DEPARTMENT OF
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State of Washington

Quality Assurance Project Plan

Yakima Railroad Area
Groundwater Performance Monitoring

August 2013

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Publication Information

Each study conducted by the Washington State Department of Ecology must have an approved Quality Assurance Project Plan. The plan describes the objectives of the study and the procedures to be followed to achieve those objectives. After completing the study, Ecology will post the final report of the study to the Internet.

The plan for this study is available on the Department of Ecology's website at www.ecy.wa.gov/biblio/1303113.html.

Data for this project will be available on Ecology's Environmental Information Management (EIM) website at www.ecy.wa.gov/eim/index.htm. Search User Study ID, YRRA.

Ecology's Activity Tracker Code for this study is 12-049.

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Quality Assurance Project Plan

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CRO: Central Regional Office
EAP: Environmental Assessment Program
EIM: Environmental Information Management database

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Abstract

In the 1980s, during routine inspections of industrial facilities, an Environmental Protection Agency contractor discovered tetrachloroethene (PCE)-contaminated soils and groundwater in the Yakima area. During subsequent investigations, the Washington State Department of Ecology (Ecology) identified 13 facilities as potential sources of PCE. Ecology defined the affected area as the Yakima Railroad Area (YRRA) in 1991. The YRRA is approximately six square miles of predominantly industrial/commercial property adjacent to the railroad corridor and residential property in the cities of Yakima and Union Gap.

The 1998 remedial investigation concluded that there did not appear to be a region-wide PCE groundwater plume within the YRRA. Rather, PCE concentrations in the shallow groundwater were localized near areas of known PCE releases. However, there is evidence that PCE is present in the aquifer beneath areas of no known source of contamination.

The goal of this project is to produce data on groundwater quality sufficient for decision making under the Model Toxics Control Act (MTCA). The data will be used by Ecology's Toxics Cleanup Program to monitor the effectiveness of previous remedial actions and identify areas of contamination that require further action within the YRRA. Groundwater samples will be collected semi-annually for volatile organic analysis from 36 of the 59 monitoring wells that are in Ecology's long-term monitoring program. This subset of wells will provide monitoring points to evaluate groundwater conditions throughout the project area.

Background

The Yakima Railroad Area (YRRA) is approximately six square miles of mixed industrial/commercial and residential properties located adjacent to the railroad corridor in parts of the cities of Yakima and Union Gap (Figure 1). Groundwater within the project area is contaminated with tetrachloroethene (PCE) that is attributed to numerous sources within the project boundaries.

During routine inspections of industrial facilities in the 1980s, a contractor to the U.S. Environmental Protection Agency (EPA) discovered PCE-contaminated soil and groundwater in the Yakima area (E&E, 1989). EPA referred its findings to the State of Washington. After numerous investigations the Washington State Department of Ecology (Ecology) defined the potentially affected area as the "Yakima Railroad Area" in 1991. Over the years, Ecology identified 13 commercial or industrial facilities as potential sources of PCE to groundwater within the YRRA (Figure 1).

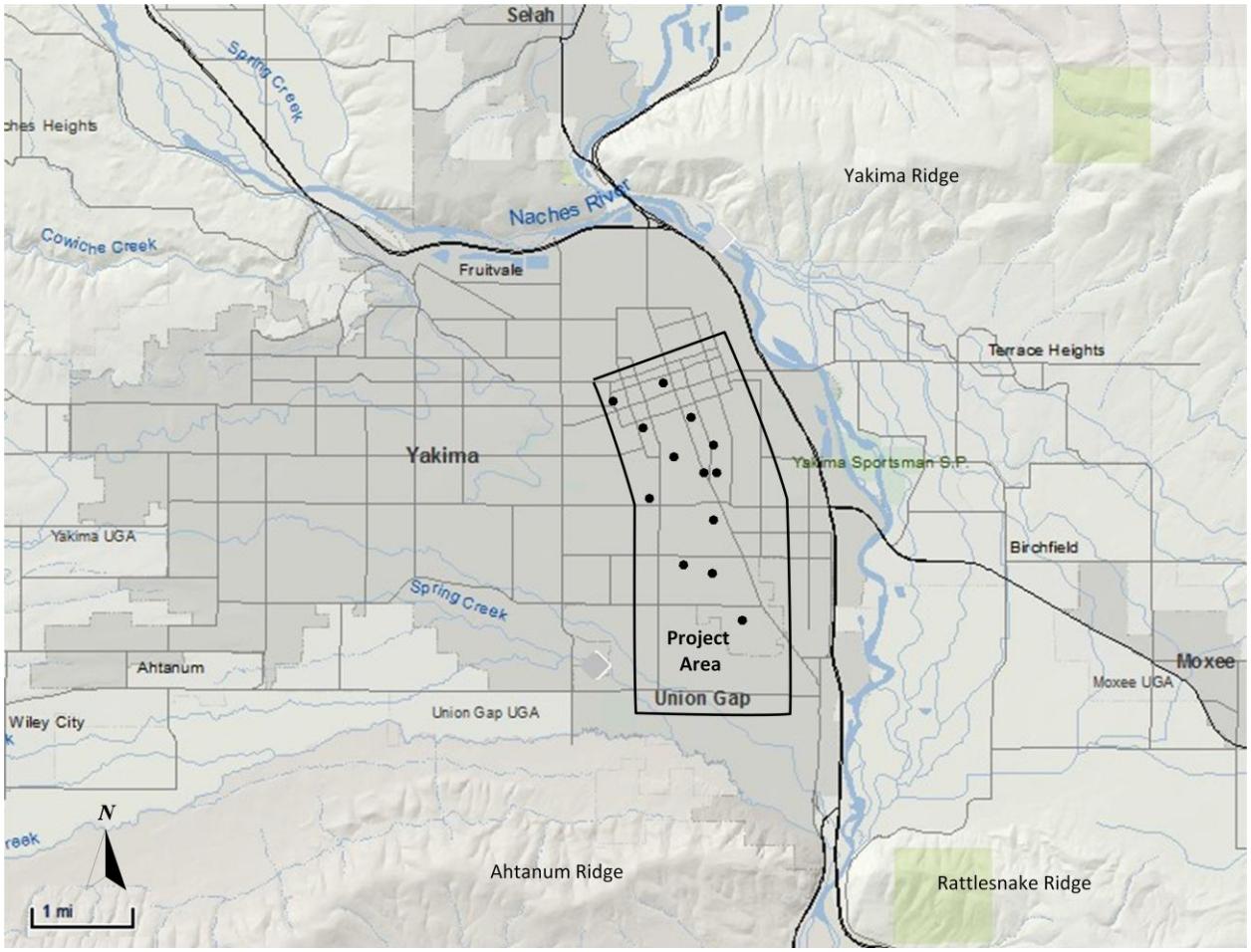

Figure 1. Yakima Railroad Area Project Location Map, Yakima, WA.

A remedial investigation (RI), completed in 1998, concluded that there did not appear to be a region-wide PCE groundwater plume within the YRRA (Secor, 1998). The most recent monitoring results indicate that the highest PCE concentrations continue to be found in the near vicinity of known source areas, but there is evidence that PCE is present in the aquifer beneath areas with no known source of contamination.

