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Yakima Railroad Area PCE Contamination

Groundwater Quality Performance Monitoring, 2013

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Yakima Railroad Area PCE Contamination

Groundwater Quality Performance Monitoring, 2013

by

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

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Table of Contents

List of Figures and Tables

Page

Figures

Tables

Abstract

In 2013, the Washington State Department of Ecology conducted semi-annual sampling of 34 wells in the Yakima Railroad Area (YRRA) groundwater monitoring network. The YRRA is a six-square-mile area located along the railroad corridor in the cities of Yakima and Union Gap. Groundwater within the project area is contaminated with tetrachloroethene (PCE) that is attributed to numerous sources within the project boundaries. Since the YRRA was defined in 1991, cleanup activities have occurred at several of the source areas and appear to have been effective in reducing contaminant concentrations.

Of the 34 wells sampled in 2013, 15 wells (44%) had PCE concentrations above the Model Toxics Control Act (MTCA) cleanup level of 5 ug/L. Maximum PCE concentrations ranged from about 6 to 19 ug/L.

Eleven of the these wells are screened in the shallow water-bearing zone (23-47 feet) and are located at five source areas: Goodwill-City of Yakima, Washington Central Railroad Roundhouse (WCRR), Cameron Yakima, Fifth Wheel Truck Repair, and Agri-Tech/Yakima Steel.

Two additional wells at the WCRR site also had elevated PCE concentrations, as well as PCE breakdown products. Vinyl chloride was detected in these two wells at concentrations that exceed (do not meet) the groundwater cleanup level of 0.2 ug/L. These wells are screened in the deeper water-bearing zone (60-120 feet).

The 2013 data indicate that high PCE concentrations are still detected at sites located in the central portion of the YRRA. These include the WCRR, Cameron Yakima, and an additional site, Frank Wear Cleaners.

The remaining two wells with elevated PCE concentrations are located on the western edge of the project area in the shallow aquifer. Source areas for this contamination are in the process of being identified. Analytical data from these wells indicate that PCE concentrations are increasing. The source and extent of the PCE contamination in the western and southwestern portion of the YRRA are still not well defined.

Because groundwater within the YRRA continues to be contaminated by both identified and unidentified source areas, cleanup activities and investigations continue to be conducted across the study area.

Introduction

The Yakima Railroad Area (YRRA) is approximately six square miles of mixed industrial/ commercial and residential properties located adjacent to the railroad corridor in the cities of Yakima and Union Gap (Figure 1). Groundwater within the YRRA 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 (Secor, 1998). 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).

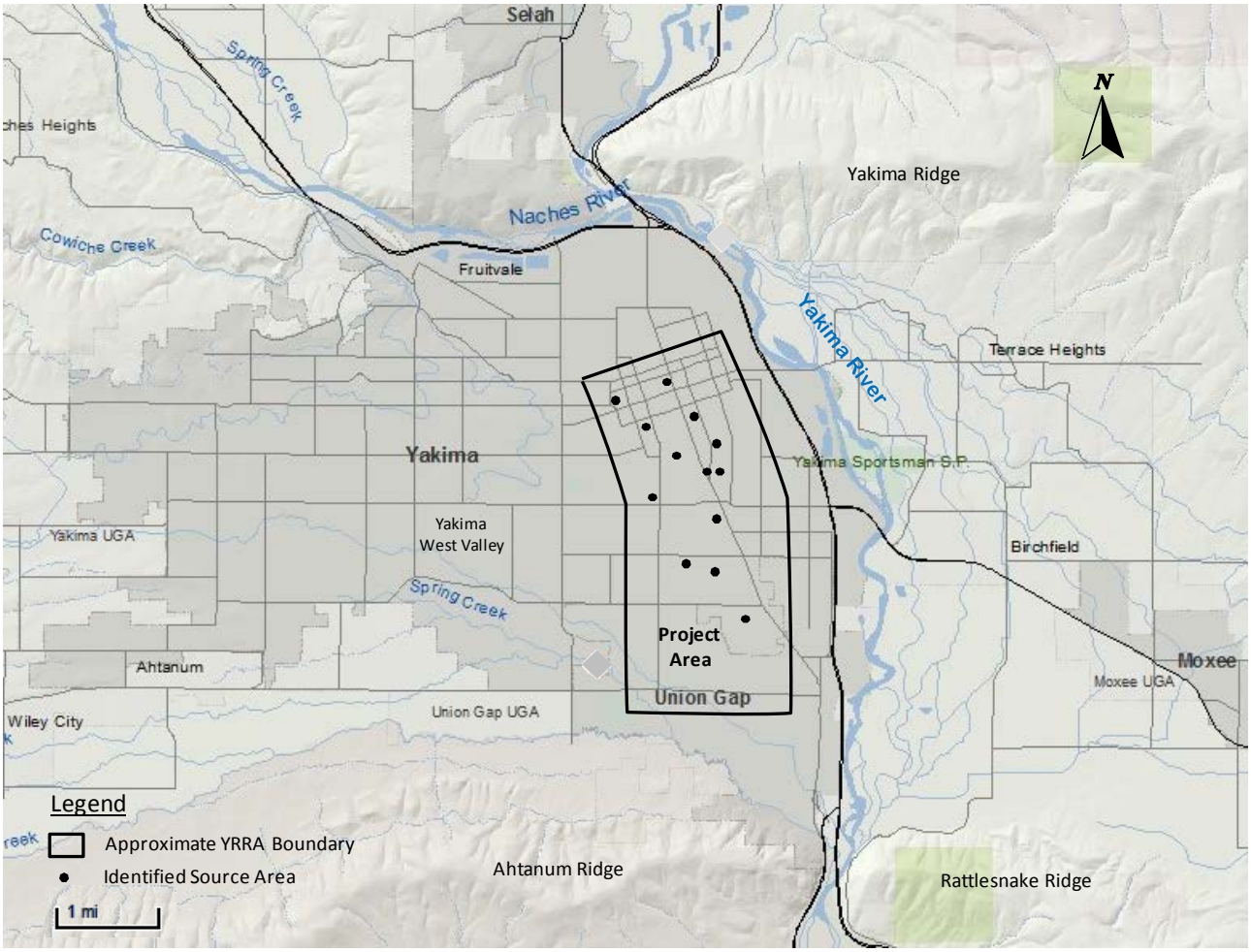

Figure 1. Yakima Railroad Area (YRRA) Project Location Map, Yakima, WA.

The identified sources included dry cleaners, machine shops, a carbon regeneration facility, and former pesticide formulation plants. During the 1990s, cleanup activities were conducted at many of these source areas. An area-wide remedial investigation (RI) for the YRRA was completed in 1998 (Secor, 1998). Since 1999 a total of 59 monitoring wells have been sampled routinely as part of an ongoing program to characterize PCE groundwater concentrations throughout the YRRA. Monitoring results indicate that some of the highest PCE concentrations continue to be found near some of the known source areas. There is evidence, however, that PCE is also present in the shallow aquifer beneath areas where the source has yet to be identified.

Ecology's Environmental Assessment Program (EAP) took responsibility of the area-wide monitoring program in 2013. In consultation with Ecology's Toxics Cleanup Program (TCP), a subset of 36 wells was selected for continued monitoring. The goal of the current work is to provide TCP with groundwater quality data to assist in evaluating the effectiveness of remedial actions taken at the identified source areas, under the Model Toxics Control Act (MTCA). The data may also be used to identify additional areas of contamination within the YRRA that require further investigation and action.

Physical Setting

The YRRA is located within the western flood plain of the Yakima River and the eastern portion of Yakima West Valley (Figure 1). The Yakima 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. (USGS, 2006)

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

Quaternary-age 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. The thickness of this unit ranges from 0 to 120 feet, with an average thickness of 20 feet. The underlying 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 terrace gravels generally occur at the surface and beneath the alluvium. The thickness of this unit ranges from 0 to 350 feet, with an average thickness of 90 feet. (USGS, 2009)

The unconsolidated Quaternary deposits are underlain by consolidated, Tertiary-age, continental sediments, primarily of the Upper Ellensburg Formation. The Ellensburg Formation ranges in thickness from 0 to up to 1800 feet, with an average thickness of about 500 feet. The Ellensburg Formation is underlain by the Columbia River basalt group in the vicinity of the YRRA.

PCE monitoring in the YRRA focuses on groundwater in the upper portion of the shallow, unconfined aquifer in the unconsolidated sands and gravels. This portion of the aquifer is, in general, highly permeable in the vicinity of the Yakima River. However, fine-grained material and

cemented gravels are more prevalent to the north and west, resulting in units of contrasting permeability. For this reason, both shallow and deep water-bearing zones were identified for the project area in the YRRA RI/Feasibility Study (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 April to October. Because of this, the 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 of 0.005 across the YRRA. The estimated direction of groundwater flow in the deep water-bearing zone is also primarily to the southeast, with an approximate gradient of 0.004 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)

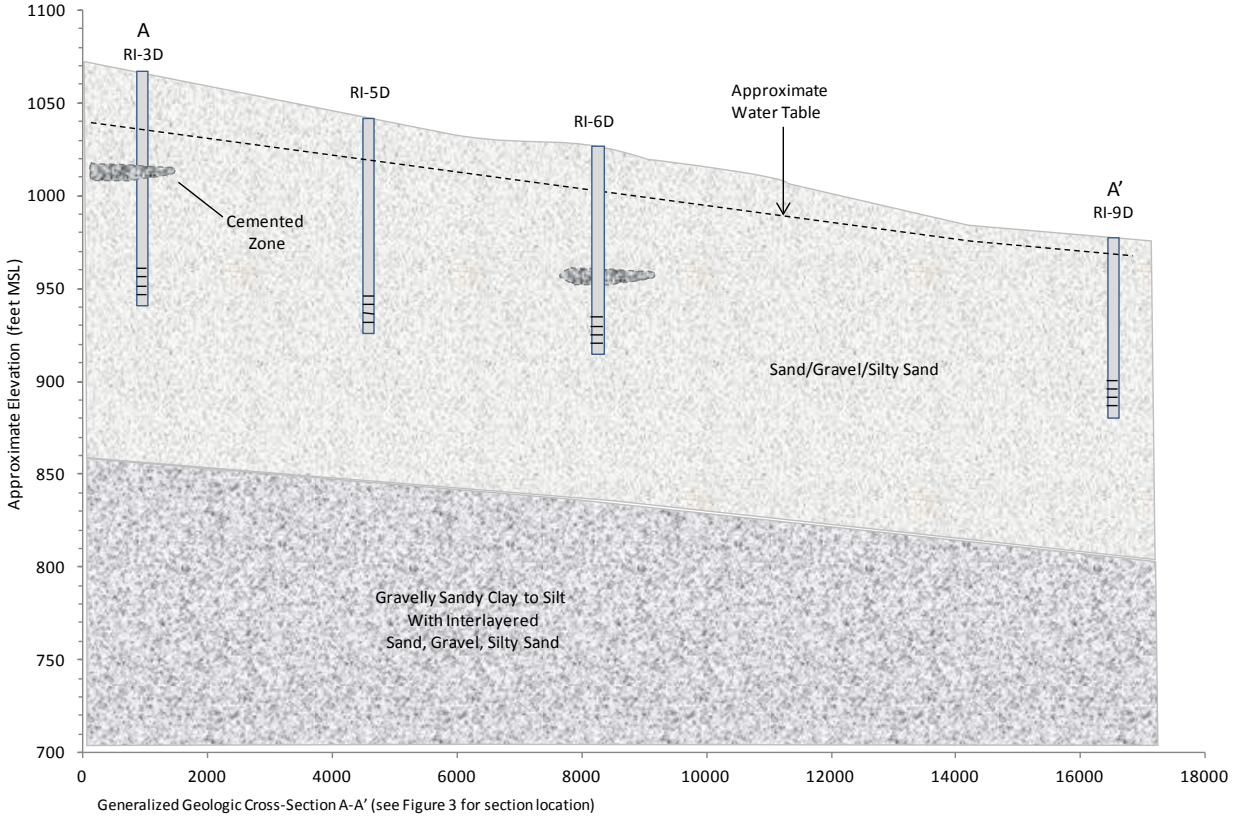

Figure 2. Interpreted Geologic Cross-Section of the YRRA Study Area.

Methods

The primary contaminant of concern for this study is tetrachloroethene (PCE), a chlorinated solvent that is attributed to numerous sources within the project boundaries.

PCE is classified as a dense non-aqueous phase liquid, commonly referred to as DNAPL. It is heavier than, and only slightly soluble, in water. Because PCE is denser than water, in a pure phase it tends to migrate both vertically and laterally through soils and groundwater until it reaches a resistant layer. PCE can exist and migrate in multiple phases (liquid, dissolved, or vapor), depending on how it was released and the site conditions.

PCE degradation typically occurs by anaerobic biodegradation following an established sequence:

PCE → Trichloroethene (TCE) → 1,2-Dichloroethene (DCE) → Vinyl Chloride (VC) → Ethene

Each successive step in the degradation process is theoretically slower than the preceding step and, therefore, at some sites, may not proceed to completion. As a result, intermediate compounds (e.g., DCE) may accumulate in groundwater. It was commonly believed that vinyl chloride would also accumulate at PCE-contaminated sites. However, it is now known that vinyl chloride can biodegrade under almost all potential conditions found in the subsurface because it can undergo direct biodegradation under both aerobic and anaerobic conditions. (ITRC, 1999)

Groundwater Sampling

There are 59 monitoring wells in the YRRA long-term monitoring program. Ecology selected a subset of 36 of these wells for continued monitoring, based on existing PCE data. Ecology excluded wells for further monitoring if they have consistently shown low or no detections for chlorinated volatile organic compounds (cVOCs). The selected subset of wells continues to provide monitoring points to evaluate groundwater conditions throughout the project area.

Ecology collected groundwater samples from 33 of the 36 wells in May 2013 and 34 of the wells in October 2013.

A total of 27 of the wells are associated with the following facilities: Goodwill-City of Yakima, Nu-Way Cleaners, Southgate Laundry, Washington Central Railroad Roundhouse, Fifth Wheel Truck Repair, Cameron Yakima, and Agri-Tech/Yakima Steel (Figure 3). Wells at these locations are monitored to evaluate the effectiveness of site-specific cleanup activities.

The remaining 9 wells were installed during the YRRA RI/FS. In total, 29 wells were installed for the RI/FS. They were spread throughout the project area to characterize aquifer properties and determine the extent of PCE contamination in the groundwater. Between 2002 and 2004, three of these wells were damaged and removed from the monitoring program (RI-12D, RI-14S, and RI-14D). The 9 wells selected for continued monitoring are located primarily along the western and southern edges of the area of contamination. Data collected from these wells may be used to

identify areas of groundwater contamination that require further investigation and action within the YRRA (Figure 3).

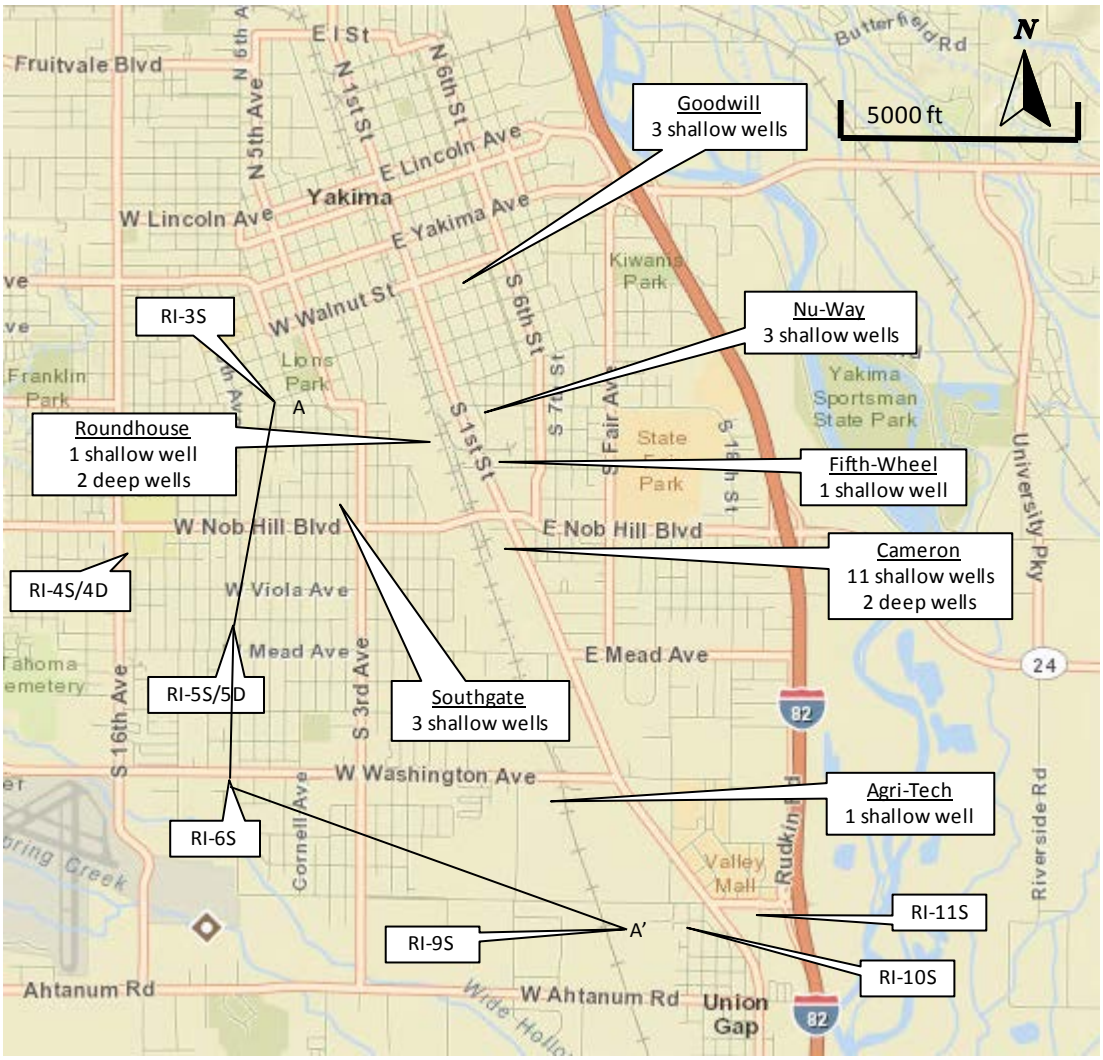

Figure 3. YRRA Sample Location Map.

All but two of the sampled wells are constructed of 2-inch PVC. The majority of the wells are completed in the sands and gravels of the shallow water-bearing zone and range in depth from approximately 23 to 47 feet below ground surface (bgs). The six deep wells sampled range in depth from 60 to 120 feet bgs. Well construction details are provided in Appendix A.

Ecology measured static water levels in all sampled wells prior to well purging and sampling. Measurements were collected according to standard operating procedure (SOP) EAP052 (Marti, 2009).

Ecology sampled all wells in accordance with Ecology's SOP EAP078 (Marti, 2014) and the site-specific Quality Assurance Project Plan (Marti, 2013).

The monitoring wells were purged and sampled using a stainless steel bladder pump with dedicated Teflon-lined LDPE tubing for each well. The pump intake was placed within the screen interval, midway between the lowest recorded water level and the screen bottom. Wells were purged at a rate of less than 0.5-liter/minute. The purge water was routed through a closed atmosphere flow cell where field parameters (pH, dissolved oxygen, specific conductance, oxidation-reduction potential (ORP), and temperature) were measured. Purging continued until all field parameters stabilized. Water removed from the well during the purging process was collected and stored in 55-gallon drums. At the completion of all sampling, the water was transferred to a storage tank at a secure location within the YRRA for disposal at a later time. Purge water waste transport and disposal procedures followed Washington State regulations (Chapter 173-303-400 WAC).

Upon completion of purging, the flow cell was disconnected while maintaining flow from the pump. Samples were then collected directly from the well's dedicated pump discharge tubing into three 40-mL glass vials with Teflon-lined septa lids for volatile organic analysis. Samples were immediately preserved with 1:1 hydrochloric acid and were free of headspace.

All samples were labeled and stored in an ice-filled cooler pending transport to Ecology's Operation Center in Lacey, Washington. Samples were kept in a walk-in cooler at the Operation Center until they were picked up by the laboratory courier and transported to the Ecology/EPA Manchester Environmental Laboratory (MEL) in Manchester, Washington. Chain-of-custody procedures were followed per MEL protocols (Ecology, 2008).

The pump was decontaminated between each well. The pump was disassembled, and each part was scrubbed with a brush in a laboratory-grade soap solution, followed by a tap water rinse, then a deionized water rinse. Equipment blanks were collected to determine if field cleaning procedures were sufficient to prevent cross-contamination of samples from the sample equipment.

Analysis

Standard methods and reporting limits used for analysis of all groundwater samples are shown in Table 1. MEL analyzed all the laboratory samples. Because MEL performs all the requested analysis on a routine basis, no problems with the laboratory methods were expected.

Table 1. Field and Laboratory Methods.

Field Measurements	Instrument Type	Method	Accuracy
Water Level	Solinst Water Level Meter	SOP EAP052	±0.03 feet
pH	YSI ProPlus with Quatro Cable	EPA 150.1 (EPA, 2001a)	±0.2 std. units
Dissolved Oxygen	YSI ProPlus with Quatro Cable	EPA 360.1 (EPA, 2002)	±0.2 mg/L
Specific Conductance	YSI ProPlus with Quatro Cable	EPA 120.1 (EPA, 2001b)	±10 umhos/cm
Temperature	YSI ProPlus with Quatro Cable	EPA 150.1	±0.2 ºC
Laboratory Analytes	Reference	Method	Reporting Limit
VOCs	EPA 1996	EPA SW-846 Method 8260B	0.5-5 ug/L

SOP: standard operating procedure.
EAP: Environmental Assessment Program.
EPA: U.S. Environmental Protection Agency.

PCE-contaminated groundwater has been monitored in the YRRA since 1997. As part of this report, the 2013 analytical data were compared to MTCA cleanup levels for the constituents of concern. PCE data for each monitoring location were also evaluated for time trends and seasonal patterns.

Results

Data Quality Assessment

Field quality control samples for this project consisted of blind field replicates and equipment blanks.

Ecology collected field replicates by splitting the pump discharge between two sets of sample bottles. Tables 2 and 3 show results of the replicate samples and the corresponding relative percent difference (RPD). RPD is calculated as the difference between replicate sample results, divided by the replicate mean with the result expressed as a percentage. The RPD calculation provides a measure of the overall sampling and analytical precision. Precision estimates are influenced not only by the random error introduced by collection and measurement procedures, but also by the natural variability of the concentrations in the media being sampled.

Table 2. Relative Percent Difference (RPD) of Replicate VOC Sample Results (ug/L), May 2013.

Sample ID:	RPD Target	RI-10S	RI-10S (Dup)	RPD (%)	CYI MW-114S	CYI MW-114S (Dup)	RPD (%)	RI-4S	RI-4S (Dup)	RPD (%)	WDOE -3D	WDOE -3D (Dup)	RPD (%)
PCE	30%	1.7	1.8	6	12	11	8	18	18	0	13	13	0
TCE	30%	1 U	1 U	--	0.41J	0.43J	--	1 U	1 U	--	3.4	3.4	0
Cis-1,2-DCE	30%	1 U	1 U	--	0.46J	0.47J	--	1 U	1 U	--	1	1	0
VC	30%	1 U	1 U	--	1 U	1 U	--	1 U	1 U	--	0.49J	0.47J	--

U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
--: RPD not calculated.

Table 3. Relative Percent Difference (RPD) of Replicate VOC Sample Results (ug/L), October 2013.

Sample ID:	RPD Target	RI-10S	RI-10S (Dup)	RPD (%)	CYI MW-102S	CYI MW-102S (Dup)	RPD (%)	RI-4S	RI-4S (Dup)	RPD (%)	WDOE -3D	WDOE -3D (Dup)	RPD (%)
PCE	30%	2.1	2.1	0	11	11	0	18	18	0	15	14	7
TCE	30%	1 U	1 U	--	1 U	1 U	--	1 U	1 U	--	2.5	2.9	15
Cis-1,2-DCE	30%	1 U	1 U	--	1 U	1 U	--	1 U	1 U	--	0.36J	0.31J	--
VC	30%	1 U	1 U	--	1 U	1 U	--	1 U	1 U	--	1 U	1 U	--

U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
--: RPD not calculated.

Field replicates were collected from wells RI-10S, CYI-MW-114S, RI-4S, and WDOE-3D in May 2013, and from RI-10S, CYI-MW-102S, RI-4S, and WDOE-3D in October 2013. These wells were selected because they represent the range of concentrations found over the YRRA study area.

All replicate results met the measurement quality objectives established in the Quality Assurance Project Plan (Marti, 2013) and are considered good and usable as qualified.

Equipment blanks were collected from the bladder pump during each sample event following pump decontamination procedures. The blanks were collected by pumping reagent-grade deionized water (supplied by MEL) through the sample equipment. Neither of the equipment blanks contained detectable levels of the target analytes.

A review of the data quality control and quality assurance from laboratory case narratives indicates that overall analytical performance was good. The reviews include descriptions of analytical methods, holding times, instrument calibration checks, blank results, surrogate recoveries, and laboratory control samples. No problems were reported that compromised the usefulness or validity of the sample results; therefore, all results are usable as qualified. Quality assurance case narratives and laboratory reporting sheets are available upon request.

All field measurements and analytical result data are available in electronic format from Ecology's EIM data management system: www.ecy.wa.gov/eim/index.htm. Search Study ID: YRRA.

Field Observations

Ecology measured depth-to-water in each of the monitoring wells prior to purging. The end-of-purge pH, dissolved oxygen, ORP, and specific conductance readings are listed by well in Appendix B. Because temperatures measured in a flow cell are influenced by ambient air conditions, temperatures are generally not considered to be representative of in-situ groundwater conditions and have been omitted from Appendix B.

In May 2013, depth-to-groundwater below the top of the well casing ranged from about 36 feet at the northern end of the project area to 6 feet at the southern end. In October 2013, depth-to-groundwater ranged from about 29 to 5 feet, respectively. The overall flow direction for the shallow groundwater appears to be to the southeast, toward the Yakima River for both May and October 2013. Water level elevations and flow direction for October 2013 are presented in Figure 4. There were not enough measurement points during 2013 to determine the groundwater flow direction in the deep water-bearing zone, but previous investigations have described it as also being to the southeast (Kane, 2011).

