ANNUAL REPORT

2013 GROUNDWATER MONITORING AND WHOLE-HOUSE FILTER PROGRAM FOR MOSES LAKE WELLFIELD SUPERFUND SITE (FORMER LARSON AIR FORCE BASE) MOSES LAKE, WASHINGTON

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LIST OF ACRONYMS AND ABBREVIATIONS

1,1-DCE	1,1-Dichloroethylene
ADR	Automatic Data Review
AFB	Air Force Base
CERCLA	Comprehensive Environmental Responsibility, Compensation, and Liability Act
cis-DCE	cis-1,2-Dichloroethene
COC	Contaminant of Concern
DCA	1,2-Dichloroethane
1,1-DCA	1,1-Dichloroethane
DERP-FUDS	Defense Environmental Restoration Program - Formerly Used Defense Sites
DQIs	Data Quality Indicators
DQOs	Data Quality Objectives
DoD QSM	Department of Defense Quality Systems Manual for Environmental Laboratories
GAC	Granular Activated Carbon
IA	Interagency Agreement
ID	Identification
MCL	Maximum Contaminant Level
MWH	Montgomery Watson Harza
NC	Not Calculated
µg/L	Micrograms per Liter
PE	Performance Evaluation
QC	Quality Control
QAPP	Quality Assurance Project Plan
QCSR	Quality Control Summary Report
RI	Remedial Investigation
RL	Reporting Limit
ROD	Record of Decision
ROE	Rights-of-Entry
SEDD	Staged Electronic Data Deliverable
TCE	Trichloroethylene
trans-DCE	trans-1,2-Dichloroethylene
TCA	1,1,1-Trichloroethane
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VC	Vinyl Chloride
VOC	Volatile Organic Compounds
WDOE	Washington (State) Department of Ecology
WHF	Whole-House Filters

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EXECUTIVE SUMMARY

The purpose of this Annual Report is to summarize findings from the 2013 Moses Lake Wellfield Superfund Site (Site) annual sampling program efforts completed by the U.S. Army Corps of Engineers (USACE) on behalf of the Region 10 U.S. Environmental Protection Agency (EPA). The objective of this sampling program is to ensure protection of human health by sampling groundwater and comparing values to the Federal drinking water Maximum Contaminant Level (MCL) standard for Site contaminants such as trichloroethylene (TCE) that are present from historic Site activities. The Site Interim Record of Decision (ROD) requires actions such as implementation of Whole House Filter (WHF) treatment systems to ensure prevention of human exposure to groundwater contaminants that exceed the MCLs for TCE and related contaminants of concern. Under an Interagency Agreement (IA) with EPA, USACE provides ongoing technical assistance including groundwater sampling and maintenance of WHF systems required to protect human health related to Site contamination.

The 2013 sampling activity consisted of three events which included sampling a total of ninety-six (96) private wells and 60 monitoring wells. The first event conducted in May 2013 focused on replacement of four WHF treatment systems at private wells that had been identified to have contaminant breakthrough in 2012 (WP-14, WP-70, WP-83, and WP-86). Additionally, the WHF at the private well WP-82 was not replaced and was removed because TCE contamination has not been detected at WP-82 for multiple years and therefore did not show evidence of an associated excess risk to human health. Following WHF replacement, there were no instances of lead or lag filter breakthrough of Volatile Organic Compound (VOC) contaminants at any of the WHF systems during the two subsequent quarters of sampling. This confirmed that the new WHFs are protecting human health as required in the ROD.

Historically, a Site action threshold of 3.5 µg/L TCE has been used as the predetermined groundwater concentration at which cautionary engineering controls such as WHFs are implemented. The action threshold accounts for analytical uncertainty of the method used for TCE quantitation to ensure human exposure above the MCL does not occur. Results from two quarterly sampling events (June and August 2013) identified four private residential wells with TCE concentrations that exceeded the TCE action threshold of 3.5 ug/L. Based on these findings, USACE coordinated with the EPA and residences and installed WHFs for private well locations WP-119, WP-121, WP-124, and WP-129.

Influent concentrations in two of the new well locations which received WHFs during 2013 (WP-119 and WP-121), exceeded the TCE MCL during the subsequent August round of quarterly sampling. WP-119 increased from 4.00 to 5.26 ug/L TCE and WP-121 increased from 4.21 to 5.26 ug/L TCE. This observation demonstrates how use the of an action threshold prevented human exposure to groundwater concentrations above the MCL. It also documents variability in Site groundwater suggesting a need to better understand the extent and drivers of system variability so that the sampling program can be further designed to ensure human protectiveness.

A condensed list of recommendations from groundwater sampling efforts completed in 2013 include:

- Collect annual groundwater samples from all private wells with any historic contaminants of concern detections on an annual basis until a better understanding of plume migration has been documented.

- Continue updating the sampling program by adding new private wells, small public water systems and monitoring wells with high likelihood of VOC detections as they are identified through Department of Ecology's well log database and the Department of Health's water system database.
- For private wells that exceed 2.0 ug/L TCE, collect quarterly groundwater samples for at least four quarters to evaluate patterns in seasonal and temporal system variability that support future sampling frequency recommendations.
- Add WHFs to private wells that exceed the action threshold of 3.5 ug/L TCE during quarterly or annual monitoring.
- Reevaluate overall extent of residential and monitoring wells to be sampled as part of the monitoring program based on findings from annual and quarterly sampling.
- There is uncertainty in how much the well purging procedure during sampling impacts the TCE results. It is recommended that a small scale purging study be completed during 2014 to better understand the variability in sample results based on purging length and duration. This study should recommend optimal purge time and volume required to ensure protectiveness for private residents.

1. INTRODUCTION

Under an Interagency Agreement (IA) with U.S. Environmental Protection Agency (EPA), Seattle District U.S. Army Corps of Engineers (USACE) provides ongoing technical assistance including groundwater sampling and Whole House Filter (WHF) maintenance as required to protect human health. The purpose of this Annual Report is to summarize findings from 2013 annual sampling program efforts completed by USACE on behalf of EPA to support requirements within the ROD. The report is broken up into seven sections as briefly described below:

- Section 1: Site background
- Section 2: Summary of 2013 field activities
- Section 3: Data results and discussion
- Section 4: Data Quality Assessment
- Section 5: State Well Inventory Database review findings
- Section 6: Summary and discussion of findings from 2013 sampling
- Section 7 Recommendations from 2013 sampling

1.1 Background

Moses Lake Wellfield Superfund Site (Site) is located within and beyond the northwestern region of the City of Moses Lake, Washington (Figure 1 & 2). The Site encompasses approximately 15 square miles, and includes the Grant County International Airport and surrounding area (formerly the Larson Air Force Base (LAFB)), commercial facilities, and residences.

Previous environmental investigations conducted at the Site identified contamination of soil and groundwater resulting from historic operation of the former LAFB and industrial activities associated with the aircraft industry. Potential source areas are scattered throughout the Site and approximately 1000 acres of groundwater have been identified as contaminated to date.

Previous investigations focused primarily on the former LAFB. The former LAFB occupied approximately 9607 acres and was active from 1942 until 1966. In 1988, three municipal wells operated by the City of Moses Lake were found to be contaminated with trichloroethylene (TCE). Additionally, TCE was historically detected in two domestic wells operated by the Skyline Water System, Inc., a private water provider located in unincorporated Grant County south of the former LAFB property. Domestic (residential) and commercial (light or heavy industrial) private wells locations outside the former base have also had detections of TCE. TCE concentrations associated with the Site have been found to exceed the EPA's National Primary Drinking Water Standards or, the Maximum Contaminant Level (MCL), under the Federal Safe Drinking Water Act. The MCL represents the maximum level of the contaminant allowed and is set at 5 micrograms per liter (ug/L) for TCE.

Based on the TCE detections described above, between 1989 and 1993 the City was required to fix the three contaminated City water-supply wells south of the Airport. In addition, the Skyline community which was dependent on the contaminated Skyline Water System received an alternative water source (bottled water) between 1997 and 2003. In 2003, USACE completed construction of a replacement water-supply well which draws water from a deeper uncontaminated groundwater aquifer and currently provides drinking water to the Skyline community.

Following findings of contaminated domestic wells and upon request from Region 10 EPA, USACE began a groundwater sampling program in 2001. Under this program, drinking water from private wells[1], small drinking water systems (Group A and B systems)[2], and monitoring wells surrounding Moses Lake were sampled for TCE related compounds. The program is used to ensure humans are not exposed to contaminant concentrations above the MCL and uses groundwater monitoring wells to monitor TCE plume migration. For ease of reporting, small drinking water systems are reported as part of private wells. Groundwater elevation data is collected where available to evaluate groundwater flow direction and is also used evaluate plume migration at groundwater monitoring wells. Groundwater monitoring wells have been installed over the last 22 years in order to monitor the Site.

The USACE annual sampling program has primarily focused on private wells. The majority of private wells sampled are located in the Cascade Valley area immediately downgradient of the main (north) and south plumes (see Figure 7 and 8 for reference of TCE plume locations in relation to the Cascade Valley). In 2002, following two private well monitoring events, a whole house filter (WHF) system was designed and installed at 5 residential sites where it was determined that TCE contamination could potentially exceed the drinking water standard for TCE (5 ug/L).

An Interim Record of Decision (ROD) (Sept. 2008) includes cleanup actions in areas with soil and groundwater contamination that exceed risk-based concentrations. The ROD required groundwater pump and treat systems to be installed for two of five identified plumes of TCE to remove contaminants until the drinking water standard of 5 ug/L is met.

The ROD specifies that information gathered during groundwater monitoring, as well as design and operation of the selected groundwater pump and treat system be used to determine the need for refinement of the selected groundwater remedy to meet groundwater restoration goals. Currently EPA is designing a pump and treat system for the southern plume that is anticipated to be operational in summer of 2015 (the southern plume as defined in the ROD is illustrated in Figure 2). Information from the operation of the southern plume treatment system will be used to make decisions on a second pump and treat system that is planned to be installed for the northern plume.

The chemicals of concern monitored in the groundwater sampling program are as follows:

- trichloroethylene (TCE)
- 1,1-dichloroethylene (1,1-DCE)
- cis-1,2-dichloroethylene (cis-DCE)
- trans-1,2-dichloroethylene (trans-DCE)
- 1,2-dichloroethane (DCA)
- vinyl chloride (VC)
- 1,1,1-trichloroethane (TCA)
- 1,1-dichloroethane (1,1-DCA)

[1] Private wells consist of wells used for drinking and other domestic uses and industrial process wells.

[2] Group A systems are defined in RCW 70.119A.020 as a public water system providing water to at least 15 service connections, 25 people per day for at least 60 days per year, or 1,000 or more people on two consecutive days. Group B water systems serve fewer than 15 service connections and fewer than 25 people per day, OR 25 or more people per day for fewer than 60 days per year provided the system doesn't serve 1,000 or more people for two consecutive days (WAC 246-291-005).

1.2 2013 Sampling Program Scope of Work

The project scope of work includes:

I. Installation, replacement, and maintenance of whole-house filter (WHF) systems;

II. Collection and analysis of water elevation data and contaminants of concern in groundwater monitoring wells;

III. Collection, analysis, and evaluation of contaminant of concern (COC) data in untreated private wells and private wells with WHF systems;

IV. Coordination and contracting with laboratories and subcontractors for data analysis and data validation.

V. Updating the project database with sampling results;

VI. Review of the Washington State Department of Ecology (WDOE) Well Inventory Database for newly constructed private wells which may be at risk of contaminants of concern; and

VII. Annual report summarizing activities, analytical results, and recommendations.

A total of ninety-six (96) private well locations and 60 monitoring well locations were sampled for contaminants of concern during three events performed on May 6-9, 2013 (Event 1), June 10-13, 2013 (Event 2) and August 26-28, 2013 (Event 3).

1.3 Geologic Setting

The Site occupies a nearly flat fluvial terrace bounded to the east by Crab Creek and to the south and west by Moses Lake. The geologic units affected by contamination include, with increasing depth and from youngest to oldest: sand and coarse gravel deposited by huge glacial floods (Hanford formation), silt and sand deposited in lakes and rivers (Ringold Formation, locally eroded away to the north and east), and several extensive basalt flows of the Wanapum Basalt Formation. The Wanapum Basalt at the Site is divided into three members, from geologically youngest to oldest: the Priest Rapids Member, the Roza Member, and the Frenchman Springs Member. At the Site, the Roza Member consists of three basalt flows, of which Roza 1 is the youngest and always the first encountered. The Priest Rapids Member overlies the Roza Member in the central portions of the Site, but is mostly highly weathered and has been eroded away entirely along the east and west margins. The basalt flows typically have a vesiculated, fractured, and sometimes brecciated flowtop overlying a dense flow interior characterized by vertical cooling fractures. The deeper and less weathered the basalt flows are, the more likely these fractures are to be completely filled by secondary minerals (ROD, 2008).

Figure 3 illustrates the Hydrogeologic Conceptual Model which shows the geological members as defined in the ROD. The three hydrostratigraphic units relevant to the Site are:

- Hanford Formation (aquifer in areas, but unsaturated beneath a substantial portion of the Site)
- Ringold Formation (locally semi-confining, locally water-bearing, absent in areas)

- Priest Rapids and flow-top of Roza 1 (aquifer)
- Dense flow interior of Roza 1 (aquitard)
- Roza 2 flow top (aquifer)
- Dense flow interior of Roza 2 (aquitard)

TCE has been detected in all three aquifers described above, indicating there is likely connectivity to some extent between aquifers. The highest concentrations of TCE are found in the Priest Rapids and flow top of Roza 1 aquifer. The TCE occurrence and migration pathways are also illustrated on Figure 3 showing the complexity of contaminant flow through the fractured basalts.

Monitoring well nomenclature is based on the Hydrogeologic Conceptual Model. The Hanford Formation aquifer is generally associated with the AW series monitoring wells; the Priest Rapids and Roza 1 aquifer is associated BW series monitoring wells; and the Roza 2 basalt flow is associated with the CW series monitoring wells. An example of the monitoring well nomenclature is 12BW05. This represents a well drilled in 2012 (12), screened within the Priest Rapids and Roza 1 aquifer (BW), that was fifth in the BW monitoring well series (05).

Contamination is primarily located in the upper basalt aquifers (Priest Rapids and Roza 1 and Roza 2). Some of the private wells may be drawing water from the overlying alluvium but drill logs suggest that the majority of the private wells are open only in basalt.

1.4 Previous Investigations

On February 16, 1988, groundwater samples were collected by the Washington Department of Social and Health Services (DSHS) from eight wells serving the City of Moses Lake municipal water supply system. Analytical results indicated that three wells contained elevated concentrations of TCE. Additional sampling by DSHS in both September and December of 1988 found TCE concentrations in excess of 5.0 µg/L in several City of Moses Lake and Skyline Water Company wells.

Based on these preliminary sampling results, EPA requested that Ecology and Environment, Inc. (E&E) outline possible approaches to identify the potential source or sources of TCE groundwater contamination in the Moses Lake area. E&E identified a number of potential source areas for the TCE contamination. In response to the detection of TCE in the municipal wells, USACE, the Department of Defense representative for deactivated armed forces bases, conducted interviews with former LAFB employees in 1989. These interviews identified four potential chemical waste disposal areas and thirteen other potential areas where TCE may have been handled, as source areas for groundwater contamination.

In 1991, under contract with USACE, Dames & Moore initiated a Phase I Remedial Investigation (RI) at the former LAFB, which included a preliminary evaluation of the extent of TCE contamination in the upper aquifer system at the former LAFB and areas downgradient from the former base. In addition, four sites previously identified by record reviews and interviews were investigated for potential sources of TCE, tetraethyl lead and radionuclides. Field investigations were conducted between August 1991 and October 1992. The final results of the Phase I RI released in a report in March 1993 indicated that TCE was consistently found in shallow alluvial Hanford Formation groundwater in the central area of the former base. The majority of the contaminant plume is contained in the Priest Rapids and Roza 1 aquifer. The investigation performed by Dames and Moore did not include the lower basalt (Roza 2) aquifer (there are currently only 12 monitoring wells in the Roza 2). The boundary of the TCE plume was partially defined to the north and east but the south and west were not clearly delineated.

On October 14, 1992, the affected areas of the former LAFB and off-site downgradient areas were listed on the National Priority List (NPL) for Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The former LAFB property is one part of the Site. The Site also includes the contaminant plumes that are generalized in Figure 2.

In 1992, an underground storage tank area associated with Pumphouse No. 1 was found to have petroleum contamination in groundwater and soils. An Independent Remedial Action under the Model Toxics Control Act (MTCA) was performed by the Port of Moses Lake for the Site and is documented in a 1998 report by Secor International, Inc. The pumphouse appears to be hydraulically upgradient of TCE contamination detected in groundwater at the Site.

In July 1995, Dames & Moore completed an addendum to the 1993 Phase I RI to further delineate TCE occurrences and potential TCE sources, and monitor TCE concentrations in the Hanford Formation and upper Priest Rapids Roza1 aquifers. Chemical results from 1993 and 1994 combined with historical data indicated that TCE occurred in the central and southern portion of the former LAFB in Hanford Formation and upper Priest Rapids Roza1 groundwater. Groundwater concentrations of TCE were relatively consistent (within the same order of magnitude) during the Dames & Moore investigations. In 2004, USACE confirmed TCE contamination in the Roza 2 aquifer. As of 1995, the data suggest that more than one source may have contributed TCE to the Hanford Formation and upper Priest Rapids Roza1 groundwater in the central portion of the former LAFB.

In 1998, URS Greiner completed a sampling round of private water wells and wells for Class A and Class B water systems east, south and southwest of the previously known TCE plume. There were eight detections of TCE during this study. Four wells that were previously outside of the TCE plume were found to be above the detection limit (MWH, September 23, 1999).

During 1999, the USACE retained Montgomery Watson to perform a remedial investigation at the Site. During the course of the RI, several private wells were tested and found to be contaminated with TCE. In 2001, the USACE contracted with MSC Environmental to install single stage WHF carbon filtration units at five of the wells. In 2007, CALIBRE began replacing the original single filter units with lead-lag systems. In 2008, two rounds of monitoring occurred in April and June, and change outs of carbon cartridge filters at WP-14, WP-70, WP-82, WP-83, and WP-86 during the June 2008 monitoring event were performed by CALIBRE under contract for the USACE. In 2009-2012, four rounds of monitoring occurred in conjunction with change-outs of carbon cartridge filters from WHF systems at wells WP-14, WP-82, WP-83, and WP-86. This work was performed by EHS-International (EHSI) under contract with USACE through 2011. In 2012, field work was performed by USACE staff, sample analysis was performed by Analytical Resources, Inc (ARI), and analytical data was validated by Laboratory Data Consultants, Inc (LDC).

1.5 USACE Investigation Strategy

The investigation strategy includes sampling groundwater monitoring wells and private wells to ensure protection of human health for comparison to Federal drinking water Maximum Contaminant Level (MCL) standard for Site contaminants such as trichloroethylene (TCE) that are present from historic Site activities.

1.5.1 Groundwater Monitoring Wells

Ninety-one (91) monitoring wells have been installed within the Moses Lake area by USACE over the last 22 years in order to monitor the project area. An additional 15 monitoring wells were installed by EPA in

2012 in support of the first phase of groundwater pump and treat design. Prior to 2013, groundwater monitoring wells were last sampled in 2005.

In coordination with EPA, the USACE annual sampling program was assessed in February 2013 to reevaluate the list of monitoring wells. This reassessment analyzed historical data trends for TCE plume migration, resulting in a comprehensive groundwater monitoring event during 2013. The results confirmed TCE plume extent. Separate from efforts completed by USACE, a limited number of additional monitoring wells were recently sampled in support of the southern plume pump and treat system design executed under a separate contract by EPA.

1.5.2 Private Wells

The Moses Lake Interim ROD requires prevention of human exposure to groundwater above the MCL for contaminants of concern. TCE is the focus for interim groundwater monitoring mitigation activities since it is the only contaminants of concern that historically exceeded the MCL of 5 ug/L.

The investigation strategy for the private well sampling program historically began with a list of existing private wells within the 5 µg/L TCE plume boundary or near the leading edge of the plume boundary. Some well owners were recruited for the private groundwater sampling program in the 1990s and early 2000s. Other residents have asked to be included in the sampling program over the years. As more information has become available that helps identify private wells that may be impacted, well owners have been and will continue to be recruited for evaluation.

Sampling efforts of private wells prior to 2013 consisted of selecting up to 53 domestic wells per year to spot check TCE concentrations within the Site. The majority of private wells sampled are located in the Cascade Valley area immediately down gradient of the (north) and south plumes (Figures 4 and 5).

Limited information regarding private well depth and screen length is typically found in WDOE installation records or based on the well owner's personal knowledge. It is believed that groundwater collected from private wells in the Moses Lake area is primarily from the upper basalt aquifers. While information on groundwater monitoring wells is more complete, there are only two groundwater monitoring wells located within the Cascade Valley and none immediately upgradient. Therefore the conceptual site model of the Cascade Valley is incomplete.

Historically a Site action threshold of 3.5 µg/L TCE has been used as the predetermined groundwater concentration at which cautionary engineering controls such as WHFs are implemented. The action threshold accounts for analytical uncertainty of the method used for TCE quantitation to ensure human exposure above the MCL does not occur. This value is based on the analytical laboratory lower recovery limit of 30 percent, applied to the MCL of 5 µg/L TCE (5.0 µg/L – (0.30% *5) = 3.5 µg/L). Wells with existing WHFs are sampled annually to determine contaminant loading to the activated carbon filters for calculation of potential contaminant breakthrough.

The 2013 reassessment described above resulted in the removal of 16 private wells and the addition of 51 private wells to the annual sampling program. The 16 private wells were removed due to consistent low or non-detect results during previous monitoring events. The 51 residential wells were added based on their proximity to the plumes. The 2013 monitoring events included approximately 98 percent of the residences north of Dick Road NE in the Cascade Valley (Figure 5). Table 1 includes a complete list of wells sampled.

2. SAMPLING AND FIELD ACTIVITIES

Water samples and associated quality control (QC) samples collected from groundwater monitoring wells and private wells were collected in accordance with the Work Plan. Field QC samples included field duplicates, field blanks, trip blanks, matrix spike (MS) and matrix spike duplicates (MSD). A performance evaluation (PE) sample, provided by Environmental Resource Associates (ERA) of Arvada, Colorado, was submitted for Volatile Organic Compounds (VOC) analysis. Appendix A documents all sampling activities for 2013 sampling events, which are summarized below.

2.1 Groundwater Monitoring and Private Wells

2.1.1 Groundwater Monitoring Wells

Sampling of groundwater monitoring wells is focused on identifying the plume concentration and extent, and included collection of groundwater elevation data to evaluate groundwater flow direction and plume migration. Samples were obtained from dedicated bladder pumps installed in the well or from diffusion bags. The majority of the monitoring wells are located outside the Cascade Valley area (Figure 4).

2.1.2 Private Wells

Private well sampling is focused on protection of human health by assuring that drinking water sources do not expose residents to COC concentrations above the MCL. Groundwater elevation data is not obtained from the domestic wells due to the potential to entangle cords from elevation monitoring equipment (sounder cords) with pump cords present in domestic wells.

At wells with whole-house filtration systems, samples were collected upstream of the filtration system, between the lead and lag filter units, and from the filter system effluent. Private wells without WHF systems were sampled from a water tap as close to the well head as possible. Sampling procedure details are included in Appendix A.

2.2 Sampling Events

The 2013 sampling activity consisted of three events described below. Sixty (60) monitoring wells and ninety-six (96) private wells were sampled during the three events. Samples were analyzed by ARI in Tukwila, Washington, for VOC analysis by EPA Method 524.3. Table 1 lists the wells that were sampled and Appendix B includes a comprehensive analytical results table for all 2013 events.

2.2.1 Event 1 (May 2013)

2.2.1.1 Groundwater Monitoring Wells

During Event 1, diffusion bags were deployed in 29 groundwater monitoring wells that were subsequently sampled during Event 2. Groundwater elevation data was collected from 61 monitoring wells.

2.2.1.2 Private Wells

During Event 1, five private wells with whole house filters were sampled as described below.

All five of the WHF wells present at the start of the May 2013 sampling event (WP-14, WP-70, WP-82, WP-83, and WP-86) were sampled from ports downstream of the filtration system (tap water) to document the presence of any contaminants of concern prior to WHF replacement.

After sample collection, USACE contractors replaced the existing WHF systems with an updated system design at WP-14, WP-83, WP-86, and WP-70. In addition, totalizing flow meters were installed in line to the WHF systems to record the total volume of water moving through the system for correlation with changes in treatment efficiency during the following year. Original WHF system components were replaced with upgraded systems including new sampling ports. WP-86 was relocated from the basement of the house to an insulated 8 foot by 10 foot Tuff Shed that now house the new WHF system, expansion tank, and well pump.

Following replacement of the WHFs, samples were collected from the influent, between the lead and lag filters, and the effluent sampling ports to ensure the new WHF systems were functioning to specifications. The WHF system at WP-82 was removed without replacement as several rounds of validated analytical data resulted in undetected contaminants. Because of its proximity to other contaminated wells, WP-82 will remain on an annual sampling schedule for the foreseeable future.

2.2.2 Event 2 (June 2013)

2.2.2.1 Groundwater Monitoring Wells

During Event 2, 60 groundwater monitoring wells were sampled in accordance with the Field Sampling Plan. Groundwater elevation data was also obtained from monitoring wells with bladder pumps but not in wells where diffusion bags had been deployed during Event 1.

2.2.2.2 Private Wells

During Event 2, 73 private wells were sampled in accordance with the Field Sampling Plan. Sample ports for most private well locations were the exterior hose bibs located as close to the wellhead as practical.

2.2.3 Event 3 (August 2013)

2.2.3.1 Groundwater Monitoring Wells

No Groundwater wells were sampled during Event 3.

2.2.3.2 Private Wells

Following monitoring Event 2 (June 2013), a value of 2.0 µg/L TCE was recommended as the lower threshold value above which private wells would be monitored quarterly for a minimum of one year. Quarterly monitoring data will support identification of the effect of seasonal groundwater elevation fluctuation (i.e., due to irrigation activities, decrease in precipitation, etc.) on private well contaminant concentrations.

A total of 29 private wells were sampled during Event 3 in accordance with the Field Sampling Plan. This included the remaining targeted wells in the Cascade Valley that were not sampled in Event 1 or 2, all six WHF wells including two new systems, WP-119 and WP-121, and additional wells from Event 1 and 2 that exceeded 2.0 µg/L as discussed above.

Because the WHF system had previously been removed from WP-82 this well was not sampled in Event 3.

Based on Event 3 results, two additional private wells, WP-124 and WP-129, were recommended for WHF installation which were installed in late October. Results for WHFs installed in late October and sampled in late November will be provided in the 2014 Annual Report. A detailed summary of each sampling event can be found in the 2013 Groundwater Sampling Field Report (Appendix A).

2.3 Analytical Procedures

The analytical laboratory for this project was ARI of Tukwila, WA. Samples were analyzed by EPA Method 524.3 in accordance with the Quality Assurance Project Plan (QAPP). The method produces data with the analytical sensitivity required to evaluate whether drinking water meets the Federal MCLs.

3. ANALYTICAL RESULTS AND DISCUSSION

Analytical results from the three monitoring events completed in 2013 are summarized below. A complete table with analytical results is included in Appendix B. Complete laboratory analytical reports for all samples are attached as Appendix F.

