Quarterly Groundwater Monitoring Report-Outside (Non-Tunnel) Wells

Red Hill Bulk Fuel Storage Facility, Pearl Harbor, O‘ahu, Hawai‘i

Latitude: 21°22’15”N
Longitude: 157°53’33”W

DOH Facility ID No. 9-102271
DOH Release ID No. 99051, 010011, 020028

June 2011

Department of the Navy
Naval Facilities Engineering Command, Hawai‘i
400 Marshall Road
Pearl Harbor, HI 96860-3139

Environmental Technical Services
Contract Number N62742-08-D-1930, Contract Task Order HC14

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Prepared for:

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Naval Facilities Engineering Command, Hawai‘i
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Environmental Technical Services
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List of Acronyms

<	less than
µg/L	micrograms per liter
%	percent
amsl	above mean sea level
bTOC	below top of casing
COPC	chemical of potential concern
DL	detection limit or method detection limit (MDL)
DLNR	Department of Land and Natural Resources
DOH	State of Hawai‘i Department of Health
DON	Department of the Navy
DRO	diesel range organics
dup	duplicate
EAL	Environmental Action Level
EPA	U.S. Environmental Protection Agency
F-76	marine diesel fuel
FISC	Fleet and Industrial Supply Center
GRO	gasoline range organics
HAR	Hawai‘i Administrative Rules
IDW	investigation-derived waste
J	Estimated result. Indicates that the compound was identified but the concentration was above the DL and below the LOQ
JP	Jet Propellant
LOD	limit of detection
LOQ	limit of quantitation or reporting limit (RL)
MS	matrix spike
MSD	matrix spike duplicate
NA	not available
NAVFAC	Naval Facilities Engineering Command
ND	not detected
PAHs	polycyclic aromatic hydrocarbons
pH	hydrogen activity
PHWS	Pearl Harbor Water System
PPE	personal protective equipment
Q	data qualifier
QC	quality control
RHSF	Red Hill Bulk Fuel Storage Facility
RPD	relative percent difference
TEC	The Environmental Company, Inc.
TOC	top of casing
TPH	total petroleum hydrocarbons
U	Indicates the compound or analyte was analyzed for but not detected. The result is reported as ND.
U.S.	United States
USGS	United States Geological Survey
UST	underground storage tank
VOC	volatile organic compound

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Executive Summary

There are 18 active and two inactive, 12.5 million gallon capacity, field-constructed underground storage tanks (USTs) located at the Red Hill Bulk Fuel Storage Facility (RHSF). Previous environmental site investigations indicated a release had occurred and contaminated the groundwater underlying the RHSF.

The United States (U.S.) Navy implemented a groundwater monitoring program, which includes collecting quarterly groundwater samples from U.S. Navy Well 2254-01 (RHMW2254-01) and four groundwater monitoring wells (RHMW01, RHMW02, RHMW03, and RHMW05) installed in the RHSF lower access tunnel. The U.S. Navy Well 2254-01 is located approximately 3,000 feet downgradient from the RHSF and provides approximately 24 percent of the potable water to the Pearl Harbor Water System (PHWS). The groundwater samples are analyzed for petroleum constituents and compared against State of Hawai'i Department of Health (DOH) Drinking Water Environmental Action Levels (EALs) (DOH, 2009).

In response to increasing concentrations of chemicals of potential concern (COPCs) in the groundwater monitoring wells within the facility (specifically RHMW02) during 2008, plans were made to conduct four quarterly sampling events starting in August 2009 and ending in April 2010 at the following outside (non-tunnel) monitoring well locations:

- RHMW04;
- Oily Waste Disposal Facility Monitoring Well 01 (OWDFMW01); and
- Hālawa Deep Well 2253-03 (HDMW2253-03).

The four consecutive quarterly sampling events indicated all COPC concentrations were below the EALs for samples collected at monitoring well RHMW04. In January 2010 concentrations of total petroleum hydrocarbons (TPH) diesel range organics (DRO) were above the EALs at OWDFMW01 and HDMW2253-03. As a result, quarterly monitoring was discontinued at RHMW04 and continued at the two remaining outside monitoring wells. This groundwater monitoring report presents the analytical results for samples collected on April 21, 2011 at the two outside monitoring wells (OWDFMW01 and HDMW2253-03).

Laboratory analytical results indicate that all COPC concentrations during the April 2011 groundwater sampling event were below the EALs. Benzene was detected in monitoring well HDMW2253-03 at an estimated concentration of 0.42 micrograms per liter (µg/L). Xylenes and toluene were detected in monitoring well OWDFMW01 at estimated concentrations of 0.39 µg/L and 0.21 µg/L, respectively. Benzene was also detected in the monitoring well OWDFMW01 duplicate sample at an estimated concentration of 0.29 µg/L. Benzene was not detected in the OWDFMW01 primary sample. All other COPCs were not detected at or above the limits of detection (LODs) and limits of quantitation (LOQs). All LODs and LOQs were generally below the EALs. In the case where an EAL for a specific COPC is less than the LOQ, it is generally acceptable to consider the LOQ in place of the EAL (DOH, 2009). The results of this groundwater monitoring event indicate significant concentrations of COPCs detected within the facility are not impacting these two outside wells.

Section 1 Introduction

This report presents the results of the April 2011 quarterly groundwater monitoring event at the two outside monitoring wells (OWDFMW01 and HDMW2253-03) at the RHSF, Pearl Harbor, Oʻahu, Hawaiʻi (Figure 1-1). The groundwater monitoring was performed by Environet for the Department of the Navy (DON), Naval Facilities Engineering Command (NAVFAC) Hawaiʻi under Environmental Technical Services, Contract Number N62742-08-D-1930, Contract Task Order Number HC14.

This groundwater monitoring event is considered supplemental to the quarterly groundwater monitoring program conducted within the tunnels of the RHSF. This supplemental groundwater monitoring was conducted in response to increasing concentrations of COPCs in a groundwater monitoring well within the RHSF, specifically RHMW02, during the October 2008 groundwater monitoring event. The field activities performed for the April 2011 quarterly groundwater monitoring event were conducted in accordance with the procedures described in the *Work Plan, Long-Term Monitoring, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, Oʻahu, Hawaiʻi* (Environet, 2010).

1.1 Project Objective

The groundwater monitoring was performed to evaluate the presence of COPCs in groundwater surrounding the RHSF. The groundwater monitoring was conducted to ensure the DON remains in compliance with DOH UST release response requirements as described in Hawaiʻi Administrative Rules (HAR) 11-281 Subchapter 7, Release Response Action.

1.2 Background

The U.S. Navy implemented a groundwater monitoring program, which includes collecting quarterly groundwater samples from U.S. Navy Well 2254-01 (RHMW2254-01) and four groundwater monitoring wells (RHMW01, RHMW02, RHMW03, and RHMW05) installed in the RHSF lower access tunnel. The U.S. Navy Well 2254-01 is located approximately 3,000 feet downgradient from the RHSF and provides approximately 24 percent of the potable water to the PHWS. The groundwater samples are analyzed for petroleum constituents and compared against DOH Drinking Water EALs (DOH, 2009).

In response to increasing concentrations of COPCs in the groundwater monitoring wells within the facility (specifically RHMW02) during 2008, plans were made to conduct four quarterly sampling events starting in August 2009 and ending in April 2010 at the following outside (non-tunnel) monitoring well locations:

- RHMW04;
- Oily Waste Disposal Facility Monitoring Well 01 (OWDFMW01); and
- Hālawa Deep Well 2253-03 (HDMW2253-03).

The four consecutive quarterly sampling events indicated all COPC concentrations were below the EALs for samples collected at monitoring well RHMW04. In January 2010 concentrations of TPH-DRO were above the EALs at OWDFMW01 and HDMW2253-03. As a result, quarterly monitoring was discontinued at RHMW04 and continued at the two remaining outside monitoring wells. This groundwater monitoring report presents the analytical results for samples collected on April 21, 2011 at the two outside monitoring wells (OWDFMW01 and HDMW2253-03). The following sections provide a description of the site and information on the RHSF and USTs.