Groundwater pH ranged from 6.3 to 7.6 in the shallow wells. In the deeper wells, the pH range was slightly higher at 6.9 to 8.2. Dissolved oxygen measurements from most of the wells ranged from 2.4 to 9.4 mg/L, indicating aerobic conditions in both the shallow and deep wells. The deeper Roundhouse wells (WDOE-3I and WDOE-3D) were the exception with a dissolved oxygen range of 0.16 to 0.41 mg/L. Dissolved oxygen values below 1 mg/L indicate an anaerobic environment. Overall ORP values ranged from 160 to 300 mV, with the exception of wells WDOE-3I and

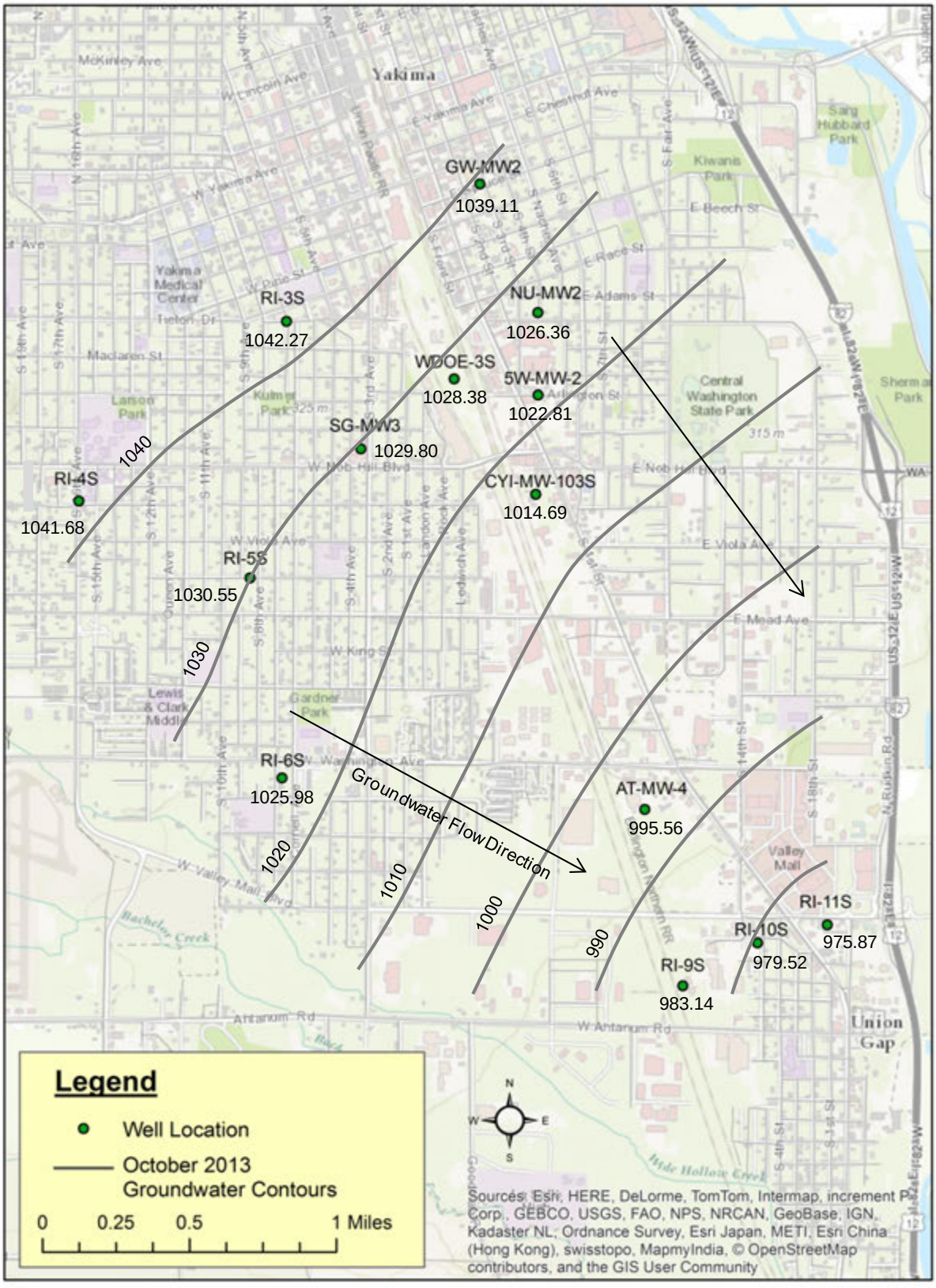

Figure 4. Shallow Zone Groundwater Flow Direction Map, October 2013.

WDOE-3D which decreased to 101 mV and 9 mV, respectfully. Specific conductance measurements had a range of 113 to 403 in the majority of the wells. Higher readings were recorded in wells RI-4S, RI-6S, and RI-5D, at a range of 474 to 743 umhos/cm.

Wells NU-MW-2 and WDOE-3S were not sampled in May due to an insufficient amount of water in the well. This has always been the condition for the shallow Roundhouse well (WDOE-3S).

Analytical Results

Project results have been separated into sections representing the different contaminant source areas within the YRRA: Goodwill-City of Yakima, Nu-Way Cleaners, Southgate Laundry, Washington Central Railroad Roundhouse, Fifth Wheel Truck Repair, Cameron Yakima, Inc., and Agri-Tech\Yakima Steel. Analytical results for these source areas, as well as groundwater MTCA Method A cleanup levels, are summarized in Tables 4-10 and presented in Figures 5-10. Table 11 and Figure 11 presents results for the YRRA Remedial Investigation (RI) wells.

For long-term perspective on water quality trends over time, a summary of project data collected since 1997 is presented in Appendix C.

Goodwill-City of Yakima

Ecology collected groundwater samples from three Goodwill-City of Yakima site wells in 2013. Tetrachloroethene (PCE) was not detected in upgradient well GW-MW1. It was the only chlorinated solvent detected in the two downgradient wells, GW-MW2 and GW-MW4 (Table 4; Figure 5). PCE was detected in well MW-2 at concentrations above the MTCA cleanup level of 5 ug/L in both May and October.

Table 4. Summary of Target VOC Analyte Results (ug/L) for Goodwill-City of Yakima, May and October 2013.

Analyte	PCE		TCE		Cis-1,2-DCE		VC	
MTCA Method A Cleanup Level	5 ug/L		5 ug/L		70 ug/L		0.2 ug/L	
Date	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13
GW-MW1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
GW-MW2	**10**	**14**	1 U	1 U	1 U	1 U	1 U	1 U
GW-MW4	**1.5**	**1.1**	1 U	1 U	1 U	1 U	1 U	1 U

U: Analyte was not detected at or above the reported value.
Bold: Analyte was detected.
Shade: Values are greater than MTCA cleanup levels.

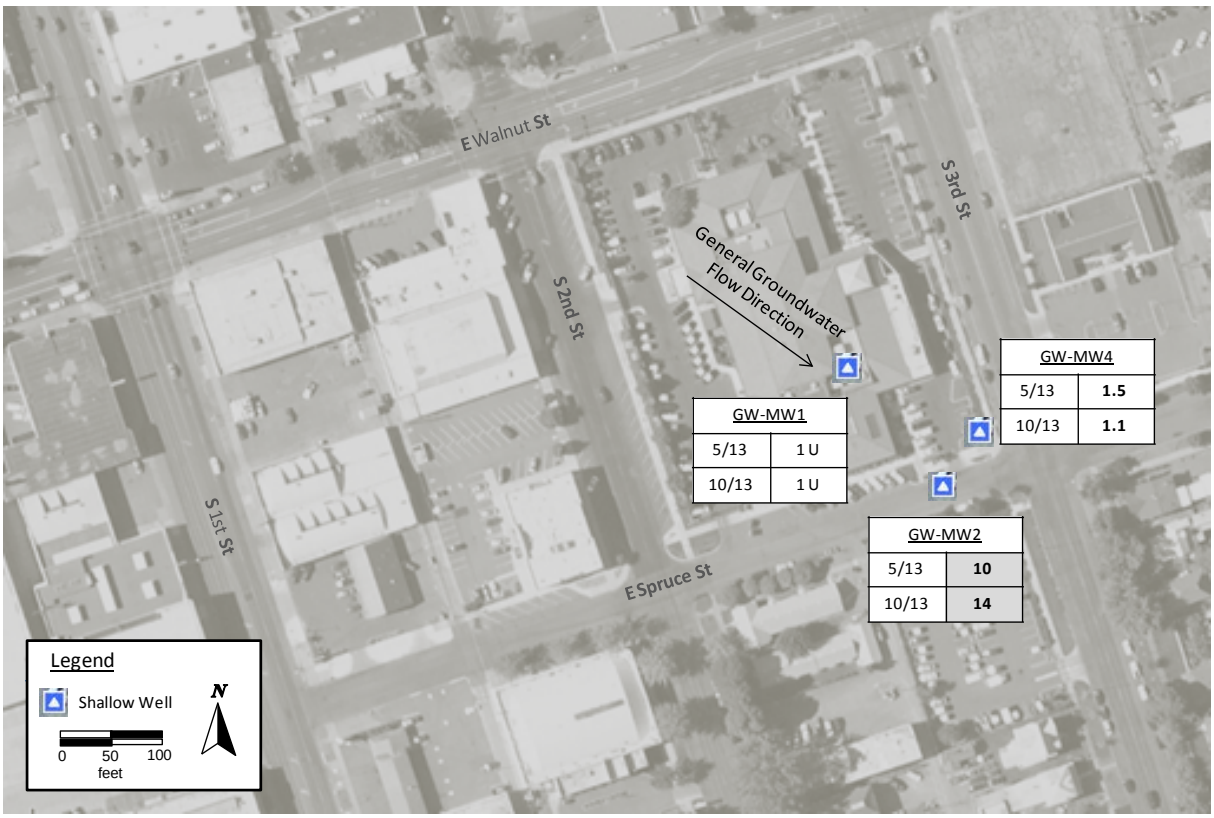

Figure 5. Goodwill-City of Yakima Well Locations and PCE Results (ug/L).

Trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC) were not detected at the Goodwill-City of Yakima site. Although the reporting limit for vinyl chloride was 1 ug/L, which is greater than the MTCA cleanup level of 0.2 ug/L, the method detection limit for the May and October analysis was 0.22 ug/L. As shown in Appendix C, vinyl chloride has never been detected at this site.

Nu-Way Cleaners

In 2013, only two of the three Nu-Way wells were sampled. Well NU-MW3 was not sampled because it was inaccessible during both sample events. Well NU-MW2 was not sampled in May because the well had an insufficient volume of water.

PCE was detected in well NU-MW1 and downgradient well NU-MW2 in 2013. Results were near the reporting limit of 1 ug/L and below the MTCA Method A cleanup level of 5 ug/L (Table 5; Figure 6). No other VOCs were detected.

Table 5. Summary of Target VOC Analyte Results (ug/L) for Nu-Way Cleaners, May and October 2013.

Analyte	PCE		TCE		Cis-1,2-DCE		VC	
MTCA Method A Cleanup Level	5 ug/L		5 ug/L		70 ug/L		0.2 ug/L	
Date	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13
NU-MW1	**1.6**	**2.3**	1 U	1 U	1 U	1 U	1 U	1 U
NU-MW2	NS	**1.6**	NS	1 U	NS	1 U	NS	1 U
NU-MW3	--	--	--	--	--	--	--	--

U: Analyte was not detected at or above the reported value.
Bold: Analyte was detected.
NS: Not sampled due to a low water level and/or insufficient volume of water.
-- Well not sampled because it was inaccessible.

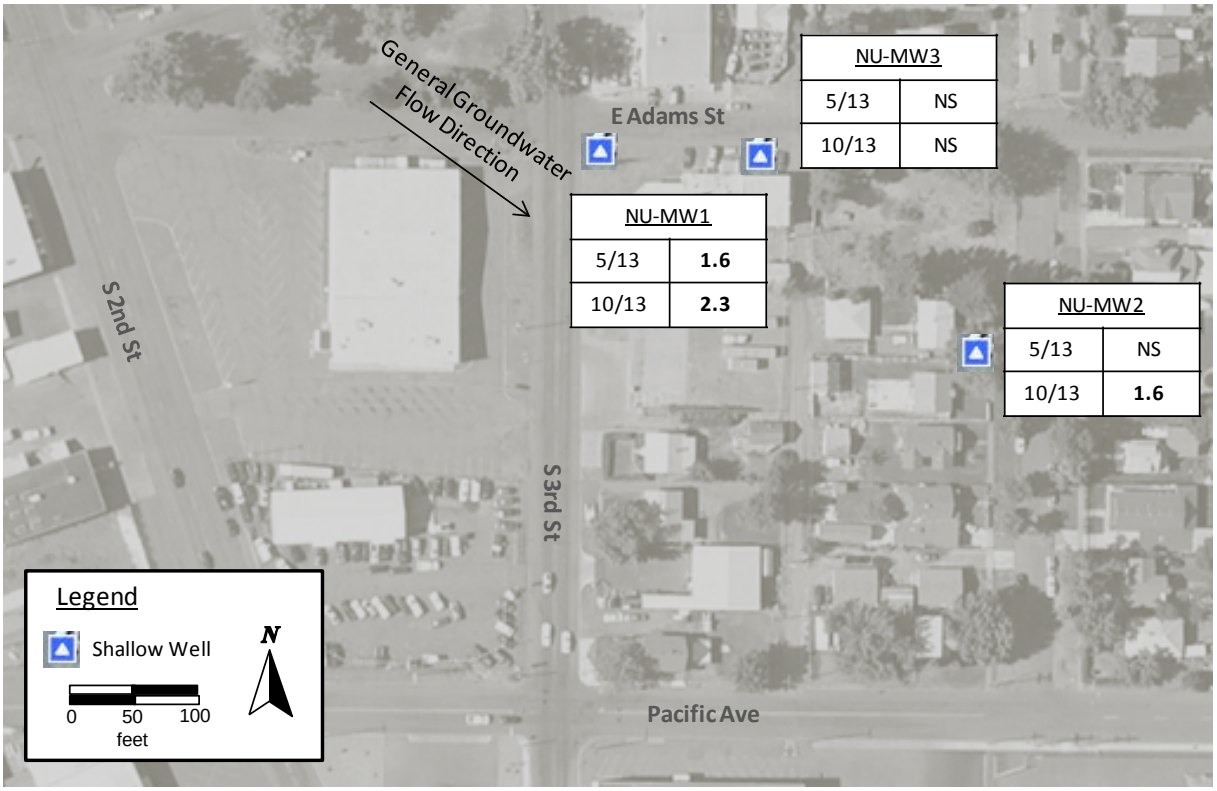

Figure 6. Nu-Way Cleaners Well Locations and PCE Results (ug/L).

Southgate Laundry

Of the three wells sampled at Southgate Laundry in 2013, PCE was not detected in upgradient well SG-MW1 but was detected in the two downgradient wells, SG-MW2 and SG-MW3. PCE concentrations in the two wells were below the MTCA cleanup level in both May and October 2013 (Table 6; Figure 7).

Table 6. Summary of Target VOC Analyte Results (ug/L) for Southgate Laundry, May and October 2013.

Analyte	PCE		TCE		Cis-1,2-DCE		VC	
MTCA Method A Cleanup Level	5 ug/L		5 ug/L		70 ug/L		0.2 ug/L	
Date	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13
SG-MW1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SG-MW2	**1.5**	**1.9**	1 U	1 U	1 U	1 U	1 U	1 U
SG-MW3	**1.7**	**2.4**	1 U	1 U	1 U	1 U	1 U	1 U

U: Analyte was not detected at or above the reported value. **Bold**: Analyte was detected.

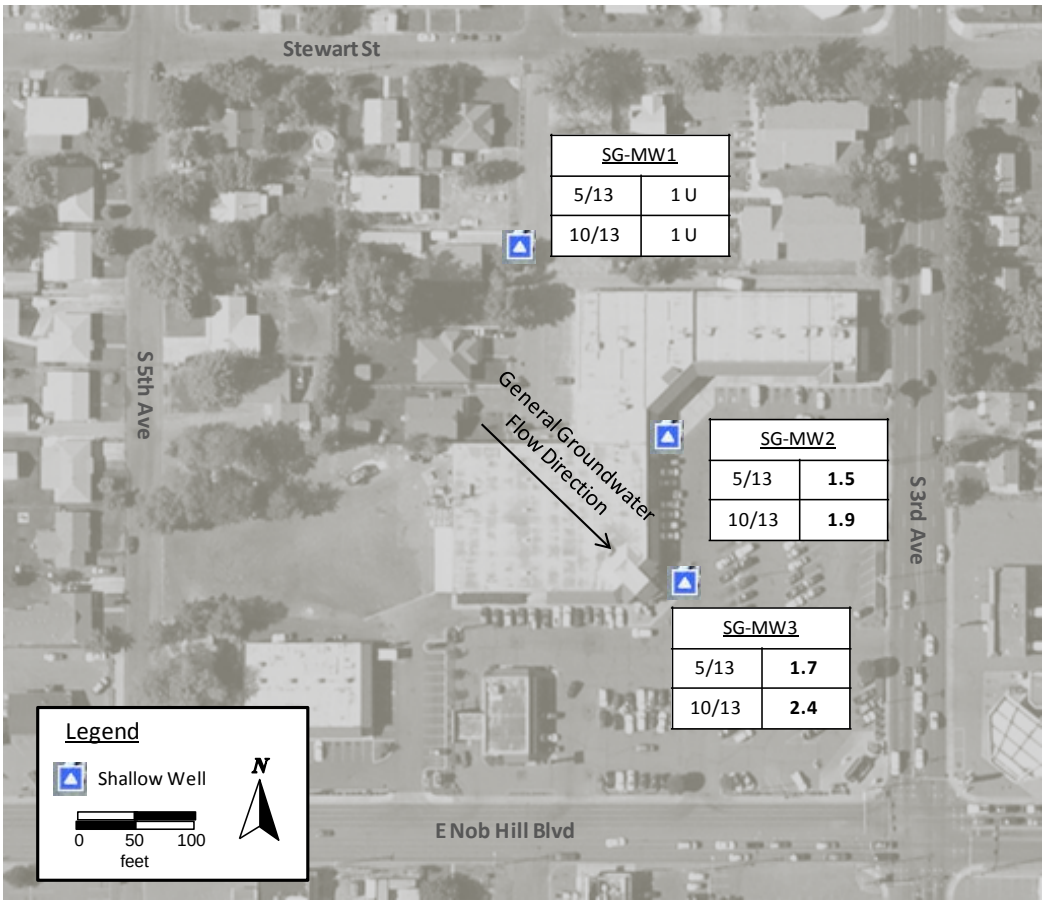

Figure 7. Southgate Laundry Well Locations and PCE Results (ug/L).

Washington Central Railroad Roundhouse

Some of the highest contaminant concentrations in the YRRA area-wide well network continue to be detected in the three wells located at the Washington Central Railroad Roundhouse. The Roundhouse wells are a well cluster and range in depths of approximately 30 feet (WDOE-3S), 58 feet (WDOE-3I), and 100 feet (WDOE-3D).

In May, PCE was detected in the deepest Roundhouse well at a concentration of 13 ug/L, above the cleanup level of 5 ug/L. In October, PCE was detected above the cleanup level in all three wells; concentrations ranged from about 8 to 19 ug/L (Table 7; Figure 8).

Table 7. Summary of Target VOC Analyte Results (ug/L) for Washington Central Railroad Roundhouse, May and October 2013.

Analyte	PCE		TCE		Cis-1,2-DCE		VC	
MTCA Method A Cleanup Level	5 ug/L		5 ug/L		70 ug/L		0.2 ug/L	
Date	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13
WDOE-3S	NS	**19**	NS	1 U	NS	1 U	NS	1 U
WDOE-3I	**4.3**	**8.2**	**3.2**	**4.8**	**2.6**	**3.5**	**6.4**	**3.1**
WDOE-3D	**13**	**15**	**3.4**	**2.5**	**1**	**0.36 J**	**0.49 J**	1 U

U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
NS: Not sampled due to a low water level and/or insufficient volume of water.
Bold: Analyte was detected. Shade: Values are greater than MTCA cleanup levels.

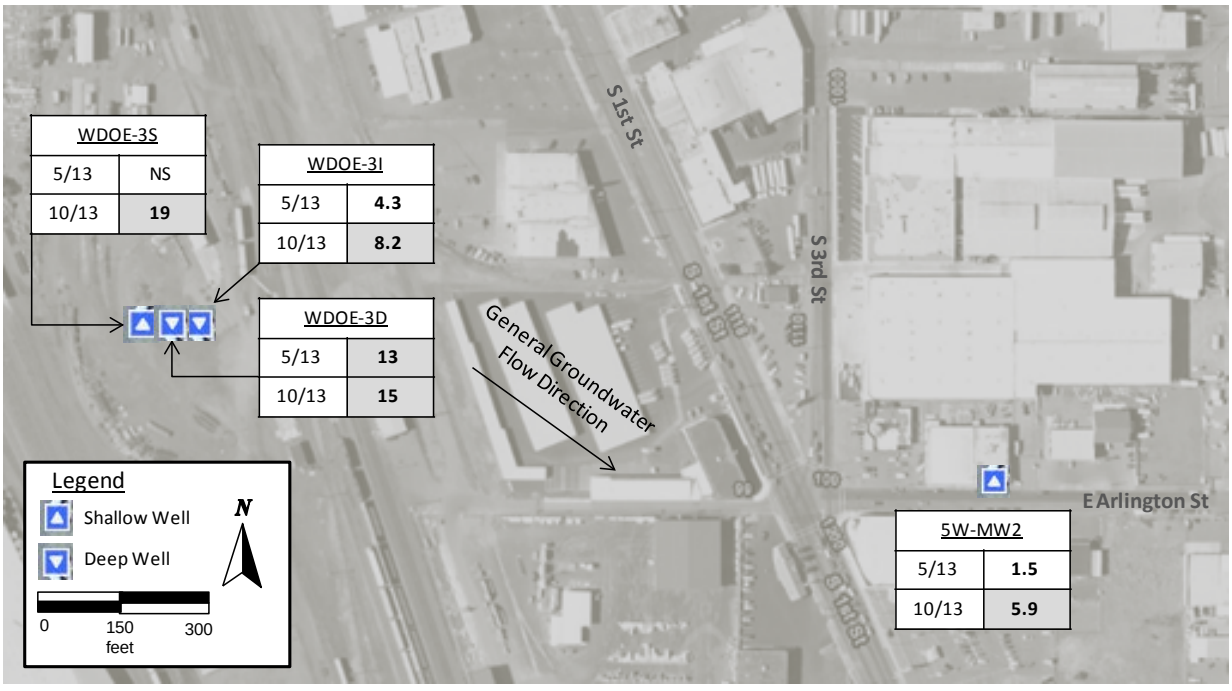

Figure 8. Washington Central Railroad Roundhouse and Fifth Wheel Truck Repair Well Locations and PCE results (ug/L).

Metabolic breakdown products of PCE were also detected in wells WDOE-3I and WDOE-3D. These are the only two wells to display anaerobic conditions (Appendix B, Table B-1). TCE and cis-1,2-DCE were detected at concentrations below their respective MTCA Method A cleanup levels. Vinyl chloride was detected at elevated concentrations in well WDOE-3I and just above the cleanup level of 0.2 ug/L in well WDOE-3D. These PCE-associated breakdown products have consistently been detected in these two wells, as shown in Appendix C. Wells WDOE-3I and WDOE-3D are the only two wells in the YRRA monitoring program that have had detectable concentrations of vinyl chloride.

1,1-dichloroethane, 1,1-dichloroethene, and trans-1,2-dichloroethene were also detected in wells WDOE-3I and WDOE-3D, but at estimated concentrations below the reporting limit of 1 ug/L.

Fifth Wheel Truck Repair

Ecology sampled one downgradient well at the Fifth Wheel Truck Repair site. PCE was detected in both May and October 2013, with the October results above the MTCA cleanup level (Table 8; Figure 8 above).

Table 8. Summary of Target VOC Analyte Results (ug/L) for Fifth Wheel Truck Repair, May and October 2013.

Analyte	PCE		TCE		Cis-1,2-DCE		VC	
MTCA Method A Cleanup Level	5 ug/L		5 ug/L		70 ug/L		0.2 ug/L	
Date	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13
5W-MW-2	**1.5**	**5.9**	1 U	1 U	1 U	1 U	1 U	1 U

U: Analyte was not detected at or above the reported value.
Bold: Analyte was detected.
Shade: Values are greater than MTCA cleanup levels.

Cameron Yakima, Inc.

In 2013, Ecology collected groundwater samples from 13 wells on the Cameron Yakima site. As seen in Table 9 and Figure 9, PCE is still detected in all the site wells that were sampled, including upgradient wells CYI-MW-106S and CYI-MW-107S. PCE concentrations ranged from approximately 1 to 13 ug/L during the 2013 monitoring. TCE and cis-1,2-DCE were also detected in a few of the wells but at estimated concentrations below the reporting limit of 1 ug/L.

PCE was also detected in the two deep wells sampled (CYI-MW-103D and CYI-MW-113D). Concentrations ranged from about 3 to 4.5 ug/L.

Vinyl chloride has not been detected at this site since sampling began in the 1997 (Appendix C).

Table 9. Summary of Target VOC Analyte Results (ug/L) for Cameron Yakima, Inc., May and October 2013.

Analyte	PCE		TCE		Cis-1,2-DCE		VC	
MTCA Method A Cleanup Level	5 ug/L		5 ug/L		70 ug/L		0.2 ug/L	
Date	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13
Upgradient Well								
CYI-MW-106S	**3.6**	**7.8**	1 U	1 U	1 U	1 U	1 U	1 U
CYI-MW-107S	**3.4**	**6.2**	1 U	1 U	1 U	1 U	1 U	1 U
Downgradient Well								
CYI-MW-102S	**4.6**	**11**	1 U	1 U	1 U	1 U	1 U	1 U
CYI-MW-103S	**12**	**10**	**0.63 J**	1 U	**0.63 J**	1 U	1 U	1 U
CYI-MW-103D	**3.1**	**2.9**	1 U	1 U	1 U	1 U	1 U	1 U
CYI-MW-108S	**3.5**	**4.1**	1 U	1 U	1 U	1 U	1 U	1 U
CYI-MW-109S	**4.1**	**4.2**	1 U	1 U	1 U	1 U	1 U	1 U
CYI-MW-110S	**4.5**	--	1 U	--	1 U	--	1 U	--
CYI-MW-111S	**1.2**	**0.93 J**	1 U	1 U	1 U	1 U	1 U	1 U
CYI-MW-112S	**9**	**11**	**0.44 J**	1 U	**0.45 J**	1 U	1 U	1 U
CYI-MW-113S	**12**	**13**	**0.58 J**	1 U	**0.51 J**	1 U	1 U	1 U
CYI-MW-113D	**4**	**4.5**	1 U	1 U	1 U	1 U	1 U	1 U
CYI-MW-114S	**12**	**12**	**0.41 J**	1 U	**0.46 J**	1 U	1 U	1 U

U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
Bold: Analyte was detected.
Shade: Values are greater than MTCA cleanup levels.
-- Well not sampled because it was inaccessible.

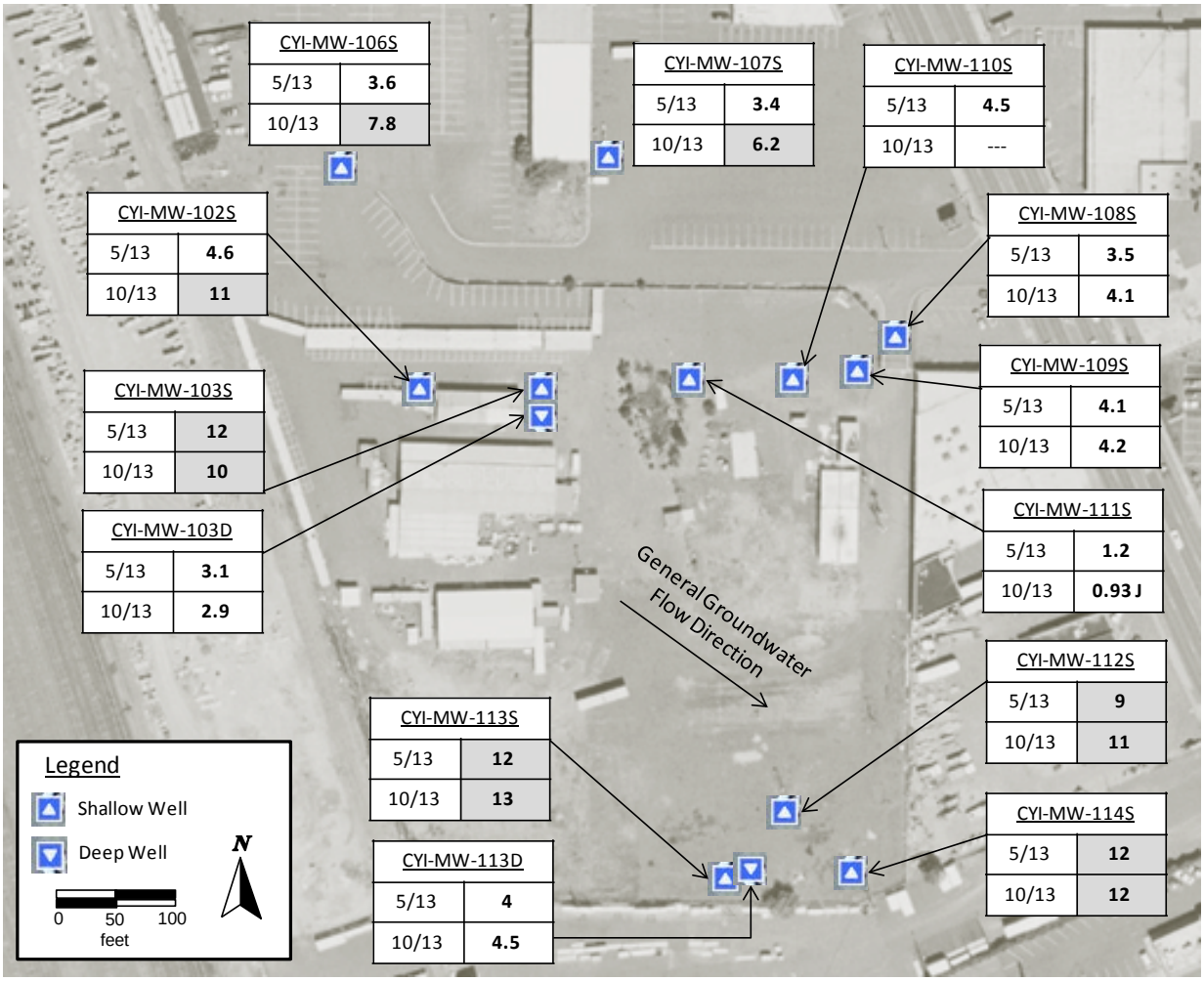

Figure 9. Cameron Yakima Well Locations and PCE Results (ug/L).