3.1 Groundwater Monitoring Wells

3.1.1 Groundwater Elevation

Groundwater elevations from groundwater monitoring well sampling completed in May and June are summarized in Table 2. Groundwater elevations were collected for 61 monitoring wells in May and 34 monitoring wells in June. The Surfer® Kriging method was used to produce groundwater elevation contours of the B monitoring wells (Priest Rapids Roza1 aquifer) for the Site (Figure 6). The general flow direction in the northern portion of the Site (southwest) is consistent with previous groundwater elevation data. The groundwater gradient within the southern plume is southerly (Figure 6). The software generated groundwater contours were reviewed by a hydrogeologist and deemed to be accurate.

3.1.2 Analytical Results

Twenty-one (21) of the 60 monitoring well locations sampled had no contaminants of concern reported above the analytical reporting limit (nondetect). The remaining 39 monitoring well locations had detected concentrations for TCE of which five also had cis-DCE detections. The maximum detection of TCE occurred in well 12BW05 with a concentration of 78.2 ug/L. The maximum detection of cis-DCE occurred in well 04BW06 with a concentration of 2.62. ug/L. TCE and cis-DCE were the only contaminants of concern detected out of the eight analytes evaluated in 2013 (Table 3). A total of eighteen monitoring wells exceeded the MCL for TCE of 5.0 ug/L .

3.2 Private Wells

This section summarizes results for private wells without WHFs. For houses where WHFs were installed sometime during the 2013 sampling year, results are summarized until the point at which the WHF was added. After this point, results are summarized in the following Section 3.3.

3.2.1 Groundwater Elevation

Due to the risk of entangling sounder cords with private well pumps, groundwater elevation data was not collected from private wells.

3.2.2 Analytical Results

Detected contaminants of concern in private wells included TCE and cis-DCE (Table 4).

Of the 96 private well locations sampled, 32 locations had no contaminants of concern reported above the detection limit. TCE was detected in 64 wells and was the only analyte detected that exceeded the MCL. The maximum TCE concentration was detected in well WP-04 at 5.48 µg/L (4.7 µg/L in 2012). Fifteen private well samples had detections of cis-DCE. The maximum private well cis-DCE concentration was in well WP-04 at 1.68 µg/L (1.5 µg/L in 2012), which is below the MCL of 70 µg/L.

The following summarizes private well exceedences of the 5.0 ug/L TCE MCL, the 3.5 ug/L TCE action threshold, and the 2.0 ug/L TCE recommended quarterly sampling level for all private wells sampled from May to August 2013 that did not already have WHFs.

- One private well (WP-04) used for industrial process water exceeded the MCL of 5.0 ug/L. The business associated with WP-04 has previously been informed of the elevated risk associated with TCE and has been asked to provide signage stating that well water should not be used for human or animal consumption.
- Four wells, (WP-119, WP-121, WP-124, and WP-129) exceeded the action threshold of 3.5 ug/L TCE. Whole house filters were installed at all four of these locations in 2013.
- Seven wells, (WP-27, WP-123, WP-125, WP-129, WP-131, WP-167, and WP-168) exceeded the 2.0 ug/L TCE recommended quarterly sampling concentration. These seven wells will be monitored quarterly for a minimum of one year.

3.3 Whole House Filter Discussion

Table 5 summarizes sample results from WHF wells with TCE or cis-DCE detections from May, June and August 2013 monitoring events. Table 6 summarizes purge volumes collected prior to sampling at whole house filter systems during the August 2013 sampling event. In addition, the total water volumes passed through each new WHF systems since installation in May are also summarized in Table 6.

As summarized in the 2012 annual report, five residential wells historically had WHF systems to prevent potential exposure to TCE greater than the MCL. Filtration systems are constructed with a lead filter, followed by a lag filter as a safety system to capture any contaminant breakthrough. During 2012, lead filter breakthrough of TCE and cis-DCE occurred at four of the five WHF systems (WP-14, WP-70, WP-83, and WP-86). Samples collected after the lag filter (which represent household drinking water) had detected concentrations of TCE and cis-DCE below the MCL.

Breakthrough of the filter units experienced in 2012 was expected to be the result of channeling or clogging within the GAC filter beds. Following a preliminary round of sampling that occurred in May 2013,

the filter systems in all WHF wells were replaced to eliminate this problem. Following WHF change out in May 2013, TCE and cis-DCE were not detected after the lead or the lag filter for any of the WHFs currently installed. Note that Table 5 shows an effluent sample for WP-83 collected on 5/6/13 that had cis-DCE and TCE detections, however, this sample was taken just prior to filter change out.

Table 4 shows residential wells WP-119 and WP-121 with influent concentrations that exceeded the action criteria of 3.5 µg/L when sampled during the June event. For this reason, WHFs were installed at these locations prior to the August event. Sampling results from the August event showed that WHFs at WP-119 and WP-121 were working effectively and all results were non detections in the mid or effluent samples. WHFs were also installed at WP-124 and WP-129 following the August sampling event when these wells exceeded the action threshold of 3.5 ug/L. WHF results for WP-124 and WP-129 will be summarized within the 2014 annual report. Since VOCs have not been detected in WP-82 since 2004, this WHF system was removed in 2013.

4. DATA QUALITY ASSESSMENT

All sampling and analytical activities were executed in compliance with project DQOs and results are considered acceptable for use. A full chemical data quality assessment is provided in Appendix D. The Quality Control Summary Report (QCSR) summarizing analytical performance expressed in terms of data quality indicators (DQIs) can be found in Appendix E. The overall quality of data is known and acceptable for the intended use.

Two technical issues were evaluated during data quality assessment. It was identified that purging procedures (Appendix A) plus variation in private well system configuration may bias TCE results creating increased sampling uncertainty. A low sample bias induced by purging may increase the risk that exposures remain undetected. Therefore, these factors should be further evaluated.

Secondly, it was noted during the data evaluation of the third sampling event that an equipment blank for WP-123 showed a concentration of 3.02 ug/L TCE on August 27, 2013. It is thought that the field team may have used influent water for WP-123 rather than deionized water to collect the field blank. The resulting value labeled as an equipment blank for WP-123 should be interpreted as a duplicate rather than a equipment blank. Discussions with the sampling team and changes to the standard operating procedures for collecting equipment blank samples have occurred to clarify the process and prevent similar situations from occurring in the future.

5. STATE WELL INVENTORY DATABASE SEARCH

To determine whether additional private wells were installed within or near the VOC plume, information from the Washington State Department of Ecology (WDOE) Well Logs database (https://fortress.wa.gov/ecy/waterresources/map/WCLSWebMap/textsearch.aspx) was reviewed.

The database was searched for wells constructed or well logs received between 01 January 2012 and 04 December 2013, and screened or open to the upper basalt flows - Priest Rapids, Roza 1 and Roza 2 geologic members (see Figure 3).

Following the Groundwater Institutional Control Boundary, all or portions of the following Township, Range and Sections were queried: T19N, R28E, Sections 4, 5, 6, 7, 8, 9, 16, 17, 18 and T20N, R28E, Sections 16, 17, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32, 33, 34. The Groundwater Institutional Control Boundary is shown on Figure 2.

Five private wells were installed between 01 January 2012 and 04 December 2013. One well is potentially inside the southwest edge of the north plume in Cascade Valley (BCE059). Two others are one mile south of the southwest edge of the north plume in Cascade Valley (BCE482 and BCE483). The fourth is on the very east edge of the south plume (BHP602) and the fifth is located approximately 1300 feet east of the edge of the northeast plume (BHP603). The five wells are shown on Figure 4 and labeled with their respective WDOE well tag IDs. Copies of the State of Washington Water Well Reports for the five new private wells are provided in Appendix C.

Two of the five private wells are recommended for sampling during the next event. WDOE well tag ID BCE059 is potentially inside the southwest edge of the north plume in Cascade Valley and is located between WP-155 and WP-157 (TCE values for WP-155 and WP-157 were 0.40 µg/L and non-detect respectively). WDOE well tag ID BHP602 is on the eastern edge of the south plume but near a historic contaminant detection at WP-28 (0.19 µg/L TCE).

Both BCE059 and BHP602 appear to be drawing groundwater from the upper basalt members. Groundwater from these formations has historically had results with VOC contamination in some areas. Therefore, USACE will attempt to contact the well owners prior to the next sampling event in 2014 in order to gain right of entry to sample the well.

6. SUMMARY AND DISCUSSION

Three monitoring events in 2013 included sampling a total of sixty (60) monitoring wells and ninety-six (96) private wells.

6.1 Site TCE Plume Discussion

During the June 2013 event, a comprehensive sampling round of groundwater monitoring wells occurred to confirm the TCE plume extent. Groundwater elevation data was collected from monitoring wells during the May event.

During a comprehensive round of sampling for private wells completed between June and August 2013, results showed the presence of TCE in 58 of 82 private wells located in the Cascade Valley. It is anticipated that private wells including those in the Cascade Valley, draw water from the upper basalt aquifers (Priest Rapids Roza 1 and Roza 2) and potentially the overlying alluvium. However, limited private well construction information makes it difficult to designate individual private wells to a specific aquifer. In addition, there are only two groundwater monitoring wells located within the Cascade Valley but they are too far south to help delineate the origin of contamination to groundwater occurring in the Cascade Valley.

TCE plume contours of the 5.0 ug/L TCE MCL, the action threshold of 3.5 ug/L TCE, and the recommended quarterly sampling level 2.0 ug/L were developed based on the 2013 data and are summarized in Figure 7 and 8. For well locations were two or more data points were available in 2013, the highest value was included. The contours were initially generated using the Kriging gridding method in Golden Software's Surfer® program version 8 which numerically estimates plume boundaries based on input data. The Surfer® Kriging method on log-log transformed concentration data was used to produce more systematic and accurate contouring compared to manual only developed contouring methods historically used for the Site. Where deemed appropriate, the computer generated contours were adjusted based on professional judgment (e.g. open ended contours where there are data gaps).

Figure 7 and 8 display~~s~~ data from Priest Rapids Roza 1 aquifer monitoring wells (B monitoring wells) and private wells. The contours were generated using a single dataset versus contouring the private and monitoring wells separately. Additional monitoring wells in the Cascade Valley would be needed to help predict TCE concentrations at residential wells and the extent of TCE contamination in the Roza 1 versus Roza 2 aquifer.

The updated contour map provides a more accurate depiction of the 5 µg/L plumes (Figure 7 and 8) than the generalized version presented in the ROD (Figure 2). The north plume is open ended to the southwest due to lack of monitoring well data in the downgradient direction. The northeast plume is only defined by one monitoring well (99BW15) and two private wells (WP-14 and WP-83). The northeast plume contours are open to the northeast due to lack of data in the upgradient direction. The southern plume is more continuous with the highest concentration of 78.2 µg/L at 12BW05.

Although the updated map provides a better understanding of the plumes, additional data and investigation are recommended to further expand and understand the relationship of the Site plumes to private well contamination. In addition to displaying the updated contours and specific wells sampled,

Figures 4 through 8 also show the locations of private and monitoring wells that were available for sampling but were not sampled in 2013.

The majority of private wells in Cascade Valley are downgradient or near the leading edge of the contaminant plumes. Several of the wells sampled are in the Cascade Valley area immediately downgradient of the main (north) and southern plumes. Until additional monitoring wells become available to track the plume, data from private wells is being used to help understand plume migration.

TCE results from WP-04 show increasing contaminant concentrations over the last year (4.7 ug/L TCE [2012], to 5.48 ug/L TCE [2013]) suggesting an increasing trend and possible advancement of the main plume. Four WHF systems are clustered near WP-04 and are likely drawing contaminated groundwater associated with the main plume. Contours around WP-04 are open to the northeast due to lack of data in the upgradient direction. Over the 2013 sampling events, six of seven private wells sampled near WP-04 also showed increased TCE concentrations. Current data suggest that the private wells downgradient (generally southwest, see Figure 8) of WP-04 without WHF systems are the greatest concern in that area.

WP-27 is located approximately one mile southeast of WP-04 had a concentration of 2.5 ug/L TCE in 2012, 2.16 ug/L TCE in June 2013, and decreased to 0.82 ug/L TCE in August 2013. Four of the remaining five wells (WP-14, WP-82, WP-83 and WP-86) that were sampled twice in 2013 did not have significant changes in TCE concentrations. Based on the May 2013 groundwater elevation contours (B monitoring wells) and 2013 TCE contours depicted on Figure 6, it appears that the source of TCE contamination in the northern Cascade Valley is from the main TCE plume versus the southern plume.

Following the June 2013 sampling event, a value of 2.0 µg/L TCE was recommended by USACE and agreed by EPA as the lower threshold value above which private wells would be monitored quarterly for a minimum of one year given the limited amount of available historic data for private wells. This recommendation was made in order to evaluate groundwater fluctuations based on seasonal changes (i.e., changes in irrigation activities, decrease in precipitation, etc.) and determine whether fluctuations have the potential to result in a need to take action to prevent ingestion of contaminated drinking water.

To date there is minimal information from which to assess the impacts of seasonal fluctuations on TCE concentrations. Only 12 private wells were sampled in during both the 2013 June and the August sampling event. Of the twelve wells, the largest TCE increase observed between events occurred in wells WP-119 and WP-129. WP-119 and WP-129 increased by 1.26 µg/L and 1.17 µg/L TCE respectively. Given the observation of quarterly fluctuation as great as 1.26 µg/L TCE, the recommendation for quarterly sampling of wells that exceed 2.0 µg/L TCE appears to be necessary over the next year to minimize the potential for wells monitored only annually to unintentionally exceed the 3.5 µg/L action threshold or the 5 ug/L MCL for TCE.

In addition, due to the presence of multiple contaminant plumes and uncertainty of private well construction, all other private wells within the Moses Lake area with any historic contaminants of concern detections are recommended to be monitored on an annual basis until a better understanding of the plume migration has been documented. Additional houses may be added based on their proximity to wells with elevated concentrations.

6.2 Whole House Filters

A previous breakthrough of multiple lead filter units in 2012 was thought to have occurred due to channeling or clogging of the filter beds. Since VOCs have not been detected in WP-82 since 2004, this

WHF system was removed in 2013. The filter systems in all wells except WP-82 were replaced to eliminate this problem in May 2013. There were no instances of lead filter breakthrough of VOC contaminants at any of the WHF systems during the two quarters of sampling following system replacement. All samples between the lead and lag filter were non-detect for TCE and cis-DCE in June and August 2013. Post WHF replacement sampling confirmed that updated WHFs preventing contaminant breakthrough and are protecting human health as required in the ROD.

Because lead and lag filter breakthrough has occurred in past events, USACE will perform quarterly sampling quarterly for the first year to ensure the filter efficiency of the new systems is established. Analysis of concentration changes over time will become a predictive tool for approximating when breakthrough is expected to occur. This will help determine the filter sampling schedule and filter change out requirements (whether the change out frequency of one year will remain protective). Installation of totalizing flowmeters which occurred in May 2013 as part of the WHF systems will provide measurement of total volume pumped between sampling events.

Influent concentrations in two of the new private well locations which received WHFs during 2013 (WP-119 and WP-121), exceeded the TCE MCL during the subsequent August round of quarterly sampling. WP-119 increased from 4.00 to 5.26 ug/L TCE and WP-121 increased from 4.21 to 5.26 ug/L TCE. This observation demonstrates how use of an action threshold prevented human exposure to groundwater concentrations above the MCL. It also documents variability in Site groundwater concentrations suggesting a need to better understand the extent and drivers of system variability so that the sampling program can be designed to ensure human protectiveness.

2013 results indicate that there was no TCE or cis-DCE breakthrough in the eight existing WHF locations. In summary, whole house filter systems are effectively reducing TCE concentrations in drinking water below the MCLs.

7. RECOMMENDATIONS

Recommendations for the 2014 sampling and investigation program include the following:

Groundwater Monitoring Wells

- Evaluate historical groundwater elevation data and TCE concentrations for evidence of seasonal fluctuations to support future adjustments to the monitoring program.
- Evaluate recent groundwater elevation data collected in support of the 2015 pump and treat startup in parallel with historic groundwater information to ensure sufficient baseline data is available to support future monitoring efforts prior to pump and treat startup.
- There are currently only two monitoring wells located in Cascade Valley. The monitoring well pair is located south of Dick Road which is approximately one mile south of the main Cascade Valley plume to the north. Installation of 3-4 monitoring wells in the basalt aquifers is recommended to better define contaminant concentrations in the private wells, specifically upgradient of the two elevated COC areas in Cascade Valley. In addition, review of historical concentration data and geological information to determine locations and well completion depths is necessary.
- Complete a small scale WHF purging study to identify if the variability in sample results is based on purging length and duration. This study would help develop an optimal purge time and volume required to ensure protectiveness for private residents.

Private Wells

- Collect annual groundwater samples from all private wells with any historic contaminants of concern detections on an annual basis until a better understanding of plume migration has been documented.
- Continue updating the sampling program by adding new private wells, small public water systems and monitoring wells with high likelihood of VOC detections as they are identified through Department of Ecology's well log database.
- For private wells that exceed 2.0 ug/L TCE, collect quarterly groundwater samples for at least four quarters to evaluate patterns in seasonal and temporal system variability that support future sampling frequency recommendations.
- Reevaluate overall extent of residential and monitoring wells to be sampled as part of the monitoring program based on findings from quarterly sampling.
- Continue to coordinate with residents who have not agreed to groundwater monitoring but are located in areas anticipated to have elevated TCE concentrations. Document the resident's have declined to participate in the monitoring program and that the Government has informed residents of the risks associated with exposure to water exceeding the ROD defined MCL (5.0 ug/L TCE).
- There is uncertainty in how much the well purging procedure during sampling impacts the TCE results. It is recommended that a small scale purging study be completed during 2014 to better

understand the variability in sample results based on purging length and duration. This study should recommend optimal purge time and volume required to ensure protectiveness for private residents.

Whole House Filter Systems

- Continue to install WHF systems at private wells that exceed the action threshold of 3.5 ug/L TCE as identified during quarterly or annual monitoring.
- Continue monitoring the efficiency of WHF systems for signs of contaminant breakthrough between the lead and lag filter.
- Use information from the WHF totalizing flow meters installed that measure the volume of water treated by the WHF systems to monitor and evaluate the efficiency of the treatment systems.
- Over time as concentrations at the influent to WHFs decline, work with EPA to assess potential removal of WHFs from residential wells on a case by case basis.

8. REFERENCES

CALIBRE, Inc., Draft Sampling Event Summary Report prepared for the Domestic Well Whole-House Filter Program for Moses Lake Wellfield Superfund Site (Former Larson Air Force Base), Moses Lake, Washington, August 2008.

DoD Quality Systems Manual for Environmental Labs, Version 4.2, October 25, 2010.

EHS-International, Inc., Final Management Plan, Domestic Well Whole-House Filter Program for Moses Lake Wellfield Superfund Site (Former Larson AFB), Moses Lake, Washington, Updated June 2009.

EHS-International, Inc., Sampling Event Summary Report, Domestic Well Whole-House Filter Program for Moses Lake Wellfield Superfund Site (Former Larson Air Field Base), Moses Lake, Washington, FINAL, November 2009.

Montgomery Watson (MWH), Management Plan Volume II - Part 1, Field Sampling Plan Remedial Investigation/Feasibility Study Moses Lake Wellfield Superfund Site – FINAL, September 1999.

MWH, Supplemental Management Plan, January 13, 2003.

USEPA, Interim Record of Decision, Moses Lake Wellfield Superfund Site, September 30, 2008

Figures

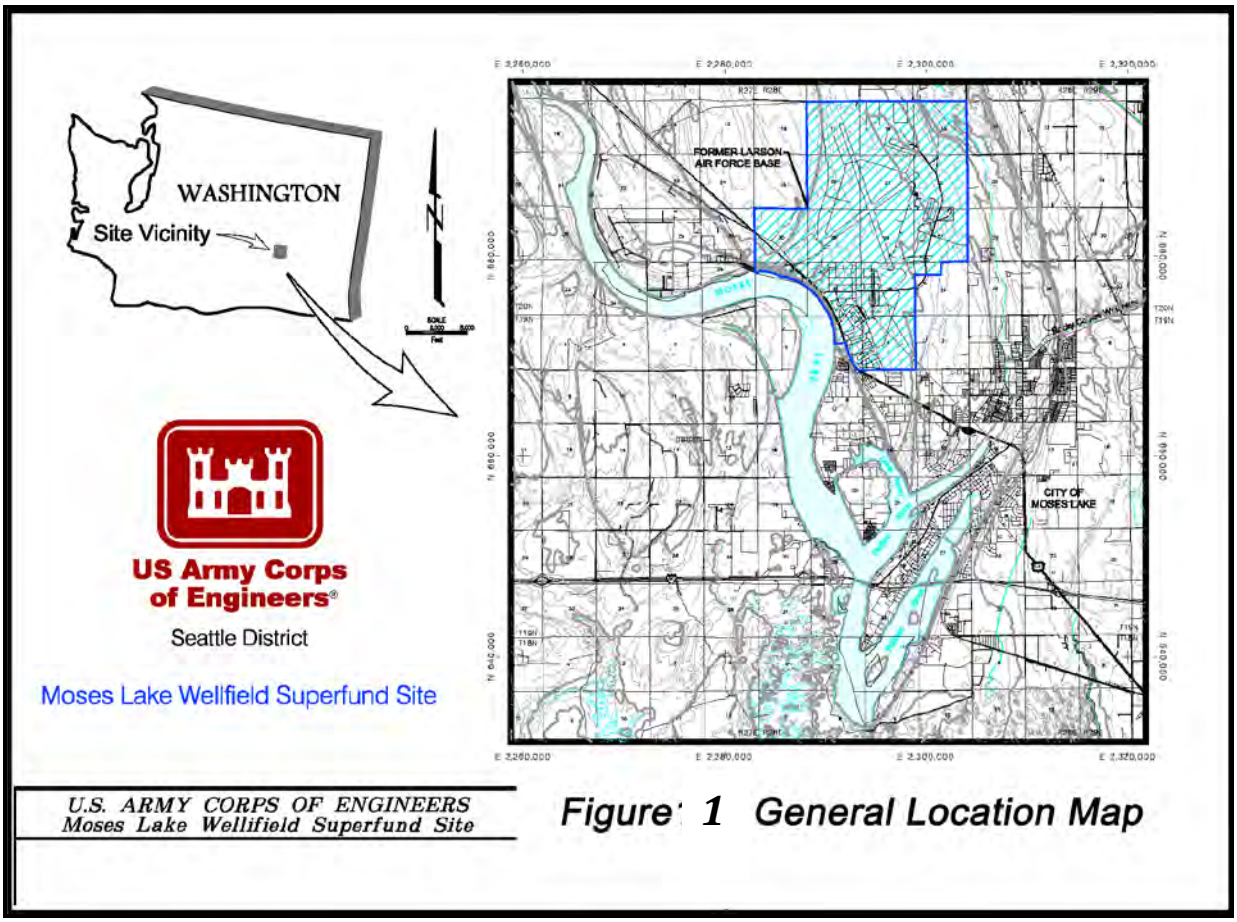
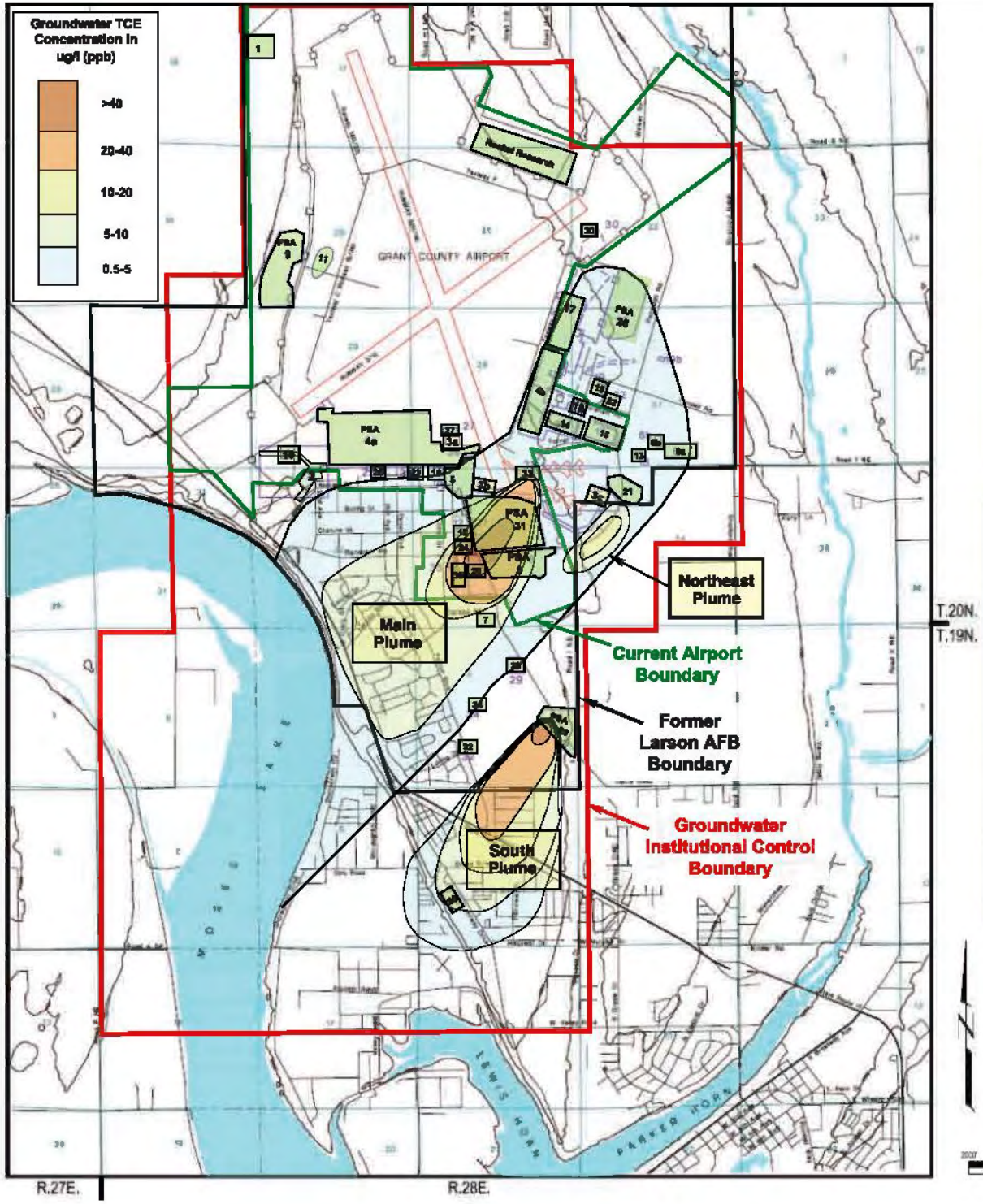


Figure 1 General Location Map

U.S. Environmental Protection Agency
Moses Lake Wellfield Contamination Superfund Site
Cleanup Plan for Contaminated Groundwater and Soils
Moses Lake, Washington



Contaminated Groundwater Plumes

Groundwater Base Actions for all TCE-Contaminated Groundwater Plumes:

- Test drinking water wells within "Institutional Control" boundary
- Provide water filters or alternate water supply for wells with TCE > 5 µg/L (ppb)
- Drill more monitoring wells to define the extent of contamination in lower aquifers
- Conduct long-term groundwater monitoring

Actions for Main/Northeast and South TCE Plumes in the Upper Basalt Aquifer (Roza 1):

- "Pump and Treat" groundwater to remove and contain the highest TCE concentration areas near the source zones