Numerous monitoring wells have been installed within the YRRA. Fifty-nine of these wells have been sampled routinely as part of an on-going monitoring program to characterize PCE groundwater concentrations. A representative subset of these wells and PCE concentrations from October 2012 is presented in Figure 2. Ecology has selected a subset of 36 wells for continued monitoring. Ecology excluded wells for further monitoring if they were not located within the property boundary of a known source area, and if they consistently showed low or no detections for chlorinated volatile organic compounds (cVOCs). RI wells installed up-gradient of the YRRA typically have non-detectable quantities of cVOCs. Downgradient RI wells at the southern boundary of the YRRA were retained.

Study Area

Water Resource Inventory Area (WRIA) and 8-digit Hydrologic Unit Code (HUC) numbers for the study area

The Water Resource Inventory Area (WRIA) of this study is 37. The Hydrologic Unit Code (HUC) number is 17030003.

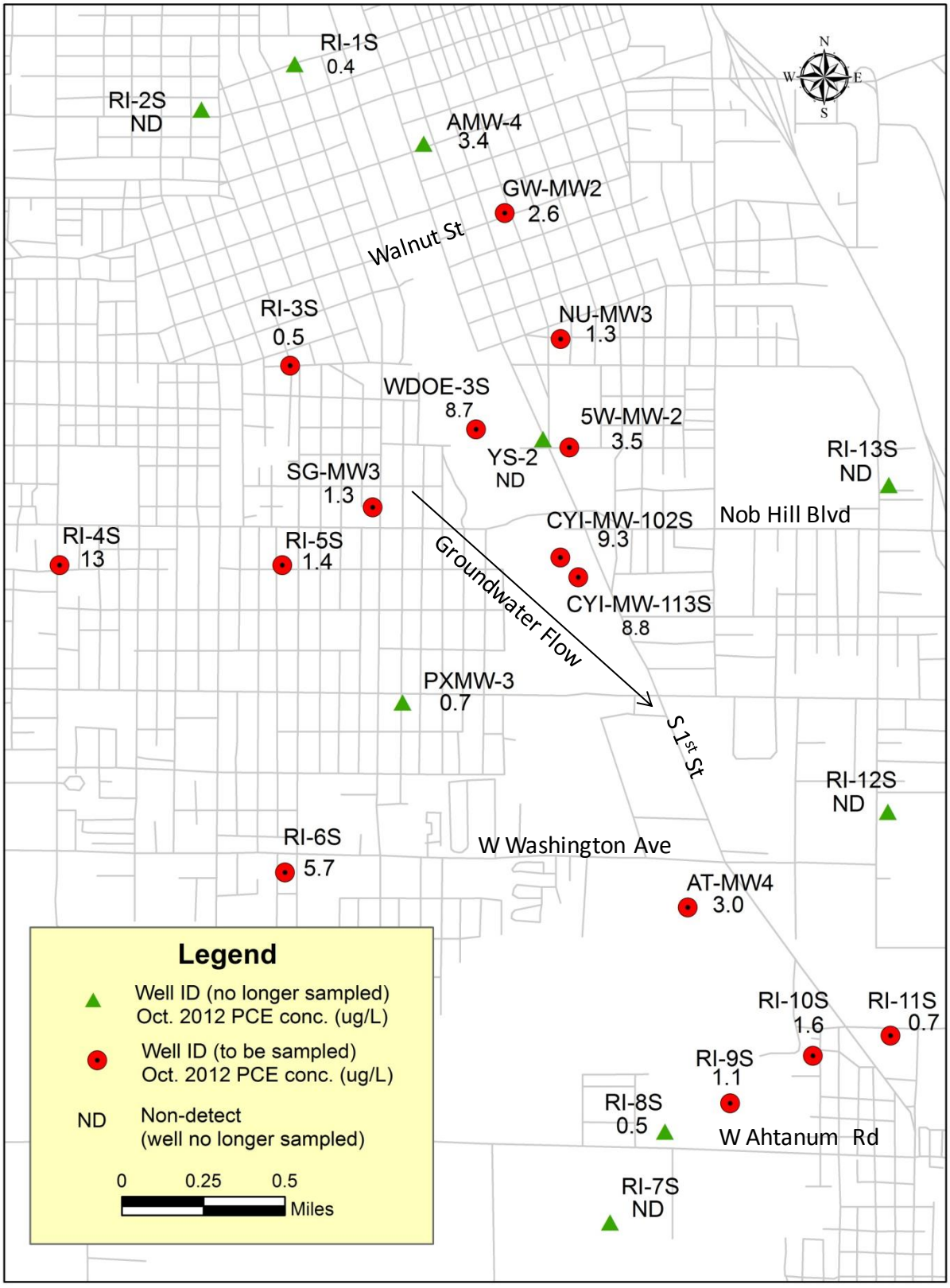

Figure 2. Yakima Railroad Area - Select PCE Concentration (ug/L), October 2012.

Physical Setting

The YRRA is located west of the Yakima River, within the floodplain of the Yakima River and the eastern portion of Yakima West Valley. The Yakima West Valley lies within a broad syncline bounded by the east-west trending anticline ridges of the Yakima fold belt. These ridges include the Yakima Ridge to the north and the Ahtanum and Rattlesnake Ridges to the south. The Yakima River bisects these folded uplands at Selah Gap and Union Gap, respectively (Figure 1). (USGS, 2009).

The YRRA site is underlain in some areas by manmade fill material and deposits of sand and gravel. Fill material was placed along the valley bottom during the construction of the railways and other development. The fill material, which is present from the surface to depths as low as 20 feet, typically consists of reworked sands and gravels, but it may also include debris, organic soil, or fine-grained materials.

Alluvial and terrace deposit sands and gravels underlie the fill material. The alluvium consists of unconsolidated silts, sands, gravels, and cobbles deposited by rivers and streams. It can extend to a depth of 90 feet but, on average, is 30 feet. The terrace deposits consist of coarse-grained gravels deposited by high-energy streams associated with glacial retreats and advances with discontinuous layers of silts, clays, sands, or cemented gravels. The gravels occur at the surface in some areas and extend to depths as low as 350 feet. (USGS, 2009)

The valley gravels are underlain by the Upper Ellensburg Formation, pyroclastic and sedimentary deposits that interfinger with the Columbia River Basalt Group. The Ellensburg Formation ranges in depth from 0 to up to 1800 feet below ground surface (bgs). The Ellensburg Formation is underlain by the Columbia River basalt group in the vicinity of the YRRA.

Regional hydrogeology of the Yakima area consists of three distinct aquifer systems that extend to depths greater than 1500 feet (USGS, 2009):

- The uppermost aquifer consisting of unconfined, relatively uninterrupted sand and gravel to depths of 350 feet bgs.
- An intermediate lower aquifer consisting of confined coarse-grained interbeds in the Upper Ellensburg Formation to depths of over a 1000 feet bgs.
- The lower-most aquifer system consisting of confined interflow zones in the Columbia River Basalt Formation to depths of 5000 feet bgs.