1.2.1 *Site Description*

The RHSF is located on the island of O‘ahu, Hawai‘i, approximately 2.5 miles northeast of Pearl Harbor in Hālawa Heights (Figure 1-1). Land adjacent to the north of the RHSF is occupied by the Hālawa Correctional Facility and private businesses. Land to the south and west of the facility includes the Coast Guard Reservation and other residential neighborhoods. Moanalua Valley is located east of the facility (Environet, 2010).

The Navy Public Works Department operates a potable water infiltration tunnel approximately 1,550 feet hydraulically downgradient from the RHSF (Environet, 2010). The U.S. Navy Well 2254-01 is located approximately 3,000 feet downgradient (west) of the RHSF and provides approximately 24 percent of the potable water to the PHWS, which serves approximately 52,200 military consumers (The Environmental Company, Inc. (TEC), 2008).

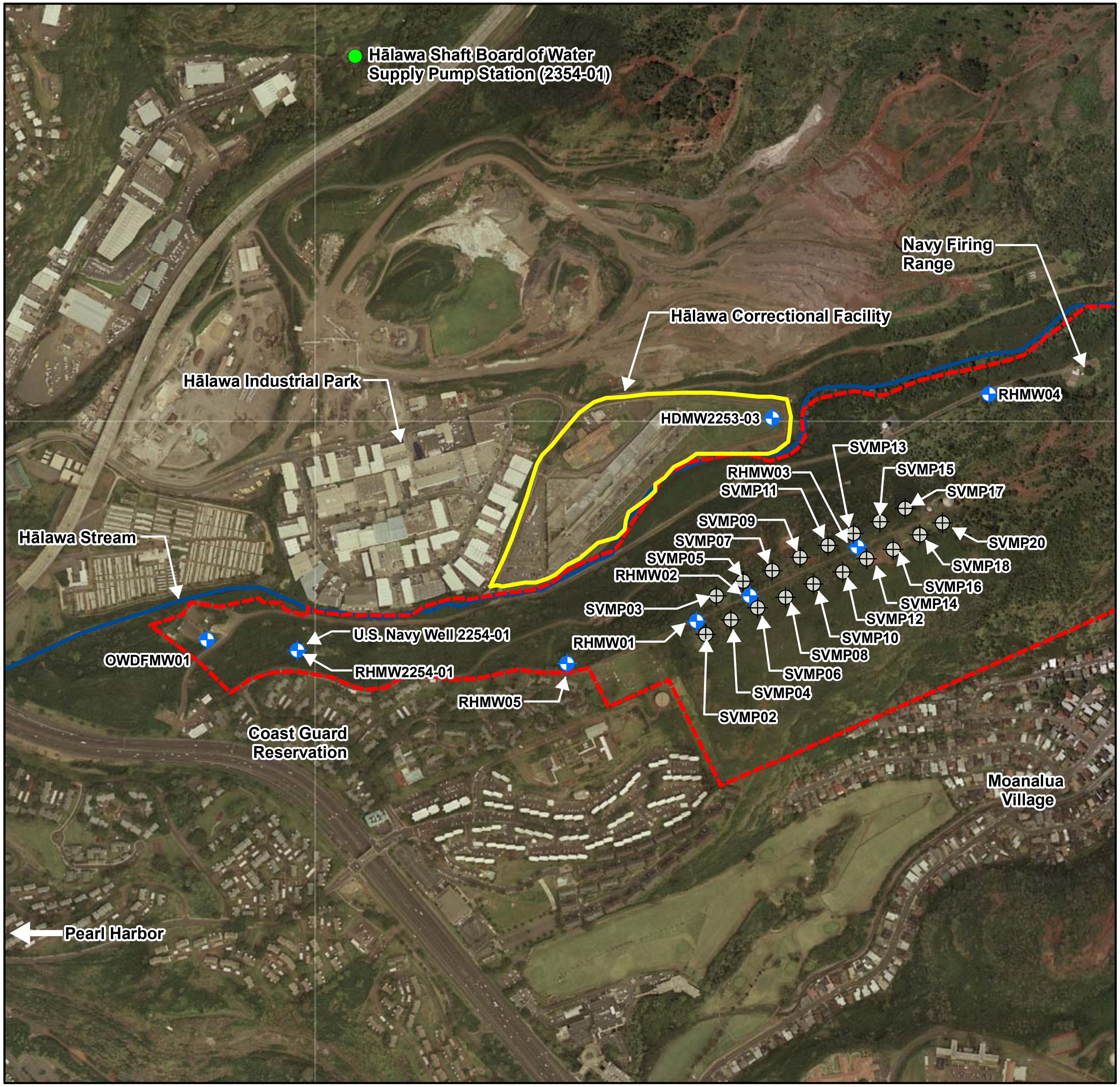
1.2.2 *Facility Information*

The RHSF consists of 18 active and two inactive USTs operated by the Navy Fleet and Industrial Supply Center (FISC) Pearl Harbor. Each UST has a capacity of 12.5 million gallons. The RHSF is located approximately 100 feet above the basal aquifer (Dawson Group, Inc., 2006).

In 2002, the U.S. Navy installed a groundwater monitoring well (RHMW01) into the basal aquifer, directly down-gradient from the RHSF, within the lower access tunnel. Groundwater samples from this well indicated that petroleum from the RHSF has migrated to the basal aquifer (AMEC Earth and Environmental, Inc., 2002). In 2005, the U.S. Navy began quarterly monitoring of the aquifer to protect their down-gradient drinking water resource associated with the U.S. Navy Well 2254-01.

By September 2005, the U.S. Navy had installed two more groundwater monitoring wells (RHMW02 and RHMW03) within the RHSF UST system, a groundwater monitoring well (RHMW04) north of the RHSF (adjacent to the U.S. Navy Firing Range), and a groundwater monitoring well within the U.S. Navy Well 2254-01 infiltration gallery (RHMW2254-01). Since 2005, RHMW01, RHMW02, RHMW03, and RHMW2254-01 have been sampled quarterly for TPH-DRO, TPH-gasoline range organics (GRO), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and dissolved lead.

Due to increasing concentrations of COPCs at the groundwater monitoring wells within the RHSF (specifically RHMW02) during 2008, response measures were warranted. In April 2009, another groundwater monitoring well (RHMW05) was installed within the lower access tunnel



LEGEND

⊕ Soil Vapor Monitoring Points
⊕ Groundwater Monitoring Wells
● Board of Water Supply Pump Station
🟨 Halawa Correctional Facility
🟥 Red Hill Naval Reservation
— Hālawa Stream

SOURCE

USGS, 2005

Figure 1-1
Groundwater Monitoring Well Location Map
Quarterly Groundwater Monitoring Report-Outside (Non-Tunnel) Wells, Red Hill Bulk Fuel Storage Facility, Pearl Harbor, O'ahu, Hawai'i

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between RHMW01 and RHMW2254-01. It was installed to identify the extent of contaminant migration in groundwater before it reaches the infiltration gallery at RHMW2254-01.

Additionally, plans were made to sample three monitoring wells surrounding and outside of RHSF: RHMW04, OWDFMW01, and HDMW2253-03 (Figure 1-1 and Table 1-1). RHMW04 was installed to evaluate groundwater within the basal aquifer upgradient from RHSF. OWDFMW01 (originally known as MW08) was installed into the basal aquifer in 1998 for a Phase II Remedial Investigation/Feasibility Study for the Red Hill Oily Waste Disposal Facility (Earth Tech, Inc., 2000). It is located geographically down-gradient of the USTs and U.S. Navy Well 2254-01. HDMW2253-03 is controlled by the State of Hawai‘i Commission on Water Resource Management. HDMW2253-03 is located between the RHSF and the municipal drinking water supply well which is operated by the City and County of Honolulu Board of Water Supply (Hālawa Shaft Pumping Station 2354-01) (Figure 1-1).