Possible Actions for TCE Plumes located in the Lower Basalt Aquifer (Roza 2):

- Conduct source treatment if high TCE source is found that needs to be treated

Contaminated Soil Areas

PSA 1	Liquid Waste Disposal Site
PSA 3	Aircraft Wash Rack (Areas 3a, 3b, 3c)
PSA 8	Randolph Road Base Dump
PSA 10	Fire Training Pit A
PSA 11	Fire Training Pit B
PSA 31	19th Avenue Base Dump
PSA 33	Dump At End of Runway 32
PSA 6a	Base Closure Landfill
PSA 19	LOX Plant
PSA 20	South Base Dump
PSA 22	Paint Hangar Leach Pit
-------	Rocket Research Perchlorate Disposal

Cleanup Actions for These Soil Areas:

- Conduct additional investigation to determine if soil areas are contaminated or are a continuing TCE source
- Excavate contaminated soil and dispose off-site if contamination is above risk-based levels
- Apply "Institutional Controls" such as deed restrictions

N

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Figure 2

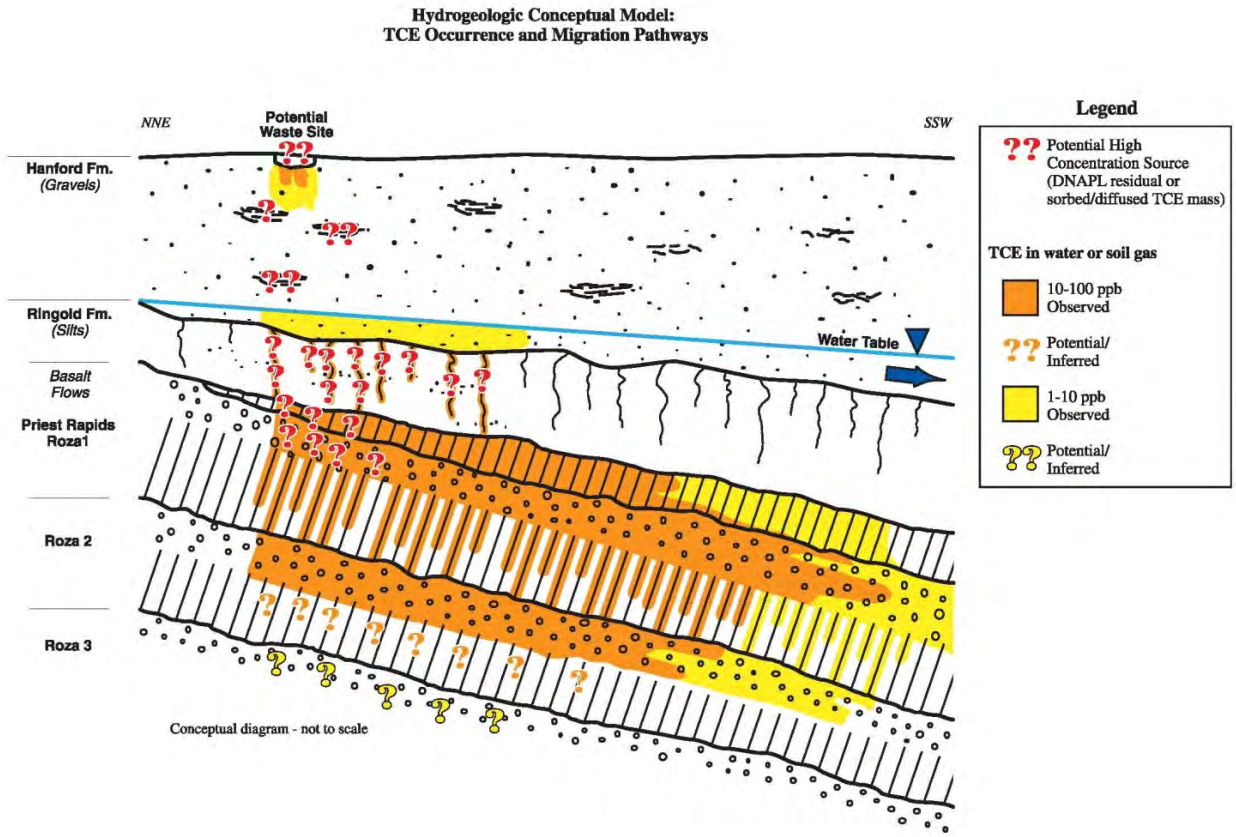

Figure 3. Conceptual Geologic Profile (ROD, 2008)

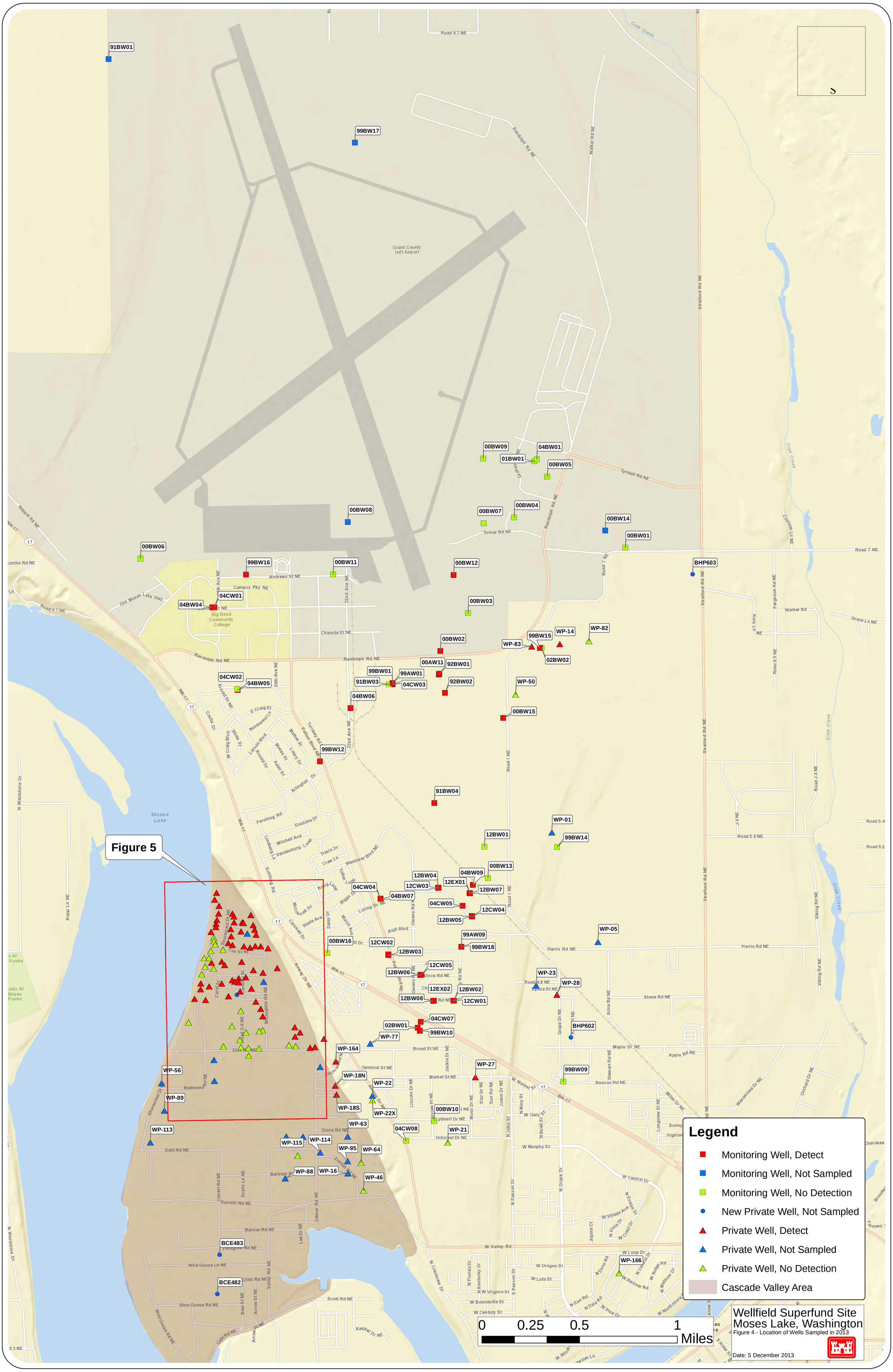
Figure 5
Legend
Monitoring Well, Detect
Monitoring Well, Not Sampled
Monitoring Well, No Detection
New Private Well, Not Sampled
Private Well, Detect
Private Well, Not Sampled
Private Well, No Detection
Cascade Valley Area
0 0.25 0.5 1 Miles
Wellfield Superfund Site
Moses Lake, Washington
Figure 4 - Location of Wells Sampled in 2013
Date: 5 December 2013
91BW01
99BW17
00BW09
04BW01
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00BW05
00BW08
00BW07
00BW04
00BW14
00BW01
00BW06
99BW16
00BW11
00BW12
BHP603
04CW01
04BW04
00BW03
WP-14
WP-82
99BW15
WP-83
02BW02
00BW02
00AW11
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99BW01
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99AW09
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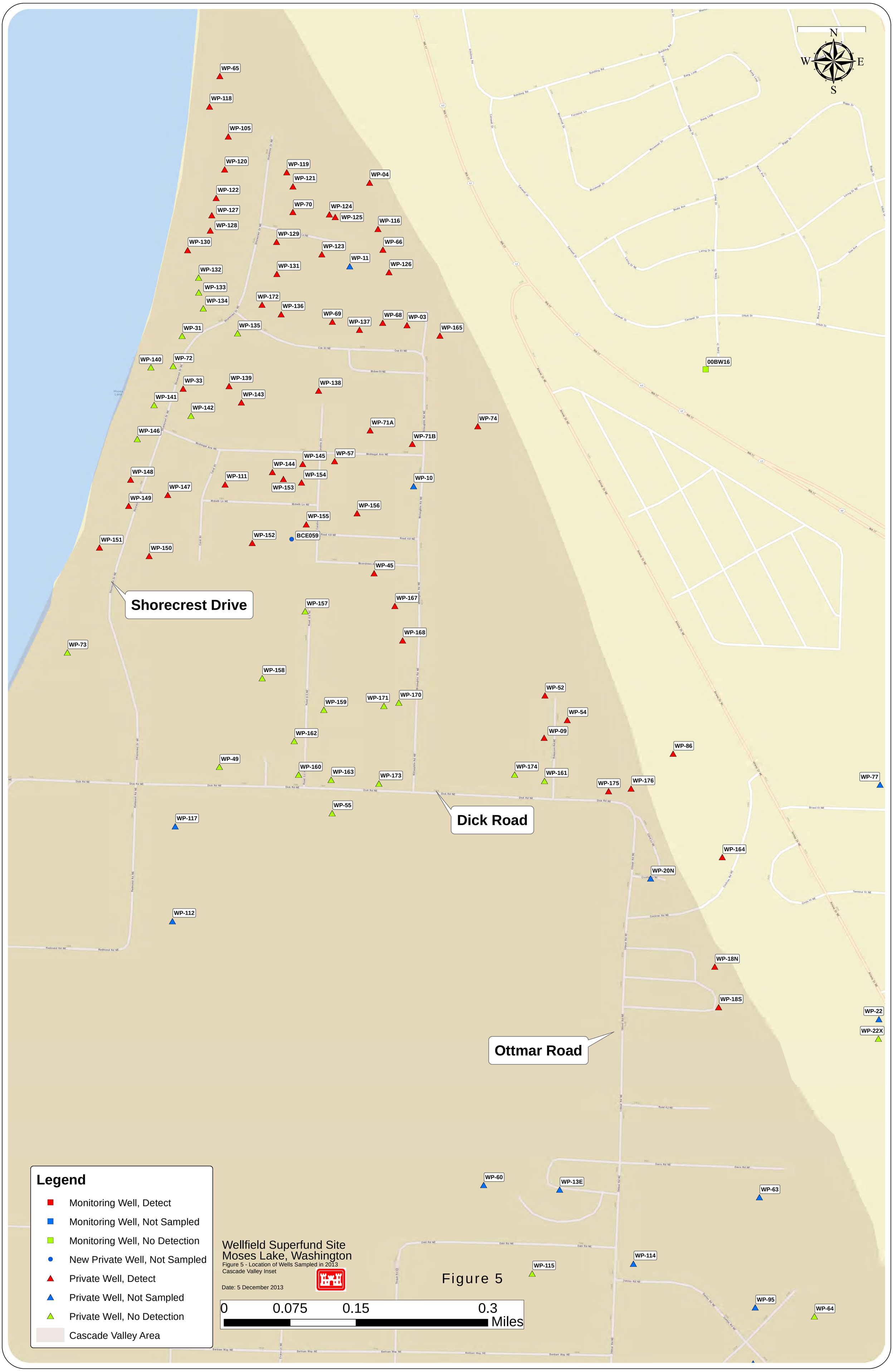
12CW02
12BW03
12CW05
12BW06
WP-23
WP-28
12EX02
12BW02
12BW08
12CW01
04CW07
02BW01
99BW10
BHP602
WP-77
WP-164
WP-27
99BW09
WP-56
WP-18N
WP-22
WP-89
WP-18S
00BW10
WP-22X
WP-63
04CW08
WP-21
WP-113
WP-115
WP-114
WP-95
WP-64
WP-88
WP-16
WP-46
BCE483
WP-166
BCE482
Moses Lake
Randolph Rd NE
Stratford Rd NE
Road 7 NE
Tyndell Rd NE
Walker Rd NE
Crab Creek
Road 9.7 NE
Grant County Int'l Airport
Big Bend Community College
Andrews St NE
Campus Pky NE
Chanute St NE
Old Moses Lake Hwy
Road 6.7 NE
Neppel Rd NE
Turner Rd NE
Ferguson Rd NE
Walker Rd
Grace Ln NE
Road 6.5 NE
Harris Rd NE
Stone Rd NE
Road 5.6 NE
Road 5.4
Road 5.2
Aspi Blvd
Broad St NE
Terminal St NE
Market St NE
Davis Rd NE
Dahl Rd NE
Konishi Rd NE
Rainier Rd NE
Wild Goose Ln NE
Blue Goose Rd NE
Scott Rd NE
Kestrel Dr NE
W Valley Rd
W Murphy St
W Central Dr
W Loop Dr
W Oregon St
W Luta St
W Virginia St
W Bonneville St
W Century St
Maple Dr NE
Apple Rd NE
Beacon Rd NE
Stone Rd NE
Harris Rd NE
Road 4.8 NE
Space St NE
Kopp Ln NE
N Westshore Dr
Viking Rd NE
Orchard Dr NE
Wenatchee Dr NE
Cherokee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WP-111
WP-154
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WP-156
WP-155
WP-152
BCE059
WP-151
WP-150
WP-45
Shorecrest Drive
WP-157
WP-167
WP-168
WP-73
WP-158
WP-52
WP-159
WP-171
WP-170
WP-54
WP-09
WP-162
WP-86
WP-49
WP-160
WP-163
WP-173
WP-174
WP-161
WP-175
WP-176
WP-77
WP-55
Dick Road
WP-117
WP-164
WP-20N
WP-112
WP-18N
WP-18S
WP-22
WP-22X
Ottmar Road
WP-60
WP-13E
WP-63
WP-114
WP-115
WP-95
WP-64
Legend
Monitoring Well, Detect
Monitoring Well, Not Sampled
Monitoring Well, No Detection
New Private Well, Not Sampled
Private Well, Detect
Private Well, Not Sampled
Private Well, No Detection
Cascade Valley Area
Wellfield Superfund Site
Moses Lake, Washington
Figure 5 - Location of Wells Sampled in 2013
Cascade Valley Inset
Date: 5 December 2013
Figure 5
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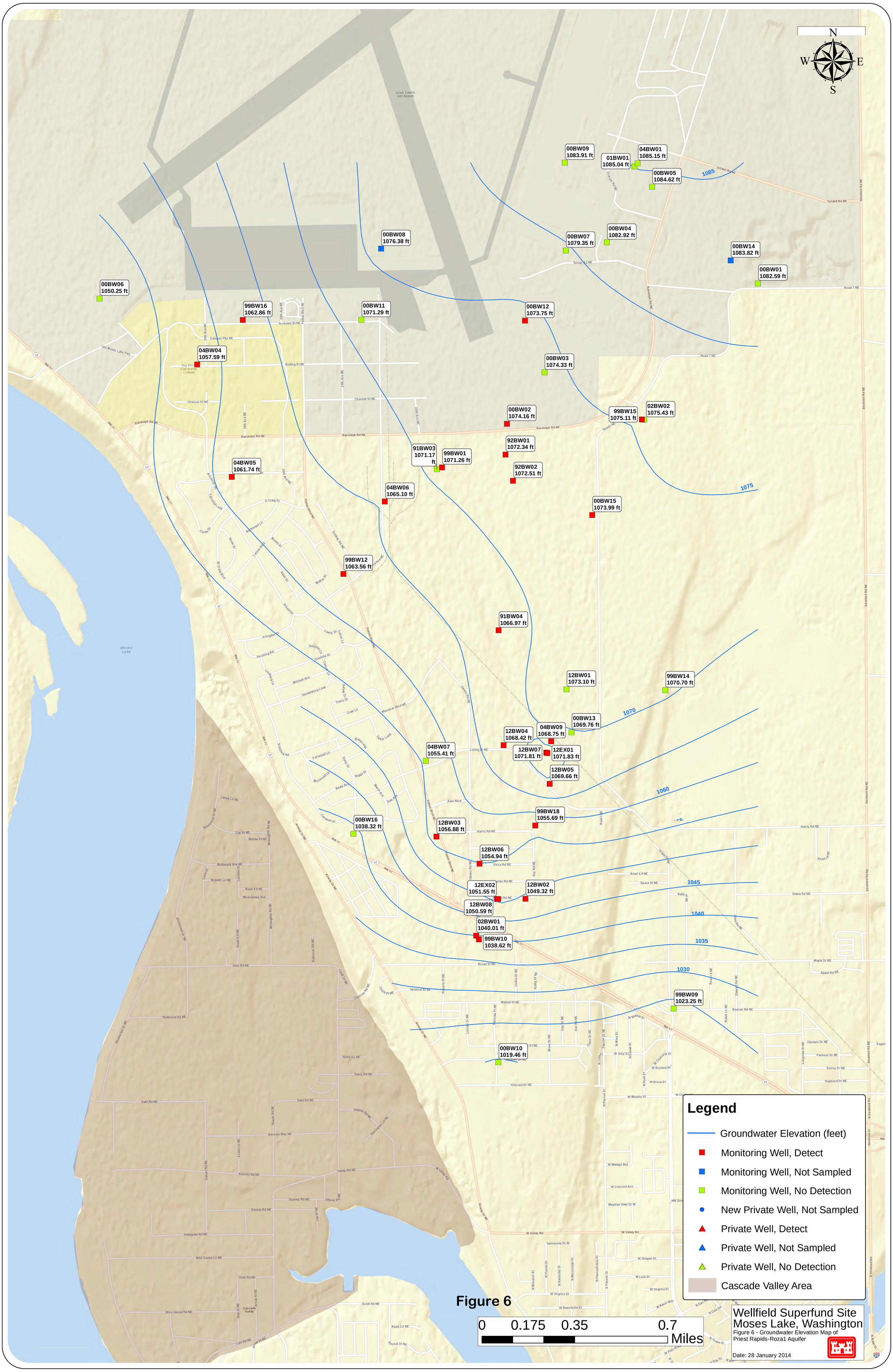
N
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00BW09
1083.91 ft
01BW01
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04BW01
1085.15 ft
00BW05
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00BW08
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00BW07
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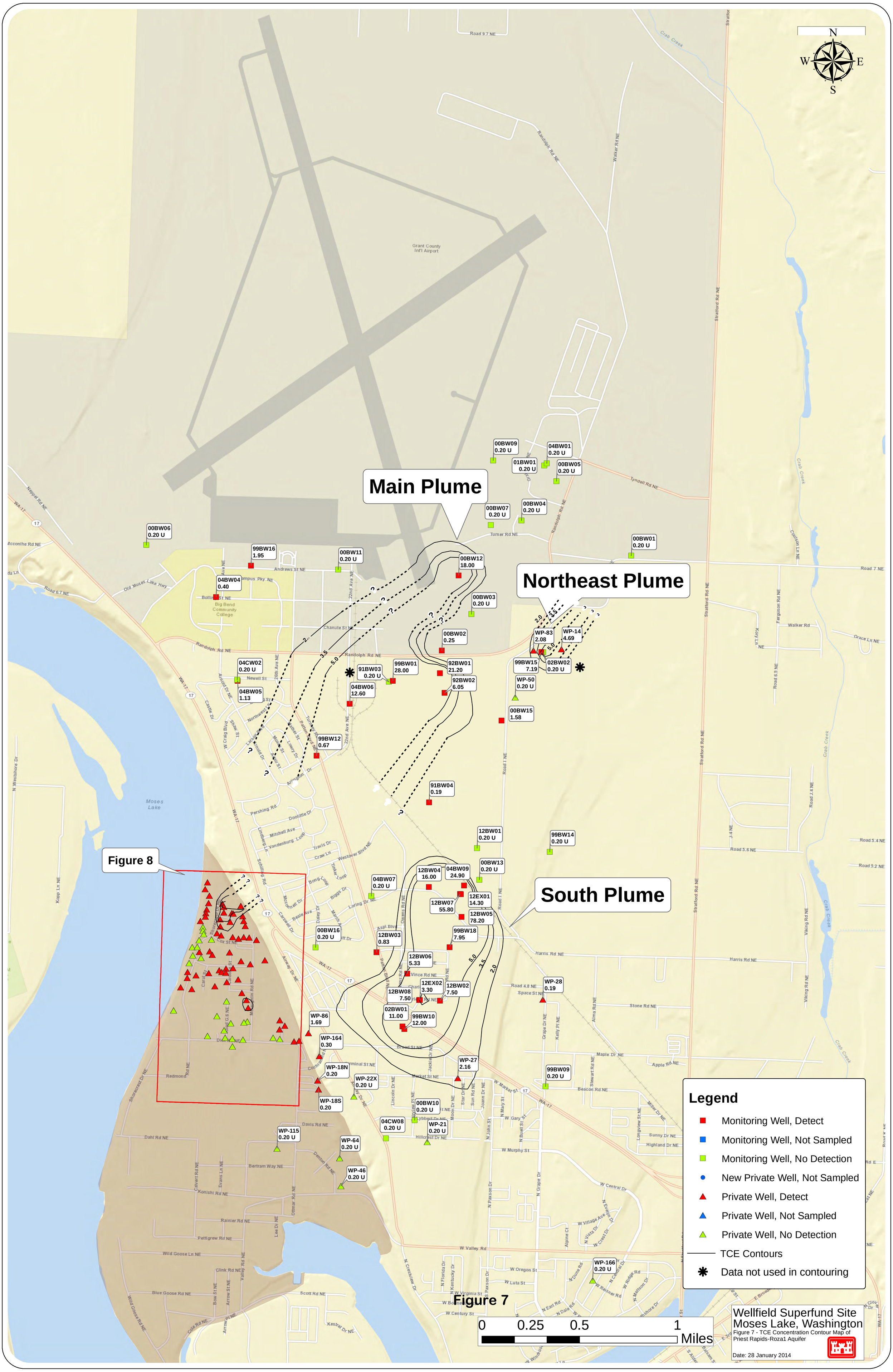
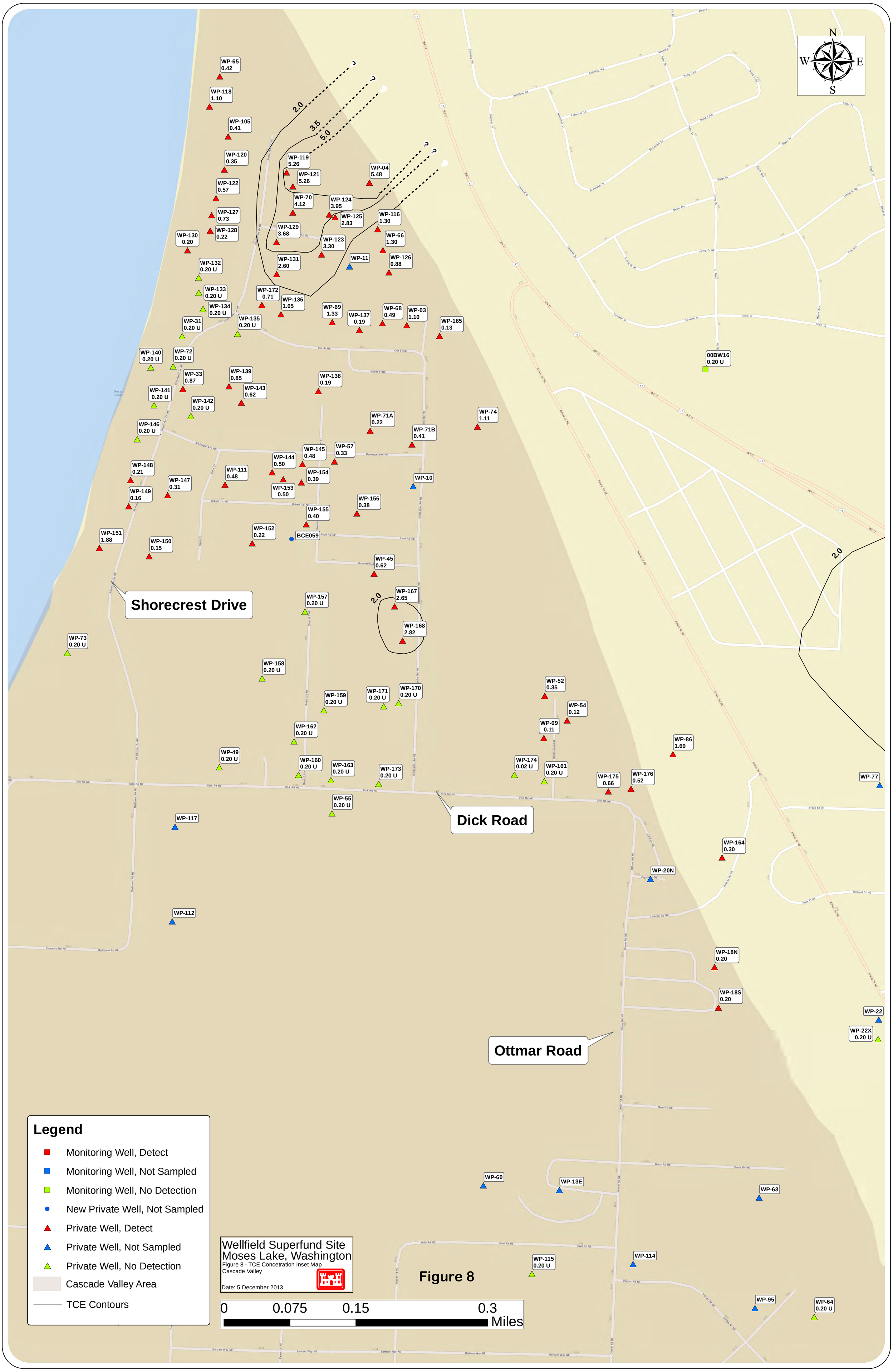
00BW04
1082.92 ft
00BW14
1083.82 ft
00BW01
1082.59 ft
00BW06
1050.25 ft
99BW16
1062.86 ft
00BW11
1071.29 ft
00BW12
1073.75 ft
04BW04
1057.59 ft
00BW03
1074.33 ft
00BW02
1074.16 ft
99BW15
1075.11 ft
02BW02
1075.43 ft
91BW03
1071.17 ft
99BW01
1071.26 ft
92BW01
1072.34 ft
92BW02
1072.51 ft
04BW05
1061.74 ft
04BW06
1065.10 ft
1075
00BW15
1073.99 ft
99BW12
1063.56 ft
91BW04
1066.97 ft
12BW01
1073.10 ft
99BW14
1070.70 ft
1070
00BW13
1069.76 ft
04BW09
1068.75 ft
12BW04
1068.42 ft
12BW07
1071.81 ft
12EX01
1071.83 ft
04BW07
1055.41 ft
12BW05
1069.66 ft
1060
99BW18
1055.69 ft
00BW16
1038.32 ft
12BW03
1056.88 ft
12BW06
1054.94 ft
12EX02
1051.55 ft
12BW02
1049.32 ft
1045
12BW08
1050.59 ft
1040
02BW01
1040.01 ft
99BW10
1038.62 ft
1035
1030
99BW09
1023.25 ft
00BW10
1019.46 ft
Legend
Groundwater Elevation (feet)
Monitoring Well, Detect
Monitoring Well, Not Sampled
Monitoring Well, No Detection
New Private Well, Not Sampled
Private Well, Detect
Private Well, Not Sampled
Private Well, No Detection
Cascade Valley Area
0
0.175
0.35
0.7
Miles
Wellfield Superfund Site
Moses Lake, Washington
Figure 6 - Groundwater Elevation Map of
Priest Rapids-Roza1 Aquifer
Date: 28 January 2014