Agri-Tech\Yakima Steel

One well was sampled at the Agri-Tech\Yakima Steel site. PCE was detected in both the May and October 2013 samples, with the October results above the MTCA cleanup level (Table 10; Figure 10). TCE and cis-1,2-DCE were also detected in the Agri-Tech well at concentrations below their respective cleanup levels.

Table 10. Summary of Target VOC Analyte Results (ug/L) for Agri-Tech\Yakima Steel, May and October 2013.

Analyte	PCE		TCE		Cis-1,2-DCE		VC	
MTCA Method A Cleanup Level	5 ug/L		5 ug/L		70 ug/L		0.2 ug/L	
Date	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13
AT-MW4	**3**	**6.5**	**0.52 J**	1 U	**3.1**	**0.62 J**	1 U	1 U

U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
Bold: Analyte was detected. Shade: Values are greater than MTCA cleanup levels.

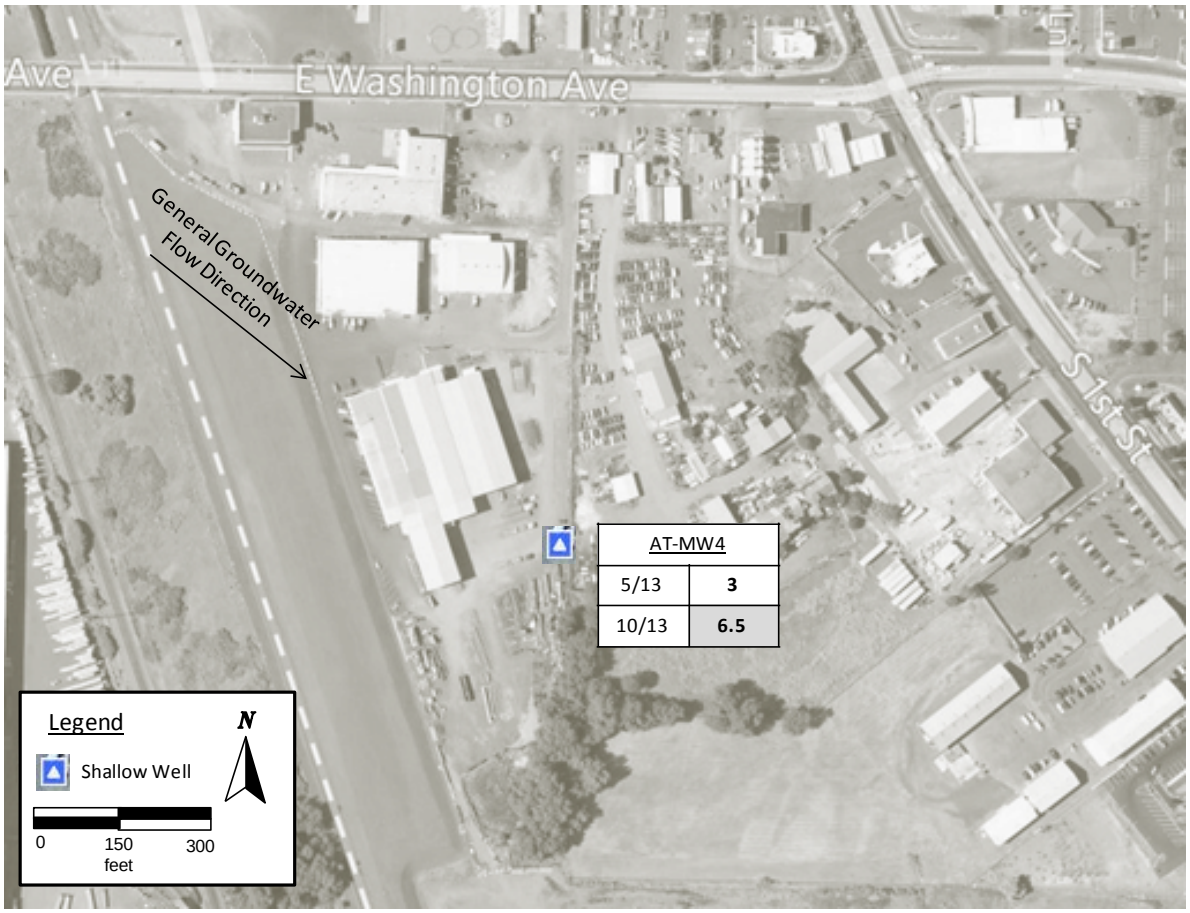

Figure 10. Agri-Tech\Yakima Steel Well Location and PCE Results (ug/L).

YRRA Remedial Investigation Wells

Nine of the 25 remaining Remedial Investigation (RI) wells were sampled, seven shallow and two deep wells. These wells were installed throughout the YRRA to determine the extent of the PCE contaminated groundwater away from the known source areas. The YRRA RI wells were also installed as shallow and deep pairs to characterize groundwater quality in the upper and lower water-bearing zones.

PCE was detected in five of the shallow wells and the two deep wells at concentrations near the reporting limit of 1 ug/L (Table 11; Figure 11).

The other two shallow wells had PCE concentrations above the cleanup level of 5 ug/L. Well RI-4S had reported PCE concentrations of 18 ug/L in both May and October. This well is located on the western edge of the YRRA project area. PCE was also detected in the deep well (RI-4D) but at concentrations near the reporting limit of 1 ug/L.

In October 2013, PCE was detected above the cleanup level in well RI-6S. This well is located in the southwest portion of the YRRA.

TCE, cis-1,2-DCE, and VC were not detected in any of the YRRA RI wells.

Table 11. Summary of Target VOC Analyte Results (ug/L) for Remedial Investigation Wells, May and October 2013.

Analyte	PCE		TCE		Cis-1,2-DCE		VC	
MTCA Method A Cleanup Level	5 ug/L		5 ug/L		70 ug/L		0.2 ug/L	
Date	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13
RI-3S	1 U	**0.88 J**	1 U	1 U	1 U	1 U	1 U	1 U
RI-4S	**18**	**18**	1 U	1 U	1 U	1 U	1 U	1 U
RI-4D	**1**	**1.1**	1 U	1 U	1 U	1 U	1 U	1 U
RI-5S	**2.4**	**2.1**	1 U	1 U	1 U	1 U	1 U	1 U
RI-5D	**1.1**	**1.2**	1 U	1 U	1 U	1 U	1 U	1 U
RI-6S	**3.8**	**8.2**	1 U	1 U	1 U	1 U	1 U	1 U
RI-9S	**1.4**	**1.8**	1 U	1 U	1 U	1 U	1 U	1 U
RI-10S	**1.7**	**2.1**	1 U	1 U	1 U	1 U	1 U	1 U
RI-11S	**0.83 J**	**1**	1 U	1 U	1 U	1 U	1 U	1 U

U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
Bold: Analyte was detected.
Shade: Values are greater than MTCA cleanup levels.

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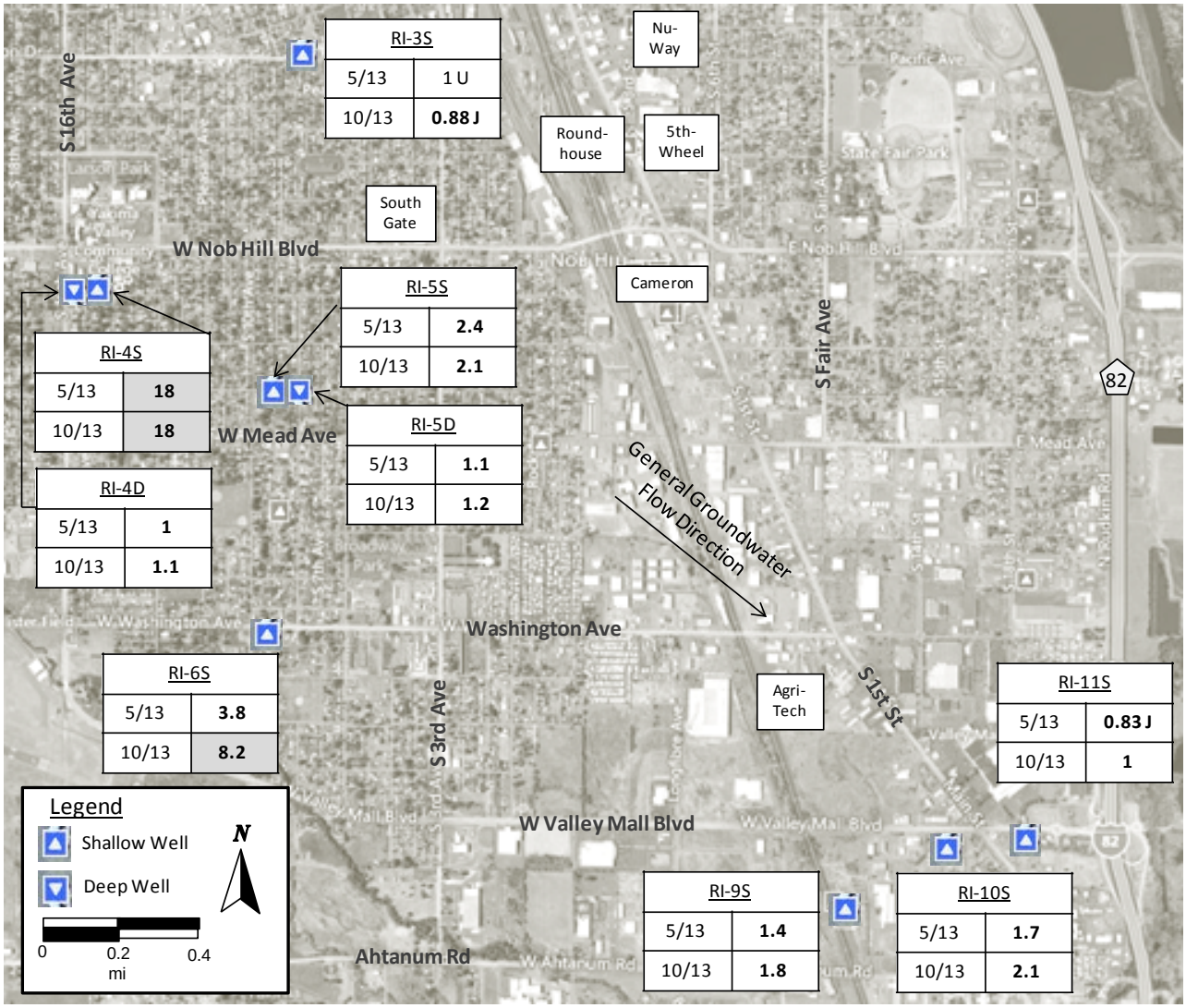

Figure 11. YRRA Remedial Investigation Well Locations and PCE Results (ug/L).

PCE Results Summary

Of the 34 wells sampled in 2013, 15 wells (44%) had PCE concentrations above the cleanup level of 5 ug/L (Table 12). These wells are located at Goodwill-City of Yakima, Washington Central Railroad Roundhouse, Fifth Wheel Truck Repair, Cameron Yakima, and Agri-Tech/Yakima Steel. Two of the YRRA RI wells along the western edge of the study area also had elevated PCE concentrations.

Thirteen of the wells with elevated PCE are screened in the shallow water-bearing zone and range in depth from approximately 26 to 40 feet below ground surface (bgs). The maximum PCE concentrations in these wells ranged from about 6 to 19 ug/L.

The remaining two wells with elevated PCE concentrations are the deeper Roundhouse wells, WDOE-3I (58 feet) and WDOE-3D (100 feet). PCE concentrations above the cleanup level ranged from 8 to 15 ug/L. These wells exhibited anaerobic groundwater conditions and had vinyl chloride concentrations above the cleanup level of 0.2 ug/L. Although PCE was detected in the four other deep wells, concentrations were below the cleanup level and consistent with historical data.

Figure 12 shows PCE concentration in the shallow groundwater for the October 2013 monitoring.

Table 12. Wells with Concentrations (ug/L) above MTCA Method A Cleanup Levels for Groundwater, May and October 2013.

Analyte	PCE		TCE		Cis-1,2-DCE		VC	
MTCA Cleanup Level	5 ug/L		5 ug/L		70 ug/L		0.2 ug/L	
Date	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13
Goodwill-City of Yakima								
GW-MW2	**10**	**14**	1 U	1 U	1 U	1 U	1 U	1 U
Washington Central Railroad Roundhouse								
WDOE-3S	Dry	**19**	Dry	1 U	Dry	1 U	Dry	1 U
WDOE-3I	**4.3**	**8.2**	**3.2**	**4.8**	**2.6**	**3.5**	**6.4**	**3.1**
WDOE-3D	**13**	**15**	**3.4**	**2.5**	**1.0**	**0.36 J**	**0.49 J**	1 U
Fifth Wheel Truck Repair								
5W-MW-2	**1.5**	**5.9**	1 U	1 U	1 U	1 U	1 U	1 U
Cameron Yakima								
CYI-MW-102S	**4.6**	**11**	1 U	1 U	1 U	1 U	1 U	1 U
CYI-MW-103S	**12**	**10**	**0.63 J**	1 U	**0.63 J**	1 U	1 U	1 U
CYI-MW-106S	**3.6**	**7.8**	1 U	1 U	1 U	1 U	1 U	1 U
CYI-MW-107S	**3.4**	**6.2**	1 U	1 U	1 U	1 U	1 U	1 U
CYI-MW-112S	**9**	**11**	**0.44 J**	1 U	**0.45 J**	1 U	1 U	1 U
CYI-MW-113S	**12**	**13**	**0.58 J**	1 U	**0.51 J**	1 U	1 U	1 U
CYI-MW-114S	**12**	**12**	**0.41 J**	1 U	**0.46 J**	1 U	1 U	1 U
Agri-Tech\Yakima Steel								
AT-MW4	**3**	**6.5**	**0.52 J**	**0.62 J**	**3.1**	1 U	1 U	1 U
Remedial Investigation Wells								
RI-4S	**18**	**18**	1 U	1 U	1 U	1 U	1 U	1 U
RI-6S	**3.8**	**8.2**	1 U	1 U	1 U	1 U	1 U	1 U

U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
Bold: Analyte was detected. Shade: Values are greater than MTCA cleanup levels.

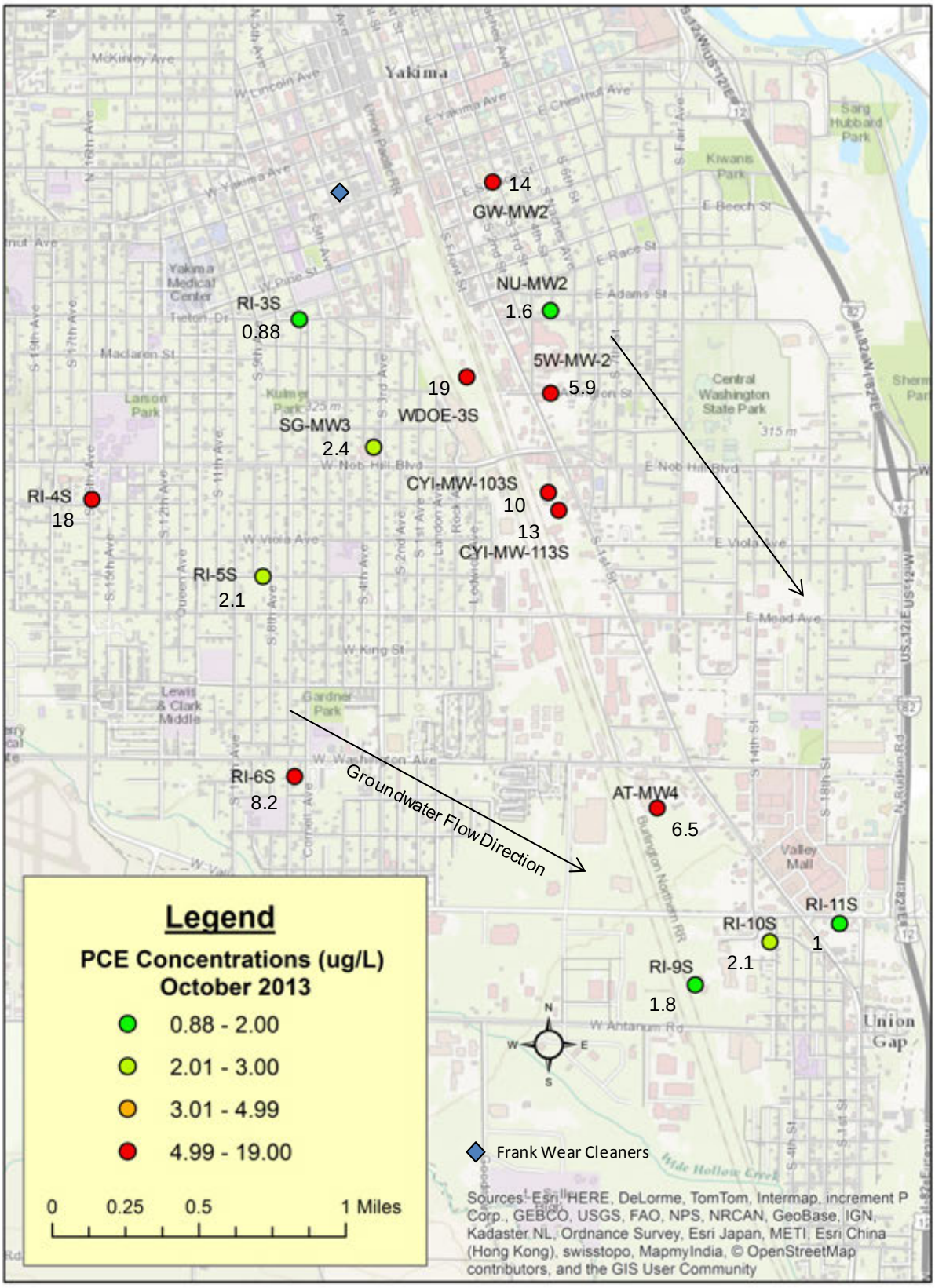

Figure 12. Shallow Zone PCE Concentrations (ug/L), October 2013.

Chloroform

Although not a contaminant of concern with respect to PCE, chloroform was detected in both the May and October 2013 groundwater samples throughout the YRRA project area. Most concentrations ranged from about 1 to 5 ug/L. Higher chloroform concentrations were found in samples collected from the Goodwill wells, ranging from 21 to 55 ug/L in May and from 5 to 12 ug/L in October.

Chloroform continues to appear to be widespread throughout the YRRA. It has been detected in YRRA site monitoring wells as early as 1994. Although chloroform can be the result of point sources from a variety of industries, it is also widely distributed in the environment through the discharge of chlorinated water supplies. Chloroform, along with other trihalomethanes, is a disinfection by-product commonly produced during the chlorination of water supplies and wastewater. (Ivahnenko et al., 2006). Concentrations detected in the YRRA wells did not exceed EPA's Maximum Contaminant Level (MCL) of 80 ug/L for total trihalomethanes.

Discussion

PCE Concentration Trends Over Time

Area-wide monitoring of PCE contaminated groundwater has occurred in the YRRA since 1997. Following is a discussion of PCE trends over time for data collected at each of the source areas and data collected at the YRRA Remedial Investigation (RI) wells. A summary of the project data is presented in Appendix C. The data have been divided following the spring/fall monitor schedule to provide the reader with a visual aid on possible trends.

Goodwill-City of Yakima

The Goodwill-City of Yakima site is the present location of the City of Yakima Police and Justice Center. The three wells sampled are currently the most northern wells in the YRRA monitoring program. Contaminated soil was removed from this site as part of an interim action in 1995 during the demolition of the Goodwill building and subsequent construction of the new police station (Huntingdon Engineering, 1995). Groundwater monitoring data are available for this site from 1997 to the present (Appendix C, Table C-1).

PCE concentrations in upgradient well GW-MW1 have consistently been below the MTCA cleanup level of 5 ug/L since 2009 (Figure 13).

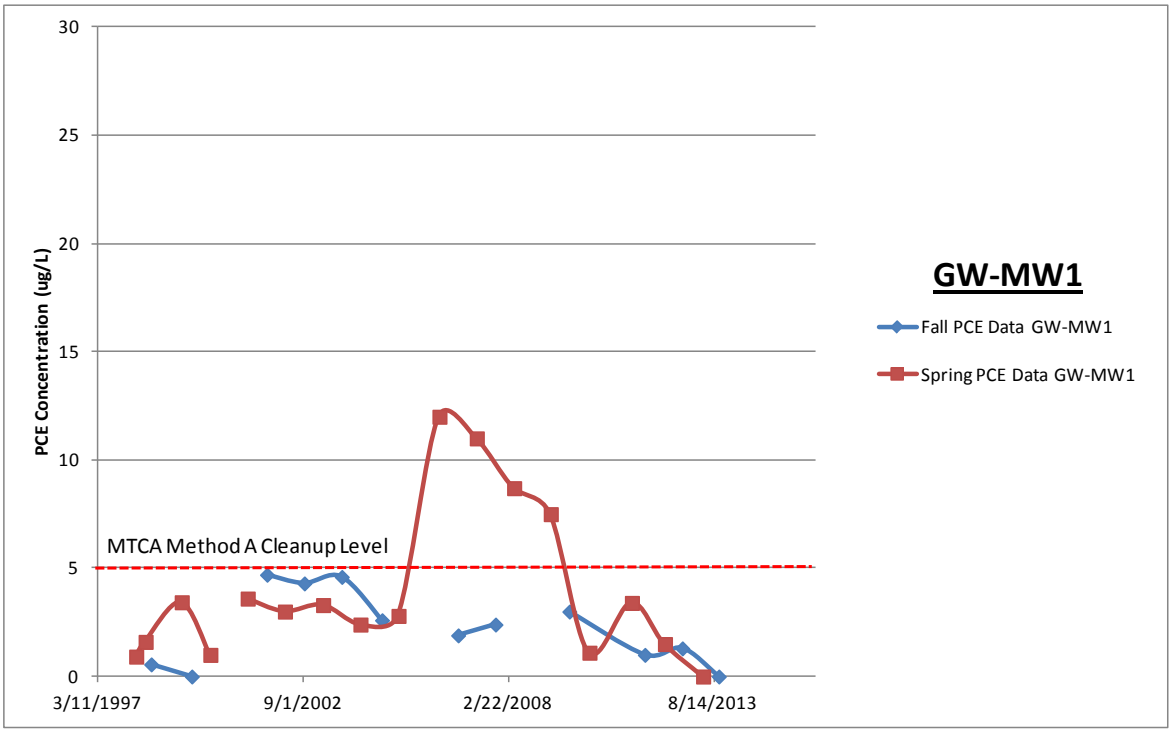

Figure 13. Goodwill, Well GW-MW1 PCE Results (ug/L), March 1998 to October 2013.

PCE concentrations in downgradient well GW-MW2 (Figure 14) continue to exceed the cleanup level, with no noticeable change in concentrations or seasonal pattern. Although PCE concentrations in this well have been as low as 1.1 ug/l, concentrations since 1997 have consistently ranged from 5 to 25 ug/L.

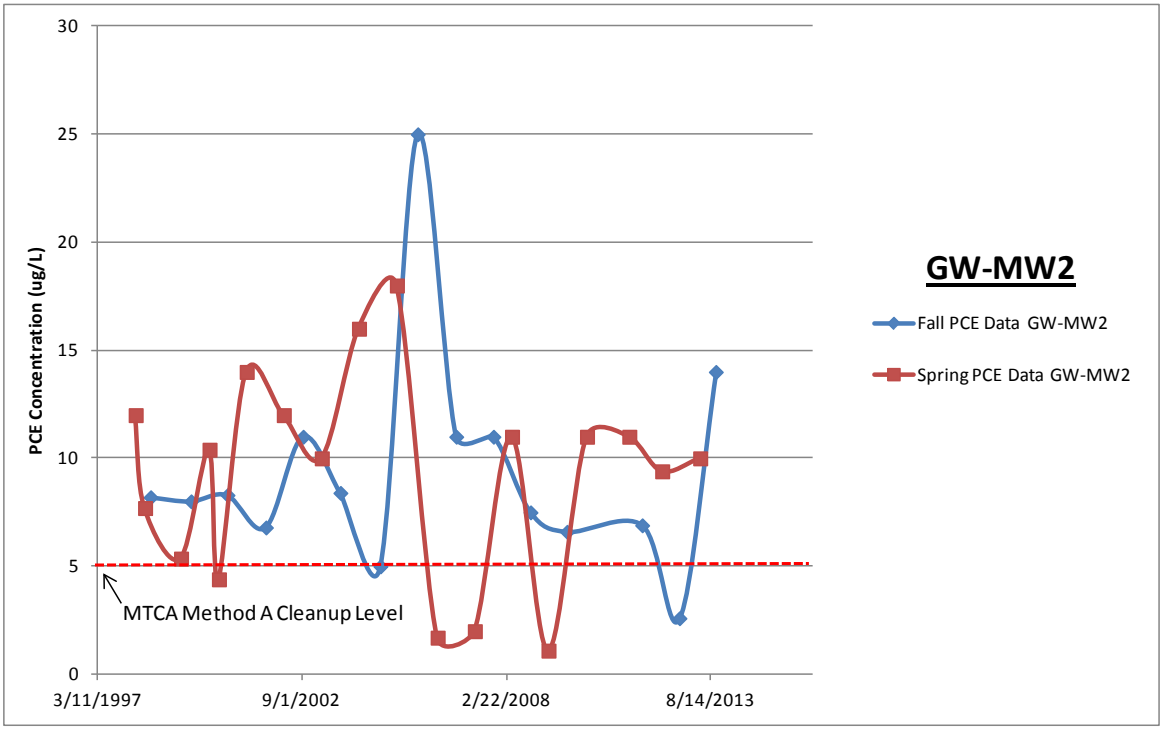

Figure 14. Goodwill, Well GW-MW2 PCE Results (ug/L), March 1998 to October 2013.

PCE concentrations in downgradient well GW-MW4 have decreased, being below the cleanup level since 2006 (Figure 15).

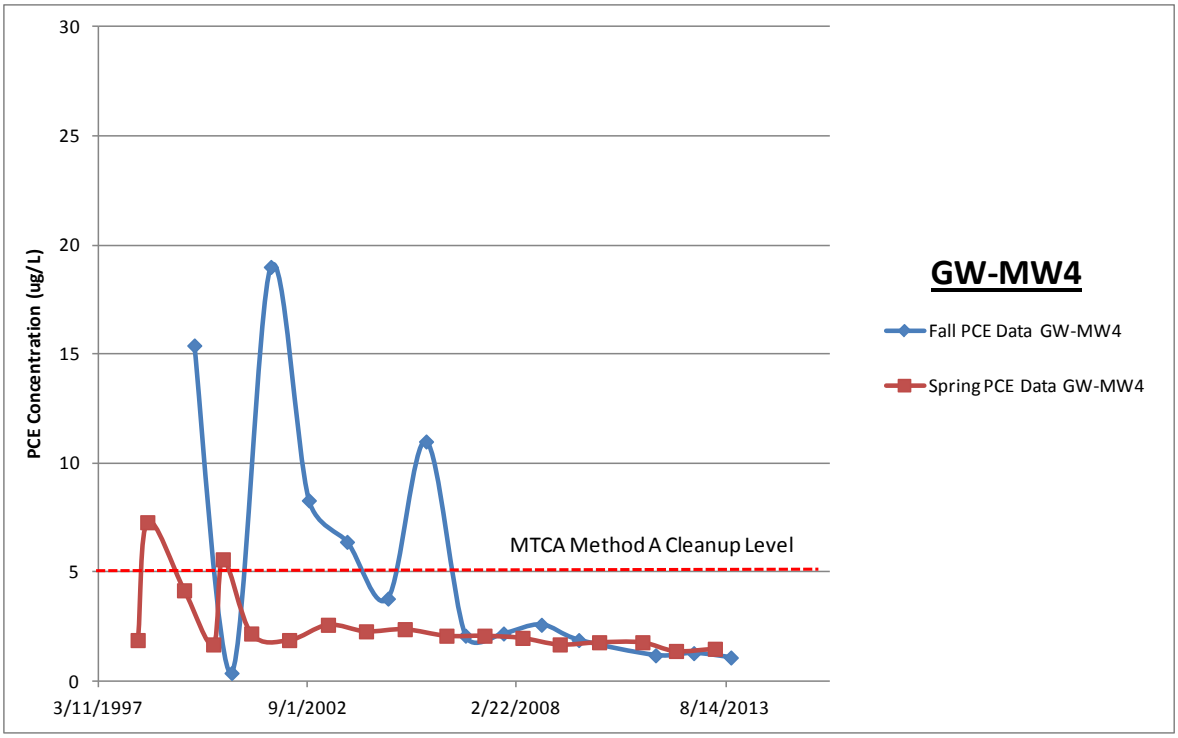

Figure 15. Goodwill, Well GW-MW4 PCE Results (ug/L), March 1998 to October 2013.