Table 1-1: Outside Monitoring Well Information

Groundwater Monitoring Well	bTOC Elevation (feet amsl)	Depth to Water (feet bTOC)	Total Depth of Well (feet)
RHMW04	313.03	---	320
OWDFMW01	138.94	120.00	142.8
HDMW2253-03	225	207.67*	1,575

Notes:
*Depth to water provided by the Department of Land and Natural Resources (DLNR) on April 21, 2011.
--- Depth to water was not gauged at RHMW04 during the April 2011 groundwater sampling event.
amsl - above mean sea level
bTOC - below top of casing

1.2.3 *UST Information*

The USTs were constructed in the early 1940s. The tanks were constructed of steel and currently contain Jet Propellant (JP)-5 fuel, JP-8, and marine diesel fuel (F-76). Previously, several tanks stored Navy Special Fuel Oil, Navy Distillate, aviation gasoline, and motor gasoline. Each tank measures approximately 245 feet in height and 100 feet in diameter. The upper domes of the tanks lie at depths varying between approximately 100 feet and 200 feet below the existing ground surface (TEC, 2006).

1.2.4 *Regulatory Updates*

During the summer and fall of 2008, DOH updated their EALs, which resulted in significant changes to the action levels associated with methylnaphthalenes. The drinking water toxicity EAL for these compounds was 240 µg/L. This concentration presumed that methylnaphthalenes were non-carcinogenic. Evidence that they are human carcinogens has now been accepted by the U.S. Environmental Protection Agency (EPA). As a result, DOH adopted more rigorous EALs of 4.7 µg/L for 1-methylnaphthalene and 24 µg/L for 2-methylnaphthalene, corresponding to a residential tap water scenario, and a one in a million cancer risk (DOH, 2009).

Also, the drinking water EAL for naphthalene was increased from 6.2 µg/L to 17 µg/L (DOH, 2009). Finally, the DOH Drinking Water EAL for TPH-DRO was increased from 100 µg/L to 210 µg/L, although the DOH Groundwater Gross Contamination EAL for TPH-DRO remains 100 µg/L.

1.3 Previous Reports

The following groundwater monitoring reports were previously submitted to the DOH for the groundwater monitoring wells within the RHSF:

1. Groundwater Sampling Report, First Quarter 2005 (submitted April 2005);
2. Groundwater Sampling Report, Second Quarter 2005 (submitted August 2005);
3. Groundwater Sampling Report, Third Quarter 2005 (submitted November 2005);
4. Groundwater Sampling Report, Fourth Quarter 2005 (submitted February 2006);
5. Groundwater Monitoring Results, July 2006 (submitted September 2006);
6. Groundwater Monitoring Results, December 2006 (submitted January 2007);
7. Groundwater Monitoring Results, March 2007 (submitted May 2007);
8. Groundwater Monitoring Results, June 2007 (submitted August 2007);
9. Groundwater Monitoring Results, September 2007 (submitted October 2007);
10. Groundwater Monitoring Results, January 2008 (submitted March 2008);
11. Groundwater Monitoring Results, April 2008 (submitted May 2008);
12. Groundwater Monitoring Results, July 2008 (submitted October 2008);
13. Groundwater Monitoring Results, October and December 2008 (submitted February 2009);
14. Groundwater Monitoring Results, February 2009 (submitted May 2009);
15. Groundwater Monitoring Results, May 2009 (submitted July 2009);
16. Groundwater Monitoring Results, July 2009 (submitted September 2009);
17. Groundwater Monitoring Results, October 2009 (submitted December 2009);
18. Groundwater Monitoring Results, January, February, and March 2010 (submitted April 2010);
19. Groundwater Monitoring Results, April 2010 (submitted May 2010);
20. Groundwater Monitoring Results, July 2010 (submitted August 2010);
21. Groundwater Monitoring Results, October 2010 (submitted December 2010); and
22. Groundwater Monitoring Results, January 2011 (submitted March 2011).

The following groundwater monitoring reports were previously submitted to the DOH for the groundwater monitoring wells outside the RHSF:

1. Groundwater Monitoring Results, August 2009 (submitted September 2009);
2. Groundwater Monitoring Results, October 2009 (submitted December 2009);
3. Groundwater Monitoring Results, January 2010 (submitted April 2010);

4. Groundwater Monitoring Results, April 2010 (submitted May 2010);
5. Groundwater Monitoring Results, July 2010 (submitted August 2010);
6. Groundwater Monitoring Results, October 2010 (submitted December 2010); and
7. Groundwater Monitoring Results, January 2011 (submitted March 2011).

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Section 2 Monitoring Activities

Groundwater monitoring was conducted on April 21, 2011 in accordance with the site specific Work Plan (Environet, 2010). Field activities were documented in the field notebook (Appendix A).

2.1 Groundwater Gauging

Groundwater gauging measurements were collected at the two monitoring wells (OWDFMW01 and HDMW2253-03) prior to purging and sample collection. A Solinst water level meter was used to measure the depth to groundwater to the nearest 0.01 foot within monitoring well OWDFMW01, according to the procedures described in Procedure I-C-3, *Monitoring Well Sampling* (DON, 2007). The depth to groundwater for monitoring well HDMW2253-03 was measured by a Department of Land and Natural Resources (DLNR) employee prior to well purging (Table 1-1).

2.2 Groundwater Sampling

Groundwater samples were collected from the two monitoring wells according to the procedures described in Procedure I-C-3, *Monitoring Well Sampling* (DON, 2007).

2.2.1 *Monitoring Well Purging*

Due to the well construction characteristics of OWDFMW01 and HDMW2253-03 (large casing diameter of approximately 12 inches from the top of casing (TOC) to approximately 50 feet below the groundwater surface then the well is open [not cased] from approximately 250 feet below TOC to 1,575 feet below TOC), three well casing volumes were not purged prior to sampling. Instead, water was purged using disposable bailers until three or more successive water quality parameter measurements had stabilized within 10 percent. A Horiba® U-22 multi-parameter water quality meter was used to measure hydrogen activity (pH), temperature, specific conductivity, dissolved oxygen, turbidity, and oxidation reduction potential. At least six readings were recorded on Groundwater Sampling Log data sheets (Appendix B).

2.2.2 *Groundwater Sample Collection*

Groundwater samples were collected from OWDFMW01 and HDMW2253-03 using four and two-inch disposable bailers. Groundwater samples were collected directly into laboratory provided, specially cleaned, sample containers already containing the appropriate preservatives (i.e., nitric acid for dissolved lead analysis). The dissolved lead samples were filtered in the field and placed in polyethylene bottles containing the appropriate preservative.

2.2.3 *Sample Management and Shipment*

Each sample container sent to the laboratory was assigned a project-specific chain of custody identification number and a descriptive identification number. The sample identifiers provided specific data unique to each sample and were entered into the field notebook. The samples were labeled according to the procedures described in Procedure III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody* (DON, 2007).

Following sample collection and labeling, the sample containers were packaged with bubble wrap and placed into individual ZipLoc® bags, then immediately into insulated coolers with ice for preservation. The samples were shipped via FedEx to the laboratory on the same day of collection. The samples were managed under standard chain of custody protocol and documentation from collection to delivery to the laboratory. Sample handling, storage, and transport were performed according to the requirements described in Procedure III-F, *Sample Handling, Storage, and Shipping* (DON, 2007).

2.3 Analytical Program

During the April 2011 groundwater monitoring event, two sets of primary groundwater samples, one set of duplicate groundwater samples, and one set of quality control (QC) groundwater samples were submitted to APPL, Inc. located in Clovis, California. Groundwater samples were analyzed for VOCs and TPH-GRO by EPA Method 8260B, TPH-DRO by EPA Method 8015B, PAHs by EPA Method 8270D SIM, and dissolved lead by EPA Method 6020. The results of the laboratory analyses are presented and discussed in Section 3.