Figure 6


Main Plume
Northeast Plume
South Plume
Figure 8
Figure 7
Legend
Monitoring Well, Detect
Monitoring Well, Not Sampled
Monitoring Well, No Detection
New Private Well, Not Sampled
Private Well, Detect
Private Well, Not Sampled
Private Well, No Detection
TCE Contours
Data not used in contouring
0 0.25 0.5 1 Miles
Wellfield Superfund Site
Moses Lake, Washington
Figure 7 - TCE Concentration Contour Map of Priest Rapids-Roza1 Aquifer
Date: 28 January 2014
N
S
E
W
Grant County Int'l Airport
Moses Lake
00BW09 0.20 U
04BW01 0.20 U
01BW01 0.20 U
00BW05 0.20 U
00BW07 0.20 U
00BW04 0.20 U
00BW06 0.20 U
99BW16 1.95
00BW11 0.20 U
00BW12 18.00
00BW01 0.20 U
04BW04 0.40
00BW03 0.20 U
00BW02 0.25
WP-83 2.08
WP-14 4.69
99BW15 7.19
02BW02 0.20 U
04CW02 0.20 U
91BW03 0.20 U
99BW01 28.00
92BW01 21.20
92BW02 6.05
04BW05 1.13
04BW06 12.60
WP-50 0.20 U
00BW15 1.58
99BW12 0.67
91BW04 0.19
12BW01 0.20 U
99BW14 0.20 U
00BW13 0.20 U
12BW04 16.00
04BW09 24.90
04BW07 0.20 U
12EX01 14.30
12BW07 55.80
12BW05 78.20
00BW16 0.20 U
12BW03 0.83
99BW18 7.95
12BW06 5.33
12EX02 3.30
12BW02 7.50
12BW08 7.50
WP-28 0.19
02BW01 11.00
99BW10 12.00
WP-86 1.69
WP-164 0.30
WP-27 2.16
WP-18N 0.20
WP-22X 0.20 U
99BW09 0.20 U
WP-18S 0.20
00BW10 0.20 U
04CW08 0.20 U
WP-21 0.20 U
WP-115 0.20 U
WP-64 0.20 U
WP-46 0.20 U
WP-166 0.20 U
2.0
3.5
5.0


N
W
E
S
WP-65 0.42
WP-118 1.10
WP-105 0.41
WP-120 0.35
WP-122 0.57
WP-127 0.73
WP-128 0.22
WP-130 0.20
WP-132 0.20 U
WP-133 0.20 U
WP-134 0.20 U
WP-31 0.20 U
WP-135 0.20 U
WP-140 0.20 U
WP-72 0.20 U
WP-33 0.87
WP-141 0.20 U
WP-142 0.20 U
WP-146 0.20 U
WP-148 0.21
WP-147 0.31
WP-149 0.16
WP-151 1.88
WP-150 0.15
WP-73 0.20 U
WP-49 0.20 U
WP-112
WP-117
2.0
3.5
5.0
WP-119 5.26
WP-121 5.26
WP-04 5.48
WP-70 4.12
WP-124 3.95
WP-125 2.83
WP-116 1.30
WP-129 3.68
WP-123 3.30
WP-66 1.30
WP-131 2.60
WP-11
WP-126 0.88
WP-172 0.71
WP-136 1.05
WP-69 1.33
WP-137 0.19
WP-68 0.49
WP-03 1.10
WP-165 0.13
WP-139 0.85
WP-143 0.62
WP-138 0.19
WP-71A 0.22
WP-71B 0.41
WP-74 1.11
WP-145 0.48
WP-57 0.33
WP-144 0.50
WP-111 0.48
WP-154 0.39
WP-153 0.50
WP-10
WP-156 0.38
WP-155 0.40
WP-152 0.22
BCE059
WP-45 0.62
WP-157 0.20 U
WP-167 2.65
WP-168 2.82
WP-158 0.20 U
WP-159 0.20 U
WP-171 0.20 U
WP-170 0.20 U
WP-162 0.20 U
WP-160 0.20 U
WP-163 0.20 U
WP-173 0.20 U
WP-55 0.20 U
WP-52 0.35
WP-54 0.12
WP-09 0.11
WP-174 0.02 U
WP-161 0.20 U
WP-175 0.66
WP-176 0.52
WP-86 1.69
00BW16 0.20 U
WP-77
WP-164 0.30
WP-20N
WP-18N 0.20
WP-18S 0.20
WP-22
WP-22X 0.20 U
WP-60
WP-13E
WP-63
WP-115 0.20 U
WP-114
WP-95
WP-64 0.20 U
Shorecrest Drive
Dick Road
Ottmar Road
Legend
Monitoring Well, Detect
Monitoring Well, Not Sampled
Monitoring Well, No Detection
New Private Well, Not Sampled
Private Well, Detect
Private Well, Not Sampled
Private Well, No Detection
Cascade Valley Area
TCE Contours
Wellfield Superfund Site
Moses Lake, Washington
Figure 8 - TCE Concetration Inset Map
Cascade Valley
Date: 5 December 2013
Figure 8
0
0.075
0.15
0.3
Miles

Tables

TABLE 1 –WELLS SAMPLED DURING 2013 SAMPLING EVENT

	Event 1, May 2013 Sample Type		Event 2, June 2013 Sample Type		Event 3, August 2013 Sample Type	
Well ID	COC	GW el.	COC	GW el.	COC	GW el.
WP-03			X			
WP-04			X			
WP-09			X			
WP-14	X				X	
WP-18N			X			
WP-18S			X			
WP-21			X			
WP-22X			X			
WP-27			X		X	
WP-28			X			
WP-31			X			
WP-33			X			
WP-45			X			
WP-46			X			
WP-49			X			
WP-50			X			
WP-52			X			
WP-54			X			
WP-55			X			
WP-57			X			
WP-64			X			
WP-65			X			
WP-66			X			
WP-68			X			
WP-69			X			
WP-70	X				X	
WP-71A			X			
WP-71B			X			
WP-72			X			
WP-73			X			
WP-74			X			
WP-82	X				X	
WP-83	X				X	
WP-86	X				X	
WP-105			X			
WP-111			X			
WP-115			X			
WP-116			X			
WP-118			X			
WP-119			X		X	
WP-120			X			
WP-121			X		X	
WP-122			X			
WP-123			X		X	
WP-124			X			
WP-125			X		X	
WP-126			X			
WP-127			X			
WP-128			X			
WP-129			X		X	
WP-130			X			
WP-131			X		X	
WP-132			X			
WP-133			X			

WP-134			X			
WP-135			X			
WP-136			X			
WP-137			X			
WP-138			X			
WP-139			X			
WP-140			X			
WP-141			X			
WP-142			X			
WP-143			X			
WP-144			X			
WP-145			X			
WP-146			X			
WP-147					X	
WP-148					X	
WP-149			X			
WP-150			X			
WP-151					X	
WP-152					X	
WP-153					X	
WP-154					X	
WP-155					X	
WP-156			X			
WP-157			X			
WP-158			X			
WP-159			X			
WP-160			X			
WP-161			X			
WP-162					X	
WP-163			X			
WP-164			X			
WP-165			X			
WP-166			X			
WP-167					X	
WP-168					X	
WP-170					X	
WP-171					X	
WP-172					X	
WP-173					X	
WP-174					X	
WP-175					X	
WP-176					X	
00AW11		X	X	X		
00BW01		X	X	X		
00BW02		X	X	X		
00BW03		X	X	X		
00BW04		X	X	X		
00BW05		X	X	X		
00BW06		X	X	X		
00BW07		X	X	X		
00BW08		X		X		
00BW09		X	X	X		
00BW10		X	X	X		
00BW11		X	X	X		
00BW12		X	X	X		
00BW13		X	X	X		
00BW14		X		X		
00BW15		X	X	X		
00BW16		X	X	X		

01BW01		X	X	X		
02BW01		X	X			
02BW02		X	X	X		
04BW01		X	X			
04BW04		X	X			
04BW05		X	X			
04BW06		X	X			
04BW07		X	X			
04BW09		X	X			
04CW01		X	X			
04CW02		X	X			
04CW03		X	X			
04CW04		X	X			
04CW05		X	X			
04CW07		X	X			
04CW08		X	X			
12BW01		X	X			
12BW02		X	X			
12BW03		X	X			
12BW04		X	X			
12BW05		X	X			
12BW06		X	X			
12BW07		X	X			
12BW08		X	X			
12CW01		X	X			
12CW02		X	X			
12CW03		X	X			
12CW04		X	X			
12CW05		X	X			
12EX01		X	X			
12EX02		X	X			
91BW03		X	X	X		
91BW04		X	X	X		
92BW01		X	X	X		
92BW02		X	X	X		
99AW01		X	X	X		
99AW09		X	X	X		
99BW01		X	X	X		
99BW09		X	X	X		
99BW10		X	X	X		
99BW12		X	X	X		
99BW14		X	X	X		
99BW15		X	X	X		
99BW16		X	X	X		
99BW18		X	X	X		

Notes:
COC = Contaminant of Concern sample
GW el. = Grouundwater elevation measurement

TABLE 2 – 2013 SAMPLING RESULTS – Groundwater Monitoring Wells – GROUNDWATER ELEVATION - 2013

Well ID	GW Elevation (ft) May 7-8, 2013	GW Elevation (ft) June 10-13, 2013	Screened Interval	Bladder Pump Installed	Stick Up or Flush Mount	NAD 83	Coordinates	Notes
91BW-01 (WL only)	na	na	193-203	No	Stick Up	47.227	119.342	Unsafe to Access due to C-17s
91BW-03	1071.17	1071.16	170-180	Yes	Stick Up	47.180	119.312	Tank farm well
91BW-04	1066.97	1066.88	178-188	Yes	Stick Up	47.171	119.307	
92BW-01	1072.34	1072.34	143-153	Yes	Stick Up	47.181	119.307	
92BW-02	1072.51	1072.45	147-157	Yes	Stick Up	47.180	119.306	Deep reach for airline in casing.
99AW-01	1071.7	1071.7	101-111	Yes	Stick Up	47.180	119.312	Tank farm well
99BW-01	1071.26	1071.24	141.5-151.5	Yes	Stick Up	47.180	119.312	Tank farm well
99AW-09	1064.13	1064.11	97.5-107.5	Yes	Stick Up	47.161	119.305	
99BW-09	1023.25	1022.21	110-120	Yes	Stick Up	47.151	119.294	East well in well pair.
99BW-10	1038.62	1038.39	175-185	No	Flush Mount	47.155	119.309	
99BW-12	1063.56	1063.37	162-172	Yes	Flush Mount	47.168	119.310	
99BW-13	na	na	Destroyed	Destroyed	Was Stick Up	47.168	119.294	well destroyed
99BW-14	1070.7	1070.64	85-95	Yes	Stick Up	47.183	119.296	
99BW-15	1075.11	1075.05	90-100	Yes	Flush Mount	47.189	119.327	
99BW-16	1062.86	1062.76	146-156	Yes	Stick Up	47.220	119.315	Bentonite leaking from casing.
99BW-17 (WL only)	na	na	120-140	No	Stick Up	47.161	119.305	Unsafe to Access due to C-17s
99BW-18	1055.69	1055.46	143-153	Yes	Stick Up	47.190	119.286	
00BW-01	1082.59	1082.53	68-78	Yes	Stick Up	47.183	119.306	
00BW-02	1074.16	1073.47	87-97	Yes	Stick Up	47.185	119.303	
00BW-03	1074.33	1074.33	85-95	Yes	Stick Up	47.192	119.298	
00BW-04	1082.92	1082.88	70-80	Yes	Stick Up	47.195	119.295	
00BW-05	1084.62	1084.55	80-90	Yes	Stick Up	47.190	119.339	
00BW-07	1079.35	1079.31	75-85	Yes	Stick Up	47.192	119.316	
00BW-08 (WL only)	1076.38	1076.38	92-102	Yes	Stick Up	47.192	119.316	Next to parking apron. GPS revised
00BW-09	1083.91	1083.86	79.5-89.5	Yes	Stick Up	47.148	119.308	
00BW-10	1019.46	1019.44	186.2-196.2	Yes	Stick Up	47.188	119.318	
00AW-11	1072.18	1072.13	81-91	Yes	Stick Up	47.181	119.306	Located 25' SW of 92BW-01
00BW-11	1071.29	1071.01	107-117	Yes	Flush Mount*	47.188	119.305	New vault - use 3/4 in. socket.
00BW-12	1073.75	1073.43	101-111	Yes	Stick Up	47.166	119.302	
00BW-13	1069.76	1069.7	133-143	Yes	Stick Up	47.191	119.288	
00BW-14	1083.82	1083.82	62-72	Yes	Flush Mount*	47.178	119.300	* 25 3/4" from surface to pump cap.
00BW-15	1073.99	1073.95	105.6-115.6	Yes	Stick Up	47.160	119.319	
00BW-16	1038.32	1037.09	186.4-196.4	Yes	Stick Up	47.197	119.296	
01BW-01	1085.04	1085.04	85-95	Yes	Flush Mount	47.197	119.296	
02BW-01	1040.01		188-192.5	Removed	Flush Mount	47.150	119.430	
02BW-02	1075.43	1075.43	109-118.5	Yes	Flush Mount	47.183	119.295	

Well ID	GW Elevation (ft) May 7-8, 2013	GW Elevation (ft) June 10-13, 2013	Screened Interval	Bladder Pump Installed	Stick Up or Flush Mount	NAD 83	Coordinates	Notes
04BW-01	1085.15		96-116	No	Stick Up	47.197	119.296	
04BW-04	1057.59		190-210	No	Stick Up	47.186	119.331	
04BW-05	1061.74		176-196	No	Stick Up	47.180	119.328	
04BW-06	1065.1		174-194	No	Stick Up	47.178	119.316	
04BW-07	1055.41		195-215	No	Stick Up	47.164	119.313	Transducer installed - pull to sample.
04BW-09	1068.75		139-149	No	Flush Mount	47.165	119.303	Triangle shaped monument.
04CW-01	1034.52		298-308	No	Stick Up	47.186	119.331	
04CW-02	1035.11		297-307	No	Stick Up	47.180	119.329	
04CW-03	1025.58		264-284	No	Stick Up	47.180	119.312	Tank farm well
04CW-04	1056.26		303-313	No	Stick Up	47.164	119.313	Transducer installed - pull to sample.
04CW-05	1056.44		260-280	No	Stick Up	47.164	119.304	
	1026.17		283-293	No	Stick Up	47.155	119.309	Well has 2 screened intervals.
04CW-07			303-309	No				
04CW-08	1023.92		294-314	No	Flush Mount	47.146	119.311	Triangle shaped monument.
12BW-01	1073.1		162 - 172	No	Stick Up	47.168	-119.302	
12BW-02	1049.32		174 - 194	No	Flush Mount	47.157	-119.306	
	1187.04	1,056.88	179 - 189	No	Stick Up			Well has 2 screened intervals.
12BW-03			199 - 219	No		47.160	-119.313	
	1169.02	1,068.42	158 - 168	No	Stick Up			Well has 2 screened intervals.
12BW-04			178 - 188	No		47.165	-119.307	
12BW-05	1069.66		167 - 187	No	Stick Up	47.163	-119.303	
12BW-06	1054.94		170 - 200	No	Flush Mount	47.159	-119.309	
12BW-07	1071.81		160 - 180	No	Stick Up	47.165	-119.304	
12BW-08	1050.59		178 - 198	No	Flush Mount	47.157	-119.308	
12CW-01	1029.43		274 - 294	No	Flush Mount	47.157	-119.306	Need 15/16 in. Socket to Open
12CW-02	1031.87		300 - 320	No	Stick Up	47.160	-119.313	
12CW-03	1060.48		288-298	No	Stick Up	47.165	-119.307	
12CW-04	1058.96		255 - 265	No	Stick Up	47.163	-119.303	
12CW-05	1029.86		287 - 307	No	Flush Mount	47.159	-119.309	
12EX-01	1071.83		160 - 180	No	Stick Up	47.165	-119.304	
12EX-02	1051.55		180 - 198	No	Flush Mount	47.157	-119.308	In large rectangular vault

Indicates Bladder Pump installed and designated for sample collection.
Indicates Passive Diffusion Bag well.
Indicates 2 screened intervals requiring two PDBs set at the mid-screen depths.

Water levels not measured in Passive Diffusion Bag Wells during Jun 2013 sampling event.

TABLE 3 – 2013 SAMPLING RESULTS – GROUNDWATER MONITORING WELLS– DETECTS ONLY

				CIS-DCE	TCE
Sample ID	Well ID	Date Sampled	Sample Type	Results ug/L (MCL 70)	Results ug/L (MCL 5)
Hanford Formation Aquifer Wells					
13MLW00100AW11	00AW-11	6/12/2013	N	0.20 U	**1.16**
13MLW00199AW01	99AW-01	6/13/2013	N	0.20 U	**0.53**
13MLW20199AW01	99AW-01	6/13/2013	FD	0.20 U	**0.56**
13MLW00199AW09	99AW-09	6/11/2013	N	0.20 U	**1.58**
Priest Rapids and Roza 1 Aquifer Wells					
13MLW00100BW02	00BW-02	6/10/2013	N	0.20 U	**0.25**
13MLW00100BW12	00BW-12	6/10/2013	N	0.20 U	**18**
13MLW00100BW15	00BW-15	6/13/2013	N	**0.27**	**1.58**
13MLW00102BW01	02BW-01	6/10/2013	N	0.20 U	**11**
13MLW00104BW04	04BW-04	6/12/2013	N	0.20 U	**0.4**
13MLW00104BW05	04BW-05	6/12/2013	N	0.20 U	**1.13**
13MLW00104BW06	04BW-06	6/11/2013	N	**2.62**	**12.6**
13MLW00104BW09	04BW-09	6/12/2013	N	0.20 U	**24.9**
13MLW00112BW02	12BW-02	6/10/2013	N	0.20 U	**7.5**
13MLW001A12BW03	12BW-03	6/11/2013	N	0.20 U	**0.83**
13MLW001B12BW03	12BW-03	6/11/2013	N	0.20 U	**0.69**
13MLW001A12BW04	12BW-04	6/10/2013	N	0.20 U	**16**
13MLW001B12BW04	12BW-04	6/10/2013	N	0.20 U	**16**
13MLW00112BW05*	12BW-05*	6/11/2013	N	0.20 U	**78.2**
13MLW00112BW06	12BW-06	6/11/2013	N	0.20 U	**5.33**
13MLW00112BW07	12BW-07	6/12/2013	N	0.20 U	**55.8**
13MLW00112BW08	12BW-08	6/10/2013	N	0.20 U	**7.5**
13MLW00191BW04	91BW-04	6/12/2013	N	0.20 U	**0.19 J**
13MLW00192BW01	92BW-01	6/12/2013	N	0.20 U	**21.2**
13MLW00192BW02	92BW-02	6/13/2013	N	**0.67**	**6.05**
13MLW00199BW01	99BW-01	6/13/2013	N	0.20 U	**28**
13MLW00199BW10	99BW-10	6/10/2013	N	0.20 U	**12**
13MLW00199BW12	99BW-12	6/12/2013	N	0.20 U	**0.67**
13MLW00199BW15	99BW-15	6/12/2013	N	**1.66**	**7.19**
13MLW00199BW16	99BW-16	6/12/2013	N	0.20 U	**1.95**
13MLW00199BW18	99BW-18	6/11/2013	N	0.20 U	**7.95**
Roza 2 Aquifer Wells					
13MLW00104CW01	04CW-01	6/12/2013	N	0.20 U	**0.43**
13MLW00104CW03	04CW-03	6/13/2013	N	0.20 U	**3.16**
13MLW00104CW04	04CW-04	6/11/2013	N	0.20 U	**0.46**
13MLW00104CW05	04CW-05	6/11/2013	N	0.20 U	**3.02**
13MLW001A04CW07	04CW-07	6/10/2013	N	0.20 U	**4.7**
13MLW001B04CW07	04CW-07	6/10/2013	N	0.20 U	**4.8**
13MLW00112CW01	12CW-01	6/10/2013	N	0.20 U	**3.7**
13MLW00112CW02	12CW-02	6/11/2013	N	0.20 U	**0.41**
13MLW00112CW03	12CW-03	6/10/2013	N	0.20 U	**0.52**
13MLW00112CW04	12CW-04	6/11/2013	N	0.20 U	**0.74**
13MLW00112CW05	12CW-05	6/11/2013	N	0.20 U	**0.93**
13MLW20112CW05	12CW-05	6/11/2013	FD	0.20 U	**0.96**
Extraction Wells					
13MLW00112EX01	12EX-01	6/12/2013	N	**0.54**	**14.3**
13MLW00112EX02	12EX-02	6/10/2013	N	0.20 U	**3.3**

*Well 12BW-05 was qualified with U and J for 1,1-DCE, trans-DCE, DCA, VC, TCA, and 1,1-DCA.
UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value

	Cells shaded grey exceed the 2.0 ug/L TCE concentration identified for quarterly sampling
	Cells shaded orange exceed the 3.5 ug/L TCE action threshold for WHF installation criteria
	Cells shaded red exceed the 5.0 ug/L TCE MCL risk level

MCL = Maximum Contaminant Level
N = normal sample
FD = field duplicate
FB = field blank
EB = equipment blank
U = undetected
J = estimated

TABLE 4 – 2013 SAMPLING RESULTS - PRIVATE WELLS EXCLUDING WHOLE HOUSE FILTER – DETECTS ONLY

Sample ID	Well ID	Date Sampled	Sample Type	CIS-DCE Results ug/L (MCL 70)	TCE Results ug/L (MCL 5)
13MLW001WP03	WP-03	6/11/2013	N	**0.21**	**1.03**
13MLW201WP03	WP-03	6/11/2013	FD	**0.22**	**1.1**
13MLW001WP04	WP-04	6/12/2013	N	**1.68**	**5.48 J-**
13MLW001WP09	WP-09	6/11/2013	N	0.20 U	**0.11 J**
13MLW001WP18N	WP-18N	6/11/2013	N	0.20 U	**0.2**
13MLW001WP18S	WP-18S	6/11/2013	N	0.20 U	**0.2**
13MLW001WP27	WP-27	6/10/2013	N	0.20 U	**2.16**
13MLW002WP27	WP-27	8/27/2013	N	0.20 U	**0.82**
13MLW001WP28	WP-28	6/10/2013	N	0.20 U	**0.19 J**
13MLW001WP33	WP-33	6/12/2013	N	0.20 U	**0.87**
13MLW001WP45	WP-45	6/11/2013	N	0.20 U	**0.62**
13MLW001WP52	WP-52	6/11/2013	N	0.20 U	**0.35**
13MLW001WP54	WP-54	6/11/2013	N	0.20 U	**0.12 J**
13MLW001WP57	WP-57	6/12/2013	N	0.20 U	**0.33**
13MLW001WP65	WP-65	6/10/2013	N	0.20 U	**0.42**
13MLW001WP66	WP-66	6/10/2013	N	**0.27**	**1.3**
13MLW001WP68	WP-68	6/11/2013	N	0.20 U	**0.49**
13MLW001WP69	WP-69	6/11/2013	N	0.20 U	**1.33**
13MLW001WP71A	WP-71A	6/12/2013	N	0.20 U	**0.22**
13MLW001WP71B	WP-71B	6/12/2013	N	0.20 U	**0.41**
13MLW001WP74	WP-74	6/11/2013	N	0.20 U	**1.11**
13MLW001WP105	WP-105	6/10/2013	N	0.20 U	**0.41**
13MLW001WP111	WP-111	6/12/2013	N	0.20 U	**0.48**
13MLW001WP116	WP-116	6/10/2013	N	**0.28**	**1.3**
13MLW001WP118	WP-118	6/10/2013	N	0.20 U	**1.1**
13MLW001WP119	WP-119	6/10/2013	N	0.20 U	**4**
13MLW001WP120	WP-120	6/10/2013	N	0.20 U	**0.29**
13MLW201WP120	WP-120	6/10/2013	FD	0.20 U	**0.35**
13MLW001WP121	WP-121	6/11/2013	N	0.20 U	**4.21**
13MLW001WP122	WP-122	6/10/2013	N	0.20 U	**0.57**
13MLW001WP123	WP-123	6/10/2013	N	**0.12 J**	**3.3**
13MLW302WP123	WP-123	8/27/2013	EB	0.20 U	**3.02**
13MLW000WP124	WP-124	8/27/2013	N	**0.64**	**3.95**
13MLW001WP125	WP-125	6/10/2013	N	**0.41**	**2.3**
13MLW002WP125	WP-125	8/27/2013	N	**0.51**	**2.83**
13MLW001WP126	WP-126	6/10/2013	N	0.20 U	**0.88**
13MLW001WP127	WP-127	6/10/2013	N	0.20 U	**0.73**
13MLW001WP128	WP-128	6/10/2013	N	0.20 U	**0.22**
13MLW001WP129	WP-129	6/11/2013	N	0.20 U	**2.51**
13MLW002WP129	WP-129	8/27/2013	N	0.20 U	**3.68**
13MLW001WP130	WP-130	6/11/2013	N	0.20 U	**0.19 J**
13MLW201WP130	WP-130	6/11/2013	FD	0.20 U	**0.2**
13MLW001WP131	WP-131	6/10/2013	N	0.20 U	**2.6**
13MLW002WP131	WP-131	8/27/2013	N	0.20 U	**1.84**
13MLW001WP136	WP-136	6/11/2013	N	0.20 U	**1.05**
13MLW001WP137	WP-137	6/11/2013	N	0.20 U	**0.19 J**
13MLW001WP138	WP-138	6/10/2013	N	0.20 U	**0.19 J**
13MLW001WP139	WP-139	6/10/2013	N	0.20 U	**0.85**
13MLW001WP143	WP-143	6/10/2013	N	0.20 U	**0.62**
13MLW001WP144	WP-144	6/12/2013	N	0.20 U	**0.5**

Sample ID	Well ID	Date Sampled	Sample Type	CIS-DCE Results ug/L (MCL 70)	TCE Results ug/L (MCL 5)
13MLW001WP145	WP-145	6/12/2013	N	0.20 U	**0.48**
13MLW000WP147	WP-147	8/27/2013	N	0.20 U	**0.31**
13MWL000WP147	WP-147	8/27/2013	N	0.20 U	**0.31**
13MLW000WP148	WP-148	8/27/2013	N	0.20 U	**0.21**
13MLW001WP149	WP-149	6/12/2013	N	0.20 U	**0.16 J**
13MLW001WP150	WP-150	6/10/2013	N	0.20 U	**0.15 J**
13MLW000WP151	WP-151	8/28/2013	N	**0.21**	**1.88**
13MLW000WP152	WP-152	8/27/2013	N	0.20 U	**0.22**
13MLW000WP153	WP-153	8/28/2013	N	0.20 U	**0.5**
13MLW000WP154	WP-154	8/28/2013	N	0.20 U	**0.39**
13MLW000WP155	WP-155	8/27/2013	N	0.20 U	**0.4**
13MLW001WP156	WP-156	6/12/2013	N	0.20 U	**0.38**
13MLW001WP164	WP-164	6/11/2013	N	0.20 U	**0.3**
13MLW001WP165	WP-165	6/11/2013	N	0.20 U	**0.13 J**
13MLW000WP167	WP-167	8/28/2013	N	0.20 U	**2.65**
13MLW000WP168	WP-168	8/27/2013	N	0.20 U	**2.82**
13MLW000WP172	WP-172	8/27/2013	N	0.20 U	**0.71**
13MLW000WP175	WP-175	8/28/2013	N	0.20 U	**0.66**
13MLW000WP176	WP-176	8/28/2013	N	0.20 U	**0.47**
13MLW200WP176	WP-176	8/28/2013	N	0.20 U	**0.52**

Cells shaded grey exceed the 2.0 ug/L TCE concentration identified for quarterly sampling
Cells shaded orange exceed the 3.5 ug/L TCE action threshold for WHF installation criteria
Cells shaded red exceed the 5.0 ug/L TCE MCL risk level

There was an equipment blank taken for WP-123 on 8/27/13 that showed a concentration of TCE of 3.02 ug/L. After speaking with the field team, it appeared that the field team used influent water for WP-123 rather than DI water to collect the field blank, therefore, this value acts as a duplicate rather than an equipment blank.