Work in the YRRA site focuses on the upper portion of the shallow unconfined aquifer in the sands and gravels. The unit is highly permeable in the vicinity of the Yakima River. However, the content of fine-grained material and cemented gravels are more present to the north and west, resulting in zones of decreased permeability. For this reason both shallow and deep water bearing zones were identified for the project area in the RI/FS (Secor, 1998). The shallow and deep water-bearing zones appear to be hydraulically separate in the northern portion of the YRRA and interconnected in the southern portion of the project area.

Groundwater within the YRRA is encountered from about 3 to 30 feet below the ground surface, depending on the topography and seasonal irrigation practices. In general, the depth to groundwater is greatest in the north and least in the southern part of the YRRA. The Yakima Valley is heavily irrigated from May to October. Because of this, the upper unconfined water table is typically deeper in the spring before the start of the irrigation season and shallower in the summer and fall. Groundwater levels fluctuate seasonally from less than 1 foot to greater than 12 feet.

Direction of groundwater flow in the shallow water-bearing zone is to the southeast with an approximate gradient 0.005 feet per foot across the YRRA. The estimated direction of groundwater flow in the deep water-bearing zone is to the east-southeast in the northern portion of the study area and southeast in the southern portion of the study area, with an approximate gradient of 0.004 feet per foot across the site. Overall, the vertical gradient across the project area is downward. The downward gradients between the shallow and deep water-bearing zones ranged from -0.278 feet per foot in the northern portion of the project area to -0.005 feet per foot in the southern portion of the project area. (Secor, 1998)

Project Description

The goal of this project is to produce groundwater quality data sufficient for making decisions under the Model Toxics Control Act (MTCA). The data will be used by Ecology's Toxics Cleanup Program to monitor the effectiveness of previous remedial actions at the identified source areas within the Yakima Railroad Area. The data may also be used to identify areas of contamination that require further investigation and action within the YRRA.

The technical objectives of the project include:

- Collect groundwater samples and water level measurements from 36 of the 59 monitoring wells associated with the long-term monitoring program of the Yakima Railroad Area sites. Samples will be collected semi-annually (spring/fall) for the target analytes of tetrachloroethene (PCE) and its by-products.
- Prepare an annual technical report at the completion of the fall sample event which will include:
    - Maps of the study area showing sample sites, water levels in monitoring wells, groundwater flow direction, and contaminant concentrations and distribution.
    - Discussion of water quality results.
    - Comparison of results to the Washington State MTCA cleanup standards for the constituents of concern.
    - Significant or potentially significant findings.
- Load analytical data into Ecology's Environmental Information Management (EIM) system.

Organization, Schedule and Analytical Costs

Table 1 lists the people involved in this project. All are employees of the Washington State Department of Ecology.

Table 1. Organization of Project Staff and Responsibilities.

Staff (all are EAP except client)	Title	Responsibilities
Jason Shira Toxics Cleanup Program Central Regional Office Phone: 509-454-7834	EAP Client	Clarifies scope of the project. Provides internal review of the QAPP and approves the final QAPP.
Pam Marti GFF Unit Statewide Coordination Section Phone: 360-407-6768	Project Manager	Writes the QAPP. Oversees field sampling and transportation of samples to the laboratory. Conducts QA review of data, analyzes and interprets data, and enters data into EIM. Writes the draft report and final report.
Martha Maggi GFF Unit Statewide Coordination Section Phone: 360-407-6453	Unit Supervisor for the Project Manager	Provides internal review of the QAPP, approves the budget, and approves the final QAPP.
Will Kendra Statewide Coordination Section Phone: 360-407-6698	Section Manager for the Project Manager	Reviews the project scope and budget, tracks progress, reviews the draft QAPP, and approves the final QAPP.
Tom Mackie Eastern Operations Section Phone: 509-454-4244	Section Manager for the Study Area	Reviews the project scope and budget, tracks progress, reviews the draft QAPP, and approves the final QAPP.
Joel Bird Manchester Environmental Laboratory Phone: 360-871-8801	Director	Approves the final QAPP.
William R. Kammin Phone: 360-407-6964	Ecology Quality Assurance Officer	Reviews the draft QAPP and approves the final QAPP.

EAP: Environmental Assessment Program
GFF: Groundwater/Forest and Fish
EIM: Environmental Information Management database
QAPP: Quality Assurance Project Plan.

Table 2 shows the proposed timeline for the work to be completed annually on this project.

Table 2. Proposed Schedule for Completing Field and Laboratory Work, Data Entry into EIM, and Reports.

Field and laboratory work	Due date	Lead staff
Field work completed	October annual	Pam Marti
Laboratory analyses completed	December annual	
Environmental Information System (EIM) database		
EIM user study ID	YRRA	
Product	Due date	Lead staff
EIM data loaded	March annual	Pam Marti
EIM quality assurance	April annual	Pam Marti
EIM complete	May annual	Pam Marti
Annual report		
Author lead / Support staff	Pam Marti	
Schedule		
Draft due to supervisor	February annual	
Draft due to client/peer reviewer	March annual	
Final (all reviews done) due to publications coordinator	April annual	
Final report due on web	May annual	

Table 3 presents the estimated analytical costs for one year of semi-annual sampling on this project. Ecology's Manchester Environmental Laboratory (MEL) will analyze all the samples.

Table 3. Project Analytical Costs.

Parameter	Number of Samples [1]			Cost per Sample [2]	Cost per Event
	Field	QC	Total		
cVOCs (May 2013)	36	7	43	$163	$7009
cVOCs (October 2013)	36	7	43	$163	$7009
Total Project Cost					$14,018

[1] Assumes 36 monitoring wells, 4 duplicate and 3 quality assurance samples for each sample event.
[2] Assumes MEL *planned* price (50% discount).
cVOCs: chlorinated volatile organic compounds

Quality Objectives

The data quality objectives for this project include:

- Produce groundwater quality data that are representative of in-situ groundwater conditions.
- Minimize bias introduced into the sampling results by using standard sampling and analytical procedures.
- Detect cVOCs concentrations in groundwater at levels at or below state regulatory criteria. The MTCA Method A cleanup level for tetrachloroethene is 5 ug/L.

Variations in groundwater chemistry can occur due to natural environmental heterogeneity, as well as alterations caused by the sampling or analytical procedures. For this project to succeed, the precision (random error) and bias (systematic error) introduced into the sample results by the field or laboratory procedures must be minimized to reveal variability in concentrations between samples. Standard procedures and quality control testing will be used during the project to reduce these sources of data error.

The precision and bias routinely obtained by MEL for the selected analytical methods will meet the measurement quality objectives (MQOs) for this project. Table 4 lists the MQOs for assessing project data quality.

Table 4. Laboratory Analyte Measurement Quality Objectives.

Parameter	LCS% Recovery Limits	Laboratory Replicates (RPD)	Matrix Spikes% Recoveries	Matrix Spikes Duplicates (RPD)	Required Reporting Limit[1]
cVOCs	30-174%	30%	30-174%	30%	1-5 ug/L

LCS: Laboratory Control Standard
RPD: Relative Percent Difference
[1] RL may vary depending on dilutions, matrix interference, etc.

These goals are based on performance characteristics of measurements done by the Manchester Environmental Laboratory. Analytical and field quality control samples are discussed in the Quality Control Procedures section below.