2.4 Field Quality Control Samples

Field QC procedures were followed to ensure viability and integrity of sample analytical data. Field duplicates were collected according to the procedures described in Procedure III-B, *Field QC Samples (Water, Soil)* (DON, 2007) and the Work Plan (Environet, 2010). Field duplicate samples were collected at a minimum of 10 percent of primary samples and analyzed for the same contaminants. Field rinsate samples were not required since disposable bailers were used.

2.5 Laboratory Quality Control Samples

Laboratory QC samples were analyzed as part of the standard laboratory QC protocols as presented in the Work Plan (Environet, 2010). Laboratory QC for the groundwater monitoring event consisted of matrix spike (MS)/matrix spike duplicate (MSD) samples for organic analysis. Laboratory QC samples were collected and analyzed according to the procedures described in Procedure III-A *Laboratory QC Samples (Water, Soil)* (DON, 2007). Laboratory QC MS/MSD samples are an aliquot (i.e., a subset) of the field sample; they are not separate samples, but a special designation of an existing sample. Laboratory QC MS/MSD samples were analyzed for the same constituents as the standard samples. At a minimum, one MS/MSD sample pair was required per 20 samples, including duplicates.

2.6 Equipment Decontamination

Decontamination of monitoring equipment was performed to ensure data quality, to prevent cross contamination, and to prevent the potential introduction of contaminants into previously un-impacted areas. Decontamination of monitoring equipment (i.e., Solinst water level meter and Horiba® U-22 water quality meter) was conducted between monitoring locations according to the procedures described in Procedure I-F, *Equipment Decontamination* (DON, 2007). Decontamination water generated at monitoring well OWDFMW01 was disposed of in the RHSF's lower tunnel oil/water separator sump.

2.7 Investigation-Derived Waste (IDW) Management

IDW was managed in accordance with the procedures described in Procedure I-A-6, *IDW Management* (DON, 2007). The various potential waste streams included the following:

- personal protective equipment (PPE) including: nitrile gloves, etc.;
- liquids including: equipment rinse water and purged groundwater; and
- disposable sampling equipment and supplies, including: bailers, poly sheeting, etc.

Equipment rinse water and purge water from OWDFMW01 was disposed of in the RHSF’s lower tunnel oil/water separator sump. Purge water from monitoring well HDMW2253-03 was disposed of in the surrounding grass (as directed by DLNR) since it was of drinking water quality. Spent PPE and non-contaminated sample jars and bottles (acid free) were disposed of on a daily basis as solid waste.

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Section 3 Groundwater Analytical Results

This section provides a summary of analytical results for groundwater samples collected from the two outside monitoring wells on April 21, 2011. Complete analytical laboratory reports are provided in Appendix C.

3.1 Summary of Groundwater Analytical Results

OWDFMW01

Benzene (only in the duplicate sample), xylenes and toluene were detected in OWDFMW01 at estimated concentrations of 0.29 µg/L, 0.39 µg/L, and 0.21 µg/L which are below both the Drinking Water EAL (5 µg/L for benzene, 10,000 µg/L for xylenes, and 1,000 µg/L for toluene) and the Gross Contamination EAL (170 µg/L for benzene, 20 µg/L for xylenes, and 40 µg/L for toluene) (Table 3-1, Table 3-2).

All other COPCs were not detected at or above the LODs and LOQs in OWDFMW01. All LODs and LOQs were generally below the EALs. In the case where an EAL for a specific COPC is less than the LOQ, it is generally acceptable to consider the LOQ in place of the EAL (DOH, 2009).

HDMW2253-03

Benzene was detected in HDMW2253-03 at an estimated concentration of 0.42 µg/L which is below both the Drinking Water EAL (5 µg/L) and the Gross Contamination EAL (170 µg/L) (Table 3-1).

All other COPCs were not detected at or above the LODs and LOQs in HDMW2253-03. All LODs and LOQs were generally below the EALs. In the case where an EAL for a specific COPC is less than the LOQ, it is generally acceptable to consider the LOQ in place of the EAL (DOH, 2009).

3.1.1 *Data Quality Control Results*

The laboratory quality control results were all within the control limits. The relative percent difference (RPD) of field duplicates for all analytes were within the 50 percent criteria. The trip blank that accompanied the outside well samples did not contain detectable levels of any COPCs. The data quality control results indicate that the data obtained for this monitoring event are suitable for their intended use (Table 3-2).

Benzene, xylenes, and toluene were not detected in the laboratory blank samples (Appendix C).

3.2 Groundwater Contaminant Trend

Concentrations of PAHs and VOCs were previously not detected above the EALs during the August 2009, October 2009, January 2010, April 2010, July 2010, October 2010, and January

2011 groundwater monitoring events. These constituents were also not detected above the EALs during this groundwater monitoring event.

TPH-DRO concentrations in OWDFMW01 have significantly decreased from January 2010 (1,490 µg/L) to April 2010 (288 µg/L) and to non-detect in October 2010, January 2011, and April 2011 (Table 3-1 and Table 3-3). TPH-DRO concentrations at this well are decreasing.

The concentrations of TPH-DRO at HDMW2253-03 have decreased to non-detect for five consecutive events (Table 3-3). TPH-DRO concentrations at this well are decreasing.

The October 2010 detection of acetone at an estimated concentration below the DOH Drinking Water EAL was the first at monitoring well OWDFMW01. Acetone was also detected at an estimated concentration in the trip blank sample. This suggested that acetone was introduced to the samples during transport to and from the laboratory, and is not representative of groundwater at OWDFMW01. The previous conclusion that acetone is not representative of groundwater at OWDFMW01 is confirmed in the January 2011 sampling event and during this sampling event as acetone was not detected in any of the samples collected.

The October 2010 detections of lead at concentrations below the DOH Drinking Water EAL were the first at these two monitoring wells (OWDFMW01 and HDMW2253-03). Lead was not detected in any of the samples in the January 2011 sampling event and during this sampling event. This suggests that the October 2010 detection of lead was an anomaly.

The January 2011 detection of benzene at an estimated concentration below the DOH Drinking Water EAL in OWDFMW01 was the first at this monitoring well. Benzene was detected at an estimated concentration in the duplicate sample collected from OWDFMW01 during this sampling event.

The April 2011 detections of xylenes and toluene in OWDFMW01 and benzene in HDMW2253-03 at estimated concentrations below the DOH Drinking Water EALs were the first at these monitoring wells.

Table 3-1: Analytical Results for Quarterly Groundwater Monitoring-Outside (Non-Tunnel) Wells, April 2011