MCL = Maximum Contaminant Level
N = normal sample
FD = field duplicate
FB = field blank
EB = equipment blank
U = undetected
J = estimated
J- = estimated, biased low

TABLE 5 – 2013 SAMPLING RESULTS – WHOLE HOUSE FILTER (WHF) PRIVATE WELLS – DETECTS ONLY

Sample ID	Well ID	Sample Location	Date Sampled	Sample Type	CIS-DCE Results ug/L (MCL 70)	TCE Results ug/L (MCL 5)
13MLW01AWP14	WP-14	Influent	5/9/2013	N	**1.2**	**4.4**
13MLW21AWP14	WP-14	Influent	5/9/2013	FD	**1.1**	**4**
13MLW02AWP14	WP-14	Influent	8/26/2013	N	**1.14**	**4.69**
13MLW01AWP70	WP-70	Influent	5/9/2013	N	0.20 U	**3.3**
13MLW02AWP70	WP-70	Influent	8/26/2013	N	**0.12 J**	**4.12**
13MLW00CWP83	WP-83	Effluent	5/6/2013	N	**0.38**	**0.5**
13MLW01AWP83	WP-83	Influent	5/9/2013	N	**0.29**	**2.1**
13MLW02AWP83	WP-83	Influent	8/26/2013	N	**0.28 J**	**2.08**
13MLW01AWP86	WP-86	Influent	5/9/2013	N	0.20 U	**1.5**
13MLW02AWP86	WP-86	Influent	8/26/2013	N	0.20 U	**1.69**
13MLW001WP119	WP-119	**no WHF**	6/10/2013	N	0.20 U	**4**
13MLW00AWP119	WP-119	Influent	8/28/2013	N	**0.11 J**	**5.26**
13MLW001WP121	WP-121	**no WHF**	6/11/2013	N	0.20 U	**4.21**
13MLW00AWP121	WP-121	Influent	8/28/2013	N	**0.12 J**	**5.26**

Only lead filters had detects during 2013 except for the effluent sample for WP-83 collected on 5/6/13 (highlighted in orange). Samples collected on 5/6/13 were taken just prior to filter changeout. The WHF for WP-83 was resampled on 5/9/13 following changeout and again on 8/26/13 resulting in non-detects for all mid and effluent samples.

WHFs were installed for WP-119 and WP-121 following exceedance of of 3.5 ug/L TCE action level. Therefore, sample locations are designated as "no WHF" since the filters were not installed at this time. They are included on this table only for comparison of filtered well samples to non-filtered well sample concentrations.

Sample IDs locations are as follows:

A - influent before lead, B - in between lead and lag filter, C - effluent after lag,
Those without an A, B, or C did not yet have a WHF installed (i.e. WP-119, & WP-121)

MCL = Maximum Contaminant Level
N = normal sample
FD = field duplicate
U = undetected
J = estimated

TABLE 6 –WHOLE HOUSE FILTER – PURGE AND TOTALIZER VOLUME SUMMARY- 2013

August 2013 Event			
Location	**Purge Volume** (Gallons)	**Totalizer Start** (Total Gallons)	**Totalizer End** (Total Gallons)
WP-14	32	na	274,230
WP-70	32	na	21,690
WP-83	32	na	549,840
WP-86	42	na	117,220
WP-119	90	na	160
WP-121	75	na	na

APPENDIX A

FIELD SAMPLING REPORT

Private Wells and Monitoring Wells Groundwater Sampling Field Report

Fiscal Year 2013 Field Sampling Events

Moses Lake Wellfield Superfund Site
Moses Lake, Washington

Field Investigations:
6-9 May, 10-13 June, and 26-28 August 2013
Report Prepared:
August 2013

By: Geotechnical and Environmental Restoration Branch

US Army Corps of Engineers ®
Seattle District

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1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION

1.1 BACKGROUND

The Moses Lake Wellfield Superfund Site is located between the Grant County Airport and the City of Moses Lake, Washington. The Site includes the former Larson Air Force Base (LAFB) property and adjacent properties affected by groundwater contamination. The Site is listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 National Priorities List (NPL) for Uncontrolled Hazardous Waste Sites.

The Moses Lake Wellfield Superfund Site is an area of approximately 15 square miles, which includes the former LAFB, commercial facilities, and residences. The former LAFB occupied approximately 9,607 acres three miles northwest of the City of Moses Lake. The United States Air Force was active at the site from 1942 until 1966. Previous site investigations have focused primarily on the former LAFB, where in 1988, three municipal wells operated by the City of Moses Lake were found to be contaminated with trichloroethylene (TCE). Wells outside the former base also have shown detections of TCE. The Seattle District, US Army Corps of Engineers (USACE) has completed a Remedial Investigation (RI) phase in 2003. Appendix A of this report shows the general location map and a site map.

During the course of the RI, several private wells were tested and found to be contaminated with TCE. In 2001, the USACE contracted installation of carbon filtration units – known as whole house filter systems (WHF) - at five of these wells. Several years of groundwater monitoring data has been evaluated since the WHF systems were installed.

The final results of the Phase I RI released in a report in March 1993 indicated that TCE was consistently found in shallow alluvial and upper basalt (*a*-basalt) groundwater in the central area of the former base.

On October 14, 1992, the affected areas of the former LAFB and off-site down gradient areas, termed the "Moses Lake Wellfield Contamination", were listed on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 for Uncontrolled Hazardous Waste Sites. The former LAFB property is one part of the Moses Lake Wellfield Superfund Site; the site also includes the contaminant plume.

Chemical results from 1993 and 1994 combined with historical data indicated that TCE occurred in the central and southern portion of the former LAFB in alluvial and *a*-basalt groundwater. In 2004, USACE confirmed TCE contamination in the next lower basalt aquifer (c-basalt). As of 1995, the data suggest that more than one source may have contributed TCE to the alluvial and *a*-basalt groundwater in the central portion of the former LAFB.

In 1998, URS Greiner completed a sampling round of private water wells and wells for Class A and Class B water systems east, south and southwest of the previously known TCE plume. There were eight detections of TCE during this study. Four wells that were previously outside the plume extent were found to be above the detection limit.

1.2 FY 13 GROUNDWATER SAMPLING SUMMARY AND OBJECTIVES

Three Moses Lake Wellfields Superfund Site groundwater sampling events were conducted by USACE in fiscal year 2013 in coordination with the U.S. Environmental Protection Agency (USEPA) Region 10. The events described in this report involve USACE environmental field teams verifying sample point locations; discussion of sampling techniques; recording groundwater observations; collecting groundwater samples; and shipping those samples by overnight delivery for laboratory analysis. Environmental sampling team members included Joseph Marsh, David Sullivan, Matt Brookshier, Aaron King, Edward Wilson, Robert Wilkins, Blair Kinser, and Jose Valdes.

All of the work described in this report was accomplished in accordance with the Moses Lake Wellfield Superfund Site Quality Assurance Project Plan. In addition, the team followed the guidance presented in: the Seattle District, USACE Safety and Health Plan; USACE Safety Manual EM 385-1-1; Seattle District, USACE, Sampling Standard Operating Procedures.

The private wells and monitoring wells designated for sampling is displayed on a map found at Appendix A. These wells have been selected based on their down-gradient locations relative to the inferred flow direction of TCE-contaminated groundwater and validated sampling analytical data from previous monitoring events.

Event 1: The first event was conducted from 6 to 9 May 2013, and consisted of groundwater sampling from the original five whole house filter (WHF) systems. This event also included sampling of four newly upgraded systems and one former system location restored to original condition once filtration was deemed unnecessary.

Event 2: The second event was conducted from 10 to 12 June 2013, and consisted of groundwater sampling from 75 private well systems in the Cascade Valley area, and 60 monitoring wells located across the entire site (31 dedicated bladder pump monitoring wells and 29 monitoring wells with passive diffusion bags installed). Some of the wells sampled either had never been previously sampled or had not been sampled for many years.

Event 3: The third event was conducted from 26-28 August 2013, and consisted of groundwater sampling from four upgraded WHF systems, two new WHF systems, and one restored former WHF system. In addition, the USACE team collected groundwater samples from 45 private well systems not previously sampled in the Cascade Valley.

The objectives of groundwater sampling at Moses Lake are to: 1) collect representative samples from designated private well systems and monitoring wells yielding data of known and sufficient quality to evaluate TCE concentrations and define existing TCE plumes; 2) to assure compliance with the requirements of USEPA; and 3) to make critical project - specific decisions based on the evaluated data.

2.0 DESCRIPTION OF WORK

2.1 ACTIVITIES PRIOR TO SAMPLE COLLECTION

The project team worked to collect signatures on Department of the Army Right of Entry forms as required before conducting the well sampling on private, city or county government property. For some properties, previously signed Right of Entry forms were still valid. For all properties designated for sample collection, owners (and renters if applicable) were contacted to coordinate sample collection times during sampling events held in May, June, and August of 2013. Many of the owners allowed the sampling teams to work on their property while they were not at home. At some of the properties, home owners or well system managers had to unlock pump houses and open valves for the sampling teams – requiring prior coordination.

The June 2013 event was unique because four USACE sampling teams conducted field work simultaneously instead of fielding a single team due to the total number of sample points. The sampling teams worked independently each day, sampling groundwater from a pre-determined list of private wells and monitoring wells.

For every sampling event, the teams verified the address and map location were correct, and that the Right of Entry form had been signed prior to arriving at each sampling location.

Each team was responsible for identifying potentially dangerous conditions at each sampling location. If so, an alternate water tap would be selected for sample collection in a safer area of the property. Also, if the pump was not operating at a specific residence, and the owner/tenant could not start the pump, no sampling would be conducted at that location (the teams did not experience this problem). The sampling teams were also tasked with determining the most appropriate cold-water tap or other sample port as close to each wellhead as practical, while comparing notes on sample points collected during previous sampling events. The teams were briefed that groundwater samples would not be taken from taps delivering chlorinated, aerated, softened or filtered water.

2.2 WHOLE HOUSE FILTER SAMPLING PROCEDURES

The two heavy gauge steel granular activated carbon (GAC) filter canisters have formerly been located in wood-framed sheds of WP-12, WP-82, WP-86 and WP-70 (or in the crawlspace of WP-86) near the wellhead of each property. Today, new lightweight composite tanks and improved sampling ports and plumbing have replaced the heavy steel systems. The original sampling procedures called for: opening each of three sample ports labeled “A” for the sample port upstream of the lead filter; “B” for the between filters mid sample port; and “C” for the sample port downstream of the lag filter where filtered water was directed to the residence. Purge flow rates averaged one gallon per minute as measured with graduated cylinder, and purged water was captured in a five gallon bucket. As the water flowed at each port, water temperature was measured and recorded. Purging would cease once a stabilized temperature was reached, usually after five to ten gallons had been collected at each port. Sample collection consisted of regulating the flow rate of each port to approximately 200 to 400 milliliters per

minute (ml/min). to achieve a smooth, non-turbulent stream if possible, then filling three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface outside of the pump house after the samples were collected.

Improved standard operating procedures are under development for future WHF systems and private well sampling with the intent of increasing reliability and repeatability in analytical data quality.

2.3 Private Well Sampling Procedures

Upon arrival at each sampling point (water tap), the sampling team opens a water tap nearest to the wellhead as practical and directed a steady water stream into a five-gallon bucket. The water flow rate can be measured in gallons per minute using a graduated container. This and all other pertinent data is entered in the project field book. While one team member records field data, the other used a precision GPS receiver to record new sample point coordinates for updating the project map. Next, water temperature is monitored and a stabilized reading in degrees Fahrenheit shall be entered into the project field book. During this activity, water is allowed to flow for approximately 5 to 10 minutes depending on sample collection point in relation to the wellhead to flush stagnant water from the system. Stabilized temperature readings were a good indicator that stagnant water had passed through the piping. Less flushing time was required if the tap was located on the wellhead or pump house.

Prior to collecting a water sample, the flow rate at each tap shall be reduced to approximately 100 to 200 milliliters per minute to minimize sample aeration if possible. Field personnel shall don new Nitrile gloves prior to sample collection at each residence. All sample containers shall be filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point location and components of the plumbing system should be noted to assist in data interpretation. A photographic record of each sample point shall be made by the team.

After the sample containers are filled, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time are placed on the containers. The samples are then packaged in bubble wrap bags and plastic zipper type bags, placed into pre-iced sample shipping coolers and prepared for shipment as described in Section 3.0. All sampling teams must work to ensure each property was left just as they found it with no damage done, and any doors or gates closed as required.

Improved standard operating procedures are under development for future WHF systems and private well sampling with the intent of increasing reliability and repeatability in analytical data quality.

2.4 Monitoring Well Sampling Procedures

2.4.1 Monitoring Well Sampling Using Dedicated Bladder Pumps

Moses Lake monitoring well groundwater purging and sampling was performed in accordance with the Seattle District's Low-Flow Ground Water Purging and Sampling Standard Operating Procedures, prepared in March 1999 and revised on 1 Sep 2009 (Appendix D). Data generated during purging were recorded on the MicroPurge/Low-Flow Sampling Log forms (Appendix C).

Prior to purging each well, the depth to static water level in each well was measured and checked periodically to monitor draw down as a guide to flow rate adjustment (no greater than 0.4' foot drawdown is permitted to prevent pumping stagnant casing water).

Purging operations at each well commenced once the following equipment was prepared: the MP20 MicroPurge® Controller equipped with an adjustable pressure regulator was connected to the Well Wizard® bladder pumps via air line and quick connect fittings. Another air line was quick-connected to a pressurized CO2 cylinder (or backup portable electric air compressor) to drive the pump. Pump flow rates were then adjusted during a "pre-purge" period to maximize withdrawal rates and minimize excessive drawdown in each well. The evacuated pre-purge volume at each well was intended to flush out a bladder pump and tubing volume prior to monitoring stabilization parameters. Finally, a QED MicroPurge® basics MP20 Flow Cell was connected to the pump's discharge line at ground surface to measure established stabilization parameters (pH, specific conductivity, temperature, DO, ORP, and turbidity).

One of the low-flow purging objectives is to minimize extraction of well casing water and sample only the formation water (i.e., minimal drawdown). In order to document drawdown, depth to water measurements during purging were monitored and recorded to verify that minimal drawdown occurred. The initial flow rate also was closely monitored during purging (dividing volume purged by elapsed time). A graduated measuring cup was used to determine the volume purged. After determining the optimum flow rate, the controller unit's setting was throttled to the desired pump flow rate. During the field sampling event, flow rates ranged from 200 to 400 milliliters/minute. Purge data was recorded every 2 minutes.

Low-flow purging continued until three consecutive measurements of the stabilization parameters met stabilization requirements. Stabilization parameter requirements are as follows:

Temperature	+/- 0.2 ºC
Specific Conductivity	+/- 0.020 mS/cm
DO	+/- 0.2 mg/l
pH	+/- 0.2 units
ORP	+/- 20 mV

Turbidity shall also be measured and recorded on the purge logs, but is not a water chemistry parameter and has no bearing in determining stabilization of the well (achieving a reading of 10 NTU or less is desirable). Groundwater sample collection may begin immediately after achieving stabilization of water quality parameters during low flow purging at each well using dedicated or portable bladder pump systems as described previously.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory (ARI).

All sample containers were filled immediately following purging by disconnecting the flow-through cell from the pump tubing system, and capturing water directly from the discharge end of the tubing. All sample containers were carefully filled at a low-flow rate to minimize agitation. During sample collection, significant physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms and project field book as needed.

After filling the sample containers, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time were placed on each container and the container was placed in a plastic zipper bag. The vials were placed into foam blocks or bubble wrap bags. The bagged containers were then placed into pre-iced coolers to begin sample cooling to the required 4° centigrade sample preservation temperature.

At the conclusion of groundwater sampling at each well, the well covers were closed and padlocked.

2.4.2 Monitoring Well Sampling Using Passive Diffusion Bags

Passive Diffusion Bag samplers (PDBs) were been selected by the Moses lake Project Delivery Team as the most appropriate, cost-effective method for groundwater sample collection from Moses Lake monitoring wells lacking dedicated bladder pumps. The PDBs were purchased from ALS Environmental laboratory under license by the US Geological Survey and The General Electric Company, both co patent-holders. The 1 ¼" diameter low-density polyethylene PDBs were pre-filled with 220 ml or 330 ml of ASTM Type II certified, laboratory-grade, analyte-free, deionized water. Each filled PDB was then heat sealed by the laboratory prior to shipment to USACE via overnight delivery in hermetically sealed pouches. A representative sample from the same lot of deionized water used to fill the PDBs was tested by the vendor using low-level EPA Method 8260B, down to 1.0 ppb, and verified to be contaminant free. The USACE environmental field team shall pick up the PDBs and prepare for immediate deployment in wells on the following day in accordance to the following procedures:

Passive Diffusion Bag Deployment

1. Verify each monitoring well location and identification number with project maps and tables. Verify work can proceed safely in the vicinity of moving vehicular traffic or other hazards. Place plastic sheeting over the work area adjacent to each monitoring well. Use an electronic water level indicator to measure the static water level reading, and sound the well if possible to verify well depth and to determine existence of, and depth to potential sediments at the bottom of each well. Recover and decontaminate the water level meter using Alconox® and distilled water.

2. Don new, clean Nitrile gloves. Remove each dedicated PDB assembly from the protective shipping/storage pouch. The selected PDBs will be 36 inches long, and 1.25 inches in diameter. Verify the PDB is not damaged or leaking. If so, use a backup PDB ordered with the rest of the samplers.

3. While working over clean plastic sheeting placed on the ground surface, lower the PDB assembly designated for that well (weight first) into the open well riser. Note: the sampling team shall secure PDBs to Dacron line with minimum 110 lb. breaking strength, and attach stainless steel weights beneath each PDB (provided by vendor). The team will lower each assembly down into the monitoring wells until the line begins to go slack, indicating the bottom has been reached. Next, the team shall slowly raise the assembly five feet (for 10 foot screens) or as directed by well logs to ensure the PDB is at mid-screen depth.

The PDB placement strategy calls for the mid-length location of each PDB (18 inches down from top of PDB) to be set at the mid-depth position of each well screen. For wells with two screened intervals, two PDBs shall be used – setting each centered at the mid-depth position of each well screen.

4. Both sampling team members will work together to lower the weight into the well first, followed by the suspension line and PDBs. They will work to keep the assembly centered within the well casing as they slowly lower it to the well bottom. The suspension line can also be fastened to the well riser plug for security using steel wire. .

5. Secure each monitoring well cap or cover plate before moving on to the next well.

Passive Diffusion Bag Retrieval and Sample Collection
The environmental field team allowed a minimum of 14 days to elapse before returning to the Moses Lake site for groundwater sample collection per PDB guidance. PDB retrieval and sampling consisted of the following procedures:

1. The team verified each monitoring well location and identification number with project maps and tables. They verified work can proceed safely in the vicinity of moving vehicular traffic as required. The PDBs were prepared over clean sheets of aluminum foil prior to being placed into each well. The team used a pry bar, hex or Allen wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard “stick-up” well completions. The team donned new Nitrile gloves for groundwater sample collection. One team member grasped the well cap and lifted it up as the other grasped the PDB suspension line for security.

2. Both team members worked together to carefully haul the samplers to the surface. The sampling team carefully cut the top corner off each bag using decontaminated steel scissors. Next, one person held the vials and the other carefully and slowly tilted each bag – open side down toward the open sample vial. Scissors may be used to disconnect each PDB from the suspension line after sample collection. The team filled each vial just to overflowing and maintained a reverse meniscus. The vials were capped and inspected making sure there were no bubbles or headspace per standard VOC sampling procedures. There was no down time once the PDB has been brought to the surface until sample collection was complete at each well. Any residual sample water in the used PDBs was discharged to ground surface. Therefore, no IDW water shall be generated and stored during this sampling event.

2. Each PDB represented a unique sample ID number based on the well ID (and sample interval if two PDBs are deployed into one well). With the exception of the MS/MSD, all QC samples were submitted "blind" to the laboratory using a separate unique sample ID number not labeled as duplicate or trip blank per USACE standard sampling procedure. Trip blanks were required one per cooler. An extra laboratory- prepared PDB was shipped to the site and was used for collection of the trip and field blanks at the direction of the USACE project chemist.

3. Once recovered and sampled the PDBs and suspension lines were be discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials shall be disposed of as municipal waste. The PDBs and other solid waste material wasbe placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and returned to the Seattle District, USACE office.

4. Finally, the team securely capped and locked each monitoring well riser and cover plate when finished.

2.5 EVENT 1

Fiscal Year 2013 environmental field activities commenced during May 2013 with groundwater sample collection at the five original Whole house filter (WHF) systems. USACE PM Dan Sacks contacted the owners or residents at each of the five homes containing the whole house filter systems to set up times for sample collection prior to arrival at Moses Lake. Also, rights of entry permits were still in effect during the field activities. Residents of WP-83 and WP-86 observed the field sampling activities.

On 6 May 2013, a USACE field sampling team (Joseph Marsh and David Sullivan) collected water samples from the "lag out" filter sampling ports at WP-82, WP-14, WP-83, WP-86, and WP-70 to obtain water quality and filter performance data prior to filter system change-out. USACE contractors were on site during this same time period to install new WHF systems at WP-14, WP-83, WP-86, and WP-70. The contractors removed and disposed of all original WHF system components and replaced them with new upgraded systems including new sampling ports. The project team directed contractors to remove the filter system without replacement at WP-82 as several rounds of validated analytical data proved no need for continued filtration at that well system. Future groundwater samples at WP-82 shall be collected from a tap near the wellhead. At the same time, contractors installed a shed on the south side of the WP-86 home to permit safer and easier access to the new filter system and sample ports formerly situated in the crawlspace under the house.

WP-82: The two heavy gauge steel (GAC) filter canisters were located along the west wall inside of an unlocked wooden shed on the south side of the home. The lag out sampling port (house influent) was found to be clearly labeled "C" with a black permanent marker for verification. The filter influent and between filter sampling ports were grey plastic marked "Hayward PVC pressure regulator 1/4 inch" with screw top valve controls. The Lead Out sampling port was a brass Watts "precision low pressure regulator 3/8 inch" with "T" handle valve control. The discharged water was directed into a five gallon plastic bucket. Flow rates were measured with a graduated container, and stabilized temperature readings monitored using

a digital thermometer. The measured flow rate from each port was regulated to approximately 500 milliliters per minute with a stable temperature of 56.8 degrees F after five minutes of flushing. Approximately three gallons of water was flushed from the sample port, and then discharged to ground surface outside of the shed. Lead filter pressure gauge indicated 30 psi. Lag filter pressure gauge indicated 35 psi. Sample collection consisted of regulating the flow rate of the port to a smooth, non-turbulent stream, then filling three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. No significant problems were noted. The shed doors were closed at the completion of sampling activities.

WP-14: The two heavy gauge steel GAC filter canisters were located inside of an unlocked wooden well house shed across the driveway on the west side of the home. The lag out sampling port (house influent) was found to be clearly labeled "C" with a black permanent marker for verification. The Lag out sampling port was a brass Watts "precision low pressure regulator 3/8 inch" with "T" handle valve control fitted with a two foot length of Teflon sample tubing installed to reduce aeration and turbulence during sampling. The flow rate was measured with a graduated container, and stabilized temperature readings monitored using digital thermometer. The measured flow rate from each port was regulated to approximately 500 milliliters per minute with a stable temperature of approximately 57 degrees F after five minutes of flushing. Approximately three gallons of water was flushed from the filter influent port, and approximately one gallon from each of the other two sample ports during the sampling activity. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface outside of the pump house after the samples were collected. Sample collection consisted of regulating the flow rate of each port to a smooth, non-turbulent stream if possible, then filling three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. The shed door was held closed by a cement block at the conclusion of sampling activities at the request of the resident.

WP-83: The two heavy gauge steel GAC filter canisters were located inside of an unlocked wooden well house shed at the east end of the lawn on the east side of the home. The lag out sampling port (house influent) was found to be clearly labeled "C" with a black permanent marker for verification. The Lag out sample port was a grey plastic valve marked "Hayward PVC pressure regulator 1/4 inch" with screw top valve control. This valve was also fitted with upstream butterfly valves as a secondary flow control. Lead filter gauge displayed 44 psi, and the lag pressure gauge displayed 48 psi. Flow rates were measured with a graduated container, and stabilized temperature readings monitored using a digital thermometer. The measured flow rate from the lag port was regulated to approximately 500 milliliters per minute with a stable temperature of 15.12 degrees C after five minutes of flushing. Approximately three gallons of water was flushed from the filter influent port, and approximately one gallon from each of the other two sample ports during the sampling activity. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface outside of the pump house after the samples were collected. Sample collection consisted of regulating the flow rate of each port to a smooth, non-turbulent stream if possible, then filling three pre-preserved VOA vials to zero headspace. At this location, the Lag out sample port had to be fitted with Teflon sample tubing to control the high pressure fine stream emitted by the regulator valve. The Teflon tubing was bent into an "S" shape to yield a smooth, turbulence free flow to the sample vials. New Nitrile

gloves were donned before collecting samples at each port. The shed door was closed at the completion of sampling activities.

