PBS | Engineering + Environmental

October 7, 2014

Mr. Matthew Durkee
Washington Department of Ecology
15 W. Yakima Avenue Suite 200
Yakima, Washington 98930

Re: Proposed Monitoring Well Installation and Groundwater Monitoring Plan
ARCO Roadrunner
1820 So. Third Avenue
Yakima, Washington
Facility # 89282545 and VCP # CE0382
PBS Project No. 63565.000

Dear Mr. Durkee:

PBS Engineering + Environmental (PBS) is pleased to submit this work plan for installing a monitoring well and performing groundwater sampling at the ARCO Roadrunner gasoline station, located at 1820 S. 3rd Avenue in Yakima, WA. This proposed project is based on previous work conducted at the site by PBS, and the Voluntary Cleanup Program (VCP) opinion letter dated March 5, 2013.

PROJECT BACKGROUND

Prior Reports

PBS understands that the Site has been in use as a gasoline station since the 1970s, operating three underground storage tanks (USTs). PBS was originally contacted in the fall of 2008 to provide site assessment activities as part of the decommissioning of one UST. Work performed by PBS at the Site includes the following:

- Completed an *Underground Storage Tank Decommissioning/Site Assessment Report* in March 2009. One UST was decommissioned and removed, and petroleum contamination was detected in the UST basin groundwater.
- Completed an *Underground Storage Tank Decommissioning/Site Assessment Report* in December 2009. Two USTs were decommissioned by removal and a release of petroleum to soil and groundwater was documented and reported to the Washington State Department of Ecology (WDOE).
- Completed a report entitled *Site Assessment, Well Construction and Remediation Plan* in May 2010. This report presented the findings of an environmental investigation that included the advancement of soil borings and installation of three monitoring wells. Results of groundwater sampling for one quarter (April 2010) were also included in this report. The two down-gradient wells were found to be impacted with gasoline and benzene above Washington Department of

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Ecology (WDOE) Model Toxics Control Act (MTCA) Method A Cleanup levels. No contaminant concentrations were detected in the sample from MW-3 (up-gradient).

Oxygen releasing compound (ORC) was emplaced in the UST basin after the last UST was removed from the Site as a remedial action in 2009.

Voluntary Cleanup Program Opinion Letter

In late 2012 the site owner, Amar Singh joined the Ecology Voluntary Action Program (VCP). An important feature of the program is that it allows owners, through a technical consultation process with Ecology, to apply for and receive a No Further Action (NFA) letter once Ecology has reviewed the cleanup documentation and is satisfied the cleanup has been successfully conducted. The goal of this proposed project is to conduct the investigation to determine the extent of contamination and assess if additional work is required; the ultimate goal is to obtain a NFA determination from Ecology. Notification that Mr. Singh's voluntary application was received by Ecology and accepted was presented in a letter dated December 11, 2012. The site is designated as Facility #89282545 and VCP # CE0382.

After joining the VCP, PBS and the owner Amar Singh requested an opinion letter from Ecology. The VCP opinion letter was issued on March 5, 2013. An important requirement of this letter was the need to characterize groundwater down gradient of monitoring wells MW-1 and MW-2. These two wells are on the east side of the site, and with the groundwater flow direction to the southeast, there is no practical down gradient location available on the site itself. Consequently a downgradient location across South Third Avenue, east of the existing gasoline station, is the best option for this proposed well. The proposed well would be placed within the city right-of-way and in a location that is accessible for groundwater sampling.

Site Characteristics

The property is located in the northeast quarter of Section 36, Township 13 North, Range 18 East of the Willamette Meridian, on Yakima County Tax Parcel 181336-14032. The lot size is approximately 22,796 square feet, with a one-story convenience store and gasoline station on the site. The Yakima County assessor data shows the building size as about 2,650 square feet, and indicates the building has exterior walls constructed of masonry block. The building is on a concrete foundation. The site is located immediately west of S. 3rd Street and north of W. Washington Avenue. Adjoining property use on the north is a single family residence, and on the west is an auto body shop. The property to the east is a United States Post Office, and a restaurant is located to the south.

