Pump dec	dicated to	ubing	<u>1/7 / Temp/pH/E.C./D.O</u> Horiba U-22- U-40	
Bailer	Bailer Type <u>N/A</u>						•	Water Level Probe Waterline/Solinst/Her	on
Filter T	уре		1	None			•	Other OLP Pen	
4) We	ll Cond	itions	OK Not OK					Explain 3 bolts, I shared off	

HC Standards/Field Forms/GW-Well ID

	Gro	undw	ater S	Samp	ling Da	ata - We	ell I.D.			(	CMP-5					11
	Project	t		Port of	Seattle - T	erminal 5			Date	e/Time Sa	mpled	613	110	1200	)	
	Job No	).		17627-	-00			_	Tidal	llv Influen	ced -	Y	es X	100	No	1
	Project	t Manage	r	Roger	McGinnis			-	Well	Depth in	Feet		15			J
	Field R	Reps.		CFR/K	MR/AJG)				Scre	ened Inte	- rval in Feet		5-15			
	1) Pu	rging D	Data/Fie	eld Me	asureme	ents: All N	Aeasure	ement	s Re	lative to	Top of Ca	asing (	TOC)			
	Well De	epth in Fe	eet		15	- 1			Casi	na Volum	e in Gallons			1.61		
	Depth of	of Sedime	ent (DTS	) in Feet	t	14.9'		-	[1" dia	ameter = x	.041 gal/ft, <b>2</b>	"d.=x.	163 gal/ft	, 4" d. = >	x .653 ga	
	Depth of	of Water	(DTW) in	Feet		8.71		_	Purg	e Volume	in Gallons		-		-	
	(DTS -	DTW)		·		6.19			Actua	al Purge i	n Gallons			~5L	-	
	Time	No. of Gallons Purged	рН	Temp in °C	Conduct in mS/cm	Turbidity NTU	DO MAIL Commen	ts: Qua	lity, Re	ecovery Co	lor, Odor, She	een, Acc	umulated	Silt/Sand		
	1247	IL	6.41	13.3	0,735	D	0,46	-L	10	Slight	lu turbial	m ni	Kal vo	d-nran	vir this	nover
	1250	21	6.47	13.3	0.133	0	0.11	) - ;	21	Claa	1 Iornan		<u>aa.i , 11</u>	CI UIQI	J Jun	1 Sid
	1752	31	6.47	13.3	A 117	0	D. 12	-	7	Cied	Ŷ					
	1254	41	1.10	1211	6 111	0	10 7-		2	1 i			1	<u> </u>		
	1200	51	1.00	12.1	DILLI A 270	Å	UIL		1					Clear	: • • • • • • • • • • • • • • • • • • •	
<b>JPL</b>	10.	UL	6.70	12.4	0.40	0	0.15		/	1V				Y		V
S	1500									1						
	Comm	ients														
)			<del></del>			×										
		Met	lhod	Purgin L	ng Rate in /min	Depth of Eq Fee	uipment in		Bails	dry?		Y	es		No	
F	urge	Perist	altic	~0,	3 Umin	~ 14			At no	o. of Casin	ig Volumes			~1		
Sa	ample	4	/	,	L	$\checkmark$			Purge	e Water D	)isposal Met	hod/Vol	ume	Ons	ite	
									(Store	ed in 1,00	0 gallon ten	nporary	onsite st	orage ta	ink.)	
_	2) Sar	mpling	Data						•							
Bot	tle Type	No of Co	ontainers		Analyse	S	Perserv.	Filter		Т	otal Numbe	er of Bo	ttles		9	
HP	DE	1 - 500r	nL	Total Me	etals - As, Pl	0	HNO3	N				2. 20			<u> </u>	
Am Am	ber ber	2 - 500r 2 - 11	nL	cPAHs			None	N		D	uplicate Sa	mple I.	D.			
Am	ber	2 - 500r	nL	TPH-Dx	w/ silica gel	cleanup	None	N		Fi	eld Blank I	.D.				
Am	ber	2 - 500r	nL	Bis(2-eth	nylhexyl)phth	nalate	None	N								
						<del></del> ,,				Ri	inseate Sai	mple I.I	Э.			
	3) Fie	ld Equi	ipment						Тур	e/Brano	l/Serial N	o./Mat	erial/U	nits		
	Pump <sup>-</sup>	Type/Tu	bing Tvr	e	Peristaltic	: Pump der	dicated to	Jbing	1/4'	"PE T4	emp/nH/F (		Horib	a    _22	10	
	Bailer 1	Туре	9.31		N/A			- wing	/1	۲ <u>~ ۲</u>	ater I evel	Probe	Mate	rling		
	Filter T	vpe		-	None	4					ther		e Pa	1119/20	JIIISI/H	
		J F 7								0		UK	TTEN			;
	4) We	ll Cond	litions		ОК	X	Not OK	LX_	Exp	plain 🗍	Stripped b	off	,			

Explain Strepped WH HC Standards/Field Forms/GW-Well ID

	Gro	undwa	ater S	Samp	ling Da	ata - V	Vell I.	D.		CMP-1	5			
	Project			Port of	Seattle - T	erminal 5			Date/Time	Sampled	61311	10	nayo	
	Job No	).		17627-	00				Tidally Influ	uenced	Yes	X	No	_
	Project	Manage	r	Roger I	McGinnis				Well Depth	in Feet	2	17		
	Field R	leps.	/	CFR/KI	MR/AJG)				Screened	Interval in Fe	et	7-17		
	1) Pu	rging D	ata/Fie	Id Mea	asureme	ents: Al	Meas	ureme	nts Relati	ve to Top o	of Casina	(TOC)	·	
		onth in Ec	oot		)	7'		с.	Octor Mal		J	/	19	
	Depth of	of Sedime	ent (DTS)	) in Feet	<u>/</u>	17.10		<u></u>	Casing Vol	ume in Gallo		//	//	
÷	Depth o	of Water (	(DTW) in	Feet		9.75		-	Purge Volu	me in Gallon	1, 2 U X. I	55 gai/it, 4	u. = x .653 g	jai/πj
	(DTS -	DTW)	. ,			7,35		-	Actual Pure	ge in Gallons	8	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	512	
		No. of	T				0n	MD	1				02	
	Time	Gallons	nH	Temp	Conduct in	Turbidity	mark	mV	in Beenvor	Color Oder (	Chassa Ass		~	
	Nagi	1)	( 10U	141	1.02	2	A L	-29	All All		Sheen, Accur	nulated Silt	/Sand	
	NAM	21	EUI	1112	1.61	2	A 1/1	-27	1 Cular	, rea . John	UN FINT	, no ac	NOY JULI	$\sim$
	0-12-1	21	<u><u><u>u</u></u><u>u</u><u>y</u></u>	19.L	11:05	0	014	21						
- 1	0932	36	6,64	14.2	6.95	0	0.10	-36		J			<u> </u>	
	0935	4L	6.64	14,2	6,92	0	0.07	-36		no co	lor			
2	<u>0938</u>	bL	6.64	14.2	6.92	0	0.05	-37	V		,		L	
SMF	0940												<b>4</b>	
	Comm	ents												
5			a.		118 12 1 1									
2	2													
		Mot	bod	Purgin	g Rate in	Depth of E	Equipmen	t	Poile day?		Vee			
F	lurge	David	Jalic	~ h	24.			-			res	·]		
	ange	Teris	Jan C	01	L		$\frac{\varphi}{1}$				es			Imial
00	ampie				¥		P		Purge Wate (Stored in 1	er Disposal M I.000 gallon t	/lethod/Volu temporary o	me	ONSITE	IDVV
	2) Sar	nnlina	Data						(	,	iomporary o		igo tant.)	
	_) 0u.	iipiiig					l	1 1						
Bot	lle Type	No of Co	ntainers		Analyses		Perserv.	Filter		Total Num	ber of Bott	les	-10-	9
HP	DF	1 - 500n	nl	Total Me	tals-As, Pb,	Sb, Cr,	HNO3	N						
Am	ber	2 - 500n	nL	cPAHs			None	N		Duplicate 3	Sample I.D	).	-	
Am	ber	2 - 1L	-1	PCBs			None	N						
Am Am	ber ber	2 - 500n 2 - 500n	nL nL	TPH-Dx Bis(2-eth	w/ silica gel	cleanup nalate	None	N		Field Blan	k I.D.			
					, jiiion ji)pina					Rinseate S	Sample I.D			-
												/2	1(* ) (* )	
								J						
	3) Fie	ld Equi	pment						Type/Bra	nd/Serial	No./Mate	erial/Unit	ts	
	Pumn -		hing Tyr		Paristaltic	Dumed	odiaata	dtubie	11."0-	Tomp/s11/		11	100 10	
	Bailer 1		οπιά τλή	··· ·		, Fump a	euicate	ບັບບັນເກ	y 14 re	_ remp/pH/l		Horiba U	-22.10	
	Filter T	vne		<u>i</u>	None					Other	ei Probe	vvaterline	e/Solinst/H	eron
		366		-	NUTE					ouner .	D/K	r ren		
	4) We	ll Cond	litions		ок [	X	Not OK		Explain	4 BOLTS	, GOOD	CONDITIO	N	

HC Standards/Field Forms/GW-Well ID

	Gro	undwa	ater S	Samp	ling Da	ata - We	ell I.D.	•		CM	1P-17					
	Project	8		Port of	Seattle - T	erminal 5			Date/Tir	ne Samol	ed (	6/4/10	2	Ma	45	
	Job No	×		17627-	00				Tidally	nfluenced	<u> </u>	×/		100	No	ľ
	Project	Manager	r	Roger	McGinnis			-	Woll Do	nth in Eco	, .+	10		1		J
)	Field R	ens	•	CERK	MRIAIG			-	Scroope	d Intonvol	- Lin East		6.40			
	, ioid i i	ope.		C	WI VII VII VII VII VII VII VII VII VII V			-	Screene	u mervar			0-10			
	1) Pu	rging D	ata/Fie	eld Mea	asureme	ents: All N	Neasure	ement	s Relati	ve to To	op of Ca	asing (1	FOC)			
	Well De	epth in Fe	eet			16			Casing V	Volume in	Gallons			109		_
	Depth of	of Sedime	ent (DTS	) in Feet		15.5'			[1" diame	ter = x .04	1 gal/ft, 2	" d. = x .1	63 gal/ft,	)4" d. = x	.653 gal/ft]	
	Depth of	of Water (	(DTW) in	Feet		8,31			Purge V	olume in (	Gallons					
	(DTS -	DTW)		-		6.6	•	_	Actual P	urge in G	allons		~	6L		
		No. of Gallons		Temp	Conduct in	Turbidity	DO	OPY	31					į.	1	
-	Time	Purged	pН	in °C	mS/cm	NTU	Commer	ts: Qua	lity, Recov	ery Color, (	Odor, She	een, Accu	mulated S	Silt/Sand		
(	835	IL	10.13	13.7	0.504	327	0.35	11-	币	abid o	manar	- hom	n tint	ni	Adorla	shaw
	1831	21	10,110	13.7	0,499	258	1.17	125		Î Î	j		i jun	1 110 1	1	er order y
	1929	31	6.18	128	h 492	162	h no-	17-	1					60045 Millionaria		
	naul1	41	1. 18	12 0	1 1122	100	10.00	11	<u></u>			1				
1	SG112	G	1 10	120	01700	152	0.00	12	0		1	<u>v</u>	1			
<b>JPL</b>	0042	54	6.17	120	0,485	00	0,03	14	0	2	light y	ellow hi	14	18.211		
SI	0845	6L	6.19	13.8	0,485	135	0.02	1729	51	V	J	1			V	
	Comm	ents														
)																
1		r		Г <sup></sup>				1						1		ſ
	4	Mol	bod	Purgin	g Rate in	Depth of Eq	uipment in		Della du	0		.,				
		Dedic	atal		min	Fee	et	1	Balls dry	7		Ye	s	J	No	
F	Purge	DEAL	BP	0.5	\$ min	~14	,		At no. of	Casing V	olumes/			nI		
			,		J					0					(	
Sa	ample	V		L	¥	V			Purge W	ater Dispo	osal Met	hod/Volu	me	Unsi	e	
		11 -							(Stored I	n 1,000 ga	alion ten	nporary c	insite sto	oragé tai	nk.)	
	2) Sar	npling	Data						2							
Bot	tie Type	No of Co	ntainers		Analyse	s	Perserv.	Filter		Total	Numbe	er of Bot	les		12	
HP	DE	1 - 500n	nL	Total Me	tals - As, Pl	0	HNO3	N								
Am	iber	2 - 500n	nL	cPAHs			None	Ν		Dupli	icate Sa	mple I.E	).	-		
Am Am	iber	2 - 1L	<u></u>	PCBs		-1	None	N		E. LI		5				
Am	ber	2 - 500n 2 - 500n	nL	IPH-DX	W/ SIIICa gel	cleanup	None	IN .		Field	Blank I	.D.		weige the second		
VO	A Vial	3 - 40ml	L	Chlorinat	ted Ethanes	& Ethenes	HCL	N		Rinse	eate Sa	mple I D			and Andrew Transformery	
												inplo i.B	• ×		- 100 - 100	
						• #										
	3) Fie	ld Equi	pment						Type/E	Brand/Se	erial N	o./Mate	erial/Ur	nits		
														3.		
	Pump <sup>-</sup>	Type/Tul	bing Typ	be .	Dedicated	d QED Bla	dder Pur	np	Temp/pl	H/E.C./D	.0 H	loriba U	22/0	7		
	Bailer 7	Гуре			N/A				Water L	evel Prot	be 🗸	Vaterline	Solinst	/Heron		()
	Filter T	уре		-	None				Other		~	M	PP P		P	

Explain <u>4 Bolts</u>, Removed Aspect Locik HC Standards/Field Forms/GW-Well ID

			÷.
4)	Well	Condition	S

N/A		-
None		
ОК	X	Not OK

	Grou	undwa	ater S	amp	ling Da	ata - N	/ell I.D	)	MW-26	۲ I	DUP	1240
	Project			Port of	Seattle - T	erminal 5		Da	te/Time Sampled	614110	> 17	תו
	Job No	•		17627-	00			- Tid	ally Influenced	Yes	XI	No
	Project	Manage	•	Roger I	McGinnis			- We	Well Depth in Feet			
	Field R	eps.		CFRKI	MR(AJG)		-	Screened Interval in Feet 6.5-16.5				
	1) Pu	rging D	ata/Fie	ld Mea	asureme	ents: All	Measu	rements	Relative to Top of	Casing (TO	DC)	
	Well Depth in Feet 16.5							_ Ca	sing Volume in Gallon	s _	1.10	2
	Depth of Sediment (DTS) in Feet 16.25							_ [1"	diameter = x .041 gal/ft	2 <sup></sup> d. = x .163 g	al/ft, 4" d. =	x .653 gal/ft]
	Depth c	of Water (	DTW) in	Feet		1,40		- Pu	rge Volume in Gallons		No. of Concession, Name	
	(DTS - DTW) <u>(0.85</u>						_ Act	ual Purge in Gallons	X	~5	L	
	Time	No. of Gallons Purged	pН	Temp in °C	Conduct in mS/cm	Turbidity NTU	DO MIL Comment	OLP mV s: Quality,	Recovery Color, Odor, Sh	neen, Accumula	ited Silt/San	d
	1154	IL	6.89	14,4	10.6	60	0.29	13	Slightly turbid	l, brownt	wit, no	odor/sheen
	157	22	6.88	14.2	10,2	38	6.12	3			,	
	1260	32	6.88	14.2	9.6	19	1,08	-2				
	1203	4L	6,81	4.2	9.2	15	0.67	-4	Clear			
ے	1206	5L	6.86	14.2	9.6	1]	0.05	17				
SMF	121D											
	Comm	ents	Well 1	OLATIC	w: Re	w 60	21, BA	y 39,	STACK D			
							/					
			h. d	Purgin	g Rate in	Depth of E	quipment					

	Method	Purging Rate in L/min	Depth of Equipment in Feet
Purge	Penstaltic	0,34min	~11.5
Sample	V	F	L

## 2) Sampling Data

Bottle Type	No of Containers	Analyses	Perserv.	Filter
HPDE	1 - 500mL	Total Metals-As, Pb, Sb, Cr, Cu, Ni	HNO3	N
Amber	2 - 500mL	cPAHs	None	N
Amber	2 - 1L	PCBs	None	N
Amber	2 - 500mL	TPH-Dx w/ silica gel cleanup	None	N
Amber	2 - 500mL	Bis(2-ethylhexyl)phthalate	None	N
		47BEHP		

### 3) Field Equipment

Bails dry?		Yes	No
At no. of Casir	ng Volumes		n
Purge Water D (Stored in 1,00	Disposal Method/V 00 gallon temporar	olume y onsite sto	ONSITE rage tank.)
T	otal Number of E	Bottles	. 18
D	uplicate Sample	I.D	MW-26RD (Duplicate)
Ei	ield Blank I.D.	-	
R	inseate Sample	I.D	

## Type/Brand/Serial No./Material/Units

Pump Type/Tubing Type	Peristaltic Pump dedicated tubing 1/4 "PE	_Temp/pH/E.C./D.O _Horiba U-22 /O
Bailer Type	N/A	Water Level Probe Waterline/Solinst/Heron
Filter Type	None	Other ORP Pen
4) Well Conditions	OK X Not OK Explain	H BOLTS, Romosed Aspect Rock HC Standards/Field Forms/GW-Well ID

Gro	undwater S	Sampling Da	nta - V	/ell I.D	D	MW-3	6	
Project		Port of Seattle - T	erminal 5		Dat	te/Time Sampled	6/2/10	11,0212
Job No	).	17627-00			– Tid	ally Influenced	Yes	X No
Project	Manager	Roger McGinnis			– We	II Depth in Feet	7	3
Field R	leps.	CFR/KMR/AJG)			– Scr	eened Interval in F	eet 5	8-73
1) Pu	rging Data/Fie	eld Measureme	nts: All	Measu	- rements	Relative to Top	of Casing (TC	)C)
Well De	epth in Feet		75'? (	73 per As	stert) Cas	sing Volume in Gal	lons	10.71
Depth o	of Sediment (DTS	) in Feet	75'		[1" (	diameter = x .041 gal	/ft, 2" d. = x .163 ga	al/ft_4" d. = x .653 gal/ft]
Depth o	of Water (DTW) in	Feet	9.31		_ Pur	ge Volume in Gallo	ons	
(DTS -	DTW)		65.69		_ Act	ual Purge in Gallor	ns	~ 51
Time 1607 1610	No. of Gallons Purged pH 1 L 7,43 7 L 7,43 2 J 7,12	Temp in °C         Conduct in mS/cm           5,0         39,3           14,9         39,9           14,9         39,9	Turbidity NTU 5 5	Do commen 0.47 0.25	$rac{P}{P}$	Recovery Color, Odor Clear, yell	, Sheen, Accumula ow Fint, NI	ted Silt/Sand Doctor/Sheen
1610	41 712	14,7 40,0		10111	-Ed	<u> </u>		
11.10	51 710	411 400	<u><u></u><u></u><u><u></u><u></u><u></u><u><u></u><u></u><u></u><u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u></u></u></u>	0.0	1-54		V	
	DL 1AD	14, 1 40,0	2	0:06	6	L Hiv	rllow trut	
σ <u>[[6/()</u> Comm					1			
Comm						1,2 - 		
)		· · · · · · · · · · · · · · · · · · ·			 ]			
	Method	Purging Rate in L/min	Depth of E in F	Equipment Teet	Bail	s dry?	Yes	NoX
Purge	Perista Hill	0.3 LImin	~ 74	4	Atr	io. of Casing Volun	nes	21
Sample	L	¥	1	/	Pun	ge Water Disposal	Method/Volume	ONSOF
2) Saı	mpling Data				(Sto	ored in 1,000 gallor	temporary onsit	e storage tank.)
Bottle Type	No of Containers	Analyses	<b>******</b>	Porcon	Filter	Total Nu	mbor of Dollar	
Joine Type	, to or containers	Total Metals-As Ph	Sb. Cr	r craerv.	riiter	i otar Nul	IDEL OF DOLLES	9
HPDE	1 - 500mL	Cu, Ni		HNO3	Ν			
Amber	2 - 500mL	cPAHs		None	N	Duplicate	e Sample I.D.	
Amber	2 - 10 2 - 500mL	TPH-Dx w/ silica gel	cleanup	None	N	Field Bla	nkID	
Amber	2 - 500mL	Bis(2-ethylhexyl)phth	alate	None	N		UK 1.U.	
						Rinseate	Sample I.D.	
3) Fie	ld Equipment				Туј	oe/Brand/Seria	I No./Materia	I/Units
Pump <sup>-</sup>	Type/Tubing Typ	e <u>Peristaltic</u>	Pump d	edicated	tubing V4	<sup>q</sup> PETemp/pH	/E.C./D.O H	oriba U-2210
Bailer	Туре	N/A				Water Le	vel Probe	aterline/\$olinst/Heron
Filter T	уре	None		and the rest of the	•2	Other	ORP	len
4) We	ll Conditions	ок [	X	Not OK	[ Е	xplain <u>Replac</u>	red I-Plug	
			7.				~ /	

HC Standards	Field Forms/GW-Well ID
--------------	------------------------

# Groundwater Sampling Data - Well I.D.

MW	-4	4
----	----	---

Project	•	Port of Seattle - Terminal 5	Date/Time Sampled	6/2110	1150
Job No.		17627-00	Tidally Influenced	Yes	No
Project Mana	ager	Roger McGinnis	Well Depth in Feet	78.5	-
Field Reps.		CFR/KMR(AJG)	Screened Interval in Feet	NA	

1) Purging Data/Field Measurements: All Measurements Relative to Top of Casing (TOC)

V	Well Depth in Feet 78.5								Casi	ng Volume in Gallons /0,77		
C	Depth (	of Sedime	ent (DTS	) in Feet		510		[1" diameter = x .041 gal/ft, 2" d. = x .163 gal/ft) 4" d. = x .653 gal/ft]				
C	Depth (	of Water (	DTW) in	Feet	8	,94		-	Purg	e Volume in Gallons		
(	DTS -	DTW)						-	Actu	al Purge in Gallons L9L		
	Time	No. of Gallons Purged	рН	Temp in °C	Conduct in mS/cm	Turbidity NTU	Commen	ts: Quali	0 /L) itv. Rec	overv Color, Odor, Sheen, Accumulated Silt/Sand		
	1/20	11	5.32	15.2	-	~75		10:	32	TURRIDE HI WEART Solution of Land	1	
/	1/38	41	5.87	15.2	6.012	175	87	-	_	TORBIBE TO UISIABLE SEAMENT TIODUSI, NOT	re	
1	140	61	5.80	14.9	0,011	175	91	7.	01			
,	1148	8L	5.941	14,9	0.011	175	84	6	.35	$\checkmark$		
Idws	150	91	5194	14,9	0.011	175	84	6	,88	10 //		
0	Comm	ents	To	RBIDUT	Y 15	505	PECT	FOR	MAL	- 44		
			LOCAT	ION ->	> Row	6011	3AJ 39	) STA	C161	r		
)				101-		wiji						
		Purging Rate in Depth of Equipment Method L/min in Feet				Equipment <sup>=</sup> eet		Bails	dry? Yes No X			
Pu	rge	Perista	.Itic	0,5	54mm	17	4		At no	. of Casing Volumes		
Sar	nple	V			V	1	/	]	Pura	Water Disposal Method/Volume		
		L						1	(Stor	ed in 1,000 gallon temporary onsite storage tank.)		
2	) Sai	mpling	Data									
Bottle	Type	No of Co	ntainers		Analyses	and a second second	Perserv	Filter	7	Total Number of Bottles		
HPD	E	1 - 1L		Total Me	tals - As, P	b	HNO3	N				
HPD	F	1 - 11		Total Me	tals-As, Pb	, Sb, Cr,	HNO3	N		Duplicate Sample LD		
Amb	er	2 - 500n	nL	cPAHs			None	N	1			
Amb	er	2 - 1L		PCBs			None	N	1	Field Blank I.D.		
Amb	er	2 - 500n	nL	TPH-Dx	w/ silica ge	cleanup	None	N				
Amb	er	2 - 500n	nL	Bis(2-eth	ylhexyl)pht	halate	None	N	-	Rinseate Sample I.D.		
VUA	viai	<u>3 - 40m</u>		Ethenes			HCL	N	-			
3	) Fie	ld Equi	pment				L		Тур	e/Brand/Serial No./Material/Units		
P	ump <sup>.</sup>	Type/Tul	oing Typ	)e	Peristalti	c Pump	dedicate	d tubin	g 1/4"	E Temp/pH/E.C./D.O Horiba U-29-10		
В	ailer -	Гуре			N/A				<del>× / '</del>	Water Level Probe Waterline/Solinst/Heron		
F	ilter T	уре			None					Other ORP Pen		

4) Well Conditions

OK Not OK

Explain

HC Standards/Field Forms/GW-Well ID

Gr	oundwater S	Sampling D	ata - We	ell I.D.	r			MW-1	25				
Proj	ect	Port of Seattle -	Terminal 5			Date/	lime S	ampled	613	110	16	Ø	
Job	No.	17627-00				Tidally Influenced Yes No					lo		
Proje	ect Manager	Roger McGinnis			_	Well Depth in Feet 15							
Field	d Reps.	CFR/KMR/AJG			Scree	ned Ini	terval in F	eet	5-1	15			
1) F	Purging Data/Fie	eld Measurem	ents: All I	Measure	ement.	s Rela	ative t	to Top o	f Casing	g (TOC)	)		
Well	Depth in Feet		15'			Casino	a Volu	me in Gal	lons		1.12		
Dept	Depth of Sediment (DTS) in Feet 13,15'				[1" diameter = x .041 gal/ft .2" d = x .163 gal/ft .4" d = x .652 gal/ft							3 gal/ft1	
Dept	th of Water (DTW) ir	Feet	0.25'			Purae	Volum	ne in Gallo	ons		<i></i>	A .00	o gann
(DTS	(DTS - DTW) (g. 9 D					Actual	Purge	in Gallor	IS	$\overline{\sim}$	(IL		
	No. of	Temp Conduct is	T	00	OK	P. 1							
Tim	e Purged pH	in °C mS/cm	NTU	Commen	its: Qual	ity, Rec	overv C	Color, Odor	. Sheen. A	ccumulate	ed Silt/Sa	and	~
155	50 1L 10.36	15.7 6.380	0	511	12	2	Cla	ar hr	ting hi	it who	nder	15 mai	~
155	52 21 6.35	152 0.381	0	5,59		7		1 0	uge in	<u>u , 110</u>		( Shace	L.
155	54 31 1.42	5.2 0.385	0	3.4	1 5	53	$\neg$				$\rightarrow$	<u></u>	
155	8 41 6,41	15.2 0,287	0	2-9	5	a			t				
155	8 54 641	15,10,387	0	2.59	15	al			AD (a)	/		90 - 2010 - 080	
Idws 160	0 61 6.47	1510.381	ß	2.47	Ge	7		,	10 00	(	-	1	
Com	ments	1		Let' 1 4	10		N	/	$\mathbf{V}$		V		
)					<del>.</del>								
r	Method	Purging Rate in L/min	Depth of Eq Fee	uipment in et		Bails d	ry?			Yes		N	
Purge	Dedicated DED.B.P.	~0.54/min	~13			At no.	of Cas	ing Volum	nes		~	λ.	
Sample		V	V			Purge	Water	Disposal	Method/\	/olume	6	insita	P
		0				(Stored	l in 1,0	000 gallon	tempora	ry onsite	storage	e tank.)	)
2) S	ampling Data										,		
Bottle Typ	pe No of Containers	Analyse	s	Perserv.	Filter		٦	Total Nur	nber of E	Bottles		46	- 17
HPDE	1 - 500mL	Total Metals - As, P	b	HNO3	Ν								
Amber	2 - 500mL	cPAHs		None	Ν		[	Duplicate	Sample	I.D.		-	Nep
Amber	2 - 1L	PCBs		None	N								
Amber	12 - 500mL	TPH-Dx w/ silica gel	cleanup	None	N		F	Field Blar	nk I.D.				-
Amber	12 - 500mL	Bis(2-ethylhexyl)phthalate		None	N		-						

Rinseate Sample I.D.

## Type/Brand/Serial No./Material/Units

Pump Type/Tubing Type	Dedicated QED Bladder Pump	Temp/pH/E.C./D.O	Horiba U-2210
Bailer Type	N/A	Water Level Probe	Waterline/Solinst/Heron
Filter Type	None	Other	ORP Pen
4) Well Conditions	ок 🔀 Not ОК 🗌	Explain	

HCL

Ν

VOA Vial 3 - 40mL

3) Field Equipment

Chlorinated Ethanes & Ethenes

	Groundwater Sampling Data - Well I.D.							MW-308A(N)					
	Project			Port of	Seattle - T	erminal 5		D	ate/Time Sampled	6/3/10	> 111	75	
	Job No			17627-	00			Т	- idally Influenced	Yes	X	No	
	Project	Manager	r	Roger	McGinnis			W	/ell Depth in Feet		17.5	-	
	Field R	eps.	(	CFR/K	MRAJG			S	creened Interval in Feet		12.5-17.5		
	1) Purging Data/Field Measurements: All Measurements Relative to Top of Casing (TOC)												
	Well De	epth in Fe	et		17	'5 '		c	asing Volume in Gallons	3	1.9	18	
	Depth of Sediment (DTS) in Feet /7.5 '								" diameter = x .041 gal/ft, 2	" d. = x .163	gal/ft, 4" d.	= x .653 g	jal/ft]
	Depth o	of Water (	DTW) in	Feet		5.73'		_ P	urge Volume in Gallons	Contra a Contra Contra Contra			
	(DTS -	DTW)		. <u> </u>		/1.77		_ A	ctual Purge in Gallons		~ 6	L	
	Time	No. of Gallons Purged	рН	Temp in °C	Conduct in mS/cm	Turbidity NTU	Do MAIL Commen	OKP ts: Buality	Recovery Color, Odor, Sh	een, Accum	ulated Silt/Sa	and	
	1051	L	7.07	13.6	1.68	5	0.19	-24	Some sed on onse	t. Clear	, red tiv	H.100	day Ishien
	1054	21	7.05	13.6	1.67	0	0.11	-35	1	,		,	/
	1057	32	7.07	13.9	1.46	0	0.39	-51	Changed out Peristality				
	1000	41	7.08	13.8	0.962	D	0.10	-52	5		V		
L.Y	1103	5L	7.08	13.7.	6.960	0 -	0.04	-53			light nan	or hint	
SMF	1106	62	7.08	13,8	0,959	0	0.03	-5+			L	3	V

Bails dry?

At no. of Casing Volumes

Purge Water Disposal Method/Volume

(Stored in 1,000 gallon temporary onsite storage tank.)

**Total Number of Bottles** 

Duplicate Sample I.D.

Rinseate Sample I.D.

Field Blank I.D.

Comments

aundurates C-

malina Data

	Method	Purging Rate in L/min	Depth of Equipment in Feet
Purge	Peristaltic	~0.34min	N 16.5
Sample	L	V	V

#### 2) Sampling Data

		1		1
Bottle Type	No of Containers	Analyses	Perserv.	Filter
HPDE	1 - 500mL	Total Metals - As, Pb	HNO3	N
Amber	2 - 500mL	cPAHs	None	N
Amber	2 - 1L	PCBs	None	N
Amber	2 - 500mL	TPH-Dx w/ silica gel cleanup	None	N
Amber	2 - 500mL	Bis(2-ethylhexyl)phthalate	None	N
			_	
				+

#### 3) Field Equipment

Type/Brand/Serial No	o./Material/Units
----------------------	-------------------

Yes

Onsite IDW

9

Pump Type/Tubing Type	Peristaltic Pump dedicated tubing 1/4 " PE	Temp/pH/E.C./D.O Horiba U_22-10
Bailer Type	N/A	Water Level Probe Waterline/Solinst/Heron
Filter Type	None	Other ORP Pen
4) Well Conditions	OK Not OK Explain	BOLTS, CUT LOCK, GOOD CONDITION HC Standards/Field Forms/GW-Well ID

Gro	Groundwater Sampling Data - Well I.D						-			MW-30	)8B(S)			
Projec	ct		Port of	Seattle - T	Ferminal 5			Date	/Time	Sampled	10/3	1112	17	05
Job N	о.		17627-	-00				Tida	lly Influ	uenced	- 610	res		No
Projec	t Manage	r	Roger	McGinnis				Well	Depth	n in Feet		40	1	
Field F	Reps.		CFRIK	MRAJG				Scre	ened I	Interval in Fe	et	35-40		
1) Pu	urging D	)ata/Fie	eld Me	asurem	ents: All N	Aeasure	ements	s Re	lative	to Top of	Casing	TOC)		
Well D	)enth in Fe	opt			40			Casi				Ē	561	
Depth	of Sedime	ent (DTS	) in Fee	t Z	£9.35		-	Casi	ng voi ameter	= x 0.041  call/ff		162 mal/ft	11	. 0501/61
Depth	of Water (	、 (DTW) ir	Feet		550		-	Pura	e Volu	ume in Gallor	, <b>z u. – x</b> . Is		+ u. – x	c.oos gai/itj
(DTS -	- DTW)				33.19		_	Actu	al Purç	ge in Gallons		~ 5	ĴI_	
Time	No. of Gallons		Temp	Conduct in	Turbidity	DO	ORA	1						
1152		770	12-1	12	010	Commer	its: Quali	ty, He	covery Λι	Color, Odor, S	Sheen, Acc	umulated Si	It/Sand	
1151		1.10	12.1	1416	<u> </u>	U.M	- 6	51	Cre	ar bran	ptivit	10 00	lov /	Sheen
1100	4	7.79	12,1	12.8	0	0,11	-6	6			1			
1157	3L	1.19	13.7	12.3	0	6.09	-7				V			
1202	4L	7.79	13.7	13.0	0	0.04	-7	7		U.	ow tint			
1215	5L	7,79	B.7	13.0	0	0.02	-8	0			Y	ζ	6	
SMF									8096 - MAR					
Comm	nents					<b>.</b>								
V				an a										
)	r				3									
r	Met	hod	Purgin L	ig Rate in /min	Depth of Equ Fee	uipment in It		Bails	dry?		Y	es		No
Purge	Penista	utic	201	3 L/min	~ 38			At no. of Casing Volumes						
Sample	V	/			L			Dura	Moto	n Disposal N	lothod/ (al		Dect	1
L							י L (	(Store	ed in 1	,000 gallon t	emporary	onsite stor	age ta	<u>te (DW</u> nk.)
2) Sa	mpling	Data												•
	T					<u> </u>								
Bottle Type	No of Co	ntainers	Total Ma	Analyse	IS	Perserv.	Filter			Total Num	ber of Bo	ttles _		9
Amber	2 - 500m	nL	cPAHs	als - AS, FI	<u>.</u>	None	N			Duplicate \$	Sample I.	D.		
Amber	2 - 1L		PCBs			None	Ν					-		
Amber	2 - 500m 2 - 500m	nL	TPH-Dx Bis(2-eth	w/ silica gel	cleanup	None	N			Field Blank	k I.D.	e <u>-</u> -		
			515(2-01)	упехурла	lalate	None				Rinseate S	Sample I.I	D.	184	
												-		
	1		0 0			<b>6</b> 1								
3) Fie	ld Equij	pment					2	Туре	e/Bra	nd/Serial	No./Mat	erial/Un	its	
Pump	Type/Tuk	oina Tyr	)e	Peristaltic	Pump dor	licated 4	ubing )	14 " 0	t	Tomalall		11	11.00	10
Bailer	Type			N/A		แขลเช่น แ	Juny /	7_[	-			Horiba	0-22	10
Filtor T	Type		-	None						water Leve	el Probe	Vvaterli	ne/So	linst/Heron
	None None									Other	0	rt Yen		

4)	Well	Conditions
----	------	------------

/\			water Leve
one			Other
ок	Not OK	Explain	3 Stripp
	1		L

HC Standards/Field Forms/GW-Well ID

#### Groundwat mnli - 4 -

SMPL

Gro	unawa	iter 3	samp	oling Da	ata - We	ell I.D.			FM-1	05			
Project	t		Port of	Seattle - T	erminal 5			Dat	e/Time Sampled	61	2/10	15	m
Job No	).		17627	-00				Tide	ally Influenced	_0	You Vool	10	No
Project	t Manager		Roger	McGinnis			_	Wol	II Denth in Feet		10		
Field R	leps.		CFR/K	MRIAJG			-	Scr	eened Interval in F	Eeet	7 17	,	
<b>4</b> D.				$\Theta$				001		ee <u>.</u>			
1) Pu	rging Da	ata/Fie	eld Me	asureme	ents: All I	Neasure	emen	ts Re	elative to Top c	of Casing	(TOC)		
Well D	epth in Fee	et						Cas	sing Volume in Ga	llons		1.15	
Depth	of Sedimer	nt (DTS	) in Fee	t[	1.78			[1" d	Jiameter = x .041 ga	l/ft, 2" d. = ;	x .163 gal/f	t. 4" d. = x	.653 gal/ft]
Depth	of Water ([	DTW) ir	Feet	l	0.70			Pur	ge Volume in Gall	ons			Jan I
(DTS -	DTW)				7.08			Actu	ual Purge in Gallo	ns		271	
[	No. of		1	1	,	00	-	01					
	Gallons		Temp	Conduct in	Turbidity	pol	OR	۴					
Time	Purged	pH	in °C	mS/cm	NTU	Commen	its: Qua	ility, R	Recovery Color, Odo	r, Sheen, A	ccumulated	Silt/Sand	
1448	3L	6.54	12.3	0,397	0	1,29	4	D	Clear, liah	t brown	tint v	no odo	Sheen
1451	4L	6.51	12.2	0.397	(	1.07	4	10			, .	60 B	
1454	51	6.48	12.2	6,298	$\bigcirc$	0.98	4	3		1			
1457	61	1.14	12 1	h 200	6	0110		7					1
17-71	92	0171	141	1,511	0	0.94	14	1		no coli	J√		
1200		6.45	12.1	0.399	0	0.9	1 4	10		V	1		L
Comm	ents								1				
	-												
)	-												
			Purair	no Rate in	Depth of Fo	uinment in	]						
	Meth	od	L	/min	Fee	et		Bails	s dry?		Yes	- 8	NoX
-	Dedicate	d	10.2	Luis	N. 15	5							
Jurge	GEI	B.P.		> IMIN		ر 	4	At no	o. of Casing Volur	nes		11	
ample	$\vee$			V	J	e		Dure		Math - 101	- 1	Anil	
umpio		10 Mar 11		V I			1	(Stor	red in 1.000 gallor	ivietnod/v	olume v onsite s	UNSH torage tai	<u>e</u>
2) 6-1	nnlina F							1		rempora	y onoite a	lorage tai	ik.)
2) Sai				0		·							
tle Type	No of Con	tainers		Analyse	s.	Persen	Filtor		Total Nu	mbor of F	attlaa		10
DE	1 - 500m	L	Total Me	etals - As, Pt	<u>,</u>	HNO3	N		TOTALINU		otties		12
ber	2 - 500m	L	cPAHs			None	N	1	Duplicate	e Sample	I.D.		Martinetine susary
iber	2 - 1L		PCBs			None	N						
ber	2 - 500m		IPH-Dx Bis(2-off	w/ silica gel	cleanup	None	N		Field Bla	nk I.D.			and the second se
A Vial	3 - 40mL	<u> </u>	Chlorina	ted Ethanes	& Ethenes	HCL	N		Rinseate	Sample	חו		
										Campic	I.D.	0	
5.1.5													
3) Eio	ld Fauin	mont						T	(Due 1/0 )				× -
5) 1 10	a cyuip							тур	e/Brand/Seria	u NO./Ma	aterial/U	inits	~
Pump <sup>-</sup>	Tyne/Tubi	ing Tyr		Dedicator		dor Du-	<b>a</b> n	Tom		119	11.00		
Poller 7		ing i Àf				uei Pun	iþ	rem	ip/pH/E.C./D.O	Horiba	0-7210		
Daller	rype			IN/A				Wate	er Level Probe	Waterl	ine/Soling	st/Heron	

Explain

Bailer Type Filter Type

None		
ОК	$\square$	Not OK

Temp/pH/E.C./D.O	Horiba U-2210	
Water Level Probe	Waterline/Solinst/Heron	
Other	ORP Pon	

HC Standards/Field Forms/GW-Well ID

	Method	Purging Rate in L/min	Depth of Equipment in Feet
Purge	Dedicated GED B.P.	~0.3 -1min	~15
Sample	$\downarrow$	V	$\checkmark$

### 2) Sampling Da

Bottle Type	No of Containers	Analyses	Perserv.	Filter
HPDE	1 - 500mL	Total Metals - As, Pb	HNO3	N
Amber	2 - 500mL	cPAHs	None	N
Amber	2 - 1L	PCBs	None	N
Amber	2 - 500mL	TPH-Dx w/ silica gel cleanup	None	N
Amber	2 - 500mL	Bis(2-ethylhexyl)phthalate	None	N
VOA Vial	3 - 40mL	Chlorinated Ethanes & Ethenes	HCL	N
19 <sup>1</sup>				

## 3) Field Equipn

4) Well Conditions

Sample Cus	tody Ri	ecord		Zor	N		Hart Crowser, Inc. 1910 Fairview Avenue East
Samples Shipped to:	ART				(r	<b>HARTCROWSER</b>	seattie, wasnington 98102-3099 Phone: 206-324-9530 FAX: 206-328-5581
IOB 17(637	-CC IAR	NUMBER		 - -	REQU	JESTED ANALYSIS	SU97
PROJECT NAME	TERNINAL	6			(280) (28) (57) (57)	Q.e.	
HART CROWSER CONT	ACT C	Rust			2) < 3) < 3) < 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	,7 J+	COMPOSITING INSTRUCTIONS
SAMPLED BY:	RU A 77-				1-HJ 57 978- 978- 978- 978- 978- 978- 978- 978	138	0 '0N
LAB NO SAMPLE ID	DESCRIPTION	ON DATE	TIME	MATRIX	- 		
HH-01W	WATER	6/2/10	1155	WATER	XXXX		9 6-5cml, 3-100ml
C-9M2		6/3/10	1305	WATER	XXX XX	×	6
CMP-4		O  e  o  O	1510	WATER	XXX XX	×	6
Mu-36	<b>&gt;</b>	[0/2/10	1620	MATER	XXXX		↑
	2		-				
	-						
		:					
Relinguished by 1	DATE	RECEIVED BY		DATE	SPECIAL SHIPMENT HA	ANDLING OR	36 TOTAL NUMBER OF CONTAINERS
	11/11	0 0 24/0	)	ייודאי	STORAGE REQUIREME	ENTS:	SAMPLE RECEIPT INFORMATION
SIGNATURE / US T	U/M/C	SIGNATURE	2 5	TIME	1) AS \$b: 107AL	Metals COICE/CO30	CUSTODY SEALS: CYES CINO CINIA
	00°21	PRINT NAME	-	(724)	2) 45 (b) 20, (c) 2) 7PH-D× 61711 .	LU, NI . IOTAL METALS CORPORTS	
	PATT PATT			DATE			SHIPMENT METHOD: CHAND SHIPMENT METHOD: CHAND
					COOLER NO.:	STORAGE LOCATION:	TURNAROUND TIME:
SIGNATURE	TIME	SIGNATURE		TIME			24 HOURS
PRINT NAME	· · · · ·	PRINT NAME			See Lab Work Order N	0.	□ 48 HOURS XSTANDARD
COMPANY		COMPANY			for Other Contract Rec	quirements	C T2 HOURS OTHER
White and Yellow Copies to Lab	Pink to Proj	ect Manager La	ab to Return W	hite Copy to Har	Crowser Gold to Samp	ole Custodian	