Sampling Design and Field Procedures

Ecology staff will sample 36 of the 59 monitoring wells remaining in the Yakima Railroad Area long-term monitoring program. Wells to be sampled are located at Fifth Wheel Truck Repair/Hahn Motors, Goodwill Industries, Nu-Way Cleaners, Southgate Laundry, Washington Central Railroad Roundhouse, Agri-Tech/Yakima Steel, and Cameron Yakima. Wells at these locations continue to be monitored to evaluate the effectiveness of remedial actions taken at these source areas. A selection of additional remedial investigation (RI) wells spread throughout the project area will also continue to be monitored. These wells are not associated with any known source areas. Data collected from these wells may be used to identify areas of contamination that require further investigation and action within the YRRA (Figure 3).

Specific well locations and characteristics are listed in Table 5 and shown in Appendix A.

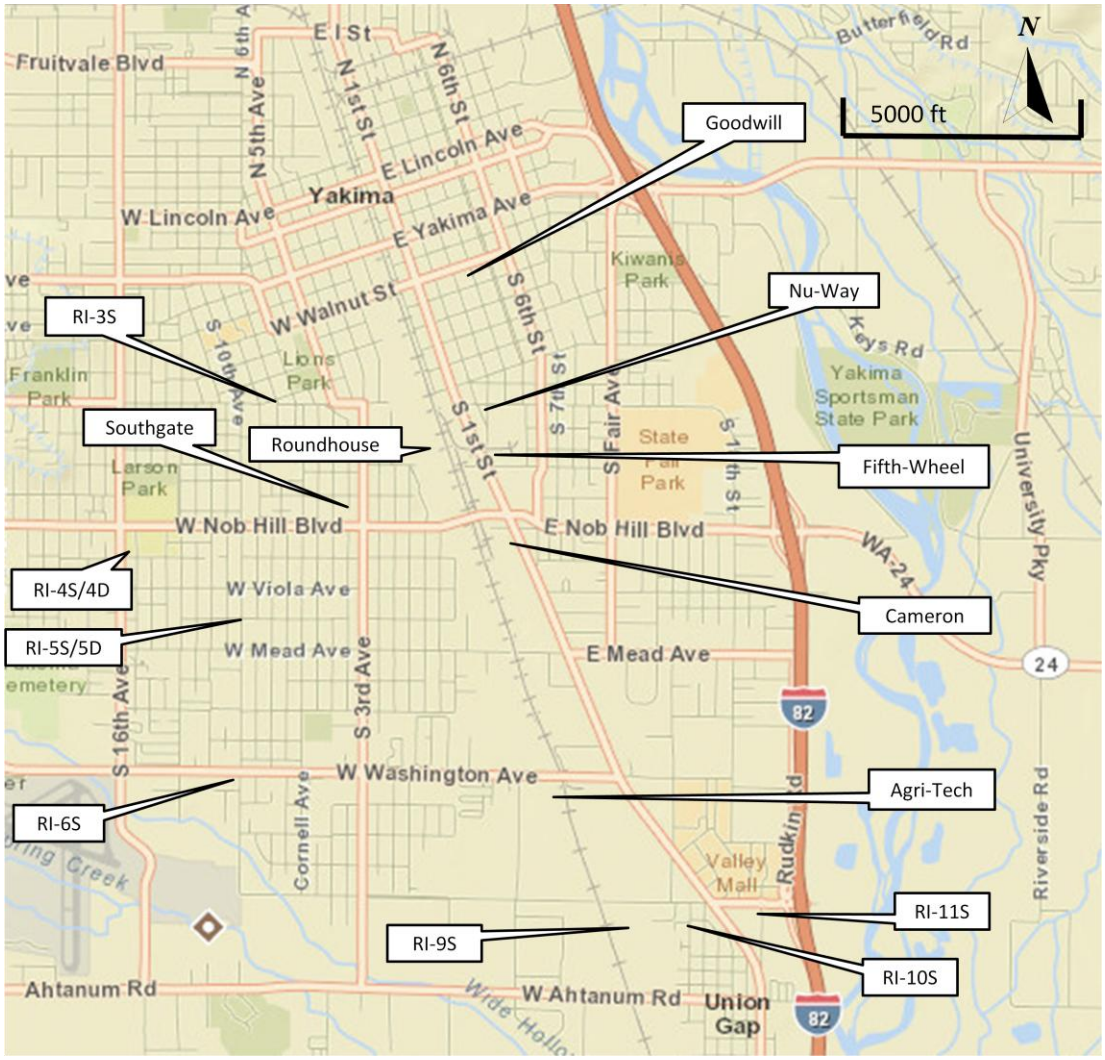

Figure 3. Yakima Railroad Area Sample Location Map.

Table 5. Monitoring Well Description.

Well Identification	Location	Well Dia. (In)	Screen Interval (feet bgs)	Total Depth (feet)	Water Level (feet)	PCE Concentrations 2008-2012	
						Max.	Min.
5W-MW2	Fifth Wheel Truck Repair	2	15-35	33.6	14-21	7.5	1.1
AT-MW4	Agri-Tech\ Yakima Steel	2	--	26.2	3-8	6.1	3
GW-MW1	Goodwill – City of Yakima	2	13-23	31	15-19	8.7	1
GW-MW2		2	13-23	28.7	14-19	11	1.1
GW-MW4		2		31	15-20	2.6	1.2
NU-MW1	Nu-Way Cleaners	2	--	24.10	13-21	5.5	0.38
NU-MW2		2	--	23.60	14-22	4	0.2 U
NU-MW3		2	--	23.80	13-22	4.8	0.24
SG-MW1	Southgate Laundry	2	15-45	44.7	20-35	0.31	0.2 U
SG-MW2		2	15-45	44.2	21-36	4.5	0.31
SG-MW3		2	15-45	45	19-34	3.4	1.3
WDOE-3S	Washington Central Railroad Roundhouse	2	--	29.9	22-29	130	7.9
WDOE-3I		2	--	58.5	22-33	34	0.13
WDOE-3D		2	--	100	24-32	30	6.3
CYI-MW-102S	Cameron Yakima Inc.	2	--	30	13-19	11	5.1
CYI-MW-103S		2	--	29.5	13-19	12	3.6
CYI-MW-103D		2	--	61	14-21	4.8	1.9
CYI-MW-106S		2	--	29.2	14-21	9.3	2.9
CYI-MW-107S		2	10-30	29.3	16-23	8.7	2.4
CYI-MW-108S		2	10-30	24	14-21	5.8	0.2 U
CYI-MW-109S		2	10-30	29	12-19	4.2	0.29
CYI-MW-110S		2	10-30	29	11-18	5.8	0.59
CYI-MW-111S		2	10-30	31	12-19	5.5	0.43
CYI-MW-112S		2	10-30	29	12-18	8.5	1.8
CYI-MW-113S		2	11-31	30	11-18	14	1.7
CYI-MW-113D		2	50-60	60	13-19	6.1	2.7
CYI-MW-114S		2	10-30	30.68	11-17	13	3.4
RI-3S	Remedial Well	2	33-48	47.2	24-39	2.5	0.2 U
RI-4S		6	20-35	32.5	8-15	25	11
RI-4D		6	106-116	120.1	8-14	2.1	0.64
RI-5S		2	24-39	38.4	11-20	2.4	1.3
RI-5D		2	109-119	120.3	17-28	1.7	0.48
RI-6S		2	24-39	38.9	7-10	6.9	2.7
RI-9S		2	15-30	28.8	4-7	1.9	0.97
RI-10S		2	20-35	33.3	8-10	2	1.3
RI-11S		2	24-39	38.1	12-14	1.3	0.43

Groundwater samples for chlorinated hydrocarbons will be collected semi-annually in the spring and fall to coincide with the low and high water seasons and to capture seasonal variation in cVOCs concentrations.