Method	Chemical	DOH Drinking Water EALs for Human Toxicity[a]	DOH Groundwater Gross Contamination EALs[a]	OWDFMW01 (ES029)					HDMW2253-03 (ES028)				
				Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL
EPA 8015B (Petroleum)	TPH-DRO	210	100	ND	U	150	80.8	40.4	ND	U	150	80.8	40.4
EPA 8260B (Petroleum)	TPH-GRO	100	100	ND	U	20.0	12.12	6.06	ND	U	20.0	12.12	6.06
EPA 8270D SIM (PAHs)	Acenaphthene	370	20	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06
	Acenaphthylene	240	2000	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06
	Anthracene	1800	22	ND	U	0.2	0.10	0.05	ND	U	0.2	0.10	0.05
	Benzo(a)anthracene	0.092	4.7	ND	U	0.2[b]	0.14	0.07	ND	U	0.2[b]	0.14	0.07
	Benzo(g,h,i)perylene	1500	0.13	ND	U	0.2[b]	0.16	0.08	ND	U	0.2[b]	0.16	0.08
	Benzo(a)pyrene	0.2	0.81	ND	U	0.2	0.14	0.07	ND	U	0.2	0.14	0.07
	Benzo(b)fluoranthene	0.092	0.75	ND	U	0.2[b]	0.12	0.06	ND	U	0.2[b]	0.12	0.06
	Benzo(k)fluoranthene	0.92	0.4	ND	U	0.2	0.14	0.07	ND	U	0.2	0.14	0.07
	Chrysene	9.2	1	ND	U	0.2	0.10	0.05	ND	U	0.2	0.10	0.05
	Dibenzo(a,h)anthracene	0.0092	0.52	ND	U	0.2[b]	0.10	0.05	ND	U	0.2[b]	0.10	0.05
	Fluoranthene	1500	130	ND	U	0.2	0.16	0.08	ND	U	0.2	0.16	0.08
	Fluorene	240	950	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06
	Ideno(1,2,3-cd)pyrene	0.092	0.095	ND	U	0.2[b]	0.14	0.07	ND	U	0.2[b]	0.14	0.07
	1,-Methylnaphthalene	4.7	10	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06
	2,-Methylnaphthalene	24	10	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06
	Naphthalene	17	21	ND	U	0.2	0.10	0.05	ND	U	0.2	0.10	0.05
	Phenanthrene	240	410	ND	U	0.2	0.14	0.07	ND	U	0.2	0.14	0.07
	Pyrene	180	68	ND	U	0.2	0.16	0.08	ND	U	0.2	0.16	0.08
EPA 8260B (VOCs)	1,1,1-Trichloroethane	200	970	ND	U	1.0	0.28	0.14	ND	U	1.0	0.28	0.14
	1,1,2-Trichloroethane	5	50,000	ND	U	1.0	0.40	0.20	ND	U	1.0	0.40	0.20
	1,1-Dichloroethane	2.4	50,000	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	1,1-Dichloroethylene (1,1-Dichloroethene)	7	1,500	ND	U	1.0	0.60	0.30	ND	U	1.0	0.60	0.30
	1,2,3-Trichloropropane	0.6	50,000	ND	U	2.0[b]	0.78	0.39	ND	U	2.0[b]	0.78	0.39
	1,2,4-Trichlorobenzene	70	3,000	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21
	1,2-Dibromo-3-chloropropane	0.04	10	ND	U	2.0[b]	1.52	0.76	ND	U	2.0[b]	1.52	0.76
	1,2-Dibromoethane	0.0065	50,000	ND	U	1.0[b]	0.40	0.20	ND	U	1.0[b]	0.40	0.20
	1,2-Dichlorobenzene	600	10	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17
	1,2-Dichloroethane	0.15	7,000	ND	U	1.0[b]	0.28	0.14	ND	U	1.0[b]	0.28	0.14
	1,2-Dichloropropane	5	10	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17
	1,3-Dichlorobenzene	180	50,000	ND	U	1.0	0.22	0.11	ND	U	1.0	0.22	0.11
	1,3-Dichloropropene (total of cis/trans)	0.43	50,000	ND	U	1.0	0.36	0.18	ND	U	1.0	0.36	0.18
	1,4-Dichlorobenzene	75	5	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	Acetone	22,000	20,000	ND	U	10.0	1.90	0.95	ND	U	10.0	1.90	0.95
	Benzene	5	170	ND	U	1.0	0.32	0.16	0.42	J	1.0	0.32	0.16
	Bromodichloromethane	0.22	50,000	ND	U	1.0[b]	0.28	0.14	ND	U	1.0[b]	0.28	0.14
	Bromoform	100	510	ND	U	1.0	0.28	0.14	ND	U	1.0	0.28	0.14
	Bromomethane	8.7	50,000	ND	U	2.0	0.48	0.24	ND	U	2.0	0.48	0.24
	Carbon Tetrachloride	5	520	ND	U	1.0	0.20	0.10	ND	U	1.0	0.20	0.10
	Chlorobenzene	100	50	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21
	Chloroethane	8,600	16	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21
	Chloroform	70	2,400	ND	U	1.0	0.14	0.07	ND	U	1.0	0.14	0.07
	Chloromethane	1.8	50,000	ND	U	1.0	0.62	0.31	ND	U	1.0	0.62	0.31
	cis-1,2-Dichloroethylene (cis-1,2-Dichloroethene)	70	50,000	ND	U	1.0	0.32	0.16	ND	U	1.0	0.32	0.16
	Dibromochloromethane (Chlorodibromomethane)	0.16	50,000	ND	U	1.0[b]	0.38	0.19	ND	U	1.0[b]	0.38	0.19
	Ethylbenzene	700	30	ND	U	1.0	0.46	0.23	ND	U	1.0	0.46	0.23
	Hexachlorobutadiene	0.86	6	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	Methyl ethyl ketone (2-Butanone)	7,100	8,400	ND	U	10.0	1.20	0.60	ND	U	10.0	1.20	0.60
	Methyl isobutyl ketone (4-Methyl-2-pentanone)	2,000	1,300	ND	U	10.0	3.80	1.90	ND	U	10.0	3.80	1.90
	Methyl tert-butyl Ether	12	5	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	Methylene chloride	4.8	9,100	ND	U	5.0	0.70	0.35	ND	U	5.0	0.70	0.35
	Styrene	100	10	ND	U	1.0	0.50	0.25	ND	U	1.0	0.50	0.25
	Tetrachloroethane, 1,1,1,2-	0.52	50,000	ND	U	1.0	0.26	0.13	ND	U	1.0	0.26	0.13
	Tetrachloroethane, 1,1,2,2-	0.067	500	ND	U	1.0[b]	0.20	0.10	ND	U	1.0[b]	0.20	0.10
	Tetrachloroethylene (Tetrachloroethene)	5	170	ND	U	1.0	0.30	0.15	ND	U	1.0	0.30	0.15
	Toluene	1,000	40	0.21	J	1.0	0.34	0.17	ND	U	1.0	0.34	0.17
	trans-1,2-Dichloroethylene (trans-1,2-Dichloroethene)	100	260	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
	Trichloroethylene (Trichloroethene)	5	310	ND	U	1.0	0.32	0.16	ND	U	1.0	0.32	0.16
	Vinyl chloride	2	3,400	ND	U	1.0	0.46	0.23	ND	U	1.0	0.46	0.23
	Xylenes	10,000	20	0.39	J	1.0	0.38	0.19	ND	U	1.0	0.38	0.19
EPA 6020	Lead	15	5000	ND	U	0.5	0.22	0.11	ND	U	0.5	0.22	0.11

Notes:

All units are in micrograms per liter (µg/L).

[a] DOH EALs (DOH, 2009): Table D-1b. Groundwater Action Levels (Groundwater is a current or potential drinking water resource; surface water body is not located within 150 meters of release site.)

[b] In the case where an EAL for a specific chemical is less than the LOQ for a commercial laboratory, it is generally acceptable to consider the LOQ in place of the action level (DOH, Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater 2008, updated March 2009).

DL - detection limit or method detection limit (MDL)
DRO - diesel range organics
GRO - gasoline range organics
J - Estimated result. Indicates that the compound was identified but the concentration was above the DL and below the LOQ.
LOD - limit of detection
LOQ - limit of quantitation or reporting limit (RL)
ND - not detected
PAHs - polycyclic aromatic hydrocarbons
Q - data qualifier
TPH - total petroleum hydrocarbons
U - Indicates the compound or analyte was analyzed for but not detected. The result is reported as ND.
VOC - volatile organic compound
Bold - Result exceeds one or both DOH EALs.