蓋

Sample Cust	ody Re	scord	, 、	Z OF			(27) $(100)$ Hart Crowser, Inc. 1910 Fairview Avenue East
Samples Shipped to:	AKI				(11/2	HARTCROWSER	Phone: 206-324-9530 FAX: 206-328-5581
Ine 17/27-CC		HIMBER				STED ANALYSIS	
	ERMINE				(20) (20) (20) (20) (20) (20) (20) (20)	1.57 1.	
HART CROWSER CONTAC		Rust			e × 2) 52 15 H ×+?W	°E.) : r(R)	COMPOSITING INSTRUCTIONS
					∇- 772 77		-0F
SAMPLED BY: CF	TR/AJ	2			HJL J J 1014	197 197	ÖN
LAB NO. SAMPLE ID	DESCRIPTIC	DATE	TIME	MATRIX			
CMP-15	LATER	e 613/110	940	LATER	× × × × × ×		6
MN-302/N			1105	_	× × × ×		6
MW-323(5)			1205		× × × ×		6
CMP-S		-	/3¢C		× × × × ×		6
Fu-105			1500		× × × ×	X	t/
Mu-125	$\rightarrow$	$\rightarrow$	/PCO	$\rightarrow$	X X X X X		~/
TRIP BLAN	$\rightarrow$	$\rightarrow$		$\rightarrow$		×	E
				····			
	-						
RELINQUISHED BY	DATE	RECEIVED B'	Υ.	DATE	SPECIAL SHIPMENT HAP	VDLING OR	60 TOTAL NUMBER OF CONTAINERS
And my	6/3/10	Cani Pel	Ner	ديالح)فا	STORAGE REQUIREMEN	TS: $\mathcal{D}_{\mathcal{L}}$	SAMPLE RECEIPT INFORMATION
AMILE CARINE	TIME			TIME	1) WINDIAN C	C 4 10 20 6 6 2	CYES CNO CN/A
COMPANY COMPANY	1730	COMPANY	SL	RELI	3) TPH-DX 1117	+ SILLA CEL (LANUT	GOUD CONDITION CYES TEMPERATURE
RELINQUISHED BY	DATE	RECEIVED B		DATE			SHIPMENT METHOD:  COURIER COURIER COURIER COVENIGHT
88					COOLER NO.:	STORAGE LOCATION:	TURNAROUND TIME:
	TIME	SIGNATURE		TIME			24 HOURS 1 WEEK
👹 🗗 PRINT NAME		PRINT NAME	-		See Lab Work Order No.		48 HOURS     X5TANDARD
COMPANY		COMPANY			for Other Contract Requ	irements	T2 HOURS OTHER
White and Yellow Copies to Lab	Pink to Proje	ct Manager	Lab to Return W	hite Copy to Har	t Crowser Gold to Sample	Custodian	

LAB NUMBER       MILVAL S       CIRDEN       CIRDEN       AJC       AJC	80908) 5,23) (20208) 5,23) (20208) 5,23) (20208) 5,23) (20208) 5,443 (20208) 5,443 (20	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS COMPOSITING INSTRUCTIONS
AJC ESCRIPTION DATE TIME MATRI ESCRIPTION DATE TIME MATRI ATER (44/1/0 845 kmet 945 kmet 1340 1340	Image: state	
ESCRIPTION DATE TIME MATRI. MATER G/4/1/O 845 MATERI 945 1040 1340 1340 1340 1340		60000
MTER 644110 845 NATEI 945 1310 1340 	× ×	60000
945-1040	X X	00000
040 1310	X X X X X X X X X X X X X X X X X X X X	6 6 6 <b>6</b>
1310 1340		668
1340	XXXXXXXX	6
		¢ Ø
DATE BECEIVED BY DATE	SPECIAL SHIPMENT HANDLING OR	50 TOTAL NUMBER OF CONTAINERS
TIME ANOTON SON VILLINE	STORAGE REQUIREMENTS: 1) 60/08/6020 For As Po	SAMPLE RECEIPT INFORMATION CUSTODY SEALS: CYES INO IN/A
SO COMPANY 1550	2) (alob/lazo tor As, Ro, Sb, Cr, R. 2) TOH-NY WITH SIMEN GER (15)	らいが、GOOD CONDITION ついた ロートロ TEMPERATURE
DATE RECEIVED BY DATE		SHIPMENT METHOD: CHAND COURIER COVERNIGHT
	COOLER NO.: STORAGE LOCATI	ION: TURNAROUND TIME:
TIME SIGNATURE TIME		24 HOURS     1 WEEK
PRINT NAME	See Lab Work Order No.	a 48 Hours
COMPANY	for Other Contract Requirements	C 72 HOURS OTHER

GROUNDWATER SAMPLING FORMS ASPECT CONSULTING, LLC



0	cart	n+water				CM	P-1-0.	8101	3	
ROUNE	WATER S	AMPLING RI	ECORD			WELL NUME	BER: CMP-	1		Page: 1 of 1
roject Nan ate: <u>(0</u> eveloped leasuring I creened Ir	he: SOUTHV (3/08) by: <u>DFR/AT</u> Point of Well hterval (ft. TC	VEST HARBOR	PROJECT - 7.0-17.0	Phase II GC	:WMP	Project Numb Starting Wate Casing Sticku Total Depth ( Casing Diam	ber: 080064 er Level (ft T up (ft) <u>:</u> ft TOC <u>);</u> eter (inches	OC): <b>12</b> -0.29 16.85 2	92	
liter Pack asing Volu asing volu	Interval (ft. 1 ume <u>3,</u> umes: 2" = 0 <u>2" = (</u>	OC) <b>13</b> (ft Water) 0.16 gpf 4 0.62 Lpf 4	x <b>0.1</b> x <b>0.1</b> = 0.65 gpf = 2.46 Lpf	<b>6</b> (Lpfv)( <b>6</b> 6'' = 6''	p) = <u>0</u> . ( = 1.47 gpf = 5.56 Lpf	<u>.3</u> (L)@)			Sample Int	ake Depth (ft TOC): ~12 ft
Time	G MEASUR Cumul. Vol. (gal o	Purge Rate (gpm or pm	Water Level (ft)	Temp. (C or F)	Specific Conductance	Dissolved Oxygen	рH	Eh ORP	Turbidity (NTU)	Comments
30	/	0.4		/	(µS/cm)	(mg/L)		(mv)	/	clear discharge
26	2		17 44	142	597	0.76	1.72	316.7	13.0	Luched after YSI
40	<u> </u>		12.99	14 2	576	0.10	6.17	209.2	12.0	1
45	6		12.93	14.4	567	0.41	6.86	189.5	/	
50	8		17.94	14.4	564	0.36	6.87	188.3	3.56	
355	10		12.96	14.4	565	0.31	6.99	178.6	1.78	V
900	12	$\overline{\mathbf{v}}$	12.96	14.4	563	0.30	6.90	181.7	1.76	turbid w/o YSI
otal Galio	ns Puraed:	3,1				Total Casing	Volumes R	emoved:	4.9	
nding Wa	ter Level (ft	TOC): 12	.96			Ending Total	l Depth (ft T	OC): 16.85		
AMPLE Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea Color	arance Turbidity & Sediment		Remarks
900	1L	HPDE		1	none	нноз	clear	none	Total Meta	ıls - As, Pb
900	500mL	Amber glass		2	none	none	1	<u> </u>	cPAHs	
900	1L	Amber glass		2	none	none	<b>├ -  </b>	<b> </b>	PCBs	
900	500mL	Amber glass		2	none	none	<b>└──│</b> ──		TPH- DX	
900	500mL	Amber glass		2	none	none	<b>₩</b>	√	Bis(2-ethy	t hexyl) phthalate
IETHOI ampling I urging Ec	I DS Equipment ar quipment:	nd IDs: Peristaltic Pu	Peristaltic I mp w/ dedic	Pump and Ya	SI 556 # <b>I Y</b>	<b>7</b> Decon Equ	upment:	Alconox, D	i vistilled Wat	ier
Disposal o Observatio	t Discharged	ts:	Stored in 1	,000 gallon t	emporary onsi	te storage tan	<u>к</u>			

•

-

						CMP.	-2-0	081013			
GROUNE	WATER S	AMPLING R	ECORD			WELL NUM	BER: CMP	-2			Page: 1 of 1
Project Nar	ne: SOUTHW		PROJECT -	Phase II GC	WMP	Project Num	ber: 08006	4	4.0		I
Jate: Developed	by: DER/AT	00				Starting wat	er Level (π up (ff):	-0.29	9Z		
Veasuring	Point of Well	TOC				Total Depth	(ft TOC):	17.3			
Screened li	nterval (ft. TC	DC)	7.0-17.0		<u>-</u>	Casing Dian	neter (inche	٤ <u>2</u>			
Filter Pack	Interval (ft. T	0C)	5.0-19.0								
Casing Vol Casing volu	ume <u>4,5</u> umes: 2" = 0 2" = 0	<b>8</b> (ft Water) ).16 gpf     ₄ ).62 Lpf     ₄	x0.65 gpf 4" = 2.46 Lpf	(Lpfv)(g 6" : 6"	ੴ) = <u>0.    </u> = 1.47 gpf = 5.56 Lpf	<u>+0</u> (L)(gal)			Sample Int	ake Depth	i (ft TOC): ~12 ft
PURGIN	G MEASU	REMENTS	<u> </u>								
Time	Cumul. Vol. (gal o	Purge Rate (gpm or L	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	Turbidity (NTU)		Comments
930	/	0.4	/	/	/	/	/		/	clear	discharge
435	2	1	12.94	16.7	1197	0.16	7.98	140.5	2.37	turbid	after YSI
240	4		12.93	16.8	1269	0.11	8.85	131.0	/		
945	6		12.95	16.9	1276	0.11	9.18	131.8	/		
450	g		17.95	16.9	1273	0.10	9.36	137.6	1.20		
455	10		17.95	16.9	1273	0.09	9.36	135.3	0.92		/
1000	17.		17 45	16.9	1272	6.09	9.38	134.3	0.86	turbid	w/a YS1
							<u> </u>				
									•		
Total Galic	ons Purged:	3.1		•	<u> </u>	Total Casin	g Volumes	Removed:	<u>4.4</u>		
		TOC): <u>12.</u>	13			Ending Lota	al Depth (ft	100): 17.3			
Time		Bottle Type		Quantity	Filtration	Preservatio	n App	arance		F	Remarks
	Volumo						Color	Turbidity & Sediment			
1000	1L	HPDE		1	none	нноз	clear	none	Total Metals - As,		b
1000	500mL	Amber glass	· ·	2	none	none	1_1		cPAHs		
1000	1L	Amber glass		2	none	none	_		PCBs		
1000	500mL	Amber glass		2	none	none		<u> </u>	TPH- DX		
1000	500mL	Amber glass		2	none	none			Bis(2-ethy	'l hexyl) ph	thalate
1											e an Melde a
METHO	DS		1		<u>I</u>	1	J	- I		<u></u>	
Sampling	Equipment ar	nd IDs:	Peristaltic	Pump and Y	SI 556 # <b>147</b>						
Purging E	quipment:	Peristaltic Pu	imp w/ dedic	ated tubing		_ Decon Eq	uipment:	Alconox, D	Distilled Wa	ter	
Disposal o	of Discharged	Water:	Stored in 1	,000 gallon f	temporary onsi	te storage tai	nk				

ROUNT			FCORD				BER: CMP-	.3		Page 1 of 1
Project Ner			PROJECT	Phase II CC		Project Numb		1		
Date: /	0/14/08		- 100201 -	1 11030 11 GC	Z ¥ V IVII <sup>−</sup>	Starting Wate	er Level (ft T	- FOC):	8.40	
) eveloped	by: DFR/AT					Casing Sticku	up (ft):	-0.3	7	·
leasuring	Point of Well	TOC				Total Depth (	ft TOC <u>):</u>	15.8	4	
Screened I	nterval (ft. TC	DC)	6.0-16.0			Casing Diam	eter (inches		2	
ilter Pack	Interval (ft. T	OC)	4.0-17.5	_						
Casing Vol	ume <u>7.</u>	<u>4 4</u> (ft Water)	x0.1	<b>6</b> (Lpfv)(g	ipf) =	(L)(gal)				
Casing volu	umes: 2" = 0	).16 gpf 4	" = 0.65 gpf	6" :	= 1.47 gpf				Sample Int	ake Depth (ft TOC): ~11 ft
	2" = (	J.62 Lpt 2	1" = 2.46 Lpt	6"	= 5.56 Lpt					
	G MEASU	REMENTS			- 15					
lime	(gal or(_)	Purge Rate (gpm or Imp)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	(NTU)	Comments
815	/	0.4	8.40	/	1	1	/	/	1	clear discharge
820	Z	1	8.45	19.2	572	0.47	10,39	143.5	5,82	turbed for the
825	ч		8.42	19.6	588	0.30	10.73	127.5	1.62	at the second se
0.70			Q U7	10 7	667	0.90 0.94	(014)		1.07	
050	0		0.76	147	012	0.27	0.85	123.0	1, 14	
055	3		0.76	101-	1.00	0121	10.82	154	$r_1, \sigma_1$	
040	10		0.92	1-1-0	600	V-1-1	RI: NI	145.2	1.08	
845	12	V	8.42	19.5	613	0.19	10.96	192.7	1.07	torbed w/o YSI
										•
							-			
· · · ·		1								
						<u> </u>				
	]									
lotal Gallo	ns Purged:	3.15				Total Casing	Volumes R	emoved:	2.63	5
- - nding We	iter i evel (# 7	<b>8.</b> 9	42			Ending Total	Depth (ft T	OC) <sup>,</sup> 15 8	4	
							Dobru (it L	557. 10.0	•	
				Oursette	<b>F</b> ilder-4!	Dressmith	A			Demo-l
i IMe	voiume			Quantity	Filtration	reservation	Appea	arance		remarks
							Color	Sedimen	t	
845	1L	HPDE		1	none	HNO3	clanr	none	Total Meta	als - As, Pb
845	500mL	Amber glass		2	none	none	1	1	cPAHs	
845	11	Amber glass		2	none	none			PCBs	Manager (Manager 1977) 1977 - 1977
845	500ml	Amber close	1	1 1	none	none				
245	FOOM			-						wanca yer deanup)
ידט	1500mL	Amber glass		2	none	Inone	1		Bis(2-ethy	i nexyi) phthalate
VIETHO	12					-				
Sampling I	Equipment ar	nd IDs:	Peristaltic F	Pump and Y	SI 556 # <b>l</b> Y	7				
Purging Ed	quipment:	Peristaltic Pu	mp w/ dedica	ated tubing		_ Decon Equ	ipment:	Alconox,	Distilled Wat	er
Disposal o	f Discharged	Water:	Stored in 1	<u>,000 gallon</u> t	<u>emporary on</u> sil	<u>e storage tan</u> l	٢			
	-									
		4								

ł

ROUND	WATER S	AMPLING R	ECORD			WELL NUM		Page: 1 of 1			
roject Nam	ne: SOUTHV	VEST HARBOR	PROJECT -	Phase II G	CWMP	Project Num					
ate:	10/14/0	8				Starting Wate	<u> </u>				
eveloped b	by: DFR/AT					Casing Stick	up (ft):	-0.32	•		
easuring F	Point of Well		70470			Total Depth (	(ft TOC <u>):</u>	17			
creened in Itor Book I	iterval (ft. 10		<u>7.0-17.0</u>		······	Casing Diam	ieter (inches	2			
ILEI FAGKI			0.0-17.0		· · ·	<i>r</i>					
asing Volu	וויפ (ime	(ft Water)	) X	<u>م</u> (Lpfv)(ر	pf) = <u>0 • 1</u>	<u>ゝ</u> (L)(gal)					
asing volu	mes: 2" = 0	0.16 gpt 4	4" = 0.65 gpt	6"	= 1.47 gpt				Sample Inta	ake Depth (1	π TOC): ~12 π
	2" = (		4" = 2.46 LPT	6	= 5.56 Lpt						
URGING	S MEASUR	REMENTS									
Time	Cumul. Vol.	Purge Rate	Water	Temp.	Specific	Dissolved	рН	Eh	Turbidity (NTU)		Comments
	(gai u	(gpin of cpin)			(µS/cm)	(mg/L)		(mv)	(1110)		
115	/	0,4	11.04	/	/	/			/	clear	discharge
20	2		1 60	10.8	1013	DUD	910	277.4	4.67	Lich 1	CI YEL
20	<u> </u>		11.00	10.0		<u>v.</u> w	0.00	210.1	7 76		4++++ 521
25	4		11.08	16.9	497	0.33	8,77	212.0	2.77		
430	6		11.04	16.9	449	0.26	8.32	198.3	1.76		
935	8		11.08	17.0	439	0.23	8.02	194.3	1.67		
940	10		11.08	117.0	438	0.24	7.81	193.3	1.55		
945	17	V V	104	17 1	440	0.25	770	189.6	3,90	1 I	6 A Vs
	10		1.00	<u> </u>		<u> </u>	1.10	10.0		TUBIA	before 13
		-									
			·							·	
						,					
								1			••••••••••••••••••••••••••••••••••••••
										Į	
otal Gallor	ns Purged:	3.15				Total Casing	Volumes R	Removed:	3.32		
	-		<u>، ۵</u>			-					
nding Wat	er Level (ft 1	FOC):	03			Ending Total	I Depth (ft T	OC): 17.0			
AMPLE	INVENTO	RY									
Time	Volume	Bottle Type	Bottle Type		Filtration	Preservation	ation Appearance		F		.emarks
							Color	Turbidity &			
DANG						·	00101	Sediment			
201012	<u>1L</u>	HPDE		1	none	HNO3	clear	none	Total Metals - As, Pb		
	500mL	Amber glass		2	none	none			cPAHs		
	1L <sup>.</sup>	Amber glass		2	none	none		}	PCBs		
	500ml	Amber glass		2	none	none				w/silica del «	cleanup)
$\mathbf{\nabla}$	500ml	Amberglass								haved) whith	alata
	SUUML	Amber glass		4	none	none			Bis(2-ethy)	nexyi) phin	alale
								<u> </u>			
			<u> </u>			<u> </u>					
IETHOD	)S										
ampling E	quipment ar	nd IDs:	Peristaltic F	Pump and Y	SI 556 # 147	7					
urgina Ea	uipment:	Peristaltic Pu	mp w/ dedica	ated tubing		Decon Ear	lipment:	Alconox. D	istilled Wate	ər	
ienoeol of	Dioobaras	Motor:	Stored in 4	000 galles f							
ISDO241 OF	LISCHAIGED	vvalel.	SUCED IN 1	,uuu gallori t	emporary onsit	e sioraye ian	N				



0	ean	n+water				CMP	6- C	6101	163				
GROUN	OWATER S	AMPLING R	ECORD			WELL NUM	BER: CM	P-5	<b></b>		Page: 1 of 1		
Project Na Date: <u>10</u> Developed Measuring	me: SOUTHV 13/08 by: <u>DFR/AT</u> Point of Well	VEST HARBOR	PROJECT -	Phase II G	CWMP	Project Number:         080064           Starting Water Level (ft TOC):         12.92 10.09           Casing Stickup (ft):         -0.27           Total Depth (ft TOC):         15.1							
Screened	nterval (ft. TC	)C)	5.5-15.5			Casing Diameter (inches							
Filter Pack	Interval (ft. T	OC)	3.0-19.0			<b>.</b>							
Casing Vo Casing vol	ume <u>5.0</u> umes: 2" = ( 2" = (	(ft Water) 0.16 gpf 4 0.62 Lpf	) x <u> </u>	(Lpfv)( 6" 6	( <b>)</b> ) = <u>0.80</u> = 1.47 gpf = 5.56 Lpf	(L)( <b>(3)</b> )			Sample Inf	take Depth	(ft TOC): ~10.5 ft		
PURGIN	G MEASU	REMENTS											
Time	Cumul. Vol. (gal or <b>()</b>	Purge Rate (gpm or (pm))	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pН	Eh ORP (mv)	Turbidity (NTU)		Comments	A FR	
930	$\sim$	-0.4-								dear	dischard	- Wrov	
1450		0.4	-					/		clear	discharge	ve	
1455	2	$\checkmark$	10.25	16.4	359	0.08	6.73	183.4	4.32		· · · · ·		
1500	4	0.3	10.50	16.2	343	0.08	6.46	180.3	2.08	dischar	my reduced.	too much !	
1505	5.5		10.48	16.0	346	0.07	6.68	154.8	1.22		1		
1510	7.0		10.46	16.0	352	0.08	6.56	137.4	1.35				
1515	9.5	1	10.46	16.0	358	0.07	6.73	111.3	0.78				
1520	10.0	0,3	16 <b>.46</b>	16.0	358	0.07	6.73	112.6	0.81	turbid	w/o YSI		
					1						-		
Total Gallo	ons Purged:	2.63				Total Casing	y Volumes	Removed:	3.28				
Ending Wa	ater Level (ft -	ГОС): <u>10.4</u>	6			Ending Tota	I Depth (ft	TOC): 15.1					
SAMPLE		RY	T		·····	1 .							
Time	Volume	Bottle Type		Quantity	Filtration	Preservatior	n Appe Color	Turbidity & Sediment		Remarks			
1520	1L	HPDE		1	Inone	НNO3	clear	none	Total Meta	otal Metals - As. Pb			
	500mL	Amber glass		2	none	none	1	1	cPAHs				
	1L	Amber glass		2	none	none			PCBs		·		
	500mL	Amber glass		2	none	none			TPH- DX (	w/silica gel	cleanup)		
$\checkmark$	500mL	Amber glass		2	2 none	none			Bis(2-ethy	l hexyl) pht	halate		
METHO	DS								···				
Sampling	- <del>-</del> Equipment er	nd IDs:	Peristaltic I	Pumn and Y	SI 556 # 141								
Puraina Fi	uipment:	Peristalfic Pu	mp w/ dedic	ated tubing	<u></u>	Decon Fa	lipment.	Alconox F	istilled Wat	er			
Disposal c	f Discharged	Water:	Stored in 1	,000 gallon	temporary onsit	te storage tan	<u>k</u>	7					
Observatio	ons/Commen	ts:									······		

ROUNE	WATER S	AMPLING RI	ECORD			WELL NUME		Page: 1 of 1			
ject Nar	me: SOUTHW	EST HARBOR	PROJECT -	Phase II GO	WMP	Project Numl	ber: 080064	4		•	
te:	10/14/08					Starting Wate					
veloped	by: <u>DFR/AT</u>					Casing Stick	up (ft):	-0.29			
asuring	Point of Well	TOC				Total Depth (	(ft TOC <u>):</u>	17.05			
creened I	nterval (ft. TO	C)	7.0-17.0			Casing Diam	eter (inches	2			
iter Pack	Interval (ft. 10	JC)	4.0-17.4								
asing Vol	ume <b>6.6</b>	(ft Water)	x_0.16	(Lpfv)(g	pf) = <b>1.06</b>	(L)(gal)					
asing volu	umes: 2" = 0	.16 gpf 4	" = 0.65 gpf	6" :	= 1.47 gpf				Sample Inta	ake Depth (	π TOC): ~12 π
	$2^{\prime\prime} = 0$		+" = 2.46 Lpt	0	= 5.56 Lpt					· · · · · · · · · · · · · · · · · · ·	
URGIN		REMENIS			0 15			<b>F</b> /-	T	1	0
lime	Cumul. Vol.	Purge Rate	Water	(CorF)	Specific	Dissolved	рн		(NTU)		Comments
	(galoric)	(gpin or Epin)		0.17	(µS/cm)	(mg/L)		(mv)	(110)		
155	/	0.4	10138	. /	(	/	(	1	~	clear	ducharal
200	2		10 50	5.5	1861	0.31	6.73	204.9	2.26	turk d	flor XSI
706			10.09	17.8	2014	0.77	1.97	1807	1.14	(- <b>vy</b> (or	ATTER QUI
210	4		1. 116		7 6 0	~~~~~	4.0-	.00.0	1 26		
210			10.77	17.3	0170	0.12	6.87	92.1	1.20		
215	<u> </u>		10.49	17.7	2158	0.08	6.08	48.7	1.20		
220	10		10.49	17.7	2334	0.08	6.89	44.4	1.26		
2.25	12	V	10,49	17.7	2336	0.008	6.88	48.1	1.12	trobed	etterwo VSI
	· · · · · · · · · · · · · · · · · · ·										
								· · · ·			
			-								
otal Gallo	ins Purged	4	5,15			Total Casino	Volumes F	Removed:	2.92		
oral Galic	no ruigoa.					rotar odoling	, volanioo i	ionio rou.			
nding Wa	ater Level (ft T	гос): <b>l(</b>	.44			Ending Tota	l Depth (ft T	OC): 17.05			
		RY									
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Арре	arance	Remarks		marks
							Color		4		
		~				1	000	Sediment			1.788-Mar.
225	11500 mL	HPDE		21	none	HNO3	dear	noue	Total Meta	is - As, Pb,	Sb, Cr, Cu, Ni
	500mL	Amber glass		2	none	none	ļ		cPAHs		
	1L	Amber glass		2	none	none			PCBs		
	500mL	Amber glass		2	none	none			TPH- DX (	w/silica gel	cleanup)
V	500ml	Amber glass	1		none	none		1 1	Bis(2-ethyl	hexyl) nhth	alate
-		, and grass					1				
ETUO			l		<u>.</u>	I					
	03					~					
ampling	Equipment ar	id IDs:	Peristaltic I	<sup>o</sup> ump and Y	SI 556 # <b>1 4</b>	†					
	quipment:	Peristaltic Pu	mp w/ dedic	ated tubing		_ Decon Equ	ipment:	Alconox, E	Distilled Wat	er	
urging E											
urging E	of Discharged	Water:	Stored in 1	,000 gallon t	emporary onsi	<u>te storage tan</u>	<u>k</u>				

en gernere



-						CM	P1+-	08101	<u>5</u> .			
ROUNE	WATER S	AMPLING R	ECORD			WELL NUMBER: CMP-17 Page: 1 of 1						
roject Nar ate: <u>to</u> eveloped leasuring creened l	ne: SOUTHV //3/08 by: <u>DFR/AT</u> Point of Well nterval (ft. TC	VEST HARBOR	PROJECT - - 6.0-16.0	Phase II GC	:WMP	Project Num Starting Wate Casing Stickt Total Depth ( Casing Diam						
ilter Pack	Interval (ft. T	OC)	4.0-16.5	· · · ·		L						
asing Vol asing volu	ume <u>6.7</u> umes: 2" = 0 2" = 0	.16 gpf 0.16 Lpf	) x <u>0.[6</u> 4" = 0.65 gpf 4" = 2.46 Lpf	(Lpfv)( <b>g</b> 6" 6"		(L)@a))			Sample Inte	ake Depth (ft TOC): 14 ft		
URGIN	G MEASU	REMENTS						·		· · · · · · · · · · · · · · · · · · ·		
Time	Cumul, Vol. (gal o(_)	Purge Rate (gpm or pp)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рH	Eh ORP (mv)	Turbidity (NTU)	Comments		
350	/	0.210	9.47	/	/	/	/	/	/	clear discharge		
355	~1		9.50	17.8	459	1.86	6.63	201.8	12.5	turbed after YSI		
400	~2		9.50	17.6	555	0.48	6.53	194.8	2.67			
405	~ 3		9.50	17.6	564	0.27	6.65	191.8	2.00			
410	~4		9,50	17.6	572	0.18	6.62	189.4	2.02			
415	~5		9.50	17.6	573	0,15	6,64	188.8	3.64			
420	~6	<b>√</b>	9.50	17.6	569	0.10	6.61	185.8	1.74	turbid w/o YSI		
otal Gallo	ns Purged:		57 60			Total Casing	y Volumes F	Removed:	 			
naing wa	ater Level (π	100):	11.30		·······	Ending Total		100): 16.21				
SAMPLE		DRY Bottle Turne		Quantity	Eiltrotion	Broconvotion	1 0000	aranco	1	Pemarka		
TINE	Volume	Bottle Type		Quantity	Thration	Fleseivalion	Color	Turbidity & Sediment	Remarks			
1420	1L	HPDE		1	none	нноз	clear	none	Total Meta	lls - As, Pb		
1420	500mL	Amber glass		2	none	none			cPAHs			
1420	1L	Amber glass		2	none	none	└─┨───	+	PCBs			
1420	500mL	Amber glass	*	2	none	none	<u>  ·                                   </u>	┼─-	TPH- DX (	w/silica gel cleanup)		
1420	500mL	Amber glass		2	none	none	<u>                                      </u>		Bis(2-ethyl hexyl) phthalate			
1420	40mL	VOA vial		3	none	HCI			Chlorinate	d Ethanes and Ethenes (CEEs		
<b>METHO</b> Sampling I Purging Ed	 D <b>S</b> Equipment ar quipment:	nd IDs: Dedicated Q	Dedicated	QED Well W ard Bladder	/izard Bladder Pump	Pump and YS _ Decon Equ	   556 # <b>  4</b> ipment:	I7 Alconox, E	Distilled Wat	er		



					FMIC	05-08	31013						
GROUNE	WATER S	AMPLING	RECORD			WELL NUME	BER: FM-1		Page: 1 of 1				
Project Nan Date: <u>}</u> Developed Measuring Screened In Filter Pack	ne: SOUTHW DISDER/AT Point of Well Interval (ft. TO	TOC	R PROJECT - 	Phase II GO		Project Numl Starting Wate Casing Stick Total Depth ( Casing Diam	ber: 08006 er Level (ft up (ft): (ft TOC): eter (inches						
	uma la R	(ft \\/at	(0,0,1)	n (1 nfv)(a	(hf) = 1	(L)(cal)							
Casing volu	umes: 2" = 0 2" = 0	.16 gpf .62 Lpf	4" = 0.65 gpf 4" = 2.46 Lpt	6" 6"	= 1.47 gpf = 5.56 Lpf		-		Sample Int	ake Depth (I	't TOC): 15 ft		
PURGIN	G MEASUF	REMENTS			·								
Time	Cumul. Vol. (gal o <b>r()</b>	II. Vol. Purge Rate Water Temp. Specific Dissolved pH Eh Turbidity (gpm or Lpm Level (ft) (C or F) Conductance Oxygen ORP (NTU) (μS/cm) (mg/L) (mv)								Comments			
1045	0.210	0.210	11.20						/	clear	discharge		
1050	~/`		11.20	11.8	715	1.31	8.65	2\$8.2	38.5	turbed	after YSI		
1055	~ 2		11.20	14.8	600	1.17	8.35	197.3	32,4				
1100	~ 3		11.20	14.2	479	0.77	7.77	190.5	14.4	· · · ·			
1105	~4		11.20	14.7	448	0.53	7.41	187.5	6.54				
1110	5.5		11.20	14.8	442	0.44	7.21	189.3	11.8		·		
1115	~6.5		11.20	14.8	441	0.34	7.09	183,7	1.99				
(120	~7.5		11.20	14.8	440	0,37	7.06	181.6	1.25	ļ			
[125	8.8		[1,20	14.8	440	6.37	7.03	181.9	2.1	turbid	w/c YSI		
		0 9											
I otal Gallo Ending Wa	ns Purged: iter Level (ft 1	-oc): <u>11</u>	.20	········		Ending Tota	I Depth (ft 1	Removed: FOC): 18					
SAMPLE		RY											
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appe Color	arance Turbidity & Sediment	Remarks				
1125	1L <sup>.</sup>	HPDE		2	none	ниоз	clear	none	Total Meta	ls - As, Pb	·		
<u> </u>	500mL	Amber glass		4	none	none	<u> </u>		cPAHs				
	1L	Amber glass		4	none	none		<u> </u>	PCBs				
L	500mL	Amber glass		4	none	none	<u>                                     </u>		TPH- DX (	w/silica gel	cleanup)		
	500mL	Amber glass		4	none	none			Bis(2-ethy	l hexyl) phth	alate		
<b>₩</b>	40mL	VOA vial		·	none	НСІ		$\downarrow$ V	Chlorinate	d Ethanes a	ind Ethenes (CEEs)		
METHO	DS												
Sampling	 Equipment ar	d IDs:	Dedicated	QED Well W	Vizard Bladder	Pump and YS	1 556 # L	47					
Puraina Fa	auioment.	Dedicated	QED Well Wiz	ard Bladder	Pump	Decon Equ	lipment:	Alconox. [	Distilled Wat	er			
Disposal	f Discharged	Water:	Stored in 1	noilea 000.	temporarv onsi	te storage tan	k						
Observatio	ons/Commen	ts: Fille	d same	ie b	ottles u	nHI V	230						
	Second set	of bottles colle	ected for duplic	cate sample	FMto	5-081	013P	colled	rd @	1130	on CeC		

الطور الأنان


MWZGR-081014 /	MWZGR-081014D

GROUNE	WATER S		ING R	ECORD			WELL NUME	3ER: MW-2	26R		Page: 1 of 1
Project Nar Date: Developed	ne: SOUTHW 신이니어 by: DFR/AT	/EST H   0 <b>%</b>	IARBOR	PROJECT -	Phase II GC	;WMP	Project Numb Starting Wate Casing Sticku	oer: 080064 sr Level (ft 1 up (ft):	1 ГОС) <u>: <b>1</b></u> , 0.32	91	
Measuring	Point of Well		тос				Total Depth (i	ft TOC <u>):</u>	17.05		
Screened I	nterval (ft. TC	)		6.5-16.5			Casing Diame	eter (inches	2		
Filter Pack	interval (tt. T	)		4.0-17.0	<u> </u>						
Casing Vol Casing volu	ume <u>1.10</u> umes: 2" = 0 2" = 0	1 ( .16 gpf ).62 Lpf	(ft Water) 4 2	x <u>0-16</u> 1" = 0.65 gpf 1" = 2.46 Lpf	Lpfv)(g) = 6" = 6" :	pf) = <u>[.[</u> = 1.47 gpf = 5.56 Lpf	<b>1</b> (L)(gal)			Sample Inta	ake Depth (ft TOC): ~ 11.5 ft
PURGIN	G MEASUF	REME	NTS	<u> </u>						.,	
Time	Cumul. Vol. (gal or(b)	Purg (gpm	e Rate or L	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	Turbidity (NTU)	Comments
1015	/	0.	4	9.91	/	/	/	/	/		dear ducharge
1020	2			9.91	16.2	12290	0.35	7.03	201.8	2.47	turbid after YSI
1025	4			9.93	16.5	11600	0.23	7.15	195.3	1.39	
1030	6			9.95	16.6	9,930	0.15	7.30	187.9	1.16	
1035	8			9.95	16.3	9 735	0.13	7.30	187.1	0.70	
1040	10			9.95	16.9	16.130	0.11	7.30	184.6	0.80	
aut	12	<b>v</b>	/	4.95	10.6	10 164			194.5	0.24	turbed w/ XCI
1075					- (6 - 1	10110		1.6.1			
											· · · ·
						<u> </u>				[	
						<u> </u>	<u> </u>				
							<u> </u>				
									<u> </u>		
						<u> </u>					
Total Car	ne Durec -!		315	<u> </u>	L	L.,			lemound:	1.71	
	na rurgea;		 	95			Total Casing	volumes R	centoved:	- 76	
Ending Wa	ter Level (ft 7	UC): _	٦.	i J		<u> </u>	Ending Total	Depth (ft T	UC): 17.05		<b>m</b>
SAMPLE		RY		1			·	1		r	
Time	Volume	Bottl	іе Туре		Quantity	Filtration	Preservation		arance Turbidity &	-	Remarks
	41								Sediment	Tetel	
1075	11L 500 ·		!-	+				lear	none	I I OTAL Meta	18 - 78, 70, 80, 67, 60, NI
	1500mL	Amber	glass		4	none	none		┼──┦───		······································
┠─-}	1L	Amber	r glass	+	4	none	none	╀ ┨ ──	┼ ╎	PCBs	
	1500mL	Amber	glass		4	none	Inone		+	<u> TPH- DX (</u>	w/silica gel cleanup)
	1500mL	Amber	r glass		4 4	none	Inone	-	+	Bis(2-ethyl	hexyl) phthalate
									·	<u> </u>	- 10 - 11 - 11 - 11 - 11 - 11 - 11 - 11
METHO	DS	<u> </u>		<u> </u>	L	L	1	I	1	L	
Sampling	Equipment or	nd IDe.		Peristaltic E	ump and Vo	31 556 # <b>1 U J</b>					
Purging F			staltic Du		and tubier			inment.	Alconov D	)istilled Mat	er
Diepocal -	f Discharge d	<u>refis</u>	stanic PU	Stored in 4		amporant analt	e storage for	αρτησημ	AIGOHOX, L		
Dispusal 0	n Discriarged	vvaleľ:			,ooo gallon t		ie aloraye lani	<u>v</u>			
Observatio	ons/Comment	is:							.1	NER	
	Second set	of bottle	es collect	ted for duplic	ate sample	- MWZE	F-0810	014D	at i	030	
P											

ROUND	WATER S	AMPLING F	RECORD			WELL NUME	BER: MW-3	36		Pag	je:1 of 1
roject Nan	ne: SOUTHW	EST HARBOR	R PROJECT -	Phase II G	CWMP	Project Numb	oer: 080064	4			
ate: <u>ເບ</u>	14/08					Starting Wate	er Level (ft 1	ГОС): <u>1</u>	0.0 <b>0</b>		
eveloped	by: <u>DFR/AT</u>					Casing Stick	up (ft):	-0.23			
easuring l	Point of Well	TOC				Total Depth (	(ft TOC <u>):</u>	73			
creened Ir	nterval (ft. TO	C)	58.0-73.0			Casing Diam	eter (inches	2			
ilter Pack	Interval (ft. T	(סכ	55.0-71.0					· · · · ·			
asing Volu	ume 63	(ft Wate	r)x 0.16	(Lpfv)(	p(t) = lo.0	8 (L)((a))					
asing volu	ımes: 2" = 0	.16 gpf	4" = 0.65 gpf	6"	= 1.47 gpf				Sample Inta	ake Depth (ft T(	DC): ~ 65.5 ft
-	2" = 0	.62 Lpf	4" = 2.46 Lpf	6"	= 5.56 Lpf	2					
	G MEASUF	REMENTS	·								
Time	Cumul Vol	Purge Rate	Water	Temp	Specific	Dissolved	рН	Eh	Turbidity	C	omments
TIMO	(gal or L)	(gpm or Lpm)	Level (ft)	(C or F)	Conductance	Oxygen	p.,	ORP	(NTU)	_	
					(µS/cm)	(mg/L)		(mv)			
1250	/	0.4	10.00	1	1	/	1	-	/	clear di	schurge
use	7	1	10.04	14.2	26 900	0.11	715	-30 0	1.55	tuched.L	. Alex Ys
.235	<i>и</i>				26,100	7	1.17	-50.0	7		y aiki L
300	7	·	10.07	9.6	36,760	0.0+	7:27	-9010	1.0>		
1305	6		10.04	14.7	36,480	0.07	7.34	-65.7	1.90	•	
310	8		10.04	14.6	36,380	0.06	7.39	-70.5	1.23		
1315	10		10.04	14.6-	36 220	0.05	744	-78.9	1.17		
					21.16.	6.65	741	201	1 7 6		
1320	12		10109	19.6	56,170	0107	116	747	1.20		• -
325	14	V	10.04	14.6	36,200	0.06	1.11	- +9.5	1.02	turbed whe	, <u>YSI</u>
					· · · · · · · · · · · · · · · · · · ·	· · · ·					
								ļ			
			_								
Fotol Galia	na Buraod:	3.66	}			Total Casino	Volumes F	Removed:	0.36		
i otal Galio	ns Purged.		)			Tutal Casing	y volumes i	temoveu.			
Ending Wa	iter Level (ft 1	roc): <b>10.</b>	04			Ending Tota	l Depth (ft T	TOC): 73			
									1		
				0	<b></b>		- Anno			Bomo	
lime	Volume	Bottle Type		Quantity	Filtration	Preservation			-	Rema	1.5
							Color	Sediment			
1325	11.500mL	HPDE		2,	none	HNO3	clear	now	Total Meta	als - As, Pb, Sb,	Cr, Cu, Ni
1	500ml	Ambor glass			none	none	1	1	cPAHs	<u> </u>	
1	11	Ambor close				none	1		PCBs	105 Ave	
		Amberglass				none					
	500mL	Amber glass			none	none			IPH-DX (	(W/SIIICa gel clea	anup)
V	500mL	Amber glass			2 none	none			Bis(2-ethy	l hexyl) phthala	te
									-		
											a
METHO	DS										
Sampling I	Equipment ar	nd IDs:	Peristaltic	Pump and Y	SI 556 # <b>\                                  </b>	7		. <u>.</u>			
Purging Ed	quipment:	Peristaltic F	ump_w/_dedic	ated tubing		_ Decon Equ	uipment:	Alconox, i	Distilled Wat	ter	
Disposal a	f Discharged	Water:	Stored in 1	non asilon	temporany one	ite storane tan					
Jiapuaal 0	n Discridiged			Jood galloff	tomporary ons	no otorage tan					
							· · · · · · · · · · · · · · · · · · ·				