The site is at an elevation of 1033 feet above sea level (amsl) and the lot is completely developed. Operational USTs are located on the west side of the property, in a large, flat asphalt covered area. The Yakima River is approximately two miles to the east and represents the most substantial surface water in the project vicinity. The river lies at approximately 980 feet amsl; the entire area slopes gently easterly toward the river.

PBS installed three monitoring wells at the site in 2010. Monitoring wells MW-1 and MW-2 were placed as downgradient wells from the former UST basin. Monitoring well MW-3 was placed as an upgradient

well. In MW-2, the well closest to the former UST basin, depth to water has ranged from 9.85 feet to 12.81 feet below top of casing. Groundwater flow has been to the southeast, toward the Yakima River.

The surface geology is mapped by the online Geologic map of Washington (https://fortress.wa.gov/dnr/geology/?Site=wigm) as terraced deposits of the Quaternary Period. Previous drilling at the site by PBS noted that below the surface soil was a deposit of brown sandy silt to a depth of about 8 feet. Underlying the silt were dense sandy gravels to a depth of 19 feet.

PROPOSED WORK PLAN

Purpose of this Work

The purpose of this well will be to act as a sentinel well that is located further down gradient than monitoring wells MW-1 and MW-2. This new well will be the primary means of characterizing the extent of contamination in the groundwater. This characterization has been deemed necessary to define the downgradient extent of contamination based on the past exceedance of the Model Toxics Control Act (MTCA) Method A cleanup levels in monitor well MW-2.

PBS plans to install a monitoring well in the city right-of-way or within the United States Post Office parking lot on the east side of South 3rd Avenue. PBS has briefly discussed placing a monitoring well within the city sidewalk with both the City of Yakima. PBS has also discussed placing a monitoring well in the Post Office parking lot and no definite decision has yet been made as to the final location of the well. A figure showing the proposed well location's is included in Attachment 1.

Once the well is installed and developed, PBS will sample the well for four consecutive quarters. All work will proceed in consultation with the owner, Vertex (insurance company representative), and Ecology.

Project Personnel

The project team members and responsibilities are summarized below.

Site Owner/Manager	ARCO Roadrunner Amar Singh
Insurance Company consultant	Vertex Greg Steen
Environmental Consultant	PBS Engineering + Environmental Dana B. Ertel, LG, Project Manager/Geologist Dulcy Berri, LHG, Principal Hydrogeologist/Reviewer
Washington Department of Ecology Project Manager	Matthew Durkee

Proposed Tasks
The following tasks are proposed to accomplish the objectives of this work plan.

Locate the right of way using a licensed surveyor. The well is planned to be within the city right-of-way and in a location that is accessible for groundwater sampling.

A private utility locate will be requested from a private utility locating service prior to conducting any work at the site that involves drilling activities.

A site-specific Health and Safety Plan (HASP) will be prepared to address safety during the project. This plan will include site health and safety for the proposed drilling operations, and will include soil boring and monitoring well installation.

PBS anticipates a sonic drill rig will be used for completing the project based on the likely presence of gravel and cobbles beneath the site. A logged description of the soil will be done by a PBS geologist, including the documentation of subsurface soil type, moisture, color, odor and volatiles. Volatiles will be evaluated qualitatively with a photoionization detector (PID). Soil samples will be collected from above the water table and/or where other zones of contamination are suspected.

The monitoring well will be constructed in accordance with Washington Department of Ecology monitoring well construction regulations provided in WAC Chapter 173-160 and 173-162. Wells will be constructed with 2-inch casing to a depth of approximately 10 feet below the top of the groundwater at the site. With the use of 10 feet of screened casing, approximately 3 to 4 feet of screen will be placed above the water table. The well will be flush mounted and constructed in such a configuration that the top of casing can be surveyed and the surface of the groundwater table can be determined, along with groundwater flow direction and gradient. Well surveying will be completed by PBS, with an accuracy of 0.01 feet vertical accuracy measured against the existing temporary site datum.