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Table 3-2: Field QC Results-Outside Wells, April 2011

Method	Chemical	DOH Drinking Water EALs for Human Toxicity[a]	DOH Groundwater Gross Contamination EALs[a]	OWDFMW01 ES029					OWDFMW01 dup ES031					RPD Duplicate (%)	Trip Blank (4/21/2011) ES030, ES032				
				Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL		Result	Q	LOQ	LOD	DL
EPA 8015B (Petroleum)	TPH-DRO	210	100	ND	U	150	80.8	40.4	ND	U	150	80.8	40.4	0	--	--	--	--	--
EPA 8260B (Petroleum)	TPH-GRO	100	100	ND	U	20.0	12.12	6.06	ND	U	20.0	12.12	6.06	0	ND	U	20.0	12.12	6.06
EPA 8270D SIM (PAHs)	Acenaphthene	370	20	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06	0	--	--	--	--	--
	Acenaphthylene	240	2000	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06	0	--	--	--	--	--
	Anthracene	1800	22	ND	U	0.2	0.10	0.05	ND	U	0.2	0.10	0.05	0	--	--	--	--	--
	Benzo(a)anthracene	0.092	4.7	ND	U	0.2[b]	0.14	0.07	ND	U	0.2[b]	0.14	0.07	0	--	--	--	--	--
	Benzo(g,h,i)perylene	1500	0.13	ND	U	0.2[b]	0.16	0.08	ND	U	0.2[b]	0.16	0.08	0	--	--	--	--	--
	Benzo(a)pyrene	0.2	0.81	ND	U	0.2	0.14	0.07	ND	U	0.2	0.14	0.07	0	--	--	--	--	--
	Benzo(b)fluoranthene	0.092	0.75	ND	U	0.2[b]	0.12	0.06	ND	U	0.2[b]	0.12	0.06	0	--	--	--	--	--
	Benzo(k)fluoranthene	0.92	0.4	ND	U	0.2	0.14	0.07	ND	U	0.2	0.14	0.07	0	--	--	--	--	--
	Chrysene	9.2	1	ND	U	0.2	0.10	0.05	ND	U	0.2	0.10	0.05	0	--	--	--	--	--
	Dibenzo(a,h)anthracene	0.0092	0.52	ND	U	0.2[b]	0.10	0.05	ND	U	0.2[b]	0.10	0.05	0	--	--	--	--	--
	Fluoranthene	1500	130	ND	U	0.2	0.16	0.08	ND	U	0.2	0.16	0.08	0	--	--	--	--	--
	Fluorene	240	950	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06	0	--	--	--	--	--
	Ideno(1,2,3-cd)pyrene	0.092	0.095	ND	U	0.2[b]	0.14	0.07	ND	U	0.2[b]	0.14	0.07	0	--	--	--	--	--
	1,-Methylnaphthalene	4.7	10	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06	0	--	--	--	--	--
	2,-Methylnaphthalene	24	10	ND	U	0.2	0.12	0.06	ND	U	0.2	0.12	0.06	0	--	--	--	--	--
	Naphthalene	17	21	ND	U	0.2	0.10	0.05	ND	U	0.2	0.10	0.05	0	--	--	--	--	--
	Phenanthrene	240	410	ND	U	0.2	0.14	0.07	ND	U	0.2	0.14	0.07	0	--	--	--	--	--
	Pyrene	180	68	ND	U	0.2	0.16	0.08	ND	U	0.2	0.16	0.08	0	--	--	--	--	--
EPA 8260B (VOCs)	1,1,1-Trichloroethane	200	970	ND	U	1.0	0.28	0.14	ND	U	1.0	0.28	0.14	0	ND	U	1.0	0.28	0.14
	1,1,2-Trichloroethane	5	50,000	ND	U	1.0	0.40	0.20	ND	U	1.0	0.40	0.20	0	ND	U	1.0	0.40	0.20
	1,1-Dichloroethane	2.4	50,000	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19	0	ND	U	1.0	0.38	0.19
	1,1-Dichloroethylene (1,1-Dichloroethene)	7	1,500	ND	U	1.0	0.60	0.30	ND	U	1.0	0.60	0.30	0	ND	U	1.0	0.60	0.30
	1,2,3-Trichloropropane	0.6	50,000	ND	U	2.0[b]	0.78	0.39	ND	U	2.0[b]	0.78	0.39	0	ND	U	2.0[b]	0.78	0.39
	1,2,4-Trichlorobenzene	70	3,000	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21	0	ND	U	1.0	0.42	0.21
	1,2-Dibromo-3-chloropropane	0.04	10	ND	U	2.0[b]	1.52	0.76	ND	U	2.0[b]	1.52	0.76	0	ND	U	2.0[b]	1.52	0.76
	1,2-Dibromoethane	0.0065	50,000	ND	U	1.0[b]	0.40	0.20	ND	U	1.0[b]	0.40	0.20	0	ND	U	1.0[b]	0.40	0.20
	1,2-Dichlorobenzene	600	10	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17	0	ND	U	1.0	0.34	0.17
	1,2-Dichloroethane	0.15	7,000	ND	U	1.0[b]	0.28	0.14	ND	U	1.0[b]	0.28	0.14	0	ND	U	1.0[b]	0.28	0.14
	1,2-Dichloropropane	5	10	ND	U	1.0	0.34	0.17	ND	U	1.0	0.34	0.17	0	ND	U	1.0	0.34	0.17
	1,3-Dichlorobenzene	180	50,000	ND	U	1.0	0.22	0.11	ND	U	1.0	0.22	0.11	0	ND	U	1.0	0.22	0.11
	1,3-Dichloropropene (total of cis/trans)	0.43	50,000	ND	U	1.0	0.36	0.18	ND	U	1.0	0.36	0.18	0	ND	U	1.0	0.36	0.18
	1,4-Dichlorobenzene	75	5	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19	0	ND	U	1.0	0.38	0.19
	Acetone	22,000	20,000	ND	U	10.0	1.90	0.95	ND	U	10.0	1.90	0.95	0	ND	U	10.0	1.90	0.95
	Benzene	5	170	ND	U	1.0	0.32	0.16	0.29	J	1.0	0.32	0.16	0	ND	U	1.0	0.32	0.16
	Bromodichloromethane	0.22	50,000	ND	U	1.0[b]	0.28	0.14	ND	U	1.0[b]	0.28	0.14	0	ND	U	1.0[b]	0.28	0.14
	Bromoform	100	510	ND	U	1.0	0.28	0.14	ND	U	1.0	0.28	0.14	0	ND	U	1.0	0.28	0.14
	Bromomethane	8.7	50,000	ND	U	2.0	0.48	0.24	ND	U	2.0	0.48	0.24	0	ND	U	2.0	0.48	0.24
	Carbon Tetrachloride	5	520	ND	U	1.0	0.20	0.10	ND	U	1.0	0.20	0.10	0	ND	U	1.0	0.20	0.10
	Chlorobenzene	100	50	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21	0	ND	U	1.0	0.42	0.21
	Chloroethane	8,600	16	ND	U	1.0	0.42	0.21	ND	U	1.0	0.42	0.21	0	ND	U	1.0	0.42	0.21
	Chloroform	70	2,400	ND	U	1.0	0.14	0.07	ND	U	1.0	0.14	0.07	0	ND	U	1.0	0.14	0.07
	Chloromethane	1.8	50,000	ND	U	1.0	0.62	0.31	ND	U	1.0	0.62	0.31	0	ND	U	1.0	0.62	0.31
	cis-1,2-Dichloroethylene (cis-1,2-Dichloroethene)	70	50,000	ND	U	1.0	0.32	0.16	ND	U	1.0	0.32	0.16	0	ND	U	1.0	0.32	0.16
	Dibromochloromethane (Chlorodibromomethane)	0.16	50,000	ND	U	1.0[b]	0.38	0.19	ND	U	1.0[b]	0.38	0.19	0	ND	U	1.0[b]	0.38	0.19
	Ethylbenzene	700	30	ND	U	1.0	0.46	0.23	ND	U	1.0	0.46	0.23	0	ND	U	1.0	0.46	0.23
	Hexachlorobutadiene	0.86	6	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19	0	ND	U	1.0	0.38	0.19
	Methyl ethyl ketone (2-Butanone)	7,100	8,400	ND	U	10.0	1.20	0.60	ND	U	10.0	1.20	0.60	0	ND	U	10.0	1.20	0.60
	Methyl isobutyl ketone (4-Methyl-2-pentanone)	2,000	1,300	ND	U	10.0	3.80	1.90	ND	U	10.0	3.80	1.90	0	ND	U	10.0	3.80	1.90
	Methyl tert-butyl Ether	12	5	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19	0	ND	U	1.0	0.38	0.19
	Methylene chloride	4.8	9,100	ND	U	5.0	0.70	0.35	ND	U	5.0	0.70	0.35	0	ND	U	5.0	0.70	0.35
	Styrene	100	10	ND	U	1.0	0.50	0.25	ND	U	1.0	0.50	0.25	0	ND	U	1.0	0.50	0.25
	Tetrachloroethane, 1,1,1,2-	0.52	50,000	ND	U	1.0	0.26	0.13	ND	U	1.0	0.26	0.13	0	ND	U	1.0	0.26	0.13
	Tetrachloroethane, 1,1,2,2-	0.067	500	ND	U	1.0[b]	0.20	0.10	ND	U	1.0[b]	0.20	0.10	0	ND	U	1.0[b]	0.20	0.10
	Tetrachloroethylene (Tetrachloroethene)	5	170	ND	U	1.0	0.30	0.15	ND	U	1.0	0.30	0.15	0	ND	U	1.0	0.30	0.15
	Toluene	1,000	40	0.21	J	1.0	0.34	0.17	ND	U	1.0	0.34	0.17	0	ND	U	1.0	0.34	0.17
	trans-1,2-Dichloroethylene (trans-1,2-Dichloroethene)	100	260	ND	U	1.0	0.38	0.19	ND	U	1.0	0.38	0.19	0	ND	U	1.0	0.38	0.19
	Trichloroethylene (Trichloroethene)	5	310	ND	U	1.0	0.32	0.16	ND	U	1.0	0.32	0.16	0	ND	U	1.0	0.32	0.16
	Vinyl chloride	2	3,400	ND	U	1.0	0.46	0.23	ND	U	1.0	0.46	0.23	0	ND	U	1.0	0.46	0.23
	Xylenes	10,000	20	0.39	J	1.0	0.38	0.19	ND	U	1.0	0.38	0.19	0	ND	U	1.0	0.38	0.19
EPA 6020	Lead	15	5000	ND	U	0.5	0.22	0.11	ND	U	0.5	0.22	0.11	0	--	--	--	--	--