ROUNE	WATER S		NG RE	CORD			WELL NUMB	ER: MW-	44		P	age: 1 of 1	
roject Nar	ne: SOUTHW	VEST HAI	RBOR	PROJECT -	Phase II GO	CWMP	Project Numb	er: 08006	4				
)ate:	10/14/02	3					Starting Wate	er Level (ft	TOC): [8	90			
eveloped	by: DFR/AT						Casing Sticku	ıp (ft) <u>:</u>	-0.18				
leasuring	Point of Well			n/a		<u> </u>	Lotal Depth (1 Casing Diame	π TOC <u>):</u> ater (inches	<u>73.9</u> : 2	• • • • • • • • • • • • • • • • • • • •			
ilter Pack	Interval (ft. TO	00)		n/a			Dasing Diame		- <u></u>				
Seeing Vol	uma (Z	<u> </u>	Water)	0.16	(1 pfy)(c	$unf) = L_{h} h$	<b>3</b> (1)(dal)						
asing volu	umes: 2" = 0	7 (" ).16 gpf	(valer	" = 0.65 gpf	6"	= 1.47 gpf				Sample Inta	ake Depth (ft	TOC): <u>~ 68 ft</u>	
	2" = 0	).62 Lpf	4	" = 2.46 Lpf	6"	= 5.56 Lpf					a		
URGIN		REMEN	TS	Matar	Tomp	Specific	Dissolved		Eh	Turbidity		Comments	
Time	(gal or L)	(gpm or	Lpm)	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)	pn	ORP (mv)	(NTU)			
1045	/	ο,	4	10.90	<pre></pre>	/	-	/	/	/	dear	dish	
1050	2			11.00	15.8	2,020	2.31	8.01	161.2	6.35	turbed	nfter	<u> </u>
1055	ч			11.00	15.5	193	2.68	8.23	170.9	7.71			
100	6			11.00	15.5	090	2.36	7.92	181.2	5.79			
105	8			11.00	15.4	061	1.96	7.41	188.6	5.36			
116	10			11.012	15.4	0.52	1.90	7.38	197.8	5,21			
	17			11.00	.e.u	046	164	7.71	196.2	6.32			
117.				11.00	ISIT_	010	1.60	17.	140.1	4.22			<u></u>
	19				1711	097	1.64	1 17	1 44.1	2.7.1	ا سط	In Ve	,
1125	16	•		11.00	7.7	041	1.71	1,19	1-1-1-1	3000	TVERA	w 0 15	M
				1	•	· -						~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
Total Gallo	ons Purged:	4	21				Total Casing	Volumes I	Removed:	٥.41			
	Ū												
Ending Wa	ater Level (ft 1	TOC):	11.0	<b>b</b>			Ending Total	Depth (ft ]	FOC): 73.9			76.MP	
SAMPLE		DRY					<u> </u>			1			
Time	Volume	Bottle	Туре		Quantity	Filtration	Preservation	Appe	arance	-	Ren	narks	
								Color	Sediment				
1125	12 500 ml	HPDE		-	21	none	ниоз	clear	none	Total Meta	lls - As, Pb, S	Sb, Cr, Cu, Ni	
1	500mL	Amber o	lass		2	none	none	1		cPAHs			
	11.	Ambero	lass				none			PCBs			
	500ml	Ambor	lace			Inone	none			TPH- DX (	w/silica del c	leanup)	
	500ml		1000				nono			Bie(2 othy	herel phil		
-		Amber g	lass						+		r nevyi) prime	11010	
								-					
METUO				<u> </u>				l ·	1	1			
							1						
Sampling	Equipment ar	nd IDs:		Peristaltic	Pump and Y	SI 556 # 14	<u>†</u>						
Purging E	quipment:	Perist	altic Pu	mp w/ dedic	ated tubing		_ Decon Equ	ipment: _	Alconox, E	Distilled Wat	er		
Disposal o	of Discharged	Water:		Stored in 1	,000 gallon	temporary onsi	te storage tan	k					

and the second sec

· · · · •



0				·		MWIZ	5-08	31013				
GROUND	WATER S	AMPLING R	ECORD			WELL NUME	BER: MW-1	25		I	Page: 1 o	F 1
Project Nan Date: Developed   Measuring I Screened Ir	ne: SOUTHV O \ \ S b by: <u>DFR/AT</u> Point of Well nterval (ft. TC	VEST HARBOR	PROJECT -	Phase II GC		Project Numb Starting Wate Casing Stickt Total Depth ( Casing Diam	ber: 080064 er Level (ft 1 up (ft): ft TOC): eter (inches	-OC): -1.11 13.35 2	.88		· · · · · ·	
Filter Pack	Interval (ft. T	00)	3.0-15.0									
Casing Volu	ume <u>6.9</u> umes: 2" = 0 <u>2" = 0</u>	.16 gpf 0.16 gpf 0.62 Lpf	) x <u>0.[6</u> 4" = 0.65 gpf 4" = 2.46 Lpf	(Lpfv)(g 6" 6"	gpf) = <b>L.0</b> = 1.47 gpf = 5.56 Lpf	(L)(gal)			Sample Int	ake Depth (f	t TOC): <u>13</u>	ft
Time		REIVIENI 3	Water	Temn	Specific	Dissolved	nH	Fh	Turbidity	1	Commen	ts
Time	(gal or L)	(gpm or (gpm))	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)		ORP (mv)	(NTU)			
1255		.210	6.88	/	/		/	/		clear	disci	harge
1300	~1		6.88	18.1	429	1.37	6.72	192.0	3.42	turbid	after	<u> YSI '</u>
1305	~2		6.98	18.5	428	0.90	6.66	197.7	1.25			<u>.                                    </u>
1310	~ 3		6.98	18.5	423	0.73	6.63	198.5	1.23			
1315	~ 4		7.00	18.6	420	0.66	6.67	197.9	0.97	1		
1320	~5		7.01	18.6	415	0.56	6.62	196.4	0.60			
1325	~ 6	$\checkmark$	7.01	18.6	412	0.52	6.61	196.0	0.90	NW 0	YSI	
1988	A	-	The second	_								
Total Gallo	ns Purged:	L.65				Total Casing	y Volumes F	Removed:	1.65			
Ending Wa	ater Level (ft	TOC):	. 01			Ending Tota	I Depth (ft I	00): 13.35				
SAMPLE		DRY					<b>A</b>		1		marko	
lime	Volume	Bottle Type		Quantity	Filtration	Preservation	Color	Turbidity & Sediment		Re	marks	
1325	1L	HPDE		1	none	HNO3	clear	none	Total Meta	ils - As, Pb		
	500mL	Amber glass		2	none	none			cPAHs			
	1L	Amber glass		2	none	none			PCBs			
	500mL	Amber glass		2	none	none			TPH- DX	w/silica gel	cleanup)	
	500mL	Amber glass		2	none	none			Bis(2-ethy	l hexyl) phth	alate	
	40mL	VOA vial		3	none	нсі	<u> </u>	<u> </u>	Chlorinate	d Ethanes a	and Ethene	s (CEEs)
METHOI Sampling I Purging Ec Disposal o	<b>DS</b> Equipment and quipment: of Discharged	nd IDs: Dedicated Q I Water:	Dedicated ED Well Wiz Stored in 1	QED Well V ard Bladder ,000 galion	Vizard Bladder Pump temporary onsi	Pump and YS Decon Equ ite storage tan	uipment:k	17- Alconox, I	Distilled Wa	ter		
Observatio	ons/Commen	its:									· · · · ·	



0	eart	it e water				MW30	<u>8N-0</u>	8101	3		
ROUNI	WATER S	AMPLING R	ECORD			WELL NUME	BER: MW-	308N			Page: 1 of 1
roject Nai ate: eveloped	ne: SOUTHV () () () () () () () () () () () () () (		PROJECT -	Phase II GC	CWMP	Project Numb Starting Wate Casing Sticku	ber: 080064 er Level (ft <sup></sup> up (ft) <u>:</u> ft TOC):	4 TOC):	6.53 .29 .95		
creened I	nterval (ft. TC		12.5-17.5			Casing Diam	eter (inches	<u>الم</u>	2		
lter Pack	Interval (ft. T	OC)	10.0-21.5	.16							L
asing Vol asing vol	ume <u>11.</u> umes: 2"=0 2"=0	• <b>2</b> (ft Water)	xX  " = 0.65 gpf 4" = 2.46 Lpf	(Lpfv)(c 6" 6"	gpf) = <u>{</u> = 1.47 gpf = 5.56 Lpf	• (L)(gal)			Sample	e intake Depti	n (ft TOC): <u>~15 ft</u>
URGIN	G MEASU	REMENTS	···								
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance (uS/cm)	Dissolved Oxygen (mg/L)	pН	Eh ORF (mv	P (NTI	dity U)	Comments
645	/	6.4	6.53	/	(µ0/0/11)	(1.9)-/	/	/		' cleo	ir discharge
650	2	l	6.70	16.7	1.850	0.03	8.10	- 83.	7 29.	3 turbu	1 after YSI
1655	4		6.71	16.7	1,595	0.02	7.82	- 96.	4 23.	.8	
700	6		6.71	16.7	1,585	0.02	7.68	- 86.	5 22.	2	
705	8		6.72	16.7	1, 586	0.03	7.61	- 85	2 17.	9 turba	1 w/o YSI
710	10		6.73	16. 7	1,586	0.02	7.60	- 87	.3 16.	2 turbs	d ~/o YSI
715	12		6.75	16.8	1,586	0.02	2,59	- 80	9 12.	7 tuibid	wo YSI
											<u> </u>
	1										
otal Gallo	ons Purged:	3.15	2~	· · ·		Total Casing	J Volumes I	Remove	d: <u>-</u> 3-	.15 1.7	29
Inding W	ater Level (ft	TOC):	<u> </u>			Ending Tota	I Depth (ft	TOC): 17	7.95		
		DRY	1			D	0				Pomarka
lime	Volume	Bottle Type		Quantity	Flitration	Preservation	Color	Turbid Sedim	ity & nent		Renarks
1715	1L	HPDE		1	Inone	ниоз	slighty	no	Ve Total I	Metals - As, F	۰b
1	500mL	Amber glass		2	2 none	none	1000	1	cPAH	<u>s</u>	WARMON
	1L	Amber glass		2	2 none	none			PCBs		
	500mL	Amber glass		2	2 none	none		<b>\</b>	TPH-	DX (w/silica <u>c</u>	jel cleanup)
$\checkmark$	500mL	Amber glass			2 none	none		<u>↓</u> ↓	Bis(2-	<u>ethyl hexyl) p</u>	hthalate
			-								
METHO	DS	1	1		I		1				La L
Sampling	Equipment a	nd IDs:	Peristaltic	Pump and Y	<u>′SI 556 # 19</u> ′	۲ <b>۲</b>					
Purging E	quipment:	Peristaltic Pu	1mp w/ dedic	ated tubing		_ Decon Equ	uipment:	Alcon	ox, Distilled	Water	
Disposal	of Dischargeo	Water:	Stored in 1	,000 gallon	temporary onsi	ite storage tan	ik				
Observati	ons/Commer	nts:									



ROUND	WATER S	AMPLING R	ECORD			WELL NUME	BER: MW-3	308S		Page: 1 of 1				
roject Nan	ne: SOUTHV	EST HARBOR	PROJECT -	Phase II GC	WMP	Project Numl	oer: 080064	1						
ate:						Starting Wate	er Level (ft ]	гос): <u>6.</u>	30					
eveloped	by: <u>DFR/AT</u>					Casing Stick	up (ft) <u>:</u>	-0.61						
creened Ir	nterval (ft TC	 	35 0-40 0		<u>.</u>	Casing Diam	eter (inches	40.0	1 01 11 8 8 1 10 1					
ilter Pack	Interval (ft. T	0C)	31.0-40.0		[									
		(ft \A(otor)	× 61/	(1 pf.)/a	- 5.477									
asing volu asing volu	umes: 2"=0	16 opf	$ ^{x} = 0.65 \text{ mpf}$	(۲۵۹۲) 6" :	= 1 47 apf	(L)(gai)			Sample Int	ake Depth (ft TOC): ~ 37.5 ft				
	2" = ( 2" = (	. 10 gpr -	4" = 0.00 gp; 4" = 2.46 Lpf	6"	= 5.56 Lpf				oumpio me	and Bopin (in 100). <u></u>				
URGIN	G MEASUI	REMENTS				****								
Time	Cumul, Vol.	Purge Rate	Water	Temp.	Specific	Dissolved	рH	Eh	Turbidity	Comments				
	(gal or	(gpm or Lഗ്രീ)	Level (ft)	(C or F)	Conductance	Oxygen		ORP	(NTU)					
	-		<u> </u>		(µS/cm)	(mg/L)		(mv)						
600		0.9	6.30							clear discharge				
605	2		7,00	14.9	15,290	0.04	7.77	3.0	3.7	turbidity taken after				
1610	Ч	0.3	6.80	14.9	15,260	0.03	7.93	- 20.6	0.81	disch reduced too muc				
1615	4555	Jr	6.97	15.0	15,250	0.03	8.01	-43.0	1.81					
620	6.7	275	6.95	15.0	15,250	0.03	8.08	-57.9	1.79	disch reduced for with				
125	 	0.0.	610	16 0	15 2 30	0.03	810	- 56 9	141	with revoler, 100 min				
1.20	ð		0.10	19.0	17 2 10		0.10		0.10	Lal / Yes				
050	- 9	V	6.60	15.0	15,230	0.05	8.11	- 56.8	2.15	turbed w/o 151				
										-				
					-									
								<u> </u>						
otal Gallo	ns Purged:	2.36			_	Total Casing	Volumes F	Removed:	0.4	3				
			~											
Ending Wa	ter Level (ft	OC): <b>6.6</b>	د			Ending Tota	I Depth (ft T	OC): 40.5						
SAMPLE		RY												
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	n Appe	arance		Remarks				
						ļ	Color	Turbidity &						
11.74							slightly	Gedinient	T-1-1 Mata					
16 70	11L	HPDE	-	1	none	HNU3	<u> </u>	none		als - As, PD				
	500mL	Amber glass		2	none	none	<u>}_</u> {		cPAHs					
	1L	Amber glass		2	none	none		<b> </b>	PCBs					
	500mL	Amber glass		2	none	none			TPH- DX (	(w/silica gel cleanup)				
$\mathbf{V}$	500mL	Amber glass		2	none	none			Bis(2-ethy	l hexyl) phthalate				
METHO		J	1	I	I	1	1	1						
				<b>.</b>		า								
Sampling E	Equipment ar	nd IDs:	Peristaltic F	Pump and Y	SI 556 # 19	<u>†</u>								
Purging Ec	quipment:	Peristaltic Pu	mp w/ dedica	ated tubing		_ Decon Equ	ipment:	Alconox,	Distilled Wat	ter				
		<b>147</b> ( ).	<u>.</u>	000		o otorogo ton	10							
Disposal of	f Discharged	vvater:	Stored in 1	,000 gallon t	emporary onsit	e storage tan	ĸ							

 $(1-\delta_{i})_{i=1}^{k} = (1-\delta_{i})_{i=1}^{k} = (1-\delta_{i})_{i=1}^{k} \Phi_{i}(\phi_{i})_{i=1}^{k} = (0,1)_{i=1}^{k} \Phi_{i}(\phi_{i})$ 

Additional function         Intermediation         Page         of         Addition formation         Addition			ומוטוא או	יי כוכלוםו	cyucor								
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Assigned Number:	Turn-around	Requested:			Page:		of assessment				Analytical Res Analytical Che	sources, Incorporated emists and Consultants
Contract:	Client Company:	3	Phone: 206	180 93	4	Date:	312008	ce Present?				4611 South 13 Tukwila, WA 9	34th Place, Suite 100 98168
Triplet Nume:     Analysis Request     Analysis Request     Analysis Request     Model Comments       Kunset:     Hurchar     Froget     Runset:     Froget     Runset:     Froget     Runset:       Boble     Doug     Time     Matrix     Rower     Runset:     Runset: <t< td=""><td>It Contact:</td><td></td><td></td><td></td><td></td><td>No. ôf Coolers:</td><td>1:  -  -</td><td>cooler /5, e</td><td>1-10</td><td><math>\overline{\mathbf{A}}</math></td><td></td><td>206-695-6200</td><td>) 206-695-6201 (fax)</td></t<>	It Contact:					No. ôf Coolers:	1:  -  -	cooler /5, e	1-10	$\overline{\mathbf{A}}$		206-695-6200	) 206-695-6201 (fax)
March	it Project Name:	6					*	Analysi	s Requested				Notes/Comments
MPF1-5         DB1061:         Sample ID         Date         Time         Matrix         Res Rate Note State         State Note Note Note Note Note Note Note No	uthwest Harbor Prov	ect - Pr	ax 2	GWCA	₹ V	>1 51	7') 0'	~~	чин. Т Х (				
Sample ID         Date         Time         Mark         No common $\frac{2}{2} \otimes \frac{2}{3} \otimes \frac$	ut Project #: もしのんち	Samplers: DAvE	RUGH/	A.N.Y. TIN	a	(9) (90)	5 1 7'45 209/	80	オフゥ 10 + 3- H	20 d	T s	_,,	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Sample ID	Date	Time	Matrix	No. Containers	N +07 8 0100 N +07	337 98'5V 80109	>£28 >H Vd	9 TWN 192910 192910	7478 H = 9	୫୦୫ ୫୦୫		
AP 2 - 081013         I         Boo         I         X	47-1-081013	10/13/08	900	Watel	0	$\times$		$\times$	X	Х	X		
$ \begin{bmatrix} 165 - 681 0   2 \\ 105 - 681 0   3 \\ 105 - 681 0   3 \\ 113 0 \\ 113 0 \\ 113 0 \\ 113 0 \\ 113 0 \\ 112$	2 - 08 1013	9 0000-75	0000	Qioqua;	Prom	$\times$		×	×	, ×	X		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	105 - 081013	110000000000	1125	60#5-70-494464	2	$\times$		$\times$	$\times$	$\times$	$\times$		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	9210180-501	, vertoorersoorerse	1130	. Andreas and a second s	i Zanato	$\times$	<u>`</u>	$\times$	$\times$	$\times$	$\times$		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	210180-521	laskindaradir	5721	an a	12	$\times$		X	X	X	X		
$ \frac{125 - 681013}{3058 - 081013} = 162.0 + 4 \times 1 \times$	210120-519	adigaira.co.co.go	0211	antine the state of the state o	2	$\times$		$\langle - \rangle$	X	$\times$	X		
$ \frac{3685 - 681013}{305N - 631013}  V  1715  V  3  X  X  X  X  X  X  X  X  X$	125-081013	Salar San Salar	1520	geogliket notativ	J	. X		$\times$	. X	X	X		
$ \frac{36}{30} \times -03 \times 1613 \times 1715 \times 17$	2080 - 2802	ana	0291		6	X	•	X	X	X	X		
Interstations     Relinquished by     Relinquished by     Relinquished by       Pole we what CoMe     Isgnature)     Relinquished by     Relinquished by       Pole we what CoMe     Isgnature)     Signature)     Signature)       Pole we what CoMe     Isgnature)     Signature)     Signature)       Pole we what CoMe     Isgnature)     Isgnature)     Signature)       Pole we what CoMe     Isgnature)     Isgnature)     Isgnature)       Isgnature)     Isgnat	30.5N - 091013	Ż	512	~~>>	linera	$\times$		Х	$\times$	X	$\times$		
Interstyle     Relinquished by:     Relinquished by:     Relinquished by:       Pple     Relinquished by:     Received by:     Received by:       Pple     Reveal     Received by:     Received by:       Printed Name:     DR     DR     Reveal       Pate & Line:     Company:     Company:     Company:       Date & Time:     Date & Time:     Date & Time:     Date & Time:				<									
Printed Name: Pr	nents/Special Instructions	Relinquished by: (Signature)	10	210	Received by (Signature)		Ì	Relinquist (Signature	ied by:			Received by: (Signature)	
L&L&L&L&Company: Company: Company: Company: Company: Company: Date & Time: Date & T	ppiemental COR	Printed Name:		-164	Printed Name:	Mear	2	Printed N	ame:			Printed Name:	- 
Date & Time:         Date & Time:         Date & Time:         Date & Time:           10/13/10         1         8         1         0         1	L 6 6 9 5	Compañy	L +	LC.	Company:			Company			-	Company:	
		Date & Time: ・ いいしょろう/ //	α	8	Date & Time: / ◯ // ິ /	2	12020	Date & Tir	ne:			Date & Time:	

Lutters of Labury: And with period an equession services in accordance with appropriate memously formously and statigation operating modelanes and the Ant Quality Assurance mogram. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or considered. signed agreement between ARI and the Client. Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

All Clear Correction All Clear Construction All Clear Construction All Clear Construction All Clear Construction All Clear Construction Clear Clear Clea	ARI Assigned Number:	Turn-around	Requested:			Page:	of	etteration		V	C	Analytical Resources, Incorpo
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	ARI Client Company:	2	Phone:			Date:		6				4611 South 134th Place, Suite
Officient         Construction         Construction<	Aspect Consulting	777	20	6.780.	9370	10/14	108 4	esent?		<b>7</b>		Tukwila, WA 98168
Other Project Annual Project Project Project Annual Project Proje	Client Contact:					No. of Coolers:	а ЧС (	oler mps:				206-695-6200 206-695-6201
Sample ID         Date         Time         Matrix         Luch         Association	Client Project Name:						N:	Analysis	Requested			Notes/Comments
Other Project         Barrobest         Samplest         Color Project         Samplest           C/D50564         Date         Time         Matrix         No. Consumer         #2420 fc. 1 + 0. 2 fc.	Southwest Harbor Pro	1207 -	Phase.	2 GW	CMD	51	50	W	dn2   1			
Sample IDDateTimeMatrixRo contained $\frac{2}{29} \lesssim \frac{2}{7} \lesssim \frac{2}{9} \lesssim \frac{1}{10} \lesssim \frac{1}{60} \lesssim \frac{2}{60} \approx 2$	Client Project #: C 8 6 0 6 4	Samplers: DA v । D	RUGH	AMY	The	47) (9d 209, 1471	51 17'4' 299/	ris/5 \$} 9	clean + 01 []	70- D	28 Z8	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Sample ID	Date	Time	Matrix	No. Containers	N 401 180109 180109 180109	(v20) 5'42'50 80109	0F18 1A9 0F18	nsilis/m Issaid Hatwn	E 28 1138	'08 '7d	
IMP4 - GSIGIU $I145$ $I45$ $I<$ $X$ <td>MP3-081014</td> <td>tolulos</td> <td>845</td> <td>water</td> <td>guess</td> <td><math>\times</math></td> <td></td> <td><math>\times</math></td> <td><math>\times</math></td> <td>X</td> <td>X</td> <td></td>	MP3-081014	tolulos	845	water	guess	$\times$		$\times$	$\times$	X	X	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	N P4- NBINIC	ese estatuta	2 7 7	and the second	v	$\times$		×	$\times$	X	X	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	MMD C. C. OSINICI	o escuencia	555		5			$\sim$	$\times$	Ń	$\times$	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	MUTLE - GRIDIN	p anto Goldenstope	020	er febrechterfor	a a a a a a a a a a a a a a a a a a a				$\times$	$\times$	$\times$	
TMP15 - 081014 $1225$ $16$ $X$	MW144- 281014	t szintratok		é atra-qui fiscato	<b>C</b>			$\times$	×	X	X	
MW 36 - 081014     V     1325     V     10     X<	r worz - 28 MU	1	12	i Disagolio.cg. s	<		~	$\times$	. ×	X	ľ	.1
Comments/Special Instructions     Relinquished by     Relinquished by     Relinquished by       Comments/Special Instructions     Relinquished by     Relinquished by     Relinquished by       Supple we what I Code     Printed Name:     Relinquished by     Relinquished by       Supple we what I Code     Printed Name:     Relinquished by     Relinquished by       Supple we what I Code     Printed Name:     Relinquished by     Relinquished by       Supple we what I Code     Printed Name:     Relinquished by     Relinquished by       Supple we what I Code     Printed Name:     Relinquished by     Relinquished by       Supple we what I Code     Printed Name:     Relinquished by     Relinquished by       Supple we what I Code     Printed Name:     Relinquished by     Relinquished by       Supple we what I Code     Relinquished by     Relinquished by     Relinquished by       Supple we what I Code     Reling     Reling     Relinquished by     Reling       Supple we what I Code     Reling     Reling     Reling     Reling     Reling       Supple we what I Code     Reling     Reling     Reling     Reling     Reling       Supple we what I Code     Reling     Reling     Reling     Reling     Reling       Suplate we me     Reling     Reling     R	WW 26- 091014		- 22 -		0			$\times$	· ×	$\times$	X	
Comments/Special Instructions     Relinquished by:       Supple we what I Code     Relinquished by:       Date & Time:     Relinquished by:       Supple we what I Code     Relinquished by:       Date & Time:     Relinquished by:       Supple we what I Code     Relinquished by:       Reline in the Reline     Reline in the Reline									*			
Comments/Special Instructions     Relinquished by:       Relinquished by:     Relinquished by:       Comments/Special Instructions     Relinquished by:       Supple we with Lode     Received by:       Supple we with Lode     Relinquished by:       Supple we with Lode     Relinquished by:       Printed Name:     Relinquished by:       Supple we with Lode     Received by:       Date & Time:     Relinquished by:       Supple we with Lode     Relinquished by:       Date & Time:     Relinquished by:       Supple we with Lode     Relinquished by:       Relinquished by:     Relinquished by:												
Comments/Special Instructions     Relinquished by     Received by:       Supple we what     Comments/Special Instructions     Relinquished by       Supple we what     Company:     (Signature)       Supple we what     Company:     (Signature)       Supple we what     Company:     (Signature)       Date & Time:     Date & Time:     Company:				<								
Supplementation Collection (Signature) (Si	Comments/Special Instructions	Relinquished by:	4		Received by:			Relinquishe	d by:			Received by:
S_LBI695 Company: ASDECTLC Date & Time: Date & Time:	Supplemental Code	(Signature) Printed Name:	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	JAV P	(Signature)			(Signature) Printed Nar	ne:			(Signature) Printed Name:
S_LBI695 Company: Assect LLC NR Date & Time: Date & Time:	~ (	Д 4 U	2	16H	JAN A	NN NN	W WY VU	~				
Date & Time:           10/14/5         1430         1430         1430         1430         1430	S-LB1695	Company:			Cómpány:	*	i i i i i	Company:				Company:
		Date & Time:	8	130	Date & Time:	71 8	130	Date & Tim	ö			Date & Time:

- Apple

on salations

meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.



#### CMP1-090331

							_				
GROUN	DWATER	SAMPLING F	RECORD			WELL NUN	BER: CM	P# 1			Page: 1 of 1
Project Na	ame: SOUTH	WEST HARBOR	R PROJECT	- Phase II (	GCWMP	Project Nur	nber: 0800	64			
Date:	3/31/2	004	-			Starting Wa	ater Level (f	t TOC): 12			
Develope	d by: <u>DFR/AT</u>			-		Casing Stic	kup (ft):	-0.29			
Measuring	g Point of we	1 <u> </u>	70170			Total Depth	(ft TOC <u>):</u>		16.85	<u> </u>	
Screeneu Filter Pac	k Interval (it. i	UC <u>/</u>	<u>7.0-17.0</u> 5.0-19.0			Casing Diat	meter (inchi	≝		<u> </u>	
Coping W	shumo G	64 (ft Minto	w pil	n /Int⊮	A	1 /1 // 0.0	n				
Casing ve	Jumes: 2" =	0 16 opf	//x <u> </u>	<u>د (</u> دلواند) الم	)(gpi) = <u>0 ⊌0</u> " = 1.47 anf	1(L)(ga	u)		Sample Int	ako Donth (	(8 TOC):12 8
Casing ve	2" =	0.62 Lpf	4" = 2.46 Lp	of 6	6" = 5.56 Lpf				Sample Int	ake Deptin	(it 100). ~12 it
PURGIN	IG MEASU	REMENTS	<u> </u>								· · ··································
Time	Cumul. Vol.	Purge Rate	Water	Temp.	Specific	Dissolved	рН	Eh	Turbidity	T	Comments
	(gal or L)	(gpm or Loົງງາ)	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)		ORP (mv)	(NTU)		
915	/	0.4	1	/			/	/	/	cleur	discharge
920	2		12.26	12.7	566	0.48	6.63	144,5	4.65	tubid	after YSI
925	4	12.273	12AT	12.7	537	0.37	6.53	239.5	4,80		
930	6		12.27	12.7	521	6.32	6.26	278.4	1.70		
435	8		12.27	12.7	513	0.27	6.04	266.5	1,02		
940	10		12,25	12.7	511	0.27	6.20	244.6	0.81		
945	12		1775	17 7	506	0 19	6 7.2	2206	1.12	tuchil	hilmen VS
			- Cal Del		200			10-103.C	1 61 1	1. 0104	parcy e toi
					· ·						
								- <u> </u>			
					· · · · ·				·		
							<u> </u>	. <u> </u>			
							·				
								<u> </u>			
Total Gall	ons Purged:	3.	15			Total Casing	) Volumes F	Removed:	3.88		
Ending W	ater Level (ft <sup>-</sup>	TOC): 12,	25			Ending Tota	l Depth (ft T	OC): 45	16,85		
SAMPL		DRY									
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Ren	narks
				-			Color	Turbidity &			
y							3	Sediment			
147	1 <u>L</u>	HPDE		1	none	HNO3	elen v	nove	Total Metals	s - As, Pb_	
┣─┤──	500mL	Amber glass		2	none	none			cPAHs		
	1L	Amber glass		2	none	none	<b>└ \</b>	<b> </b>	PCBs		
	500mL	Amber glass		2	none	none			TPH- DX		
<u> </u>	500mL	Amber glass		2	none	none			Bis(2-ethyl I	hexyl) phtha	late
							-		· · · · -		
METHO	DS										
Sampling	Equipment ar	nd IDs:	Peristaltic P	ump and YS	SI 556 # 4	<u>}-</u>			<u> </u>		
Purging E	quipment:	Peristaltic Pur	np w/ dedica	ted tubing		Decon Equ	ipment:	Alconox, Di	stilled Wate	r	
Disposal o	f Discharged	Water:	Stored in 1,0	000 gallon t	emporary onsite	e <u>storage tan</u>	k				
Observatio	ons/Comment	s:									
3223, raik			· •			· · · · ·					

<u> </u>				-C-AA-P	<u> </u>	33104	<u> </u>	MP Z'	09	033	<u> </u>
GROUN	DWATER		ECORD		-	WELL NUM	BER: CM	₽ <b>₽</b> 2_		Р	age: 1 of 1
Project Na	me: SOUTH	WEST HARBOR	R PROJEČŤ	- Phase II (	GCWMP	Project Num	iber: 08006	64			
ate:	<u>3/3//</u>	2009	-			Starting Wa	ter Level (ft	TOC <u>):</u>	2.92	=	
eveloped leasuring	Dy: <u>DFR/A1</u> Point of We	TOC				Casing Stick	(up (tt <u>):</u> (ft TOC):	-0.29	17	2	
creened	Interval (ft. T	OC)	7.0-17.0		·	Casing Dian	neter (inche	: 2	<u>_</u>		
ilter Pack	Interval (ft.	тос)	5.0-19.0				•				
asing Vol	lume <u>4,3</u>	<u>8</u> (ft Wate	r) x <u>0.16</u>	(Lpfv)	(gpf) =	10(L)(gal	}				
asing vol	umes: 2" =	0,16 gpf.	4" = 0.65 gp	f 6	" = 1.47 gpf				Sample Inte	ake Depth (ft	: TOC): ~12 ft
	2" =	0.62 Lpf	4" = 2.46 Lp	f 6	" = 5.56 Lpf						
URGIN	G MEASU	REMENTS		<del></del>	<u>,                                     </u>			<b>1</b> =-			-
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or (pm))	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	Turbidity (NTU)		Comments
815	/	0.4	/	/		/	1	/	/	Clear	discharge
320	2	i.	12,95	14.3	1650	0.52	9.20	148.5	4.09	turbid	after YSI
325	4		12.96	14,4	1550	0.40	4.29	132.7	1.96	1	
330	6		12.96	14.5	1487	036	9,31	156.2	1.90		
335	3		17.96	14.6	1447	0.22	976	120.7	1. 87		<u></u>
1840	10		17.96	14.6	1415	0.29	9.04	1244	1 7 7		
6 UC	17		12 41	14.1	1407	0.26	4 08	1744	1,00	الم الم	LOKE
							, ,,				
otal Gallo	ns Purged:	<u> </u>	<u>5</u>		_	Total Casing	Volumes F	Removed:	415	-  >	
nding Wa	iter Level (tt	10C): <u>12.</u>	19			Ending Total	Depth (ft T	OC): 16:85		>	
				<u> </u>							
Ime	volume	воше туре		Quantity	Filtration	Preservation	Appe: Color	arance Turbidity & Sediment		Rem	arks
345	1L	HPDE	,	1	none	HNO3	Clear	none	Total Metal	s - As, Pb	
1	500mL.	Amber glass		2	none	none	1.		cPAHs		
	1L	Amber glass		2	none	none			PCBs		
	500mL	Amber glass		2	none	none			TPH- DX		
$\checkmark$	500mL	Amber glass		2	none	none	1	$\vee$	Bis(2-ethvl	hexyl) phthal	ate
1		¥									
ETUO											
		1.100	/	-		,					
ampling E	quipment an	id IDs:	Peristaltic P	ump and Y	SI 556 # 19 -						
urging Eq	uipment:	Peristaltic Pu	np w/ dedica	ted tubing		Decon Equi	ipment:	Alconox, Di	stilled Wate	H	
sposal of	Discharged	Water:	Stored in 1,0	000 gallon t	emporary onsit	e storage tan	k				
servatio	ns/Comment	·c-									
200110100	15/001111011										

and a second second

•

٠

· ·



Direction         Direction <thdirection< th="">         Direction         <thdirection< th="">         Direction         <thdirection< th=""> <thdirection< th=""> <thdir< th=""><th>GROUNI</th><th>DWATER</th><th>SAMPLING I</th><th>RECORD</th><th></th><th></th><th>WELL NUN</th><th>IBER: CM</th><th>P-3</th><th></th><th>Page: 1 of 1</th></thdir<></thdirection<></thdirection<></thdirection<></thdirection<>	GROUNI	DWATER	SAMPLING I	RECORD			WELL NUN	IBER: CM	P-3		Page: 1 of 1
Date: $\frac{1}{1/1} \frac{12007}{1000}$ Developed by DFRAT       Stanting Water Level (H TOC):       7, 4 0         Measuring Point of Wel       TOC       6.0-16.0         Stanting Water Level (H TOC):       15.84         Casing Stokue, If:       1.94         Zasing Stokue, If:       1.94         Casing Stokue, If:       1.94         PURGING MEASUREMENTS       Trend, Spacellic         Time       Caruel, Vol.       1.94         Stokue, If:       1.94         Stokue, If:       1.94         Stokue, If:       1.94         Stokue, If:       1.94         Time       Caruel, Vol.         (and C)       Caruer Alter         Stokue, If:       1.94         Stokue, If: </th <th>Project Na</th> <th>me: SOUTH</th> <th>WEST HARBO</th> <th>R PROJECT</th> <th>- Phase II</th> <th>GCWMP</th> <th>Project Nun</th> <th>nber: 0800</th> <th> 34</th> <th></th> <th></th>	Project Na	me: SOUTH	WEST HARBO	R PROJECT	- Phase II	GCWMP	Project Nun	nber: 0800	 34		
Developed by <u>DFRAT</u> Casing Stokup (ft):         0.37           Screened Interval (ft: TOC):         6.0-16.0         Casing Damater (Inche	Date:	4/1/	2007	_			Starting Wa	iter Level (f	TOC):	7,90	
Measuring Noticit Weil         TOC         15.84           Secretal Interval (ft. TOC)         6.0-16.0         Casing Dameter (inche         2           Ellier Peak Interval (ft. TOC)         4.0-17.5         Casing Dameter (inche         2           Casing Volume 7.11         1.12         Casing Dameter (inche         2         2           Casing Volume 7.11         4.0-17.5         Casing Dameter (inche         2         2           Casing Volume 7.12         1.12         Casing Dameter (inche         2         2           Casing Volume 7.12         4.0-16.0         0.16.0         1.12         Casing Dameter (inche         2           PURCING MEASUREMENTS         Team (iffic (iffic C))         Comments         Orgen         Orgen         Orgen         0.15         1.12         0.13         1.81,5         6.19         Junch 4.84/2 X/S           8 \Left 2.15         1         7.19         1.3.3         7.18         0.33         10.13         1.81,5         6.19         Junch 4.84/2 X/S           8 \S_D         5, 10         1.14,10         0.25,6         7.3         1.01,0         3.3.7         1.40         1.5,0         1.12,1         1.12,0         1.2,1         1.12,0         1.1,0         1.1,2         1.1,1 <td< td=""><td>Developed</td><td>by: DFR/AT</td><td>-</td><td></td><td></td><td></td><td>Casing Stic</td><td>kup (ft<u>):</u></td><td>-0.37</td><td>·</td><td></td></td<>	Developed	by: DFR/AT	-				Casing Stic	kup (ft <u>):</u>	-0.37	·	
Schere During Mitter Mit 1: 10:	Measuring	Point of We		6.0.40.0			Total Depth	(ft TOC <u>):</u>	15.84	<u> </u>	<u> </u>
Total and ref. Vol.       Total Sector       Total Casing Volume : Total Graph Af = 0.65 gpt       Implementation of the sector in the secto	Screened I Filter Pack	Interval (II. 1		<u>4 0-17 5</u>			Casing Diar	neter (inche	<u> </u>		
Classing Volumes         2* - 0.18 gpt         4* - 0.5 gpt         6* - 1.7 gpt         Classing Volumes         2* - 0.18 gpt         4* - 0.24 gpt         6* - 1.7 gpt         Sample Intake Depth (ft TOC): -11 ft           2* - 0.8 gpt         4* - 0.24 gpt         6* - 1.7 gpt         6* - 1.7 gpt         Sample Intake Depth (ft TOC): -11 ft           2* - 0.8 gpt         4* - 2.44 lpt         6* - 5.58 Lpt         Provide Intervention         Control Intervention         Contro		-7 G	100, <u> </u>	<u>4.0-17.0</u>	1		<b>a</b>				
Cashing Volumes         2 = 0.62 [pt]         4 = 0.46 [pt]         Sample intake Leph (tf. 100): -11 ff           PURCING MEASUREMENTS         Time         Control         Specific         Dissolved         pH         Eh         Turbidity         Comments           Time         Control         Specific         Dissolved         pH         Eh         Turbidity         Comments           8 H0         -         0, 5         -	Casing Vol	ume <u>/ /  </u>	(ft Wate	(") X () () () () () () () () () () () () ()	الم (Lpfv	)(gpf) = <u>  /</u> _	(L)(ga	I)		<b>.</b>	
PURCING MEASUREMENTS           Time         Count Vol.         Furper Rest.         Tempore         Origin or Light         Water         Tempore         Origin or Light         Countrients           8 H0         0.5         7         0         7         0         0.13         1.81/5         6.99         Jourday         Aurybud		<u>2" =</u>	0.62 Lpf	4" = 0.65 gp 4" = 2.46 Lp	i 6	6 = 1.47 gpt 6" = 5.56 Lpf				Sample Int	ake Depth (ft TOC): ~11 ft
Time       Currul, Vol.   tegro ar Ligon       Water       Temp.       Specific       Dissolved       PH       En       En       Currul, NUL       Comments         8 +10       /       0, 5       /	PURGIN	G MEASU	REMENTS								
8 H0       /       0, 5       / </td <td>Time</td> <td>Cumul. Vol. (gal or L)</td> <td>. Purge Rate (gpm or Lom)</td> <td>Water Level (ft)</td> <td>Temp. (C or F)</td> <td>Specific Conductance (µS/cm)</td> <td>Dissolved Oxygen (mg/L)</td> <td>рН</td> <td>Eh ORP (mv)</td> <td>Turbidity (NTU)</td> <td>Comments</td>	Time	Cumul. Vol. (gal or L)	. Purge Rate (gpm or Lom)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	Turbidity (NTU)	Comments
8 4 5       2 15       1       7.90       13.3       7.18       0,38       10.13       181,5       6.80       Jurch all all all all all all all all all al	870	/	0,5	/							char discharge
8 50       5.0       7.40       12.1       715       0.32       4.75       185.8       4.74         8 5.5       7.5       3.40       13.1       119       0.25       9.33       2.01.0       3.37         4 00       16.0       3.40       13.1       119       0.25       9.33       2.01.0       3.37         4 00       16.0       3.40       13.1       149       0.25       9.33       2.01.0       3.37         4 00       17.4       7.90       12.9       72.3       0.224       8.67       2.11.0       1.78         905       12.4       7.90       12.9       72.3       0.224       8.68       2.01.3       1.30       446       4.51         910       15.0       7.90       12.9       72.3       0.244       8.68       2.01.3       1.30       446       4.51         910       15.0       12.9       72.6       0.26       8.68       2.01.3       1.30       446       4.51         910       15.9       12.9       72.9       Total Casing Volumes Removed:       3.10       3.10         910       10.01       12.9       12.9       Total Casing Volumes Removed: <td< td=""><td>845</td><td>2.5</td><td>1</td><td>7.90</td><td>13.3</td><td>718</td><td>0,38</td><td>10.12</td><td>181,5</td><td>6.80</td><td>Luchd a How Yal</td></td<>	845	2.5	1	7.90	13.3	718	0,38	10.12	181,5	6.80	Luchd a How Yal
B S S T T S       T T S       T T S       T T S       T S <td>850</td> <td>5,0</td> <td></td> <td>7.40</td> <td>13.1</td> <td>715</td> <td>0.37</td> <td>9.70</td> <td>1850</td> <td>4,24</td> <td>1 1 1 1 1 1 1 1</td>	850	5,0		7.40	13.1	715	0.37	9.70	1850	4,24	1 1 1 1 1 1 1 1
0.0       1	056	7.5		7.90	12 1	1716	0.24	9.22	2010	3 2 1	<mark>├───</mark>
105       12.5       1.10       1.18       1.18       1.18         106       12.5       7.10       12.9       723       0.24       8.67       2.11.0       1.18       4         101       15.0       7.10       12.9       723       0.24       8.67       2.11.0       1.18       4         101       15.0       7.10       12.9       726       0.26       8.68       2.01.3       1.30       h, ibud w/o       ¥51         101       15.0       7.10       12.9       726       0.26       8.68       2.01.3       1.38       h, ibud w/o       ¥51         101       15.0       7.10       12.9       726       0.26       8.68       2.01.3       1.38       h, ibud w/o       ¥51         11       12.9       729       726       12.6       8.168       7.0       1.18       1.11	<u> </u>	16.0		2 60	121	210	0.26	4 61	1911 1	2124	
703       17.1       17.10       12.1       72.5       07.25       8.64       211.0       17.48       4         9110       15.0       71.90       12.9       72.6       0.26       8.68       2.01.3       1.30       1.48.44       4       55         9110       15.0       71.90       12.9       72.6       0.26       8.68       2.01.3       1.30       1.48.44       4       55         9110       15.0       71.90       12.9       72.6       0.26       8.68       2.01.3       1.30       1.48.44       4       4       55         9110       15.0       91.4       91.6 <td< td=""><td>900</td><td>10.0</td><td><u>} - </u>{·</td><td>1 90</td><td>101</td><td>717</td><td>0.20</td><td>0.17</td><td>010</td><td>6.1</td><td></td></td<>	900	10.0	<u>} - </u> {·	1 90	101	717	0.20	0.17	010	6.1	
910       15.0       V       1/90       12.9       17.6       0,26       0,18       7.9,13       7.50       hp / but w/p ×51         Image: State of the stat	<u> 705</u>	15			121	725	0.2.1	8.07	211.0	1-18	<u> </u>
Image: Source in the second	-(10	· >、()			12.9	776	0:26	8,68	2015	1.50	tuibid w/o XSI
Image: Solution of the second seco		•									
Image: State of the state											<u> </u>
Image: State of the state											
Total Gallons Purged:       3.94       Total Casing Volumes Removed:       3.10         Total Gallons Purged:       3.94       Total Casing Volumes Removed:       3.10         Ending Water Level (It TOC):       12.9       Ending Total Depth (ft TOC): 15.84         SAMPLE INVENTORY       Quantity       Filtration       Preservation       Appearance       Remarks         11       HPDE       1 none       HNO3       Lear       volume       Total Metals - As, Pb         600mL       Amber glass       2 none       none       CPAHs       Total Metals - As, Pb         11       Amber glass       2 none       none       PCBs         500mL       Amber glass       2 none       none       PCBs         500mL       Amber glass       2 none       none       Bis(2-ethyl hexyl) phthalate         10       I       Peristaltic Pump and YSI 566 #       Purging Equipment:       Peristaltic Pump and YSI 566 #											
Image: Store of Discharged Water:       3.14       Image: Store of Discharged Water:       3.10         Fotal Gallons Purged:       3.14       Total Casing Volumes Removed:       3.10         Fotal Gallons Purged:       12.9       Ending Total Depth (ft TOC): 15.84         SAMPLE INVENTORY       Image: State of Discharged Water:       Quantity       Filtration       Preservation       Appearance       Remarks         10       11       HPDE       1 none       HNO3       Appearance       Remarks         110       11       HPDE       1 none       None       Image: State of Discharged Water:       Total Metals - As, Pb         110       11       Amber glass       2 none       none       Image: CPAHs         111       Amber glass       2 none       none       PCBs         111       Amber glass       2 none       none       PCBs         111       Amber glass       2 none       none       PCBs         112       Amber glass       2 none       none       PCBs         113       Amber glass       2 none       none       PCBs         114       Amber glass       2 none       none       PCBs         115       Amber glass       2 none       none								-			<u> </u>
Total Gallons Purged:       3.94       Total Casing Volumes Removed:       3.10         Ending Water Level (ft TOC):       12.9       Ending Total Depth (ft TOC): 15.84         SAMPLE INVENTORY       Time       Volume       Bottle Type       Quantity       Filtration       Preservation       Appearance       Remarks         10       11       HPDE       1       none       HNO3       elsear       v.o.vd.       Total Metals - As, Pb         1       500mL       Amber glass       2       none       none       1       cPAHs         11       Amber glass       2       none       none       PCBs         500mL       Amber glass       2       none       none       PCBs         Sampling Equipment and IDs:       Peristaltic Pump and YSI 566 #       Purging					,						
Total Casing Volumes Removed: 3.10         Total Gallons Purged:       3.94       Total Casing Volumes Removed:       3.10         Ending Water Level (ft TOC):       12.9       Ending Total Depth (ft TOC): 15.84         SAMPLE INVENTORY         Time       Volume       Bottle Type       Quantity       Filtration       Preservation       Appearance       Remarks         4 L0       1L       HPDE       1 none       HNO3       elsear       viewet       Total Metals - As, Pb         500mL       Amber glass       2 none       none       PCBs       Total Casing Volumes       Total Metals - As, Pb         11       Amber glass       2 none       none       PCBs       Total Metals - As, Pb         500mL       Amber glass       2 none       none       PCBs       TOtal Casing Volumes       TOtal Metals - As, Pb         500mL       Amber glass       2 none       none       PCBs       TOtal Casing Volumes       TOtal Metals - As, Pb         500mL       Amber glass       2 none       none       PCBs       TOtal Metals - As, Pb       Bis(2-ethyl Mexyl) phthalate         500mL       Amber glass       2 none       none       PCBs       PCBs       Parging Equipment and IDs:       Peristaltic Pump and YSI 556 #<		· · · · · ·				·					<u> </u>
Ending Water Level (ft TOC):12.9         Ending Total Depth (ft TOC): 15.84         SAMPLE INVENTORY         Time       Volume       Bottle Type       Quantity       Filtration       Preservation       Appearance       Remarks         10       1L       HPDE       1 none       HNO3       clear       varet       Total Metals - As, Pb         10       1L       HPDE       1 none       none       1       cPAHs         11L       Amber glass       2 none       none       PCBs         500mL       Amber glass       2 none       none       PCBs         Sampling Equipment and IDs:	Total Gallor	ns Purged:	3.44	ļ i			Total Casing	Volumes F	Removed:	3.10	
Energy rout Depin (11 DE), rout         SAMPLE INVENTORY         Time       Volume       Bottle Type       Quantity       Filtration       Preservation       Appearance       Remarks         410       1L       HPDE       1 none       HNO3       ellew/       volume       Total Metals - As, Pb         500mL       Amber glass       2 none       none       1       cPAHs         11       Amber glass       2 none       none       PCBs         500mL       Amber glass       2 none       none       PCBs         METHODS       Sampling Equipment and IDs:       Peristaltic Pump and YSI 556 #         Purging Equipment:       Peristaltic Pump w/ dedicated tubing       Decon Equipment:       Alconox, Distilled Water         Disposal of Discharged Water:	Ending Wat	ter Level (ft '	TOC):	12.9		_	Ending Total	Denth (ft T	OC): 15.84		
Time       Volume       Bottle Type       Quantity       Filtration       Preservation       Appearance       Remarks         410       1L       HPDE       1       none       HNO3       eleer       volue       Total Metals - As, Pb         500mL       Amber glass       2       none       none       1       cPAHs         1L       Amber glass       2       none       none       PCBs         500mL       Amber glass       2       none       none       PCBs         METHODS       Peristaltic Pump and YSI 556 #       Purging Equipment:       Alconox, Distilled Water         Disposal of Discharged Water:       Stored in 1,000 gation temporary onsite storage tank       St											
Mile       Volume       Data Hype       Coloritie       Appendice       Remarks         410       1L       HPDE       1       none       HNO3       elener       volue       Total Metals - As, Pb         500mL       Amber glass       2       none       none       1       cPAHs         1L       Amber glass       2       none       none       PCBs         500mL       Amber glass       2       none       none       PCBs         METHOPS       Sampling Equipment and IDs:       Peristaltic Pump and YSI 566 #       Purging Equipment:       Alconox, Distilled Water         Disposal of Discharged Water:       Stored in 1,000 gallon temporary onsite storage tank       Storage tank		Volume	Bottle Type		Quantity	Filtration	Procervation				
4 10       1L       HPDE       1       none       HNO3       elser       were       Total Metals - As, Pb         500mL       Amber glass       2       none       none       1       cPAHs         1L       Amber glass       2       none       none       PCBs         500mL       Amber glass       2       none       none       PCBs         SomL       Amber glass       2       none       none       PBis(2-ethyl hexyl) phthalate         9       9       9       9       9       9       9       9         METHODS       Peristaltic Pump and YSI 556 #       Purging Equipment:       Peristaltic Pump widedicated tubing       Decon Equipment:       Alconox, Distilled Water         Disposal of Discharged Water:	Time				Guantity	- Intration	rieservation	Color	Turbidity & Sediment		Remarks
500mL       Amber glass       2 none       none       cPAHs         1L       Amber glass       2 none       none       PCBs         500mL       Amber glass       2 none       none       PCBs         500mL       Amber glass       2 none       none       TPH- DX (w/silica gel cleanup)         500mL       Amber glass       2 none       none       Bis(2-ethyl hexyl) phthalate         500mL       Amber glass       2 none       none       Bis(2-ethyl hexyl) phthalate         500mL       Amber glass       2 none       none       Bis(2-ethyl hexyl) phthalate         METHODS       Sampling Equipment and IDs:       Peristaltic Pump and YSI 556 #       Purging Equipment:       Alconox, Distilled Water         Disposal of Discharged Water:       Stored in 1,000 gallon temporary onsite storage tank       Storage tank       Storage tank	910	1L	HPDE		1	none	HNO3	clear	none	Total Metals	<u>a -</u> As, <u>Pb</u>
1L       Amber glass       2 none       none       PCBs         500mL       Amber glass       2 none       none       TPH- DX (w/silica gel cleanup)         500mL       Amber glass       2 none       none       Bis(2-ethyl hexyl) phthalate         500mL       Amber glass       2 none       none       Image: state st		500mL	Amber glass		2	none	none	1	1	cPAHs	
500mL       Amber glass       2 none       none       TPH- DX (w/silica gel cleanup)         500mL       Amber glass       2 none       none       Bis(2-ethyl hexyl) phthalate         600mL       Amber glass       2 none       none       Bis(2-ethyl hexyl) phthalate         METHODS       Sampling Equipment and IDs:       Peristaltic Pump and YSI 556 #       Purging Equipment:       Peristaltic Pump w/ dedicated tubing         Decon Equipment:       Peristaltic Pump w/ dedicated tubing       Decon Equipment:       Alconox, Distilled Water         Disposal of Discharged Water:       Stored in 1,000 gallon temporary onsite storage tank       Storage tank		1L	Amber glass		2	none	none			PCBs	
SoomL       Amber glass       2 none       none       Bis(2-ethyl hexyl) phthalate         METHODS       Bampling Equipment and IDs:       Peristaltic Pump and YSI 556 #         Purging Equipment:       Peristaltic Pump w/ dedicated tubing       Decon Equipment:       Alconox, Distilled Water         Disposal of Discharged Water:       Stored in 1,000 gallon temporary onsite storage tank       Storage tank			Amber alass			none	none	1		 TPH_ DY /···	
Index grass       2 more       more       Mercence         METHODS       Mercence       Mercence       Mercence         Sampling Equipment and IDs:       Peristaltic Pump and YSI 556 #       Peristaltic Pump w/ dedicated tubing       Decon Equipment:       Alconox, Distilled Water         Disposal of Discharged Water:       Stored in 1,000 gallon temporary onsite storage tank       Storage tank       Stored in 1,000 gallon temporary onsite storage tank		500ml	Amber close		^ ^	Dano		$\downarrow$			
METHODS Sampling Equipment and IDs:Peristaltic Pump and YSI 556 # Purging Equipment: Peristaltic Pump w/ dedicated tubing Decon Equipment:Alconox, Distilled Water Disposal of Discharged Water:Stored in 1,000 gallon temporary onsite storage tank			Amber glass		2	none			·· `-	BIS(2-etnyi r	nexyl) phthalate
METHODS         Sampling Equipment and IDs:       Peristaltic Pump and YSI 556 #         Purging Equipment:       Peristaltic Pump w/ dedicated tubing         Decon Equipment:       Alconox, Distilled Water         Disposal of Discharged Water:       Stored in 1,000 gallon temporary onsite storage tank			· · ·								
Sampling Equipment and IDs: Peristaltic Pump and YSI 556 # Purging Equipment: Peristaltic Pump w/ dedicated tubing Decon Equipment: Alconox, Distilled Water Disposal of Discharged Water: Stored in 1,000 gallon temporary onsite storage tank	METHOD	)S			<u>.</u>				•		
Purging Equipment: Peristaltic Pump w/ dedicated tubing Decon Equipment: Alconox, Distilled Water Disposal of Discharged Water: Stored in 1,000 gallon temporary onsite storage tank	Sampling E	quipment an	id IDs:	Peristaltic P	ump and Y	SI 556 #					
Disposal of Discharged Water: Stored in 1,000 gallon temporary onsite storage tank	Purgina Eau	uipment:	Peristaltic Pu	mp w/ dedica	ted tubino		Decon Equi	pment:	Alconox. Di	stilled Water	
	Disposal of	Discharged	Water:	Stored in 1 (	00 gallon f	emporary onsife	e storane tan	· · · · · · · · · · · · · · · · · · ·			
		Somergen			24 gallon (	aniporary origite	Solorago (alif	<u>`</u>			<u> </u>