Investigation-Derived Waste (IDW)
PBS will work with Amar Singh to identify a temporary IDW storage location on-site. Soil and purged groundwater/decontamination water will be contained in drums or smaller containers and stored on-site in a location approved by Mr. Singh. The drums will be sealed and labeled. The proper disposal of these drums will be determined after the laboratory results have been reviewed.

Monitoring Well Development
Well development by the driller and/or PBS will occur upon completion of well installation. The PBS standard operating procedure for well development will be followed. This procedure is included as Attachment 2 to this work plan. All purge water from the well will be stored on-site in a drum and the analytical data from the monitoring well will be used to determine how to dispose of the well development water. Disposal of the purge water will take place after sample analysis is received.

Groundwater Sampling
PBS will wait a minimum of 48 hours after development before sampling. Prior to sampling, gauging the depth to groundwater in all the monitoring wells will be performed using an oil-water interface meter.

Following collection of water level data, the wells will be sampled per PBS' Standard Operating Procedure (SOP) for low-flow sampling (Attachment 3) and in accordance with Ecology procedures. PBS will use Teflon or polyethylene disposable tubing for the sampling. Groundwater sampling data sheets will be completed for each well sampled.

Groundwater will be collected into laboratory-provided containers by PBS personnel wearing disposable nitrile gloves. Following sample collection, sample containers will be stored in a cooler with ice. All samples will be shipped to an accredited laboratory under chain-of-custody documentation and within specified holding times.

Analytical Procedures
Proposed soil and groundwater analytical procedures will be performed as indicated in the following table. PBS will confirm that the method reporting limits will be sufficiently low to evaluate the data against the project cleanup criteria established by Ecology. PBS anticipates using MTCA Method A soil and groundwater cleanup levels as site cleanup goals. PBS will use an Ecology-accredited laboratory for all analytical work.

Constituent	Proposed Analytical Procedures
Petroleum Products (Gasoline)	NWTPH-Gx
Benzene	EPA Method 8260C
Toluene	EPA Method 8260C
Ethyl benzene	EPA Method 8260C
Xylenes	EPA Method 8260C
EDB/EDC	EPA Method 8260C
MTBE	EPA Method 8260C
Napthalenes	EPA Method 8260C
Total Lead	EPA Method 200.8
Diesel Range Organics	NWTPH-Dx

QA/QC Procedures
Sample QA/QC procedures will include collecting one duplicate soil sample during the drilling of the soil boring/monitoring well, and which will be submitted to the laboratory with the other samples. The duplicate will be numbered separately for comparison to the initial sample. Excessive deviation (greater than +/- 30 percent from the primary sample) between the primary samples and duplicates will trigger further evaluation of other QA/QC procedures or may require re-sampling. The laboratory's daily batch quality control testing will also be reviewed for data quality.

A duplicate sample will be collected from one monitoring well during each quarterly groundwater sampling event. The sample will be submitted to the laboratory with the other samples and will be numbered separately for comparison to the primary sample.

Trip blanks will be shipped with each cooler that contains volatile samples.

Reporting
Once the well is installed and developed, PBS will begin quarterly groundwater monitoring of the well, in conjunction with the other monitoring wells at the site. A report for each quarterly event will be prepared and submitted to the parties as shown in the project personnel above.

Signature Page
PBS has prepared this scope of work to conduct additional characterization at the site. PBS requests Ecology to review and comment on this scope of work prior to implementation. Please feel free to call me at 509.942.1600 with any questions.

Sincerely,
PBS Engineering + Environmental

Dana Ertel, LG
Project Manager/Licensed Geologist

Reviewed by Tom Mergy, LG
PBS Senior Geologist

cc: Greg Steen - Vertex
Amar Singh - ARCO Roadrunner

Attachments:
Attachment 1: Proposed Monitor Well Location
Attachment 2: Standard Operating Procedure Development of a Groundwater Monitoring Well
Attachment 3: PBS Low Flow Sampling Procedure

ATTACHMENT I

Proposed Monitor Well Location


New well location
ARCO Gas Station
© 2014 Google
Google earth
92 ft
1996
Imagery Date: 7/9/2013 46°34'15.49" N 120°30'34.45" W elev 1032 ft eye alt 1432 ft