Nu-Way Cleaners

Nu-Way Cleaners is located approximately 0.5 miles southeast of the Goodwill site. Source removal activities occurred at this site in 1996 and included the removal of two sumps and three underground storage tanks, as well as the associated contaminated soil. It was concluded in the 1996 remedial investigation that PCE concentrations in the three monitoring wells had decreased since source reduction activities at the site (Enviros, 1996).

Since 1997, PCE concentrations in all three wells have continued to decrease (Figures 16, 17, 18), with concentrations ranging from less than 1 to 5.5 ug/L (Table C-2). Overall, PCE concentrations have been below the cleanup level at this site since 2003. The data at this site indicate that higher PCE concentrations tend to occur during the spring monitoring while water levels are lower. Downgradient PCE concentrations at this site are consistent with upgradient conditions, indicating that this site no longer appears to pose a significant source of contamination to the larger YRRA plume.

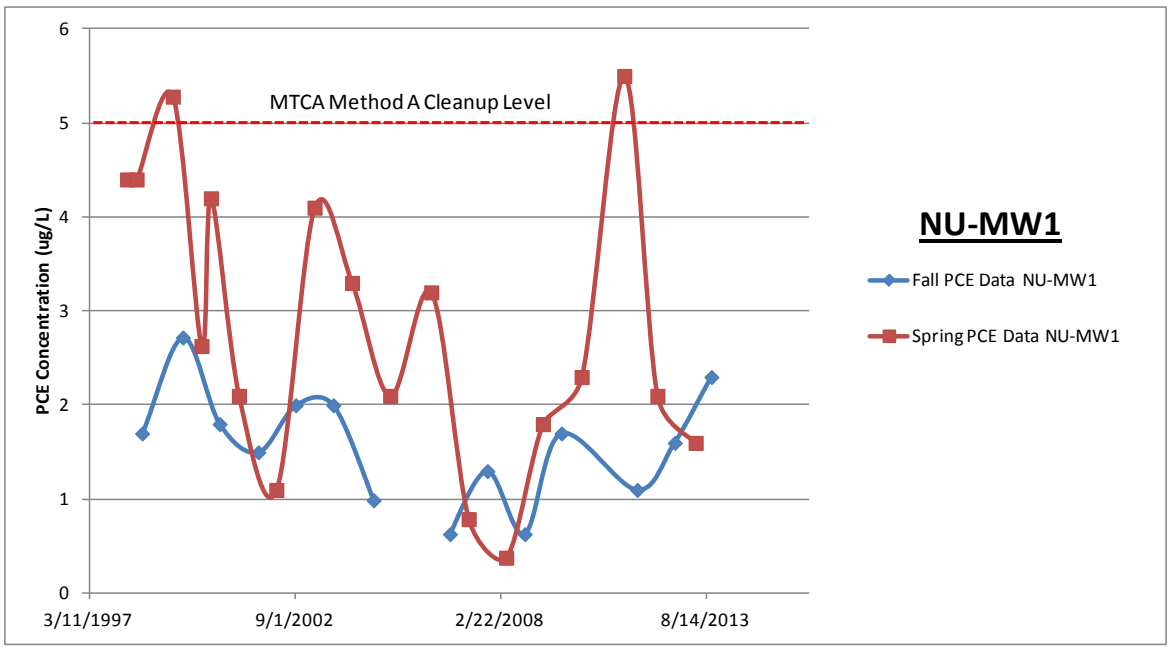

Figure 16. Nu-Way Cleaners, Well NU-MW1 PCE Results (ug/L), March 1998 to October 2013.

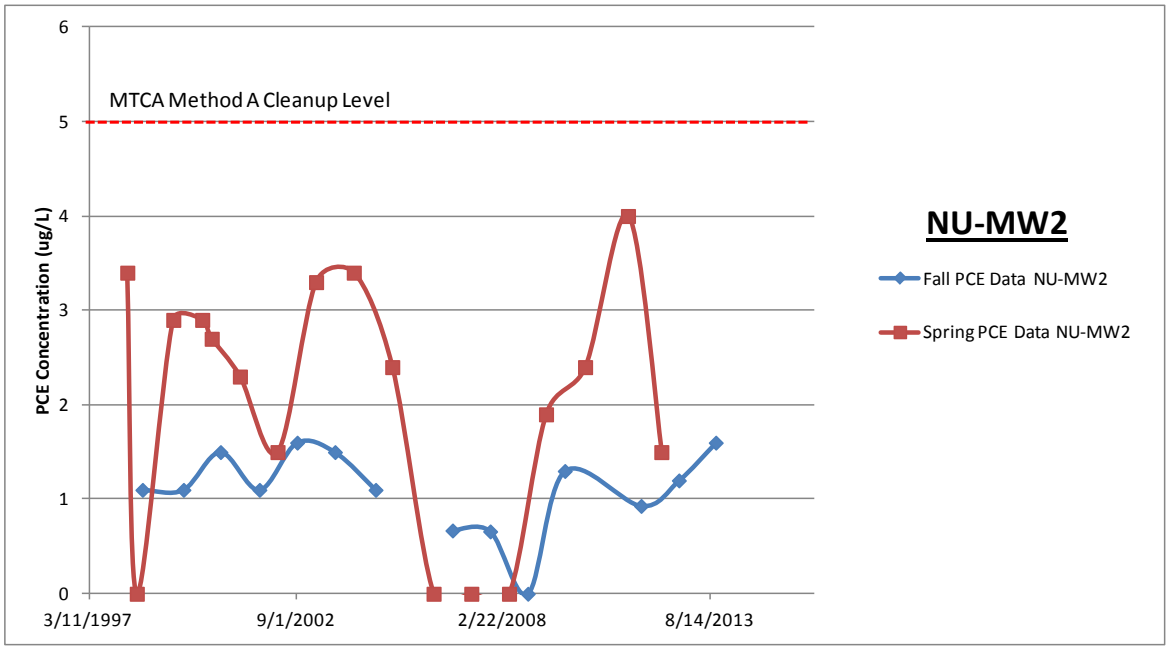

Figure 17. Nu-Way Cleaners, Well NU-MW2 PCE Results (ug/L), March 1998 to October 2013.

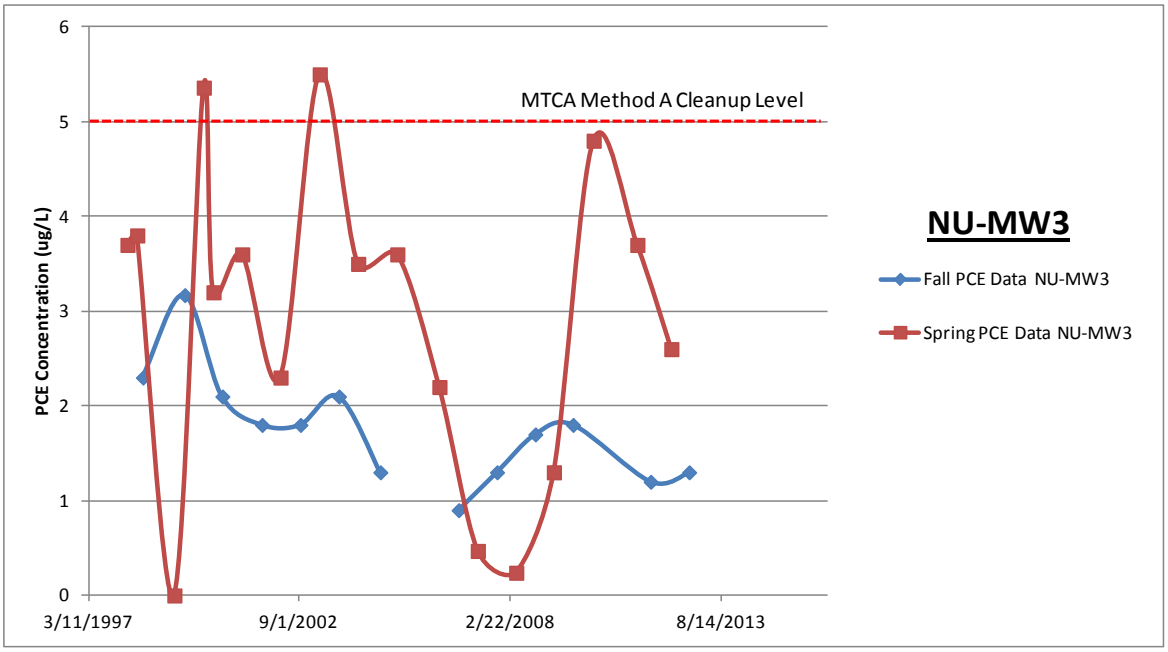

Figure 18. Nu-Way Cleaners, Well NU-MW3 PCE Results (ug/L), March 1998 to October 2012.

Southgate Laundry

Contaminated soils were removed from the Southgate Laundry site in 1997 as part of an interim action. The 1998 investigative report noted a substantial decline in PCE concentrations in the downgradient wells following source removal (Maxim, 1998). Groundwater monitoring data for the site is available from 1999 through 2013 (Table C-3, Figures 19 - 21). PCE concentrations in upgradient well SG-MW1 (Figure 19) have consistently been below MTCA cleanup levels over the monitoring period. PCE concentrations in downgradient wells SG-MW2 (Figure 20) and SG-MW3 (Figure 21) were above the cleanup levels until 2005, with concentrations in both wells ranging from about 2 to 29 ug/L. Since 2006, PCE concentrations have decreased, ranging from less than 1 to 4.5 ug/L. This indicates that past source-removal activities have been successful in reducing the PCE groundwater concentrations at the site.

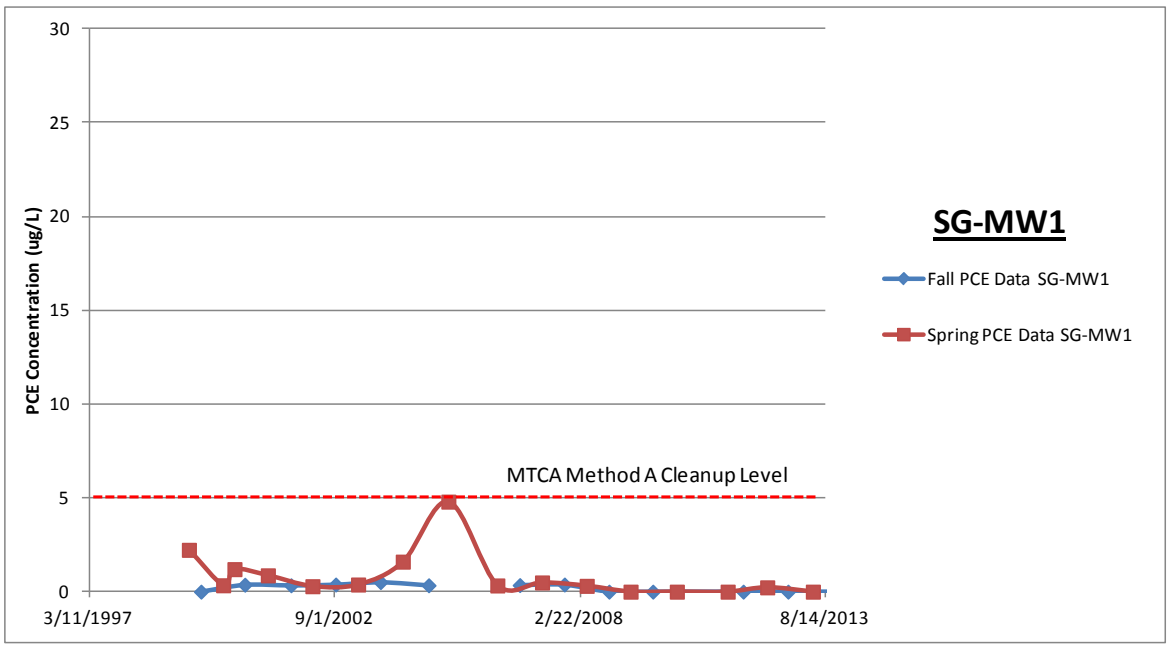

Figure 19. Southgate Laundry, Well SG-MW1 PCE Results (ug/L), June 1999 to October 2013.

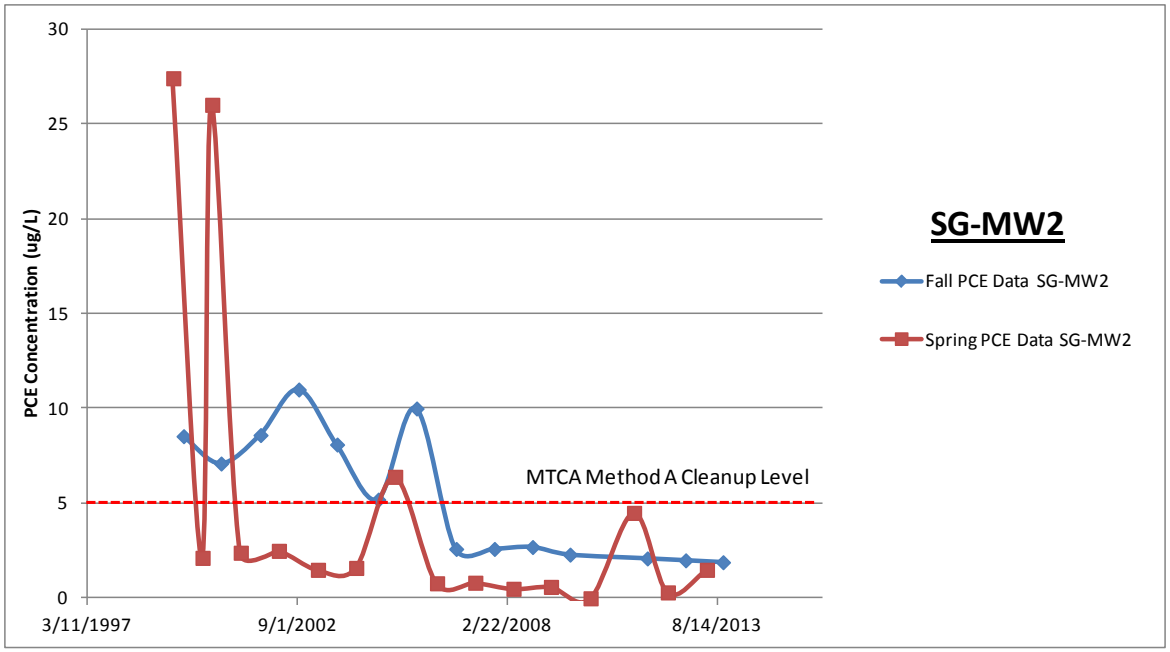

Figure 20. Southgate Laundry, Well SG-MW2 PCE Results (ug/L), June 1999 to October 2013.

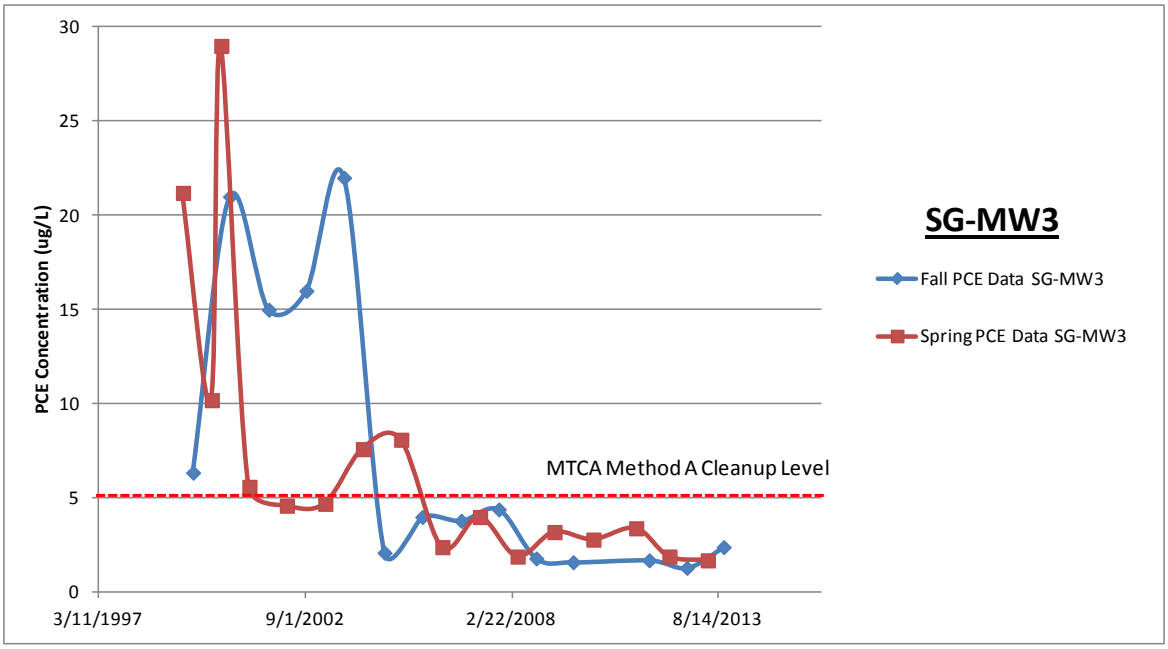

Figure 21. Southgate Laundry, Well SG-MW3 PCE Results (ug/L), June 1999 to October 2013.

Washington Central Railroad Roundhouse

The Washington Central Railroad Roundhouse (WCRR) is located in the central portion of the YRRA (Figure 12). The three wells located at this site consistently have the highest PCE concentrations of all the wells sampled in the study area (Table 12). From 1997 to 2013, PCE concentrations ranged from 4.5 to 90 ug/L (WDOE-3S), 0.13 to 42 ug/L (WDOE-3I), and 1.6 to 16.4 ug/L (WDOE-3D) (Table C-4). PCE concentrations decreased substantially in the shallow (WDOE-3S) and intermediate (WDOE-3I) wells after June 2000, to 4.5 to 19 ug/L and less than 1 to 18 ug/L, respectively. The reason for the decrease in concentrations in 2000 is unknown since there is no record of any direct remediation at this site to address the PCE contamination. PCE concentrations in both wells continue to exceed the cleanup level in the fall (Figure 22 and 23), when higher PCE concentrations tend to occur. PCE concentrations in the deep well (WDOE-3D) have been more constant, ranging from about 6 to 16 ug/L (Figure 24), with concentrations also being slightly higher in the fall.

Current PCE concentrations in wells WDOE-3I and WDOE-3D, which are approximately 60 feet and 100 feet deep, indicate that the contaminant plume has a vertical component that reaches the deep water-bearing zone in this portion of the YRRA.

PCE breakdown products are also consistently detected in wells WDOE-3I and WDOE-3D (Table C-4), an indication that natural biodegradation is occurring. With a few exceptions, TCE has been detected below the cleanup level of 5 ug/L in both wells. However, TCE concentrations in well WDOE-3I appear to be increasing (Figure 25). Vinyl chloride is also consistently detected in these two wells, with concentrations ranging from 0.21 to 7.5 ug/L (WDOE-3I) and 0.27 to 3.6 ug/L (WDOE-3D). Although, it appears that vinyl chloride concentrations in the deeper well are decreasing. The MTCA cleanup level for vinyl chloride is 0.2 ug/L.

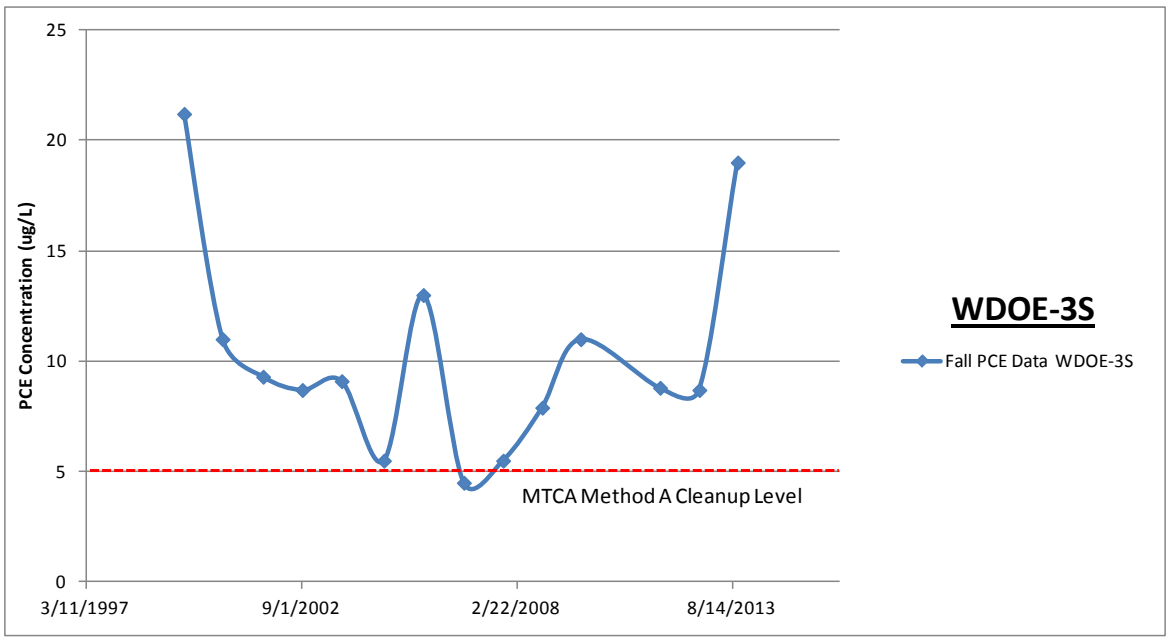

Figure 22. Washington Central Railroad Roundhouse, Well WDOE-3S PCE Results (ug/L), September 1999 to October 2013.

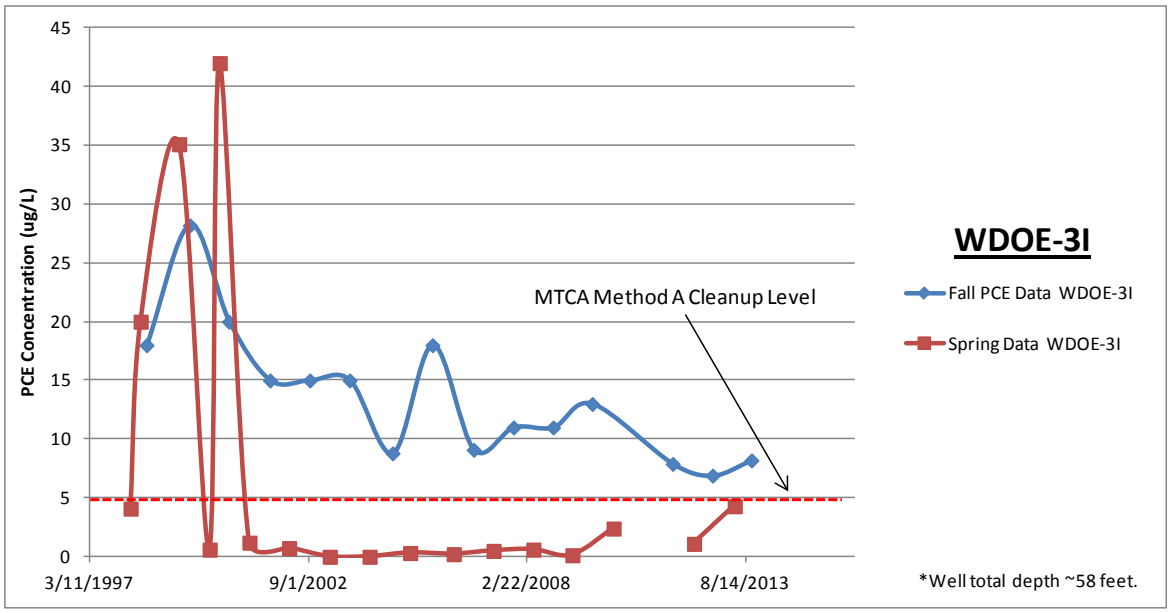

Figure 23. Washington Central Railroad Roundhouse, Well WDOE-3I PCE Results (ug/L), March 1998 to October 2013.

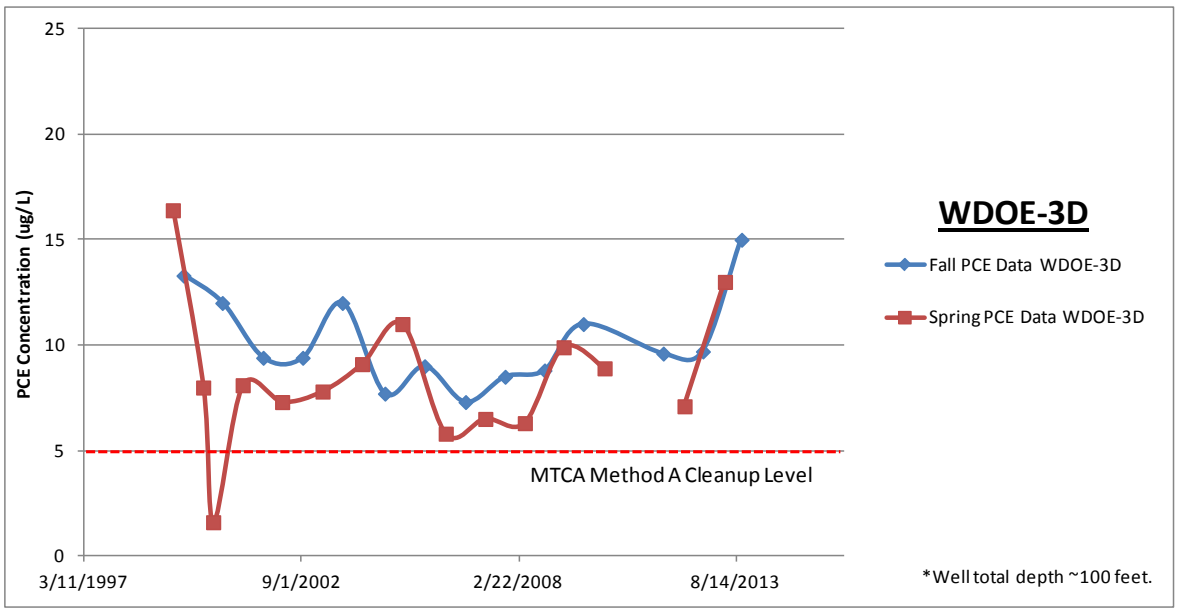

Figure 24. Washington Central Railroad Roundhouse, Well WDOE-3D PCE Results (ug/L), June 1999 to October 2013.

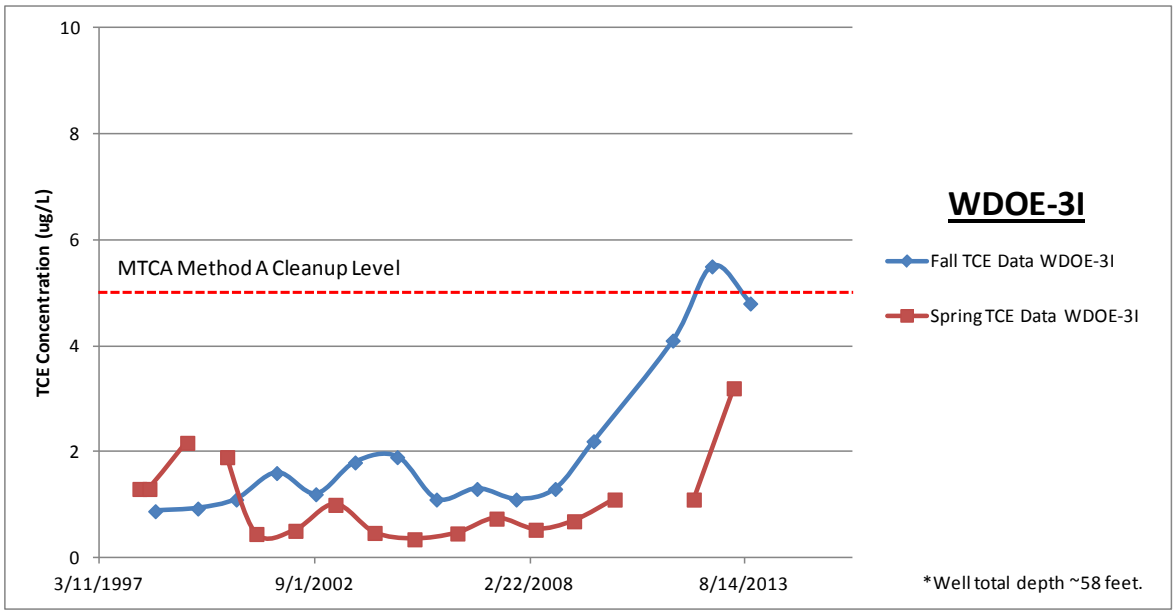

Figure 25. Washington Central Railroad Roundhouse, Well WDOE-3I TCE Results (ug/L), June 1999 to October 2013.