•		th Pwater		CMP	4-090	5402				
GROUN	DWATER	SAMPLING F	ECORD			WELL NUM	BER: CM	P-4		Page: 1 of 1
Project Na Date: Developed Measuring Screened	ime: SOUTH <u> 6빅 / 62 /</u> I by: <u>DFR/AT</u> I Point of We Interval (ft. T	WEST HARBOF 2.00 4 - H <u>TOC</u> OC)	7.0-17.0	- Phase II C	GCWMP	Project Num Starting Wai Casing Stick Total Depth Casing Dian	aber: 0800 ter Level (fi kup (ft <u>):</u> (ft TOC <u>):</u> meter (inche	64 t TOC): / -0.32 17 ∋:2	0.34	
Filter Pack	(Interval (ft.	TOC)	5.0-17.5							
Casing Vo Casing vol	lume <u>6, k</u> lumes: 2" = 2" =	0.16 gpf 0.62 Lpf	r) x <u> </u>	f (Lpfv) f 6' f 6	(gpf) = <u>1,06</u> ' = 1.47 gpf '' = 5.56 Lpf	(L)(gal	)		Sample Int	ake Depth (ft TOC): ~12 ft
PURGIN	IG MEASU	IREMENTS						<u> </u>		
Time	Cumul. Vol (gal or L)	. Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	pH	Eh ORP (mv)	Turbidity (NTU)	Comments
825		015	/	/	<u> </u>	/	/			clear discharge
830	215		10.41	12,6	617	0,45	6.83	117,2	1.52	turbid after YSI
835	5.0		10.42	12.7	618	0.93	6.66	151.7	1.18	
840	7.5		10.43	12.7	618	1.07	6,43	136.2	0,86	
845	1010		10.43	12,6	617	0.83	6.29	151.1	0177	
350	12.5		10.43	12.6	617	0.75	6.20	137.2	0,86	$\checkmark$
855	15,0	V	10.43	12,6	619	0,74	6014	192.3	0,83	torbid w/s YSI
Total Gallo	ns Purged:	,	14		_	Total Casing	Volumes I	Removed:	3.7	(
Ending Wa	ater Level (ft	тос): <u>10</u> ,	43			Ending Total	Depth (ft 1	FOC): 17.0		
SAMPLE		DRY						. <u> </u>	1	
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Арре	arance	-	Remarks
							Color	Turbidity & Sediment		
855	1L	HPDE		1	none	HNO3	clear	none	Total Metal	s - As, Pb
	500mL	Amber glass		2	none	none		1	cPAHs	
	1L	Amber glass		2	none	none			PCBs	
	500mL	Amber glass		2	none	none			TPH- DX (v	v/silica gel cleaлup)
$\downarrow$	500mL	Amber glass		2	none	none	$\checkmark$		Bis(2-ethyl	hexyl) phthalate
METHO	l DS									<u>.</u>
Sampling E	Equipment ar	nd IDs:	Peristaltic P	ump and YS	GI 556 #					
Purging Eq	uipment:	Peristaltic Pur	np w/ dedica	ted tubing		Decon Equi	ipment:	Alconox. D	istilled Wate	рг. — — — — — — — — — — — — — — — — — — —
Disposal of	f Discharged	Water:	Stored in 1.0	000 gallon te	emporary onsite	e storage tan				
Observatio	ns/Commeni									
SSSC VallU								_		

.

. .



GROUN	DWATER	SAMPLING R	ECORD			WELL NUM	iber: CM	P-5			Page: 1 of 1
Project Na	me: SOUTH	WEST HARBOR	<b>PROJECT</b>	- Phase II (	GCWMP	Project Num	nber: 0800	64	10		
Date:	HITTERAT					Starting Wa	iter Level (fi kup (ft):	1 TOC): 5	198	······	
Measuring	Point of We	I <u> </u>				Total Depth	(ft TOC <u>):</u>	15.1			
Screened	Interval (ft. T	oc <u>)</u>	5.5-15.5			Casing Diar	neter (inche	÷2	<u> </u>		
Filter Pack	(Interval (ft.	TOC)	3.0-19.0								
Casing Vo	lume <u>6.6</u>	22(ft Water	)×	<u>)</u> (Lpfv)	(gpf) = <u>[ / 0</u>	<u> 5(L)(ga</u>	I)				
Casing vol	lumes: 2" =	0.16 gpf 0.62 l nf	4" ≕ 0.65 gp 4" ≕ 2.46 l n	t 6 f 6	" = 1.47 gpf " = 5.56 Lpf				Sample Int	ake Depth	(ft TOC): ~10.5 ft
PURGIN	G MEASU	REMENTS	- 2.40 25	<u> </u>	0.00 Lp.						······································
Time	Cumul. Vol.	Purge Rate	Water	Temp.	Specific	Dissolved	pН	Eh	Turbidity		Comments
	(gal or ( <u>)</u>	(gpm or Lpm)	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)		ORP (mv)	(NTU)		
1245		015	8.48	/	/	/	/			ilear	discharge
1250	7.15	↓ <u> </u>	8.73	11,00	467	0,41	6.22	230.1	12.3	tornal	wffer YSI
1255	5.0	0.19	8,76	11.2	480	0,31	6.22	231,8	11.4		
1300	7,0	0,4	8,75	11.1	482	0.42	6,22	<u>z\$4.3</u>	8.91		
1305	9.0		8,75	11.2	482	0.47	5.96	272,9	8,85		
1310	1110_		<u>8,75</u>	11.2	160	0:55	6.1Z	258.3	4,77		/
1515	- 13,0		$B_{i} = C$	11.2	480	0.32	6105	257.6	4.11	torbid	<u>w/o YSI</u>
							1				
-		``									
Total Gallo	ons Purged:	3.4	2			Total Casing	y Volumes I	Removed:	3,25		
Ending M/c	tor Loval (ft	TOC). 8,7	-5-		_	Ending Total	l Donth (ft ]	COC): 15 1			
SAMPLE								00). 13.1			
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Арре	arance		Re	marks
				-			Color	Turbidity &			
12,5	1	HPDE		1	none	HNO3	1 Anno	Mag (A.	Total Metal	s-As Ph	
1	500mL	Amber class		2	none	none	1	1	cPAHs		<u></u>
	1L	Amber glass		2	none	none			PCBs		
	500mL	Amber glass		2	none	none			TPH- DX (v	v/silica gel	cleanup)
V	500mL	Amber glass		2	none	none		14	Bis(2-ethyl	hexyl) phth	alate
				_							
METHO	5		B =								
Sampling E	-quipment an	id IDs:	Peristaltic P	ump and Y	SI 556 #						
	juipment:	Peristaltic Pur	np w/ dedica			Decon Equ	ipment:	Alconox, D	istilled Wate	er	
Disposal of	Discharged	water:	Stored in 1,0	JUU gailon t	emporary onsit	e storage tan	к				
Observatio	ns/Comment	s:									
								<del></del>			

٠

•



с 12 1

• •

CMP15-090402

• •

GROUN	DWATER	SAMPLING F				WELL NUN	IBER: C	MP-15		Page: 1 of 1
Project Na	me: SOUTH	WEST HARBOR	R PROJECT	- Phase II (	GCWMP	Project Nun	nber: 080	064		
Date:	4/2/2	007	-			Starting Wa	iter Level	(ft TOC <u>):</u> 0	1.91	
Developed	by: <u>DFR/AT</u>					Casing Stic	kup (ft <u>):</u>	-0.29	)	İ
Screened	Point of we Interval (ft. T	n <u> </u>	70-170			Cooling Dior	(π ΤΟ <u>Ο):</u> notor (inc	17.05	<u>)</u>	
Filter Pack	Interval (ft	00 <u>7</u> TOC)	4 0-17 4			Casing Diai	meter (inc			
		(1 <u></u>	<u></u>	1		(1				
Casing Vol	lume <u>/ . (</u>	<u>~1</u> (it Wate	f) X <u> </u>	(Lptv)	(gpt) = <u>  ,  </u>    = 4 47f	<u>-1</u> (L)(ga	4)		<b>.</b>	
Casing voi	unies. Z –	0.10 gpi 0.62 l.of	4 = 0.05 gp	4 0 4 6	= 1.47 gpt				Sample Int	ake Depth (ft TOC): ~12 ft
PURCIN		DEMENTE	4 - 2.40 Lp	<u> </u>	- 0.00 chi		_			
Time			141-1	<u> </u>	0		· · · · · · · · · · · · · · · · · · ·			
n nine	(gal or L)	(gpm or Lpm)	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)	рн	ORP (mv)	(NTU)	Comments
1645	$\overline{}$	015				1	1			clear discharge
IDSD	2:5		10.02	13.3	7340	0.14	682	- 2079	0.97	tuibid after YSI
1055	SID		10.03	13.5	7044	0.15	6.56	5 210.0	1.19	
1100	7.5		10.03	13.4	7295	0.15	6,31	206-6	0,46	
1105	10,0		10.04	13.4	7196	0,12	6.20	207.7	0.49	
1110	145		10.04	13,3	7070	oill	6.12	203.5	1,04	
1115	15.0		10.04	13.2	7059	0,10	6.69	198.2	0.73	torked ets YSI
	U		•							1
-										
										· · · · · · · · · · · · · · · · · · ·
							ļ	<del>-</del>		
u							<u> </u>	-		
•								_		
		2 41					4	1		
Total Gallo	ns Purged:				_	Total Casing	y Volumes	Removed:	3,45	
Ending Wa	iter Level (ft	TOC): 10,0	4			Ending Total	l Depth (fi	TOC): 17.05		
SAMPLE		DRY	•				`	,		
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	App	earance		Remarks
				,			Color	Turbidity &		
سبيون ا							0000	Sediment		
1112	1L	HPDE		1	none	HNO3	<u>clenr</u>	none	Total Metal	s - As, Pb, Sb, Cr, Cu, Ni
	500mL	Amber glass		2	none	none	<u> </u>		cPAHs	
<u>                                     </u>	1L	Amber glass		2	пone	none	<u> </u>	<u> </u>	PCBs	
	500mL	Amber glass		2	пone	none			TPH- DX (w	v/silica gel cleanup)
$\checkmark$	500mL	Amber glass		2	none	none	$\downarrow$		Bis(2-ethyl	hexyl) phthalate
METHO	DS									
Sampling E	quipment an	d IDs:	Peristaltic P	ump and YS	SI 556 #					
Purging Eq	uipment:	Peristaltic Pur	np w/ dedica	ited tubing		Decon Equi	ipment: _	_Alconox, D	istilled Wate	۲ <u>ــــــــــــــــــــــــــــــــــــ</u>
Disposal of	Discharged	Water:	Stored in 1,0	000 gallon t	emporary onsite	e storage tan	k	·		· · · ·
Observatio	ns/Comment	s:								
						·······			-	P
				· · · · · · · · · · · · · · · · · · ·		· <u> </u>	;	<u> </u>		



	541	()) To AV a COL		Ĺ	IMP17	- 090	331			
GROUN	DWATER	SAMPLING	RECORD			WELL NUM	BER: CMF	P-17		Page: 1 of 1
Project Na Date: Developed Measuring	ime: SOUTH 3 3 0 <sup>c</sup> by: <u>DFR/AT</u> Point of We	WEST HARBO	Ř PROJECŤ -	- Phase II C	BCWMP	Project Num Starting Wat Casing Stick	iber: 08006 ter Level (ft (up (ft <u>):</u> (ft TOC):	34 TOC <u>):</u> -0.17 16.21	9.05	
Screened	Interval (ft. T		6.0-16.0			Casing Dian	neter (inche	2		
Filter Pack	t Interval (ft.	TOC)	4.0-16.5			l		<u></u>		
Casing Vo Casing vol	lume <u>7</u> . lumes: 2" = 2" =	0.16 gpf 0.62 Lpf	er) x <u>16</u> 4" = 0.65 gp 4" = 2.46 Lp	(Lpfv) f 6' f 6'	(gpf) =i " = 1.47 gpf " = 5.56 Lpf	(L)(gal	)		Sample Int	ake Depth (ft TOC): 14 ft
PURGIN	G MEASU	REMENTS								
Time	Cumul. Vol. (gal or L)	e Purge Rate (gpm or لوتام)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	Turbidity (NTU)	Comments
1415		0,35		/	/	/		/	/	clear discharge
1426	1.75		9,08	12.4	663	0,80	6.03	2876	33	SI cloudy
1425	3,50		9.08	12.4	680	0,60	6.04	284.1	16	turbid affer YSI
1430	5.25		9:08	12,3	679	0.47	6,03	281.6	5.46	
1435	7.00		1.08	12.3	681	0,44	6:05	Z80,8	3.11	
14.40	8.75		9,68	12,3	678	0,39	6,04	279,5	6:08	
1445	1015		9,08	12.3	679	0.41	6.04	279,1	6,04	
1450	12.25	.↓/ 	9.08	12,3	678	0:39	605	278,3	2.00	furbid w/o YSI
										-
		1							-	· · · ·
		1								
Total Gallo	ons Purged:	3.2	-2	I	<u> </u>	Total Casing	l Volumes F	Removed:	2,8	2
Ending Wa	ater Level (ft	TOC):	<u>4.08</u>			Ending Total	l Depth (ft T	OC): 16.21		
SAMPLE		ORY								
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Remarks
							Color	Turbidity & Sediment		
1450	1L	HPDE	<u> </u>	1	none	HNO3			Total Metal	is - As, Pb
	500mL	Amber glass	ļ	2	none	none			cPAHs	· · · · · · · · · · · · · · · · · · ·
	1L	Amber glass		2	none	none			PCBs	
	500mL	Amber glass	ļ	2	none	none	<u> </u>		TPH- DX (v	w/silica gel cleanup)
/_	500mL	Amber glass	ļ	2	none	none			Bis(2-ethyl	hexyl) phthalate
~	40mL	VOA vial		3	none	HCI			Chlorinated	Ethanes and Ethenes (CEEs)
METHO	DS	I	1	<u> </u>						·
Sampling I	Equipment ar	nd IDs:	Dedicated (	<u>QED Well M</u>	izard Bladder	Pump and YS	1 <u>556 </u> #			
Purging Ec	uipment:	Dedicated Q	ED Well Wiz	ard Bladder	Pump	Decon Equ	ipment:	Alconox, D	istilled Wate	Br
Disposal o	f Discharged	Water:	Stored in 1,	000 gallon t	emporary onsit	te storage tan	k			
Observatio	ns/Commen	ts:								
					<u> </u>					
<del>~ .</del>	<u> </u>	······	···							

GROUN	DWATER	SAMPLING R	ECORD			WELL NUM	BER: FM-	105			Page: 1 of 1
roject Na	me: SOUTH	WEST HARBOR	RPROJECT	- Phase II (	GCWMP	Project Num	ber: 08006	4			
)ate:			-			Starting Wa	ter Level (ft	TOC <u>): 1</u>	0.76		
eveloped	by: <u>DFR/AT</u>	TOC				Casing Stick	(tip (ft):	-0.2			
reened	nterval (ft. T	0C)	7.0-17.0			Casing Dian	neter (inche	2			
lter Pack	Interval (ft.	тос)	6.0-17.5				`				
asing Vo	ume <u>1.</u>	24 (ft Water	r)x0,i	16_(Lpfv)	(gpf) =	(L)(gal	)				
asing vol	umes: 2" =	0.16 gpf	4" = 0.65 gpi	f 6'	" = 1.47 gpf				Sample Inte	ake Depth (f	ft TOC): 15 ft
	2" =	0.62 Lpf	4" = 2.46 Lp	f 6	" = 5.56 Lpf						
	G MEASU	REMENTS		r <del></del>					<u> </u>	1	
Time	Cumul. Vol. (gal or L)	(gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance _ (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	(NTU)		Comments
1105		0.35	/	/	/	/	/	$\langle$		clear	discharol
110	1.75		10,80	11.7	519	1.90	6.31	73.8	2.69	turb, 1	Her YSI
115	3,50		10.80	11.7	513	1.24	6.32	65.0	1.37	1	
120	5.25		10,00	ilib	601	1.20	6.30	44.1	1.07		
125	7 00		10,80	11.6	491	LIDR	6.30	31.7	0.74		
130	8.25		10.An	11.6	486	1.43	6.26	42.2	0.69		
<u>135</u>	16.5		10.01	11.5	480	0.44	6,23	75.4	0.60	$\checkmark$	
1910	12.25		In BI	11.5	476	N.96	6.76	74.3	0.53	turbed	he frame YSI
<u>, 19</u>	1	*	10.01	111 2		Une	0.20				<u> </u>
•											
						•					
	na Buraadi	ן מרי <sup>י</sup>	, I	•		Total Cooine	l Volumon F	l Romovod:	7 80		
otal Galic	ns Purgea:	<u></u>	~		_	rotar Casing	y volumes r	temoveu.			
nding Wa	ter Level (ft	тос): <u>Ì 8</u> ,	81			Ending Tota	Depth (ft T	OC): 18			
AMPLE	INVENTO	DRY				<b>_</b>				-	
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Ren	narks
140 fo	s sumply	FM105-	090331				Color	Turbidity & Sediment			
1145	11 fer 1	HELE		2	none	HNO3	1 and	<u>م</u> امد:	Total Metal	s-As Pb	
1	500ml	Amber class		4	none	none	1	1	cPAHs		
1	11	Amher alass		т л	none	none			PCBs		· ·
	500m!	Amber glass		4	none	none				weilice ool o	leanun)
	500ml	Amber close		4	none	none			Bie(2 other	hovul) inhthe	
$\forall$	10ml			4	10010 0000				Chloringte -		alate
-	4VIIIL	VUA Viai		6					Ciliorinated	i ⊂inanes ar	iu ⊑uieries (∪EES)
IETHO	DS				ł				1		
ampling	 auioment ar	nd IDs:	Dedicated C	)FD \//ell \/	(izard Bladder I	Pumn and VC	3 556 #				
uraina Er	uinment:	Dedicated OF		and Blodder	Pump	Decon Fro	inment:		istilled Mot		<u>.</u>
urging EC	Discharge d	Weter:	Stored in 4				.pment	AIGUNOX, L	natingu vvatt	51	· · · · · · · · · · · · · · · · · · ·
isposal 0	Discharged	vvater:	Stored in 1,	uoo gallon t	emporary onsit	e siorage ian	IN				

-

ROUNI	WATER S	SAMPLING R	ECORD			WELL NUM	BER: MW	-26R		F	Page: 1 of 1
oject Na	me: SOUTH	WEST HARBOR	RPROJECT	- Phase II C	CWMP	Project Num	iber: 08006	64			
ate:	<u> </u>	2009				Starting Wat	ter Level (ft	TOC):	1,66		
eveloped	by: <u>DFR/AT</u>	<u>.                                    </u>				Casing Stick	cup (ft <u>):</u>	-0.32			
easuring	Point of Wel	TOC			•	Total Depth	(ft TOC <u>):</u>	17.05			
reened I ter Deek	Interval (ft. 10	DC <u>)</u>	6.5-16.5			Casing Dian	neter (Inche	e: <u> </u>			
LEI FOUN	nitervar (n. 1	00) <u> </u>	<u>4.0-17.0</u>			Ð					
ising Vol	ume <u>175</u>	1 (ft Water	') X <u> </u>	>(Lptv)	(gpt) = <u>  -  </u>   = 1 47 cof	<u> </u>	1)		Comple Int	aka Danth (f	
asing voi	umes: ע = י י = ייכי	D. To gpr D.62 Lof	4 = 0.00 gp 4" = 2.46 lp	i o F S'	- 1.47 gpi '= 5.56 l of				Sample Inta	аке ферш (л	(100) 11.5 it
	C MEASH	DEMENTS	<u>+ - 2.40 Lp</u>	<u> </u>	- 0.00 Epi				<u>-</u> ,		
Time		Durge Rate	Mater	Temp	Specific	Dissolved	nH	Eb	Turbidity		Comments
nine.	(gal or L)	(gpm or Lpm)	Level (ft)	(C or F)	Conductance (uS/cm)	Oxygen (mg/L)	i pri	ORP (mv)	(NTU)		Continents
150		0.5		TTB					/	clear	discharg
<u> </u>	2.0	· · · · ·	9.66	17 1	ISCA	0.47	6.54	2472	771	hav.	allow VSI
<u>、 シン</u>	-ι <u>)</u> Γ Λ	├ <u></u>	9.1.1	12.0	13411	0.1L	6 51	-1777	7 27	1	NTTU U
000	7.5		1100	14.6			0.30	25212	6,66	├───	
005_	5	<b>└──</b>	11.00	14.4	1304	0.16	6.47	125310	0,92	<b> </b>	
010	0.0		7,66	14.4	1238	0,25	6.42	1446	1124	└──┼	
015	12.5		9,66	12,4	1212	0,22	6.41	227.3	1.06		
070	15.0		1,66	12,3	1193	0,22	6:43	229,6	n.93	turbid	w/0 Y51
									-		
_	· · · =·										
_											
otal Gallo	ns Puraed:	3,40	4			Total Casing	Volumes F	Removed:	3,34	ł	
					-						
nding Wa	ter Level (ft	тос): <u> </u>	66			Ending Tota	l Depth (ft 1	FOC): 17.05			
AMPLE		RY									
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Арре	arance		Rem	arks
							Color	Turbidity &			
1120	41	HDDE			nane		C. and	in a w	Total Metal	e-As Ph S	b Cr Cu Ni
<u></u>	500ml	Amher dass		2 	none	none	1	1	cPAHs	,,	
1	1L	Amber class		4	none	none			PCBs		
-	500ml	Amber gloss		, л	none	none				- w/silica det d	eanup)
1-	5000			. 4				$  \downarrow  $		hourd'shite -	lato
<u>س</u> ور و	SUUML	Amper glass		4		NOTIC		>		Texat huma	
045	, <b></b>									<u>64</u> 44	+ Can. El ma
			l			<u> </u>		<u> </u>	MW	26.12- 1	0707016S
ETHO	28							•			
Impling E	Equipment ar	ud IDs:	Peristaltic F	ump and Y	SI 556 #						
rging Ec	uipment:	Peristaltic Pu	mp w/ dedica	ated tubing		Decon Equ	ipment:	Alconox, D	istilled Wate	er	
sposal o	f Discharged	Water:	Stored in 1,	000 gallon t	emporary onsit	e storage tan	ık				
	-										
oon ett-	ne/Commo-										

GROUN	DWATER \$	SAMPLING R	ECORD			WELL NUM	BER: MW	-36	·		Page: 1 of 1
Project Na	me: SOUTH	WEST HARBOF	RPROJECT	- Phase II G	GCWMP	Project Num	iber: 08006	64			
Date:	412/2	-004				Starting Wat	ter Level (ft	TOC <u>): </u>	<u>1,06</u>		
Jevelopec Accouring	Boint of Mol	TOC				Casing Stick	(up (ft <u>):</u>	-0.23		<u> </u>	
creened	Interval (ft. Ti	<u> </u>	58.0-73.0	<u> </u>		Casing Dian	(it 100 <u>).</u> teter (inche				
ilter Pack	Interval (ft. 1	ГОС)	55.0-71.0		······································						
asing Vo	lume 63.	년년 (ft Water	)x Oil	(Lpfv)	$(qpf) = lO_1 Z$	23 (L)(gal	)				
asing vol	umes: 2" = 2" =	0.16 gpf 0.62 Lpf	4" = 0.65 gp 4" = 2.46 Lp	f 6' f 6'	' = 1.47 gpf ' = 5.56 Lpf		,		Sample Int	ake Depth (f	t TOC): ~ 65.5 ft
URGIN	G MEASU	REMENTS							-		
Time	Cumul. Vol. (gal of E)	Purge Rate (gpm or ﷺ)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	Turbidity (NTU)		Comments
945		015	/	/			~			cland	Aschurge
150	215	ì	9.11	1215	3657	0.7.4	6.41	211.6	D, 98	forbid	alter VSI
1 <u>77</u>	5.0		413	12.6	3689	0 18	630	217.3	1.12	1	where I are
000	715		G 1Z	12.0	3712	0.12	la CA	2762	0.97		
615	16.6		a., 2	12.5	3722	6.17	C. 4Q	7643	0.95		
<u>7 - 03</u> 16 i 6	12.00		4 17 G 17	1210	2727	10112	1 110	D14 7	2 97		
<u>سد ہے</u>	5	<u> </u>	0.13	1211	2/27	0.16	0170 0110	210, 7			
.013	₩¥,0			-16:1	3.[.7]		0+10		0107	+07.010	
<u> </u>											
								.=			
otal Galio nding Wa	ns Purged: iter Level (ft ]	<u> </u>	1		-	Total Casing	Volumes F	Removed:	013.	<u> 3</u>	
AMPLE		RY									
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Rem	arks
							Calar	Turbidity & Sediment			
1015	1L	HPDE		1	none	HNO3	clear	none	Total Metal	ls - As, Pb, S	b, Cr, Cu, Ni
	500mL	Amber glass		2	none	none	1		cPAHs		
	1L	Amber glass		2	none	none			PCBs		
	500mL	Amber glass		2	none	none			TPH- DX (v	w/silica gel cl	eanup)
	500mL	Amber glass		2	поле	none	<u>۲</u>	<u> </u>	Bis(2-ethyl	hexyl) phtha	late
ETHO	os								· · ·		
ampling E	Equipment an	d IDs:	Peristaltic P	ump and YS	SI 556 #						
urging Eq	uipment:	Peristaltic Pur	np w/ dedica	ted tubing		Decon Equi	ipment:	Alconox, D	istilled Wate	er	
isposal of	Discharged	Water:	Stored in 1.0	000 gallon te	emporary onsite	e storage tan					
-	0							· · · · ·			



MW125-040331 GROUNDWATER SAMPLING RECORD WELL NUMBER: MW-125 Page: 1 of 1 Project Name: SOUTHWEST HARBOR PROJECT - Phase II GCWMP Project Number: 080064 Date: 3/3//2009 Starting Water Level (ft TOC): 6.40 Developed by: DFR/AT Casing Stickup (ft): -1.11 Measuring Point of Wel TOC Total Depth (ft TOC): 13.35 Screened Interval (ft. TOC) 5.0-15.0 Casing Diameter (inche 2 Filter Pack Interval (ft. TOC) 3.0-15.0 Casing Volume <u>6.99</u> (ft Water) x <u>0.6</u>  $(Lpfv)(gpf) = /_{\delta} / / (L)(gal)$ Casing volumes: 2" = 0.16 gpf 4" = 0.65 apf 6'' = 1.47 apf Sample Intake Depth (ft TOC): 13 ft 2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf PURGING MEASUREMENTS Time Cumul. Vol. Purge Rate Water Temp. Specific Dissolved pН Eh Turbidity Comments (gal or L) (gpm or Lpīn) Level (ft) (C or F) Conductance Oxygen ORP (NTU) (µS/cm) (mg/L) (mv) / clear discharge 0,35 \_ 1310 / 6,56 11.4 608 2.65 131.5 turbid 1315 6.26 1.75 1.75 1320 3.50 6,56 609 2.44 6.30 118.7 1.27 1325 5.25 604 2.27 6.30 155,8 1.02 6.56 1330 7.00 11.4 593 6.56 2.05 631 1643 1.01 1335 8,75 6 156 11.3 586 1.84 6.25 162.9 0.68 1340 10.5 6,58 1,77 11.4 586 6.19 224.30.79 13:45 12,25 6.58 11.4 1,74 150,10.74 589 6,18 751 tuvv.d 3.22 2,90 Total Gallons Purged: Total Casing Volumes Removed: 6.58 Ending Water Level (ft TOC): Ending Total Depth (ft TOC): 13.35 SAMPLE INVENTORY Time Volume Bottle Type Quantity Filtration Preservation Appearance Remarks Turbidity & Color Sedimen 1345 11 HPDE HNO3 dear 1 none none Total Metals - As, Pb 500mL Amber glass 2 none none cPAHs 1L Amber glass 2 none PCBs none Amber glass 2 none 500mL none TPH- DX (w/silica gel cleanup) 500mL Amber glass 2 none none Bis(2-ethyl hexyl) phthalate 40mL VOA vial 3 none HCL Chlorinated Ethanes and Ethenes (CEEs) METHODS Sampling Equipment and IDs: Dedicated QED Well Wizard Bladder Pump and YSI 556 # 144 Dedicated QED Well Wizard Bladder Pump Purging Equipment: Decon Equipment: Alconox, Distilled Water Disposal of Discharged Water: \_\_\_\_\_ Stored in 1,000 gallon temporary onsite storage tank Observations/Comments:



•	ear	tn+water		٨v	V44 - C	9040	t			
GROUN	DWATER	SAMPLING R	ECORD			WELL NUM	BER: MW	-44		Page: 1 of 1
Project Na Date: Developed Measuring Screened	me: SOUTH <u>'( / ô (</u> ) by: <u>DFR/AT</u> Point of Wel Interval (ft. T	WEST HARBOR <u>2009</u> I <u>TOC</u> OC)	R PROJECT	- Phase II G	6CWMP	Project Num Starting Wa Casing Stick Total Depth Casing Dian	ter: 08006 ter Level (ft (up (ft <u>):</u> (ft TOC <u>):</u> neter (inche	)4 TOC <u>): {</u> -0.18 73.9 2	8,94	
Filter Pack	interval (ft.	TOC)	n/a					-		
Casing Vo	tume <u>69</u> umes: 2" = <u>2" =</u>	<u>. 9</u> (ft Water 0.16 gpf 0.62 Lpf	r) x <u>0 / /</u> 4" = 0.65 gp 4" = 2.46 Lp	<u>6</u> (Lpfv) f 6' f 6'	(gpf) = <u>10,3</u> ' = 1.47 gpf <u>' = 5.56 Lpf</u>	<u>9                                    </u>	)		Sample Int	ake Depth (ft TOC): <u>~ 68 ft</u>
PURGIN	G MEASU	REMENTS			0	Disasterat	<u> </u>			- Ourseaste
lime	(gal or L)	(gpm or Lpm)	Vvater Level (ft)	(C or F)	Specific Conductance (uS/cm)	Dissolved Oxygen (mg/L)	рн	En ORP (mv)	(NTU)	Comments
(070		015		/	<u> </u>	<u> </u>		$\leq$	$\angle$	ellar disch
1035	2.5	1	8.45	12.1	106	7.07	7.25	138:3	10.32	turbid of YSI
1040	5.0		8.96	11.9	67	6.94	7.13	120.6	9,57	<u> </u>
1045	75		8.97	123	48	6.97	6.89	164,4	9.47	
1050	10.0		8.98	124	43	7.18	6.74	1620	9.31	
105 <sup>5</sup>	12.5		8,59	12,4	49	7.06	6.60	179,9	9,79	
1100	15.0	<u> </u>	9.10	11.5	46	7.25	6.42	194.8	7,33	turbed w/o YSI
			· · · ·							
Total Gallo	ns Purged:	3.94			_	Total Casing	i Volumes F	Removed:	0,3	8
Ending Wa	ter Level (ft	тос):	01			Ending Total	Depth (ft T	OC): 73.9		
SAMPLE		DRY			· · · · ·					
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea Color	Turbidity & Sediment		Remarks
1100	1L	HPDE		1	none	HNO3	Clear	hone	Total Metal	s - As, Pb, Sb, Cr, Cu, Ni
	500mL	Amber glass	· <u> </u>	2	none	none			cPAHs	
	1L	Amber glass		2	none	none			PCBs	
	500mL	Amber glass		2	none	none			TPH- DX (v	v/silica gel cleanup)
	500mL,	Amber glass		2	none	none			Bis(2-ethyl	hexyl) phthalate
METUO										
		- UD	Deviate Mr. 7	h						
Sampling E	quipment ar			rump and YS	51 555 #	Der			iotillod Mot-	······································
Purging Eq	upment:	Peristaltic Put	np w/ dedica			Decon Equ	ipment:	AICONOX, D	ISTUED VVATE	······································
Observation	ns/Common	vvaler:	Stored in 1,	uuu gallon ti	emporary onsit	e storage tan	<u>қ</u>		,	
4										



MW308N - 090402

GROUN	DWATER	SAMPLING R	ECORD		· · · · · · · · · · · · · · · · · · ·	WELL NUM	IBER: MW	-308N			Page: 1	of 1
Project Na	me: SOUTH	WEST HARBOR	R PROJECT	- Phase II (	GCWMP	Project Num	nber: 08006	64				
Date:	1/2/20	09				Starting Wa	ter Level (ft	TOC <u>):</u>	5.86			
Developed	Dy: <u>DFR/AT</u> Point of Wei	TOC		<u> </u>		Casing Stick	kup (f <u>1):</u>	-0.29	1	—		
Screened I	Interval (ft. T	0C)	12.5-17.5			Casing Diar	neter (inche	; <u>17.93</u>				
Filter Pack	Interval (ft. 1	roc)	10.0-21.5									
Casing Vol	lume 12.0	04(ft Water	)× <u>o.i</u>	لم	(gpf) = <u>1, 9</u>	<u>}(L)(ga</u>	I)					
Casing vol	umes: 2" = 1 2" =	0.16 gpf	4" = 0.65 gp 4" = 2.46 Lp	f 6 f 6	" = 1.47 gpf " = 5.56 Lpf				Sample Int	ake Depth	(ft TOC): <u>^</u>	-15 ft
PURGIN	G MEASU	REMENTS	<u>+ - 2.40 Lp</u>	· _ ·	<u> </u>							
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance	Dissolved Oxygen	рН	Eh ORP	Turbidity (NTU)		Comme	nts
12.40		0.5	/	~	(µS/cm)	(mg/L)		(mv)	7			
1245	2.5	0.3	7.06	12.0	2400	0.35	6.74	180,1	24,0	alage	particle	- overalt
1250	4.0	0.25	7,20	12.3	1801	0.07	10.6D	183.74	CHERRY	55.6	turbid	atter YSI
1255	5.5	v. 2	8,00	17.2	1766	0.06	6.50	181.5	14,1		1	•
1700	7.0	1	8.00	12.2	1748	0.06	6.45	176.2	13.5			
7051	8,5		A. 30	12,2	1734	0.06	6.43	182.4	115			
1310	10,0		B132	12.3	1114	0.06	642	190.9	8.92		$\overline{\mathbf{v}}$	
1215	12.5	$\overline{\mathbf{v}}$	R.34	12.2	1712	0.05	6.45	198.3	8.67	tushed	J.Y	si
	4 <b>2</b> - <b>-</b>			1.21.9	1,	Ŭ	0110	10,010		10101	-101	<u></u>
									1			
						r						
					-						· ·	
Tatal Calla							L	<u> </u>	<u>ו</u> ו	L		
Total Gallo	ns Purgea:	5,22	í		_	Total Casing	) Volumes F	Removed:	117	09		
Ending Wa	ter Level (ft ]	гос): <u> </u>	34			Ending Total	l Depth (ft T	OC): 17.95				
SAMPLE	INVENTO	RY										
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Rer	narks	
							Color	Turbidity &				
1315	11	HPDE		. 1	none	HNO3		Jediment	Total Metal	s-As Ph		
- <u></u> \	500mL	Amber class		2	none	none			cPAHs	<u></u>		
	11	Amber glass		2	none	none			PCBs			
	- 500ml	Amber place		<u> </u>	none	none				vísilica del v		
	500ml	Amber alsee		 ຳ	none	none			Bis/2-othul	hevul) phil	alate	
		ransor glass		<u>Z</u>			,	· · · · ·	Distz-cittyl	лекуј раш	0010	
4			··		· · · · · · · · · · · · · · · · · · ·							
METHOD	)S		I	<u></u>	<u> </u>			I				
Sampling E	quipment an	d IDs:	Peristaltic P	ump and Y	SI 556 #							
Purging Ea	uipment:	Peristaltic Pur	np w/ dedica	ted tubina		Decon Equi	ipment:	АІсолох. D	istilled Wate	er		
Disposal of	Discharged	Water:	Stored in 1.0	000 gallon t	emporary onsite	e storage tan	 k					
0												
Observation	ns/Comment:	s:										
		<u></u>										