ATTACHMENT II

PBS SOP: Development of a Groundwater Monitoring Well

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STANDARD OPERATING PROCEDURE
DEVELOPMENT OF A GROUNDWATER MONITORING WELL

1.00 PURPOSE

The purpose of monitoring well development is to remove drilling fluids or other fluids introduced during drilling or well installation, stabilize the filter pack, and remove fine-grained sediment entering the well. This is typically done following groundwater monitoring well construction, no sooner than 24 hours following setting of a bentonite seal. If a dry granular bentonite seal is placed, you may begin development as soon as 12 hours (OAR 690-240-0485) following completion. U. S. EPA recommends waiting at least 48 hours, especially if vigorous surging methods are to be used during well construction.

2.00 EQUIPMENT LIST

1. Well lock keys
2. Field book
3. Electronic water level probe
4. Interface probe (if dense or light non-aqueous phase liquids are [DNAPL or LNAPL] is present)
5. Knife or scissors
6. Decontamination equipment
7. Site map and health and safety plan
8. Personal Protection Equipment (PPE) appropriate for the site
9. Submersible pump, air lift pump or other appropriate pump and associated equipment
10. Surge block
11. Polyvinyl Chloride (PVC) or stainless steel bailer (close in size to inside diameter of well)
12. Disposable tubing, if necessary
13. Field water quality monitoring equipment
14. Turbidity meter
15. Containers for purge water

3.00 PROCEDURE

The diameter of the well, the total depth of the well, and depth to water will determine the type of pump and equipment used for well development. Surging of the well can be done with a surge block tool or with a submersible pump if it is close in size to the inside diameter of the well. A PVC or stainless steel bailer may work if it is close in size to the inside diameter of the well. The purpose of surging is to suspend as much sediment as possible in the water column so it can be pumped out of the well. It also helps to get the filter pack and aquifer settled and cleaned of fine-grained sediment. The filter pack should have been surged during well construction, prior to placing the overlying seal in the well.

1. Note the general condition of the well. Check the well for damage or evidence of tampering and record pertinent observations. Note any maintenance tasks that should be completed, such as well cap or padlock replacement.

2. Open the well and wait a sufficient period of time for the atmospheric pressure to equalize, allowing the water levels to approach an equilibrium state before taking any measurements.
3. Measure the depth to water (DTW), (and DNAPL or LNAPL if present) relative to the marking on the well casing. If there is no mark, use the north side of the casing. Record the water level in the field book.
4. Measure and record the total depth of the well, making note if the bottom of the well is "soft" and compare it to the finished depth of the well from the well log. Also note the total screen length from the well log.
5. Subtract DTW from total depth for length of water column (WC).
6. Calculate one casing volume as follows:

CF x WC = Number of gallons in one casing volume

CF = conversion factor (dependent on well diameter listed in table below)
WC = length of water column in feet.

Well diameter (inches)	Conversion Factor (gallons/foot)
1	0.04
2	0.17
4	0.65

Annular space is calculated as follows:

$[(\text{Borehole diameter-casing diameter}/2)^2]$ H *N = Number of gallons in annular space

H = length of wetted filter pack in feet
N = porosity of filter pack (0.3 to 0.5)

7. Start by surging the well, moving a surge block tool or bailer up and down the length of the screened interval. Following surging (5 to 10 minutes), remove the surge block and install the pump. Place the pump in the bottom half of the screen and pump at a fairly high rate.
8. After the pump has been pumping for awhile, measure turbidity and record it. If water begins to clear, measure turbidity, again. Also, surge the well using the pump. If the water becomes more turbid, continue to pump. Record the time, amount pumped and turbidity in the field book.
9. The amount of water required to be pumped from the well is equal the amount of water put into the boring during well drilling and/or construction plus a minimum of 5 to 10 well bore volumes.

Bore hole volume = Number of gallons in annular space + casing volume

At least five well bore volumes need to be removed for monitoring wells set in silty, clayey sands, or silts. If there are coarse-grained soils in the screened interval such as sands and gravels, then 10 well bore volumes should be removed from the boring.