The data indicate that the WCRR facility continues to act as a significant source of chlorinated solvent contamination to groundwater, including to deeper portions of the aquifer system.

Fifth Wheel Truck Repair

Fifth Wheel Truck Repair is located approximately 0.3 miles east (cross-gradient) of the Roundhouse wells. It was a heavy-truck repair shop for the Hahn Motor Company. Hahn Motors, which was across the street from the repair shop, was also identified as an YRRA source area (Grover, 1992). Cleanup activities occurred at the Fifth Wheel site from 1991 to 2001 and included the removal of a catch basin, a dry well, and the associated petroleum and PCE contaminated soils (Maxim, 1996a). Groundwater monitoring data are available for well 5W-MW-2 from 1999 to 2013 (Table C-5). During that time PCE concentrations in the well have ranged from less than 1 to 11 ug/L, with higher concentrations consistently occurring in the fall. PCE concentrations appear to be gradually decreasing but still exceed the cleanup level on occasion (Figure 26).

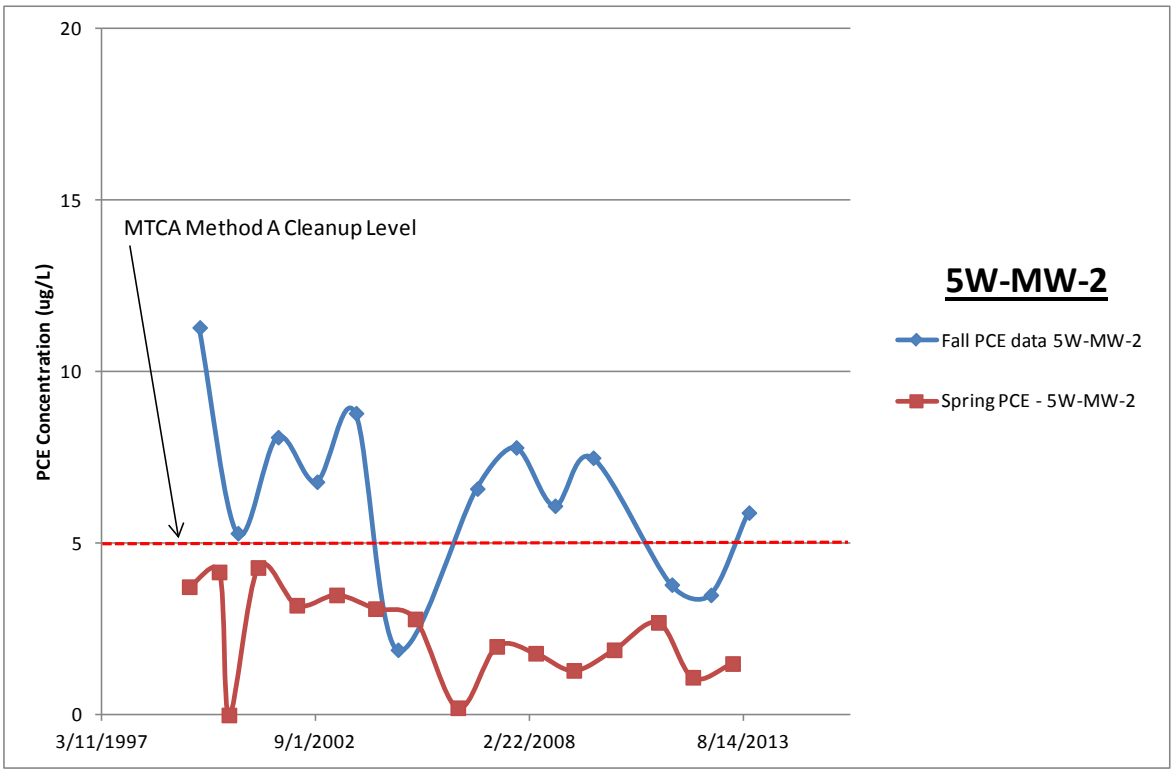

Figure 26. Fifth Wheel Truck Repair, Well 5W-MW-2 PCE Results (ug/L), June 1999 to October 2013.

Cameron Yakima, Inc.

Cameron Yakima is also located in the central portion of the YRRA, approximately 0.5 miles southeast (downgradient) of the Roundhouse wells (Figure 12). Cameron Yakima operated as a carbon regeneration/reactivation facility beginning in 1953. A wide variety of industries sent their spent contaminated carbon to this facility for treatment or disposal, resulting in a wide range of organic contaminants in the subsurface beneath the site. The business ceased operations in 1997. All former structures were removed in the fall of 1998. In 2000, Ecology conducted cleanup activities on the Cameron property, due to the immediate threat to public health and the environment posed from the onsite soil contamination. Groundwater monitoring data from onsite monitoring wells are available from 1997 to the present (Table C-6).

PCE concentrations in the two upgradient wells (CYI-MW-106S and CYI-MW-107S) ranged from about 8 to 27 ug/L between 1997-1999 (Table C-6). Concentrations at these upgradient locations have been decreasing since the 2000 cleanup activities but continue to exceed the MTCA cleanup level of 5 ug/L (Figures 27 and 28). The monitoring results indicate that PCE concentrations are consistently higher during the fall in well CYI-MW-106S, but no seasonal concentration pattern is seen in the MW-107S data. Since PCE concentrations in both upgradient wells continue to be elevated, this may indicate continued PCE contamination from sources upgradient of the Cameron site.

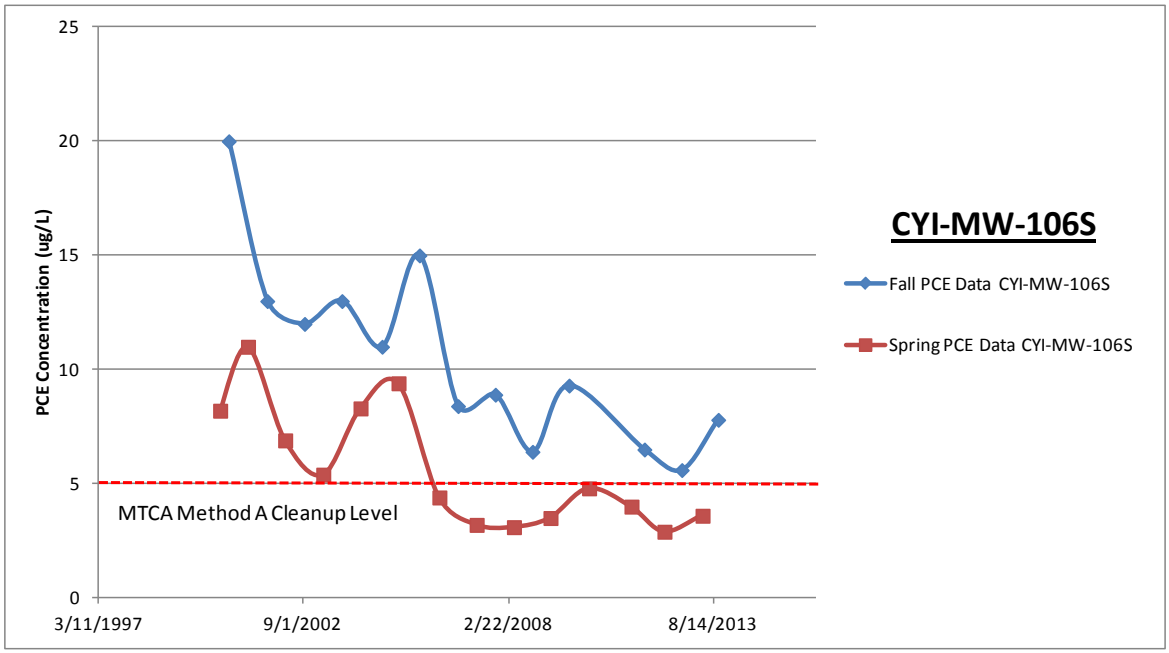

Figure 27. Cameron Yakima, Well CYI-MW-106S PCE Results (ug/L), June 2000 to October 2013.

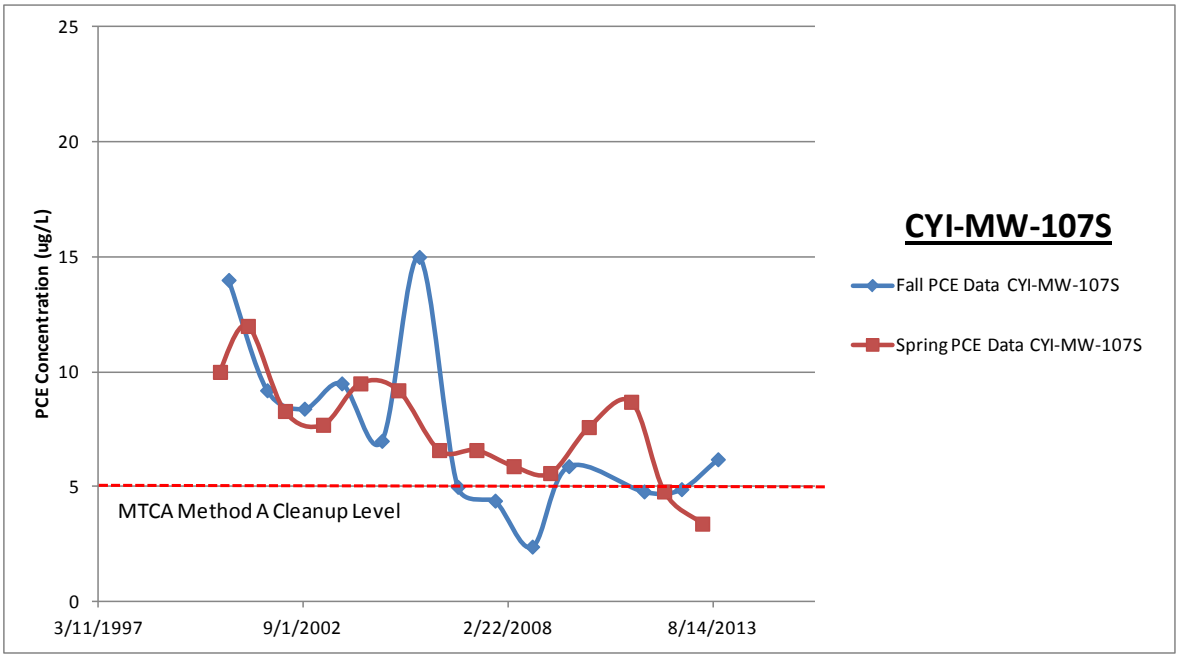

Figure 28. Cameron Yakima, Well CYI-MW-107S PCE Results (ug/L), June 2000 to October 2013.

Wells CYI-MW-102S, CYI-MW-103S, and CYI-MW-103D are located in the northwest corner of the Cameron site. Prior to soil removal, the two shallow wells had some of the highest PCE concentrations found in the YRRA at 72 ug/L (CYI-MW-102S) and 139 ug/L (CYI-MW-103S) (Table C-6). PCE concentrations decreased substantially after 2000, with maximum concentrations of 17 ug/L and 57 ug/L, respectively (Figures 29 and 30). Although PCE concentrations continue to exceed the cleanup level in these two shallow wells, concentrations have continued to decrease to near or below 10 ug/L since 2006. Well CYI-MW-102S has a seasonal pattern of higher concentrations in the fall. PCE concentrations in the deep well (CYI-MW-103D) have been more constant since monitoring began in 1997, with a range of approximately 2 to 5 ug/L (Figure 31). PCE concentrations in the deep well also appear to be decreasing.

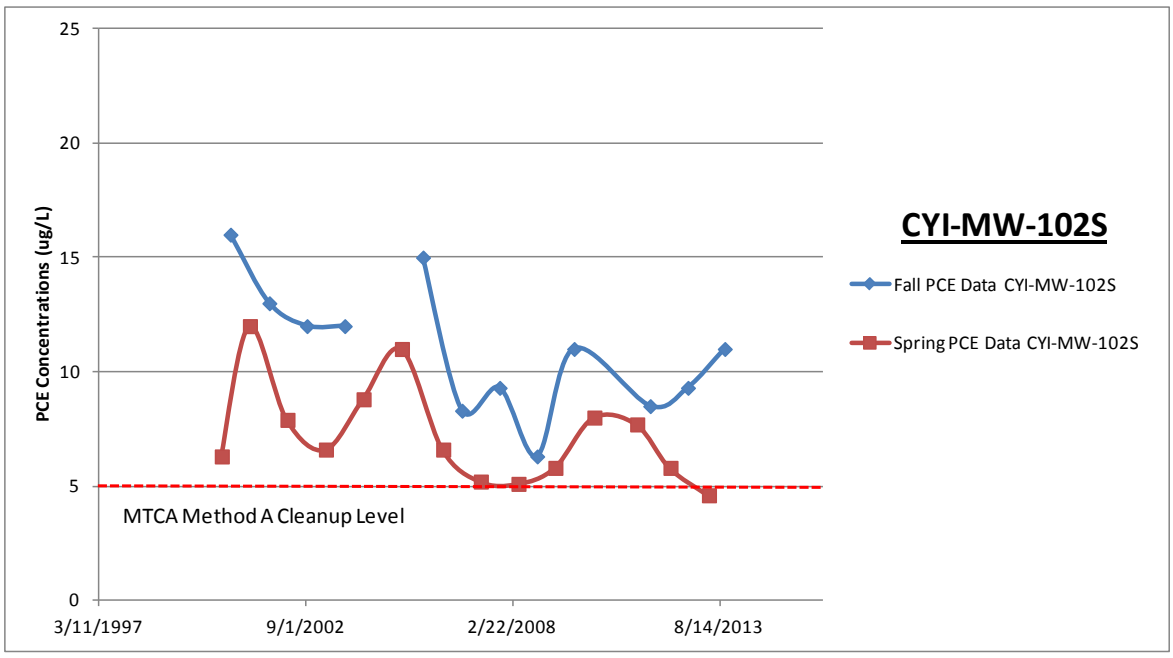

Figure 29. Cameron Yakima, Well CYI-MW-102S PCE Results (ug/L), June 2000 to October 2013.

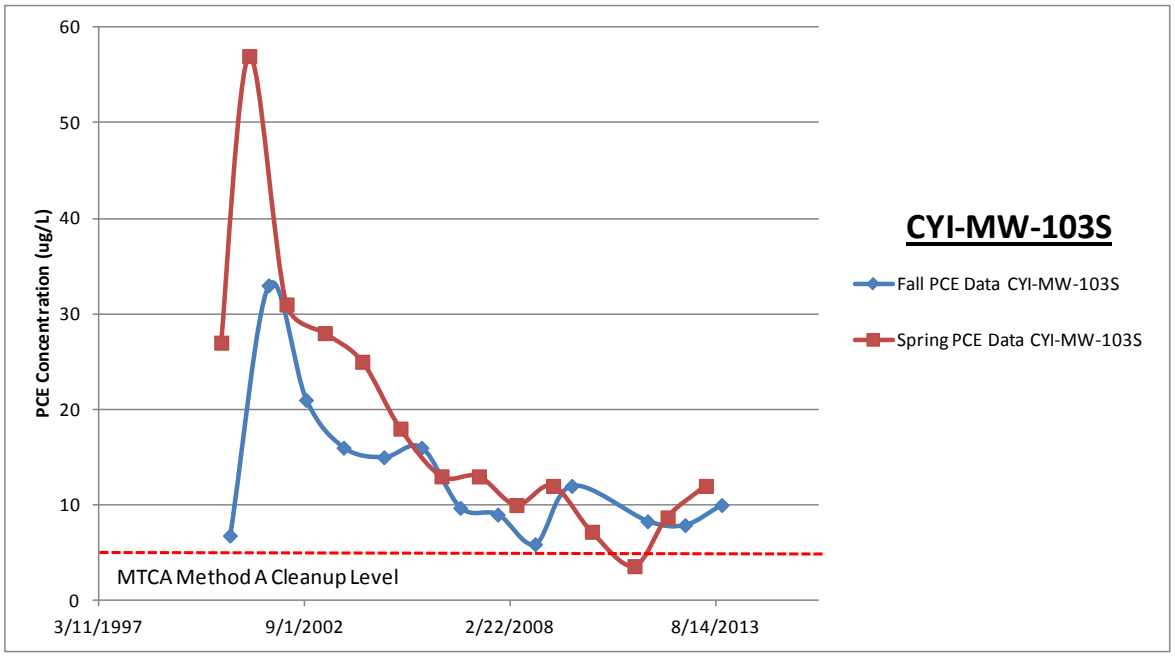

Figure 30. Cameron Yakima, Well CYI-MW-103S PCE Results (ug/L), June 2000 to October 2013.

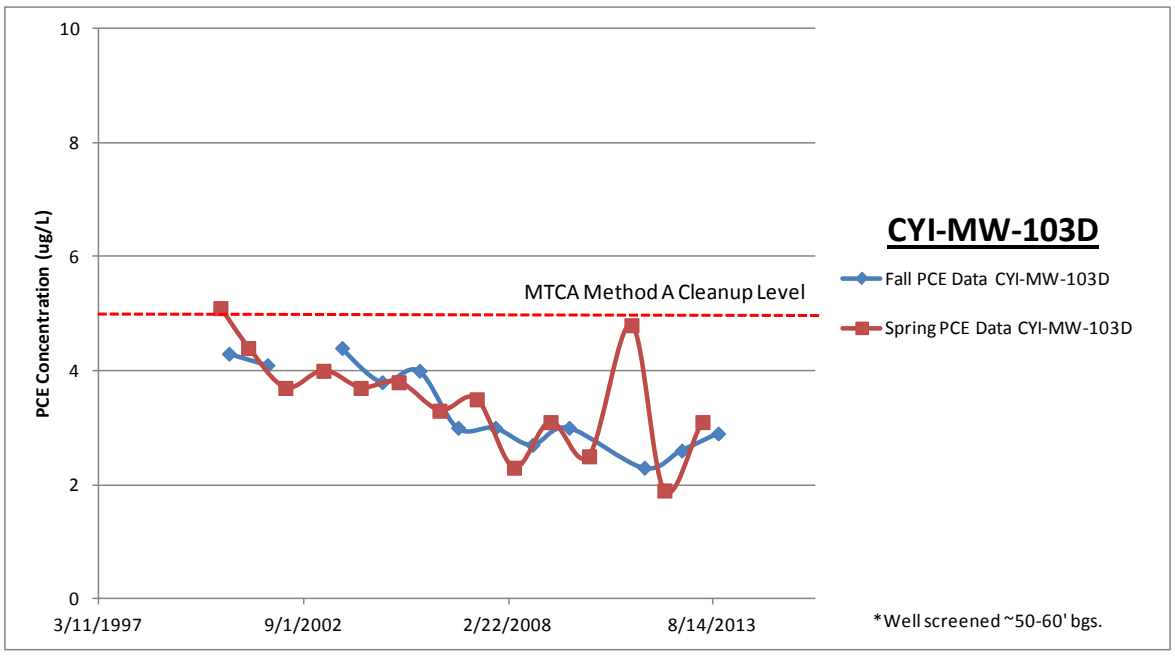

Figure 31. Cameron Yakima, Well CYI-MW-103D PCE Results (ug/L), June 2000 to October 2013.

Wells CYI-MW-108S, CYI-MW-109S, CYI-MW-110S, and CYI-MW-111S are located in the northeast corner of the site. PCE concentrations in these wells were lower between 1997 and 1999, ranging from approximately 3 to 9 ug/L (Table C-6). For the most part, concentrations have deceased to below or near the cleanup level of 5 ug/L since the interim action in 2000 (Figures 32, 33, 34, 35).

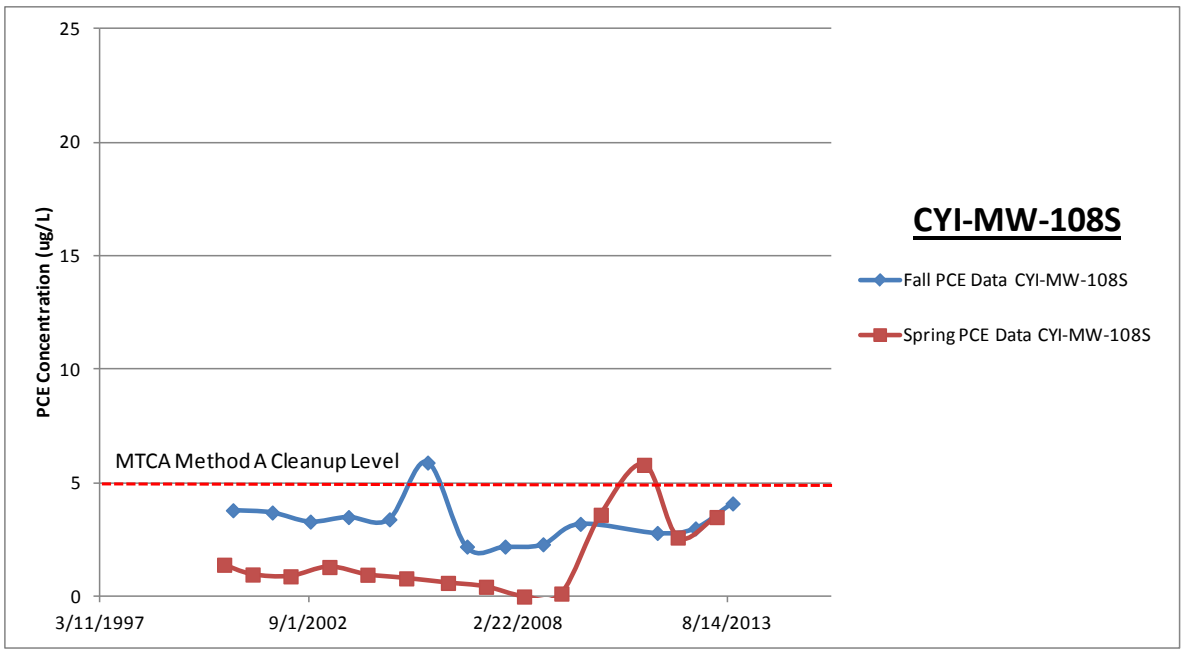

Figure 32. Cameron Yakima, Well CYI-MW-108S PCE Results (ug/L), June 2000 to October 2013.

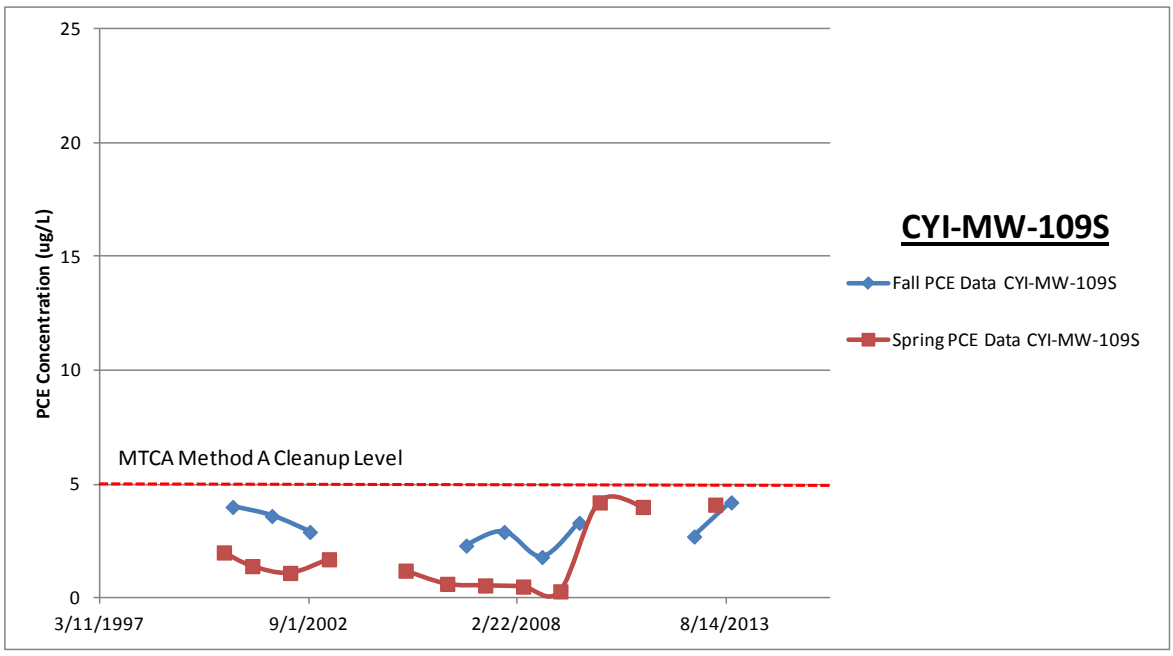

Figure 33. Cameron Yakima, Well CYI-MW-109S PCE Results (ug/L), June 2000 to October 2013.

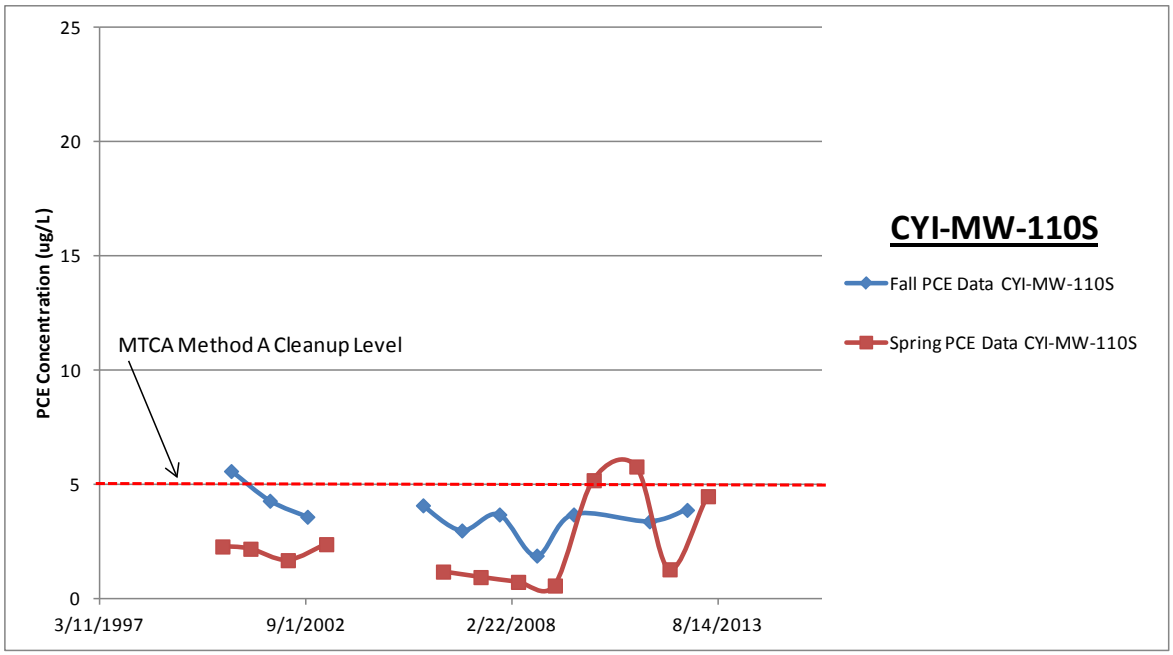

Figure 34. Cameron Yakima, Well CYI-MW-110S PCE Results (ug/L), June 2000 to May 2013.