				At	# 30	$\equiv$ MW	13085	-09	0401	
GROUN	DWATER	SAMPLING F	ECORD			WELL NUM	IBER: MW	-3085		Page: 1 of 1
Project Na	ame: SQUTH	WEST HARBOF	ROJECT	- Phase II (	JCWMP	Project Num	1ber: 0800f	34		
Date:	<u> </u>	2005	_			Starting Wa	ter Level (ft	. TOC):	5.74	
Developer	d by: <u>DFR/AT</u>	-	·			Casing Stick	кир (ft) <u>:</u>	-0.61	<u></u>	
Measuring	g Point of We	TOC				Total Depth	(ft TOC):	40.5	<u>;                                    </u>	·
Screened	Interval (ft. T	<u>'0C)</u>	35.0-40.0			Casing Dian	neter (inche	a: <u>2</u>		
Filter Pacl	k Interval (ft.	TOC)	31.0-40.0							
Casing Vc	olume <u>37</u>	176 (ft Wate	r) x <u>0. l</u>	<u>6</u> (Lpfv)	(gpf) = <u>5، 5</u>	<u> </u>	1)			
Casing vo	lumes: 2" =	0.16 gpf	4" = 0.65 gp	וּ 6' ר ה	" = 1.47 gpf				Sample Int	take Depth (ft TOC): <u>~ 37.5 ft</u>
PURGIN	 ₄G MEASU	IREMENTS	4" = 2.40 Lp	<u>, it u</u>	<u>" = 5.30 г.н.</u>					
Time	TCumul, Vol	T Purge Rate	Water	Temp.	T Specific	Dissolved	На	T Eh	Turbidity	T Comments
•••••	(gal or L)	(gpm or Lpm)	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)		ORP (mv)	(NTU)	
1400	$\Box$	015	5.74				/			clear discharge
1405	1,5	0.3	6 LIB	12.1	ILGQ.	D.12	1.55	2.28.7	179	I I I IVLI
iLIN)	4 0	λ. <u>γ</u>	1.27	12 2	10.2	110	1-1-10	1290	1.01	tu/bul w/ (.7/
			0.5%	<u>  &gt;u</u>	170T		Time	4010		[
1415	5.5	015	6.23	12.9	1561	0,08	7.16	232,6	0.96	
1420	1.0		6.25	12.9	1567	0.09	7.15	205.5	1013	
1425	8,5		6.25	17.9	1565	0.03	7.13	1123	143	
1420	10,0	1	. 73	17.4	141.5		- 12	3 nd 9		hull 1 XGI
11N			Bec J	14.07	1761	0,00	- <i>1-1-7</i>	10011	1,01	1000/α 0/0 1 01
	+	<b></b>	<u> </u> '	<b> </b>	<u> </u>	<b>├</b> ───/	'	<u> </u> '	<b> </b> '	
			<u> </u> '	ļi	1	<b> </b>	<sup> </sup>	<sup>!</sup>	<b> </b> '	
		<u> </u> !	<u> </u> '			<u></u> /		'		
	+	<u> </u>	<b> </b> '			<u>├</u> ────┤	<sup> </sup>	'	<b>├</b> ───┦	
			<b>├</b> ────'	<u> </u>	i		<u> </u> !	 	<u> </u>	
		+	<u> </u> '		'	<u>                                     </u>	<u> </u> !	ļ!	<b> </b>	
	<del> </del>		<b> </b> !	<u> </u> '		<b>├</b> ───┦	<b>├</b> ────┦	<b>├</b> ────′	<b> </b>	·
Total Galle	Purried:	2,63	۱ ۲	L	<u> </u>	Total Casino	- Volumes F	)-moved.	0.42	<u> </u>
	JIIS Fulgea.		<u>.</u>		-	Total Gaariy	Volumean	temoveu.		<u> </u>
Ending Wa	ater Level (ft	тос): <u>6, 2</u>	-3			Ending Total	I Depth (ft T	OC): 40.5		··· • • • • • • • • • • • • • • • • • •
SAMPLE	<u>= INVENTC</u>	JRY			<u> </u>					
Time	Volume	Bottle Type	l l	Quantity	Filtration	Preservation	Appea	arance	1	Remarks
							Color	Turbidity & Sediment		
1430	1L	HPDE	!	<u> </u>	none	HNO3	CLUV	nove	Total Metal	s - As, Pb
1	500mL	Amber glass		2	none	none			cPAHs	
	1L	Amber glass			none	none	Ī. ļ. l		PCBs	
	500mL	Amber glass	<u> </u>	2	none	none			TPH- DX (v	N/silica gel cleanup)
$\vee$	500mL	Amber glass	<u> </u>	2	попе	лопе	$\forall$		Bis(2-ethyl	hexyl) phthalate
<u> </u>	 	ļ!	I	<u> </u>			<u> </u>	]	<u> </u>	
				!			L]		<u> </u>	
METHO	DS									•.
Sampling F	Equipment ar	nd IDs:	Peristaltic P	ump and Y	<u>SI 556 #</u>				ž	
Purging Ec	quipment:	Peristaltic Pur	mp w/ dedica	ated tubing		Decon Equi	ipment:	Alconox, D	istilled Wate	۶r
Disposal o	f Discharged	Water:	Stored in 1,	000 gallon t	emporary onsit	e storage tanl	k			· · ·
Observatio		te ·							-	
0000 1000	na oomne	.a		,				•	·····	<u></u>

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Turn-around	Requested:			Page:	-	of				Ana	Intical Resources, Incornorated
ST					1710-		-			Ana	lytical Chemists and Consultant
r	Phone:	500	0	Date:	1/200	Presen	< 13			461 Tuki	1 <sup>´</sup> South 134th Place, Suite 100 <i>w</i> ila. WA 98168
			:	No. of Coolers:	h Ry	Cooler Temps:	10 10 10	an GCC		206	-695-6200 206-695-6201 (fax)
-	21.	117 6	- ^ A > O			/	Analysis,Re	equested	-		Notes/Comments
Samplers:	Pu64	AMY ?	rice	etals 16020 Pb)	's .0b	S C SIM	- PX + OIL I cleanny	р 0 с	s 2		
Date	Time	Matrix	No. Containers	Tot M SOICB, (As,	CEE 82.6	(PAH 87.70	NWTPh Presel V/silice	BEH 82.7	PC B 80 8		
3/31/09	642	٤	هـ.	$\times$		$\times$	$\times$	$\times$	$\times$		
1077,98308.01	242		ana)	$\times$		×	X	X	Х		
	190	an an an an an an an an an an an an an a	N	$\times$	×	X	×	X	X		
	1345		2	$\times$	×	×	$\times$	×	$\times$		
hora	1450	<u> </u>	- 2	×	$\times$	×	$\times$	×	X		
¢	147	€	- 2	$\times$	$\times$	×	$\times$	$\times$	$\times$		
Relinquished by: (Signature)	オの	5	Received by: (Signature)	X	1		Relinquished b Signature)	Y:		Receive (Signatu	əd by: ure)
Printed Name:	Ó.	v6H	Printed Name:	1510a.V	050	<u> </u>	rinted Name:			Printed	Name:
Company:		2	Company:	R			Jompany:			Compar	ny:
Date & Time: 5 3 /0	4 15	05.	Date & Time:/	100	ir	96	)ate & Time:			Date &	Time:
* requested sei tal llability of ant of a prope	rvices in acco ARI, its office osal for servic	rdance with a rs, agents, en es by ARI rele	opropriate me iployees, or st ase ARI from	thodology fi uccessors, a any liability	ollowing AF arising out in excess	łl Standarc of or in con thereof, no	l Operating nection wii t withstand	) Procedur th the requ ling any pr	es and the A ested service ovision to the	RI Quality Ass es, shall not e contrary in a	surance Program. This program xceed the Invoiced amount for ny contract, purchase order or co-
Client.								ייק ניים צווו		i von an an an an	ווץ כטוונמטו, מעוטומעם טועסו ער ער-
	Turn-around       Samplers:       Samplers:       Date       Date       Bignature       Signature       Signature	Turm-around Requested:       ST Phone:       Stamplers:     Phone:       Date     Time       Date     Time       Date     Time       Jate     1140       Jate     1345       Jate     1145       Jate     115       Jate     115       Jate     115 </td <td>Turn-around Requested:       STP       Phone:       2 CE       Phone:       2 CE       1 CF       Phuse:       Date       Time       MAVT       Pate       Time       MAVT       Pate       Time       MAVT       Pate       Time       Matrix       Signature       NAVID       HIGS       HIGS</td> <td>Turn-around Requested:       STD       Phone:       2 CE       2 CE       Bamplers:       Date       Time       Matrix       No. Containers       1145       112       1145       112       112       112       112       1145       112       112       112       112       1145       112       1145       112       112       112       112</td> <td>Turn-around Requested:     Page:       STD     2.66     7.80     9.37.2     One       Samplers:     Date     Time     Matrix     No. containeer     5.00       Date     Time     Matrix     No. containeer     5.00     5.00       Date     11450     1     2     X     1     2       Date     11450     1     2     X     1       Date     Time     Signaure     Signaure     Signaure     Signaure       Signaure     No     Signaure     Signaure     Signaure     Signaure   &lt;</td> <td>Turn-around Requested:     Page:       C     1 C6       Phone:     3/31/200       Date:     3/31/200       Samplers:     3/31/200       Date     1       Date     1       Date     Time       Matrix     No. Containers       Date     Time       Date     Time       Matrix     No. Containers       J31/201     EV6H / AMY TILE       Date     Time       Matrix     No. Containers       J31/201     EV6H / AMY TILE       Date     Time       Matrix     No. Containers       J31/201     EV6H / AMY TILE       Date     Time       Matrix     No. Containers       J31/201     EV6H / AMY TILE       Signature     J345       J31/201     J345       J34/201     J350       J34</td> <td>Turn-around Requested:     Page:     Page:     Page:       Phone:     2.06     T.B.O. 13.7.0     Date:     Date:     No. of     Present       Samplers:     PLAVE:     PLUEH     AMY TILE     Coolers:     Y L</td> <td>Turn-around Requested:     Page:     of     I       STD     Phone:     <math>2 \in 180</math> <math>37 \circ</math> lt;</td> <td>Time anomal Requested:     Page:     of     1       Phone:     <math>2 \in I = B = 3 \neq a</math>     Date:     <math>3 \neq 3 \mid / 2 = q</math>     Present     Y       Consist:     <math>P = 1 = 3 \neq a</math>     Date:     <math>3 \neq 3 \mid / 2 = q</math>     Present     Y       Consist:     <math>P = 1 = 3 \neq a</math>     Date:     <math>3 \neq 3 \mid / 2 = q</math>     Present     Y       Consist:     <math>P = 1 \neq a \neq a</math> <math>2 \neq a \neq a \neq a</math> <math>3 \neq 3 \mid / 2 = q</math>     Present     Y       Consist:     <math>P = 1 \neq a \neq a \neq a</math> <math>2 \neq a \neq a \neq a \neq a \neq a \neq a \neq a \neq a \neq a \neq </math></td> <td>Turn anound Requested:       Page:       of       1         Phone:       <math>2.6</math> <math>12.0</math> <math>3.3</math> <math>1/2</math> <math>2.6</math> <math>10.0</math> <math>3.3</math> <math>1/2</math> <math>10.0</math> <math>1.3</math> <math>3.3</math> <math>1/2</math> <math>1.3</math> <math>3.3</math> <math>1/2</math> <math>1.3</math> <math>3.3</math> <math>1/2</math> <math>1.3</math> <math>3.3</math> <math>1/2</math> <math>1.3</math> <math>3.3</math> <math>1.2</math> <math>3.3</math> <math>1.4</math> <math>3.3</math> <math>3.3</math> <math>1.4</math> <math>1.3</math> <math>3.3</math> <math>1.4</math> <math>1.3</math> <math>3.3</math> <math>1.4</math> <math>1.3</math> <math>3.3</math> <math>1.4</math> <math>1.2</math> <math>X</math> /td> <td>Turnscurd Requested:     Page:     of     1       Prove:     C C C BO F3 2 o     Date:     Date:     No. of     Main:     Prove:     C C C C C C C C C C C C C C C C C C C</td>	Turn-around Requested:       STP       Phone:       2 CE       Phone:       2 CE       1 CF       Phuse:       Date       Time       MAVT       Pate       Time       MAVT       Pate       Time       MAVT       Pate       Time       Matrix       Signature       NAVID       HIGS       HIGS	Turn-around Requested:       STD       Phone:       2 CE       2 CE       Bamplers:       Date       Time       Matrix       No. Containers       1145       112       1145       112       112       112       112       1145       112       112       112       112       1145       112       1145       112       112       112       112	Turn-around Requested:     Page:       STD     2.66     7.80     9.37.2     One       Samplers:     Date     Time     Matrix     No. containeer     5.00       Date     Time     Matrix     No. containeer     5.00     5.00       Date     11450     1     2     X     1     2       Date     11450     1     2     X     1       Date     Time     Signaure     Signaure     Signaure     Signaure       Signaure     No     Signaure     Signaure     Signaure     Signaure   <	Turn-around Requested:     Page:       C     1 C6       Phone:     3/31/200       Date:     3/31/200       Samplers:     3/31/200       Date     1       Date     1       Date     Time       Matrix     No. Containers       Date     Time       Date     Time       Matrix     No. Containers       J31/201     EV6H / AMY TILE       Date     Time       Matrix     No. Containers       J31/201     EV6H / AMY TILE       Date     Time       Matrix     No. Containers       J31/201     EV6H / AMY TILE       Date     Time       Matrix     No. Containers       J31/201     EV6H / AMY TILE       Signature     J345       J31/201     J345       J34/201     J350       J34	Turn-around Requested:     Page:     Page:     Page:       Phone:     2.06     T.B.O. 13.7.0     Date:     Date:     No. of     Present       Samplers:     PLAVE:     PLUEH     AMY TILE     Coolers:     Y L	Turn-around Requested:     Page:     of     I       STD     Phone: $2 \in 180$ $37 \circ$ <	Time anomal Requested:     Page:     of     1       Phone: $2 \in I = B = 3 \neq a$ Date: $3 \neq 3 \mid / 2 = q$ Present     Y       Consist: $P = 1 = 3 \neq a$ Date: $3 \neq 3 \mid / 2 = q$ Present     Y       Consist: $P = 1 = 3 \neq a$ Date: $3 \neq 3 \mid / 2 = q$ Present     Y       Consist: $P = 1 \neq a \neq a$ $2 \neq a \neq a \neq a$ $3 \neq 3 \mid / 2 = q$ Present     Y       Consist: $P = 1 \neq a \neq a \neq a$ $2 \neq a \neq a \neq a \neq a \neq a \neq a \neq a \neq a \neq a \neq $	Turn anound Requested:       Page:       of       1         Phone: $2.6$ $12.0$ $3.3$ $1/2$ $2.6$ $10.0$ $3.3$ $1/2$ $10.0$ $1.3$ $3.3$ $1/2$ $1.3$ $3.3$ $1/2$ $1.3$ $3.3$ $1/2$ $1.3$ $3.3$ $1/2$ $1.3$ $3.3$ $1.2$ $3.3$ $1.4$ $3.3$ $3.3$ $1.4$ $1.3$ $3.3$ $1.4$ $1.3$ $3.3$ $1.4$ $1.3$ $3.3$ $1.4$ $1.2$ $X$	Turnscurd Requested:     Page:     of     1       Prove:     C C C BO F3 2 o     Date:     Date:     No. of     Main:     Prove:     C C C C C C C C C C C C C C C C C C C

-----

· · · · · · · ·

....

į

Chain of Custody Record & Laboratory Analysis Request

Chain of Custody Record	d & Labora	atory An	alysis F	lequest								
ARI Assigned Number:	Turn-around R	equested:			Page:		oţ	~			Analyti	cal Resources, Incorporated
ARI Client Company:		Phone:	180 0	222	Date: $4/1$	2.000	Ice Present	52465			4611 S Tukwila	outh 134th Place, Suite 100
Client Contact: Chip Goodhive					No. of Coolers:	W N;)	Cooler Temps:	6.6.5	h'Ľ'7		206-69	5-6200 206-695-6201 (fax)
Client Project Name:	5	5		J		JU	Ą	vnalysi <u>s</u> Re	quested			Notes/Comments
Southwest Harbor Mare		X 6	W C M		15 20	15 Zo r. (	^	140.				
Client Project #: 0 800 64	Samplers: DAV IV	RUGH	AMY	Tict	Лена! /60: _РЬ)	1603 56,01	15 51M	r Oil • cleu	ہ د ص	Р5 82		
Sample ID	Date	Time	Matrix	No. Containers	Tot A 6010B (As	Tot N 6010B (As,Pb,	6 PA	Diesel Visilica	61- HI 827	80.		
CMP 3-090401	4/1/2009	910	٤	-	$\times$		$\times$	X	X	$\times$		
MW26R-096401		620	Z	_^		$\times$	×	$\times$	X	$\times$		
MW26R-0404010		025	Ź			×	$\times$	X	X	$\times$		
MW44-090401		1166	۶	-0		X	$\times$	$\times$	$\times$	ス		
CMP 5-090401		3	≶	2	X	CR.	X	Χ,	$\times$	۲ ,		Metals - As Pb and
10000-5805WW	E	430	Ź	<u></u>	$\times$		$\times$	$\times$	X	$\times$		. /
			-									
									-			
							:	-				
	-		4.									
Comments/Special Instructions	Kelinquished by:	NA P		Received by: (Signatore)/////	s. T	S	<u></u>	lelinquished by Signature)			Received by (Signature)	
	Printed Name:	D R	іс Н	PrintègiName:	E	SPA		rinted Name:			Printed Nam	IC:
	Company:	+	5	Company: ALT		Ĝ	0	ompany:			Company:	
	Date & Time? -1/1/69	154	0		R	1540		ate & Time:	,	ч. т.	Date & Time	Ä
Limits of Liability: ARI will perform all meets standards for the industry. The to said services. The acceptance by the clu- signed agreement between ARI and the	· requested serv otal liability of A lent of a propos Client.	ices in accor RI, its officer al for service	dance with a s, agents, en s by ARI rele	ppropriate me ployees, or si sase ARI from	thodology ) uccessors, : any liability	ollowing AF arising out c ' in excess 1	ll Standaro of or in con hereof, not	Operating nection wit withstand	Procedure h the reque ng any pro	s and the AR sted services vision to the c	l Quality Assura , shall not exce ontrary in any c	ance Program. This program ed the Invoiced amount for xontract, purchase order or co-
signed agreement between AHI and the	Client.											

Support for the second s

r

. .

:

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sconer than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

.

(c);

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Quality Assurance Program. This program shall not exceed the Invoiced amount for ntrary in any contract, purchase order or co-	ires and the ARI ( uested services, s rovision to the co	ing Procedu with the req nding any p	lard Operati connection not withsta	ARI Stanc It of or in u Is thereof,	r following . , arising ou ty in exces	ethodology successors n any liabili	ppropriate m nployees, or s sase ARI fron	rdance with a 's, agents, en as by ARI rele	vices in acco 4RI, its office. sal for servic	requested ser tal liability of , ent of a propc Client.	Limits of Liability: ARI will perform all meets standards for the industry. The to said services. The acceptance by the cli signed agreement between ARI and the
Date & Time:		9	Date & Time	0	JH C	10004		100	1 10		
Company:			Company:			70		C	7	AZ OC C	
Printed Name:		ne:	Printed Nam	Who	$\frac{1}{1}$			10	D Ru	DAVI	
(Signature)			(Signature)			WWW	(Signature)	)		(Signature)	
			Belinguiche				Renalved hv.		2	Relinquished by:	Comments/Special Instructions
							*	-			
					2 2 2						
	X	X	×	X		×	-	4	515	E	MW30AN - CAD402
	X	X	×	$\times$	×		2	- <b>-</b>		97.53 <u>/2</u> .espinyte	CMP15-090402
	×	X	X	×	X		-		1015	A ST DIVERSITE	MW36-090402
	X	$\times$	X	$\times$		X		Water	555	412/09	CMPY-OTA Ogoyoz
	PC B 808	BEHP 82.70	NwTPH Diesel Vsilic	CPAH 82.70	Total COLOB, (AS, Pb	Total 6010B, (As,	No. Containers	Matrix	Time	Date	Sample ID
	s 2	، د	1D + 01 a cle	's < si	Meta 1602 d Sb, CI	Meta 1602 Pb)	Ict	AMY T	RUGH /	Samplers:	Client Project #: 08006 4
Notes/Comments		Requested	Analysiga	M	its a r, c.u.	15 0	FMP	GW O	hase	ect - P	Southwest Harber Prox
206-695-6200 206-695-6201 (fax)			ps:	Tem	N; )	No. o					Chip Goodhue
4611 South 134th Place, Suite 100 Tukwila, WA 98168			ient?	lce Pres	1/2007	Date	26	180 93	Phone:	てつ	ARI Client Company: Aspect Consulting
Analytical Resources, Incorporated Analytical Chemists and Consultants			١	of		Page	\.=		requested:	Turn-around I STし	ARI Assigned Number:

en de serve

۰.

.≇**\***\$ Chain of Custody Record & Laboratory Analysis Request

- 2

A state of the sta



## CHIPI ODCACI

GROUN	DWATER	SAMPLING F	RECORD			WELL NUN	IBER: CM	P-1		Page: 1 of 1
Project N	ame: SOUTI	WEST HARBO	R PROJECT	- Phase II	GCWMP	Project Nun	nber: 0800	64		
Date:	<u>9 1410 °</u>		-			Starting Wa	iter Level (f	t TOC):	2.10	
Develope	d by: <u>DFR/A</u> a Daint of M/					Casing Stic	kup (ft) <u>:</u>	-0.29	}	
Screened	Interval (ff		7 0-17 0			Casing Diar	(π TOC <u>):</u> neter (inch	16.85	)	
Filter Pac	k Interval (ft.	тос)	5.0-19.0			Casing Diar		<u>م</u>	•	
Casing V	Jume 2,	75 (ft Wate	r) y ().()	2 (Infv	$\gamma(ant) = 2$	33 (L)(na	al)			
Casing vo	olumes: 2" =	• 0.16 gpf	4" = 0.65 qr	of e	3" = 1.47 apf	(=//90			Sample Int	ake Depth (ft TOC): ~12 ft
	2" =	= 0.62 Lpf	4" = 2.46 Lj	of 6	6" = 5.56 Lpf					· · · ·
PURGIN	IG MEASL	JREMENTS								
Time	Cumul. Vol (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	Turbidity (NTU)	Comments
0819	0	350	13.10	~			a.	····		NOU ALIO 451
0277	11 6 13	a construction of the second s	13.11	13.01	536	1.06	6.27	23 4	10.1	Princel Last
09.7 5	716		13.11	12.99	521	0.11	1. 21	10.2	754	radiua
02.12	5100		12 11	1305	5	1.62	10 2 5	010	142	HEARCE
0721	11200	<u>↓ ↓</u>	12 1	12.0		0.00	10-7-0	2.0	N-10	
0001	9200	, r	12.1	19.00		<u> </u>	967		0.48	
					·		· · ·	· ·	<u> </u>	<u> </u>
		· · · ·			·			<u> </u>		
	ļ				ļ					
-										
								· · · · · ·		
Total Gallo	ons Purged:	n-(1.0	5 U   C	<u>Y ()</u>	_	Total Casing	L I Volumes F	L Removed:	1.94	ρ
Endina Wa	ater Level (ft	TOC):	3日 -			Ending Total	l Denth (ft 1	OC): 16.85	5	
					······································		- Dopar (it i	00). 10.00	,	
JAIVIFLE				Quantity	Eiltrotion	Proconvotion	Anno			Domorko
-	Volume	Donie Type		Quantity	Fillation	Fleseivation	Appea	Turbidity &		Remarks
NG20	·						Color	Sediment		
100.202	1L	HPDE		1	none	HNO3	near	enery:	Total Metal	s - As, Pb
	100000L	Amber glass		2	none	none		1	DCP-	
	500ml			2	none	none	1			
	500mL	Amber glass		~ ~ ~						
<u>V</u>	SUUML	Amberglass			none	IKUTE		~y	Bis(2-ethyl i	nexyi) phinalate
									<u> </u>	
METHO									L,	
			Denter III -		N	)				
Sampling t	quipment a	10 IDS:	Peristaltic P	ump and YS	51 556 #_165					
Purging Ec	uipment:	Peristaltic Pun	np w/ dedica	ted tubing		Decon Equi	pment:	Alconox, D	istilled Wate	er
Disposal o	f Discharged	Water:	Stored in 1,0	000 gallon t	emporary onsite	e storage tanl	<u>k</u>			
Observatio	ns/Commen	ts:								
										···· · · · ·
									· · ·	



CMP2.	-D909D2
-------	---------

2

GROUN	IDWATER	SAMPLING F	RECORD			WELL NUN	IBER: CM	P-2		Page: 1 of 1
Project N	ame: SOUTH	HWEST HARBO	R PROJECT	- Phase II	GCWMP	Project Nur	nber: 0800	64		
Date:	12109	,,,,,,,	-			Starting Wa	iter Level (f	1 TOC <u>):</u>	13.60'	
Measurin	a by: <u>DER/A</u> 2 Point of W/					Total Depth	(ft TOC):	-0.28	} ≥	]
Screened	Interval (ft. 1	гос)	7.0-17.0			Casing Diar	neter (inche	3 2	) }	(
Filter Pac	k Interval (ft.	TOC)	5.0-19.0			L÷				
Casing Ve	olume 3.	7 (ft Wate	r) x O, Q	2. (Lpfv	(qpf) = 2.2	A (L)(ga	al)			
Casing vo	lumes: 2" =	0.16 gpf	4" = 0.65 g	of (	6" = 1.47 gpf				Sample Int	ake Depth (ft TOC): ~12 ft
	2" =	0.62 Lpf	<u>4" = 2.46 L</u>	of (	3" = 5.56 Lpf					
Time		Burge Rate	Motor	Tomp	Specific	Dissolved	- <u></u>	Eb	Turbidity	Commente
	(gal or ()	(gpm or Lpm) m Lpm	Level (ft)	(Øor F)	Conductance (µS/cm)	Oxygen (mg/L)	pri	ORP (mv)	(NTU)	Comments
०४८३	O	480	13.60					e		NTU THN YSI
0856	1 44	480	13.59	16.28	1685	.35	8.40	170.4	0.87	except lad reacting
0859	2.28	480	13.62	16.23	1662	.27	8.43	159.2	0.48	
0907	4.32	480	13.59	16.19	1669	24	8.42	1489	1.31	
+ 1- 6-		1				<u> </u>				
				,				1		
			1							
								·		
· · .										
-			-						1	
								· · · ·		
Total Gallo	ons Purged:	n LI,	S Li	CrS		Total Casing	Volumes F	Removed:	1.97	·
	Ŭ		<u>ca</u>	~~~	_		,			
Ending Wa	ater Level (ft	TOC):7>	-9-1			Ending Total	l Depth (ft T	OC): 17.3		
SAMPLE		DRY								
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Remarks
							Color	Turbidity &		
0905	11	HPDE		1	none		class	Securieric	Totol Motol	α Δα Dh
	500ml			י י	none	nano		1		5-76, FD
		Amber class		2		none			CPAHS	
_		Amber glass		2	none	none			PCBS	
	500mL	Amber glass		2	none	none			TPH- DX	
•	500mL	Amber glass		2	none	none		·9	Bis(2-ethyl	hexyl) phthalate
		:								
WETHOI	18					_				
Sampling I	Equipment ar	nd IDs:	Peristaltic P	ump and Y	SI 556 # 12	0				
Purging Ec	uipment:	Peristaltic Pun	np w/ dedica	ted tubing		Decon Equi	pment:	Alconox, D	istilled Wate	or
Disposal o	f Discharged	Water:	Stored in 1,0	)00 gallon t	emp <u>orary onsite</u>	e storage tanl	k			
Ohservatio	ns/Comment	ts:								
C NOOI VallU	no comment									
										· · · · · · · · · · · · · · · · · · ·
·										



#### CMP3.090903

ļ

GROUN	DWATER	SAMPLING F	RECORD			WELL NUN	IBER: CM	 P-3		Page: 1 of 1
Project N	mę: SOUTH	WEST HARBO	R PROJECT	- Phase II	GCWMP	Project Num	nber: 08000	54		
Date:	113/09		_			Starting Wa	iter Level (fl	t TOC <u>):</u>	8.45	
Develope	d by: <u>DFR/AT</u>	[		<u> </u>	<u>-</u>	Casing Stick	kup (ft):	-0.37	,	
Measuring	Interval (8		60.160	<u> </u>		Fotal Depth	(ft TOC <u>):</u>	15.84		
Filter Pack	interval (n. 7 c Interval (ft		4 0-17 5		,	Casing Diar	neter (Inche	32	<u> </u>	
		39 (4)	$\rightarrow$ $0 [0]$	9 0-6	V-0-11 (	5.9	. 15			
Casing vo Casing vo	lumes: 2" =	$\frac{2}{16}$ (n wate	4'' = 0.65  or	<u>t</u> (Lprv	)(gpt) = <u> </u>	<u>-20</u> (L)(ga	u)		Sample Int	ake Depth (ft TOC): ~11 ft
Caoing 10	2" =	0.62 Lpf	4" = 2.46 Lt	of (	5" = 5.56 Lpf				oampie ina	ake Deptil (it 100). «11 it
PURGIN	IG MEASU	REMENTS								
Time	Cumul. Vol.	Purge Rate	Water	Temp.	Specific	Dissolved	pH	Eh	Turbidity	Comments
	(galorL)   ≻⊲ (	(gpm or Lpm) ドロンロショ	Level (ft)	(CorF)	Conductance (uS/cm)	Oxygen (mg/L)		ORP (mv)	(NTU)	
0845	Ô	400m	8.45			· · · ·	-		-	NTU THIN 451
$\mathcal{P}_{\mathcal{S}}^{(1)}[Z]$	1200	400mL	8.45	18.76	685	0.82	9.97	169	19.8	evie of last
0251	2+ <u>1</u> 6 <b>0</b>	400	8.2 10	19.58	597	0.183	10.03	139.9	11.D	
08511	3600	400	8.48	19.77	205	0,40	10.01	124.8	5.3	
								•		
							1			
										·
		<u> </u>								
										<del></del>
			·							<u> </u>
fotal Gallo	ns Purged:	4-1	<u></u>		_	Total Casing	FVolumes F	Removed:	0.81	
- Endina Wa	iter Level (ft "	toci S	12			Ending Total	Denth (ff T	CC): 15.84		
								007. 10.04	· · · · · · · · · · · · · · · · · · ·	
Time	Volume	Botile Type		Ouantity	Filtration	Preservation	Annea	rance		Remarks
T III IIC	volume	Dome Type		Guanny	1 110 80011	r reactivation		Turbidity &		Nemarka
0000							Color	Sediment		
0100	<u>1L</u>	HPDE		1	none	HNO3	PLOYE	1120 1	Total Metals	s - As, Pb
	500mL	Amber glass		2	none	none	j		cPAHs	
	1L	Amber glass		2	none	none		7	PCBs	
	500mL	Amber glass		2	none	none			TPH- DX (w	//silica gel cleanup)
₩.	500mL	Amber glass		2	none	none	Vr.	V.	Bis(2-ethyl I	nexyl) phthalate
							,			
VETHOD	)S				<u> </u>		I		<u>.</u>	······································
Sampling E	quipment an	d IDs:	Peristaltic P	ump and Y	SI 556 # 12.0	<u>)                                    </u>	•			
Purgina Ea	uipment:	Peristaltic Pun	np w/ dedica	ted tubina		Decon Equi	pment:	Alconox. D	istilled Wate	er
Disposal of	Discharged	Water:	Stored in 1.0	)00 gallon t	emporary onsife	e storage tan	k			·
			0.0100.01.11	<u>yanor</u>	- porary onald		N			
Observatio	ns/Comment	s:								



# CMPIL 090904

Project N	NDWATER	SAMPLING F	RECORD			WELL NUM	BER: CM	P-4		Page: 1 of 1
	Name: SOUTH	IWEST HARBOI	R PROJECT	- Phase II	GCWMP	Project Num	iber: 0800	64		····································
Date:	<u>913/09</u>					Starting Wa	ter Level (fi	TOC):	1.0	
Develope	ed by: <u>DFR/A</u> an Boint of We				<u> </u>	Casing Stick	(up (ft) <u>:</u>	-0.32	2	
Screener	d Interval (ff. 1		70-170			Casing Dian	(π TOC <u>):</u> oter (inche	<u>1</u>	/	]
Filter Par	ck Interval (ft.	тос)	5.0-17.5			Casing Dian		·	•	
Casing V	/olume <u>5</u> ?	19(ft Wate	r) x <u>() . (</u>	2(L.pfv	)(gpf) = <u>3</u> , -	<u>}  </u> (L)(ga	}			
Casing v	olumes: 2" = 2" =	0.16 gpf 0.62 Lpf	4" = 0.65 gp 4" = 2.46 Lt	of E	5" = 1.47 gpf 5" = 5.56 Lpf				Sample Int	ake Depth (ft TOC): ~12 ft
PURGI	NG MEASU	REMENTS								
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рĤ	Eh ORP (mv)	Turbidity (NTU)	Comments
0934	0	400	10.01	*****			×			NTD the Stat
0937	1200	400	11.06	16.81	789	0.25	9,92	38.9	6.96	THE REPORT
ngun	2400	Lino	11.05	1697	1226	0.21	\$ 9 h	201	762	
<u>5 ( 10</u> 2942	21.00	400	11 00	MAR		019	912	79 1	276	· · · · · · · · · · · · · · · · · · ·
<u>, ()</u>	12000		<u> </u>	14.62		0.()	012		12.42	· · ·
					<u>.</u>				<u> </u>	
		 							``	
								~~~~~	<u></u>	<b></b>
							-	-	!	
									· · · · · · ·	
										· · · ·
			1 Liles		i					· · · · · · · · · · · · · · · · · · ·
otal Gall	ions Purged:	~!	-1 Citer	<		Total Casing	Volumes F	temoved:	1.08	· · · · · · · · · · · · · · · · · · ·
otal Gali	ions Purged: /ater Level (ft	~ /	1 (ite) 11.05	<	i	Total Casing	Volumes F Depth (ft T	Removed: OC): 17.0	_1.08	· · · · · · · · · · · · · · · · · · ·
otal Gali Inding W	ions Purged: /ater Level (ft E INVENTC		1 (ite) 11.05	< <u></u>	i	Total Casing	Volumes F Depth (ft T	Removed: OC): 17.0	1.08	·
otal Gali Inding W SAMPL	lons Purged: /ater Level (ft E INVENTC Volume		1 (ite) 11.05	Quantity	- Filtration	Total Casing Ending Total Preservation	Volumes F Depth (ft T Appea	emoved: OC): 17.0 rance	_1.08	Remarks
otal Gall Inding W SAMPL	lons Purged: /ater Level (ft E INVENTC Volume	TOC): DRY Bottle Type	<u>1 (140)</u> 11.05	Quantity	- Filtration	Total Casing Ending Total Preservation	Volumes F Depth (ft T Appea	Removed: OC): 17.0 rance Turbidity &	1.08	Remarks
fotal Gall Ending W SAMPLI Time	lons Purged: /ater Level (ft E INVENTC Volume	TOC): DRY Bottle Type	-1 Litev _11.05	Quantity	- Filtration	Total Casing Ending Total Preservation	Volumes F Depth (ft T Appea Color	Removed: OC): 17.0 rrance Turbidity & Sediment	1.08	Remarks
iotal Gall Inding W SAMPL Time	lons Purged: /ater Level (ft E INVENTC Volume	TOC):	-1 (1:105	Quantity	Filtration	Total Casing Ending Total Preservation	Volumes F Depth (ft T Appea Color	Removed: OC): 17.0 rrance Turbidity & Sediment	1.05	Remarks
fotal Gall Ending W SAMPL Time	Ions Purged: /ater Level (ft E INVENTC Volume 1L	TOC): DRY Bottle Type HPDE Amber glass	-1 (140) -11.05	Quantity 1 2	Filtration	Total Casing Ending Total Preservation HNO3 none	Volumes F Depth (ft T Appea Color	Removed: OC): 17.0 rrance Turbidity & Sediment	1.08 Total Metals cPAHs	Remarks - As, Pb
fotal Gall Ending W SAMPL Time	lons Purged: /ater Level (ft E INVENTC Volume 1L 500mL 1L	TOC):	-1 (iiki 11.05	Quantity 1 2 2	Filtration none none none	Total Casing Ending Total Preservation HNO3 none none	Volumes F Depth (ft T Appea Color	temoved: OC): 17.0 Irance Turbidity & Sediment	1.08 Total Metals cPAHs PCBs	Remarks
fotal Gall Ending W SAMPL Time	Ions Purged: /ater Level (ft E INVENTC Volume 1L 500mL 1L 500mL	TOC): DRY Bottle Type HPDE Amber glass Amber glass Amber glass	-1 (iiic) _(1.05	Quantity 1 2 2 2	Filtration none none none none none	Total Casing Ending Total Preservation HNO3 none none none	Volumes F Depth (ft T Appea Color	Removed: OC): 17.0 Introduction Turbidity & Sediment	Total Metals cPAHs PCBs TPH- DX (w	Remarks - As, Pb /silica gel cleanup)
iotal Gall Ending W SAMPL Time	Ions Purged: /ater Level (ft E INVENTC Volume 1L 500mL 500mL 500mL	TOC): DRY Bottle Type HPDE Amber glass Amber glass Amber glass Amber glass	-1 (iiic) 11.05	Quantity 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Filtration none none none none none	Total Casing Ending Total Preservation HNO3 none none none none	Volumes F Depth (ft T Appea Color	Removed: OC): 17.0 rrance Turbidity & Sediment	Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethyl I	Remarks - As, Pb /silica gel cleanup)
iotal Gall inding W SAMPL Time	Ions Purged: /ater Level (ft E INVENTC Volume 1L 500mL 500mL 500mL	TOC):	-1 (iiic) (1.05	Quantity 1 2 2 2 2	Filtration none none none none none	Total Casing Ending Total Preservation HNO3 none none none none	Volumes F Depth (ft T Appea Color	temoved: OC): 17.0 Irance Turbidity & Sediment	Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethyl I	Remarks As, Pb /silica gel cleanup)
fotal Gall Ending W SAMPL Time	Ions Purged: /ater Level (ft E INVENTC Volume 1L 500mL 1L 500mL 500mL	TOC): DRY Bottle Type HPDE Amber glass Amber glass Amber glass Amber glass	1.05	Quantity 1 2 2 2 2 2	Filtration none none none none none	Total Casing Ending Total Preservation HNO3 none none none	Volumes F Depth (ft T Appea Color	Removed: OC): 17.0 rance Turbidity & Sediment	Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethyl I	Remarks - As, Pb /silica gel cleanup) nexyl) phthalate
fotal Gall Ending W SAMPL Time	Ions Purged: /ater Level (ft E INVENTC Volume 1L 500mL 500mL 500mL DS	TOC): DRY Bottle Type HPDE Amber glass Amber glass Amber glass Amber glass		Quantity 1 2 2 2 2 2	Filtration none none none none none	Total Casing Ending Total Preservation HNO3 none none none	Volumes F Depth (ft T Appea Color	Removed: OC): 17.0 rance Turbidity & Sediment	Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethyl )	Remarks s - As, Pb /silica gel cleanup) hexyl) phthalate
fotal Gall Ending W SAMPL Time	Ions Purged: /ater Level (ft E INVENTO Volume 1L 500mL 500mL 500mL DS Equipment an	TOC): DRY Bottle Type HPDE Amber glass Amber glass Amber glass Amber glass Amber glass Amber glass	Peristaltic Per	Quantity 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Filtration none none none none none SI 556 # 12.	Total Casing Ending Total Preservation HNO3 none none none	Volumes F Depth (ft T Appea Color	Removed: OC): 17.0 Irance Turbidity & Sediment	Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethyl h	Remarks
iotal Gall Inding W SAMPL Time	Ions Purged: /ater Level (ft E INVENTO Volume 1L 500mL 1L 500mL 500mL DS Equipment an quipment:	TOC): DRY Bottle Type HPDE Amber glass Amber glass Amber glass Amber glass Amber glass Amber glass Amber glass	-1 (1.05	Quantity 1 2 2 2 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4	Filtration none none none none none SI 556 # \2 C	Total Casing Ending Total Preservation HNO3 none none none none Decon Equip	Volumes F Depth (ft T Appea Color	Removed: OC): 17.0 rance Turbidity & Sediment	1.08 Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethyl )	Remarks
fotal Gall inding W SAMPL Time ) 9 ( {5 1 1 1 1 1 1 1 1 1 1 1 1 1	Ions Purged: /ater Level (ft E INVENTC Volume 1L 500mL 1L 500mL 500mL DS Equipment an quipment: of Discharged	TOC): DRY Bottle Type HPDE Amber glass Amber glass Amber glass Amber glass Amber glass d IDs: Peristaltic Pum Water:	Peristaltic Properties	Quantity 1 2 2 2 2 2 ump and YS ted tubing 000 gallon te	Filtration  Filtration  none  none  none  SI 556 # 12.C	Total Casing Ending Total Preservation HNO3 none none none Decon Equip	Volumes F Depth (ft T Appea Color	Removed: OC): 17.0 rrance Turbidity & Sediment	Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethy) I	Remarks
iotal Gall Ending W SAMPL Time	Ions Purged: /ater Level (ft E INVENTC Volume 1L 500mL 1L 500mL 500mL 500mL DS Equipment an quipment: of Discharged ons/Comment	TOC): DRY Bottle Type HPDE Amber glass Amber glass Amber glass Amber glass Amber glass d IDs: Peristaltic Purr Water: s:	Peristaltic Properties of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second	Quantity 1 2 2 2 2 ump and YS ted tubing 100 gallon te	Filtration  Filtration  none  none  none  none  SI 556 # \2 C	Total Casing Ending Total Preservation HNO3 none none none Decon Equip	Volumes F	Removed: OC): 17.0 rrance Turbidity & Sediment	1,0%	Remarks
iotal Gall inding W SAMPL Time ) C (C ) 1ETHO ampling urging En isposal c bservatio	Ions Purged: /ater Level (ft E INVENTC Volume 1L 500mL 500mL 500mL 500mL DS Equipment an quipment: of Discharged ons/Comment	TOC): DRY Bottle Type HPDE Amber glass Amber glass Amber glass Amber glass Amber glass d IDs: Peristaltic Pum Water: s:	Peristaltic Po pw/ dedicar Stored in 1,0	Quantity 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Filtration  Filtration  none  none  none  SI 556 # \2 C	Total Casing Ending Total Preservation HNO3 none none none none Decon Equip storage tank	Volumes F	Removed: OC): 17.0 rance Turbidity & Sediment	1,0%	Remarks