10. After the bottom portion of the water column clears, move the pump up in the well screen and continue to pump. As the water clears, surge using the pump.
11. An alternative to surge and pump would be to use a PVC or stainless steel bailer, close in size to the inside diameter of the well. The bailer could be used as a surge block, catching both sediment and removal of turbid water. It is particularly effective to bounce the bailer off the bottom of the well casing when there is sediment on the bottom of the well, in order to stir up the sediment and get it re-suspended so it can be removed. Sometimes a combination of both pumping and a bailer may be used.

12. Following development, record total depth of well and compare it to initial measurement and total depth at construction. Any sediment in the bottom of the well should be removed during well development, as much as possible. Also record the final water level and turbidity.
13. Decontaminate all pumps and equipment prior to moving to the next well.
14. All water should be stored in drums, tanks or other container, as appropriate.
15. Wells should be allowed to rest and recover at least 24 to 48 hours prior to sampling.

Resources consulted for this SOP include:

Oregon Department of Environmental Quality. (1992). *Groundwater Monitoring Well Drilling, Construction, and Decommissioning.* DEQ Guidance Document. August 24, 1992.

OAR 690-240 Construction, Maintenance, Alteration, Conversion and Abandonment of Monitoring Wells, Geotechnical holes and Other Holes in Oregon, (as of October 15, 2007).

U.S. Environmental Protection Agency. (2001). *Standard Operating Procedure 2044, Revision 0.1, Monitor Well Development.* October 23, 2001.

ATTACHMENT III

PBS SOP: Low Flow Groundwater Sampling

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STANDARD OPERATING PROCEDURE
GROUNDWATER SAMPLING USING LOW-FLOW SAMPLING TECHNIQUES

1.0 BACKGROUND AND PURPOSE

Groundwater samples are collected from monitoring wells and temporary borings for analysis of physical and chemical parameters, either by using field observations and portable equipment and/or using off-site laboratory analytical methods. Groundwater is typically purged prior to sample collection to ensure that water sampled is representative of the formation. Traditional groundwater sampling methods required removal of multiple casing volumes of water, resulting in large quantities of water requiring disposal and increasing the potential for volatilization of organic compounds due to a high pump rate. The agitation from this removal could increase turbidity as well.

Low-flow purging and sampling methods were developed to minimize purge water volume and reduce the potential for contaminant volatilization. Low-flow techniques have become the industry standard for collecting a groundwater sample because the method minimizes turbidity and produces a more representative groundwater sample. Although it is preferable to use pumps dedicated to specific wells, low-flow techniques can be achieved with a portable pump.

The procedures in this Standard Operating Procedure (SOP) are specific to standard monitoring wells with a single-slotted interval. This SOP is generally acceptable for use with temporary borings.

2.0 EQUIPMENT LIST

1. Well lock keys
2. Groundwater Sampling Field Form
3. Electronic water level probe
4. Interface probe (if dense or light non-aqueous phase liquids are [DNAPL or LNAPL] is present)
5. Knife or scissors
6. Decontamination equipment
7. Site map and health and safety plan
8. Personal Protection Equipment (PPE) appropriate for the site
9. Submersible pump or peristaltic pump and associated equipment
10. Compressed gas source (Nitrogen or air compressor), battery source, or generator and fuel
11. Control box
12. Disposable tubing, if necessary
13. Field water quality monitoring equipment
14. Buckets or containers for purge water and drum labels
15. Sample containers, labels, packaging material

3.0 PROCEDURE

Low-flow techniques rely on stabilization of field water quality parameters to determine when groundwater is representative of aquifer conditions. Measurement of groundwater quality

parameters occurs in a closed system in which groundwater does not come in contact with open air; dissolved oxygen (DO), oxygen-reduction potential (ORP), and pH measurements are sensitive to reactions with the atmosphere. A flow-through cell (flow cell) serves as this closed system and is used to measure field parameters prior to collecting groundwater samples. Stabilization of selected parameters indicated that conditions are suitable for sampling to begin.