Most of the monitoring wells to be sampled are associated with seven identified source areas and have been installed between 1989 and 1998. The RI wells were installed in 1997. All but 2 wells are constructed of 2-inch PVC. Most of the wells to be sampled are completed in the shallow water-bearing zone of the sands and gravels and range in depth from 24 to 45 feet. The deep wells range in depth 58 to 120 feet.

Static water levels will be measured in all the monitoring wells before sampling. Measurements will be collected according to the standard operating procedure (SOP) EAP052 (Marti, 2009).

Wells will generally be sampled in order of the historically lowest concentration of contaminants to the highest. Sample order will be based on previous sample results (Table 5).

Monitoring wells will be purged and sampled using a stainless steel bladder pump, at a rate of less than 0.5 liter per minute. The wells will be purged through a continuous flow cell where pH, temperature, specific conductance, and dissolved oxygen will be monitored and recorded at regular intervals. Purging will continue until field parameter readings stabilize as shown in Table 6.

Table 6. Well Purging Criteria.

Purge Parameters	Stabilization Criteria
pH	±0.1 standard unit
Temperature	±0.1 ^{o}C
Specific Conductance	±10 umhos/cm for values <1000 umhos/cm
	±20 umhos/cm for values >1000 umhos/cm
Dissolved Oxygen	±0.05 mg/L for values < 1 mg/L
	±0.2 mg/L for values > 1 mg/L
Or	
All parameters	< ±10% change over 3 consecutive readings at 3 minute intervals

Samples will be collected from each well at the completion of purging. The flow cell will be disconnected and the samples collected directly from the pump's discharge tubing into appropriate sample containers (Table 7).

Table 7. Sample Containers and Preservation.

Parameter	Matrix	Minimum Quantity Required	Container	Preservative
cVOCs	Groundwater	40 mL No headspace	Three 40 mL vials with Teflon-lined septa caps	Preserve to pH < 2 with 1:1 HCl. Cool to ≤6°C

Field personnel will wear nitrile gloves while handling the samples throughout the sample collection process. Care will be taken not to contaminate the samples with extraneous material.

Filled sample bottles will be labeled with a unique sample number obtained from Manchester Environmental Laboratory, placed in plastic bags, and then stored in ice-filled coolers. Samples will be transported to Ecology's Operation Center in Lacey, Washington. Samples will be kept in the walk-in cooler until picked up by the laboratory courier and transported to the MEL in Manchester, Washington. Chain-of-custody procedures will be followed according to Manchester Laboratory protocol (Ecology, 2008).

Field activities will be recorded on field datasheets.

Sample equipment that will be used at more than one well, such as the water level probe and bladder pump, will be decontaminated between sample locations. The water level probe will either be rinsed with deionized water or washed in a laboratory-grade detergent followed by a tap water and deionized water rinse. The bladder pump will be disassembled and washed in a laboratory-grade detergent, followed by a tap water and deionized water rinse. Pump tubing will be dedicated to each well and not reused.

Purge water will be collected and disposed of in accordance with WAC 173-303.

Laboratory Procedures

MEL will analyze all the groundwater samples. They will use standard methods and reporting limits for analysis of all the groundwater samples as shown in Table 8. MEL performs the requested analysis on a routine basis; therefore, no problems with the laboratory methods are expected. Should any problems arise, the project manager will be contacted and appropriate adjustments will be made.

Table 8. Laboratory Analytical Methods

Laboratory Analysis	Method	Reference	Reporting Limit[1]	Holding Time
cVOCs	EPA SW-846 Method 8260	EPA 1996	1-5 ug/L	14 days - preserved

EPA: U.S. Environmental Protection Agency
[1] RL may vary depending on dilutions, matrix interference, etc.

Previous samples collected at this site were analyzed using the same methods. Therefore, data collected for this project should be compatible and comparable to past data.

Quality Control Procedures

Field

Field quality control will be maintained through the use of standard operating procedures for sample collection, handling, and documentation as described in Ecology's SOP EAP078 (Marti, 2011). Any problems that occur during the sample process will be recorded in the field notebook or field datasheets.

Field quality control will also consist of collecting and analyzing field duplicate samples. Field duplicates are two samples collected at the same time and place. Duplicate results provide an estimate of the total random variability (precision) of individual results. Three to four field duplicates will be collected during each sampling event. Field duplicates will be collected from monitoring wells that represent the possible range of contaminant concentrations. The duplicate samples will be collected by filling two sets of bottles at the selected well at the same time. The relative percent difference (RPD) will be calculated for each duplicate set and will be used to estimate overall precision.

An equipment blank will be collected from the bladder pump during each sample event following pump decontamination procedures. The blank will be collected by pumping reagent grade water (supplied by MEL) through the sample equipment. The blank may indicate contamination of the sample equipment, sample containers, cross-contamination during shipment, storage, or laboratory contamination.

Laboratory

Routine quality control procedures will be sufficient to demonstrate that the MQOs for this project have been met. Laboratory quality control tests consist of method blanks, matrix spikes, surrogate recoveries, as wells as duplicate and check standards (lab control standards). Surrogate recoveries will be used to judge the accuracy for analysis of similar target analytes. Analytical precision can be estimated from duplicate and check standards, duplicate sample analysis, and duplicate spiked sample analyses. Analytical bias will be estimated from matrix spikes, matrix spike duplicates, and check standards. Recoveries from check standards provide an estimate of bias due to calibration. Mean percent recoveries of spiked sample analyses provide an estimate of bias due to interference. Results of quality control analyses will be reported in the same units as expressed for the MQOs. Laboratory staff will conduct quality assurance review of all analytical data generated at MEL prior to releasing the data to the project lead.

Data Review and Verification

At the completion of each sampling event, all field data and laboratory analytical data will be compiled and evaluated against the project MQOs.

Field methods and forms will be reviewed to assure consistency. Field datasheets will be checked for missing or improbable measurements before leaving each site. Field data entered into spreadsheets or databases will be checked against the field datasheets for errors or omissions. Missing or unusual field parameter data will be omitted from the data set.

Field duplicate variability will be evaluated by calculating the relative percent difference (RPD) for each duplicate set of samples and compared to the quality objectives listed in Table 4.

Laboratory-generated data review and reporting will follow the procedures outlined in MEL's *Lab Users Manual* (Ecology 2008). Lab results will be checked for missing or questionable data. Individual data which fails to achieve QA/QC objectives will be flagged with appropriate qualifiers and their use restricted as appropriate. A standard case narrative of laboratory QA/QC results will be sent to the project manager for each sampling event.

If the data review and verification suggests widespread problems with QA/QC for a sample event, the sample event or individual sample may be repeated at the discretion of the project client and manager.