CMP5-090902

-

GROUN	IDWATER	SAMPLING F	RECORD		. –	WELL NUN	IBER: CM	P-5		i	Page:1 of 1	
Project N	ame: SOUTH	WEST HARBO	R PROJECT	- Phase II	GCWMP	Project Nun	ber: 0800	64				
Date:	4/2/01		-			Starting Wa	ter Level (f	t TOC <u>):</u>	10.12			
Develope	d by: <u>DFR/AI</u>					Casing Stick	(up (ft):	-0.2	7			
Screened	Interval (ft T		5 5-15 5			Casing Diar	(π TOG <u>):</u> neter (inche	15.	1			
Filter Pac	k Interval (ft.	TOC)	3.0-19.0		<u> </u>	Casing Dial		·				
Casing Vo	olume U	지원 (ft Wate	nx 0.6	2 (Lpfv	(apt) = 3	09 (1)(08	в					
Casing vo	olumes: 2" =	0.16 gpf	4" = 0.65 gp	of 6	5" = 1.47 gpf		.,		Sample Int	take Depth (f	ft TOC): ~10.5 ft	
	2"=	0.62 Lpf	4" = 2.46 Lp	of 6	6" = 5.56 Lpf							
PURGIN		REMENTS						<u></u>	<u>`</u>			
1 ime	(gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	(NTU)		Comments	
1229	0	450	10.12			r-	P~~		and the second	NTU	Invo 451	
1237	1200	400	10.39	1774	509	0.78	6.05	-65.9	200		<u></u>	
1220	2400	375	10.64	1739	500	0.57	6.09	- 881	5.7			
1238	<u> </u>	375	10.70	16.84	509	0.44	6.05	-94.2	6.98		-	
	- <b> </b>					-						
		<u> </u>										
									1			
								·				
									<u> </u>			
			- 						<u> </u>			
				•								
				·,								
											·	
;												
·												
Total Gallo	ons Purged:	700		5	-	Total Casing	Volumes F	Removed:	1.29	i <u></u>		
Ending Wa	eter Level (ft '	TOC):	10.70	F		Ending Total	Denth (ft 1	OC): 15.1				
		)RY					Deptif (It I	00, 10.1				
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Annes	arance		Rem	arks	<u> </u>
	, on and	Dotte Type		Quantity		1 10301 121011	Color	Turbidity & Sediment	1	Ken		
1240	1L	HPDE		1	none	HNO3	1001	nowe	Total Metal	s - As, Pb		
1	500mL	Amber glass		2	none	none	[		cPAHs			
	1L	Amber glass		2	none	none			PCBs			
	500mL	Amber glass		2	none	none		<u> </u>	TPH- DX (w	v/silica gel cli	eanup)	
4	500mL	Amber glass		2	none	none	1	1	Bis(2-ethvl	hexyl) ohthal	ate	
		~										
METHÓI	DS						<u>_</u> I		1			
Sampling E	Equipment an	d IDs:	Peristaltic P	ump and YS	SI 556# 17 C	·						
Purging Ec	uipment:	Peristaltic Pun	np w/ dedica	ted tubina		Decon Equi	oment:	Alconox. D	istilled Wate	ег. Эг		-
Disposal o	f Discharged	Water:	Stored in 1,0	)00 gallon ti	emporary onsit	e storage tanl	(					*
Observatio	ins/Comment	s:									·	_
												_



# CMP15-090903

GROUN	DWATER	SAMPLING F	RECORD			WELL NUM	BER: CM	P-15		Page: 1 of 1
Project Na	ame: SOUTH	WEST HARBOI	R PROJECT	- Phase II	GCWMP	Project Num	nber: 08000	64		
Date:	913100	<u>]</u>	-			Starting Wa	ter Level (fl	:TOC <u>): </u> ])	), ; ( ]	
Developed	d by: <u>DFR/A</u> Deint of M/a				<u> </u>	Casing Stick	kup (ft) <u>:</u>	-0.29	}	
Screened	Interval (ft - 7	- <u></u>	7 0-17 0			Casing Dian	(it 100 <u>).</u> neter (inche	17.00	>	
Filter Pack	k Interval (ft.	TOC)	4.0-17.4	···				, <u> </u>	•	
Casing Vo	Jume 69	1 (ft Wate	nx () . (0)	/ (Infv	$L_{\rm L}$	28 (1)(na	a)			
Casing vo	lumes: 2" =	0.16 gpf	4" = 0.65 gr	of (	5" = 1.47 gpf	(=)(94			Sample Inte	ake Depth (ft TOC): ~12 ft
PURGIN	2" = IG MEASL	0.62 Lpf	4" = 2.46 L	of (	3" = 5.56 Lpf			. <u> </u>		
Time	Cumul, Vol.	Purge Rate	Water	Temp	Specific	Dissolved	Ha	Eh	Turbidity	Comments
	(gal or L)	(gpm or Lpm)	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)	P	ORP (mv)	(NTU)	
1113	<u>v</u>	350	10.14	-		-st - 1		-	<b>~</b>	NTU througs
1116	1050	_ 350	10.22	15.95	3911	0.32	01:17	- 114.7	1.92	except LOST
1119	2100	350	10.24	15.96	3706	0.34	7.60	-114.7	1.50	scoding a
1122	3150	350	1074	15.97	3542	0.36	6.25	3.5	178	
								1		· ·
					<u> </u>					
	·			· ·						
					1					
(										
Total Gallo	ons Purged:		((e)	<u> </u>		Total Casing	Volumes F	Removed:	0.93	3
C			n.24			The state of The fact	Denth (1)	001.47.0	_	
		100): <u> </u>				Ending I otai	υερτη (π. ι	00): 17.05	<u> </u>	
Time		Boffle Type		Quantity	Filtration	Preservation	Annos	pronce		Remarke
T III C	Volume	Dome Type		Quantity	1 110 20011	1 Teservation	Calar	Turbidity &		Remains
1125	1L .	HPDE		1	rione	HNO3		Sediment		s - As. Pb. Sb. Cr. Cu. Ni
1.	500ml	Amber glass		2	none	none	}	· · · · · ·	CPAHs	
	1	Amber place		2 	none	none		<del> </del>	PCBe	
	500ml	Amber glass		2	none	none				visilies ast classus)
	SOUTHL	Ambergiass		2	none	none				vsinca ger cleanup)
	500mL	Amper glass		2	none	none		-7	Bis(2-ethyl i	nexyl) phthalate
				····	· · · ·				<u> </u>	
METHOD	<u></u>								L	
Sampling E	Jo Equipment ar	nd IDs:	Peristaltic P	ump and YS	si 556 # 12	0				
Purging Ea	uipment:	Peristaltic Pun	np w/ dedica	ted tubing		Decon Equi	pment:	Alconox, D	istilled Wate	ег
Disposal of	f Discharged	Water:	Stored in 1,0	000 gallon t	emporary onsite	<u>e storage tanl</u>	<u>k</u>			
Observatio	ns/Comment	s:							<u> </u>	
					· · · ·		-			



### CMP17.090907.

GROU	JNDWATER	SAMPLING I	RECORD			WELL NUM	IBER: CM	P-17		Page: 1 of 1
Project	Name: SOUTH	WEST HARBO	R PROJECT	- Phase II	GCWMP	Project Num	nber: 0800	64		
Date:	-12109		-			Starting Wa	ter Level (f	tTOC <u>): </u>	1.50'	[
Develo	ped by: <u>DFR/AT</u>	<u> </u>				Casing Stick	<up (ft):<="" td=""><td>-0.17</td><td></td><td>  </td></up>	-0.17		
Measu	ang Point of We		60160			Total Depth	(ft FOG <u>):</u>	16.21	1	
Filter P	eu interval (it. i ack interval (it	100 <u>)</u> TOCI	4 0.16 5				neter (inche	<u>د م</u>		
Coging		(# Wata	(0.10)	7. 1.00	Vanti - L		n			
Casing	volumes: $2'' =$	0.16 gpf	4" = 0.65 gr	<u> </u>	)(gpi) = <u>(</u> )" = 1.47 gpf	<u> </u>	")		Sample Int	ake Depth (ft TOC): 14 ft
PURG	ING MEASL	JREMENTS	4 = 2.46 L	<u>, , , , , , , , , , , , , , , , , , , </u>	) = 5.56 LPI_					
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance	Dissolved Oxygen	рН	Eh ORP	Turbidity (NTU)	Comments
1020	द्रां ठ	600	9.50	,	(μο/cill) 	(mgritt)	·		<u> </u>	NMIN AT SUSTICE
1025	2 15:00	500	9.58	17 52	699	0.67	5.89	174.2	8123	with the lookely
100	1 2000	\$.00	010	19.22	1000	0.20	100	2000	0.00	Land a Charles and the second
	1 1000	500	9 60	17.10	<u> </u>	0.21	0 02	11 - 21	11.00	
1050	1 1,00	500	-1.55	1-1-96	541	0.34	5.03	115.23	41.54	· · · · · · · · · · · · · · · · · · ·
						ļ		ļ		
							[			
					<u>_</u>					
		1								
		•							] 	· · · · · · · · · · · · · · · · · · ·
					·					
		11 C 2	$\frac{1}{2}$		<u></u>		Į		1 05	2
Total G	allons Purged:		or proc		_	Total Casing	Volumes F	Removed:	100	<u>}</u>
Ending	Water Level (ft	TOC):	62			Ending Total	l Depth (ft T	OC): 16.2 <sup>4</sup>	1	
SAMP		DRY							·	· · · · · · · · · · · · · · · · · · ·
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Remarks
				·			Color	Turbidity &	1	
1410							100	Sediment		
10-10		HPDE		1	none	HNO3	ULLO V	NONP	⊺otal Metal	s - As, Pb
	500mL	Amber glass		2	none	none			cPAHs	
	-1L	Amber glass		2	none	none		<b>_</b> _	PCBs	
	500mL	Amber glass		2	none	none			TPH- DX (v	v/silica gel cleanup)
$\downarrow$	500mL	Amber glass		2	none	none		<u>_</u>	Bis(2-ethyl	hexyl) phthalate
•7	40mL	VOA vial		3	none	нсі	1	Ť	Chlorinated	Ethanes and Ethenes (CEEs)
METH	ODS									
Samplin	g Equipment ar	nd IDs:	Dedicated G	ED Well W	izard Bladder	Pump and YS	556 #   2	0		
Purging	Equipment:	Dedicated QE	D Well Wiza	urd Bladder	Pump	Decon Equi	ipment:	Alconox, D	istilled Wate	er
Disposa	l of Discharged	Water:	Stored in 1,0	000 gallon te	emporary onsit	e storage tan	k			
Oha	tional Comment									
ODSERVA	wons/comment									
		<u></u>								

ł



# TM105-090902 + 10005-0909722

3

GROUN	IDWATER	SAMPLING F	RECORD			WELL NUM	BER: FM-	105		Page: 1 of 1
Project N	ame: SOUTH	WEST HARBOI	ROJECT	- Phase II	GCWMP	Project Num	ber: 08006	64		
Date:	4/2/0	9	-			Starting Wat	ter Level (ft	тос): ј	1.36	
Develope	a by: <u>DFR/AT</u> a Boint of Ma	тос		·	<u></u>	Casing Stick	(up (ft):	-0.2		
Screened	y roint of VVe Interval /fr ⊤	0C)	7.0-17.0		<u></u>	Casing Dian	(it i OG <u>):</u> neter (inche	. <u></u>	·	—
Filter Pac	k Interval (ft.	TOC)	6.0-17.5		••••			·		
Casing Vo	olume (e.	(1) (ft Wate	r) x 0.4	2 (Lpfv	)(gpf) = L	12 (L)(ga	l)			
Casing vo	olumes: 2" =	0.16 gpf	4" = 0.65 gj	0f 6	" = 1.47 gpf		-		Sample Int	ake Depth (ft TOC): 15 ft
	2" =	0.62 Lpf	4" = 2.46 L	ot 6	6" = 5.56 Lpf					
PURGIN		REIVIEN 15	Mator	Tomp	Chapifia	Dissolved		E%	Turbiditu	Commonto
Inne	(gal or L)	furge Rate (gpm or Lpm) かしりれ	Level (ft)	(C or F)	Conductance	Oxygen (mg/L)	рп	ORP (mv)	(NTU)	Gomments
2.27	0	500	11.36							10TU -1/1004151
1:25	1500	500	11.42	1447	520	0.81	5 C 6	108.3	6.89	
1108	3000	500	11.40	1211	512	0.69	594	109.8	1.14	
1111	4900	500	1.39	1995	518	0.52	5.25	10.7	3.64	
-		-								
		i	<u> </u>		+					
·	1									······································
					·····					
	<b>├───</b>							<del></del>		
					L			L	L	
Total Galle	ons Purged:	- 25	LUCIC	<u>ر</u>	_	Total Casing	Volumes F	Removed:	1.21	
Ending 144	atar love /# -		1.39			Ending Tot-1	Dooth /4 7	001-10		
			· · · · · · · · · · · · · · · · · · ·			LINGING TO(a)	Deptii (It 1	001.10		
		Bottle Tune		Quantity	Filtration	Preservation	Annes	rance		Remarks
11116	voluitie	Dome type		Guantity	i nu auoti	i reacivation		Turbidity &		i verneti ko
111-							Color	Sediment		
1115	1L	HPDE		2	none	HNO3	<u>dens</u>	<u>e ses</u>	Total Metal	s - As, Pb
<u></u>	500mL	Amber glass		4	none	none	1		cPAHs	
	1L	Amber glass		4	none	none			PCBs	
	500mL	Amber glass		4	none	none			TPH- DX (v	v/silica gel cleanup)
	500mL	Amber glass		4	none	none			Bis(2-ethyl	hexyl) phthalate
. <u>}</u>	40mL	VOA vial		6	none	нсі	.J-	.17	Chlorinated	Ethanes and Ethenes (CEEs)
1120	e duptin	ne								
METHO	DS					r	'			
Sampling I	Equipment an	d IDs:	Dedicated C	ED Well W	izard Bladder F	<sup>p</sup> ump and YS	1 556 # 1	1.0		
Purging Ed	quipment:	Dedicated QE	D Well Wiza	rd Bladder	Pump	Decon Equi	pment:	<u>Alcon</u> ox, D	istilled Wate	<del></del>
Disposal o	f Discharged	Water:	Stored in 1,	000 gallon to	emporary onsite	e storage tanl	k .			
Observatir	ns/Comment	s:								
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Conord ort -		d for dunli-	oto comela						
	Second set o	n Dotties Collecte	su ior aupile	ate sample					· · · · · · · · · · · · · · · · · · ·	



#### MW262-090903 1 WIW262-090903D

GROUN	DWATER	SAMPLING F	RECORD			WELL NUN	IBER: I	MW-	26R		- <del></del>	Page: 1 of 1
Project N	ame: SOUTH	WEST HARBO	R PROJECT	- Phase II	GCWMP	Project Nun	nber; 08	3006	4		· · · · · · · · · · · · · · · · · · ·	
Date:	91510	<u> </u>	-			Starting Wa	ter Leve	el (ft	TOC <u>):                                    </u>	109		
Develope	a by: <u>DER/A</u> a Point of W/				<u></u>	Total Denth	κυρ (π) <u>:</u> .( <del>11</del> τος	·)·	-0.32			
Screened	interval (ft. 1		6.5-16.5			Casing Diar	neter (ir	nche	2			
Filter Pac	k Interval (ft.	TOC)	4.0-17.0				•					
Casing Ve	olume <u>7</u>	. <u>36_</u> (ft Wate	r) x_0.4	<u>, 2 (L</u> pfv	)(gpf) =;	<u>56 (L)(ga</u>	al)					
Casing vo	olumes: 2" =	0.16 gpf	4" = 0.65 g	of e	6" = 1.47 gpf					Sample Int	ake Depth	(ft TOC): ~ 11.5 ft
PURCH		0.62 Lpt	<u>4" = 2.46 Lj</u>	of 6	6" = 5.56 Lpf			<del></del>				
Time		Purge Rate	Mater	Temp	Specific	Dissolved			 Fh	Turbidity		Comments
	(gal or L)	(gpm or Lpm) <u>mlpm</u>	Level (ft)	(C or F)	Conductance (µS/cm)	Oxygen (mg/L)			ORP (mv)	(NTU)		
1335	0	400	9.69	d	•		-				NU	1mn 151
1338	1200	4100	9.18	15.14	1165	0.2.0	1931	1	20.2	S.47	eye o	Last -
1341	2400	400	9.78	15.79	1117	0.17	<b>n</b> .::	1	710.	2.10		
1344	3600	400	9.78	15,112	1043	0.15	1. t	4	-30.5	1.91		
	/											
				·								
												· · · · · · · · · · · · · · · · · · ·
										<b>.</b> .		· · · ·
								-				
			<u>.</u>		· · · · · · · · · · · · · · · · · · ·	·						
								$\rightarrow$				-
	L	L					L				2	
Total Galle	ons Purged:		UIC	د.	_	Total Casing	3 Volum	es R	emoved:	0.82	<u> </u>	
Ending Wa	ater Level (ft	тос):	7 <u>8                                    </u>			Ending Tota	l Depth	(ft TC	DC): 17.05			
SAMPLE		DRY	•	· · ·								
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Ap	pear	rance		Re	marks
							Colo	r	Turbidity &			
1390	11	HPDE		2	none		rtont	、  ,	ADIAD	Total Motal		Sh Cr Cu Ni
1	500ml	Amber aloce		<u>_</u>	none	none			1	^D∆∐a	ט - רא ד א, ד. ש,	
	11	Amber alace		4	1010	0000		-+				
	500ml	Amber glass				none	┟╼╍╍┽				ulailian ani	
	500ml	Amber class		4	none	none					wsiiica gei	oleanup)
	SUUINL	Amber glass		4		none		+	••	DIS(Z-Ethyl	nexy() phtr	າສາສເບ
1200	duck	000						-+				
	DS	11/2				· •	L	1				
Somelina	Fauipmont or	nd IDe:	Paristalija P	ump and V	31 556 # 17 0							
oampillig I Duraina Ei	uinment af	Doristoliis Dur		tod tubice	# [ <i>[/</i> ]	Decen Form	inmont			infilled Wet		
raiging E0 Dianaari	f Diashanna '	<u>renstattic PUR</u>					ipment:		NICOHOX, D	ISUIEU VVAL	<u>ei</u>	
Disposal o	T Discharged	vvater:	Stored in 1,0	JUU gallon t	emporary onsite	e storage tan	К					
Observatio	ons/Commen	ts:			<b></b> .							
	Second set	of bottles collecte	ed for duplic	ate sample								



#### mw36.090903

	DWATER	SAMPLING F	RECORD			WELL NUM	IBER: MW	-36		Page: 1 of 1
Project N	ame: SOUTH	WEST HARBO	R PROJECT	- Phase II	GCWMP	Project Num	ber: 0800	64		
Date:	9/30	-	-			Starting Wa	ter Level (fl	:TOC <u>):</u>	1.72	
Develope	ed by: <u>DFR/AI</u> a Boint of Ma	TOC				Casing Stici	(up (ft) <u>;</u>	-0.23	<u>,</u>	
Screeneo	g Forni of We Linterval (ft. T	, <u>100                                   </u>	58.0-73.0			Casing Dian	(it 100 <u>):</u> neter (inche	2	) 	[
Filter Pa	k Interval (ft.	тос)	55.0-71.0							
Casing V	olume (Ø :	3.28 (ft Wate	r) x 0.4	2 (Lpfv	(apf) = 39	23(L)(ga	Ð			
Casing v	olumes: 2" =	0.16 gpf	4" = 0.65 gr	of 6	5" = 1.47 gpf	(7,0	,		Sample Intr	ake Depth (ft TOC): ~ 65.5 ft
	2" =	0.62 Lpf	4" = 2.46 Ly	of 6	6" = 5.56 Lpf					
PURGI		REMENTS	1 147 7							
Time	(gal or L)	(gpm or Lpm)	Vvater Level (ft)	(C or F)	Conductance	Oxygen (mg/L)	рн	En ORP (mv)	(NTU)	Comments
1035	D	350	9.32	~	1.0		\$**	F	ø	NEW Brown to Bert
1037.	1050	350	9.74	14.11	3810	0.19	8.89	.93.9	1.84	a verse ( 19 contraction of the second
1010	2100	350	9 27	12 91.	2712	DIG	901	-1053	1112	Vendina
10171	2:50	160	9-21	12 07	280	0.12	028	-1101-	102	
10 14.9		3-7-0	1.19	12.01	1016	<u></u>	6.40	$\Pi \oplus \varphi$	1.0.2	
	<u> </u>					1				·
	<u> </u>									
				-						
							· · -			
	<u> </u>									· · · · · ·
					[					
									Į	
									·	
									· · · · · · · · · · · · · · · · · · ·	
Fotal Gall	ons Purged'	- 3	Suite			Total Casino	Volumes F	amoved:	0.00	
Fotal Gall	ons Purged:		SUILE	ـــــــــــــــــــــــــــــــــــــ		Total Casing	Volumes F	Removed:	0.00	
otal Gall	ons Purged: ater Level (ft	3 3 TOC):	5012e	13		Total Casing	Volumes F	Removed: TOC): 73	0.00	
Fotal Gall Ending W SAMPL	ons Purged: ater Level (ft E INVENTO	3 3 TOC): DRY	.5 Lize 1.7 Y	۱¢,		Total Casing Ending Total	Volumes F Depth (ft 1	Removed: 'OC): 73	0.00	
Fotal Gall Ending W SAMPL Time	ons Purged: ater Level (ft E INVENTC Volume	TOC):	<u>.5 Uir</u> 1.3 Y	۲ کې Quantity		Total Casing Ending Total Preservation	Volumes F Depth (ft 1	Removed: TOC): 73	0.00	Remarks
Fotal Gall Ending W SAMPL Time	ons Purged: ater Level (ft E INVENTO Volume	TOC):	.5 (i i e 1.3 4	Quantity		Total Casing Ending Total Preservation	Volumes F Depth (ft 1 Appea Color	Removed: TCC): 73	0.00	Remarks
Fotal Gall Ending W SAMPL Time	ons Purged: ater Level (ft E INVENTC Volume	TOC): PRY Bottle Type	.5 (i i e 1.7 4	Quantity	Filtration	Total Casing Ending Total Preservation	Volumes F Depth (ft 1 Appea Color	Removed: TOC): 73 Turbidity & Sediment	0.00	Remarks
Fotal Gall Ending W SAMPL Time	ons Purged: ater Level (ft E INVENTO Volume	TOC): TOC): DRY Bottle Type HPDE	.5 Uile 1.7 Y	۲۹ Quantity	Filtration	Total Casing Ending Total Preservation HNO3	Volumes F Depth (ft T Apper Color ((eo y	Removed: OC): 73 arance Turbidity & Sediment	0.0°	Remarks s - As, Pb, Sb, Cr, Çu, Ni
Fotal Gall Ending W SAMPL Time	ons Purged: ater Level (ft E INVENTC Volume 1L 500mL	TOC):	5040 1.34	Quantity	Filtration	Total Casing Ending Total Preservation HNO3 none	Volumes F Depth (ft T Appea Color	Removed: OC): 73 arance Turbidity & Sediment POMP	0.0°	Remarks s - As, Pb, Sb, Cr, Cu, Ni
Fotal Gall Ending W SAMPL Time	ons Purged: ater Level (ft E INVENTO Volume 1L 500mL 1L	TOC):	.5 (i)e	Quantity 1 2 2	Filtration none none none	Total Casing Ending Total Preservation HNO3 none none	Volumes F Depth (ft 1 Appez Color ( (eo y	Removed: COC): 73 Trance Turbidity & Sediment	O.O.C.	Remarks s - As, Pb, Sb, Cr, Cu, Ni
Fotal Gall Ending W SAMPL Time	ons Purged: ater Level (ff E INVENTO Volume 1L 500mL 1L	TOC): TOC): PRY Bottle Type HPDE Amber glass Amber glass Amber glass	.5 (ise	Quantity 1 2 2 2	Filtration none none none none	Total Casing Ending Total Preservation HNO3 none none none	Volumes F Depth (ft 1 Appez Color (	Removed: TOC): 73 arance Turbidity & Sediment	O.O.C. Total Metals cPAHs PCBs TPH- DX (w	Remarks s - As, Pb, Sb, Cr, Cu, Ni //silica gel cleanup)
Fotal Gall Ending W SAMPL Time	ons Purged: ater Level (ft E INVENTC Volume 1L 500mL 500mL 500mL	TOC):	.5 Uize	Quantity 1 2 2 2 2 2	Filtration none none none none none	Total Casing Ending Total Preservation HNO3 none none none none	Volumes F Depth (ft 1 Appea Color (Leo y	Removed: OC): 73 arance Turbidity & Sediment NDMC	O O O O O O O O O O O O O O O O O O O	Remarks s - As, Pb, Sb, Cr, Cu, Ni //silica gel cleanup) nexyl) phthalate
Fotal Gall Ending W SAMPL Time	ons Purged: ater Level (ft E INVENTC Volume 1L 500mL 500mL 500mL	TOC):	5 Uire 1.3 Y	Quantity 1 2 2 2 2	Filtration none none none none none	Total Casing Ending Total Preservation HNO3 none none none none	Volumes F Depth (ft T Appea Color ((eoy	Removed: OC): 73 arance Turbidity & Sediment NOME	O.O Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethyl I	Remarks s - As, Pb, Sb, Cr, Cu, Ni //silica gel cleanup) hexyl) phthalate
Fotal Gall Ending W SAMPL Time	ons Purged: ater Level (ft E INVENTC Volume 1L 500mL 500mL	TOC):	.5 (i)e	Quantity 1 2 2 2 2	Filtration none none none none	Total Casing Ending Total Preservation HNO3 none none none none	Volumes F Depth (ft T Appez Color (	Removed: OC): 73 Turbidity & Sediment 1	O . O ∽ Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethyl	Remarks s - As, Pb, Sb, Cr, Cu, Ni //silica gel cleanup) nexyl) phthalate
Fotal Gall Ending W SAMPL Time	ons Purged: ater Level (ft E INVENTO Volume 1L 500mL 1L 500mL 500mL	TOC):	-5 (i)e	Quantity 1 2 2 2 2	Filtration none none none none	Total Casing Ending Total Preservation HNO3 none none none none	Volumes F Depth (ft 1 Appez Color ( ( e o y	Removed: COC): 73 Trance Turbidity & Sediment 1000	O . O ↔ Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethyl I	Remarks s - As, Pb, Sb, Cr, Cu, Ni //silica gel cleanup) nexyl) phthalate
Fotal Gall Ending W SAMPL Time 10ς () 	ons Purged: ater Level (ft E INVENTO Volume 1L 500mL 1L 500mL 500mL 500mL	TOC):	SUILC 1.34	Quantity 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Filtration Filtration none none none none SI 556 # 120	Total Casing Ending Total Preservation HNO3 none none none none	Volumes F Depth (ft T Appea Color ((eo y	Removed: OC): 73 Arance Turbidity & Sediment NOMC	O O O Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethyl I	Remarks s - As, Pb, Sb, Cr, Cu, Ni //silica gel cleanup) nexyl) phthalate
Fotal Gall Ending W SAMPL Time 105(7)	ons Purged: ater Level (ft E INVENTC Volume 1L 500mL 500mL 500mL 500mL 500mL	TOC):	S Uite	Quantity Quantity 1 2 2 2 2 2 2 2 2 4 2 2 2 2 2 2 2 2 2 2	Filtration Filtration none none none none SI 556 # 120	Total Casing Ending Total Preservation HNO3 none none none none Decon Equi	Volumes F Depth (ft T Appea Color (Leoy	Removed: OC): 73 arance Turbidity & Sediment NUMP	O O O O O O O O O O O O O O O O O O O	Remarks s - As, Pb, Sb, Cr, Cu, Ni //silica gel cleanup) nexyl) phthalate
Fotal Gall Ending W SAMPL Time 10C() / / / / / / / / / / / / / / / / / / /	ons Purged: ater Level (ft E INVENTC Volume 1L 500mL 1L 500mL 500mL 500mL 500mL 500mL	TOC):	Peristaltic P np w/ dedica Stored in 1.0	Quantity Quantity 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Filtration Filtration none none none none SI 556 # 120 emporary onsit	Total Casing Ending Total Preservation HNO3 none none none none none none storage tan	Volumes F Depth (ft T Appea Color ((eoy	Removed: OC): 73 arance Turbidity & Sediment POME	O . O ↔ Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethyl I	Remarks s - As, Pb, Sb, Cr, Cu, Ni //silica gel cleanup) hexyl) phthalate
Fotal Gall Ending W SAMPL Time 10ζ() VETHO ampling 'urging E )isposal c	ons Purged: ater Level (ft E INVENTC Volume 1L 500mL 500mL 500mL 500mL 500mL 500mL 500mL	TOC):	Peristaltic P np w/ dedica	Quantity Quantity 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Filtration Filtration none none none SI 556 # 120	Total Casing Ending Total Preservation HNO3 none none none none Decon Equi	Volumes F Depth (ft 1 Appea Color ((eoy	Removed: OC): 73 Turbidity & Sediment 100-0 1	O . O ∽ Total Metals cPAHs PCBs TPH- DX (w Bis(2-ethyl I	Remarks s - As, Pb, Sb, Cr, Cu, Ni //silica gel cleanup) nexy() phthalate
Fotal Gall Ending W SAMPL Time 10ς() / / / / / / / / / / / / / / / / // //	ons Purged: ater Level (ft E INVENTO Volume 1L 500mL 1L 500mL 500mL 500mL 500mL 500mL 500mL 500mL 500mL	TOC):	Peristaltic P np w/ dedica Stored in 1,0	Quantity Quantity 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Filtration Filtration none none none SI 556 # 120	Total Casing Ending Total Preservation HNO3 none none none none Decon Equi e storage tan	Volumes F Depth (ft T Appez Color (Leo y	Removed: OC): 73 arance Turbidity & Sediment NUMC	O O O O O O O O O O O O O O O O O O O	Remarks s - As, Pb, Sb, Cr, Cu, Ni //silica gel cleanup) nexy() phthalate



# MW241-090903

GROUNDWATER SAMPLING RECORD							WELL NUMBER: MW-44 Page: 1 of 1						
Project Name: SOUTHWEST HARBOR PROJECT - Phase II GCWMP						Project Number: 080064							
Date:						Starting Water Level (ft TOC): 11. L(							
Measuring Point of We TOC							Total Depth (ft TOC): 73.9						
Screened Interval (ft. TOC) n/a							Casing Diameter (inche2						
Filter Pack Interval (ft. TOC) <u>n/a</u>							<u></u> 」						
Casing Vo	lume <u>しし</u>	.나비 (ft Wate	r) x <u>U. Ø</u>	L (Lpfv	)(gpf) = <u>_ くど</u>	<u>  [</u> (L)(ga	l)						
Casing vol	Sample Intake Depth (ft TOC): ~ 68 ft												
PURGIN	G MEASU	REMENTS	1_2.10 -		0.00 Epi								
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lpm) mup m	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	Turbidity (NTU)		Comments		
1411	0	400	11.46	•						NTI	) Times '	15!	
1414	1200	400	1151	14.40	207	4.19	6.92	1.1	11,3	2700	12 and	<del>; ``</del>	
14/3	24100	400	11.50	14.22	90	4.10	6.73	13.8	9.27	10	adines		
1420	3 GOO	400	11.50	14.12	38	396	0.72	310	6.00		C		
1423	4800	400	1.50	14.06	~ 36*	3.85	5.86	15.4	4.63	* SD.1	OF C WAL	icilio	
1126	6000	100	11.50	1407	27	3.84	5.84	80.1	3.26	5.04	Ner 1 55	anel	
	·								<i>, , , ,</i>	- 1			
				•									
		ľ											
Total Gallo	ns Purged:	~ (0	Liter	5	_	Total Casing	Volumes F	Removed:	0.15				
<b>F</b> - <b>P</b> - 142	(] / (ft =		160			<b>F</b> - <b>P</b> - <b>T</b> - <b>f</b> - <b>f</b>	Denth (0.7						
Ending Wa	ter Level (ft	10C):i				Ending Total	Depth (ft 1	OC): 73.9				-	
		Quantity		Filtration	Brocornation	Annooronoo		Demoriza					
Time	volume	bottle Type		Quantity	Fintration	Preservation	Appea	Turbidity &	Remarks				
11120							COIDT	Sediment					
1450	1L	HPDE		1	none	HNO3	3 CORCE DONE Tota		Total Metals	otal Metals - As, Pb, Sb, Cr, Cu, Ni			
	500mL	Amber glass		2	none	none			<u>cPAHs</u>	<del></del>			
	<u>1L</u>	Amber glass		2	none	none			PCBs				
	500mL	Amber glass		2	none	none			TPH- DX (w/silica gel cleanup)				
/	500mL	Amber glass		2	none	none	<u></u>	~//	Bis(2-ethyl	hexyl) phtl	nalate		
		I											
		d IDar	Doriatelija D	uman and M									
Gampling E Burging E-	uinment an	Doriotaltia Dur		tod tubine		Decon Cari	nmont	Alagaan					
-urging Eq	upment:	Penstanic Puñ	np w/ dedica			Decon Equi	pment:	аколох, D	istilied vvate	<u> </u>		—	
usposal of	Discharged	vvater:	Stored in 1,0	iou gallon te	emporary onsite	e storage tan	ĸ						
Observatio	ns/Comment	s:											
						<u> </u>					· · · · ·		
GROUN	IDWATER	SAMPLING F	₹ECORD			WELL NUM	ABER: MW	/-125		Page: 1 of 1			
------------------------------	--	----------------------------	----------------------------	--	--	--	--	--	--	--			
Project N	ame: SOUTH	WEST HARBOF	R PROJECT	- Phase II (	GCWMP	Project Num	nber: 0800/	64					
Date:	1/2/04		•		i	Starting Wa	ter Level (ff	(TOC): =	7.01				
Develope	d by: DFR/AI	<u> </u>				Casing Stick	KUP (ft):	-1.11					
Accened	J POINt OI vve Unterval (ft. 7	rnei	5.0-15.0		i	Casing Diar	(It TOU) meter (inch:	<u> </u>	,				
Filter Pac	k Interval (ft.	TOC)	3.0- <u>15.0</u>		I								
Casing V	olume (p	34 (ft Wate		7 (LOF)	A(anfl = 3.9	13 (L)(ar	)						
Casing vc	olumes: 2" =	0.16 gpf	4" = 0.65 gr	of 6	ت: = 1.47 gpf	······································	''		Sample Int	ake Depth (ft TOC): <u>13 ft</u>			
	2" =	0.62 Lpf	4" = 2.46 Lr	<u>,)f 6</u>	j" = 5.56 Lpf					· ·			
PURGIN	IG MEASU	REMENTS						_	_				
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductance	Dissolved Oxygen	рН	Eh ORP	Turbidity (NTU)	Comments			
0951	0	500 1	17.01							Alto Little			
DACH	16n0	ma	122	1974	100	LINU	ray	mail	1742	AMAN IMPLY JUS			
1001	12000	50-1	12.21	10 22	Liah	In au	Lagy	109.4	1.25	LEWAS WAST			
<u>ノーマー</u> 1 <b>ハ</b> ハハ	11000	500	1719	1922	11910	IngC	2.17	120.2	1.22	YEARENO			
10000	14300	1-600	1-1 - 1	1100	1.100	10.02	12 au	ا می منزع   این الهرمز قر	1724				
1005	10000	500	1.60	19.5	<u>  ~1 + &gt; _  </u>	0.0.21	<u>  &gt;. ~ ~  </u>	1150.21	401				
	<b> '</b>	<b> </b>	<b>├</b> ──── <sup>!</sup>	<b>⊢</b> '	<u> </u> '	<u> </u> '	<b> '</b>	<b> '</b>	<b> '</b>	<u> </u>			
	<u> </u> !	<b> </b>	<b>با</b>	<u>                                     </u>	<b>↓</b> ′	<b>└───</b> ′	<b> '</b>	<b> </b> '	<u> </u>	<b></b>			
	<b> </b> '	<b> </b>	<b>ا</b>	<del>ا</del> '	<b>↓</b> !	t'	<b> '</b>	<b>↓'</b>	<b> '</b>				
	ļ′	ļļ	<b>└────</b> ┘	<u>ا</u>	<b>↓</b> ′	<b>└───</b> ′	<b> </b> '	<b>↓</b> '	<b>↓</b> '	<b> </b>			
	لـــــــــــــــــــــــــــــــــــــ	<b>  </b>	<b>└────</b> ┘	<u>ا</u>	<b> </b> !	t'	<u>                                     </u>	<b>└───'</b>	<u> '</u>	ļ			
	<u>نــــــــــــــــــــــــــــــــــــ</u>	<b> </b>	µ]	<u>ا</u>	<u>                                     </u>	<u>ا</u>	<b> </b> '	<u> </u> '	<b>└──</b> ′	ļ			
	<b>↓</b> !		·1	<u> </u>	ļ!	Į	<b>└──</b> ′	<u>                                     </u>	<b>↓</b> '	l			
	ļ!		I	<u> </u>	L/	<u>ا</u> ــــــــــا	<u>                                     </u>	ļ′	<u>                                     </u>	ļ			
	<u>اا</u>		L]	<u>ا</u>	I!	L	<u>         '</u>	Ļ'	<u>                                     </u>	ļ			
				)	I	J	<u> </u>	<u> </u>	<u> </u>	<u> </u>			
otal Gallo	ons Purged:	<b>2 2 3 4</b>	e Lile	+ 5	_	Total Casing	J Volumes F	Removed:	1.53	<u>s                                    </u>			
indina W	ator i evel (ft	тось Э.	20			Ending Tota'	I Deoth (ft 7	FOC)+ 13.3E	-				
		<u></u>					Dopt.						
Time	Volume	Bottle Type	, <del></del>	Quantity	Filtration	Preservation		erance	[	Remarks			
• • • • • •			.	1		1	Color	Turbidity &	1	1 Williams			
- 26	<b> </b>	F	·	·	<del> </del>			Sediment	t				
<u>, CUU ,</u> M	<u> 1∟</u>	HPDE		<u></u>	none	HNO3	PONP	cloar 1	Total Metair	s - As, Pb			
<u> </u>	500mL	Amber glass		2	none	none	<b>⊢                                    </b>		cPAHs				
'	<sup>1L</sup>	Amber glass	. <u> </u>	2	none	none	┟──┼──┤	<u> </u>	PCBs				
'	500mL	Amber glass		2	none	none	$\vdash \vdash \downarrow$		<u>ТРН- DX (v</u>	v/silica gel cleanup)			
- <u>+</u> _'	500mL	Amber glass		2	none	none	<u> </u> ]		Bis(2-ethyl	hexyl) phthalate			
- ₩	40mL	VOA vial		3	none	HCI			Chlorinated	Ethanes and Ethenes (CEE			

Dedicated QED Well Wizard Bladder Pump Decon Equipment: Alconox, Distilled Water

Disposal of Discharged Water:	Stored in 1,000 gallon temporary onsite storage tank
Obconvetione/Commonte-	•

Observations/Comments: \_\_\_\_

Purging Equipment:



# MW308N-090904

•

İ

GROUN	DWATER	SAMPLING F	RECORD			WELL NUM	IBER: MW	-308N		Page: 1 of 1
Project Na	ame: SOUTH	WEST HARBOI	R PROJECT	- Phase II	GCWMP	Project Num	iber: 08000	34		
Date:	9/1/00	1 •	-			Starting Wa	ter Level (fl	<u>ى :(</u> TOC	.60	
Measuring	a by: <u>DFR/A1</u> 1 Point of We	TOC				Total Denth	(up (π) <u>:</u> (ff TOC) <sup>,</sup>	-0.29		<u> </u>
Screened	Interval (ft. T	000)	12.5-17.5			Casing Dian	neter (inche	2 2		
Filter Pack	c Interval (ft.	тос)	10.0-21.5					· · ·		
Casing Vo	olume,	<u> (</u> ft Wate	r) x <u>D , Lo</u>	<u>2_</u> (Lpfv	ل، [ = (gpf)(	0(L)(ga	l)			
Casing vo	lumes: 2" = 2" =	0.16 gpf 0.62 Lpf	4" = 0.65 gp 4" = 2.46 Lp	of 6 of 6	5" = 1,47 gpf 5" = 5,56 Lpf				Sample Int	ake Depth (ft TOC): <u>~15 ft</u>
PURGIN	IG MEASU	REMENTS							<u>.</u> .	
Time	Cumul. Vol. (gal or L)	Purge Rate (gpm or Lpm) M (DM	Water Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рH	Eh ORP (mv)	Turbidity (NTU)	Comments
0909	0	400	6.50		·	۳.	<b>-</b>	<b>4</b>		NOTO INSTATIS!
0917	1200	150	8.00	15.19	2723	0.73	6.40	111.62	6.79	etherd Loudt
0915	501	ged -			والمعهدة والمستشفة والت	All All Marco and American American	*****	ويرافى المراجع والمحافظ والمحافظ والمحافظ		reaching
· ·		¥							<u>`</u> ->	surged and purged
0920	~2400	150	8.60	•—		<b>***</b>		~~~		to attempt to
0923	2.850		850	16.26	3065	0.51	6.40	-124.4	15.0	clear seveen
0926	3300		8.62	16.31	2754	0.24	6.41	-124.2	10.7	
0429	3250	~	8.70	16.38	2539	2.23	6.52	-127.1	9.24	bucichili arowin
0932	41200	Ś.	8.72	16.34	2909	0.7%	6.55	+2:1.9	11.2:	inside cating
•										
1										
Total Gallo	ons Purged:	~ 2/20	20 m.C		_	Total Casing	Volumes F	Removed:	0.59	
Ending Wa	ter i evel (ft i	TOCH: S	72			Ending Total	Denth (ft T	OC): 17 95	i	
SAMPLE		)			······		Baptin (it i	00): 11:00		
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Remarks
							Color	Turbidity &		
0935	1L	HPDE		1	none	HNO3	dea r	hone	Total Metal	s - As, Pb
1	500mL	Amber glass		2	none	none	1	1	cPAHs	
	1L	Amber glass		2	none	none			PCBs	
	500mL	Amber glass		2	none	none			TPH- DX (v	v/silica gel cleanup)
V.	500mL	Amber glass		2	none	none	¥	Ŷ	Bis(2-ethyl	hexyl) phthalate
·										
METHOD	DS									
Sampling E	Equipment an	d IDs:	Peristaltic P	ump and YS	SI 556 # 17 (	)				
Purging Eq	uipment:	Peristaltic Pun	np w/ dedica	ted tubing		Decon Equi	pment:	Alconox, D	istilled Wate	er
Disposal of	f Discharged	Water:	Stored in 1,0	000 gallon t	emporary onsite	e storage tanl	k			
Observatio	ns/Comment	s:								
										_
										··· · · · · · · · · · · · · · · · · ·



# mw3085.090904

GROUN	IDWATER	SAMPLING F	RECORD			WELL NUN	BER: MW	-308S			Page: 1 of 1	
Project Na	ame: SOUT	HWEST HARBO	R PROJECT	- Phase II	GCWMP	Project Num	nber: 08000	34		····		
Date:	9/4/0	<u>4</u>	-			Starting Wa	ter Level (fl	; TOC <u>):</u> (	s,I쿡			
Develope	d by: <u>DFR/A</u> Point of W				<del></del>	Casing Stick	(up (ft) <u>:</u>	-0.61				
Screened	Interval (ff.	TOC)	35.0-40.0			Casing Diar	(n. 100 <u>).</u> nefer (inche	40.5				
Filter Pac	k Interval (ft	. TOC)	31.0-40.0		<u>.</u>							
Casing Vo	blume 30	1.33 (ft Wate	nx 0.0	2_ (Lpfv	(qpf) = 2.1	.2.8 (L)(ga	D					
Casing vo	lumes: 2" :	= 0.16 gpf	4" = 0.65 gr	of 6	" = 1.47 gpf		'		Sample Inte	ake Depth	(ft TOC): ~ 37.5 ft	
	2"	= 0.62 Lpf	4" = 2.46 Lp	of f	" = 5.56 Lpf							
PURGIN	IG MEAS	UREMENTS		···								
Time	Cumul. Vo (gal or L)	(gpm or Lpm)	VVater Level (ft)	Temp. (C or F)	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	рН	Eh ORP (mv)	(NTU)		Comments	
1022	0	250	6.17	-					·	DED	Thursday	
1025	750	}	6.	1401	1520	2.10	7.3		350	S Vec	1 Car	
1028	1500		10.67	14.69	1537	0.13	N.09	129,2	5.19		N. A. A. A. A. A. A. A. A. A. A. A. A. A.	
1021	2250		6.68	14.49	1541	9.11	1.08	135.2	1.51			
						,						
											······································	
-		·										
				-		1						
<u>a</u>												
						<u>  · · · · · · · · · · · · · · · · · · ·</u>					· · · · · · · · · · · · · · · · · · ·	
<b></b>								<u> </u>				
												<u></u>
						<u> </u>	- <i>-</i>					
Total Calla	no Duraodi	~ 7	Gliky	<	- 11	Total Capina		Jomeurodu	10 17		aut 5	
Total Galic	nis Fulgeu.	<i>L</i> _	$\frac{1}{1.0}$		-	rutai Gasing	VUIUITIES F	tennoveu.	0.12	· · · · · ·		
Ending Wa	ater Level (fi	t TOC):	4.40			Ending Total	Depth (ft T	OC): 40.5				
SAMPLE		ORY										
Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appea	arance		Re	marks	
			E				Color	Turbidity & Sediment				
1025	1L	HPDE		1	none	HNO3	doar	NOV	Total Metals	s - As Ph		
	500mL	Amber glass		2	none	none	1	1	cPAHs			
	1L	Amber class		· 2	none	none		11 m	PCBs			
	500ml	Amber glass	·	····· 2	none	none	1	1		/silice nel	cleanun)	
1	500ml	Amber alsee		<u> </u>	1000	none	r		Bie/2. ofby	namua yel	oloanup/	
	SOUTHE	Ambor gidaa		Z	וואנים					iekyi) pitu		
METHO	DS			<u></u> .							<u> </u>	
Sampling F	- - 	ind IDs:	Peristaltic P	umn and V	SI 556 # 17 0	)						
Purning Eq	uinment:	Peristalfic Pur	n w/ dedica	ted tubing		∠ Decon Equi	nment:	Alconov D	ietilled Wate			-
Diepoeal of	F Diecharaer	1 Water:	Stored in 1.0				ршень <u>—</u>		ionieu vvale	a		-
usposal O	ronarget			ioo gallon (	sinporary orisi	e storage tan	`	·· ·				-
Observatio	ns/Commer	nts:										
												_

•

Chain of Stody Recon	d & Labo	ratory An	alysis F	equest								$\supset$
ARI Assigned Number;	Turn-around	Requested:	9		Date:	012	03	7				Analytical Resources, Incorporated
ARI Client Company	C LLC	Phone:	200 120 120 120 120 120 120 120 120 120	9310	Page:	an ulan Philo bay	o			V		4611 South 134th Place, Suite 100 Tukwila WA 98168
Client Contact: (いい しっつくれいを	~				No. of Coolers:	\$\$.)	Cooler Temps: 1	5715 - 2720		,		206-695-6200 206-695-6201 (fax)
Client Project Name:				C 1.17 1.40				nalysis Req	uested	1		Notes/Comments
	Samplers:		Ar 4 +	0	(१त २७१/ ऽ.२१	ा <u>र</u> इ.	UNIS .	d 1011 V 1011 2011	م ر	2		
Sample ID	Date	Time	Matrix	No. Containers	15107 13007 14117	978 978	0178	14 2721 145217 145217	128	808 304		
Cmp2-690902	9/2/09	0405	3	6	$\times$			×	$\times$			
RIW125-090902	ه بعد بوهو ر	5001	<b>.</b>	(s) 	. The second second	×	7	$\geq$	×	x		
206060 . tiduo	Les de Rose, and	0h01		7	$\times$	×	7	×				
Fmics - 090902	a managera	511		12	>	×	<u>کر</u>	$\succ$	×	×		
D 206060-201114		0211		2	×	$\times$	×	×	X	×		
CM7P5-090902	1	1240		<u>C</u>	$\times$		$\succ$	¥	×	$\searrow$		
												5
										- -		
									<u> </u>			
Comments/Special Instructions	Relinqushed by:	K		Received by: , , (Signature)		-	<u> </u>	elinquished by: signature)	-		<u>а с</u>	sceived by: ignature)
		TICP		Printed Name:			<u>a</u>	inted Name:				inted Name:
	Company	410		Company:	۰. س		ŏ	ompany:			0	ompany:
		9 13610	10	Date & Time:			ă	ate & Time:				ate & Time:
Limits of Liability: ARI will perform al	ll requested se	rvices in accor	dance with a	opropriate met	hodology fo	llowing ARI	l Standard	Operating F	rocedure	s and the A	RI Quality	Assurance Program. This program

,

ŝ,

 $\left( \right)$ 

meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Involced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alernate retention schedules have been established by work-order or contract. 