This method requires care when placing a portable pump and/or tubing in the well to minimize disturbance to the water column. Low-flow purge and sample methods call for low pumping rates (0.1 to 0.5 liter/minute) to reduce drawdown. A drawdown of less than 0.3 feet in the water column, once the pumping rate has stabilized, is desirable; however depending on the lithology, this is not always possible. At a minimum, the depth-to-water should be stabilized for three consecutive readings taken between 3 to 5 minutes apart (in conjunction with the stabilization of the other parameters).

For monitoring wells, sampling should proceed as follows:

1. Note the general condition of the well. Check well for security damage or evidence of tampering and record pertinent observations. Note any maintenance tasks that should be completed, such as well cap or padlock replacement.
2. Open the well and wait a minimum of five minutes for water levels to approach an equilibrium state with atmospheric pressure before taking any measurements.
3. Measure the depth to water relative to the marking on the well casing. If there is no mark, use the north side of the casing. Record the water level on the field form. Note if DNAPL or LNAPL is present.
4. If using a portable pump setup, slowly lower the pump or tubing to the midpoint of the screen or sample interval. Secure the pump or tubing to prevent it from moving. Skip this step if using dedicated pumps.
5. Hook up the control box, compressor or nitrogen tank with regulator, or peristaltic pump, and flow cell with field water quality monitoring equipment. Put the water level probe in the well so water levels can be measured as you are pumping. Start the pump and adjust the pumping rate to between 0.1 and 0.5 liters per minute (using a measuring cup to calculate the flow rate). Begin recording readings on the field sheet. Be sure to purge the amount of water in tubing before taking readings or a sample. Monitor water levels as well as groundwater parameters.
6. During purging, take readings every 3 to 5 minutes. Record readings on the field form. Purging is considered complete when the groundwater parameters have stabilized for three consecutive readings.

Field Parameter	**Stabilization Goal**
Temperature	+/- 3%
Specific conductance	+/- 3% mS/cm
pH	+/- 0.1 pH units
DO	+/- 10% *or* +/- 0.3 mg/L
ORP	+/- 10 millivolts
Depth to Water	+/1 0.3 feet

7. Measure turbidity of the sample water using field instruments prior to sample collection and upon any obvious visual changes in turbidity during sample collection.
8. The water sample must be collected before the water passes through the flow cell. Disconnect the tubing from the flow cell and directly fill the sample containers. If you are

collecting samples for volatile organic compound (VOC) analysis, you may need to decrease the pump rate; if this is the case, other samples should be collected first. Fill unpreserved bottles first. Filtered samples should be collected after all other samples have been collected.

9. Groundwater samples for dissolved metals analyses can be field filtered with a 0.45 micron filter directly connected to the tubing. Mark “field filtered” or “FF” on the bottle label, field form, and chain of custody.
10. Prior to filling or just after filling, label each bottle and make sure it is properly sealed. Place in a cooler with ice and pack for transportation.
11. As necessary, pull pump and discard tubing. Decontaminate the pump based on the SOP for the site.
12. Close and lock the well.
13. Make sure all information is completed on the groundwater field form and sign and date it.
14. Dispose of all purge and decontamination water in the appropriate containers.

For temporary borings, the goal of minimizing the drawdown may not be obtainable for the following reasons:

- The narrow temporary casing (often 1-inch PVC) can prevent monitoring groundwater level measurements (insufficient room in the temporary casing to install a water level meter)
- Excessive fines (silt and clay) may be present in the temporary screened interval because the boring has not been developed in the manner of a constructed monitoring well.
- Excessive suspended sediment in the water column may prevent a peristaltic pump from operating at a low flow rate (the peristaltic pump often quits working at very low flow rates).

For these reasons, temporary borings should be sampled by utilizing the lowest flow rate possible and monitoring field parameters as indicated above to indicate when sampling is appropriate. All other procedural steps should be completed as appropriate to a temporary boring scenario.

References:

Puls, R.W. and M.J. Barcelona, 1996, GROUNDWATER ISSUE PAPER: Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures; U.S. Environmental Protection Agency, EPA/540/S-95/504.

Yeskis, D. and Bernard Zavala, GROUNDWATER ISSUE PAPER: Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers, U.S. Environmental Protection Agency, EPA 542-S-02-001, May 2002