Notes:

All units are in micrograms per liter (µg/L).

[a] DOH EALs (DOH, 2009): Table D-1b. Groundwater Action Levels (Groundwater is a current or potential drinking water resource; surface water body is not located within 150 meters of release site).

[b] In the case where an EAL for a specific chemical is less than the LOQ for a commercial laboratory, it is generally acceptable to consider the LOQ in place of the action level (DOH, Evaluation of Environmental Hazards at Sites with Contaminate
Soil and Groundwater 2008, updated March 2009).

DL - detection limit or method detection limit (MDL)
DRO - diesel range organics
dup - duplicate
GRO - gasoline range organics
J - Estimated result. Indicates that the compound was identified but the concentration was above the DL and below the LOQ.
LOD - limit of detection
LOQ - limit of quantitation or reporting limit (RL)
PAHs - polycyclic aromatic hydrocarbons
Q - data qualifier
RPD - relative percent difference
TPH - total petroleum hydrocarbons
U - Indicates the compound or analyte was analyzed for but not detected. The result is reported as ND.
VOC - volatile organic compound
-- not analyzed
Bold - Result exceeds one or both DOH EALs.

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Table 3-3: Historical and Current Groundwater Sample Analytical Results, August 2009 through April 2011

	OWDFMW01										HDMW2253-03									
	TPH-DRO					TPH-GRO					TPH-DRO					TPH-GRO				
	Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL	Result	Q	LOQ	LOD	DL
August 2009	ND	U	457	NA	171	ND	U	100	NA	30	--	--	--	NA	--	--	--	--	NA	--
October 2009	ND	U	444	NA	167	ND	U	100	NA	30	ND	U	494	NA	185	ND	U	100	NA	30
January 2010	**1490**		440	NA	165	ND	U	100	NA	30	**322**	J	460	NA	172	ND	U	100	NA	30
April 2010	**288**	J	471	NA	176	ND	U	100	NA	30	ND	U	471	NA	176	ND	U	100	NA	30
July 2010	--	--	--	--	--	--	--	--	--	--	ND	U	426	--	160	ND	U	100	--	30
October 2010	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06
January 2011	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06
April 2011	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06	ND	U	150	80.8	40.4	ND	U	20.0	12.1	6.06

DOH Drinking Water EALs for Human Toxicity[a] *: TPH-DRO = 210 µg/L; TPH-GRO = 100 µg/L*

DOH Groundwater Gross Contamination EALs[a] *: TPH-DRO = 100 µg/L; TPH-GRO = 100 µg/L*

Notes:
All units are in micrograms per liter (µg/L)
[a] DOH EALs (DOH, 2009): Table D-1b. Groundwater Action Levels (Groundwater is a current or potential drinking water resource; surface water body is not located within 150 meters of release site.)
-- The monitoring well was not sampled
DL - detection limit or method detection limit (MDL)
J - Estimated result. Indicates that the compound was identified but the concentration was above the DL and below the LOQ.
LOD - limit of detection
LOQ - limit of quantitation or reporting limit (RL)
NA - not available
ND - not detected
Q - data qualifier
U - Indicates that the compound was analyzed for but not detected. The result is reported as ND.
Bold - Result exceeds one or both DOH EALs.

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Section 4 Summary, Conclusions, and Recommendations

4.1 Summary

Benzene was detected at an estimated concentration of 0.42 μg/L in HDMW2253-03 during this groundwater monitoring event. This concentration is below the DOH Drinking Water EAL (5 μg/L) and the DOH Gross Contamination EAL (170 μg/L). No other COPCs were detected in HDMW2253-03 during the April 2011 groundwater sampling event.

Xylenes and toluene were detected at estimated concentrations of 0.39 μg/L and 0.21 μg/L, respectively in OWDFMW01 during this groundwater monitoring event. Benzene was also detected in OWDFMW01 duplicate sample at an estimated concentration of 0.29 μg/L. Benzene was not detected in the OWDFMW01 primary sample. These estimated concentrations are below the DOH Drinking Water EALs (5 μg/L for benzene, 10,000 μg/L for xylenes, and 1,000 μg/L for toluene) and the DOH Gross Contamination EALs (170 μg/L for benzene, 20 μg/L for xylenes, and 40 μg/L for toluene). No other COPCs were detected in OWDFMW01 during the April 2011 groundwater sampling event.

4.2 Conclusions

Concentrations of PAHs and VOCs were previously not detected above the EALs during the August 2009, October 2009, January 2010, April 2010, July 2010, October 2010, and January 2011 groundwater monitoring events. These constituents were also not detected above the EALs during this groundwater monitoring event. The data continue to suggest that TPH-DRO is the only COPC present in any notable quantity for the site.

TPH-DRO concentrations in OWDFMW01 have significantly decreased from January 2010 (1,490 μg/L) to April 2010 (288 μg/L) and to non-detect in October 2010, January, and April 2011 (Table 3-1 and Table 3-3). The concentrations of TPH-DRO at HDMW2253-03 have decreased to non-detect for five consecutive events. The data suggest that TPH-DRO concentrations are attenuating naturally at the two outside wells.

The October 2010 detection of acetone at an estimated concentration below the DOH Drinking Water EAL was the first at monitoring well OWDFMW01. Acetone was not detected in the January 2011 sampling event nor during this sampling event. This confirms acetone was introduced to the samples during transport to and from the laboratory. The October 2010 detection of acetone is not representative of groundwater at OWDFMW01. The October 2010 detections of lead at concentrations below the DOH Drinking Water EAL were the first at these two monitoring wells (OWDFMW01 and HDMW2253-03). Lead was not detected in any samples during the January 2011 sampling event nor during this sampling event. This confirms the lead detection in October 2010 was an anomaly.