-----

Chain of Pustody Record	d & Labo	ratory Ar	alysis <b>F</b>	equest	C							, O
ARI Assigned)fber:	Tum-around	Requested:	¢		Date:	9/2/10	5				Analyt Analyt	ical Resources, Incorporate
ARI Client Company: AS DECT / DMSM/H	50 L	Phone:			Page:	-1.4 (Fr. 4	ď	2			4611 S	outh 134th Place, Suite 100 and 2015
Client Confract: Child Colid h W.C.	<u> </u>				No. of Coolers:		Cooler Temps:			)	206-69	95-6200 206-695-6201 (fax
Client Project Name:				1			A	nalysis Rec	quested			Notes/Comments
Client Project # Client Project # [5<(X))c <sup>2</sup> [	Sámplers:		<u>200 / 191</u> 258	0-	5P) 1950 19130 1913	2)'4 0750 0150	Luiso	и еду) (10) Уста	<b>)</b> :			
Sample ID	Date	Time	Matrix	No. Containers	1'51) 120129 1120129	N MO N MO N MO N MO N MO N MO N MO N MO	0±78	105300	$\frac{1}{23}$	1808 59 M		
CMP3.090913	9/3/09	0060	Anste A	ى	×		$\geq$	- <sup>3</sup>	>			
CMP4-096903	4,725 Adjint,	5460		0-	×		$\times$		X			-
(mp15-090903	. skila ný pratý Pitate	5711		0		$\times$	~	×	×			
mw262-090903		1350		5		×	7	×	~			
mw262-09090	.u.\$4,477479 Xf	1395	di bala da Langai Ve	6		$\times$	$\times$	×				
MW41-090903	Lanciation	1430	مرتبا استعطروا والمراجع	e		×			×			
MW36-090903	~>	1050	->>	5	5	$\times$	X	X	×	×		
i i												
	Dollarender 10											
Comments/special instructions	(Signature)	11	;	Keceived by: (Signature)	NVV		Ē. 0)	elinquished by: ignature)			Received by (Signature)	
	Printed Name:	11:00		Printed Name:	Wen M	Ulum	₫ 	inted Name:			Printed Nan	1e:
	Company: J	-t-		Company:	d		Ŭ	ompany:			Company:	
	Date & Time: $\mathcal{O} / \mathcal{B} / \mathcal{C}$	151	2	Date & Time:	9 C	5		ate & Time:			Date & Tim	
Limits of Liability: ARI will perform all	l requested se	rvices in acco.	rdance with a	opropriate mei	thodology fo	ilowing AR	Standard	Operating I	rocedure	s and the AR	I Quality Assure	ance Program. This program

meres summance for une moustry. The total liability of AHI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alernate retention schedules have been established by work-order or contract.

ARI Assigned Nurfiber.	Turn-around	Desired.				•	ł		ļ				
	5 T				nate:	5	5					Analytical Resources	, Incorporate
ASPECT CONSULTING L	-ic	Phone: 2.01	o. 780.	\$310	Page:	# 400,000	٥f	-7 Plan				Analyucal Chemists ( 4611 South 134th Pl: Tukwila WA 98168	ace, Suite 100
Client contact: Chip OCCAPUR					No, of Coolers:	1	Cooler Temps: }	d di	<u>r</u> (1)	ſ		206-695-6200 206-	695-6201 (fax
Client Project Name:	$0 \sim 10^{\circ}$			6			<	nalysis Re	quested			Notes/C	comments
$\frac{1}{2} \frac{1}{2} \frac{1}$		PS R	- <u>2</u>	2	0) 139 19 N	(); (); (); (); (); ();	uis	1912 1912 1914	ົ			2 	
Sample ID	Date	Time	Matrix	No. Containers	11/31/) 11/801/20 11/12/01	15 97 5V 19 19009 19 19009	20128 20128 511142	111110 111110 111110 111100	0128 11130	7 303 5821			
cmp1-091904	9/11/04	0535	A at WM	<b></b>	X			×	×				
MW-208N-U90904		0935		0	$\times$		X		×	×			
mw3085-090904	~	1035	÷	۵	X		X	×	X	×			
									<u> </u>				
											İ		
Commonts/Conscient Instants	Delionushod burd												
	(Signature)	とし	(	(Signature)	)		й Ø	elinquished by ignature)			<u>ਜ ਨੇ</u>	ceived by: ignature)	
	Printed Name:	1110	0	Printed Name:		4160	<u>د</u>	inted Name:				inted Name:	:
	<sup>Company</sup> s ∫ S ()	در۲		Company:	~		ŏ	ompany:			0	impany:	r r
		6	135	Date & Time:	(*) 		<u>لطّ</u>	ate & Time:				te & Time;	

sald services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alernate retention schedules have been established by work-order or contract.

APPENDIX E DATA VALIDATION REPORT AND CERTIFICATES OF ANALYSIS

DATA VALIDATION REPORT PYRON ENVIRONMENTAL, INC. HART CROWSER, INC.

# **Data Validation Report**

# Port of Seattle, Southwest Harbor Phase II Groundwater Quality Confirmation Monitoring June 2010 Sampling

# Laboratory SDG Numbers:

# QY97, QZ16, & QZ41

Prepared for:

Hart Crowser, Inc. 1700 Westlake Avenue North, Suite 200 Seattle, Washington 98109-6212

Prepared by:

**Pyron Environmental, Inc.** 3530 32<sup>nd</sup> Way NW Olympia, WA 98502

July 15, 2010

# ACRONYMS

%D	percent difference
%D <sub>f</sub>	percent drift
%R	percent recovery
%RSD	percent relative standard deviation
AMU	atomic mass unit
ARI	Analytical Resources, Inc.
BFB	Bromofluorobenzene
ССВ	continuing calibration blank
CCV	continuing calibration verification
CF	calibration factor
CLP	U.S. EPA Contract Laboratory Program
сос	chain-of-custody
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
DFTPP	Decafluorotriphenylphosphine
ECD	electron capture detector
EPA	U.S. Environmental Protection Agency
FID	flame ionization detector
GC/MS	gas chromatograph/mass spectrometer
ICAL	initial calibration
ICB	initial calibration blank
ICP/MS	inductively coupled plasma/ mass spectrometer
ICS	ICP interference check sample
ICV	initial calibration verification
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
μg/L	microgram per liter
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NFGs	CLP National Functional Guidelines for Data Review (EPA 1999 – Organics; EPA 2004 - Inorganics)
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls

QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
RF	response factor
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
SIM	selective ion monitoring
SVOCs	semi-volatile organic compounds
ТРН	total petroleum hydrocarbon
VOCs	volatile organic compounds

# INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for samples collected during June 2010 for the referenced project. The laboratory reports validated herein were submitted by Analytical Resources, Inc. (ARI), assigned sample delivery group (SDG) numbers QY97, QZ16, and QZ47.

A level III data validation was performed on the laboratory reports. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2004 and EPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with those specified in the quality assurance project plan ([QAPP], Aspect 2008) and the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **Summary** section at the end of this report. Field duplicate results and evaluation is presented in **Appendix A**.

						A	nalysis			
Field Sample ID	Laboratory Sample ID	Sampling Date	Sample Type	VOCs	SVOCs	cPAHs	PCBs	As Pb	Metals	ТРН
MW44	QY97A	06/02/10	GW		Х	Х	х		х	х
CMP3	QY97B	06/02/10	GW		Х	Х	х	Х		х
CMP4	QY97C	06/02/10	GW		Х	Х	Х	Х		х
MW36	QY97D	06/02/10	GW		Х	Х	х		х	х
CMP15	QZ16A	06/03/10	GW		Х	Х	х		х	х
MW308(N)	QZ16B	06/03/10	GW		Х	Х	Х	Х		х
MW308(S)	QZ16C	06/03/10	GW		Х	Х	Х	Х		х
CMP5	QZ16D	06/03/10	GW		Х	Х	Х	Х		х
FM105	QZ16E	06/03/10	GW	Х	Х	Х	Х	Х		х
MW125	QZ16F	06/03/10	GW	Х	Х	Х	Х	Х		х
Trip Blank	QZ16G	06/03/10	ТВ	Х						
CMP17	QZ47A	06/04/09	GW	Х	Х	Х	Х	х		х
CMP2	QZ47B	06/04/09	GW		Х	Х	Х	Х		х
CMP1	QZ47C	06/04/09	GW		Х	Х	Х	х		х
MW26R	QZ47D	06/04/09	GW		Х	Х	Х		х	х
MW26RD	QZ47E	06/04/09	FD		Х	Х	Х		х	Х
Trip Blank	QZ47F	06/04/10	ТВ	Х						

Samples and the associated analyses validated herein are summarized as follows:

Notes: X - The analysis was requested and performed on the sample VOCs - Volatile organic compounds, chlorinated ethanes and ethenes only SVOCs - Semi-volatile organic compound, *bis*(2-ethylhexyl)phthalate only PAHs - Polycyclic aromatic hydrocarbons, carcinogenics only PCBs - Polychlorinated biphenyl Aroclors As - Arsenic Pb - Lead Metals - Antimony, arsenic, chromium, copper, lead, and nickel TPH - Diesel and motor oil range total petroleum hydrocarbon GW - Groundwater sample FD - Field duplicate TB - Trip blank

Analytical methods in respect to analytical parameters validated herein and the laboratory performing the analyses are summarized below:

Parameter	Analytical Method	Laboratory
VOCs	SW846 Method 8260B	
SVOCs	SW846 Method 8270D-Full Scan	
cPAHs	SW846 Method 8270D-SIM	Analytical Resources, Inc. (ARI)
PCB Aroclors	SW846 Method 8082	Tukwila, WA
Metals (Sb, As, Cr, Cu, Pb, & Ni)	EPA Method 200.8	
TPH-Diesel and Motor Oil	NWTPH-Dx	

Notes:

1. SW846 Methods - USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.

2. EPA Method 200.8 - USEPA Methods for Chemical Analysis of Water and Wastes, EPA –600/4-79-020, March 1983 Revision.

3. NWTPH - Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997.

4. SIM – Selective ion monitoring

# DATA VALIDATION FINDINGS

# 1. VOCs by GC/MS (EPA Method SW8260B)

#### **1.1** Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation. The temperature for coolers was outside the upper limit of  $4\pm 2^{\circ}$ C upon the receipt at the laboratory. All samples were hand-delivered to the laboratory the same day of collection. The higher cooler temperature had no significant effects on data quality. No other anomalies were identified in relation to sample preservation, handling, and transport.

Water samples should be analyzed within 14 days of collection. All samples were analyzed within the required holding time.

#### **1.2 GC/MS Instrument Performance Check**

Bromofluorobenzene (BFB) tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

#### 1.3 Initial Calibration

The National Functional Guidelines (NFGs) require that the percent relative standard deviation (%RSD) be <30% and the average response factor (RF) be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if sixpoint non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination ( $r^2$ ) be >0.99. Initial calibration met the criteria for all target compounds.

# 1.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the percent difference (%D) be within  $\pm 20\%$ , and (3) the RF be >0.01 for poor response compounds and >0.05 for all other compounds. Calibration verification analyses met the method requirements.

#### 1.5 Method Blank

A method blank was prepared and analyzed as required. Target compounds were not detected at or above the method detection limits (MDLs) in the method blank.

#### **1.6** Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD were prepared and analyzed as required by the method. All percent recovery (%R) and relative percent difference (RPD) values met the laboratory control criteria.

#### **1.7** Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

# 1.8 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

#### 1.9 Internal Standard

The method requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

#### 1.10 Reporting Limits (RLs)

The sample-specific RLs met the QAPP requirements and were supported with adequate initial calibration concentrations.

#### **1.11** Overall Assessment of VOCs Data Usability

VOCs data are of known quality and acceptable for use.

# 2. *bis*(2-Ethylhexyl)phthalate by GC/MS (EPA Method SW8270C)

#### 2.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

#### 2.2 GC/MS Instrument Performance Check

Decafluorotriphenylphosphine (DFTPP) tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

#### 2.3 Initial Calibration

The NFGs criteria require that the percent %RSD be <30% and the average RF be >0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be <15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if sixpoint non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination ( $r^2$ ) be >0.99. The initial calibration met the criteria.

#### 2.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within  $\pm 20\%$ , and (3) the RF be >0.01 for poor response compounds and >0.05 for all other compounds. Calibration verifications met the criteria.

#### 2.5 Method Blank

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the MDL in the method blanks.

#### 2.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

# 2.7 Matrix Spike (MS) and MS Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

# 2.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

#### 2.9 Internal Standards

The method requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

#### 2.10 Field Duplicates

One pair of field duplicates (samples MW26R and MW26RD) were submitted for *bis*(2-ethylhexyl)phthalate analyses. *bis*(2-Ethylhexyl)phthalate was not detected at or above the RL in these samples. The field precision met the project criterion.

#### 2.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

#### 2.12 Overall Assessment of *bis*(2-Ethylhexyl)phthalate Data Usability

*bis*(2-Ethylhexyl)phthalate data are of known quality and acceptable for use.

# 3. cPAHs by GC/MS - SIM (EPA Method SW8270C)

#### 3.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

# 3.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

#### 3.3 Initial Calibration

The NFGs criteria require that the %RSD be <30% and the average RRF be >0.05 for all target compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be <15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if sixpoint non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination ( $r^2$ ) be >0.99. The initial calibration met the criteria, except for the following:

Initial Calibration ID	Analyte	Exceedance	Affected Sample	Data Qualification
Instrument: NT11 Calibration Date: 06/12/2010	Benzo(a)pyrene	%RSD = 19.2% (>15%)	MW-44	J

# 3.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within  $\pm 20\%$ , and (3) the RF be >0.01 for poor response compounds and >0.05 for all other compounds. Calibration verification analyses met the criteria.

#### 3.5 Method Blanks

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the MDLs in the method blanks.

#### 3.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate %R values were within the laboratory control limits.

#### 3.7 Matrix Spike (MS) and MS Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

# 3.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

#### 3.9 Internal Standards

The method requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

#### **3.10** Field Duplicates

One pair of field duplicates (samples MW26R and MW26RD), were submitted for cPAHs analyses. The duplicate RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

#### 3.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

# 3.12 Overall Assessment of cPAHs Data Usability

cPAHs data are of known quality and acceptable for use.

# 4. PCB Aroclors by GC/ECD (EPA Method SW8082)

#### 4.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

#### 4.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using the mixture of Aroclor 1016 and 1260, (2) a single-point calibration be performed for the other five Aroclors to establish calibration factors (CFs) and for Aroclor pattern recognition, (3) at least 3 peaks (preferably 5 peaks) must be chosen for each Aroclor for characterization, (4) the relative standard deviation (%RSD) values of Aroclor 1016 and 1260 CFs must be  $\leq 20\%$ , and (5) if dual column analysis is chosen, both columns should meet the requirements.

The laboratory chose the internal-standard linear calibration for the Aroclor quantitation. The average RF %RSD values met the linearity criterion (20%). All RFs were >0.01, as recommended by SW846 Method 8000. The initial calibrations met the method requirements and were acceptable.

# 4.3 Calibration Verification

The method requires that (1) the initial calibration be verified prior to any analysis for each 12-hour analysis sequence, and (2) the percent drift ( $^{0}D_{f}$ ) be within ±15% to demonstrate the linearity of the initial calibration. Calibration verifications were performed at the required frequency. All  $^{0}D_{f}$  values either met the method criterion or at levels that had no effects on sample results (*e.g.*, biased-high  $^{0}D_{f}$  values where target analytes were not detected in associated samples).

#### 4.4 Method Blanks

Method blanks were prepared and analyzed as required. PCB Aroclors were not detected at or above the MDLs in the method blanks.

#### 4.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

### 4.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

# 4.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

#### 4.8 Internal Standards

The laboratory chose the internal-standard calibration approach for analyte quantitation. The SW-846, Method 8000 requires that (1) internal standard retention time be within  $\pm$ 30 seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

### 4.9 Field Duplicates

One pair of field duplicates (samples MW26R and MW26RD) were submitted for PCB Aroclors analyses. PCB Aroclors were not detected at or above the RLs in these samples. The field precision met the project criterion.

# 4.10 Reporting Limits and Target Compound Quantitation

Sample-specific RLs met the QAPP requirements. RLs in selected samples were raised due to non-target chemical interference or response peaks that did not meet the laboratory Aroclor identification criteria (*e.g.*, peak ratios, chromatographic patterns).

The dual column RPD values were within 40% for Aroclor detections greater than the RLs.

# 4.11 Overall Assessment of PCB Aroclors Data Usability

PCB Aroclor data are of known quality and acceptable for use as qualified.

# 5. Total Metals by ICP/MS (EPA Method 200.8)

#### 5.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be analyzed within 180 days. Samples were analyzed within the required holding time.

#### 5.2 ICP/MS Tuning

Instrument tuning was performed at the required frequency. The stability check (%RSD <5%), mass calibration (mass difference <0.1 AMU), and resolution check (peak width <1.0 AMU at 5% peak height) met the NFG and method criteria.

#### 5.3 Initial Calibration

The ICP methods requires that (1) a blank and one calibration standard be used in establishing the analytical curve, and (2) the average of replicate exposures be reported for all standards, QC, and sample analyses.

A check standard containing target analytes at the reporting limit levels was analyzed at the beginning of each analytical run. The results were within the NFGs criteria of 70-130%.

# 5.4 Calibration Verification (ICV and CCV)

Initial calibration verifications (ICVs) and continuing calibration verifications (CCVs) were analyzed at the required frequency. The R values met the control criteria (90 – 110%).

#### 5.5 Blanks

**Calibration Blanks:** Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed at required frequency. Target analytes were not detected at or above the MDLs in ICBs/CCBs.

**Method Blanks:** Method blanks were prepared and analyzed as required. Target analytes were not detected at or above the MDLs in the method blanks.

# 5.6 ICP Interference Check Sample (ICS)

The method requires that (1) an inter-element interference check sample be analyzed at the beginning of each analytical run, and (2) the results should be within  $\pm$  20% of the true value. ICP interference check sample analyses met the requirements.

# 5.7 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values met the control limits (80 - 120%).

#### 5.8 Duplicate Sample Analysis

Duplicate sample analyses were performed on sample CMP-15. The RPD or concentration difference values met the laboratory control limits for all target analytes.

#### 5.9 Matrix Spike (MS)

Matrix spike analyses were performed on sample CMP-15. The %R values were within the control limits for all target analytes.

#### 5.10 Internal Standards

At least three internal standards were added to all field and QC samples for ICP/MS analyses. All percent relative intensity values were within the method criteria (30 - 120% of those for the associated calibration blank).

#### 5.11 ICP Serial Dilution

Serial dilution analyses were performed on samples CMP-15 and MW-44. The %D values were within  $\pm 10\%$  for anaytes with concentrations greater than 50xMDLs.

# 5.12 Field Duplicates

One pair of field duplicates (samples MW26R and MW26RD) were submitted for metals analyses. The duplicate RPD or concentration difference values for detected analytes and data qualification are presented in Appendix A of this report.

# 5.13 Analyte Quantitation and Reporting Limits

RLs for selected analytes in a number of samples were raised due to the required dilution to overcome matrix interference associated with the samples. The QAPP requirements for quantitation limits were achieved.

#### 5.14 Overall Assessment of Metals Data Usability

Metals data are of known quality and acceptable for use.

# 6. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

#### 6.1 Holding Time

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. The extraction and analysis of samples met the requirements.

#### 6.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using individual petroleum product reference standards to ensure the proper identification and quantitation of petroleum hydrocarbons in samples, (2) the calibration curve includes a sufficiently low standard to provide the necessary reporting limits, and (3) the linear working range of the instrument be defined.

The ICAL met the method requirements. The linearity of the ICAL curve was verified with %RSD of RFs (%RSD  $\leq$  20%, according to EPA SW 846 Method 8000), and was acceptable for both diesel and motor oil range total petroleum hydrocarbon (TPH).

#### 6.3 Calibration Verification

The method requires that (1) a mid-range check standard be analyzed prior to and after each analytical batch, and (2) the percent drift value be within  $\pm 15\%$  of the true value. The calibration verification analyses met the requirements.

#### 6.4 Method Blanks

Method blanks were prepared and analyzed as required. TPH-Diesel and TPH-Motor Oil were not detected at or above the MDLs in the method blanks.

#### 6.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

#### 6.6 Duplicate Analysis

Duplicate analyses were not performed on project samples in these SDGs, and therefore were not reported. Analytical precision was evaluated based on the LCS/LCSD analyses.

# 6.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

#### 6.8 Field Duplicates

One pair of field duplicates (samples MW26R and MW26RD) were submitted for TPH-Diesel & Motor Oil analyses. The target compounds were not detected at or above the RLs in these samples. The field precision met the project criterion.

# 6.9 Reporting Limits

The reported RLs were supported with adequate ICAL concentrations. Sample-specific RLs met the QAPP requirements.

#### 6.10 Overall Assessment of TPH-Diesel and Motor Oil Data Usability

TPH-Diesel and Motor Oil data are of known quality and acceptable for use.

# SUMMARY

**I.** Data qualification are summarized as follows:

Sample ID	Analyte	Data Qualifier	Reason	Report Section
MW-44	Benzo(a)pyrene	J	The initial calibration %RSD value exceeded 15%.	3.2

#### II. Data affected by associated blanks are qualified and results adjusted as follows:

Sample ID	Analyte	Original Result	Adjusted Result	Unit	Report Section		
No data were qualified in relation to detections in blanks in these SDGs.							

# III. Data Qualifiers are defined as follows:

Data Qualifier	Definition
J	The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
ίΝ	The analyte was not definitively identified and the reported concentration was an estimated value.
R	The result was rejected and could not be used.
U	The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
IJ	The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Approved By:

Date:

Mingta Lin

# REFERENCES

- USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, October 1999, EPA540/R-99/008.
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, October 2004, EPA 540/R-04/004.
- USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- State of Washington, Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997
- Port of Seattle, Southwest Harbor Project, Phase II Groundwater Confirmation Monitoring Program, Water Quality Monitoring Plan, Aspect Consulting, Inc., October 2008.

# **APPENDIX A**

The precision criterion ( $\leq$  50%) was applied to evaluating the relative percent difference (RPD) values of field duplicate results greater than five times the RL (5xRL). For results less than 5xRL, an advisory criterion of 2xRL was applied to evaluating the concentration differences.

The RPD and concentration difference values for detected analytes and data qualification are presented as follows:

		Sample ID & Concentration (µg/L)		222	Conc.		
Detected Target Analyte	RL (μg/L)	MW26R MW26RD		кро (%)	Difference (μg/L)	Data Qualification	
Chrysene	0.01	0.014	0.014	-	0	No action	
Chromium	2	3	4	-	1	No action	
Copper	2	ND	3	-	1	No action	
Nickel	2	6	6	-	0	No action	

Notes:

RL – Reporting limit

ND – Not detected at or above the RL

RPD – Relative percent difference

Conc. Difference – Concentration difference between the parent sample and the field duplicate sample

DATA VALIDATION REPORT PYRON ENVIRONMENTAL, INC. ASPECT CONSULTING, LLC

# **Data Validation Report**

# Port of Seattle, Southwest Harbor Phase II Groundwater Quality Confirmation Monitoring October 2008 Sampling

Laboratory SDG Numbers:

NU12 & NU25

Prepared for:

Aspect Consulting, Inc. 179 Madrone Lane N Bainbridge Island, WA 98110

Prepared by:

**Pyron Environmental, Inc.** 3530 32<sup>nd</sup> Way NW Olympia, WA 98502

December 22, 2008

Pyron Environmental, Inc. Data Validation Report SW Harbor Phase II GW, Oct. 2008

# ACRONYMS

%D	percent difference
%D <sub>f</sub>	percent drift
%R	percent recovery
%RSD	percent relative standard deviation
AMU	atomic mass unit
ARI	Analytical Resources, Inc.
BFB	bromofluorobenzene
ССВ	continuing calibration blank
CCV	continuing calibration verification
CF	calibration factor
CLP	U.S. EPA Contract Laboratory Program
COC	chain-of-custody
DFTPP	decafluorotriphenylphosphine
ECD	electron capture detector
EPA	U.S. Environmental Protection Agency
FID	flame ionization detector
GC/MS	gas chromatograph/mass spectrometer
ICAL	initial calibration
ICB	initial calibration blank
ICP/MS	inductively coupled plasma/ mass spectrometer
ICS	ICP interference check sample
ICV	initial calibration verification
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
µg/L	microgram per liter
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NFGs	CLP National Functional Guidelines for Data Review (EPA 2008 – Organics, EPA 2004 - Inorganics)
РСВ	polychlorinated biphenyl
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control

Pyron Environmental, Inc. Data Validation Report SW Harbor Phase II GW, Oct. 2008

RF	response factor
RPD	relative percent difference
SDG	sample delivery group
SIM	selective ion monitoring
SVOCs	semi-volatile organic compounds
ТРН	total petroleum hydrocarbon
VOCs	volatile organic compounds

# INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for samples collected during October 2008 for the referenced project. The laboratory reports validated herein were submitted by Analytical Resources, Inc. (ARI), assigned sample delivery group (SDG) numbers NU12 and NU25.

A level III data validation was performed on the laboratory reports. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2004 and 2008) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with those specified in the quality assurance project plan ([QAPP], Aspect 2008) and the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **Summary** section at the end of this report. Field duplicate results and evaluation is presented in **Appendix A**.

				Analysis						
Field Sample ID	Laboratory Sample ID	Sampling Date	Sample Type	VOCs	SVOCs	РАН	PCBs	As Pb	Metals	ТРН
CMP1-081013	NU12A	10/13/08	GW		Х	Х	Х	х		Х
CMP2-081013	NU12B	10/13/08	GW		Х	Х	Х	х		Х
FM105-081013	NU12C	10/13/08	GW	Х	х	Х	Х	х		Х
FM105-081013D	NU12D	10/13/08	FD	Х	х	Х	Х	Х		х
MW 125-081013	NU12E	10/13/08	GW	Х	х	Х	Х	Х		Х
CMP17-081013	NU12F	10/13/08	GW	Х	х	Х	Х	х		Х
CMP5-081013	NU12G	10/13/08	GW		х	Х	Х	Х		Х
MW 308S-081013	NU12H	10/13/08	GW		х	Х	Х	Х		Х
MW 308N-081013	NU12I	10/13/08	GW		х	Х	Х	х		Х
Trip Blank	NU12J	10/13/08	ТВ	Х						
CMP3-081014	NU25A	10/14/08	GW		х	Х	Х	х		Х
CMP4-081014	NU25B	10/14/08	GW		х	Х	Х	х		Х
MW26R-081014	NU25C	10/14/08	GW		х	Х	Х		Х	Х
MW26R-081014D	NU25D	10/14/08	FD		х	Х	Х		Х	Х
MW 44-081014	NU25E	10/14/08	GW		х	Х	Х		Х	Х
CMP15-081014	NU25F	10/14/08	GW		х	Х	Х		Х	Х
MW 36-081014	NU25G	10/14/08	GW		Х	Х	Х		Х	Х

Samples and the associated analyses validated herein are summarized as follows:

Notes:

X - The analysis was requested and performed on the sample
VOCs – Volatile organic compounds, chlorinated ethanes and ethenes only
SVOCs – Semi-volatile organic compound, *bis*(2-ethylhexyl)phthalate only
PAHs – Polycyclic aromatic hydrocarbons, carcinogenics only
PCBs – Polychlorinated biphenyl Aroclors
As – Arsenic
Pb - Lead
Metals – Antimony, arsenic, chromium, copper, lead, and nickel
TPH – Diesel and motor oil range total petroleum hydrocarbon
GW – Groundwater sample
FD – Field duplicate
TB – Trip blank

Analytical methods in respect to analytical parameters validated herein and the laboratory performing the analyses are summarized below:

Parameter	Analytical Method	Laboratory		
VOCs	SW846 Method 8260B			
SVOCs	SW846 Method 8270C – Full Scan	Analytical Resources, Inc. (ARI)		
PAHs	SW846 Method 8270C-SIM			
PCB Aroclors	SW846 Method 8082	Tukwila, WA		
Metals (Sb, As, Cr, Cu, Pb, & Ni)	EPA Method 200.8			
TPH-Diesel and Motor Oil	NWTPH-Dx			

Notes:

- 1. SW846 Methods USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- 2. EPA Method 200.8 USEPA Methods for Chemical Analysis of Water and Wastes, EPA –600/4-79-020, March 1983 Revision.
- 3. NWTPH Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997
- 4. SIM Selective ion monitoring

# DATA VALIDATION FINDINGS

# 1. VOCs by GC/MS (EPA Method SW8260B)

### 1.1 Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation. The cooler temperature was measured at 10.5°C and 15°C upon the receipt at the laboratory. All samples were hand-delivered to the laboratory the same of day of collection. The higher cooler temperature had no significant effects on data quality. No other anomalies were identified in relation to sample preservation, handling, and transport.

Water samples should be analyzed within 14 days of collection. All samples were analyzed within the required holding time.

# 1.2 GC/MS Instrument Performance Check

Bromofluorobenzene (BFB) tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

# 1.3 Initial Calibration

The National Functional Guidelines (NFGs) require that the percent relative standard deviation (%RSD) be <30% and the average response factor (RF) be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination ( $r^2$ ) be >0.99. Initial calibration met the criteria for all target compounds.

# **1.4 Calibration Verification**

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the percent difference (%D) be within  $\pm 20\%$ , and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds.

Calibration verification analyses met the method requirements.

#### 1.5 Blanks

**Method Blank:** Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the method detection limits (MDLs) in method blanks.

**Trip Blank:** One trip blank was submitted with samples for VOCs analyses. No target compounds were detected at or above the RLs in the trip blank.

# 1.6 Laboratory Control Sample (LCS)

LCS and LCS duplicate (LCSD) were prepared and analyzed as required by the method. All percent recovery (%R) and relative percent difference (RPD) values met the laboratory control criteria.

# 1.7 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

# 1.8 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

#### 1.9 Internal Standard

The method requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

#### 1.10 Field Duplicates

Samples FM105-081013 and FM105-081013D were field duplicates. The duplicate sample RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

# 1.11 Reporting Limits

The sample-specific RLs met the QAPP requirements and were supported with adequate initial calibration concentrations.

# 1.12 Overall Assessment of VOCs Data Usability

VOCs data are of known quality and acceptable for use.

# 2. *bis*(2-Ethylhexyl)phthalate by GC/MS (EPA Method SW8270C)

# 2.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

# 2.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

# 2.3 Initial Calibration

The NFGs criteria require that the percent %RSD be <30% and the average RF be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination ( $r^2$ ) be >0.99. The initial calibration met the criteria.

# 2.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within  $\pm 20\%$ , and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds. Calibration verifications met the criteria.

# 2.5 Method Blank

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the RLs in the method blanks.

# 2.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. %R values for one of the four surrogate spikes, nitrobenzene-d4, were below the lower control limits in selected samples. %R values for all other surrogates were within the laboratory control limits. No data were qualified on this basis.

# 2.7 Matrix Spike (MS) and MS Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

# 2.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.
#### 2.9 Internal Standards

The method requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

#### 2.10 Field Duplicates

Two pairs of field duplicates - samples FM105-081013 and FM105-081013D; and samples MW26R-081014 and MW26R-081014D, were submitted for *bis*(2-ethylhexyl)phthalate analyses. *bis*(2-Ethylhexyl)phthalate was not detected at or above the RL in these samples. The field precision met the project criterion.

#### 2.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

#### 2.12 Overall Assessment of *bis*(2-Ethylhexyl)phthalate Data Usability

*bis*(2-Ethylhexyl)phthalate data are of known quality and acceptable for use.

# 3. PAHs by GC/MS - SIM (EPA Method SW8270C)

#### 3.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

#### 3.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

#### 3.3 Initial Calibration

The NFGs criteria require that the %RSD be <30% and the average RRF be >0.05 for all target compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995,

and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination ( $r^2$ ) be >0.99. The initial calibration met the criteria.

#### 3.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within  $\pm 20\%$ , and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds. Calibration verification analyses met the criteria.

#### 3.5 Method Blanks

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the RLs in the method blanks.

#### 3.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate %R values were within the laboratory control limits.

#### 3.7 Matrix Spike (MS) and MS Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

#### 3.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

#### 3.9 Internal Standards

The method requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

#### 3.10 Field Duplicates

Two pairs of field duplicates - samples FM105-081013 and FM105-081013D; and samples MW26R-081014 and MW26R-081014D, were submitted for PAHs analyses. The duplicate RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

#### 3.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

# 3.12 Overall Assessment of PAHs Data Usability

PAHs data are of known quality and acceptable for use.

# 4. PCB Aroclors by GC/ECD (EPA Method SW8082)

#### 4.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

#### 4.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using the mixture of Aroclor 1016 and 1260, (2) a single-point calibration be performed for the other five Aroclors to establish calibration factors (CFs) and for Aroclor pattern recognition, (3) at least 3 peaks (preferably 5 peaks) must be chosen for each Aroclor for characterization, (4) the relative standard deviation (%RSD) values of Aroclor 1016 and 1260 CFs must be  $\leq$  20%, and (5) if dual column analysis is chosen, both columns should meet the requirements.

The laboratory chose the internal-standard linear calibration for the Aroclor quantitation. The average RF %RSD values met the linearity criterion (20%). All RFs were >0.01, as recommended by SW846 Method 8000. The initial calibrations met the method requirements and were acceptable.

#### 4.3 Calibration Verification

The method requires that (1) the initial calibration be verified prior to any analysis for each 12-hour analysis sequence, and (2) the percent drift ( $\%D_f$ ) be within ±15% to demonstrate the linearity of the initial calibration. Calibration verifications were performed at the required frequency. All  $\%D_f$  values either met the method criterion or at levels that had no effects on sample results (*e.g.*,biased high recovery where target analytes were not detected in associated samples).

#### 4.4 Method Blanks

Method blanks were prepared and analyzed as required. PCB Aroclors were not detected at or above the RLs in the method blanks.

#### 4.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

#### 4.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

# 4.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

# 4.8 Internal Standards

The laboratory chose the internal-standard calibration approach for analyte quantitation. The SW-846, Method 8000 requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

# 4.9 Field Duplicates

Two pairs of field duplicates - samples FM105-081013 and FM105-081013D; and samples MW26R-081014 and MW26R-081014D, were submitted for PCB Aroclors analyses. PCB Aroclors were not detected at or above the RL in these samples. The field precision met the project criterion.

#### 4.10 Reporting Limits and Target Compound Quantitation

Sample-specific RLs met the QAPP requirements. RLs in selected samples were raised due to non-target chemical interference or response peaks that did not meet the Aroclor identification criteria (*e.g.*, peak ratios, chromatographic patterns).

#### 4.11 Overall Assessment of PCB Aroclors Data Usability

PCB Aroclor data are of known quality and acceptable for use.

# 5. Total Metals by ICP/MS (EPA Method 200.8)

#### 5.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be analyzed within 180 days. Samples were analyzed within the required holding time.

# 5.2 ICP/MS Tuning

Instrument tuning was performed at the required frequency. The stability check (%RSD <5%), mass calibration (mass difference <0.1 AMU), and resolution check (peak width <1.0 AMU at 5% peak height) met the NFG and method criteria.

#### 5.3 Initial Calibration

The ICP methods requires that (1) a blank and one calibration standard be used in establishing the analytical curve, and (2) the average of replicate exposures be reported for all standards, QC, and sample analyses.

A check standard containing target analytes at the reporting limit levels was analyzed at the beginning of each analytical run. The results were within the NFGs criteria of 70-130%.

# 5.4 Calibration Verification (ICV and CCV)

Initial calibration verifications (ICVs) and continuing calibration verifications (CCVs) were analyzed at the required frequency. The R values met the control criteria (90 – 110%).

#### 5.5 Blanks

**Calibration Blanks:** Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed at required frequency. Target analytes were not detected in ICBs/CCBs at or above the method detection limits (MDLs).

**Method Blanks:** Method blanks were prepared and analyzed as required. Target analytes were not detected at or above the RLs.

#### 5.6 ICP Interference Check Sample (ICS)

The method requires that (1) an inter-element interference check sample be analyzed at the beginning of each analytical run, and (2) the results should be within  $\pm$  20% of the true value. ICP interference check sample analyses met the requirements.

#### 5.7 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values met the control limits (80 - 120%).

#### 5.8 Duplicate Sample Analysis

Duplicate sample analyses were not performed on project samples in these SDGs, and therefore not reported. The analytical precision was evaluated based on the field duplicate results.

#### 5.9 Matrix Spike (MS)

Matrix spike analyses were not performed on project samples in these SDGs, and therefore not reported. The analytical accuracy was evaluated based on the LCS results.

#### 5.10 Internal Standards

At least three internal standards were added to all field and QC samples for ICP/MS analyses. All percent relative intensity values were within the method criteria (30 - 120% of those for the associated calibration blank).

# 5.11 ICP Serial Dilution

Serial dilution analysis were not performed on project samples in these SDGs, and therefore not reported.

#### 5.12 Field Duplicates

Two pairs of field duplicates - samples FM105-081013 and FM105-081013D; and samples MW26R-081014 and MW26R-081014D, were submitted for metals analyses. The duplicate RPD or concentration difference values for detected analytes and data qualification are presented in Appendix A of this report.

# 5.13 Analyte Quantitation and Reporting Limits

RLs for selected analytes in a number of samples were raised due to the required dilution to overcome matrix interference associated with the samples. The QAPP requirements for quantitation limits were achieved.

#### 5.14 Overall Assessment of Metals Data Usability

Metals data are of known quality and acceptable for use.

# 6. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

#### 6.1 Holding Time

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. The extraction and analysis of samples met the requirements.

#### 6.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using individual petroleum product reference standards to ensure the proper identification and quantitation of petroleum hydrocarbons in samples, (2) the calibration curve includes a sufficiently low standard to provide the necessary reporting limits, and (3) the linear working range of the instrument be defined.

The ICAL met the method requirements. The linearity of the ICAL curve was verified with %RSD of RFs (%RSD  $\leq$  20%, according to EPA SW 846 Method 8000), and was acceptable for both diesel and motor oil range total petroleum hydrocarbon (TPH).

#### 6.3 Calibration Verification

The method requires that (1) a mid-range check standard be analyzed prior to and after each analytical batch, and (2) the percent drift value be within  $\pm 15\%$  of the true value. The calibration verification analyses met the requirements.