WP-86: The two heavy gauge steel GAC filter canisters were located in a pit inside the basement crawlspace of the house – requiring the cooperation of the resident for entry into the home. Entry was made to the crawlspace by entering a basement closet next to the stairway. At the back of the closet, a hatch was removed from the wall to gain entry to the crawlspace. A light bulb was turned on to illuminate the work area before beginning the sampling procedures. The lag out sampling port (house influent) was found to be clearly labeled "C" with a black permanent marker for verification. Next the sampling team opened the regulator valve to send water through a three foot length of Teflon tubing attached to port C. A turbulence free, smooth water stream was created with small adjustments to the control valve. New Nitrile gloves were donned before collecting samples at each port. After sample collection, the water collection bucket was removed, the crawlspace light was turned off, the hatch closed, and closet door closed before leaving the house. Collected purge water was transferred to the grass lawn in the front yard.

WP-70: The two heavy gauge steel GAC filter canisters were located inside an unlocked wooden pump house located in the backyard east of the house. The Lag out sampling port was found to be clearly labeled with a black permanent marker. The filter influent and the measured flow rate from each port were regulated to approximately 500 milliliters per minute with a stable temperature of 15.40 degrees C after 10 minutes of flushing. Approximately two gallons of water was flushed from Lag out port during the sampling activity. All discharged water was directed into a five gallon plastic bucket for transfer to the grass-covered ground surface outside of the pump house after the samples were collected. Sample collection consisted of regulating the flow rate of each port to a smooth, non-turbulent stream, then filling three pre-preserved VOA vials to zero headspace. Turbulence-free flow rates were observed. No problems noted. New Nitrile gloves were donned before collecting samples at each port. The shed door was closed and left unlocked at the conclusion of sampling per resident request.

Passive Diffusion Bag Deployment: On 7 May 2013, Joseph Marsh and David Sullivan deployed passive diffusion bag assemblies into 29 monitoring wells selected for groundwater sampling, but had no dedicated bladder pumps. The PDB shipments from ALS Environmental consisted of three quality control lot numbers: 1182; 1183; and 1184. By installing all diffusion bags at this time, the minimum required 14 day in-well time prior to sample collection would be met.

Following the PDB deployment protocols, both environmental team members worked together to determine the number of required weights, length of suspension line, and number of PDBs required at each designated well. Wells deeper than 200 feet generally required two steel weights to allow proper PDB positioning. Primary samples only required the standard size 220 ml PDB. Field duplicate wells required 330 ml capacity PDBs to assure adequate volume for the primary and field duplicate samples. MS/MSD designated wells required a minimum of 360 ml sample volume to fill nine VOA vials. These custom sized PDBs were selected and placed as required to meet the analytical requirements of the project team. Steel weights, suspension lines,

and PDBs were quickly assembled at each designated well and lowered into place within 10 minutes to reduce the possibility of contaminants entering the diffusion bags.

At each specific well, the team lowered the weight into the well first, followed by the suspension line and PDB. The team worked to keep the assembly centered within the well casing as they slowly lower it to the well bottom. When the team felt the weight hit well bottom, they pulled up the line approximately one inch and tied it off securely to the casing plug or well cap. This method ensured the PDB would always be centered at the mid-well screen depth. Finally, the well cap was locked, or the cover plate secured with locking bolts depending on type of well encountered – stick up or flush mount.

No specific difficulties or problems were noted during PDB deployment.

New and Restored WHF System Sampling: On 9 May 2013, USACE environmental sampling team members Joseph Marsh and David Sullivan collected the first groundwater samples from newly upgraded WHF systems at WP-14, WP-70, WP-83, and WP-86 a day after USACE contractors completed the work.

WP-82: Also during 8 May 2013, the WP-82 wellhead plumbing was restored by USACE contractor to original condition after the WHF system was removed. The sampling team collected a sample from the tap nearest the wellhead after flushing approximately 1.5 gallons of water for approximately five minutes with a stabilized temperature of 56.8 degrees F recorded.

At the upgraded WHF systems, the sampling team followed standard operating protocols to collect groundwater samples from the lead, mid, and lag (labeled A, B, and C respectively) sample ports to provide initial data on the upgraded filter system effectiveness.

WP-14: This new system has been installed inside a small unlocked shed located west of the residence. The system consists of two cylindrical tanks made of a composite material and filled with GAC. The system was plumbed from wellhead or pressure tank to the filters, then on to the house using PEX tubing. An in-line filter was installed downstream of the filters to prevent the granular carbon material from entering the home plumbing and causing damage. Sample ports with valve controls were also installed as previously noted – each port has been clearly labeled A, B, and C according to their positions on the system. In addition, a flow totalizer meter was installed in the system so total water flow through the GAC can be monitored periodically.

At WP-14, sample port A (lead) had a slow leak and could only achieve a 50 ml/min. flow rate (200 to 400 ml/min. would be ideal for VOA sampling). Port B also ran slow and leaked. Port C had a flow of 100 ml/min and did not leak. Leaks were repaired while the team was on site. The team informed the USACE PM that the sample ports should be upgraded by contractor to a higher flow rated model sample port of at least 200 ml/min. for effective sample collection. Due to the extreme low-flow rates, accurate temperature measurements could not be made. Each of three ports was purged into the collection bucket for approximately five minutes. Total approximate volume of water flushed from the system was estimated at no more than ½ gallon. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface outside of the pump house after the samples were collected. Sample collection consisted of

regulating the flow rate of each port to a smooth, non-turbulent stream if possible, then filling three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. The shed door was held closed by a cement block at the conclusion of sampling activities at the request of the resident.

WP-83: This new system has been installed inside a small unlocked shed located in the back yard east of the residence. The system consists of two cylindrical tanks made of a composite material and filled with GAC. The system was plumbed from wellhead or pressure tank to the filters, then on to the house using PEX tubing. An in-line filter was installed downstream of the filters to prevent the granular carbon material from entering the home plumbing and causing damage. Sample ports with valve controls were also installed as previously noted – each port has been clearly labeled A, B, and C according to their positions on the system. In addition, a flow totalizer meter was installed in the system so total water flow through the GAC can be monitored periodically. The measured flow rate from port A was approximately 100 ml/min. after a blockage was cleared in the system. The maximum flow achieved at port B was only 50 ml/min. that may cause a loss of volatiles while sampling since approximately 33 seconds were required to fill each sample vial. The maximum flow achieved at port C was 100 ml/min. – still slower than ideal. Due to the extreme low-flow rates, accurate temperature measurements could not be made. Each of three ports was purged into the collection bucket for approximately five minutes. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface outside of the pump house after the samples were collected. Sample collection consisted of regulating the flow rate of each port to a smooth, non-turbulent stream if possible, then filling three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. The shed door was closed at the completion of sampling activities.

WP-86: This new system has been installed inside a new wood constructed shed located immediately south of the residence. This system was previously installed in the crawlspace under the house. The new system consists of two cylindrical tanks made of a composite material and filled with GAC. The system was plumbed from wellhead or pressure tank to the filters, then on to the house using PEX tubing. An in-line filter was installed downstream of the filters to prevent the granular carbon material from entering the home plumbing and causing damage. Sample ports with valve controls were also installed as previously noted – each port has been clearly labeled A, B, and C according to their positions on the system. In addition, a flow totalizer meter was installed in the system so total water flow through the GAC can be monitored periodically. Turbulence free, smooth water streams were created by opening up all three control valves. However, the maximum flow at all three were still too low for best practices – port A = 40 ml/min. with leaks, port B = 80 ml/min. and port C = 80 ml/min. Sample collection consisted of regulating the flow rate of each port to a smooth, non-turbulent stream, then filling three pre-preserved VOA vials to zero headspace. Turbulence-free flow rates were observed, although the sampling may have been too low - providing an opportunity for loss of volatiles into the atmosphere. No other problems were noted. New Nitrile gloves were donned before collecting samples at each port. The shed door was closed at the conclusion of sampling activities on the property.

New Nitrile gloves were donned before collecting samples at each port. After sample collection, the shed door was closed securely. Collected purge water was transferred from the collection bucket to the grass lawn in the front yard.

WP-70: This new system has been installed inside a small unlocked shed located east of the residence. The system consists of two cylindrical tanks made of a composite material and filled with GAC. The system was plumbed from wellhead or pressure tank to the filters, then on to the house using PEX tubing. An in-line filter was installed downstream of the filters to prevent the granular carbon material from entering the home plumbing and causing damage. Sample ports with valve controls were also installed as previously noted – each port labeled A, B, and C according to their positions on the system. In addition, a flow totalizer meter was installed in the system so total water flow through the GAC can be monitored periodically. Maximum flow rate achieved at port A was 100 ml/min. with small air bubbles observed. Maximum flow rate at port B was 100 ml/min. with small air bubbles observed. Maximum flow rate at port C was also 100 ml/min. with small air bubbles observed. Due to the extreme low-flow rates, accurate temperature measurements could not be made. Each of three ports was purged into the collection bucket for approximately five minutes yielding less than ½ gallon total water recovered. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface outside of the shed after the samples were collected. Sample collection consisted of regulating the flow rate of each port to a smooth, non-turbulent stream, then filling three pre-preserved VOA vials to zero headspace. Turbulence-free flow rates were observed, although the sampling may have been too low - providing an opportunity for loss of volatiles into the atmosphere. No other problems were noted. New Nitrile gloves were donned before collecting samples at each port. The shed door was closed but left unlocked at the conclusion of sampling per resident request.

Between 6 and 9 May 2013, all groundwater samples for Event 1 were shipped priority overnight to Analytical Resources, Inc. via the Grant County Airport Fedex Station. The sampling team departed project site on 9 May 2013 and returned to the USACE District Office in Seattle.

2.6 EVENT 2

2.6.1 USACE TEAM 1 PRIVATE WELL SAMPLING

Event 2 was conducted between 10 and 12 June 2013 by four USACE sampling teams – two teams collected samples from private well systems, and two teams collected samples from monitoring wells. Team 1 consisted of Edward Wilson and Robert Wilkins. They were tasked with groundwater sample collection from 19 private well systems. During the period of 10-11 June 2013, the team collected water samples from residential wells: WP-65; WP-118; WP-105; WP-119; WP-120; WP-126; WP-66; WP116; WP-125; WP-122; WP-123; WP-127; WP-128, WP-133; WP-132; WP-131, WP-150; WP-121; and WP-129. All required 40 ml VOA sample vials pre-preserved with maleic/acetic acid were obtained from Vendor ESS in Lot Number 050312 and from vendor QEC in Lot Number B-2-299-01VB.

Upon arrival at each sampling point (water tap), the sampling team opens a water tap nearest to the wellhead as practical and directed a steady water stream into a five-gallon bucket. The water flow rate can be measured in gallons per minute using a graduated container. This and all other pertinent data is entered in the project field book. While one team member records field data, the other used a precision GPS receiver to record new sample point coordinates for updating the project map. Next, water temperature is monitored and a stabilized reading in degrees Fahrenheit shall be entered into the project field book. During this activity, water is allowed to flow for approximately 5 to 10 minutes depending on sample collection point in relation to the wellhead to flush stagnant water from the system. Stabilized temperature readings were a good indicator that stagnant water had passed through the piping. Less flushing time was required if the tap was located on the wellhead or pump house.

Prior to collecting a water sample, the flow rate at each tap shall be reduced to approximately 100 to 200 milliliters per minute to minimize sample aeration if possible. Field personnel shall don new Nitrile gloves prior to sample collection at each residence. All sample containers shall be filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point location and components of the plumbing system should be noted to assist in data interpretation. A photographic record of each sample point shall be made by the team.

Significant or unusual observations made by Team 1 included: WP-65 – samples must be collected from a hose attached to the pumphouse. WP-126 had to be sampled from tap at front of house since pumphouse had no water tap. WP-125 – tap in back yard is closest to pumphouse for sample collection. WP-116 samples can be collected right at the well head. WP-150 wellhead area overgrown – snakes observed. Samples collected from closest available tap near wellhead. WP-129 sample collected from tap at front of house. Water source not available near pumphouse.

Between 10 and 11 June 2013, all groundwater samples for Event 2 were shipped priority overnight to Analytical Resources, Inc. via the Grant County Airport Fedex Station. Sampling Team 1 departed project site on the afternoon of 11 June 2013 and returned to the USACE District Office in Seattle.

2.6.2 USACE Team 2 Private Well Sampling

During Event 2, private well sampling was also assigned to USACE Sampling Team 2, consisting of Blair Kinser and Jose Valdes. They were tasked with groundwater sample collection from 54 private well systems. During the period of 10-12 June 2013, Team 2 collected water samples from the following private well systems: WP-50; WP-28; WP-27, WP-22; WP-21; WP-46; WP-166; WP-64; WP-115; WP-165; WP-74; WP-45; WP-52; WP-54; WP-09; WP-158; WP-160; WP-64; WP-139; WP-14S; WP-157; WP-161; WP-18N; WP-18S; WP-164; WP-140; WP-159; WP-163; WP-55; WP-49; WP-72; WP-134; WP-31; WP-130; WP-68; WP-136; WP-69; WP-137; WP-03; WP-04; WP-135; WP-142; WP-33; WP-156; WP-144; WP-145; WP-57; WP-71A; WP-71B; WP-141; WP-146; WP-149; WP-73; and WP-111. In addition, trip blanks were sent with every cooler delivery to the analytical lab, and field blanks were collected near the water tap sampling point at WP-111 using reagent-grade water.

All required 40 ml VOA sample vials pre-preserved with maleic/acetic acid were obtained from Vendor ESS in Lot Number 050312 and from vendor QEC in Lot Number B-2-299-01VB.

Upon arrival at each sampling point (water tap), the sampling team opens a water tap nearest to the wellhead as practical and directed a steady water stream into a five-gallon bucket. The water flow rate can be measured in gallons per minute using a graduated container. This and all other pertinent data is entered in the project field book. While one team member records field data, the other used a precision GPS receiver to record new sample point coordinates for updating the project map. Next, water temperature is monitored and a stabilized reading in degrees Fahrenheit shall be entered into the project field book. During this activity, water is allowed to flow for approximately two to five minutes depending on sample collection point in relation to the wellhead to flush stagnant water from the system. At most locations, five to ten gallons were purged. Stabilized temperature readings were a good indicator that stagnant water had passed through the piping. Less flushing time was required if the tap was located on the wellhead or pump house.

Prior to collecting a water sample, the flow rate at each tap shall be reduced to approximately 100 to 200 milliliters per minute to minimize sample aeration if possible. Field personnel shall don new Nitrile gloves prior to sample collection at each residence. All sample containers shall be filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point location and components of the plumbing system should be noted to assist in data interpretation. A photographic record of each sample point shall be made by the team.

Significant or unusual observations made by Team 2 included: WP-21 has a water softening system requiring samples to be collected upstream of that system to prevent matrix interference. WP-166 – collect samples from tap on north side of house number 5. WP-64 – collect samples from well, not from tap at front of house. WP-143 – some difficulty collecting non-aerated samples due to high velocity water stream. WP-54 collect samples from tap at front of house.WP-161 – collect samples from well. WP-164 – correct sample location determined by GPS. The WP-04 property address was corrected in the Team 2 field book. WP-142 wellhead sample location has been corrected in Team 2 field book.

Between 10 and 11 June 2013, all groundwater samples for Event 2 were shipped priority overnight to Analytical Resources, Inc. via the Grant County Airport Fedex Station. Sampling Team 1 departed project site on the afternoon of 11 June 2013 and returned to the USACE District Office in Seattle.

2.6.3 USACE Teams 3 and 4 Monitoring Well Sampling

2.6.3.1 Passive Diffusion Bag Sampling

Two USACE sampling teams (designated Team 3 and Team 4) were assigned to monitoring wells at Moses Lake during the June 2013 event. Team 3 consisted of Joseph Marsh and Matt Brookshier. Team 4 consisted of David Sullivan and Aaron King. Teams 3 and 4 conducted PDB sampling simultaneously. Team 3 worked from the north and moved south to meet Team 4

working from the south moving north. The teams allowed a minimum of 14 days to elapse before returning to the Moses Lake site for groundwater sample collection. A total of 29 monitoring wells were fitted with PDBs. The PDB wells were: 02-BW01; 04-BW01; 04-BW04; 04-BW05; 04-BW06; 04-BW07; 04-BW09; 04-CW01; 04-CW02; 04-CW03; 04-CW04; 04-CW05; 04-CW07; 04-CW08; 12-BW01; 12-BW02; 12-BW03; 12-BW04; 12-BW05; 12-BW06; 12-BW07; 12-BW08; 12-CW01; 12-CW02; 12-CW03; 12-CW04; 12-CW05; 12-EX01; and 12-EX02;

Both teams verified each monitoring well location and identification number with project maps and tables. The teams also verified that work could proceed safely in the vicinity of moving vehicular traffic. Once the wells were unlocked and opened, one team member grasped the well riser plug and lifted it up so the other team member could grasp the suspension line and begin hauling the PDB to the surface.

The teams donned new Nitrile gloves for groundwater sample collection. The sampling team worked together to carefully cut the top corner off each bag using decontaminated steel scissors. Next, one person held the open sample vials and the other carefully and slowly tilts the bags – open side down toward each open sample vial. The pre-preserved vials were filled just to overflowing to maintain a reverse meniscus. Then the vials were capped making sure there were no bubbles or headspace per standard VOC sampling procedure. The residual sample water in the used PDBs was discharged to ground surface. Therefore, no IDW water shall be generated and stored during this sampling event.

An extra laboratory- prepared PDB was shipped to the site and shall be used for collection of the PDB trip blanks at the direction of the USACE project chemist. The samples were labeled after collection and placed on ice in a shipping cooler under chain of custody for overnight delivery to the analytical laboratory. A field blank (13MLW000FW04) was collected near well 12-CW3 directly under the flight path of all air traffic. A PDB blank (13MLW0610PDBTB01) was collected near well 12-CW3 using a spare PDB shipped to the team and designated for this purpose.

There were no significant observations made during PDB sampling. All bags were completely full upon retrieval from each well – no leaks detected.

Once recovered and sampled the PDBs and suspension lines were discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials shall be disposed of as municipal waste. The PDBs and other solid waste material shall be placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and returned to the Seattle District, USACE office.

Finally, the sampling team closed and locked each monitoring well casing cover when sample collection was completed.

2.6.3.2 Bladder Pump Sampling

For Teams 3 and 4, groundwater sample collection commenced immediately after achieving stabilization of water quality parameters during low flow purging at each well using dedicated bladder pump systems as described previously. As with the PDB sampling, Team 3 worked from the north and moved south to meet Team 4 working from the south moving north. Both teams were outfitted with compressed CO2 cylinders to drive the pump systems, airlines, pump controllers, and flow cells to conduct the sampling of dedicated bladder pumps. The teams collected groundwater samples from 31 monitoring wells fitted with dedicated bladder pumps. The bladder pump wells included: 91-BW03; 91-BW04; 92-BW01; 92-BW02; 99-AW01; 99-BW01; 99-AW09; 99-BW09; 99-BW-10; 99-BW12; 99-BW14, 99-BW15, 99-BW16; 99-BW18; 00-BW01; 00-BW02; 00-BW03; 00-BW04; 00-BW05; 00-BW06; 00-BW07; 00-BW09; 00-BW10; 00-AW11; 00-BW11; 00-BW12; 00-BW13; 00-BW15; 00-BW16; 01-BW01; and 02-BW02. Well 00-BW14 could not be sampled as originally planned due to a faulty bladder pump. In addition, a water level was measured in well 00-BW08. Wells 91-BW01 and 99-BW17 were designated for water level readings, but US Air Force aircraft operating near these wells made access unsafe.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory (ARI). All sample containers were filled immediately following purging by disconnecting the flow-through cell from the pump tubing system, and capturing water directly from the discharge end of the tubing. During sample collection, physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms. Field blank 13MLW000FW05 was collected near well 91-BW03 and the old fuel tank farm and tanker trucks. All purge readings stabilized within 10 minutes. Measured temperatures ranged from 14.07 to 17.87 degrees C. Specific conductivity ranged from 0.01 to 0.61 ms/cm. Dissolved oxygen was measured between 0.85 ppm (well 00-BW11) to 9.42 ppm (well 00-BW15). PH ranged from 7.14 to only 7.88. Oxygen reduction potential ranged widely from -8 (well 00-BW06) to 527 millivolts (well 99-BW11). The discharge tubing in well 00-BW15 should be replaced due to kinks and cracking. Some limited drawdown was observed during purging at 99-BW09. Initial purging showed turbid water that cleared after several minutes at well 99-AW09. Water level transducers were replaced in wells 04-CW04 and 04-BW07 (transducers were removed to permit installation of PDBs).

Significant observations made during bladder pump sampling: Well 00-BW11 was repaired by USACE contractor during May 2013. This flush mount well vault located immediately southwest of the former airport snow shed was previously damaged by heavy vehicles. This well has new bollards and larger than standard well cover plate bolts. Follow on teams will need a ¾-inch socket to open the vault cover. Also of note here, a distinct solvent-like odor was detected in water purged from well 00-BW11 – the only well at this site with an odor associated with the groundwater. Team 3 found a failed bladder pump at well 00-BW14 requiring a new, replacement Teflon bladder before groundwater sampling can resume at this location. Well 99-BW16 shows bentonite heaved in the well casing – no corrective action recommended at this time.

All sample containers were filled with water directly from the pump sample tubing at a flow rate of approximately 200 to 400 ml/min. – forming a meniscus at the top of each vial to provide zero headspace samples as required. After filling the sample containers, sample labels describing

project, location, analysis, team members, preservative, sampling date, and collection time were placed on each container. All of the glass containers were placed and sealed into plastic bubble-wrap bags and all of the HDPE bottles were placed and sealed in plastic bags. The bagged containers were then placed into pre-iced coolers to begin sample cooling to the required 4° centigrade sample preservation temperature.

At the conclusion of sampling at each well, dedicated pump caps were replaced over the PVC risers, and the well covers were closed and padlocked.

Between 6 and 9 May 2013, all groundwater samples for Event 1 were shipped priority overnight to Analytical Resources, Inc. via the Grant County Airport Fedex Station. The sampling team departed project site on the afternoon of 28 August 2013 and returned to the USACE District Office in Seattle.

2.7 EVENT 3

From 26 through 28 August 2013, a USACE sampling team comprised of David Sullivan and Blair Kinser collected groundwater samples from: four upgraded WHF systems identified as WP-14, WP-70, WP-83 and WP-86; two new WHF systems identified as WP-119 and WP-121; one former WHF system identified as WP-82; and 23 private wells. The 23 private well sample points have been assigned identification codes WP-27, WP-123, WP-124, WP-125, WP-129, WP-131, WP-147, WP-148, WP-151, WP-152, WP-153, WP-154, WP-155, WP-162, WP-167, WP-168, WP-170, WP-171, WP-172, WP-173, WP-174, WP-175, WP-176.

Upon arrival at each new private well sampling point (exterior water tap), the team verified they were in the correct location using project documentation brought to the site, or by information provided the USACE PM who was on site to coordinate with homeowners. If the resident or owner was present, the team made contact with that person at the property to verify they were authorized to collect the samples with homeowner permission. Next, the team located the sample point closest to the wellhead, and collected sample point coordinates using a Trimble GeoExplorer XT GPS receiver to support project map updating efforts. Next, the opened the sample point tap and directed a steady water stream into a five-gallon collection bucket. The water flow rate was measured in liters per minute using a graduated container. This data was entered into the project field book. While one team member recorded field data, the other used a Trimble GeoExplorer XT GPS receiver to record sample point coordinates to update the project map. Next, water temperature was monitored and a stabilized reading in degrees Fahrenheit was entered into the project field book. During this activity, water was allowed to flow for approximately 5 to 10 minutes depending on sample collection point in relation to the wellhead to flush stagnant water from the system. Stabilized temperature readings were a good indicator that stagnant water had passed through the piping. Less flushing time was required if the tap was located on the wellhead or pump house.

Significant or unusual observations made during the August 2013 sampling event: WP-129 wellhead could not be located, but sample collected near wellhouse. A field blank (13MLW000FW07) was collected (using reagent grade water) near the WP-123 sample point.

WP-152 sample point is behind a locked gate – homeowner coordination is required. The homeowner at WP-171 stated she was unaware sampling was to be conducted on her property on 27 August 2013. Team 4 verified WP-170 and WP-171 are served by two different wells. WP-162 – no wellhead found so samples collected from tap in front yard. WP-151 was reported by Team 4 to contain some type of filter system that may be a whole house type filter.

Between 26 and 28 August 2013, four groundwater sample shipping coolers for Event 3 were shipped priority overnight to Analytical Resources, Inc. via the Grant County Airport Fedex Station. The sampling team departed project site on the afternoon of 28 August 2013 and returned to the USACE District Office in Seattle.

2.5 INVESTIGATION-DERIVED WASTE

No investigation-derived waste was generated during this sampling event. All residual well water captured in buckets during sampling activities was transferred directly to ground surface on each property near the sample point.

3.0 PACKAGING AND SHIPMENT

As mentioned in the narrative of each sampling event, groundwater samples were packaged in shipping coolers on ice and under chain of custody for priority overnight shipping to the USACE contract laboratory Analytical Resources, Inc. via the Grant County Airport Fedex Station.

All sample shipping coolers were prepared for laboratory delivery in the following manner: Each cooler was lined (sides and bottom) with plastic “bubble-wrap” sheets for shock absorption. A large 30-gallon plastic garbage bag was then placed into the cooler to contain the sample water in the event of container breakage during shipment to the laboratories. The glass sample vials were labeled, placed into plastic zip-seal bags, and placed into foam shipping blocks or bubble-wrap bags for shock protection. All the samples were placed in the shipping coolers as indicated on the corresponding chain of custody forms. Gallon size plastic zipper bags of cubed ice bags were placed between and on top of the samples in each cooler to ensure maintenance of the required four degrees centigrade (plus/minus two degrees) sample preservation temperature. The completed chain of custody (COC) forms were placed in gallon size plastic zipper bags and taped to the inside of each cooler lid. Two custody seals were affixed to the outside of each cooler. The custody seals were placed so that the coolers could not be opened without breaking the seals. Each cooler was then securely sealed with fiber tape. The field team ensured drain plugs were securely taped inside and out to prevent possible water leakage.

Lab PM (Kelly Bottem) was informed of the sample delivery and ensured the samples were properly accepted and checked in upon receipt the following morning after the sample containers were shipped. All sample coolers and sample containers were accounted for at the contract laboratory following each shipment.

4.0 LABORATORY ANALYSIS

Chemical analyses performed on the samples were as follows: VOCs (Method 524.3).

5.0 DECONTAMINATION PROCEDURES

Thermometers, flow cells, water level indicator meters, and water volume measurement containers used by each team were decontaminated at the end of the project with an Alconox®-water solution followed by triple rinsing using distilled water in the USACE Geology Laboratory.

6.0 PROTECTION LEVEL

All sampling activities were conducted under Worker Protection Level D. For this project, personnel protective equipment included reflective orange safety vests, safety splash protection glasses, Nitrile gloves, and safety steel toe boots. New pairs of Nitrile gloves were donned prior to handling acid-preserved sample containers and between each unique private well sample point or monitoring well.