The January 2011 detection of benzene at an estimated concentration below the DOH Drinking Water EAL in OWDFMW01 was the first at this monitoring well. Benzene was again detected only in the duplicate sample from OWDFMW01 at an estimated concentration below the DOH Drinking Water EAL during the April 2011 sampling event.

The April 2011 detections of xylenes and toluene in OWDFMW01 and benzene in HDMW2253-03 at estimated concentrations below the DOH Drinking Water EALs were the first at these monitoring wells.

4.3 Recommendations

Based on the results of the field observations and analytical testing, continuation of the quarterly groundwater monitoring of OWDFMW01 and HDMW2253-03 is recommended to monitor the presence of COPCs in the groundwater surrounding the RHSF.

Section 5 References

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Appendix A
Field Notebook

4/21/2011
Task: Groundwater sampling outside wells
Personnel: MS, SF
PPE : Level D
0800 : Met at office + packed truck
0830 : Went to Citymill + Storage
0945 : Checked in at gate.
10:00 : Health + Safety Meeting.
10:40 : Collected sample from HBMW22S3-03
12:30 : Collected sample from OWDF well
Collected Dup + MS/MSD from OWDF.
1400 : Tried to retrieve MW01 pump.
1600 : Return to office after Storage and scuba shop.

End of Entry

4/22/2011
Task: Ship Samples. retrieve pump
Personnel: SF, VD
PPE : Level D
0900 : Purchased equipment to retrieve pump from well.
1100 : Dropped samples off at Fed Ex
1300 : Arrived at tunnels to retrieve pump.
1530 : Unsuccessful using hooks, line and magnets.
1600 : Returned to office

End of Entry SF

Appendix B
Groundwater Sampling Logs

GROUNDWATER SAMPLING LOG

WELL ID: OWDFMW01 LOCATION: Red Hill Bulk Fuel Storage Facility PROJECT NO: 1022-015

INITIAL WATER LEVEL: 120 ft. DATE: 4/21/2011 TIME: 1205

TOTAL DEPTH OF WELL: 142.8 ft bTOC PERSONNEL INVOLVED: M.Solmssen, S.Fineran

LENGTH OF SATURATED ZONE: WEATHER CONDITIONS: Sunny

VOLUME OF WATER TO BE REMOVED: N/A METHOD OF REMOVAL: 2" and 4" disposable bailer

WATER LEVEL AFTER PURGING: 120.9 ft. PUMPING RATE: N/A

WELL PURGE DATA:

TIME	VOLUME REMOVED	pH	COND (S/m)	TURBIDITY (NTU)	DO (mg/l)	TEMP (^oC)	SALINITY (%)	REDOX (ORP) (mV)
1214	2 L	10.29	0.357	44.1	5.45	25.4	0.2	15
1217	6 L	10.47	0.357	61.0	5.77	24.6	0.2	0
1220	8 L	10.50	0.357	72.0	5.32	24.4	0.2	-8
1222	10 L	10.49	0.349	76.0	5.20	24.2	0.2	0

SAMPLE RETRIEVAL METHOD: 2" and 4" disposable bailer

APPEARANCE OF SAMPLE:
COLOR None
TURBIDITY None
SEDIMENT None
OTHER

SAMPLE ID: ES029, ESO31 (RH-OWDFMW01-GW23)
SAMPLE COLLECTION TIME: 1230
SAMPLED BY: S. Fineran, M. Solmssen

COMMENTS AND OBSERVATIONS: PID = 0.7 ppm
Collected MS/MSD sample = ES029 MS/MSD
Collected duplicate sample = ES031(RH-OWDFMW01-GW23 Dup) 8:30

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES: TPH-GRO (EPA 8260B) & VOCs (EPA 8260B),
TPH-DRO (EPA8015B) & PAHs (EPA 8270C SIM) with no preservative, and dissolved lead (EPA 6020) with nitric acid preservative

NUMBER AND TYPES OF SAMPLE CONTAINERS FILLED: Primary: (4) - 40 mL VOAs, (3) - 1 L amber bottle, (1) - 500 mL polyethylene bottle,
Duplicate: (3) - 40 mL VOAs, (3) - 1 L amber bottle, (1) - 500 mL polyethylene bottle, and MS/MSD: (6) - mL VOAs, (6) - 1 L amber bottle, (2) - 500 mL polyethylene bottle

DECONTAMINATION PROCEDURES: Alconox, triple rinse with distilled water
SAMPLES DELIVERED TO: APPL, Inc. TRANSPORTERS: VD, SF
SAMPLE DELIVERY DATE: 4/22/11 (shipped via FedEx) SAMPLE DELIVERY TIME: 1300

CAPACITY OF CASING (GALLONS/LINEAR FOOT)
2"-0.16; 4"-0.65; 6"-1.47; 8"-2.61; 10"-4.08; 12"-5.87

GROUNDWATER SAMPLING LOG

WELL ID: HDMW2253-03 LOCATION: Red Hill Bulk Fuel Storage Facility PROJECT NO: 1022-015

INITIAL WATER LEVEL: 207.67 ft bTOC DATE: 4/21/2011 TIME: 0925

TOTAL DEPTH OF WELL: 1,575 ft bTOC PERSONNEL INVOLVED: S.Fineran, M. Solmssen

LENGTH OF SATURATED ZONE: WEATHER CONDITIONS: Sunny

VOLUME OF WATER TO BE REMOVED: N/A METHOD OF REMOVAL: 2" and 4" disposable bailer

WATER LEVEL AFTER PURGING: N/A PUMPING RATE: N/A

WELL PURGE DATA:

TIME	VOLUME REMOVED	pH	COND (mS/m)	TURBIDITY (NTU)	DO (mg/l)	TEMP (^oC)	SALINITY (%)	REDOX (ORP) (mV)
1030	4 L	5.83	53.3	157.0	3.68	23.1	0.0	18
1035	8 L	5.80	47.9	176.0	8.54	22.8	0.0	-37
1040	13 L	6.13	48.2	147.0	2.43	22.7	0.0	-56
1045	17 L	6.19	54.9	147.0	2.67	22.6	0.0	-69

SAMPLE RETRIEVAL METHOD: 2" and 4" disposable bailer

APPEARANCE OF SAMPLE:
COLOR gray
TURBIDITY slightly turbid
SEDIMENT some sediment
OTHER

SAMPLE ID: ES028 (RH-HDMW2253-03-GW23)
SAMPLE COLLECTION TIME: 1040
SAMPLED BY: M. Solmssen, S. Fineran

COMMENTS AND OBSERVATIONS:
Note: depth to water was provided by DLNR (Jeremy)

LABORATORY ANALYSIS PARAMETERS AND PRESERVATIVES: TPH-GRO (EPA 8260B) & VOCs (EPA 8260B), TPH-DRO (EPA8015B) & PAHs (EPA 8270C SIM) with no preservative, and dissolved lead (EPA 6020) with nitric acid preservative

NUMBER AND TYPES OF SAMPLE CONTAINERS FILLED: (4) - 40 mL VOAs, (3) - 1 L amber bottle, (1) - 500 mL polyethylene bottle

DECONTAMINATION PROCEDURES: Alconox, triple rinse with distilled water
SAMPLES DELIVERED TO: APPL, Inc. TRANSPORTERS: SF, VD
SAMPLE DELIVERY DATE: 4/22/2011 (shipped via FedEx) SAMPLE DELIVERY TIME: 1300

CAPACITY OF CASING (GALLONS/LINEAR FOOT)
2"-0.16; 4"-0.65; 6"-1.47; 8"-2.61; 10"-4.08; 12"-5.87

Appendix C
Laboratory Analytical Results, April 2011 (on CD-ROM)