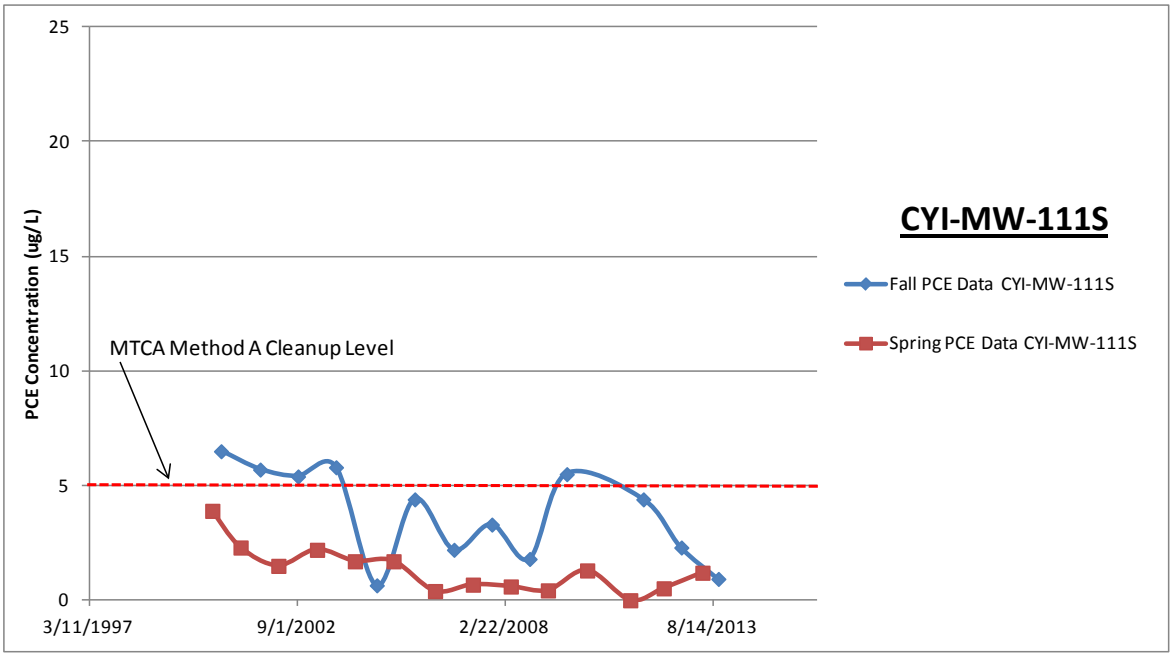

Figure 35. Cameron Yakima, Well CYI-MW-111S PCE Results (ug/L), June 2000 to October 2013.

Four wells are located in the southeast corner of the property: CYI-MW-112S, CYI-MW-113S, CYI-MW-113D, and CYI-MW-114S. PCE concentrations in the three shallow wells from this area ranged from approximately 15 to 30 ug/L between 1997 and 1999. Concentrations were gradually decreasing after the 2000 cleanup activities but have displayed an increasing trend since 2009 (Figures 36, 37, 38). PCE concentrations are now consistently above the MTCA cleanup level of 5 ug/L, with a range of 5 to 14 ug/L. The elevated PCE concentrations along the downgradient boundary of the site indicate possible off-site migration of the contaminant plume. PCE concentrations in the deep well (CYI-MW-113D) have remained fairly constant from 1998 to 2013, with a range of 3 to 6 ug/L (Figure 39). Concentrations appear to be gradually decreasing.

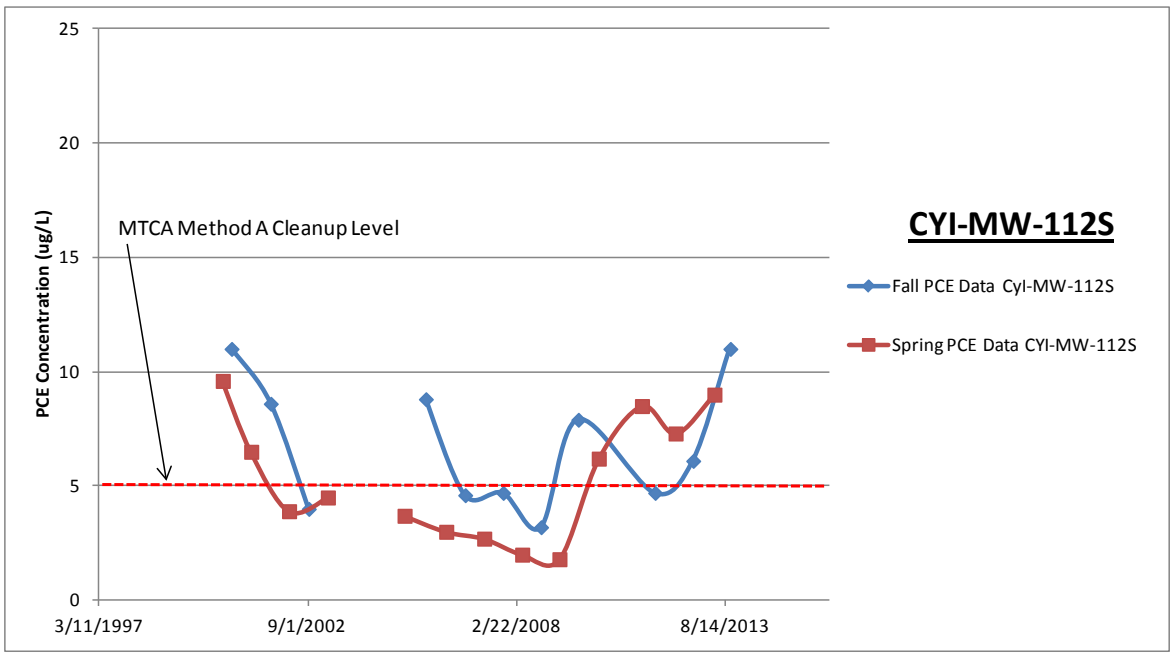

Figure 36. Cameron Yakima, Well CYI-MW-112S PCE Results (ug/L), June 2000 to October 2013.

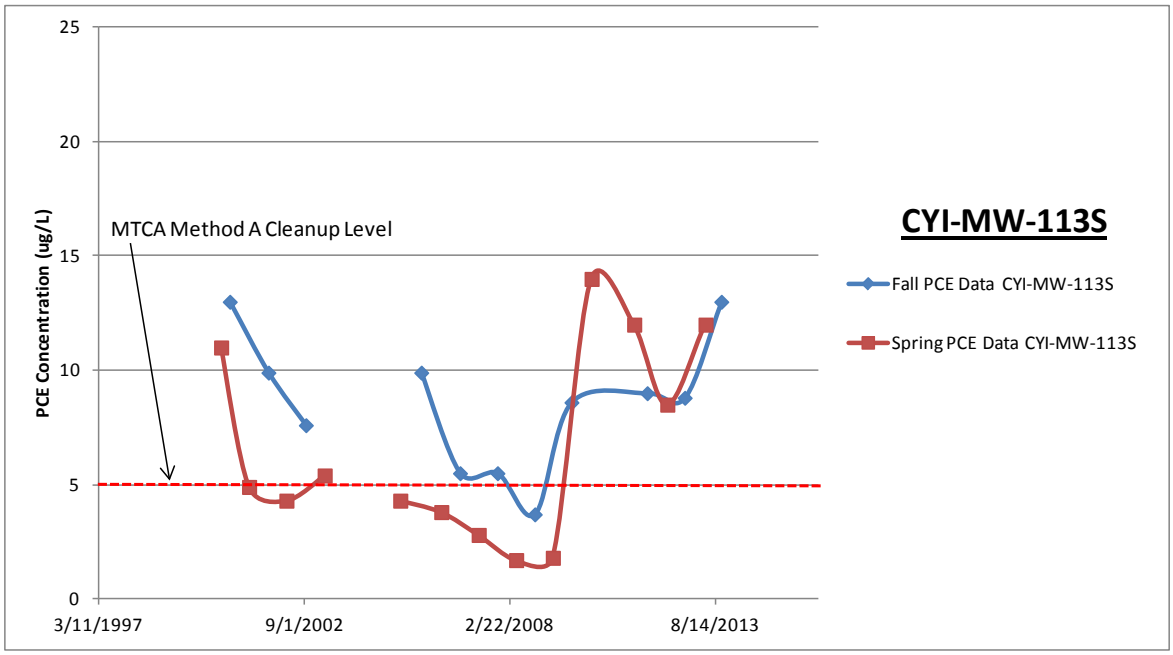

Figure 37. Cameron Yakima, Well CYI-MW-113S PCE Results (ug/L), June 2000 to October 2013.

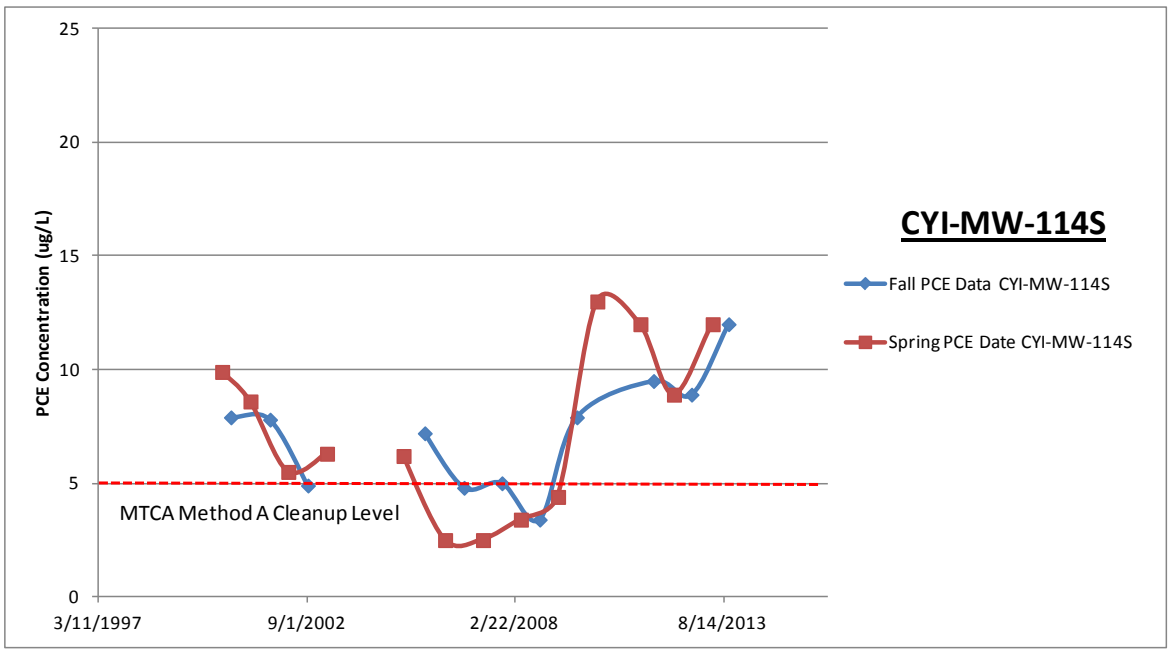

Figure 38. Cameron Yakima, Well CYI-MW-114S PCE Results (ug/L), June 2000 to October 2013.

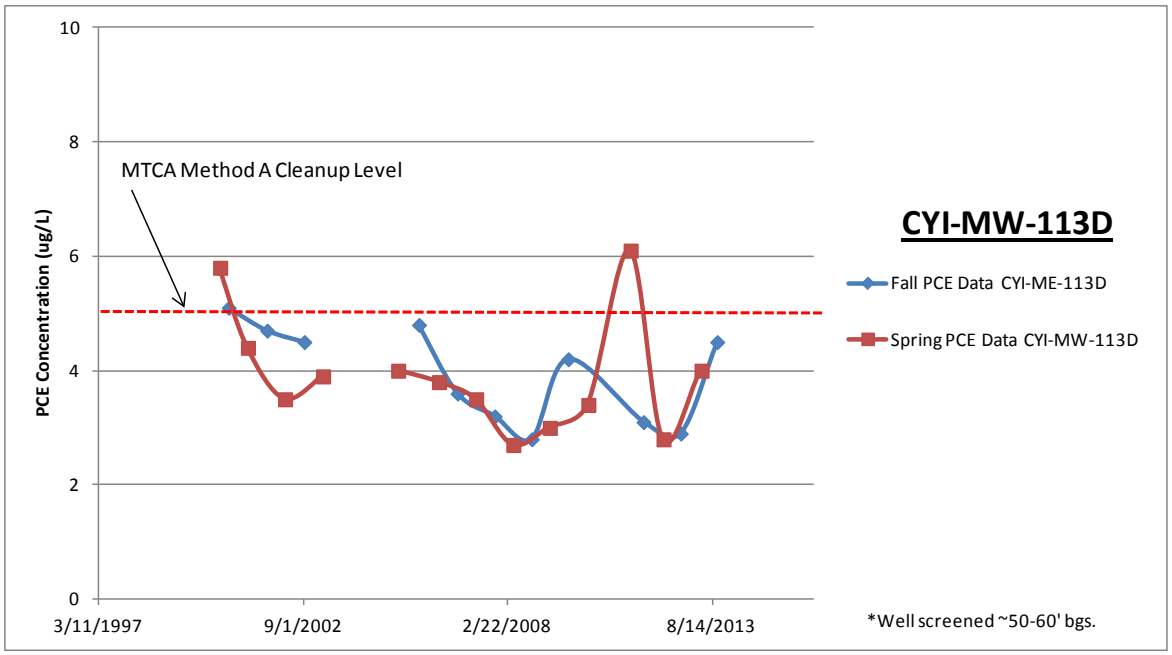

Figure 39. Cameron Yakima, Well CYI-MW-113D PCE Results (ug/L), June 2000 to October 2013.

The Roundhouse and Cameron wells confirm that the shallow groundwater in the central portion of the YRRA continues to be contaminated with elevated concentrations of PCE (Table 12, Figure 12). Whether the contaminant plumes are separate or co-mingled cannot be determined with the existing information.

Agri-Tech/Yakima Steel

The Agri-Tech\Yakima Steel site is located in the south-central end of the YRRA. The property was formerly occupied by Yakima Farmers Supply, a fertilizer and pesticide manufacturer. In 2004, a remedial site investigation identified a variety of contaminants in the soils and groundwater, including solvents, pesticides, petroleum, and heavy metals (Farallon, 2011). Groundwater monitoring data have been collected from well AT-MW4 since 1999 to the present (Table C-5). PCE concentrations have ranged from about 2 to 7 ug/L. The data indicate that PCE concentrations are typically somewhat higher in the fall (Figure 40).

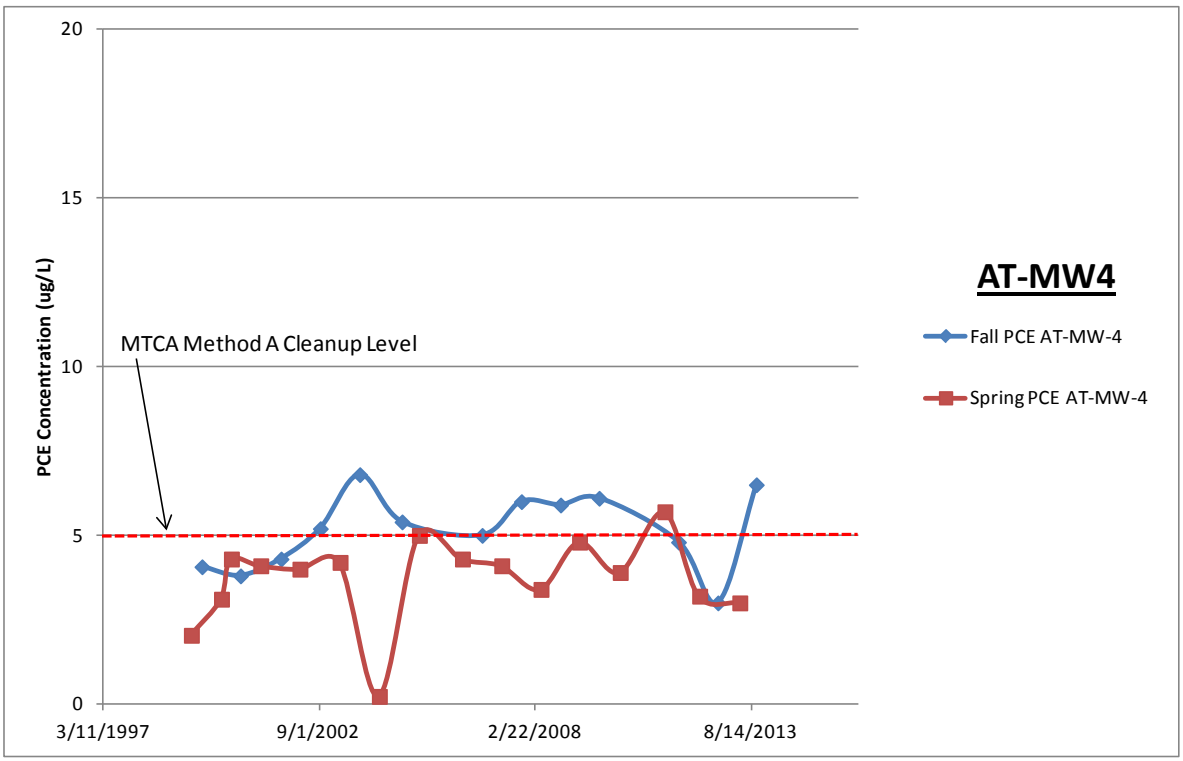

Figure 40. Agri-Tech/Yakima Steel, Well AT-MW4 PCE Results (ug/L), June 1999 to October 2013.

YRRA Remedial Investigation Wells

Nine YRRA Remedial Investigation (RI) wells were sampled in 2013, seven shallow and two deep wells. The 9 wells selected for continued monitoring are primarily located along the western and southern edges of the YRRA (Figure 12). Groundwater monitoring data for these wells is presented in Table C-7.

Well RI-3S is located about 0.5 miles northwest (upgradient) of the Southgate Laundry site and is the farthest upgradient RI well currently being sampled. Low concentrations of PCE have been detected in this well since monitoring began in 1999. Concentrations have primarily ranged from 0.2 to 2.5 ug/L and appear to be gradually decreasing (Figure 41). No seasonal pattern in PCE concentration is revealed by the data. Since PCE is not naturally occurring, the low concentrations detected in this well indicate that a low level source of PCE to the shallow aquifer continues to exist at the upgradient end of the YRRA.

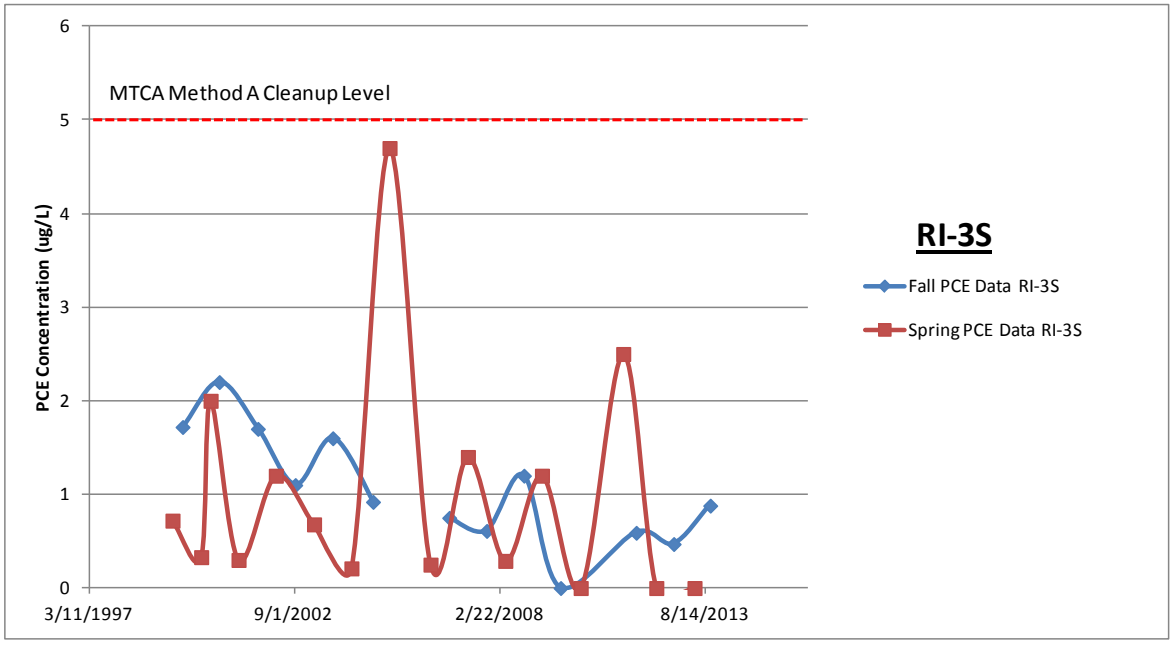

Figure 41. YRRA Remedial Investigation Well RI-3S PCE Results, June 1999 to October 2013.

Wells RI-4S and RI-4D are located on the western edge of the YRRA. Well RI-4S has the highest PCE concentrations of the RI wells, ranging from 11 to 25 ug/L between 1999 to 2013. Although concentrations had been fairly stable over most of the monitoring period, they have been exhibiting an increasing trend since 2009 (Figure 42). PCE concentrations are generally slightly higher during the spring monitoring.

PCE is detected in the deep well RI-4D (Figure 43) but at concentrations of about 0.3 to 3 ug/L. Wells logs for RI-4S/4D confirm that the geology in this portion of the project area is composed of more fine-grained materials. Sandy-silts were logged from the ground surface to a depth of 65 feet, overlying the more permeable sands and gravels. The fine grained materials may be preventing the downward migration of the contaminants in this part of the project area. The source area for the

contamination in these wells is in the process of being identified. Data from these wells indicate that the western extent of the YRRA PCE plume still needs to be defined in this part of the study area.

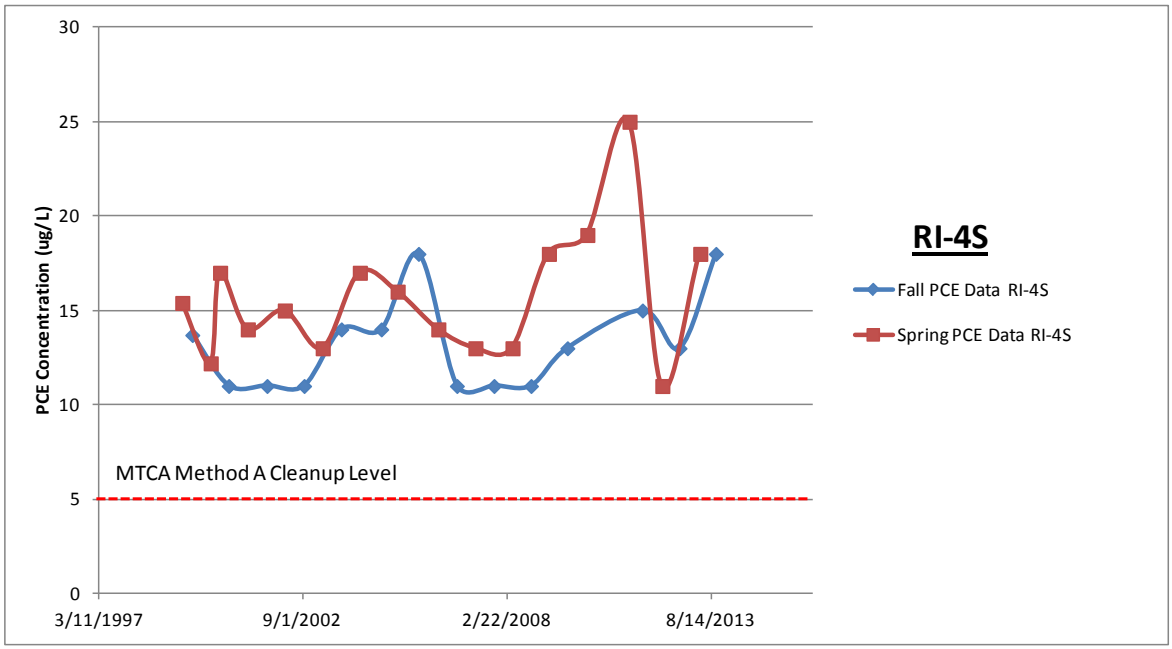

Figure 42. YRRA Remedial Investigation Well RI-4S PCE Results, June 1999 to October 2013.

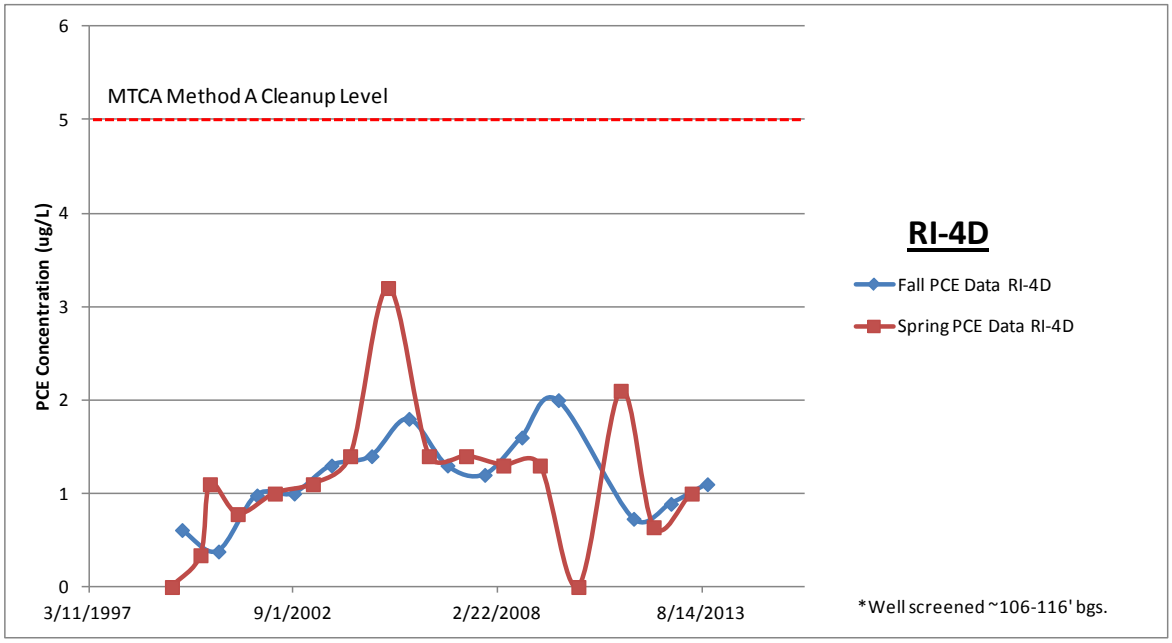

Figure 43. YRRA Remedial Investigation Well RI-4D PCE Results, June 1999 to October 2013.

Wells RI-5S and RI-5D are located in a residential area, approximately 0.7 miles southeast (downgradient) of wells RI-4S/4D. Low levels of PCE continue to be detected in both wells, with a range of about 0.4 to 2.5 ug/L (Figures 44 and 45). Concentrations are typically slightly higher in the shallow well, which exhibits a seasonal pattern of spring maximums. Concentrations in both wells appear to be increasing. Since these wells are in a residential area, the low PCE levels found in these wells are most likely from an upgradient source.

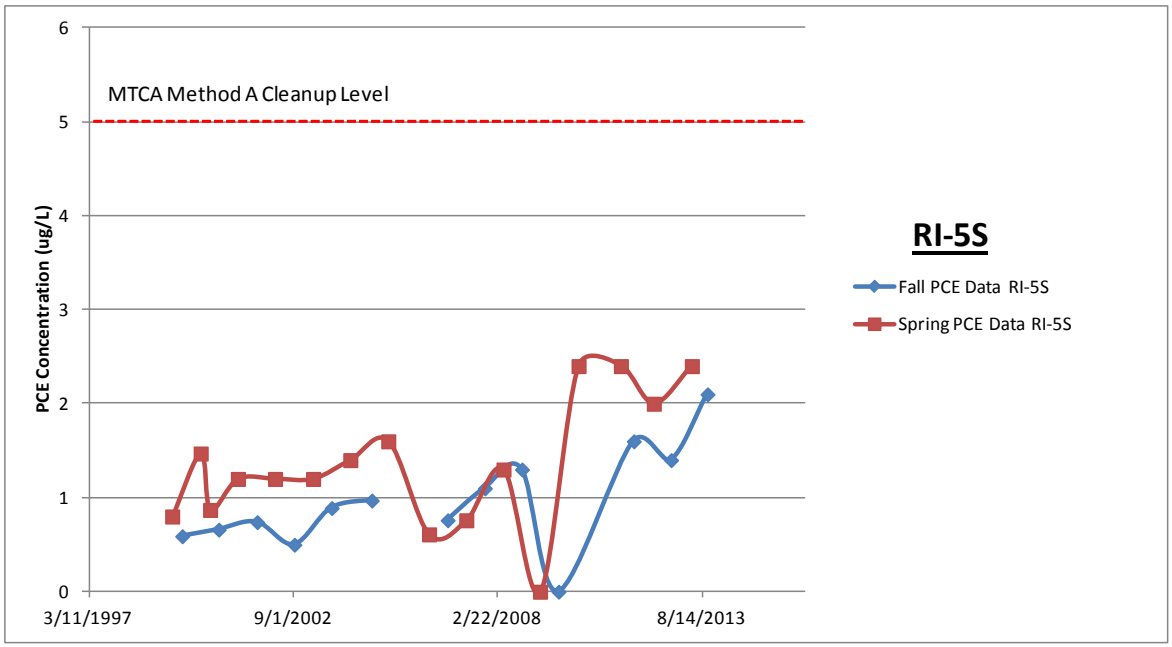

Figure 44. YRRA Remedial Investigation Well RI-5S PCE Results, June 1999 to October 2013.