End of Field Sampling Report

APPENDIX B

COMPREHENSIVE RESULTS TABLE

COMPREHENSIVE ANALYTICAL RESULTS																						
				Analyte Name	1,1,1-TCA		1,1-DCA		1,1-DCE		1,2-DCA		CIS-1,2-DCE		PCE		TRANS-1,2-DCE		TCE		VC	
				CASRN*	71-75-6		75-34-3		75-35-4		107-06-2		156-59-2		127-18-4		156-60-5		79-01-6		75-01-4	
				Units	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
Well ID	Sample ID	Sample Type	Date Sampled	Filter Sample Location	Results (MCL=200 µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=7µg/L)	Q	Results (MCL=5 µg/L)	Q	Results (MCL=70µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=100 µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=2µg/L)	Q
Whole House Filter Wells:																						
WP14	13MLW00CWP14	N	5/6/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.22		0.20	U	0.20	U	0.20	U	0.20	U
WP14	13MLW01AWP14	N	5/9/2013	Lead	0.20	U	0.20	U	0.20	U	0.20	U	1.19		0.20	U	0.20	U	4.35		0.20	U
WP14	13MLW01BWP14	N	5/9/2013	Between	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
WP14	13MLW01CWP14	N	5/9/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
WP14	13MLW02AWP14	N	8/26/2013	Lead	0.20	U	0.20	U	0.20	U	0.20	U	1.14				0.20	U	4.69		0.20	U
WP14	13MLW02BWP14	N	8/26/2013	Between	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP14	13MLW02CWP14	N	8/26/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP70	13MLW00CWP70	N	5/6/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
WP70	13MLW01AWP70	N	5/9/2013	Lead	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	3.29		0.20	U
WP70	13MLW01BWP70	N	5/9/2013	Between	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
WP70	13MLW01CWP70	N	5/9/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
WP70	13MLW02AWP70	N	8/26/2013	Lead	0.20	U	0.20	U	0.20	U	0.20	U	0.12	J			0.20	U	4.12		0.20	U
WP70	13MLW02BWP70	N	8/26/2013	Between	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP70	13MLW02CWP70	N	8/26/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP83	13MLW00CWP83	N	5/6/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.38		0.20	U	0.20	U	0.50		0.20	U
WP83	13MLW01AWP83	N	5/9/2013	Lead	0.20	U	0.20	U	0.20	U	0.20	U	0.29		0.20	U	0.20	U	2.09		0.20	U
WP83	13MLW01BWP83	N	5/9/2013	Between	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
WP83	13MLW01CWP83	N	5/9/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
WP83	13MLW02AWP83	N	8/26/2013	Lead	0.20	U	0.20	U	0.20	U	0.20	U	0.28	J			0.20	U	2.08		0.20	U
WP83	13MLW02BWP83	N	8/26/2013	Between	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP83	13MLW02CWP83	N	8/26/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP86	13MLW00CWP86	N	5/6/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
WP86	13MLW01AWP86	N	5/9/2013	Lead	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	1.54		0.20	U
WP86	13MLW01BWP86	N	5/9/2013	Between	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
WP86	13MLW01CWP86	N	5/9/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
WP86	13MLW02AWP86	N	8/26/2013	Lead	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	1.69		0.20	U
WP86	13MLW02BWP86	N	8/26/2013	Between	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP86	13MLW02CWP86	N	8/26/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP119	13MLW001WP119	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	4.04		0.20	U
WP119	13MLW00AWP119	N	8/28/2013	Lead	0.20	U	0.20	U	0.20	U	0.20	U	0.11	J			0.20	U	5.26		0.20	U
WP119	13MLW00BWP119	N	8/28/2013	Between	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP119	13MLW00CWP119	N	8/28/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP121	13MLW001WP121	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	4.21		0.20	U
WP121	13MLW00AWP121	N	8/28/2013	Lead	0.20	U	0.20	U	0.20	U	0.20	U	0.12	J			0.20	U	5.26		0.20	U
WP121	13MLW00BWP121	N	8/28/2013	Between	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP121	13MLW00CWP121	N	8/28/2013	Lag	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
Other Private Wells:																						
WP03	13MLW001WP03	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.21				0.20	U	1.03		0.20	U
WP04	13MLW001WP04	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	1.68				0.20	U	5.48	J-	0.20	U
WP09	13MLW001WP09	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.11	J	0.20	U
WP18N	13MLW001WP18N	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20		0.20	U
WP18S	13MLW001WP18S	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20		0.20	U
WP21	13MLW001WP21	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP22X	13MLW001WP22X	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U

COMPREHENSIVE ANALYTICAL RESULTS

				Analyte Name	1,1,1-TCA		1,1-DCA		1,1-DCE		1,2-DCA		CIS-1,2-DCE		PCE		TRANS-1,2-DCE		TCE		VC	
				CASRN*	71-75-6		75-34-3		75-35-4		107-06-2		156-59-2		127-18-4		156-60-5		79-01-6		75-01-4	
				Units	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
Well ID	Sample ID	Sample Type	Date Sampled	Filter Sample Location	Results (MCL=200 µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=7µg/L)	Q	Results (MCL=5 µg/L)	Q	Results (MCL=70µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=100 µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=2µg/L)	Q
WP27	13MLW001WP27	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	2.16		0.20	U
WP27	13MLW002WP27	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.82		0.20	U
WP28	13MLW001WP28	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.19	J	0.20	U
WP31	13MLW001WP31	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP33	13MLW001WP33	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.87		0.20	U
WP45	13MLW001WP45	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.62		0.20	U
WP46	13MLW001WP46	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP49	13MLW001WP49	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP50	13MLW001WP50	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP52	13MLW001WP52	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.35		0.20	U
WP54	13MLW001WP54	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.12	J	0.20	U
WP55	13MLW001WP55	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP57	13MLW001WP57	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.33		0.20	U
WP64	13MLW001WP64	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP65	13MLW001WP65	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.42		0.20	U
WP66	13MLW001WP66	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.27				0.20	U	1.33		0.20	U
WP68	13MLW001WP68	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.49		0.20	U
WP69	13MLW001WP69	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	1.33		0.20	U
WP71A	13MLW001WP71A	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.22		0.20	U
WP71B	13MLW001WP71B	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.41		0.20	U
WP72	13MLW001WP72	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP73	13MLW001WP73	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP74	13MLW001WP74	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	1.11		0.20	U
WP82	13MLW00CWP82	N	5/6/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.2	U	0.20	U	0.20	U	0.20	U
WP82	13MLW01AWP82	N	5/9/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.2	U	0.20	U	0.20	U	0.20	U
WP82	13MLW02AWP82	N	8/26/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP105	13MLW001WP105	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.41		0.20	U
WP111	13MLW001WP111	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.48		0.20	U
WP115	13MLW001WP115	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP116	13MLW001WP116	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.28				0.20	U	1.31		0.20	U
WP118	13MLW001WP118	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	1.07		0.20	U
WP120	13MLW001WP120	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.29		0.20	UJ
WP122	13MLW001WP122	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.57		0.20	U
WP123	13MLW001WP123	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.12	J			0.20	U	3.32		0.20	U
WP123	13MLW002WP123	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	3.12		0.20	U
WP124	13MLW000WP124	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.64				0.20	U	3.95		0.20	U
WP125	13MLW001WP125	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.41				0.20	U	2.29		0.20	U
WP125	13MLW002WP125	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.51				0.20	U	2.83		0.20	U
WP126	13MLW001WP126	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.88		0.20	U
WP127	13MLW001WP127	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.73		0.20	U
WP128	13MLW001WP128	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.22		0.20	U
WP129	13MLW001WP129	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	2.51		0.20	U
WP129	13MLW002WP129	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	3.68		0.20	U
WP130	13MLW001WP130	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.19	J	0.20	U
WP131	13MLW001WP131	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	2.60		0.20	U
WP131	13MLW002WP131	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	1.84		0.20	U

COMPREHENSIVE ANALYTICAL RESULTS																							
				Analyte Name	1,1,1-TCA		1,1-DCA		1,1-DCE		1,2-DCA		CIS-1,2-DCE		PCE		TRANS-1,2-DCE		TCE		VC	
				CASRN*	71-75-6		75-34-3		75-35-4		107-06-2		156-59-2		127-18-4		156-60-5		79-01-6		75-01-4	
				Units	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
Well ID	Sample ID	Sample Type	Date Sampled	Filter Sample Location	Results (MCL=200 µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=7µg/L)	Q	Results (MCL=5 µg/L)	Q	Results (MCL=70µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=100 µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=2µg/L)	Q
WP132	13MLW001WP132	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP133	13MLW001WP133	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP134	13MLW001WP134	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP135	13MLW001WP135	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP136	13MLW001WP136	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	1.05		0.20	U
WP137	13MLW001WP137	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.19	J	0.20	U
WP138	13MLW001WP138	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.19	J	0.20	U
WP139	13MLW001WP139	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.85		0.20	U
WP140	13MLW001WP140	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP141	13MLW001WP141	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP142	13MLW001WP142	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP143	13MLW001WP143	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.62		0.20	U
WP144	13MLW001WP144	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.50		0.20	U
WP145	13MLW001WP145	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.48		0.20	U
WP146	13MLW001WP146	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP147	13MLW000WP147	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.31		0.20	U
WP147	13MWL000WP147	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.31		0.20	U
WP148	13MLW000WP148	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.21		0.20	U
WP149	13MLW001WP149	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.16	J	0.20	U
WP150	13MLW001WP150	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.15	J	0.20	U
WP151	13MLW000WP151	N	8/28/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.21				0.20	U	1.88		0.20	U
WP152	13MLW000WP152	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.22		0.20	U
WP153	13MLW000WP153	N	8/28/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.50		0.20	U
WP154	13MLW000WP154	N	8/28/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.39		0.20	U
WP155	13MLW000WP155	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.40		0.20	U
WP156	13MLW001WP156	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.38		0.20	U
WP157	13MLW001WP157	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP158	13MLW001WP158	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP159	13MLW001WP159	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP160	13MLW001WP160	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP161	13MLW001WP161	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP162	13MLW000WP162	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP163	13MLW001WP163	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP164	13MLW001WP164	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.30		0.20	U
WP165	13MLW001WP165	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.13	J	0.20	U
WP166	13MLW001WP166	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.27	U			0.20	U	0.20	U	0.20	U
WP167	13MLW000WP167	N	8/28/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	2.65		0.20	U
WP168	13MLW000WP168	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	2.82		0.20	U
WP170	13MLW000WP170	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP171	13MLW000WP171	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP172	13MLW000WP172	N	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.71		0.20	U
WP173	13MLW000WP173	N	8/28/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP174	13MLW000WP174	N	8/26/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
WP175	13MLW000WP175	N	8/28/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.66		0.20	U
WP176	13MLW000WP176	N	8/28/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.47		0.20	U

COMPREHENSIVE ANALYTICAL RESULTS																							
				Analyte Name	1,1,1-TCA		1,1-DCA		1,1-DCE		1,2-DCA		CIS-1,2-DCE		PCE		TRANS-1,2-DCE		TCE		VC	
				CASRN*	71-75-6		75-34-3		75-35-4		107-06-2		156-59-2		127-18-4		156-60-5		79-01-6		75-01-4	
				Units	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
Well ID	Sample ID	Sample Type	Date Sampled	Filter Sample Location	Results (MCL=200 µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=7µg/L)	Q	Results (MCL=5 µg/L)	Q	Results (MCL=70µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=100 µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=2µg/L)	Q
Monitoring Wells:																							
AW01	13MLW00199AW01	N	6/13/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.53		0.20	U
AW09	13MLW00199AW09	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	1.58		0.20	U
AW11	13MLW00100AW11	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	1.16		0.20	U
BW01	13MLW00100BW01	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW01	13MLW00101BW01	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW01	13MLW00102BW01	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	11.2		0.20	U
BW01	13MLW00104BW01	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW01	13MLW00112BW01	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW01	13MLW00192BW01	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	21.2		0.20	U
BW01	13MLW00199BW01	N	6/13/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	28.0		0.20	U
BW02	13MLW00100BW02	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.25		0.20	U
BW02	13MLW00102BW02	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW02	13MLW00112BW02	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	7.49		0.20	U
BW02	13MLW00192BW02	N	6/13/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.67				0.20	U	6.05		0.20	U
BW03	13MLW00100BW03	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW03	13MLW00191BW03	N	6/13/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW03	13MLW001A12BW03	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.83		0.20	U
BW03	13MLW001B12BW03	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.69		0.20	U
BW04	13MLW00100BW04	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW04	13MLW00104BW04	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.40		0.20	U
BW04	13MLW00191BW04	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.19	J	0.20	U
BW04	13MLW001A12BW04	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	16.5		0.20	U
BW04	13MLW001B12BW04	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	15.8		0.20	U
BW05	13MLW00100BW05	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW05	13MLW00104BW05	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	1.13		0.20	U
BW05	13MLW00112BW05	N	6/11/2013	NA	0.20	UJ	0.20	UJ	0.20	UJ	0.20	U	0.20	U			0.20	UJ	78.2		0.20	UJ
BW06	13MLW00100BW06	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW06	13MLW00104BW06	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	2.62				0.20	U	12.6		0.20	U
BW06	13MLW00112BW06	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	5.33		0.20	U
BW07	13MLW00100BW07	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW07	13MLW00104BW07	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW07	13MLW00112BW07	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	55.8		0.20	U
BW08	13MLW00112BW08	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	7.53		0.20	U
BW09	13MLW00100BW09	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW09	13MLW00104BW09	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	24.9		0.20	U
BW09	13MLW00199BW09	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW10	13MLW00100BW10	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW10	13MLW00199BW10	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	11.7		0.20	U
BW11	13MLW00100BW11	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW12	13MLW00100BW12	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	18.1		0.20	U
BW12	13MLW00199BW12	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.67		0.20	U
BW13	13MLW00100BW13	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW14	13MLW00199BW14	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW15	13MLW00100BW15	N	6/13/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.27				0.20	U	1.58		0.20	U

COMPREHENSIVE ANALYTICAL RESULTS																						
				Analyte Name	1,1,1-TCA		1,1-DCA		1,1-DCE		1,2-DCA		CIS-1,2-DCE		PCE		TRANS-1,2-DCE		TCE		VC	
				CASRN*	71-75-6		75-34-3		75-35-4		107-06-2		156-59-2		127-18-4		156-60-5		79-01-6		75-01-4	
				Units	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
Well ID	Sample ID	Sample Type	Date Sampled	Filter Sample Location	Results (MCL=200 µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=7µg/L)	Q	Results (MCL=5 µg/L)	Q	Results (MCL=70µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=100 µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=2µg/L)	Q
BW15	13MLW00199BW15	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	1.66				0.20	U	7.19		0.20	U
BW16	13MLW00100BW16	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
BW16	13MLW00199BW16	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	1.95		0.20	U
BW18	13MLW00199BW18	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	7.95		0.20	U
CW01	13MLW00104CW01	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.43		0.20	U
CW01	13MLW00112CW01	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	3.72		0.20	U
CW02	13MLW00104CW02	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
CW02	13MLW00112CW02	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.41		0.20	U
CW03	13MLW00104CW03	N	6/13/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	3.16		0.20	U
CW03	13MLW00112CW03	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.52		0.20	U
CW04	13MLW00104CW04	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.46		0.20	U
CW04	13MLW00112CW04	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.74		0.20	U
CW05	13MLW00104CW05	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	3.02		0.20	U
CW05	13MLW00112CW05	N	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.93		0.20	U
CW07	13MLW001A04CW07	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	4.72		0.20	U
CW07	13MLW001B04CW07	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	4.79		0.20	U
CW08	13MLW00104CW08	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
EX01	13MLW00112EX01	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.54				0.20	U	14.3		0.20	U
EX02	13MLW00112EX02	N	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	3.26		0.20	U
QC Samples (see above for FDs):																						
N/A	13MLW32AWP14	EB	8/26/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW302WP123	EB	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	3.02		0.20	U
N/A	13MLW000FW03	FB	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW000FW04	FB	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW000FW05	FB	6/13/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW000FW06	FB	8/26/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW000FW07	FB	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW20199AW01	FD	6/13/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.56		0.20	U
N/A	13MLW20104BW01	FD	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW20100BW06	FD	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW20199BW14	FD	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	31.0		0.20	U
N/A	13MLW20112CW05	FD	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.96		0.20	U
N/A	13MLW20104CW08	FD	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW201WP03	FD	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.22				0.20	U	1.10		0.20	U
N/A	13MLW21AWP14	FD	5/9/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	1.11		0.20	U	0.20	U	4.01		0.20	U
N/A	13MLW20CWP14	FD	5/6/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.24		0.20	U	0.20	U	0.20	U	0.20	U
N/A	13MLW201WP31	FD	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW201WP64	FD	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW201WP73	FD	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW200CWP119	FD	8/28/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW201WP120	FD	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.35		0.20	U
N/A	13MLW201WP130	FD	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20		0.20	U
N/A	13MLW201WP142	FD	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW201WP166	FD	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW200WP174	FD	8/26/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U

COMPREHENSIVE ANALYTICAL RESULTS																							
				Analyte Name	1,1,1-TCA		1,1-DCA		1,1-DCE		1,2-DCA		CIS-1,2-DCE		PCE		TRANS-1,2-DCE		TCE		VC	
				CASRN*	71-75-6		75-34-3		75-35-4		107-06-2		156-59-2		127-18-4		156-60-5		79-01-6		75-01-4	
				Units	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
Well ID	Sample ID	Sample Type	Date Sampled	Filter Sample Location	Results (MCL=200 µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=7µg/L)	Q	Results (MCL=5 µg/L)	Q	Results (MCL=70µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=100 µg/L)	Q	Results (MCL=5µg/L)	Q	Results (MCL=2µg/L)	Q
N/A	13MLW200WP176	FD	8/28/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.52		0.20	U
N/A	13MLW00FW03	N	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13ML0509TB01	TB	5/9/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0506TB	TB	5/6/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
N/A	13MLW0509TB01	TB	5/9/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U
N/A	13MLW0610BPTB01	TB	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0610BPTB02	TB	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0610PDBTB0	TB	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0610TB01	TB	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0610TB02	TB	6/10/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0611BPTB03	TB	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0611TB03	TB	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0611TB04	TB	6/11/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0612BPTB04	TB	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0612TB05	TB	6/12/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0613PDBTB0	TB	6/13/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0826TB01	TB	8/26/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0827TB02	TB	8/27/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U
N/A	13MLW0828TB03	TB	8/28/2013	NA	0.20	U	0.20	U	0.20	U	0.20	U	0.20	U			0.20	U	0.20	U	0.20	U

Key:

1,1,1- 1,1,1-trichloroethane
1,1- 1,1-dichloethane
1,1- 1,2-dichloethylene
1,2- 1,2-dichloethane
CIS-1,2- cis-1,2-dichloroethylene
TRANS- trans-1,2-dichloroethylene
TCE trichloroethylene
VC vinyl chloride
N = normal sample
FD = field duplicate
FB = field blank
TB = trip blank
EB = equipment blank
Q=Quantifier

APPENDIX C

WDOE WATER WELL REPORTS

DEPARTMENT OF ECOLOGY State of Washington

Well Logs

TEXT SEARCH RESULTS

Back **New Search**

- **Search Criteria Used:** Township: 19N, Range: 28E, Section(s): 3458910151617, Completed From: 1/1/2012, Completed To: 12/3/2013, Received From: 1/1/2012, Received To: 12/3/2013
- There are **19** well logs that match your search criteria.
- The results are sorted by Well Owner Name

Download all 19 images | Download all 19 data records | Print this page | Help

Displaying 1 - 19 of **19** well log results Sort results by

1. **Andrey Vogtsekhoyskiy** - { View PDF }
Public Land Survey: NE, SW, S-17, T-19-N, R-28-E, Tax Parcel Number: 121126360
County: GRANT, Well Address: 7498 Wilde Goose Ln., Moses Lake 98837
Well Log ID: 848056, Well Tag ID:BCE483, Notice of Intent Number: W301366
Well Diameter: 6, Well Depth: 110
Well Type: Water, Well Completion Date: 04/13/2012, Well Log Received Date: 05/09/2012

2. **Phase 1Moses Lake Well Field US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd. & Patton Blvd., Moses Lake 98837
Well Log ID: 848064, Well Tag ID:BHE687, Notice of Intent Number: RE07602
Well Diameter: 10, Well Depth: 174.5
Well Type: Resource Protection, Well Completion Date: 06/29/2012, Well Log Received Date: 01/14/2013

3. **Phase 1Moses Lake Well Field US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd. & Patton Blvd., Moses Lake 98837
Well Log ID: 848065, Well Tag ID:BHE692, Notice of Intent Number: RE07602
Well Diameter: 10, Well Depth: 196.5
Well Type: Resource Protection, Well Completion Date: 07/24/2012, Well Log Received Date: 01/14/2013

4. **Phase 1Moses Lake Well Field US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd. & Patton Blvd., Moses Lake 98837
Well Log ID: 848067, Well Tag ID:BHE693, Notice of Intent Number: RE07602
Well Diameter: 10, Well Depth: 190.5
Well Type: Resource Protection, Well Completion Date: 07/30/2012, Well Log Received Date: 01/14/2013

5. **Phase 1Moses Lake Well Field US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd. & Patton Blvd., Moses Lake 98837
Well Log ID: 848069, Well Tag ID:BHE694, Notice of Intent Number: RE07602
Well Diameter: 10, Well Depth: 190.5
Well Type: Resource Protection, Well Completion Date: 08/01/2012, Well Log Received Date: 01/14/2013

6. **Phase 1Moses Lake Well Field US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd. & Patton Blvd., Moses Lake 98837
Well Log ID: 848071, Well Tag ID:BHE695, Notice of Intent Number: RE07602
Well Diameter: 10, Well Depth: 189.5
Well Type: Resource Protection, Well Completion Date: 06/25/2012, Well Log Received Date: 01/14/2013

7. **Phase 1Moses Lake Well Field US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd. & Patton Blvd., Moses Lake 98837
Well Log ID: 848073, Well Tag ID:BHE688, Notice of Intent Number: RE07602
Well Diameter: 10, Well Depth: 296.5
Well Type: Resource Protection, Well Completion Date: 07/12/2012, Well Log Received Date: 01/14/2013

8. **Phase 1Moses Lake Well Field US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd. & Patton Blvd., Moses Lake 98837
Well Log ID: 848075, Well Tag ID:BHE689, Notice of Intent Number: RE07602
Well Diameter: 10, Well Depth: 322.5
Well Type: Resource Protection, Well Completion Date: 07/27/2012, Well Log Received Date: 01/14/2013

9. **Phase 1Moses Lake Well Field US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd. & Patton Blvd., Moses Lake 98837
Well Log ID: 848077, Well Tag ID:BHE690, Notice of Intent Number: RE07602
Well Diameter: 10, Well Depth: 300.5
Well Type: Resource Protection, Well Completion Date: 07/09/2012, Well Log Received Date: 01/14/2013

10. **Phase 1Moses Lake Well Field US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd. & Patton Blvd., Moses Lake 98837

Well Log ID: 848079, Well Tag ID:BHE691, Notice of Intent Number: RE07602
Well Diameter: 10, Well Depth: 267.5
Well Type: Resource Protection, Well Completion Date: 06/22/2012, Well Log Received Date: 01/14/2013

11. **Randy Koon** - { View PDF }
Public Land Survey: SE, NW, S-10, T-19-N, R-28-E, Tax Parcel Number: 170478031
County: GRANT, Well Address: 4545 Kelly Pl., Moses Lake 98837
Well Log ID: 872598, Well Tag ID:BHP602, Notice of Intent Number: W307840
Well Diameter: 6, Well Depth: 218
Well Type: Water, Well Completion Date: 10/26/2012, Well Log Received Date: 01/04/2013

12. **Valley Estates** - { View PDF }
Public Land Survey: NE, NE, S-08, T-19-N, R-28-E, Tax Parcel Number: 12664104
County: GRANT, Well Address: 7609 NE MacBeth L, Moses Lake 98837
Well Log ID: 870859, Well Tag ID:BCE059, Notice of Intent Number: W309661
Well Diameter: 6, Well Depth: 300
Well Type: Water, Well Completion Date: 12/20/2012, Well Log Received Date: 02/01/2013

13. **Wellfield US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd & Patton Blvd, Moses Lake 98837
Well Log ID: 848091, Well Tag ID:BHS579, Notice of Intent Number: RE07502
Well Diameter: 4, Well Depth: 309.8
Well Type: Resource Protection, Well Completion Date: 09/27/2012, Well Log Received Date: 01/14/2013

14. **Wellfield US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd & Patton Blvd, Moses Lake 98837
Well Log ID: 848095, Well Tag ID:BHS581, Notice of Intent Number: RE07502
Well Diameter: 4, Well Depth: 200.8
Well Type: Resource Protection, Well Completion Date: 10/06/2012, Well Log Received Date: 01/14/2013

15. **Wellfield US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd & Patton Blvd, Moses Lake 98837
Well Log ID: 848101, Well Tag ID:BHS582, Notice of Intent Number: RE07502
Well Diameter: 4, Well Depth: 182.5
Well Type: Resource Protection, Well Completion Date: 09/12/2012, Well Log Received Date: 01/14/2013

16. **Wellfield US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd & Patton Blvd, Moses Lake 98837
Well Log ID: 848093, Well Tag ID:BHS580, Notice of Intent Number: RE07502
Well Diameter: 4, Well Depth: 202.8
Well Type: Resource Protection, Well Completion Date: 09/20/2012, Well Log Received Date: 01/14/2013

17. **Wellfield US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd & Patton Blvd, Moses Lake 98837
Well Log ID: 848097, Well Tag ID:BHS583, Notice of Intent Number: RE07502
Well Diameter: 4, Well Depth: 187
Well Type: Resource Protection, Well Completion Date: 10/08/2012, Well Log Received Date: 01/14/2013

18. **Wellfield US EPA** - { View PDF }
Public Land Survey: SE, SE, S-04, T-19-N, R-28-E, Tax Parcel Number: (blank)
County: GRANT, Well Address: Harris Rd & Patton Blvd, Moses Lake 98837
Well Log ID: 848099, Well Tag ID:BHS584, Notice of Intent Number: RE07502
Well Diameter: 4, Well Depth: 210
Well Type: Resource Protection, Well Completion Date: 10/23/2012, Well Log Received Date: 01/14/2013

19. **Yuliya Yaroshchuk** - { View PDF }
Public Land Survey: SW, SW, S-17, T-19-N, R-28-E, Tax Parcel Number: 12-1126-512
County: GRANT, Well Address: 7434 Blue Goose N.E., Moses Lake
Well Log ID: 848054, Well Tag ID:BCE482, Notice of Intent Number: W301365
Well Diameter: 6, Well Depth: 160
Well Type: Water, Well Completion Date: 04/12/2012, Well Log Received Date: 05/09/2012

Total Result Pages: 1

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DEPARTMENT OF ECOLOGY State of Washington

Well Logs

TEXT SEARCH RESULTS

Back **New Search**

- **Search Criteria Used:** Township: 20N, Range: 28E, Section(s): 15161720212227282932333 4, Completed From: 1/1/2012, Completed To: 12/3/2013, Received From: 1/1/2012, Received To: 12/3/2013
- There are **5** well logs that match your search criteria.
- The results are sorted by Well Owner Name

Download all 5 images | Download all 5 data records | Print this page | Help

Displaying 1 - 5 of **5** well log results Sort results by

1. **Phillips 66** - { View PDF }
   Public Land Survey: NE, NE, S-34, T-20-N, R-28-E, Tax Parcel Number: 19-0320-000
   County: GRANT, Well Address: 6864 Stratford Rd NE, Moses Lake 98837
   Well Log ID: 862477, Well Tag ID:BHP603, Notice of Intent Number: W307842
   Well Diameter: 6, Well Depth: 260
   Well Type: Water, Well Completion Date: 11/09/2012, Well Log Received Date: 01/04/2013
2. **Port Of Moses Lake** - { View PDF }
   Public Land Survey: NE, NE, S-32, T-20-N, R-28-E, Tax Parcel Number: (blank)
   County: GRANT, Well Address: 7810 Andrews St NE, Moses Lake 98837
   Well Log ID: 832883, Well Tag ID:BHL174, Notice of Intent Number: RE07013
   Well Diameter: 9.625, Well Depth: 103
   Well Type: Resource Protection, Well Completion Date: 05/09/2012, Well Log Received Date: 07/16/2012
3. **Port Of Moses Lake** - { View PDF }
   Public Land Survey: NE, NE, S-32, T-20-N, R-28-E, Tax Parcel Number: (blank)
   County: GRANT, Well Address: 7810 Andrews St NE, Moses Lake 98837
   Well Log ID: 832885, Well Tag ID:BHL175, Notice of Intent Number: RE07013
   Well Diameter: 9.625, Well Depth: 102.5
   Well Type: Resource Protection, Well Completion Date: 05/09/2012, Well Log Received Date: 07/16/2012
4. **Port Of Moses Lake** - { View PDF }
   Public Land Survey: NE, NE, S-32, T-20-N, R-28-E, Tax Parcel Number: (blank)
   County: GRANT, Well Address: 7810 Andrews St NE, Moses Lake 98837
   Well Log ID: 832887, Well Tag ID:BHL176, Notice of Intent Number: RE07013
   Well Diameter: 9.625, Well Depth: 101
   Well Type: Resource Protection, Well Completion Date: 05/09/2012, Well Log Received Date: 07/16/2012
5. **Port Of Moses Lake** - { View PDF }
   Public Land Survey: NE, NE, S-32, T-20-N, R-28-E, Tax Parcel Number: (blank)
   County: GRANT, Well Address: 7810 Andrews St NE, Moses Lake 98837
   Well Log ID: 832889, Well Tag ID:BHL177, Notice of Intent Number: RE07013
   Well Diameter: 9.625, Well Depth: 101
   Well Type: Resource Protection, Well Completion Date: 05/09/2012, Well Log Received Date: 07/16/2012

Total Result Pages: 1

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487308

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission ("x" in circle)

☒ Construction

○ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

CURRENT Notice of Intent No. EW 309661

Unique Ecology Well ID Tag No. BCE 059

Water Right Permit No. _____

Property Owner Name Valley Estates.