#### 6.4 Method Blanks

Method blanks were prepared and analyzed as required. TPH-Diesel and TPH-Motor Oil were not detected at or above the RLs in the method blanks.

#### 6.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

#### 6.6 Duplicate Analysis

Duplicate analyses were not performed on project samples in these SDGs, and therefore were not reported. Analytical precision was evaluated based on the LCS/LCSD analyses.

#### 6.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

#### 6.8 Field Duplicates

Two pairs of field duplicates - samples FM105-081013 and FM105-081013D; and samples MW26R-081014 and MW26R-081014D, were submitted. TPH-Diesel & Motor Oil were not detected at or above the RL in these samples. The field precision met the project criterion.

#### 6.9 Reporting Limits

The reported RLs were supported with adequate ICAL concentrations. Sample-specific RLs met the QAPP requirements.

#### 6.10 Overall Assessment of TPH-Diesel and Motor Oil Data Usability

TPH-Diesel and Motor Oil data are of known quality and acceptable for use.

# SUMMARY

# I. Data qualification are summarized as follows:

Sample ID	Analyte	Data Qualifier	Reason	Report Section
	No d	ata were qualif	fied in these SDGs.	

# II. Data affected by associated blanks are qualified and results adjusted as follows:

Sample ID	Analyte	Original Result	Adjusted Result	Unit	Report Section		
No data were qualified in relation to detections in blanks in these SDGs.							

# III. Data Qualifiers are defined as follows:

Data Qualifier	Definition
J	The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
NJ	The analyte was not definitively identified and the reported concentration was an estimated value.
R	The result was rejected and could not be used.
U	The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
UJ	The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Approved By:

Date:

Mingta Lin

# REFERENCES

- USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, June 2007, EPA-540-R-08-01.
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, October 2004, EPA 540/R-04/004.
- USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- State of Washington, Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997

Port of Seattle, Southwest Harbor Project, Phase II Groundwater Confirmation Monitoring Program, Water Quality Monitoring Plan, Aspect Consulting, Inc., October 2008.

# APPENDIX A

The precision criterion ( $\leq$  50%) was applied to evaluating the relative percent difference (RPD) values of field duplicate results greater than five times the MRL (5xRL). For results less than 5xRL, an advisory criterion of 2xRL was applied to evaluating the concentration differences.

The RPD and concentration difference values for detected analytes and data qualification are presented as follows:

	ы	San Concent		Conc.	Dete	
Detected Target Analyte	κι (μg/L)	FM105-081013	FM105-081013D	(%)	(µg/L)	Qualification
Arsenic	0.2	0.40	0.40	-	0	No action
cis-1,2-Dichloroethene	0.2	0.70	0.70	-	0	No action
Tetrachloroethene (PCE)	0.2	6.10	6.20	1.6%	-	No action
Trichloroethene (TCE)	0.2	0.90	0.90	-	0	No action
	RL	Sample ID & Concentration (µg/L)		RPD	Conc.	Data
Detected Target Analyte	(µg/L)	MW26R-081014	MW26R-081014D	(%)	(µg/L)	Qualification
Benz(a)anthracene	0.01	0.025	0.024	-	0.001	No action
Chrysene	0.01	0.027	0.026	-	0.001	No action
Arsenic	2	ND	3	-	3	No action
Chromium III	2	ND	3	-	3	No action
Nickel	2	6	7	-	1	No action

Note:

RL – Reporting limit

ND - Not detected at or above the RL

RPD – Relative percent difference

Conc. Difference - Concentration difference between the parent sample and the field duplicate sample

# **Data Validation Report**

# Port of Seattle, Southwest Harbor Phase II Groundwater Quality Confirmation Monitoring April 2009 Sampling

Laboratory SDG Numbers:

OT19, OT38, & OT68

Prepared for:

Aspect Consulting, Inc. 179 Madrone Lane N Bainbridge Island, WA 98110

Prepared by:

Pyron Environmental, Inc. 3530 32<sup>nd</sup> Way NW Olympia, WA 98502

May 18, 2009

Pyron Environmental, Inc. Data Validation Report SW Harbor Phase II GW, Apr. 2009

# ACRONYMS

%D	percent difference
% <b>D</b> 7	percent drift
%R	percent recovery
%RSD	percent relative standard deviation
AMU	atomic mass unit
ARI	Analytical Resources, Inc.
BFB	Bromofluorobenzene
ССВ	continuing calibration blank
CCV	continuing calibration verification
CF	calibration factor
CLP	U.S. EPA Contract Laboratory Program
COC	chain-of-custody
DFTPP	Decafluorotriphenylphosphine
ECD	electron capture detector
EPA	U.S. Environmental Protection Agency
FID	flame ionization detector
GC/MS	gas chromatograph/mass spectrometer
ICAL	initial calibration
ICB	initial calibration blank
ICP/MS	inductively coupled plasma/ mass spectrometer
ICS	ICP interference check sample
ICV	initial calibration verification
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
μg/L	microgram per liter
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NFGs	CLP National Functional Guidelines for Data Review (EPA 2008 – Organics, EPA 2004 - Inorganics)
PAHs	polycyclic aromatic hydrocarbons
РСВ	polychlorinated biphenyl
QAPP	quality assurance project plan

QA/QC	quality assurance/quality control
RF	response factor
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
SIM	selective ion monitoring
SVOCs	semi-volatile organic compounds
ТРН	total petroleum hydrocarbon
VOCs	volatile organic compounds

# INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for samples collected during April 2009 for the referenced project. The laboratory reports validated herein were submitted by Analytical Resources, Inc. (ARI), assigned sample delivery group (SDG) numbers OT19, OT38, and OT68.

A level III data validation was performed on the laboratory reports. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2004 and 2008) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with those specified in the quality assurance project plan ([QAPP], Aspect 2008) and the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **Summary** section at the end of this report. Field duplicate results and evaluation is presented in **Appendix A**.

				Analysis						
Field Sample ID	Laboratory Sample ID	Sampling Date	Sample Type	VOCs	SVOCs	PAHs	PCBs	As Pb	Metals	ТРН
CMP2-090331	OT19A	03/31/.09	GW		Х	Х	Х	Х		х
CMP1-090331	OT19B	03/31/.09	GW		Х	Х	Х	Х		Х
FM105-090331	OT19C	03/31/.09	GW	Х	Х	Х	Х	х		х
MW125-090331	OT19D	03/31/.09	GW	Х	х	Х	Х	Х		Х
CMP17-090331	OT19E	03/31/.09	GW	Х	х	Х	Х	х		х
FM105-090331D	OT19F	03/31/.09	FD	Х	х	Х	Х	Х		Х
Trip Blank	OT19F	03/31/.09	ТВ	Х						
CMP3-090401	OT38A	04/01/09	GW		х	Х	Х	Х		Х
MW26R-090401	OT38B	04/01/09	GW		х	Х	Х		Х	Х
MW26R-090401D	OT38C	04/01/09	FD		х	Х	Х		Х	Х
MW44-090401	OT38D	04/01/09	GW		х	Х	Х		Х	Х
CMP5-090401	OT38E	04/01/09	GW		Х	Х	Х	х		х
MW308S-090401	OT38F	04/01/09	GW		х	Х	Х	Х		Х
CMP4-090402	OT68A	04/02/09	GW		х	Х	Х	Х		Х
MW36-090402	OT68B	04/02/09	GW		х	Х	Х		Х	Х
CMP15-090402	OT68C	04/02/09	GW		х	Х	Х		Х	Х
MW308N-090402	OT68D	04/02/09	GW		Х	Х	Х	Х		Х

Samples and the associated analyses validated herein are summarized as follows:

Notes:

X - The analysis was requested and performed on the sample
VOCs – Volatile organic compounds, chlorinated ethanes and ethenes only
SVOCs – Semi-volatile organic compound, *bis*(2-ethylhexyl)phthalate only
PAHs – Polycyclic aromatic hydrocarbons, carcinogenics only
PCBs – Polychlorinated biphenyl Aroclors
As – Arsenic
Pb - Lead
Metals – Antimony, arsenic, chromium, copper, lead, and nickel
TPH – Diesel and motor oil range total petroleum hydrocarbon
GW – Groundwater sample
FD – Field duplicate
TB – Trip blank

Analytical methods in respect to analytical parameters validated herein and the laboratory performing the analyses are summarized below:

Parameter	Analytical Method	Laboratory	
VOCs	SW846 Method 8260B		
SVOCs	SW846 Method 8270C – Full Scan		
PAHs	SW846 Method 8270C-SIM	Analytical Resources, Inc. (ARI)	
PCB Aroclors	SW846 Method 8082	Tukwila, WA	
Metals (Sb, As, Cr, Cu, Pb, & Ni)	EPA Method 200.8		
TPH-Diesel and Motor Oil	NWTPH-Dx		

#### Notes:

SW846 Methods - USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.

EPA Method 200.8 - USEPA Methods for Chemical Analysis of Water and Wastes, EPA –600/4-79-020, March 1983 Revision. NWTPH - Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997. SIM – Selective ion monitoring

# DATA VALIDATION FINDINGS

# 1. VOCs by GC/MS (EPA Method SW8260B)

# **1.1** Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation. The temperature for three of the coolers (7.2 °C, 6.6 °C, and 7.4 °C) was outside the upper limit of  $4\pm 2$  °C upon the receipt at the laboratory. All samples were hand-delivered to the laboratory the same day of collection. The higher cooler temperature had no significant effects on data quality. No other anomalies were identified in relation to sample preservation, handling, and transport.

Water samples should be analyzed within 14 days of collection. All samples were analyzed within the required holding time.

#### 1.2 GC/MS Instrument Performance Check

Bromofluorobenzene (BFB) tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

#### 1.3 Initial Calibration

The National Functional Guidelines (NFGs) require that the percent relative standard deviation (%RSD) be <30% and the average response factor (RF) be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination ( $r^2$ ) be >0.99. Initial calibration met the criteria for all target compounds.

#### 1.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the percent difference (%D) be within  $\pm 20\%$ , and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds.

Calibration verification analyses met the method requirements.

#### 1.5 Blanks

**Method Blank:** Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the method detection limits (MDLs) in method blanks.

**Trip Blank:** One trip blank was submitted with samples for VOCs analyses. No target compounds were detected at or above the RLs in the trip blank.

#### **1.6 Laboratory Control Sample (LCS)**

LCS and LCS duplicate (LCSD) were prepared and analyzed as required by the method. All percent recovery (%R) and relative percent difference (RPD) values met the laboratory control criteria.

#### 1.7 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

#### 1.8 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

#### 1.9 Internal Standard

The method requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

#### 1.10 Field Duplicates

Samples FM105-090331 and FM105-090331D were field duplicates. The duplicate sample RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

# 1.11 Reporting Limits

The sample-specific RLs met the QAPP requirements and were supported with adequate initial calibration concentrations.

#### 1.12 Overall Assessment of VOCs Data Usability

VOCs data are of known quality and acceptable for use.

# 2. *bis*(2-Ethylhexyl)phthalate by GC/MS (EPA Method SW8270C)

#### 2.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

# 2.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

# 2.3 Initial Calibration

The NFGs criteria require that the percent %RSD be <30% and the average RF be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination ( $r^2$ ) be >0.99. The initial calibration met the criteria.

# 2.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within  $\pm 20\%$ , and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds. Calibration verifications met the criteria.

# 2.5 Method Blank

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the RLs in the method blanks.

#### 2.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

# 2.7 Matrix Spike (MS) and MS Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

# 2.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

#### 2.9 Internal Standards

The method requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

#### 2.10 Field Duplicates

Two pairs of field duplicates - samples FM105-090331 and FM105-090331D; and samples MW26R-090401 and MW26R-090401D, were submitted for *bis*(2-ethylhexyl)phthalate analyses. *bis*(2-Ethylhexyl)phthalate was not detected at or above the RL in these samples. The field precision met the project criterion.

#### 2.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

#### 2.12 Overall Assessment of *bis*(2-Ethylhexyl)phthalate Data Usability

*bis*(2-Ethylhexyl)phthalate data are of known quality and acceptable for use.

# 3. PAHs by GC/MS - SIM (EPA Method SW8270C)

#### 3.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

#### 3.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

# 3.3 Initial Calibration

The NFGs criteria require that the %RSD be <30% and the average RRF be >0.05 for all target compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995,

and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination ( $r^2$ ) be >0.99. The initial calibration met the criteria.

# 3.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within  $\pm 20\%$ , and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds. Calibration verification analyses met the criteria or the %D values were at levels that had no effects on sample results (*e.g.*, biased-high %D values and the target analytes were not detected in associated samples).

#### 3.5 Method Blanks

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the RLs in the method blanks.

#### 3.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate %R values were within the laboratory control limits.

#### 3.7 Matrix Spike (MS) and MS Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

#### 3.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

#### 3.9 Internal Standards

The method requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

#### 3.10 Field Duplicates

Two pairs of field duplicates - samples FM105-090331 and FM105-090331D; and samples MW26R-090401 and MW26R-090401D, were submitted for PAHs analyses. The duplicate RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

#### 3.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

#### 3.12 Overall Assessment of PAHs Data Usability

PAHs data are of known quality and acceptable for use.

# 4. PCB Aroclors by GC/ECD (EPA Method SW8082)

# 4.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

# 4.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using the mixture of Aroclor 1016 and 1260, (2) a single-point calibration be performed for the other five Aroclors to establish calibration factors (CFs) and for Aroclor pattern recognition, (3) at least 3 peaks (preferably 5 peaks) must be chosen for each Aroclor for characterization, (4) the relative standard deviation (%RSD) values of Aroclor 1016 and 1260 CFs must be  $\leq$  20%, and (5) if dual column analysis is chosen, both columns should meet the requirements.

The laboratory chose the internal-standard linear calibration for the Aroclor quantitation. The average RF %RSD values met the linearity criterion (20%). All RFs were >0.01, as recommended by SW846 Method 8000. The initial calibrations met the method requirements and were acceptable.

#### 4.3 Calibration Verification

The method requires that (1) the initial calibration be verified prior to any analysis for each 12-hour analysis sequence, and (2) the percent drift ( $^{O}D_{f}$ ) be within ±15% to demonstrate the linearity of the initial calibration. Calibration verifications were performed at the required frequency. All  $^{O}D_{f}$  values either met the method criterion or at levels that had no effects on sample results (*e.g.*, biased-high  $^{O}D_{f}$  values where target analytes were not detected in associated samples).

#### 4.4 Method Blanks

Method blanks were prepared and analyzed as required. PCB Aroclors were not detected at or above the RLs in the method blanks.

#### 4.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

#### 4.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

# 4.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

#### 4.8 Internal Standards

The laboratory chose the internal-standard calibration approach for analyte quantitation. The SW-846, Method 8000 requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

#### 4.9 Field Duplicates

Two pairs of field duplicates - samples FM105-090331 and FM105-090331D; and samples MW26R-090401 and MW26R-090401D, were submitted for PCB Aroclors analyses. PCB Aroclors were not detected at or above the RL in these samples. The field precision met the project criterion.

#### 4.10 Reporting Limits and Target Compound Quantitation

Sample-specific RLs met the QAPP requirements. RLs in selected samples were raised due to non-target chemical interference or response peaks that did not meet the Aroclor identification criteria (*e.g.*, peak ratios, chromatographic patterns).

#### 4.11 Overall Assessment of PCB Aroclors Data Usability

PCB Aroclor data are of known quality and acceptable for use.

# 5. Total Metals by ICP/MS (EPA Method 200.8)

#### 5.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be analyzed within 180 days. Samples were analyzed within the required holding time.

# 5.2 ICP/MS Tuning

Instrument tuning was performed at the required frequency. The stability check (%RSD <5%), mass calibration (mass difference <0.1 AMU), and resolution check (peak width <1.0 AMU at 5% peak height) met the NFG and method criteria.

#### 5.3 Initial Calibration

The ICP methods requires that (1) a blank and one calibration standard be used in establishing the analytical curve, and (2) the average of replicate exposures be reported for all standards, QC, and sample analyses.

A check standard containing target analytes at the reporting limit levels was analyzed at the beginning of each analytical run. The results were within the NFGs criteria of 70-130%.

#### 5.4 Calibration Verification (ICV and CCV)

Initial calibration verifications (ICVs) and continuing calibration verifications (CCVs) were analyzed at the required frequency. The %R values met the control criteria (90 – 110%).

#### 5.5 Blanks

**Calibration Blanks:** Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed at required frequency. Target analytes were not detected in ICBs/CCBs at or above the method detection limits (MDLs).

**Method Blanks:** Method blanks were prepared and analyzed as required. Target analytes were not detected at or above the RLs.

#### 5.6 ICP Interference Check Sample (ICS)

The method requires that (1) an inter-element interference check sample be analyzed at the beginning of each analytical run, and (2) the results should be within  $\pm$  20% of the true value. ICP interference check sample analyses met the requirements.

#### 5.7 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values met the control limits (80 - 120%).

#### 5.8 Duplicate Sample Analysis

Duplicate sample analyses were not performed on project samples in these SDGs, and therefore not reported. The analytical precision was evaluated based on the field duplicate results.

#### 5.9 Matrix Spike (MS)

Matrix spike analyses were not performed on project samples in these SDGs, and therefore not reported. The analytical accuracy was evaluated based on the LCS results.

#### 5.10 Internal Standards

At least three internal standards were added to all field and QC samples for ICP/MS analyses. All percent relative intensity values were within the method criteria (30 - 120% of those for the associated calibration blank).

# 5.11 ICP Serial Dilution

Serial dilution analysis were not performed on project samples in these SDGs, and therefore not reported.

# 5.12 Field Duplicates

Two pairs of field duplicates - samples FM105-090331 and FM105-090331D; and samples MW26R-090401 and MW26R-090401D, were submitted for metals analyses. The duplicate RPD or concentration difference values for detected analytes and data qualification are presented in Appendix A of this report.

# 5.13 Analyte Quantitation and Reporting Limits

RLs for selected analytes in a number of samples were raised due to the required dilution to overcome matrix interference associated with the samples. The QAPP requirements for quantitation limits were achieved.

#### 5.14 Overall Assessment of Metals Data Usability

Metals data are of known quality and acceptable for use.

# 6. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

#### 6.1 Holding Time

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. The extraction and analysis of samples met the requirements.

# 6.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using individual petroleum product reference standards to ensure the proper identification and quantitation of petroleum hydrocarbons in samples, (2) the calibration curve includes a sufficiently low standard to provide the necessary reporting limits, and (3) the linear working range of the instrument be defined.

The ICAL met the method requirements. The linearity of the ICAL curve was verified with %RSD of RFs (%RSD  $\leq$  20%, according to EPA SW 846 Method 8000), and was acceptable for both diesel and motor oil range total petroleum hydrocarbon (TPH).

#### 6.3 Calibration Verification

The method requires that (1) a mid-range check standard be analyzed prior to and after each analytical batch, and (2) the percent drift value be within  $\pm 15\%$  of the true value. The calibration verification analyses met the requirements.

# 6.4 Method Blanks

Method blanks were prepared and analyzed as required. TPH-Diesel and TPH-Motor Oil were not detected at or above the RLs in the method blanks.

#### 6.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

#### 6.6 Duplicate Analysis

Duplicate analyses were not performed on project samples in these SDGs, and therefore were not reported. Analytical precision was evaluated based on the LCS/LCSD analyses.

#### 6.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

#### 6.8 Field Duplicates

Two pairs of field duplicates - samples FM105-090331 and FM105-090331D; and samples MW26R-090401 and MW26R-090401D, were submitted for TPH-Diesel & Motor Oil analyses. The target compounds were not detected at or above the RL in these samples. The field precision met the project criterion.

#### 6.9 Reporting Limits

The reported RLs were supported with adequate ICAL concentrations. Sample-specific RLs met the QAPP requirements.

#### 6.10 Overall Assessment of TPH-Diesel and Motor Oil Data Usability

TPH-Diesel and Motor Oil data are of known quality and acceptable for use.

# SUMMARY

I. Data qualification are summarized as follows:

Sample ID	Analyte	Data Qualifier	Reason	Report Section
FM105-090331 FM105-090331D	<i>bis</i> (2-Ethylhexyl)phthalate	IJ	The field duplicate result did not meet the project control limits.	Appendix A

# II. Data affected by associated blanks are qualified and results adjusted as follows:

Sample ID	Analyte	Original Result	Adjusted Result	Unit	Report Section		
No data were qualified in relation to detections in blanks in these SDGs.							

# III. Data Qualifiers are defined as follows:

Data Qualifier	Definition
J	The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
NJ	The analyte was not definitively identified and the reported concentration was an estimated value.
R	The result was rejected and could not be used.
U	The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
UJ	The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Approved By:

Date:

Mingta Lin

# REFERENCES

- USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, June 2007, EPA-540-R-08-01.
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, October 2004, EPA 540/R-04/004.
- USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- State of Washington, Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997

Port of Seattle, Southwest Harbor Project, Phase II Groundwater Confirmation Monitoring Program, Water Quality Monitoring Plan, Aspect Consulting, Inc., October 2008.

# APPENDIX A

The precision criterion ( $\leq$  50%) was applied to evaluating the relative percent difference (RPD) values of field duplicate results greater than five times the MRL (5xRL). For results less than 5xRL, an advisory criterion of 2xRL was applied to evaluating the concentration differences.

The RPD and concentration difference values for detected analytes and data qualification are presented as follows:

		Sample ID & Concentration (µg/L)			Conc.	
Detected Target Analyte	RL (µg/L)	FM105-090331	FM105-090331D	RPD (%)	Difference (µg/L)	Data Qualification
Arsenic	0.2	0.50	0.50	-	0	No action
cis-1,2-Dichloroethene	0.2	0.40	0.50	-	0.01	No action
Tetrachloroethene (PCE)	0.2	3.4	3.7	8.5%	-	No action
Trichloroethene (TCE)	0.2	0.60	0.60	-	0	No action
bis(2-Ethylhexyl)phthalate	1.0	ND	5.8	-	5.8	UJ/J
		Sample ID & Concentration (uo/L)			Conc.	
Detected Target Analyte	RL (µg/L)	MW26R-090401	MW26R-090401D	RPD (%)	Difference (µg/L)	Data Qualification
Benz(a)anthracene	0.01	ND	0.011	-	0.011	No action
Benzo(b)fluoranthene	0.01	ND	0.018	-	0.018	No action
Benzo(k)fluoranthene	0.01	ND	0.016	-	0.016	No action
Chrysene	0.01	0.011	0.022	-	0.011	No action
Chromium	2	3	3	-	0	No action
Nickel	2	6	7	-	1	No action

Notes:

RL – Reporting limit

ND – Not detected at or above the RL

RPD – Relative percent difference

Conc. Difference – Concentration difference between the parent sample and the field duplicate sample

# **Data Validation Report**

# Port of Seattle, Southwest Harbor Phase II Groundwater Quality Confirmation Monitoring September 2009 Sampling

Laboratory SDG Numbers:

PM70, PN04, & PN16

Prepared for:

Aspect Consulting, Inc. 179 Madrone Lane North Bainbridge Island, WA 98110

Prepared by:

Pyron Environmental, Inc. 3530 32<sup>nd</sup> Way NW Olympia, WA 98502

October 20, 2009

Pyron Environmental, Inc. Data Validation Report SW Harbor Phase II GW, Sep. 2009

# ACRONYMS

%D	percent difference
<b>%D</b> f	percent drift
%R	percent recovery
%RSD	percent relative standard deviation
AMU	atomic mass unit
ARI	Analytical Resources, Inc.
BFB	Bromofluorobenzene
ССВ	continuing calibration blank
CCV	continuing calibration verification
CF	calibration factor
CLP	U.S. EPA Contract Laboratory Program
COC	chain-of-custody
DFTPP	Decafluorotriphenylphosphine
ECD	electron capture detector
EPA	U.S. Environmental Protection Agency
FID	flame ionization detector
GC/MS	gas chromatograph/mass spectrometer
ICAL	initial calibration
ICB	initial calibration blank
ICP/MS	inductively coupled plasma/ mass spectrometer
ICS	ICP interference check sample
ICV	initial calibration verification
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
µg/L	microgram per liter
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NFGs	CLP National Functional Guidelines for Data Review (EPA 2007 – Organics, EPA 2004 - Inorganics)
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
QAPP	quality assurance project plan

QA/QC	quality assurance/quality control
RF	response factor
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
SIM	selective ion monitoring
SVOCs	semi-volatile organic compounds
ТРН	total petroleum hydrocarbon
VOCs	volatile organic compounds

# INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for samples collected during September 2009 for the referenced project. The laboratory reports validated herein were submitted by Analytical Resources, Inc. (ARI), assigned sample delivery group (SDG) numbers PM70, PN04, and PN16.

A level III data validation was performed on the laboratory reports. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2004 and 2007) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with those specified in the quality assurance project plan ([QAPP], Aspect 2008) and the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **Summary** section at the end of this report. Field duplicate results and evaluation is presented in **Appendix A**.

				Analysis						
Field Sample ID	Laboratory Sample ID	Sampling Date	Sample Type	VOCs	SVOCs	PAHs	PCBs	As Pb	Metals	ТРН
CMP2-090902	PM70A	09/02/09	GW		х	Х	Х	Х		Х
MW125-090902	PM70B	09/02/09	GW	Х	х	Х	Х	Х		Х
CMP17-090902	PM70C	09/02/09	GW	Х	х	Х	Х	Х		Х
FM105-090902	PM70D	09/02/09	GW	Х	х	Х	Х	Х		Х
FM105-090902D	PM70E	09/02/09	FD	Х	х	Х	Х	Х		Х
CMP5-090902	PM70F	09/02/09	GW		х	Х	Х	Х		Х
CMP3-090903	PN04A	09/03/09	GW		х	Х	Х	Х		Х
CMP4-090903	PN04B	09/03/09	GW		х	Х	Х	Х		Х
CMP15-090903	PN04C	09/03/09	GW		х	Х	Х		Х	Х
MW26R-090903	PN04D	09/03/09	GW		х	Х	Х		Х	Х
MW26R-090903D	PN04E	09/03/09	FD		х	Х	Х		Х	Х
MW44-090903	PN04F	09/03/09	GW		х	Х	Х		Х	Х
MW36-090903	PN04G	09/03/09	GW		х	Х	Х		Х	Х

Samples and the associated analyses validated herein are summarized as follows:

#### Notes:

X - The analysis was requested and performed on the sample

VOCs - Volatile organic compounds, chlorinated ethanes and ethenes only

SVOCs - Semi-volatile organic compound, bis(2-ethylhexyl)phthalate only

PAHs - Polycyclic aromatic hydrocarbons, carcinogenics only

PCBs – Polychlorinated biphenyl Aroclors

As – Arsenic

Pb - Lead

Metals – Antimony, arsenic, chromium, copper, lead, and nickel TPH – Diesel and motor oil range total petroleum hydrocarbon GW – Groundwater sample FD – Field duplicate

# Analytical methods in respect to analytical parameters validated herein and the laboratory performing the analyses are summarized below:

Parameter	Analytical Method	Laboratory		
VOCs	SW846 Method 8260B			
SVOCs	SW846 Method 8270C–Full Scan			
PAHs	SW846 Method 8270C-SIM	Analvtical Resources. Inc. (ARI)		
PCB Aroclors	SW846 Method 8082	Tukwila, WA		
Metals (Sb, As, Cr, Cu, Pb, & Ni)	EPA Method 200.8			
TPH-Diesel and Motor Oil	NWTPH-Dx			

#### Notes:

1. SW846 Methods - USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.

2. EPA Method 200.8 - USEPA Methods for Chemical Analysis of Water and Wastes, EPA –600/4-79-020, March 1983 Revision.

3. NWTPH - Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997.

4. SIM – Selective ion monitoring

# DATA VALIDATION FINDINGS

# 1. VOCs by GC/MS (EPA Method SW8260B)

# **1.1** Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation. The temperature for coolers was outside the upper limit of  $4\pm2$  °C upon the receipt at the laboratory. All samples were hand-delivered to the laboratory the same day of collection. The higher cooler temperature had no significant effects on data quality. No other anomalies were identified in relation to sample preservation, handling, and transport.

Water samples should be analyzed within 14 days of collection. All samples were analyzed within the required holding time.

# 1.2 GC/MS Instrument Performance Check

Bromofluorobenzene (BFB) tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

#### 1.3 Initial Calibration

The National Functional Guidelines (NFGs) require that the percent relative standard deviation (%RSD) be <30% and the average response factor (RF) be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination ( $r^2$ ) be >0.99. Initial calibration met the criteria for all target compounds.

# 1.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the percent difference (%D) be within  $\pm 20\%$ , and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds.

Calibration verification analyses met the method requirements.

#### 1.5 Method Blank

A method blank was prepared and analyzed as required. Target compounds were not detected at or above the method detection limits (MDLs) in the method blank.

# 1.6 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD were prepared and analyzed as required by the method. All percent recovery (%R) and relative percent difference (RPD) values met the laboratory control criteria.

#### 1.7 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

# 1.8 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

#### 1.9 Internal Standard

The method requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

#### 1.10 Field Duplicates

Samples FM105-090902 and FM105-090902D were field duplicates. The duplicate sample RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

#### 1.11 Reporting Limits (RLs)

The sample-specific RLs met the QAPP requirements and were supported with adequate initial calibration concentrations.

#### 1.12 Overall Assessment of VOCs Data Usability

VOCs data are of known quality and acceptable for use.

# 2. *bis*(2-Ethylhexyl)phthalate by GC/MS (EPA Method SW8270C)

#### 2.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

#### 2.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

#### 2.3 Initial Calibration

The NFGs criteria require that the percent %RSD be <30% and the average RF be > 0.01 for poor response compounds and >0.05 for all other compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995, and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination ( $r^2$ ) be >0.99. The initial calibration met the criteria.

# 2.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within  $\pm 20\%$ , and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds. Calibration verifications met the criteria.

#### 2.5 Method Blank

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the MDL in the method blanks.

#### 2.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits, except that the %R value for one of the surrogates, *p*-terphenyl-d<sub>14</sub>, exceeded the upper control limit in sample CMP1-090904. *bis*(2-Ethylhexyl)phthalate was not detected at or above the RL in this samples. The higher surrogate recovery had no effect on data quality; no data were qualified on this basis.

#### 2.7 Matrix Spike (MS) and MS Duplicate (MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

#### 2.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.
# 2.9 Internal Standards

The method requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

# 2.10 Field Duplicates

Two pairs of field duplicates - samples FM105-090902 and FM105-090902D; and samples MW26R-090903 and MW26R-090903D, were submitted for *bis*(2-ethylhexyl)phthalate analyses. *bis*(2-Ethylhexyl)phthalate was not detected at or above the RL in these samples. The field precision met the project criterion.

# 2.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

# 2.12 Overall Assessment of *bis*(2-Ethylhexyl)phthalate Data Usability

*bis*(2-Ethylhexyl)phthalate data are of known quality and acceptable for use.

# 3. PAHs by GC/MS - SIM (EPA Method SW8270C)

# 3.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

# 3.2 GC/MS Instrument Performance Check

DFTPP tuning was performed within each 12-hour interval. All required ion abundance ratios met the method requirements.

# 3.3 Initial Calibration

The NFGs criteria require that the %RSD be <30% and the average RRF be >0.05 for all target compounds.

The method linearity criteria require that (1) if linear average RFs is chosen as the quantitation option, the %RSD of RFs be < 15% for the analyte, (2) if least-square linear regression is chosen for quantitation, the correlation coefficient (r) be >0.995,

and (3) if six-point non-linear (quadratic) curve is chosen for quantitation, the coefficient of determination ( $r^2$ ) be >0.99. The initial calibration met the criteria.

# 3.4 Calibration Verification

The analytical method and NFGs criteria require that (1) continuing calibrations be analyzed at the beginning of each 12-hour analysis period prior to the analysis of method blank and samples, (2) the %D be within  $\pm 20\%$ , and (3) the RF be > 0.01 for poor response compounds and >0.05 for all other compounds. Calibration verification analyses met the criteria or the %D values were at levels that had no effects on sample results (*e.g.*, biased-high %D values and the target analytes were not detected in associated samples).

# 3.5 Method Blanks

Method blanks were prepared and analyzed as required. No target compounds were detected at or above the MDLs in the method blanks.

# 3.6 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate %R values were within the laboratory control limits, except that the %R value (30.9%) for one of the surrogates, 2-methylnaphthalene-d<sub>10</sub>, was less than the lower control limit in sample CMP2-090902. The sample was diluted and re-analyzed. The %R values for both surrogates were within the control limits in the re-analysis, indicating that the lower surrogate recovery in the initial analysis was a result of matrix interference rather than extraction deficiency. Data were not qualified on this basis.

# 3.7 Matrix Spike (MS) and MS Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

# 3.8 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

# 3.9 Internal Standards

The method requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

# 3.10 Field Duplicates

Two pairs of field duplicates - samples FM105-090902 and FM105-090902D; and samples MW26R-090903 and MW26R-090903D, were submitted for PAHs analyses.

The duplicate RPD or concentration difference values for detected compounds and data qualification are presented in Appendix A of this report.

# 3.11 Reporting Limits

The sample-specific RLs met the project requirements and were supported with adequate initial calibration concentrations.

# 3.12 Overall Assessment of PAHs Data Usability

PAHs data are of known quality and acceptable for use.

# 4. PCB Aroclors by GC/ECD (EPA Method SW8082)

# 4.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

# 4.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using the mixture of Aroclor 1016 and 1260, (2) a single-point calibration be performed for the other five Aroclors to establish calibration factors (CFs) and for Aroclor pattern recognition, (3) at least 3 peaks (preferably 5 peaks) must be chosen for each Aroclor for characterization, (4) the relative standard deviation (%RSD) values of Aroclor 1016 and 1260 CFs must be  $\leq$  20%, and (5) if dual column analysis is chosen, both columns should meet the requirements.

The laboratory chose the internal-standard linear calibration for the Aroclor quantitation. The average RF %RSD values met the linearity criterion (20%). All RFs were >0.01, as recommended by SW846 Method 8000. The initial calibrations met the method requirements and were acceptable.

# 4.3 Calibration Verification

The method requires that (1) the initial calibration be verified prior to any analysis for each 12-hour analysis sequence, and (2) the percent drift ( $^{O}D_{f}$ ) be within ±15% to demonstrate the linearity of the initial calibration. Calibration verifications were performed at the required frequency. All  $^{O}D_{f}$  values either met the method criterion or at levels that had no effects on sample results (*e.g.*, biased-high  $^{O}D_{f}$  values where target analytes were not detected in associated samples).

# 4.4 Method Blanks

Method blanks were prepared and analyzed as required. PCB Aroclors were not detected at or above the MDLs in the method blanks.

#### 4.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

# 4.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD analyses were not performed on project samples in these SDGs, and therefore not reported.

# 4.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed with each analytical batch. All %R and RPD values were within the project control limits.

# 4.8 Internal Standards

The laboratory chose the internal-standard calibration approach for analyte quantitation. The SW-846, Method 8000 requires that (1) internal standard retention time be within  $\pm 30$  seconds from that of the associated 12-hour calibration standard, and (2) the area counts of all internal standards be within -50% to +100% of the associated 12-hour calibration standard. All internal standards in the sample and associated QC analyses met the criteria.

# 4.9 Field Duplicates

Two pairs of field duplicates - samples FM105-090902 and FM105-090902D; and samples MW26R-090903 and MW26R-090903D, were submitted for PCB Aroclors analyses. PCB Aroclors were not detected at or above the RLs in these samples. The field precision met the project criterion.

# 4.10 Reporting Limits and Target Compound Quantitation

Sample-specific RLs met the QAPP requirements. RLs in selected samples were raised due to non-target chemical interference or response peaks that did not meet the Aroclor identification criteria (*e.g.*, peak ratios, chromatographic patterns).

The dual column RPD value for Aroclor 1248 in sample CMP3-090903 was greater than 40%. The Aroclor 1248 result in this sample was qualified (J) as estimated.

# 4.11 Overall Assessment of PCB Aroclors Data Usability

PCB Aroclor data are of known quality and acceptable for use as qualified.

# 5. Total Metals by ICP/MS (EPA Method 200.8)

# 5.1 Sample Management and Holding Times

No anomalies were identified in relation to sample preservation, handling, and transport, as discussed in Section 1.1.

Water samples should be analyzed within 180 days. Samples were analyzed within the required holding time.

# 5.2 ICP/MS Tuning

Instrument tuning was performed at the required frequency. The stability check (%RSD <5%), mass calibration (mass difference <0.1 AMU), and resolution check (peak width <1.0 AMU at 5% peak height) met the NFG and method criteria.

# 5.3 Initial Calibration

The ICP methods requires that (1) a blank and one calibration standard be used in establishing the analytical curve, and (2) the average of replicate exposures be reported for all standards, QC, and sample analyses.

A check standard containing target analytes at the reporting limit levels was analyzed at the beginning of each analytical run. The results were within the NFGs criteria of 70-130%.

# 5.4 Calibration Verification (ICV and CCV)

Initial calibration verifications (ICVs) and continuing calibration verifications (CCVs) were analyzed at the required frequency. The %R values met the control criteria (90 – 110%).

# 5.5 Blanks

**Calibration Blanks:** Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed at required frequency. Target analytes were not detected at or above the MDLs in ICBs/CCBs.

**Method Blanks:** Method blanks were prepared and analyzed as required. Target analytes were not detected at or above the MDLs in the method blanks.

# 5.6 ICP Interference Check Sample (ICS)

The method requires that (1) an inter-element interference check sample be analyzed at the beginning of each analytical run, and (2) the results should be within  $\pm$  20% of the true value. ICP interference check sample analyses met the requirements.

# 5.7 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values met the control limits (80 - 120%).

# 5.8 Duplicate Sample Analysis

Duplicate sample analyses were not performed on project samples in these SDGs, and therefore not reported. The analytical precision was evaluated based on the field duplicate results.

# 5.9 Matrix Spike (MS)

Matrix spike analyses were not performed on project samples in these SDGs, and therefore not reported. The analytical accuracy was evaluated based on the LCS results.

# 5.10 Internal Standards

At least three internal standards were added to all field and QC samples for ICP/MS analyses. All percent relative intensity values were within the method criteria (30 - 120% of those for the associated calibration blank).

# 5.11 ICP Serial Dilution

Serial dilution analysis were not performed on project samples in these SDGs, and therefore not reported.

# 5.12 Field Duplicates

Two pairs of field duplicates - samples FM105-090902 and FM105-090902D; and samples MW26R-090903 and MW26R-090903D, were submitted for metals analyses. The duplicate RPD or concentration difference values for detected analytes and data qualification are presented in Appendix A of this report.

# 5.13 Analyte Quantitation and Reporting Limits

RLs for selected analytes in a number of samples were raised due to the required dilution to overcome matrix interference associated with the samples. The QAPP requirements for quantitation limits were achieved.

# 5.14 Overall Assessment of Metals Data Usability

Metals data are of known quality and acceptable for use.

# 6. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

# 6.1 Holding Time

Water samples should be extracted within seven days of collection. Extracts should be analyzed within 40 days of extraction. The extraction and analysis of samples met the requirements.

# 6.2 Initial Calibration

The method requires that (1) a minimum of 5-point calibration be performed using individual petroleum product reference standards to ensure the proper identification and quantitation of petroleum hydrocarbons in samples, (2) the calibration curve includes a sufficiently low standard to provide the necessary reporting limits, and (3) the linear working range of the instrument be defined.

The ICAL met the method requirements. The linearity of the ICAL curve was verified with  $\Bar{SD}$  of RFs ( $\Bar{SD} \le 20\%$ , according to EPA SW 846 Method 8000), and was acceptable for both diesel and motor oil range total petroleum hydrocarbon (TPH).

# 6.3 Calibration Verification

The method requires that (1) a mid-range check standard be analyzed prior to and after each analytical batch, and (2) the percent drift value be within  $\pm 15\%$  of the true value. The calibration verification analyses met the requirements.

# 6.4 Method Blanks

Method blanks were prepared and analyzed as required. TPH-Diesel and TPH-Motor Oil were not detected at or above the MDLs in the method blanks.

# 6.5 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the laboratory control limits.

# 6.6 Duplicate Analysis

Duplicate analyses were not performed on project samples in these SDGs, and therefore were not reported. Analytical precision was evaluated based on the LCS/LCSD analyses.

# 6.7 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

# 6.8 Field Duplicates

Two pairs of field duplicates - samples FM105-090902 and FM105-090902D; and samples MW26R-090903 and MW26R-090903D, were submitted for TPH-Diesel & Motor Oil analyses. The target compounds were not detected at or above the RLs in these samples. The field precision met the project criterion.

# 6.9 Reporting Limits

The reported RLs were supported with adequate ICAL concentrations. Sample-specific RLs met the QAPP requirements.

# 6.10 Overall Assessment of TPH-Diesel and Motor Oil Data Usability

TPH-Diesel and Motor Oil data are of known quality and acceptable for use.

# SUMMARY

I. Data qualification are summarized as follows:

Sample ID	Analyte	Data Qualifier	Reason	Report Section
CMP3-090903	Aroclor 1248	J	The dual column RPD value was greater than 40%.	4.10

II. Data affected by associated blanks are qualified and results adjusted as follows:

Sample ID	Analyte	Original Result	Adjusted Result	Unit	Report Section		
No data were qualified in relation to detections in blanks in these SDGs.							

III. Data Qualifiers are defined as follows:

Data Qualifier	Definition
J	The analyte was detected above the reported quantitation limit, and the reported concentration was an estimated value.
NJ	The analyte was not definitively identified and the reported concentration was an estimated value.
R	The result was rejected and could not be used.
U	The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
UJ	The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Approved By:

Date:

Mingta Lin

# REFERENCES

- USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, June 2007, EPA-540-R-08-01.
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, October 2004, EPA 540/R-04/004.
- USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.
- State of Washington, Analytical Methods for Petroleum Hydrocarbons, ECY 97-602, Washington State Department of Ecology, June 1997
- Port of Seattle, Southwest Harbor Project, Phase II Groundwater Confirmation Monitoring Program, Water Quality Monitoring Plan, Aspect Consulting, Inc., October 2008.

# APPENDIX A

The precision criterion ( $\leq$  50%) was applied to evaluating the relative percent difference (RPD) values of field duplicate results greater than five times the MRL (5xRL). For results less than 5xRL, an advisory criterion of 2xRL was applied to evaluating the concentration differences.

The RPD and concentration difference values for detected analytes and data qualification are presented as follows:

		Sample ID & Concentration (µg/L)			Conc.	
Detected Target Analyte	RL (μg/L)	FM105-090902	FM105-090902D	RPD (%)	Difference (µg/L)	Data Qualification
Arsenic	0.2	0.50	0.50	-	0	No action
cis-1,2-Dichloroethene	0.2	0.20	0.20	-	0	No action
Tetrachloroethene (PCE)	0.2	5.2	5.0	4%	-	No action
Trichloroethene (TCE)	0.2	0.60	0.50	-	0.10	No action
		Sample ID & Concentration (µg/L)			Conc.	
Detected Target Analyte	RL (µg/L)	MW26R-090903	MW26R-090903D	RPD (%)	Difference (µg/L)	Data Qualification
Chrysene	0.01	0.013	0.013	-	0	No action
Chromium	2	3	3	-	0	No action
Copper	2	3	3	-	0	No action
Nickel	2	7	6	-	1	No action

Notes:

RL – Reporting limit

ND - Not detected at or above the RL

RPD – Relative percent difference

Conc. Difference - Concentration difference between the parent sample and the field duplicate sample

CERTIFICATES OF ANALYSIS ANALYTICAL RESOURCES, INC. HART CROWSER, INC.

CERTIFICATES OF ANALYSIS ANALYTICAL RESOURCES, INC. ASPECT CONSULTING LLC