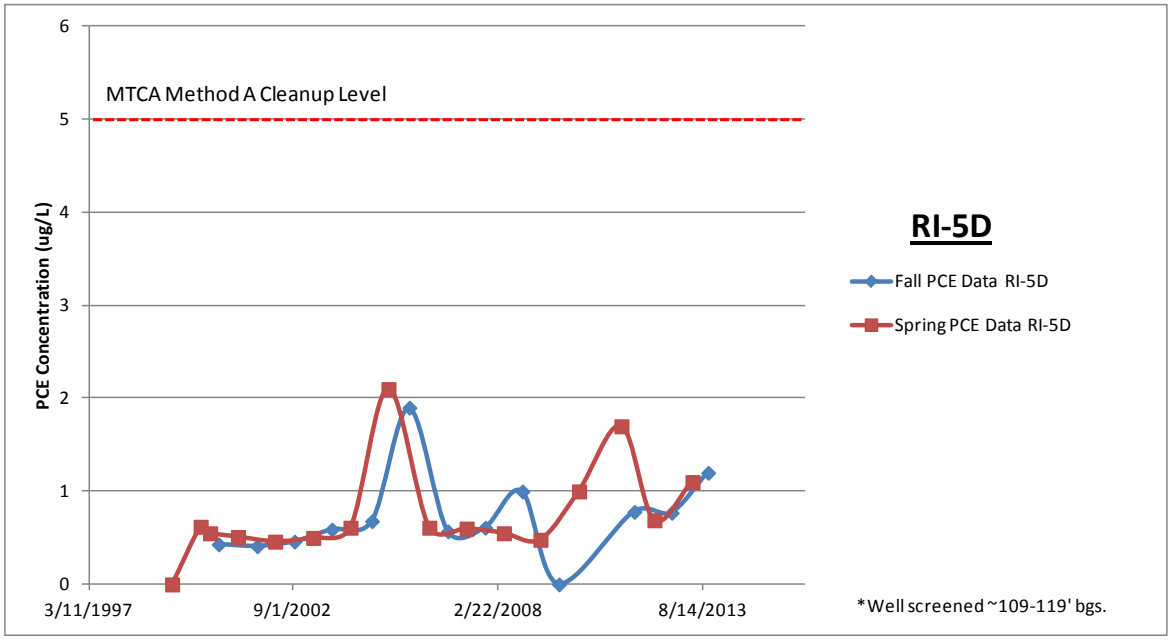

Figure 45. YRRA Remedial Investigation Well RI-5D PCE Results, June 1999 to October 2013.

Well RI-6S is about 1.2 miles southeast of wells RI-4S/4D. PCE concentrations in Well RI-6S range from about 2 to 8 ug/L. Concentrations appear to be increasing and have a seasonal pattern of higher concentrations in the fall (Figure 46). Currently there is no known source area for the contamination in this well. The extent of PCE contamination in the shallow aquifer needs to be better characterized in this portion of the YRRA.

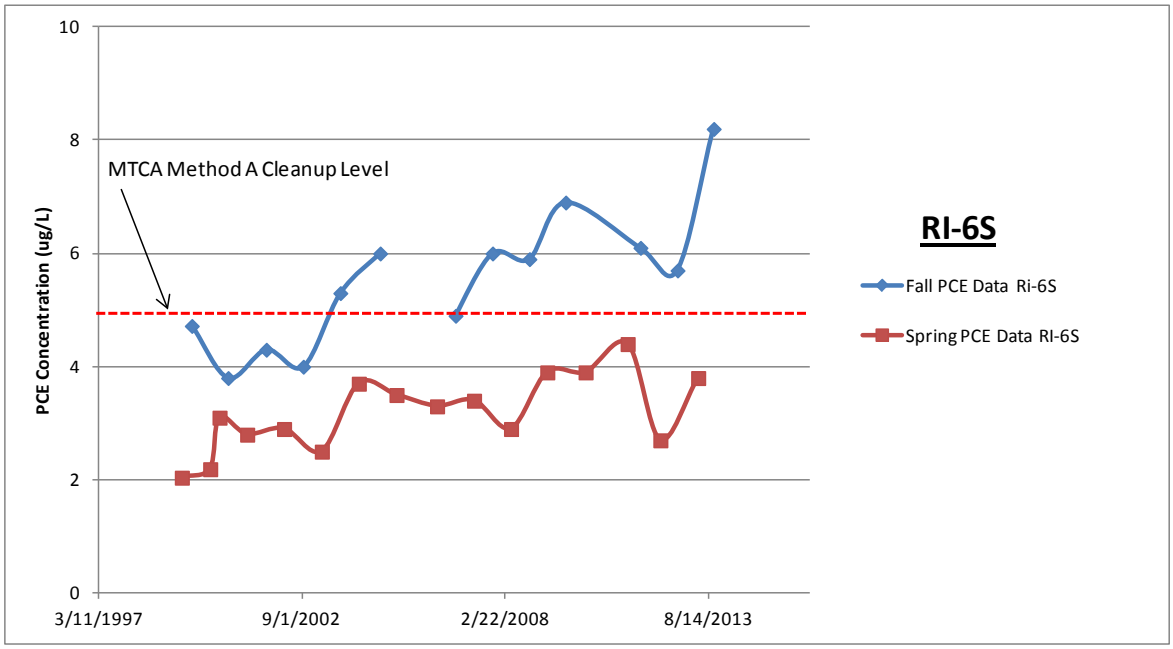

Figure 46. YRRA Remedial Investigation Well RI-6S PCE Results, June 1999 to October 2013.

Wells RI-9S, RI-10S, and RI-11S are located at the southern boundary of the study area and are the farthest downgradient wells being sampled. These three wells continue to have low levels of PCE, ranging from about 0.5 to 3 ug/L for data collected from 1999 to 2013 (Figures 47, 48, 49). Concentrations in these three wells are low and appear to be gradually decreasing.

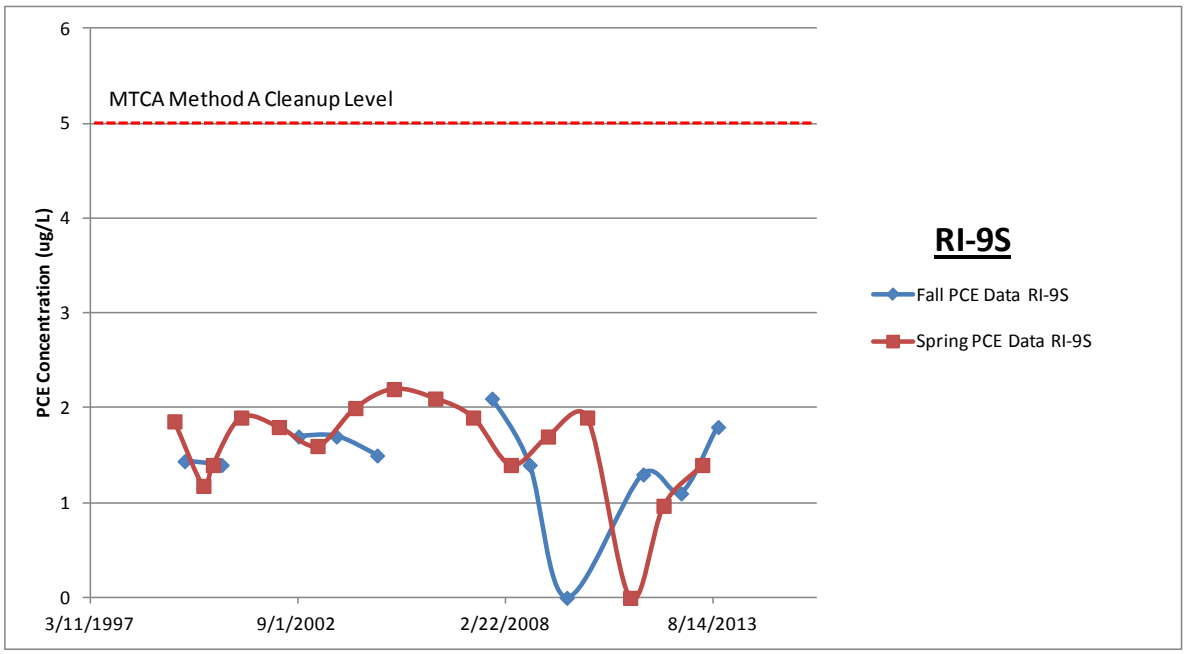

Figure 47. YRRA Remedial Investigation Well RI-9S PCE Results, June 1999 to October 2013.

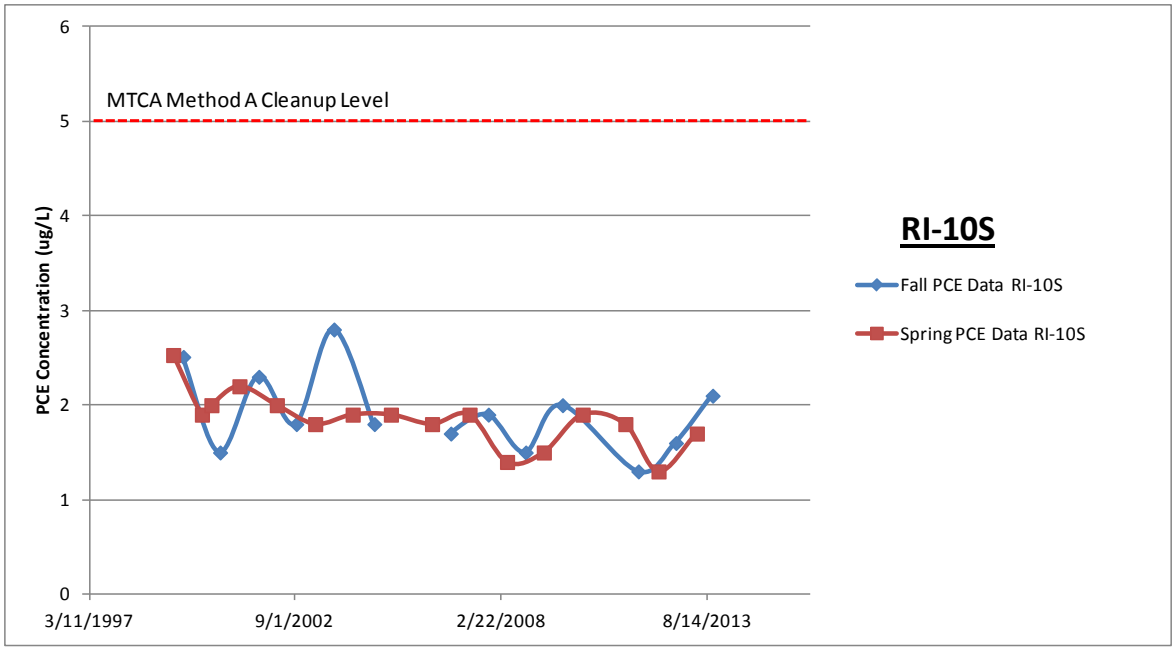

Figure 48. YRRA Remedial Investigation Well RI-10S PCE Results, June 1999 to October 2013.

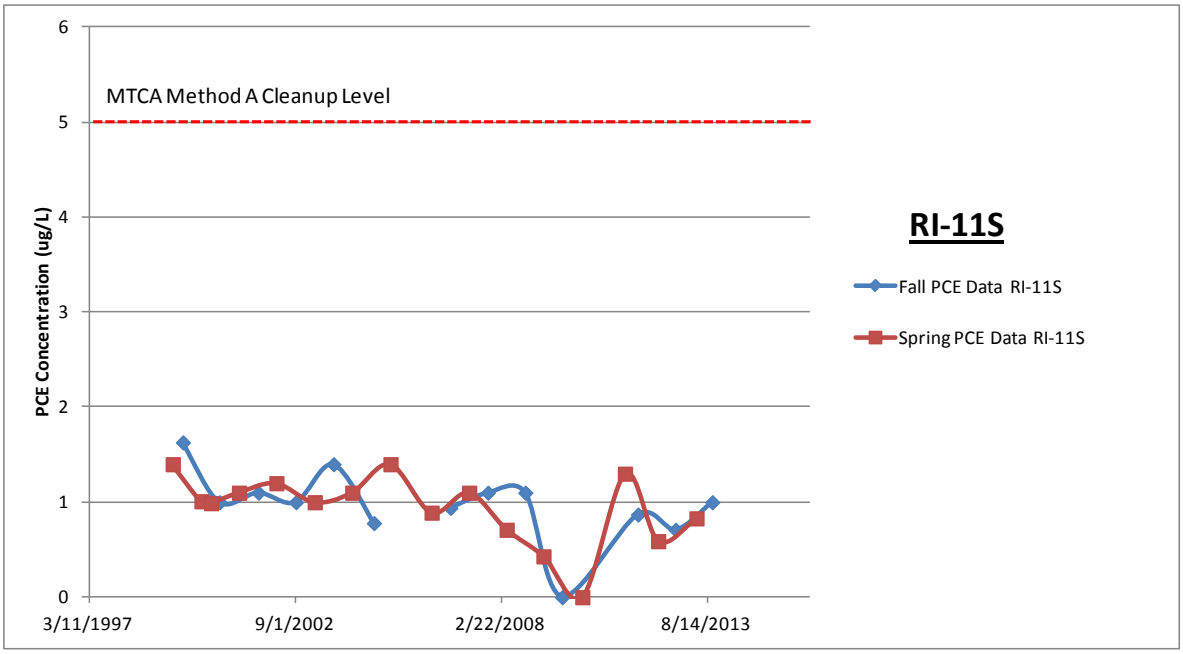

Figure 49. YRRA Remedial Investigation Well RI-11S PCE Results, June 1999 to October 2013.

Frank Wear Cleaners

Although not part of Ecology's current monitoring program, Frank Wear Cleaners is another source area identified in the YRRA. This site is a substantial source of PCE contamination to the project area. It is currently undergoing active remediation.

The Frank Wear Cleaners site is located at the north-central end of the YRRA, near the intersection of W Walnut St and S 3rd Ave (Figure 12). It is approximately 0.7 miles upgradient of the Roundhouse wells. The dry cleaning operation had a history of dangerous waste violations and was identified as a YRRA source area in 1991. Site soils and groundwater were found to be highly contaminated with PCE in 1995 (Maxim, 1996b).

A series of cleanup activities were initiated in 1995 with the removal of contaminated soil and have continued with the most recent installation of a soil vapor extraction system in 2012. Groundwater at this site is being monitored separately as part of the remediation.

High concentrations of PCE continue to be detected in both the shallow onsite and off-site down-gradient wells. Data collected in 2012 reported a groundwater concentration range of less than 1 to 2,700 ug/L (Hart Crowser, 2013). This most recent report concluded that the PCE contaminant plume extends beyond the east and south property boundaries, but the full extent of the plume beyond the current monitoring well network is unknown (Hart Crowser, 2013).

Conclusions

Dissolved tetrachloroethene (PCE) continues to be present in the shallow unconfined aquifer throughout the YRRA project area. Cleanup activities over the years appear to have been effective in reducing contaminant concentrations in groundwater at many of the identified source areas. However, there are still areas where contaminant concentrations continue to exceed (not meet) the MTCA cleanup levels.

There are 59 monitoring wells in the YRRA long-term monitoring program. In 2013, Ecology selected a subset of 36 wells for continued monitoring. Wells were removed from the program if they consistently showed low or no detections of the contaminants of concern, primarily PCE. In 2013, Ecology collected semi-annual groundwater samples from 34 of the 36 wells. The selected subset of wells continues to provide monitoring points to evaluate groundwater conditions throughout the project area.

Of the 36 wells selected for continued monitoring, 27 are associated with seven identified source areas. Five of the source areas have undergone some level of cleanup to address the PCE contamination: Goodwill-City of Yakima, Nu-Way Cleaners, Southgate Laundry, Fifth Wheel Truck Repair, and Cameron Yakima.

Cleanup activities at Nu-Way Cleaners, Southgate Laundry, and Fifth Wheel Truck Repair appear to have eliminated or reduced these areas as ongoing sources of PCE contamination.

There is no record of any direct remediation at the Washington Central Railroad Roundhouse site. The three wells at this site, which were installed as a well cluster of varying depths, have some of the highest contaminant concentrations in the YRRA. PCE concentrations in the shallow to deep wells indicate that the contaminant plume has a vertical component that reaches the deep water-bearing zone in this portion of the YRRA. In addition to PCE, metabolic breakdown products are present at this site in the two deeper wells, indicating that natural biodegradation is occurring. These are the only two wells in the YRRA that display anaerobic conditions. Low concentrations of TCE and cis-1,2-DCE have been detected at concentrations below their respective cleanup levels. Vinyl chloride however is consistently detected at concentrations that exceed the cleanup level. The two deep wells (WDOE-3I, WDOE-3D) are the only wells in the YRRA monitoring program that have had detectable concentrations of vinyl chloride. The Washington Central Railroad Roundhouse facility continues to act as a significant source of chlorinated solvent contamination to groundwater, including to deeper portions of the aquifer system.

The 2013 analytical data continue to show that the highest contaminant concentrations are still found at sites located in the central portion of the YRRA. These include Washington Central Railroad Roundhouse, Cameron Yakima, and Frank Wear Cleaners. Although cleanup activities have occurred at two of these locations, the lateral and vertical extent of the contaminant plumes is still poorly defined. Further investigation is needed at each of these sites to determine the full extent of the PCE plumes and whether the plumes have co-mingled, as possibly indicated by the groundwater flow direction.

In 1997, 29 wells were installed for the YRRA Remedial Investigation/Feasibility Study. The wells were installed as shallow and deep pairs at 14 locations throughout the project area to characterize aquifer properties and determine the lateral and vertical extent of PCE contamination in the groundwater. Nine of these wells were sampled in 2013. The nine wells selected for continued monitoring are primarily located along the western and southern edges of the YRRA.

PCE was detected at concentrations far below the cleanup level in seven of the nine wells. Since PCE is not naturally occurring, the low concentrations detected in these wells indicate that low level sources of PCE continue to exist and contribute to the contamination of the YRRA.

The other two wells, RI-4S and RI-6S, which are located on the western edge of project area, consistently have elevated PCE concentrations. PCE concentrations in these wells appear to be increasing. The data from these wells show there are areas in the YRRA that are contaminated with PCE where the source areas are still being identified and that require remedial actions. In addition to source identification and remedial action, the western extent of the YRRA PCE contamination still needs to be defined in this part of the study area.

Of the 34 wells sampled, six are screened in the deeper zone (60-120 feet). Only the two wells located at the Washington Central Railroad Roundhouse site have contaminant concentrations that exceeded the MTCA cleanup levels. PCE concentrations in the four other deep wells are consistently below the cleanup levels and have remained fairly constant over the monitoring period, 1997 to 2013. Two of these wells are located at the Cameron site, and two are located in the western portion of the project area.

Because groundwater within the YRRA continues to be contaminated by both identified and unidentified source areas, cleanup activities and investigations continue to be conducted across the project area.

Recommendations

Based on the 2013 monitoring results for the YRRA, the following recommendations are provided:

- Additional investigations are needed at the Washington Central Railroad Roundhouse and Cameron Yakima sites to determine the full lateral and vertical extent of the contaminant plumes, since off-site contaminant migration at these two sites is most likely occurring.
- Continued investigation of the Frank Wear Cleaners site is recommended since the PCE contaminant plume extends beyond the current site monitoring well network.
- Continued investigation is recommended into the potential source areas for PCE contamination detected in Remedial Investigation wells RI-4S/4D and RI-6S.
- Although the monitoring network was reduced in 2013 from 59 wells to 36 wells, additional modifications to the monitoring program should be considered. After evaluating PCE concentrations, seasonal patterns, and time trends at each sample location, the following changes to the YRRA monitoring program are suggested to improve the cost effectiveness of the program:

Proposed Sampling Modifications Based on PCE Concentrations.

Spring Seasonal Pattern - Sample Spring Only	Fall Seasonal Pattern - Sample Fall Only	No Seasonal Pattern, PCE Exceeds 5 ug/L - Sample Spring and Fall	No Seasonal Pattern, PCE Below 5 ug/L - Sample Spring or Fall
GW-MW1	SG-MW2	GW-MW2	GW-MW4
NU-MW1	WDOE-3S	CYI-MW-107S	SG-MW1
NU-MW2	WDOE-3I	CYI-MW-103S	CYI-MW-103D
NU-MW3	WDOE-3D	CYI-MW-112S	CYI-MW-113D
SG-MW3	5W-MW2	CYI-MW-113S	RI-3S
RI-4S	CYI-MW-106S	CYI-MW-114S	RI-4D
RI-5S	CYI-MW-102S		RI-5D
	CYI-MW-108S		RI-9S
	CYI-MW-111S		RI-10S
	AT-MW4		RI-11S
	RI-6S		

- Wells CYI-MW-109S and CYI-MW-110S could be removed from the monitoring network because these wells are difficult to access and are in close proximity to other wells (CYI-MW-108S, CYI-MW-111S) being sampled.

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Appendices

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Appendix A. Well Construction Details

Table A-1. Well Construction Details.

Well ID	Well Installation Date	Well Tag ID	Latitude (decimal degrees)	Longitude (decimal degrees)	TOC Elevation (feet)	TOC Stickup (feet)	Ground Surface Elevation (feet)	Casing Diameter (inches)	Well Depth from TOC (feet)	Screen Depth (from TOC)	
										Top (feet)	Bottom (feet)
5W-MW2	2/1995	--	46.58887	-120.49778	1039.22	-0.55	1039.77	2	33.6	15	35
AT-MW4	10/1997	--	46.56834	-120.48978	1000.82	-0.27	1001.09	2	25	10	30
GW-MW1	4/1994	ABJ993	46.59949	-120.5019	--	--	--	2	31	13	23
GW-MW2	4/1994	ABJ994	46.59911	-120.50169	1055.42	--	--	2	28.7	13	23
GW-MW4	1/1996	--	46.59924	-120.50151	1055.96	--	--	2	31.3	10	30
NU-MW1	6/1995	ABJ918	46.59366	-120.49867	1044.00	--	--	2	24.1	15	25
NU-MW2	6/1995	ABJ919	46.59322	-120.49748	1044.21	-0.23	1044.44	2	23.6	10	25
NU-MW3	6/1995	ABJ920	46.59362	-120.49820	1043.83	--	--	2	23.8	15	25
SG-MW1	4/1996	--	46.58660	-120.51086	1056.90	-0.26	1057.16	2	43.7	15	45
SG-MW2	4/1996	--	46.58617	-120.51034	1056.47	-0.35	1056.82	2	44.2	15	45
SG-MW3	4/1996	--	46.58583	-120.51027	1054.77	-0.49	1055.26	2	45	15	45
WDOE-3S	--	--	46.58963	-120.50341	1053.32	2.82	1050.50	2	29.9	--	--
WDOE-3I	--	--	46.58963	-120.50325	1053.27	--	--	2	58.5	--	--
WDOE-3D	--	--	46.58962	-120.50332	1053.12	2.81	1050.31	2	100	--	--
CYI-MW-102S	--	--	46.58388	-120.49798	1030.74	--	--	2	30	--	--
CYI-MW-103S	--	--	46.58388	-120.49757	1030.65	-0.54	1031.19	2	29.5	--	--
CYI-MW-103D	1/2003	AHR176	46.58386	-120.49757	1030.66	--	--	2	61	50	60
CYI-MW-106S	--	--	46.58439	-120.49839	1033.46	--	--	2	29.2	--	--
CYI-MW-107S	8/1998	--	46.58436	-120.49738	1033.85	--	--	2	29.3	10	30
CYI-MW-108S	8/1998	--	46.58405	-120.49637	1031.45	--	--	2	24	10	30
CYI-MW-109S	8/1998	--	46.58394	-120.49649	1029.19	--	--	2	29	10	30
CYI-MW-110S	8/1998	--	46.58389	-120.49678	1028.50	--	--	2	29	10	30
CYI-MW-111S	8/1998	--	46.58389	-120.49711	1029.33	--	--	2	31	10	30
CYI-MW-112S	8/1998	--	46.58298	-120.49679	1028.84	--	--	2	29	10	30
CYI-MW-113S	8/1998	--	46.58275	-120.49690	1028.38	--	--	2	30	11	31
CYI-MW-113D	8/1998	--	46.58276	-120.49689	1028.19	--	--	2	59.5	50	60

Well ID	Well Installation Date	Well Tag ID	Latitude (decimal degrees)	Longitude (decimal degrees)	TOC Elevation (feet)	TOC Stickup (feet)	Ground Surface Elevation (feet)	Casing Diameter (inches)	Well Depth from TOC (feet)	Screen Depth (from TOC)	
										Top (feet)	Bottom (feet)
CYI-MW-114S	8/1998	--	46.58275	-120.49652	1028.18	--	--	2	30.7	10	30
RI-3S	10/1997	AEB112	46.59247	-120.51698	1071.39	-0.72	1072.11	2	47.2	33	48
RI-4S	11/1997	AEB126	46.58349	-120.52999	1051.91	-0.89	1052.80	6	32.5	20	35
RI-4D	11/1997	AEB125	46.58349	-120.53005	1052.48	--	--	6	120.1	106	116
RI-5S	10/1997	AEB114	46.57982	-120.51812	1044.51	-0.41	1044.92	2	38.4	24	39
RI-5D	10/1997	AEB113	46.57982	-120.51819	1044.54	--	--	2	120.3	109	119
RI-6S	11/1997	AEB122	46.57047	-120.51879	1033.50	-0.37	1033.87	2	38.9	24	39
RI-9S	10/1997	AEB116	46.56028	-120.48761	988.3	-0.54	988.84	2	28.8	15	30
RI-10S	11/1997	AEB128	46.56235	-120.48152	989.05	-0.62	989.67	2	33.3	20	35
RI-11S	11/1997	AEB130	46.56268	-120.47698	988.53	--	--	2	38.6	24	39

--: Information not available.
VERTICAL DATUM: NAVD88. Vertical accuracy measure +/- 10 ft (3m).
HORIZONTAL DATUM: NAD83 HARN. Horizontal accuracy measure +/- 10 ft (3m).
TOC: Top of well casing.

Appendix B. Field Parameter Results, 2013

Table B-1. Summary of Field Parameter Results, May and October 2013.