Data Management Procedures

All field and laboratory data will be entered and stored in Ecology's Environmental Information Management database (EIM) once it has been reviewed and verified. Once all the data has been entered into EIM, a designated EAP staff member will independently review 10% of the project data for possible errors. If significant data entry errors are discovered, a more intensive review will be undertaken.

All project data will be entered under the existing EIM user study ID: YRRA. All monitoring data will be available via the Internet once the project data have been validated. The URL address for the database is: http://www.ecy.wa.gov/eim/groundwater.htm

All paper and electronic files created for this project will be kept with the project data files according to EAPs record retention schedule.

Data Reporting

Once the data have been reviewed, verified, and validated, the project manager will determine if the data can be used toward the project goals and objectives. A technical report will be prepared at the completion of all sampling and will include the following:

- Maps of the study area showing sample sites, water levels, groundwater flow direction, contaminant concentrations and distribution.
- Description of field and laboratory methods.
- Discussion of data quality and the significance of any problems encountered.
- Summary tables of field and analytical data.
- Discussion of water quality results. Comparison of results to the cleanup standards for the constituents of concern.
- Significant or potentially significant findings.
- Recommendations based on project goals.

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Appendices

Appendix A. Project Well Locations

Figure A-1. Goodwill Industries Well Locations.

Figure A-2. Nu-Way Cleaners Well Locations.

Figure A-3. Southgate Laundry Well Locations.

Figure A-4. Washington Central Railroad Roundhouse and Fifth Wheel Truck Repair/Hahn Motors Well Locations.

Figure A-5. Cameron Yakima Well Locations.

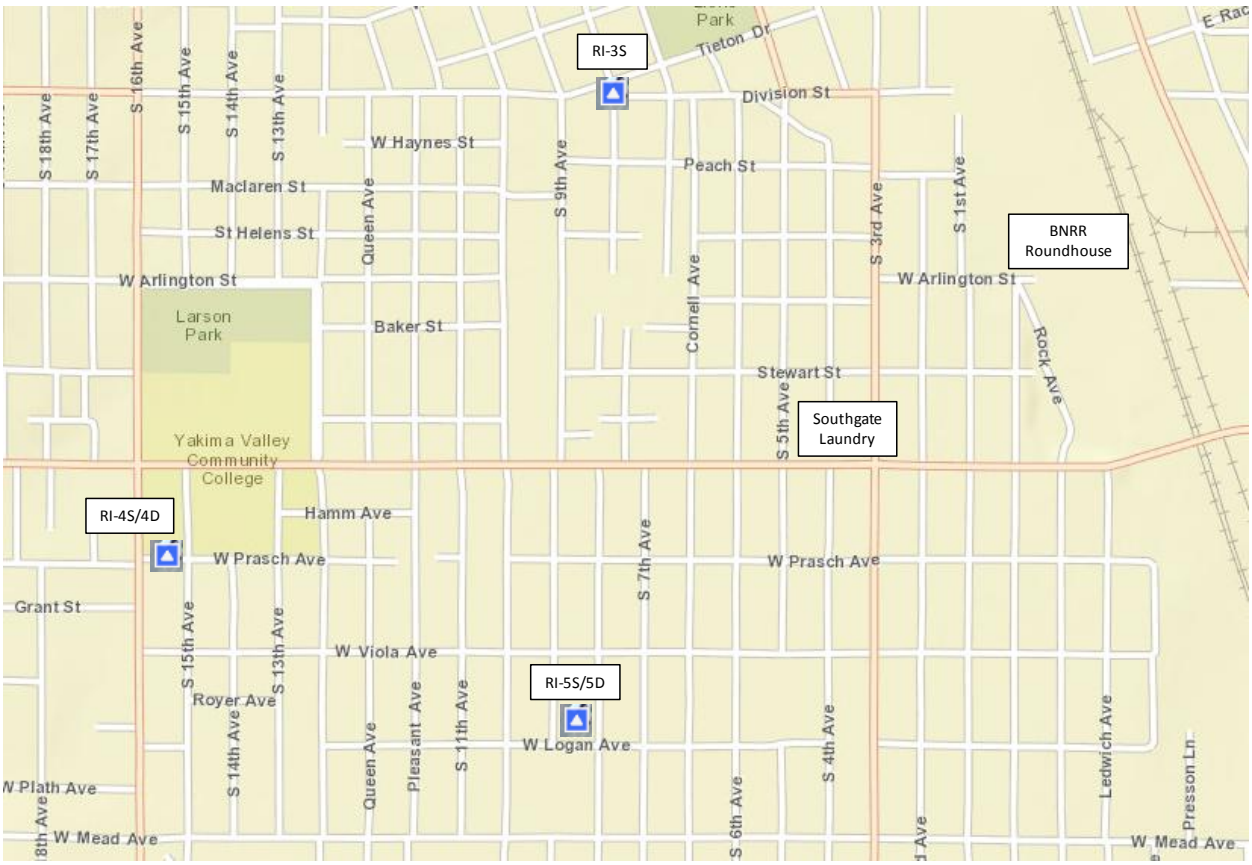


Figure A-6. Remedial Investigation Wells RI-3S, RI-4S/4D and RI-5S/5D Locations.

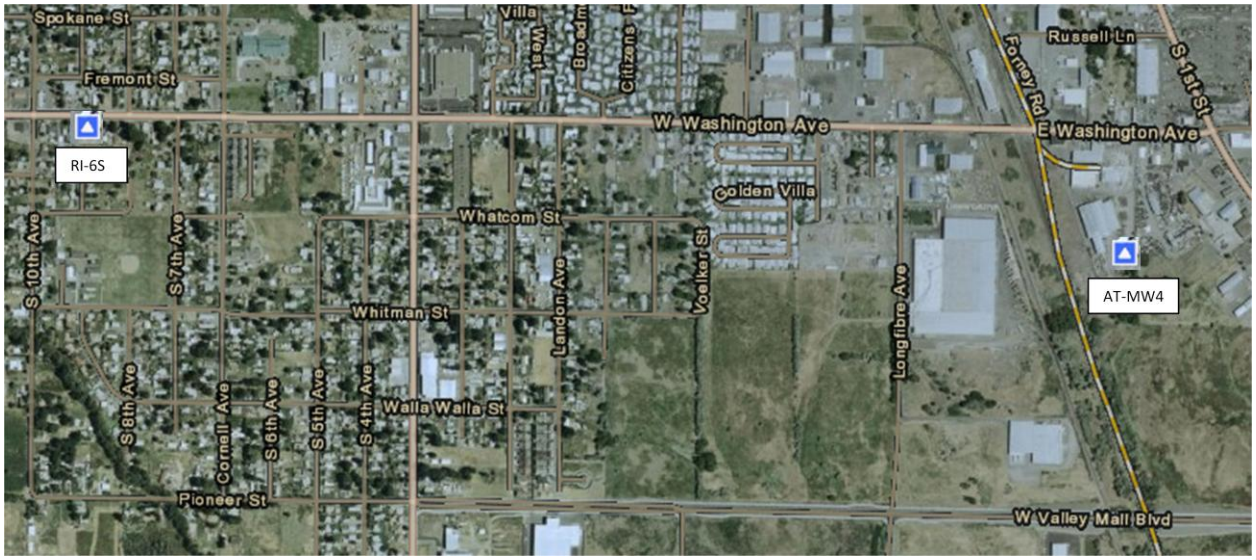


Figure A-7. Remedial Investigation Well RI-6S and Agri-Tech/Yakima Steel Locations.