Well Street Address 7609 NE Macbeth Ln.

City Moses Lake County Grant.

Location NE 1/4-1/4 NE 1/4 Sec 8 Twn 19 R 28 (EWM or WWM) circle one

Lat/Long (s, t, r Still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

Tax Parcel No. 12 664-104 Lot #4

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) _____

☒ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 300 ft. Depth of completed well 300 ft.

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 6" Diam. from +1 ft. to 114 ft. ☐ Liner installed _____" Diam. from _____ ft. to _____ ft. ☐ Threaded _____" Diam. from _____ ft. to _____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location _____

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☐ No ☐ Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 20 ft.

Material used in seal Bentonite

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? _____ Depth of strata _____

Method of sealing strata off _____

PUMP: Manufacturer's Name Goulds

Type: Sub 37 gpm H.P. 3

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 9.2 ft. below top of well Date 12-20-12

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom? _____

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 50 gal./min. with stem set at 290 ft. for 2 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water 61 Was a chemical analysis made? ☒ Yes ☐ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Dirt	0	2
Sand & Gravel	2	69
Clay yellow	69	82
Clay Brown	82	96
Clay blue	96	110
Basalt fractured	110	114
Basalt Gray	114	236
Basalt fractured	236	242
Basalt black	242	278
Basalt black brown red	278	297
Basalt Gray	297	300

RECEIVED FEB 01 2013 DEPARTMENT OF ECOLOGY EASTERN REGIONAL OFFICE

Start Date 12-18-12 Completed Date 12-20-12

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Jim Stiems

Driller/Engineer/Trainee Signature Jim Stiems

Driller or trainee License No. 0469

Drilling Company Joy Drilling Co

Address 5369 Jared Ct

City, State, Zip Moses Lake WA

Contractor's Registration No. JOYDRC 137064 Date 12-30-12

If TRAINEE,

Driller's Licensed No. _____

Driller's Signature _____

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477481

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Construction/Decommission *("x" in circle)*

(X) Construction

( ) Decommission *ORIGINAL INSTALLATION Notice of Intent Number* W301365

CURRENT

Notice of Intent No. W301365

Unique Ecology Well ID Tag No. BCE482

Water Right Permit No.

Property Owner Name Yuliya Yaroshchuk

Well Street Address 7434 Blue Goose N.E.

City Moses Lake County Grant 13

Location SW 1/4-1/4 SW 1/4 Sec 17 Twn 19 R 28 EWM or WWM (circle one)

Lat/Long (s, t, r **Still REQUIRED**) Lat Deg ____ Lat Min/Sec ____ Long Deg ____ Long Min/Sec ____

Tax Parcel No. 12-1126-512

PROPOSED USE: (X) Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other ____

TYPE OF WORK: Owner's number of well (if more than one) ____

(X) New well ☐ Reconditioned ☐ Deepened

Method: ☐ Dug ☐ Bored ☐ Driven ☐ Cable (X) Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 160 ft.

Depth of completed well 160 ft.

CONSTRUCTION DETAILS

Casing Installed: (X) Welded 6" Diam. from +2 ft. to 118 ft.

☐ Liner installed ____" Diam. from ____ ft. to ____ ft.

☐ Threaded ____" Diam. from ____ ft. to ____ ft.

Perforations: ☐ Yes (X) No

Type of perforator used ____

SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: ☐ Yes (X) No ☐ K-Pac Location ____

Manufacturer's Name ____

Type ____ Model No. ____

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel/Filter packed: ☐ Yes (X) No ☐ Size of gravel/sand ____

Materials placed from ____ ft. to ____ ft.

Surface Seal: (X) Yes ☐ No To what depth? 18 ft.

Material used in seal Bentonite

Did any strata contain unusable water? (X) Yes ☐ No

Type of water? Surface Depth of strata 20-53

Method of sealing strata off ____

PUMP: Manufacturer's Name ____

Type: ____ H.P. ____

WATER LEVELS: Land-surface elevation above mean sea level ____ ft.

Static level 18 ft. below top of well Date 4-12-12

Artesian pressure ____ lbs. per square inch Date ____

Artesian water is controlled by ____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes (X) No If yes, by whom? ____

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ____

Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.

Airtest 8 gal./min. with stem set at 150 ft. for 2 hrs.

Artesian flow ____ g.p.m. Date ____

Temperature of water ____ Was a chemical analysis made? ☐ Yes (X) No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Top Soil	0	1
Soil & gravel	1	3
Cobbles	3	15
Black Sand & gravel	15	20
Black Sand & gravel & water	20	53
Brown Clay	53	76
Blue Clay	76	94
Brown Clay	94	108
Brown Clay & Brown Basalt	108	118
Brown Basalt	118	139
Black Basalt	139	144
Porous Brown Basalt water	144	149
Black Basalt	149	160

Start Date 4-12-12 Completed Date 4-12-12

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

(X) Driller ☐ Engineer ☐ Trainee Name (Print) Mitch Mathews

Driller/Engineer/Trainee Signature Mitch Mathews

Driller or trainee License No. 1267

If TRAINEE, Driller's Licensed No. ____

Driller's Signature ____

Drilling Company Mathews Drilling Inc.

Address 2317 Rd 10.2 NE

City, State, Zip Moses Lake, WA. 98837

Contractor's Registration No. MATHEDI 934DD Date 4-12-12

RECEIVED MAY 09 2012 DEPARTMENT OF ECOLOGY EASTERN REGIONAL OFFICE

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ECY 050-1-20 (Rev 3/05) **The Department of Ecology does NOT Warranty the Data and/or Information on this Well Report.**

477484

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission *("x" in circle)*

☒ Construction

○ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* W 301 366

CURRENT

Notice of Intent No. W 301 366

Unique Ecology Well ID Tag No. BC E 483

Water Right Permit No.

Property Owner Name Andrey Vogtsckhovskiy

Well Street Address 7498 Wildgoose Ln.

City Moses Lake County Grant 13

Location NE 1/4-1/4 SW 1/4 Sec 17 Twn 19 R 28 (EWM) or WWM circle one

Lat/Long (s, t, r Still **REQUIRED**) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

Tax Parcel No. 12-1126-360

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) _____

☒ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 110 ft.

Depth of completed well 110 ft.

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 6" Diam. from +2 ft. to 89 ft.

☐ Liner installed _____" Diam. from _____ ft. to _____ ft.

☐ Threaded _____" Diam. from _____ ft. to _____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location _____

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☒ No ☐ Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 18 ft.

Material used in seal Bentonite

Did any strata contain unusable water? ☒ Yes ☐ No

Type of water? Surface Depth of strata 22-47

Method of sealing strata off Casing

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 17 ft. below top of well Date 4-13-12

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom? _____

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 60+ gal./min. with stem set at 180 ft. for 2 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ Was a chemical analysis made? ☐ Yes ☒ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Top Soil	0	1
Soil & gravel	1	3
Cobbles	3	14
Black Sand & gravel	14	22
~~Wet~~ Black Sand & Gravel Water	22	47
Yellow Clay	47	52
Brown Clay & Sand	52	64
Brown Clay	64	86
Brown Basalt & Clay	86	89
Brown Basalt	89	98
Porous Brown Basalt & water	98	110

RECEIVED
MAY 09 2012
DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

Start Date 4-13-12 Completed Date 4-13-12

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Mitch Mathews

Driller/Engineer/Trainee Signature Mitch Mathews

Driller or trainee License No. 1267

Drilling Company Mathews Drilling Inc.

Address 2317 Rd 10.2 NE

City, State, Zip Moses Lake, Wash. 98837

Contractor's Registration No. MATHEJ 193KD0 Date 4-13-12

If TRAINEE,

Driller's Licensed No. _____

Driller's Signature _____

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ECY 050-1-20 (Rev 3/05) **The Department of Ecology does NOT warranty the Data and/or Information on this Well Report.**

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

491611

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission *("x" in circle)*

☒ Construction

○ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* W 307840

CURRENT
Notice of Intent No. W 307840
Unique Ecology Well ID Tag No. BHP 602
Water Right Permit No.
Property Owner Name Randy Koon
Well Street Address 4545 Kelley Pl.
City Moses Lake County Grant 13
Location SE 1/4-1/4 NW 1/4 Sec 10 Twn 19 R 28 EWM or WWM (circle one)
Lat/Long (s, t, r Still **REQUIRED**) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____
Tax Parcel No. 17-0478-031

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) _____
☒ New well ☐ Reconditioned ☐ Deepened
Method: ☐ Dug ☐ Bored ☐ Driven ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 218 ft.
Depth of completed well 218 ft.

CONSTRUCTION DETAILS
Casing Installed: ☒ Welded 6" Diam. from +2 ft. to 102 ft.
☐ Liner installed _____" Diam. from _____ ft. to _____ ft.
☐ Threaded _____" Diam. from _____ ft. to _____ ft.

Perforations: ☐ Yes ☒ No
Type of perforator used _____
SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location _____
Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ from _____ ft. to _____ ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☒ No ☐ Size of gravel/sand _____
Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 18 ft.
Material used in seal Bentonite
Did any strata contain unusable water? ☒ Yes ☐ No
Type of water? Sandy Depth of strata 82-84
Method of sealing strata off Casing

PUMP: Manufacturer's Name _____
Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
Static level 68 ft. below top of well Date 10-26-12
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest 45+ gal./min. with stem set at 215 ft. for 2 hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? ☐ Yes ☒ No

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JAN 04 2013
DEPARTMENT OF ECOLOGY
EASTERN REGIONAL OFFICE

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Top Soil	0	2
gravel	2	46
gravel & Brown Clay	46	53
Brown clay	53	63
Blue Clay	63	71
Sticky Brown Clay	71	82
Brown Clay & Gravel & water (Sandy)	82	84
Brown Clay	84	96
Brown Basalt	96	102
Brown Basalt & Water	102	105
Black Basalt	105	145
gray Basalt Hard	145	214
Brown Basalt & Water	214	218

Start Date 10-26-12 Completed Date 10-26-12

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Mitch Mathews
Driller/Engineer/Trainee Signature Mitch Mathews
Driller or trainee License No. 1267

Drilling Company Mathews Drilling Inc.
Address 2317 Rd 10.2 NE
City, State, Zip Moses Lake, WA. 98837
Contractor's Registration No. MATHEDI934DD Date 10-27-12

If TRAINEE,
Driller's Licensed No. _____
Driller's Signature _____

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ECY 050-1-20 (Rev 3/05) **The Department of Ecology does NOT warranty the Data and/or Information on this Well Report.**

485097

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Construction/Decommission *("x" in circle)*

☒ Construction

○ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* W 307842

CURRENT
Notice of Intent No. W 307842

Unique Ecology Well ID Tag No. BHP 603

Water Right Permit No. _____

Property Owner Name Phillips 66

Well Street Address 6864 Stratford Rd

City Moses Lake County Grant 13

Location NE 1/4-1/4 NE 1/4 Sec 34 Twn 20 R 28 EWM or WWM (circle one)

Lat/Long (s, t, r Still **REQUIRED**) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

Tax Parcel No. 19-0320-000

PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) _____

☒ New well ☐ Reconditioned ☐ Deepened

Method: ☐ Dug ☐ Bored ☐ Driven ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 260 ft.
Depth of completed well 260 ft.

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 6" Diam. from +2 ft. to 200 ft.
☐ Liner installed _____" Diam. from _____ ft. to _____ ft.
☐ Threaded _____" Diam. from _____ ft. to _____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used _____

SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location _____

Manufacturer's Name _____

Type _____ Model No. _____

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☒ No ☐ Size of gravel/sand _____

Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 200 ft.

Material used in seal Neat Grout

Did any strata contain unusable water? ☒ Yes ☐ No

Type of water? Turbid Depth of strata 58-82

Method of sealing strata off Casing

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.

Static level 52 ft. below top of well Date 11-9-12

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☐ No If yes, by whom? _____

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____

Bailer test 28 gal./min. with 258 ft. drawdown after 2 hrs.

Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ Was a chemical analysis made? ☐ Yes ☒ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Top Soil	0	1
Cobbles & Soil	1	3
gravel Large	3	12
gravel	12	51
gravel & Brown Clay	51	54
Brown Clay	54	57
Brown Clay Fractured Basalt	57	59
Fractured Basalt & water	59	82
Black Basalt	82	155
Brown Basalt & water	155	162
gray Basalt Hard	162	200
gray Basalt Mud	200	238
Brown Basalt & Water	238	246
Black Basalt	246	260

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EASTERN REGIONAL OFFICE

Start Date 11-5-12 Completed Date 11-9-12

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Mitch Matheus

Driller/Engineer/Trainee Signature Mitch Matheus

Driller or trainee License No. 1267

Drilling Company Matheus Drilling Inc.

Address 2317 Rd 10.2 NE.

City, State, Zip Moses Lake, WA. 98837

Contractor's Registration No. MATHEdJ934DO Date 11-10-12

If TRAINEE,
Driller's Licensed No. _____
Driller's Signature _____

Ecology is an Equal Opportunity Employer.

ECY 050-1-20 (Rev 3/05) **The Department of Ecology does NOT warranty the Data and/or Information on this Well Report.**

APPENDIX D

WDOE WATER WELL REPORTS
(CD Only)

APPENDIX E

QUALITY CONTROL SUMMARY REPORT AND DATA VALIDATION REPORT

Draft Final
Quality Control Summary Report

Moses Lake Wellfield Superfund Site

Groundwater Monitoring and Whole House Filter Program

May Through August 2013 Sampling Events

(CERCLIS ID No. WAD009477355)

Prepared by

U.S. Army Corps of Engineers
4375 East Marginal Way South, Building 1202
Seattle, Washington 98134

December 2013

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Acronyms and Abbreviations can be found in the Data Validation Report

1.0 INTRODUCTION

This Quality Control Summary Report (QCSR) presents an overall assessment of Stage 2A and Stage 4 data validation for samples collected May through August 2013. Data validation was conducted in accordance with the *Moses Lake Wellfield Groundwater Monitoring and Whole House Filter Program Quality Assurance Project Plan* (USACE May 2013), U.S. *Department of Defense Quality Systems Manual for Environmental Laboratories, Version 4.2* (DoD QSM) (October 25, 2010), *Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry: Method 524.3 Version 1, (EPA June 2009),* and the *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (CLPNFG)* (June 2008). Analytical data was provided by Analytical Resources, Inc of Tukwila, WA and third party data validation was performed by Laboratory Data Consultants, Inc of Carlsbad, CA.

The purpose of this QCSR is to provide: (1) an overview of the data quality, (2) specific data quality anomalies and their effects on data usability, and (3) recommendations on data usability. Data quality is expressed in terms of measurement performance criteria. The criteria relate to the parameters of precision, accuracy, comparability, completeness and sensitivity (PARCCS). These parameters indicate the qualitative and quantitative degree of quality associated with measurement data and, hence, are referred to as data quality indicators (DQIs). The quality control (QC) acceptance limits for DQIs support defensible project decisions. The specific acceptance limits are specified in the QAPP as part of the data quality objectives (DQOs).

2.0 QUALITY CONTROL ACTIVITIES

One hundred ninety-eight water samples and twenty-one field duplicates were collected from three sampling events occurring May through August, 2013. All samples were submitted for analysis of target analytes by EPA Method 524.3 for volatile organic compounds (VOCs) in drinking water. The sample identification, collection dates, analyses requested/performed, and validation levels are presented in Data Validation Report (DVR) Attachment 2.

All sample results were subjected to Stage 2A data validation which is comprised of verification and validation of sample preservation and holding times, surrogate, matrix spike/matrix spike duplicates (MS/MSDs), laboratory control sample/laboratory control sample duplicates (LCS/LCSDs), method blanks, field duplicate samples, and equipment blanks as applicable to each analysis. Stage 2A validation was performed using Laboratory Data Consultants, Inc. ADR.net software (Version 1.7.0.207).

Stage 4 data validation of QC summary forms as well as initial and continuing calibrations, instrument output and chromatograms to confirm analyte identification and quantitation was performed on approximately 9% of target compounds.

3.0 DATA QUALITY ASSESSMENT

Based on the outcomes of the data validation, the following sections evaluate if the quality of the data collected during this sampling event achieves the data quality objectives (DQOs) specified

in the QAPP. Data quality was determined based on the DQIs: precision, accuracy, representativeness, comparability, completeness, and sensitivity.

3.1 Data Quality Indicators

DQIs are defined in the following sections. QC parameters evaluated in the data review/validation and the corresponding DQIs are presented in Table 1 below.

Table 1 – DQIs and Corresponding QC Parameters

Data Quality Indicator	QC Parameters Evaluated in Data Review/Validation
Precision	RPD values of: (1) LCS/LCSD (2) MS/MSD (3) Field Duplicates
Accuracy/Bias	Percent Recovery (%R) or Percent Difference (%D) values of: (1) Initial Calibration and Calibration Verification (2) LCS & LCSD (3) MS & MSD (4) Surrogate Spikes (5) Internal Standards (area and retention times) Results of: (1) Method (preparation) Blanks (2) Trip Blanks (3) Field Blanks
Representativeness	Results of All Blanks Sample Integrity (Chain-of-Custody and Sample Receipt Forms) Holding Times Compound Identification (Retention Times, Mass Spectra)
Comparability	Sample-Specific Method Reporting Limits (MRLs) Sample Collection Methods Laboratory Analytical Methods
Completeness	Data Qualifiers Laboratory Deliverables Requested/Reported Valid Results
Sensitivity	MRLs Adequacy of Sample Dilution

3.1.1 Precision

Precision is defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Analytical precision is evaluated via the relative percent difference (RPD) values of MS/MSD and LCS/LCSD pairs. The RPD values of field duplicate analyses represent the combined precision of sample collection and analysis procedures, as well as sample homogeneity.

3.1.2 Accuracy/Bias

Accuracy is a statistical measurement of correctness and includes components of random and systematic errors. It is quantified as the degree of agreement between a measurement and a known reference. Analytical accuracy is evaluated via the percent recovery (%R) values of initial and continuing calibration (percent difference [%D] or percent drift [$\%D_f$]), internal standards, surrogate spikes, MS/MSD, LCS/LCSD, in conjunction with method blank, trip blank, and field blank results. Results of blanks assist in identifying the type and magnitude of effects that contribute to the system error introduced via field and/or laboratory procedures.

3.1.3 Representativeness

Representativeness is the level of confidence that the analytical data reflect the actual field condition. Representativeness is ensured by maintaining sample integrity during collection, preparation, and analysis. The evaluation of associated method, trip, and field blanks also assists in identifying artifacts that may skew the representativeness of the samples.

3.1.4 Comparability

Comparability is the confidence with which one data set can be compared to another data set. Using standardized methods throughout the data generation processes ensures the comparability of data generated in separate sampling days or events.

3.1.5 Sensitivity

Sensitivity depicts the level of ability an analytical system *(i.e.,* sample preparation and instrumental analysis) of detecting a target component in a given sample matrix with a defined level of confidence. Factors affecting the sensitivity of an analytical system include: analytical system background *(e.g.,* laboratory artifact or method blank contamination), sample matrix *(e.g.,* mass spectrometry ion ratio change, co-elution of peaks, or baseline elevation), instrument instability, and field procedures (including sample transport).

To evaluate the analytical sensitivity achieved, project-specific quantitation limit goals set forth in the QAPP were compared sample-specific reporting limits. In addition, sample results were compared to detections of target analytes in method blanks and trip blanks to identify potential effects of laboratory background and field procedures on sensitivity.

3.1.6 Completeness

Four types of completeness were calculated for this project: contract, analytical, technical, and field sampling. Results indicated as not reportable by the laboratory are not included in the completeness calculations. The following equations are used to calculate the four types of completeness.

Contract Compliance Completeness

Contract compliance failures are usually the result of lack of corrective action. The impact of contract compliance deficiencies varies with the specific correction action failure and will be determined during data usability assessment. Contract compliance completeness falling below the target level may result in the issuance of a corrective action request to the project laboratory.

$$\text{Contract Completeness} = \frac{\text{\# contract compliant results} \times 100\%}{\text{\# results reported}}$$

Analytical Completeness

Analytical completeness is used to assess the laboratories ability to generate high quality data. This may be a reflection of contract compliance or other issues and requires detail assessment of the cause for qualification during data usability assessment.

$$\text{Analytical Completeness} = \frac{\text{\# unqualified results} \times 100\%}{\text{\# results reported}}$$

Technical Completeness

Technical completeness is a measure which reflects the laboratories ability to produce usable results. Failure to meet this goal may indicate serious impacts to data usability (rejected results) and may result in termination of the contract. Usable data are defined as data reported by the laboratory and are not determined rejected, with or without data qualifiers including UJ, U, and J as assigned via the data validation.

$$\text{Technical Completeness} = \frac{\text{\# useable results}^{\dagger} \times 100\%}{\text{\# results reported}}$$

(Estimated results are considered as useable for project decision making.)

Field Sampling Completeness

Field sampling completeness reflects whether the samples planned for collection were actually acquired. If field samples were omitted, the PDT will determine whether or not additional mobilization to sample is necessary.

$$\text{Field Sampling Completeness} = \frac{\text{\# samples collected}}{\text{\# samples planned}} \times 100\%$$

The minimum goals for completeness are as follows: 1) Contract Compliance = 100%, 2) Analytical = 90% or greater, 3) Technical = 90% or greater and 4) Field Sampling= 100%. The goal for holding times is 100%. Estimated results are treated as usable results for technical completeness. These are considered minimum goals.

3.2 Data Quality Indicators

The following subsections present an evaluation of the data. The assessment is intended to reconcile the existing data quality with the project DQOs and is presented herein in terms of the data quality indicators.

DQIs for VOC data met project goals except for the following:

3.2.1 Accuracy and sensitivity – The QC outliers listed below indicate potential bias for VOC data:

- Two MS/MSD pairs exceeded the %R acceptance criteria for 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, trichloroethene, and vinyl chloride. The trichloroethene results in sample 13MLW001WP04 and the 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride results in sample 13MLW00112BW05 were qualified as estimated (J-) for detects and (UJ) for non-detects due to MS/MSD %Rs outside the acceptance limits. No data were qualified when the associated sample concentration was significantly greater than the spiked concentration. Details regarding MS outliers are included in DVR Attachment 9.
- One continuing calibration %D exceeded the acceptance criteria for vinyl chloride. The detected result for vinyl chloride in sample 13 MLW001WP120 was qualified as estimated with low bias (J-). Non-detected results were qualified UJ. Details regarding continuing calibration verification (CCV) %D can be found in DVR Section 2.2.

3.2.2 Precision – The QC outliers listed below indicate potential imprecision of the data:

- Two MS/MSD pairs exceeded the RPD acceptance criteria for 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, trichloroethene, and vinyl chloride. The 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride results in sample 13MLW00112BW05 were qualified as estimated (J-) for detects and (UJ) for non-detects due to MS/MSD RPDs outside the acceptance limits. No data were qualified when the associated sample concentration was significantly greater than the spiked concentration. Details regarding MS outliers are included in DVR Attachment 9.

- One field duplicate pairs exceeded the %RPD criteria for trichloroethene. No qualifiers were applied on this basis. However, the 200% RPD indicates that there was a possible source of error either in the sample collection or analysis. The root cause of this QC outlier was investigated but could not be identified. Details regarding FD results are included in DVR Attachment 8.

3.2.3 Completeness:

Completeness levels attained for the field samples are as follows:

The contract completeness level attained for the field samples was 99.2 percent. Due to quality control exceedances, 15 out of 1926 results were qualified as estimated. Percent contract compliance does not consider surrogate outliers or MS/MSD outliers when associated LCS recoveries are in control.

The overall analytical completeness level attained for the field samples was 98.9 percent. The holding time completeness level attained was 100 percent. Due to quality control exceedances, 21 out of 1926 results were qualified as estimated.

The technical completeness, which included all QC parameters, attained for the field samples was 100 percent. No results were rejected.

The field sampling completeness level attained for the field samples was 100 percent. Two-hundred thirty-eight out of 238 planned samples were collected.

4.0 PERFORMANCE EVALUATION (PE) SAMPLES

PE samples were submitted to the laboratory and analyzed for the purposed of evaluating the accuracy of the measurement performance or analytical procedures used by the laboratory.

One PE sample, 13MLW000PW01, was collected and analyzed for VOCs. All results were within the acceptance limits. The details regarding PE sample results are provided in DVR Attachment 11.

5.0 DATA USABILITY

This Section assesses the quantitative and qualitative aspects the data and identifies potential sources of error, uncertainty, and bias that may affect overall usability.

5.1 Summary Data Quality Assessment

The overall quality of data was acceptable. All project DQIs were met with the exception of those noted above. All sample holding time and preservation requirements were met. All instrument performance checks and calibrations were performed as required. All calibration factors and internal standard percent recoveries were within acceptance criteria. All surrogate,

MS/MSD and LCS/LCSD percent recoveries were within acceptance criteria with the exceptions described in Section 3.2.1. Method blanks, trip blanks, and field blanks were performed at the required frequency and no contamination was detected. Field duplicates were collected at the required frequency and precision is considered acceptable with the exception of samples 13MLW00199BW14 and 13MLW20199BW14. The source of this discrepancy could not be determined so it is recommended that this well be resampled (including a field duplicate during the 2014 sampling events.

It should also be noted that results for equipment blank 13MLW32AWP14 were deleted since it was determined that the sample was not properly collected.

APPENDIX F

LABORATORY ANALYTICAL REPORTS
(CD Only)