Figure A-8. Remedial Investigation Wells RI-9S, RI-10S and RI-11S Locations.

Appendix B. Health and Safety Plan

Name of Ecology inspector(s): Pam Marti, Jason Shira

Training requirements for this inspection:
40-hour HAZMAT training and up-to-date 8-hour annual HAZMAT refresher

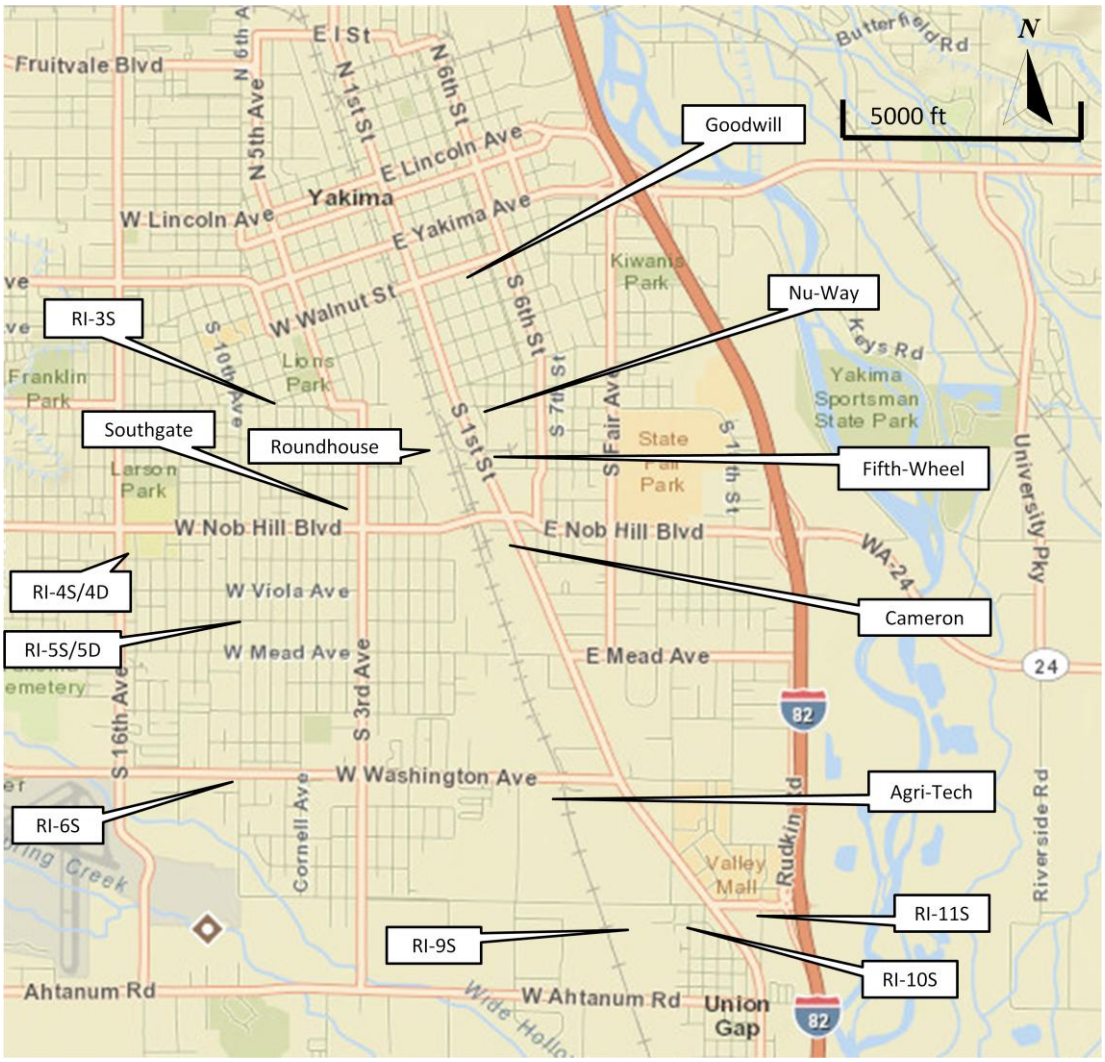
Medical monitoring requirements: Standard agency MedMon Program participation.

Date: Semi-annual sampling in May and October **Arrival time**: 8 am/daily

Total anticipated time on site: 8- to10-hour days

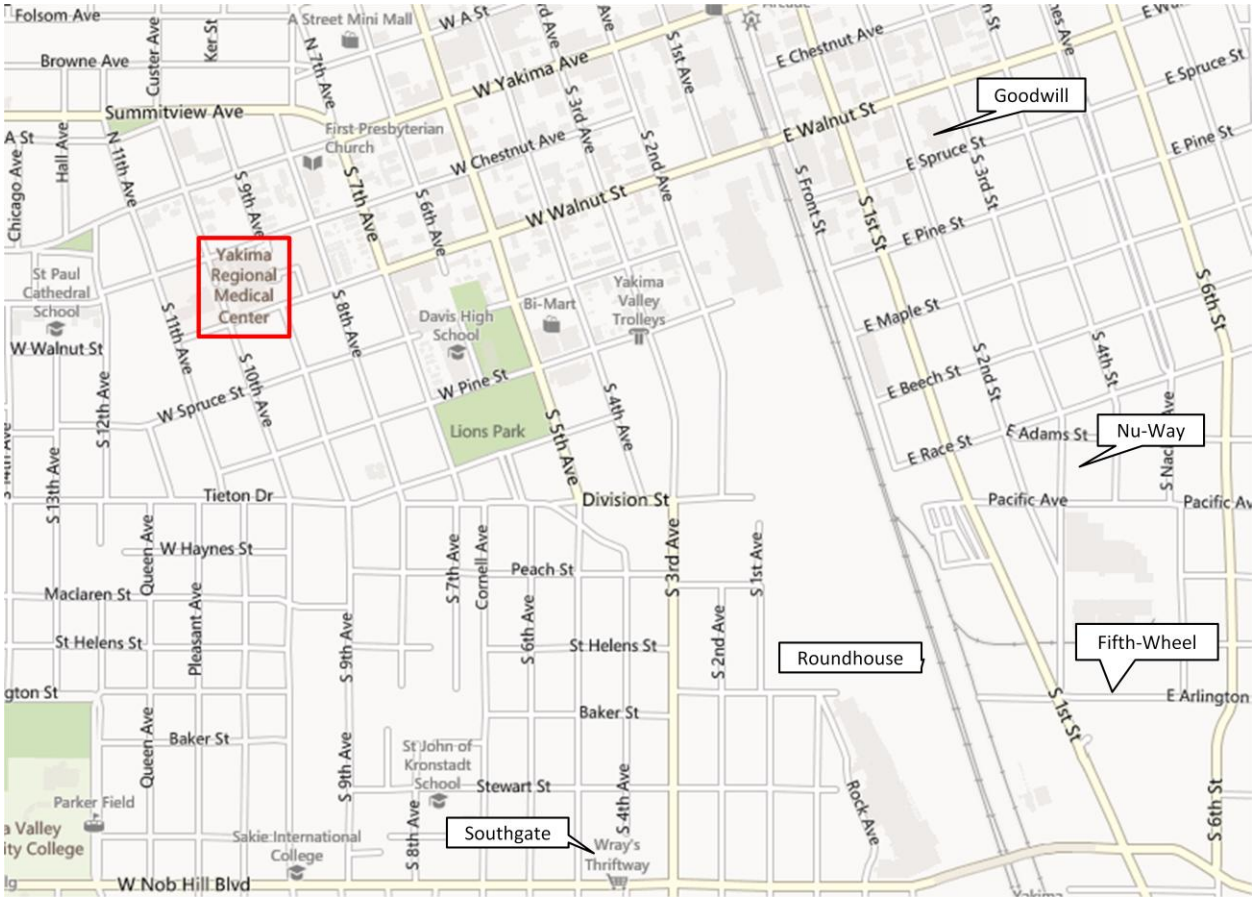
Site name: Yakima Railroad Area

Site location: Yakima Railroad Area Project Map



Nearest hospital:

Yakima Regional Medical and Cardiac Center
110 S 9th Ave
Yakima, WA 98902
(509)575-5000



Yakima Regional Medical Center Location Map

Emergency numbers and information:

Ambulance, Police, or Fire:	9-1-1
Nearest Phone:	Cell phones are carried by field staff.
Nearest Fire Extinguisher:	Located in Ecology's field vehicle on-site.
Nearest First-Aid Kit:	Located in Ecology's field vehicle on-site.

In case of an emergency, staff contact information is listed in Table 1. All are employees of the Washington State Department of Ecology.

Table 1. Staff Contact Information

Staff (all are EAP except client)	Role	Telephone Number
Jason Shira Toxics Cleanup Program Central Regional Office	Site Project Manager	509-454-7834
Pam Marti Environmental Assessment Program Statewide Coordination Section	Field Project Manager	360-407-6768 (Office) 360-280-0278 (Field)
Martha Maggi Environmental Assessment Program Statewide Coordination Section	Unit Supervisor for the Field Project Manager	360-407-6453
Valerie Bound Toxics Cleanup Program Central Regional Office	Section Manager for the Site Project Manager	509-454-7886

Name of contractor (if on site): NA

Is the site currently active? Yes X No__ **Will the buddy system be used**? Yes X No_____

Site description:

The Yakima Railroad Area (YRRA) is approximately six square miles of predominantly industrial/commercial property and residential areas adjacent to the railroad corridor in parts of the cities of Yakima and Union Gap. Groundwater within the project area is primarily contaminated with tetrachloroethene (PCE) that's attributed to several properties within the project boundaries.

Numerous monitoring wells have been installed within the YRRA over the course of previous investigations. Fifty-nine of these wells have been sampled routinely as part of the on-going monitoring program. Ecology has selected a subset of 36 wells for continued monitoring. Wells to be sampled are located at Fifth Wheel Truck Repair/Hahn Motors, Goodwill Industries, Nu-Way Cleaners, Southgate Laundry, Washington Central Railroad Roundhouse, Agri-Tech/Yakima Steel, Cameron Yakima, and a selection of RI wells spread throughout the project area (Figure 1).

Scope/objective of work:

The goal of this project is to continue to collect long-term groundwater monitoring data for the YRRA site. The data will be used by the Ecology's Toxics Cleanup Program to monitor the effectiveness of previous remedial actions and identify areas of contamination that require further action within the YRRA. Groundwater samples will be collected semi-annually for volatile organic analysis from 36 of the 59 monitoring wells that are in the on-going monitoring program. This subset of wells will provide monitoring points to evaluate groundwater conditions throughout the project area.

Project activities will follow those described in the site specific Quality Assurance Project Plan (QAPP). The QAPP provides details on the sampling methods, data analysis, anticipated schedule, and reporting. The Safety Plan is to be used in conjunction with the site-specific QAPP and the Environmental Assessment Program Safety Manual (Ecology 2012).

Known contaminants on site: Tetrachloroethene (PCE), concentration range of less than 1 ug/L to approximately 35 ug/L.

Routes of chemical exposure: Inhalation ___X___ Dermal ___X____ No exposure__

Overall risk of chemical exposure: Serious____ Moderate_____ Low __X__ Unknown____

Physical hazards: Confined space____ Noise _X_ Heat/cold stress _X_ Traffic __X__

Describe any area on site that could function as a confined/enclosed space: None

Was air monitoring conducted? Yes___ No___

Personal protection level required A B C **D**

Personal protective equipment required: Level D

Level D personal protective equipment will offer adequate protection for this project. Equipment can include:

- Hardhat (if overhead hazards)
- Steel-toed boots
- Safety glasses (if dust, particles, or other hazards are present)
- Hearing protection
- Rubber boots (if wet conditions)
- Nitrile gloves (when collecting samples and handling sample equipment)

Other (specify)_____

Overall risk of physical hazards: Serious____ Moderate ____ Low _X_ Unknown ____

Expected parameters/contaminants to be sampled: Tetrachloroethene (PCE)

Sampling matrix: Air_____ Surface water_____ Groundwater__X____ Soil_____

Sediment_____ Containers_____ Other_____

Appendix C. Glossary, Acronyms, and Abbreviations

Glossary

Analyte: Water quality constituent being measured (parameter).

Dissolved oxygen: A measure of the amount of oxygen dissolved in water.

Groundwater: Water in the subsurface that saturates the rocks and sediment in which it occurs. The upper surface of groundwater saturation is commonly termed the water table.

Parameter: A physical chemical or biological property whose values determine environmental characteristics or behavior.

pH: A measure of the acidity or alkalinity of water. A low pH value (0 to 7) indicates that an acidic condition is present, while a high pH (7 to 14) indicates a basic or alkaline condition. A pH of 7 is considered to be neutral. Since the pH scale is logarithmic, a water sample with a pH of 8 is ten times more basic than one with a pH of 7.

Specific conductance: A measure of water's ability to conduct an electrical current. Specific conductance is related to the concentration and charge of dissolved ions in water.

Turbidity: A measure of water clarity. High levels of turbidity can have a negative impact on aquatic life.

Unconfined aquifer: An aquifer containing water that is not under pressure; the water level in a well is the same as the water table outside the well.

Acronyms and Abbreviations

Following are acronyms and abbreviations used frequently in this report.

Ecology	Washington State Department of Ecology
EIM	Environmental Information Management database
EPA	U.S. Environmental Protection Agency
GPS	Global Positioning System
MEL	Manchester Environmental Laboratory
MQO	Measurement quality objective
RI	Remedial investigation
RPD	Relative percent difference
SOP	Standard operating procedures
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
YRRA	Yakima Railroad Area

Units of Measurement

°C	degrees centigrade
ft	feet
mg/L	milligrams per liter (parts per million)
mL	milliliters
NTU	nephelometric turbidity units
s.u.	standard units
ug/L	micrograms per liter (parts per billion)
umhos/cm	micromhos per centimeter