Well Sample ID	Total Depth (feet)[1]	Depth-to-Water (TOC) (feet)		Water Table Elevation (feet msl)		pH (standard units)		Dissolved Oxygen (mg/L)		ORP (mV)		Specific Conductance (umhos/cm)	
		5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13
Goodwill – City of Yakima													
GW-MW1	31	18.36	16.93	--	--	6.7	7.0	8.8	6.3	—	251	113	225
GW-MW2	28.7	17.66	16.31	1037.76	1039.11	6.5	7.0	9.0	6.4	--	259	139	222
GW-MW4	31.3	18.20	16.92	1037.76	1039.04	6.6	6.9	8.4	6.2	--	250	226	293
Nu-Way Cleaners													
NU-MW1	24.1	18.86	16.43	1025.14	1027.57	6.6	6.7	9.2	5.7	--	246	181	276
NU-MW2	23.6	--	17.85	--	1026.36	--	6.6	--	4.4	--	249	--	265
NU-MW3	23.8	--	--	--	--	--	--	--	--	--	--	--	--
Southgate Laundry													
SG-MW1	43.7	31.66	25.91	1025.24	1030.99	6.8	7.2	8.3	8.4	--	252	292	--
SG-MW2	44.2	31.84	26.85	1024.63	1029.62	6.9	7.2	7.5	7.4	207	224	327	307
SG-MW3	45	30.05	24.97	1024.37	1029.80	6.9	7.1	7.9	7.4	230	241	324	--
Washington Central Railroad Roundhouse													
WDOE-3S	29.9	28.95	24.94	1024.37	1028.38	--	6.8	--	6.4	--	253	--	313
WDOE-3I	58.5	31.07	25.59	1022.20	1027.68	7.0	7.2	0.16	0.25	--	101	314	323
WDOE-3D	100	31.52	27.71	1021.16	1025.41	7.2	7.5	0.36	0.41	--	9.2	272	293
Fifth Wheel Truck Repair													
5W-MW-2	33.6	18.29	16.41	1020.93	1022.81	6.3	6.7	4.1	--	190	259	280	369
Cameron Yakima Inc													
CYI-MW-102S	30	17.65	15.39	1013.09	1015.35	6.4	6.8	8.0	--	240	297	250	398
CYI-MW-103S	29.5	18.55	15.96	1012.10	1014.69	6.5	6.9	7.1	--	258	301	362	403
CYI-MW-103D	61	19.26	16.80	1011.40	1013.86	6.9	7.2	4.0	--	171	266	316	330
CYI-MW-106S	29.2	19.78	17.35	1013.68	1016.11	6.5	6.7	8.2	--	241	274	240	402
CYI-MW-107S	29.3	22.16	19.08	1011.69	1014.77	6.6	6.9	8.4	--	214	294	186	338
CYI-MW-108S	24	20.29	17.19	1011.16	1014.26	6.8	7.1	7.4	--	177	276	272	297
CYI-MW-109S	29	17.82	14.94	1011.37	1014.25	6.7	7.0	5.7	--	277	280	274	312
CYI-MW-110S	29	17.00	--	1011.50	--	6.6	--	7.0	--	--	--	265	--
CYI-MW-111S	31	18.14	15.47	1011.19	1013.86	6.4	7.2	9.4	--	214	265	166	304
CYI-MW-112S	29	17.16	14.79	1011.68	1014.05	6.5	6.8	7.2	--	257	288	306	366
CYI-MW-113S	30	16.43	14.04	1011.95	1014.34	6.5	6.8	5.6	--	251	296	336	377
CYI-MW-113D	59.5	18.10	15.64	1010.09	1012.55	7.1	7.2	4.9	--	216	224	282	303
CYI-MW-114S	30.7	16.90	14.44	1011.28	1013.74	6.5	6.8	6.7	--	253	300	292	367

Well Sample ID	Total Depth (feet)[1]	Depth-to-Water (TOC) (feet)		Water Table Elevation (feet msl)		pH (standard units)		Dissolved Oxygen (mg/L)		ORP (mV)		Specific Conductance (umhos/cm)	
		5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13	5/13	10/13
Agri-Tech\Yakima Steel													
AT-MW4	25	8.02	5.26	992.80	995.56	6.5	6.7	3.5	3.7	--	280	315	378
YRRA Remedial Investigation Wells													
RI-3S	47.2	36.22	29.12	1035.17	1042.27	7.1	7.2	6.8	7.7	160	222	367	335
RI-4S	32.5	12.93	10.23	1038.98	1041.68	7.5	7.6	4.9	4.9	254	199	576	732
RI-4D[2]	120.1	12.19	10.09	1040.29	1042.39	8.1	8.2	6.7	5.8	208	175	279	293
RI-5S	38.4	17.15	13.96	1027.36	1030.55	6.8	7.1	7.9	7.2	194	211	311	310
RI-5D	120.3	23.06	21.21	1021.48	1023.33	7.6	7.9	6.1	5.6	--	251	474	520
RI-6S	38.9	9.76	7.52	1023.74	1025.98	7.2	7.5	5.2	--	180	228	618	743
RI-9S	28.8	6.24	5.16	982.06	983.14	6.6	6.9	4.7	2.4	--	232	311	294
RI-10S	33.3	10.36	9.53	978.69	979.52	6.5	6.7	6.4	--	175	246	319	343
RI-11S	38.6	13.19	12.66	975.34	975.87	6.4	6.7	6.6	--	170	250	244	304

-- Not measured.

[1] Measured from top of casing.

[2] Water level dropped while purging.

TOC: Top of well casing.

ORP: Oxidation-reduction potential.

Appendix C. PCE Results, December 1997 to October 2013

Table C-1: Summary of Analytical Results (ug/L) for Goodwill-City of Yakima, December 1997 to October 2013.

	GW-MW1				GW-MW2				GW-MW4			
Date	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
12/2/97	1.4	0.18	2 U	2 U	9.8	2 U	2 U	2 U	7	2 U	2 U	2 U
3/3/98	0.92 J	1 U	1 U	1 U	12	1 U	1 U	1 U	1.9	1 U	1 U	1 U
6/1/98	1.6	1 U	1 U	1 UJ	7.7	1 U	1 U	1 UJ	7.3	1 U	1 U	1 UJ
8/31/98	0.56 J	0.34 J	1 U	1 UJ	8.2 J	0.44 J	1 UJ	1 UJ	130 E	0.22 J	0.061 J	1 UJ
6/2/99	3.43	0.15 U	0.1 U	0.14 U	5.36	0.15 U	0.1 U	0.14 U	4.18	0.15 U	0.1 U	0.14 U
9/8/99	0.25 U	0.15 U	0.1 U	0.14 U	8.01	0.15 U	0.1 U	0.14 U	15.4	0.15 U	0.1 U	0.14 U
12/7/99	0.77 J	0.15 U	0.1 U	0.14 U	14.2	0.15 U	0.1 U	0.14 U	2.23	0.15 U	0.1 U	0.14 U
3/9/00	1	0.15 U	0.1 U	0.14 U	10.4	0.15 U	0.1 U	0.14 U	1.7	0.15 U	0.1 U	0.14 U
6/7/00	--	--	--	--	4.4	0.15 U	0.1 U	0.14 U	5.6	0.15 U	0.1 U	0.14 U
8/30/00	--	--	--	--	8.3	0.15 U	0.1 U	0.14 U	68	0.39	0.1 U	0.14 U
12/12/00	--	--	--	--	11	0.15 U	0.1 U	0.14 U	2.5	0.15 U	0.1 U	0.14 U
3/6/01	3.6	0.15 U	0.1 U	0.14 U	14	0.15 U	0.1 U	0.14 U	2.2	0.15 U	0.1 U	0.14 U
9/10/01	4.7	0.2 U	0.2 U	0.2 U	6.8	0.2 U	0.2 U	0.2 U	19	0.22	0.2 U	0.2 U
3/4/02	3	0.2 U	0.2 U	0.2 U	12	0.2 U	0.2 U	0.2 U	1.9	0.2 U	0.2 U	0.2 U
9/9/02	4.3	0.2 U	0.2 U	0.2 U	11	0.2 U	0.2 U	0.2 U	8.3	0.2 U	0.2 U	0.2 U
3/11/03	3.3	0.2 U	0.2 U	0.2 U	10	0.2 U	0.2 U	0.2 U	2.6	0.2 U	0.2 U	0.2 U
9/9/03	4.6	0.2 U	0.2 U	0.2 U	8.4	0.2 U	0.2 U	0.2 U	6.4	0.2 U	0.2 U	0.2 U
3/9/04	2.4	0.2 U	0.2 U	0.2 U	16	0.2 U	0.2 U	0.2 U	2.3	0.2 U	0.2 U	0.2 U
10/5/04	2.6	0.2 U	0.2 U	0.2 U	5	0.2 U	0.2 U	0.2 U	3.8	0.2 U	0.2 U	0.2 U
3/15/05	2.8	0.2 U	0.2 U	0.2 U	18	0.29	0.2 U	0.2 U	2.4	0.2 U	0.2 U	0.2 U
10/12/05	REJ				25	0.2 U	0.2 U	0.2 U	11	0.2 U	0.2 U	0.2 U
12/14/05	1.5	0.2 U	0.2 U	0.2 U	--	--	--	--	--	--	--	--
4/19/06	12	0.2 U	0.2 U	0.2 U	1.7	0.2 U	0.2 U	0.2 U	2.1	0.2 U	0.2 U	0.2 U
10/18/06	1.9	0.2 U	0.2 U	0.2 U	11	0.2 U	0.2 U	0.2 U	2.1	0.2 U	0.2 U	0.2 U
4/18/07	11	0.2 U	0.2 U	0.2 U	2	0.2 U	0.2 U	0.2 U	2.1	0.2 U	0.2 U	0.2 U
10/17/07	2.4	0.2 U	0.2 U	0.2 U	11	0.2 U	0.2 U	0.2 U	2.2	0.2 U	0.2 U	0.2 U
4/15/08	8.7	0.2 U	0.2 U	0.2 U	11	0.2 U	0.2 U	0.2 U	2	0.2 U	0.2 U	0.2 U
10/14/08	--	--	--	--	7.5	7.5	1 U	0.2 U	2.6	1 U	1 U	0.2 U
4/7/09	7.5	1 U	1 U	0.2 U	1.1	1 U	1 U	0.2 U	1.7	1 U	1 U	0.2 U
10/6/09	3	1 U	1 U	0.2 U	6.6	1 U	1 U	0.2 U	1.9	1 U	1 U	0.2 U
4/21/10	1.1	1 U	1 U	1 U	11	1 U	1 U	0.2 U	1.8	1 U	1 U	1 U
6/7/11	3.4	1 U	1 U	0.2 U	11	1 U	1 U	0.2 U	1.8	1 U	1 U	0.2 U
10/11/11	1	0.2 U	0.2 U	0.2 U	6.9	0.2 U	0.2 U	0.2 U	1.2	0.2 U	0.2 U	0.2 U
4/23/12	1.5	0.2 U	0.2 U	0.2 U	9.4	0.2 U	0.2 U	0.2 U	1.4	0.2 U	0.2 U	0.2 U
10/11/12	1.3	0.2 U	0.2 U	0.2 U	2.6	0.2 U	0.2 U	0.2 U	1.3	0.2 U	0.2 U	0.2 U
5/2013	1 U	1 U	1 U	1 U	10	1 U	1 U	1 U	1.5	1 U	1 U	1 U
10/2013	1 U	1 U	1 U	1 U	14	1 U	1 U	1 U	1.1	1 U	1 U	1 U

Notes for Table C-1:

U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
UJ: The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately measure the analyte in the sample.
E: Reported result is an estimate because it exceeds the calibration range.
REJ: Rejected. Result considered suspect due to possible cross-contamination. Well re-sampled in December 2005.
Bold: Analyte was detected.
Shade: Values are greater than MTCA cleanup levels.
-- Not Sampled.

Table C-2: Summary of Analytical Results (ug/L) for Nu-Way Cleaners, December 1997 to October 2013.

	NU-MW1				NU-MW2				NU-MW3			
Date	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
12/2/97	1.8	2 U	2 U	2 U	2	2 U	2 U	2 U	3	2 U	2 U	2 U
3/3/98	4.4	1 U	1 U	1 U	3.4	1 U	1 U	1 U	3.7	1 U	1 U	1 U
6/1/98	4.4	1 U	1 U	1 UJ	1 U	1 U	1 U	1 UJ	3.8	1 U	1 U	1 UJ
8/31/98	1.7 J	1 U	1 U	1 UJ	1.1 J	1 UJ	1 UJ	1 UJ	2.3 J	1 UJ	1 UJ	1 UJ
6/2/99	5.28	0.15 U	0.1 U	0.14 U	2.9	0.15 U	0.1 U	0.14 U	0.25U	0.15 U	0.1 U	0.14 U
9/8/99	2.72	0.15 U	0.1 U	0.14 U	1.1	0.15 U	0.1 U	0.14 U	3.17	0.15 U	0.1 U	0.14 U
12/7/99	3.28	0.15 U	0.1 U	0.14 U	3.31	0.15 U	0.1 U	0.14 U	5.11	0.15 U	0.1 U	0.14 U
3/7/00	2.63	0.15 U	0.1 U	0.14 U	2.9	0.15 U	0.1 U	0.14 U	5.36	0.15 U	0.1 U	0.14 U
6/7/00	4.2	0.15 U	0.1 U	0.14 U	2.7	0.15 U	0.1 U	0.14 U	3.2	0.15 U	0.1 U	0.14 U
8/30/00	1.8	0.15 U	0.1 U	0.14 U	1.5	0.15 U	0.1 U	0.14 U	2.1	0.15 U	0.1 U	0.14 U
12/12/00	3.2	0.15 U	0.1 U	0.14 U	3.1	0.15 U	0.1 U	0.14 U	5.3	0.15 U	0.1 U	0.14 U
3/6/01	2.1	0.15 U	0.1 U	0.14 U	2.3	0.15 U	0.1 U	0.14 U	3.6	0.15 U	0.1 U	0.14 U
9/10/01	1.5	0.2 U	0.2 U	0.2 U	1.1	0.2 U	0.2 U	0.2 U	1.8	0.2 U	0.2 U	0.2 U
3/4/02	1.1	0.2 U	0.2 U	0.2 U	1.5	0.2 U	0.2 U	0.2 U	2.3	0.2 U	0.2 U	0.2 U
9/9/02	2	0.2 U	0.2 U	0.2 U	1.6	0.2 U	0.2 U	0.2 U	1.8	0.2 U	0.2 U	0.2 U
3/11/03	4.1	0.2 U	0.2 U	0.2 U	3.3	0.2 U	0.2 U	0.2 U	5.5	0.2 U	0.2 U	0.2 U
9/9/03	2	0.2 U	0.2 U	0.2 U	1.5	0.2 U	0.2 U	0.2 U	2.1	0.2 U	0.2 U	0.2 U
3/9/04	3.3	0.2 U	0.2 U	0.2 U	3.4	0.2 U	0.2 U	0.2 U	3.5	0.2 U	0.2 U	0.2 U
10/5/04	0.99	0.2 U	0.2 U	0.2 U	1.1	0.2 U	0.2 U	0.2 U	1.3	0.2 U	0.2 U	0.2 U
3/15/05	2.1	0.24	0.2 U	0.2 U	2.4	0.2 U	0.2 U	0.2 U	3.6	0.2 U	0.2 U	0.2 U
10/11/05	REJ				REJ				REJ			
12/13/05	2.4	0.2 U	0.2 U	0.2 U	1.8	0.2 U	0.2 U	0.2 U	2.2	0.2 U	0.2 U	0.2 U
4/18/06	3.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2.2	0.2 U	0.2 U	0.2 U
10/17/06	0.63	0.2 U	0.2 U	0.2 U	0.67	0.2 U	0.2 U	0.2 U	0.9	0.2 U	0.2 U	0.2 U
4/17/07	0.79	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.47	0.2 U	0.2 U	0.2 U
10/16/07	1.3	0.2 U	0.2 U	0.2 U	0.66	0.2 U	0.2 U	0.2 U	1.3	0.2 U	0.2 U	0.2 U
4/15/08	0.38	0.2 U	0.2 U	0.2 U	0.2U	0.2 U	0.2 U	0.2 U	0.24	0.2 U	0.2 U	0.2 U
10/13/08	0.63	1 U	1 U	0.2 U	0.8 U	1 U	1 U	0.2 U	1.7	1 U	1 U	0.2 U
4/7/09	1.8	1 U	1 U	0.2 U	1.9	1 U	1 U	0.2 U	1.3	1 U	1 U	0.2 U
10/5/09	1.7	1 U	1 U	0.2 U	1.3	1 U	1 U	0.2 U	1.8	1 U	1 U	0.2 U
4/19/10	2.3	1 U	1 U	0.2 U	2.4	1 U	1 U	0.2 U	4.8	1 U	1 U	0.2 U
6/7/11	5.5	1 U	1 U	0.2 U	4	1 U	1 U	0.2 U	3.7	1 U	1 U	0.2 U
10/11/11	1.1	0.2 U	0.2 U	0.2 U	0.93	0.2 U	0.2 U	0.2 U	1.2	0.2 U	0.2 U	0.2 U
4/24/12	2.1	0.2 U	0.2 U	0.2 U	1.5	0.2 U	0.2 U	0.2 U	2.7	0.2 U	0.2 U	0.2 U
10/10/12	1.6	0.2 U	0.2 U	0.2 U	1.2	0.2 U	0.2 U	0.2 U	1.3	0.2 U	0.2 U	0.2 U
5/2013	1.6	1 U	1 U	1 U	NS				--	--	--	--
10/2013	2.3	1 U	1 U	1 U	1.6	1 U	1 U	1 U	--	--	--	--

U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
(continued on next page)

UJ: The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately measure the analyte in the sample.
REJ: Rejected. Result considered suspect due to possible cross-contamination. Well re-sampled in December 2005.
NS: Not sampled due to a low water level and/or insufficient volume of water.
Bold: Analyte was detected.
Shade: Values are greater than MTCA cleanup levels.
-- Not Sampled. Well was inaccessible.

Table C-3: Summary of Analytical Results (ug/L) for Southgate Laundry, June 1999 to October 2013.

	SG-MW1				SG-MW2				SG-MW3			
Date	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
12/2/97	--	--	--	--	--	--	--	--	--	--	--	--
3/3/98	--	--	--	--	--	--	--	--	--	--	--	--
6/1/98	--	--	--	--	--	--	--	--	--	--	--	--
8/31/98	--	--	--	--	--	--	--	--	--	--	--	--
6/2/99	2.23	0.15 U	0.1 U	0.14 U	27.4	0.15 U	0.1 U	0.14 U	21.2	0.15 U	0.1 U	0.14 U
9/8/99	0.25 U	0.15 U	0.1 U	0.14 U	8.54	0.15 U	0.1 U	0.14 U	6.35	0.15 U	0.1 U	0.14 U
12/7/99	1.54	0.15 U	0.1 U	0.14 U	4.72	0.65 J	0.1 U	0.14 U	4.39	0.37 J	0.1 U	0.14 U
3/9/00	0.34 J	0.15 U	0.1 U	0.14 U	2.13	0.15 U	0.1 U	0.14 U	10.2	0.15 U	0.1 U	0.14 U
6/7/00	1.2	0.15 U	0.1 U	0.14 U	26	0.15 U	0.1 U	0.14 U	29	0.15 U	0.1 U	0.14 U
8/30/00	0.37	0.15 U	0.1 U	0.14 U	7.1	0.15 U	0.1 U	0.14 U	21	0.15 U	0.1 U	0.14 U
12/12/00	0.82	0.15 U	0.1 U	0.14 U	5.5	0.15 U	0.1 U	0.14 U	3.5	0.15 U	0.1 U	0.14 U
3/6/01	0.87	0.15 U	0.1 U	0.14 U	2.4	0.15 U	0.1 U	0.14 U	5.6	0.15 U	0.1 U	0.14 U
9/10/01	0.34	0.2 U	0.2 U	0.2 U	8.6	0.2 U	0.2 U	0.2 U	15	0.2 U	0.2 U	0.2 U
3/4/02	0.29	0.2 U	0.2 U	0.2 U	2.5	0.2 U	0.2 U	0.2 U	4.6	0.2 U	0.2 U	0.2 U
9/9/02	0.38	0.2 U	0.2 U	0.2 U	11	0.2 U	0.2 U	0.2 U	16	0.2 U	0.2 U	0.2 U
3/11/03	0.38	0.2 U	0.2 U	0.2 U	1.5	0.2 U	0.2 U	0.2 U	4.7	0.2 U	0.2 U	0.2 U
9/9/03	0.51	0.2 U	0.2 U	0.2 U	8.1	0.2 U	0.2 U	0.2 U	22	0.2 U	0.2 U	0.2 U
3/9/04	1.6	0.2 U	0.2 U	0.2 U	1.6	0.2 U	0.2 U	0.2 U	7.6	0.2 U	0.2 U	0.2 U
10/5/04	0.34	0.2 U	0.2 U	0.2 U	5.2	0.2 U	0.2 U	0.2 U	2.1	0.2 U	0.2 U	0.2 U
3/15/05	4.8	0.2 U	0.2 U	0.2 U	6.4	0.23	0.2 U	0.2 U	8.1	0.21	0.2 U	0.2 U
10/12/05	REJ				10	0.2 U	0.2 U	0.2 U	4	0.2 U	0.2 U	0.2 U
12/14/05	0.35	0.2 U	0.2 U	0.2 U	--	--	--	--	--	--	--	--
4/19/06	0.33	0.2 U	0.2 U	0.2 U	0.79	0.2 U	0.2 U	0.2 U	2.4	0.2 U	0.2 U	0.2 U
10/18/06	0.35	0.2 U	0.2 U	0.2 U	2.6	0.2 U	0.2 U	0.2 U	3.8	0.2 U	0.2 U	0.2 U
4/18/07	0.49	0.2 U	0.2 U	0.2 U	0.82	0.2 U	0.2 U	0.2 U	4	0.2 U	0.2 U	0.2 U
10/17/07	0.38	0.2 U	0.2 U	0.2 U	2.6	0.2 U	0.2 U	0.2 U	4.4	0.2 U	0.2 U	0.2 U
4/15/08	0.31	0.2 U	0.2 U	0.2 U	0.5	0.2 U	0.2 U	0.2 U	1.9	0.2 U	0.2 U	0.2 U
10/14/08	0.8 U	1 U	1 U	0.2 U	2.7	1 U	1 U	0.2 U	1.8	1 U	1 U	0.2 U
4/7/09	1 U	1 U	1 U	0.2 U	0.6 J	1 U	1 U	0.2 U	3.2	1 U	1 U	0.2 U
10/6/09	1 U	1 U	1 U	0.2 U	2.3	1 U	1 U	0.2 U	1.6	1 U	1 U	0.2 U
4/21/10	1 U	1 U	1 U	0.2 U	1 U	1 U	1 U	0.2 U	2.8	1 U	1 U	0.2 U
6/7/11	1 U	1 U	1 U	0.2 U	4.5	1 U	1 U	0.2 U	3.4	1 U	1 U	0.2 U
10/11/11	0.2 U	0.2 U	0.2 U	0.2 U	2.1	0.2 U	0.2 U	0.2 U	1.7	0.2 U	0.2 U	0.2 U
4/23/12	0.23	0.2 U	0.2 U	0.2 U	0.34	0.2 U	0.2 U	0.2 U	1.9	0.2 U	0.2 U	0.2 U
10/11/12	0.2 U	0.2 U	0.2 U	0.2 U	2	0.2 U	0.2 U	0.2 U	--	--	--	--
5/2013	1 U	1 U	1 U	1 U	1.5	1 U	1 U	1 U	1.7	1 U	1 U	1 U
10/2013	1 U	1 U	1 U	1 U	1.9	1 U	1 U	1 U	2.4	1 U	1 U	1 U

U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
REJ: Rejected. Result considered suspect due to possible cross-contamination. Well re-sampled in December 2005.
Bold: Analyte was detected. Shade: Values are greater than MTCA cleanup levels.
-- Not Sampled.

Table C-4: Summary of Analytical Results (ug/L) for Washington Central Railroad Roundhouse, December 1997 to October 2013.

	WDOE-3S				WDOE-3I				WDOE-3D			
Date	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
12/2/97	--	--	--	--	11	1.2 J	0.25 J	0.59 J	--	--	--	--
3/3/98	--	--	--	--	4.1	1.3	0.88 J	2.7	--	--	--	--
6/1/98	--	--	--	--	20	1.3	1 U	1 UJ	--	--	--	--
8/31/98	--	--	--	--	18	0.88 J	0.04 J	1 UJ	--	--	--	--
6/2/99	50.9	ND	ND	ND	35.1	2.17	ND	0.23 J	16.4	1.76	ND	0.98 J
9/8/99	21.2	ND	ND	ND	28.2	0.93 J	ND	ND	13.3	1.75	ND	1.19
12/7/99	40.8	ND	ND	ND	17.4	2.86	0.91 J	2.03	15.3	2.23	0.77 J	1.55
3/7/00	NS				0.61 J	ND	0.68 J	3.24	7.99	1.54	ND	2.03
6/7/00	90	0.71	ND	ND	42	1.9	0.27	0.36	1.6	3.2	0.3	0.62
8/30/00	11	ND	ND	ND	20	1.1	0.2	0.21	12	2	0.59	1.2
12/12/00	--	--	--	--	--	--	--	--	--	--	--	--
3/6/01	--	--	--	--	1.2	0.45	0.54	7.5	8.1	1.7	0.61	3.6
9/10/01	9.3	< 0.2	< 0.2	< 0.2	15	1.6	0.33	0.5	9.4	1.8	0.46	1.1
3/4/02	NS				0.74	0.51	0.35	3	7.3	1.6	0.38	1.4
9/9/02	8.7	< 0.2	< 0.2	< 0.2	15	1.2	0.27	0.26	9.4	1.7	0.48	0.74
3/11/03	NS				< 0.2	1	0.58	2.2	7.8	1.7	0.35	1.1
9/9/03	9.1	< 0.2	< 0.2	< 0.2	15	1.8	0.34	0.64	12	1.9	0.32	0.89
3/9/04	NS				< 0.2	0.47	0.32	2.8	9.1	1.8	0.4	1
10/5/04	5.5	< 0.2	< 0.2	< 0.2	8.8	1.9	0.47	0.99	7.7	1.9	0.38	1.1
3/15/05	NS				0.32	0.35	0.37	3.5	11	1.9	0.48	1.1
10/11/05	13	< 0.2	< 0.2	< 0.2	18	1.1	0.36	0.65	9	1.4	0.39	0.92
12/13/05	--	--	--	--	--	--	--	--	--	--	--	--
4/18/06	NS				0.22	0.46	0.45	4.5	5.8	1.8	0.5	1.5
10/17/06	4.5	< 0.2	< 0.2	< 0.2	9.1	1.3	0.42	0.47	7.3	1.6	0.39	0.62
4/17/07	NS				0.5	0.74	0.76	4.4	6.5	2	0.56	0.87
10/16/07	5.5	< 0.2	< 0.2	< 0.2	11	1.1	0.41	0.41	8.5	1.7	0.41	0.59
4/15/08	NS				0.61	0.53	0.69	5.7	6.3	1.7	0.45	0.92
10/13/08	7.9	1 U	1 U	0.2 U	11	1.3	1 U	0.2 U	8.8	1.7	1 U	0.2 U
4/7/09	NS				0.13 J	0.69 J	3.1	0.2 U	9.9	2.9	2.9	0.2 U
10/8/09	11	1 U	1 U	0.2 U	13	2.2	1 U	0.85	11	2.3	1 U	0.5
4/19/10	NS				2.4	1.1	1 U	3.8	8.9	2.5	1 U	1 U
6/7/11	REJ				REJ				REJ			
10/11/11	8.8	0.2 U	0.2 U	0.2 U	7.9	4.1	1.8	1.2	9.6	2	0.42	0.2 U
4/24/12	--	--	--	--	1.1	1.1	1.3	4.2	7.1	2.1	0.54	0.27
10/10/12	8.7	0.2 U	0.2 U	0.2 U	6.9	5.5	2.1	0.99	9.7	2.1	0.4	0.2 U
5/2013	NS				4.3	3.2	2.6	6.4	13	3.4	1	0.49 J
10/2013	19	1 U	1 U	1 U	8.2	4.8	3.5	3.1	15	2.5	0.36 J	1 U

Notes for Table C-4:

ND: Analyte was not detected.
NS: Not sampled due to a low water level or insufficient volume of water.
U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
UJ: The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately measure the analyte in the sample.
Bold: Analyte was detected.
Shade: Values are greater than MTCA cleanup levels.
-- Not Sampled.

Table C-5: Summary of Analytical Results (ug/L) for Fifth Wheel Truck Repair and Agri-Tech\ Yakima Steel, June 1999 to October 2013.

	5W-MW-2				AT-MW4			
Date	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
6/2/99	3.74	ND	ND	ND	2.04	ND	2.15	ND
9/8/99	11.3	ND	ND	ND	4.07	0.73 J	4.95	ND
12/7/99	8.1	0.19 J	ND	ND	3.93	0.94 J	4.77	ND
3/7/00	4.17	ND	ND	ND	3.11	ND	3.32	ND
6/7/00	ND	ND	ND	ND	4.3	0.66	2.8	ND
8/30/00	5.3	ND	ND	ND	3.8	1.1	5.7	ND
12/12/00	7.7	ND	ND	ND	5.7	1.3	1.4	ND
3/6/01	4.3	ND	ND	ND	4.1	0.94	1.5	ND
9/10/01	8.1	< 0.2	< 0.2	< 0.2	4.3	1.3	1.8	< 0.2
3/4/02	3.2	< 0.2	< 0.2	< 0.2	4	0.94	0.68	< 0.2
9/9/02	6.8	< 0.2	< 0.2	< 0.2	5.2	1.2	1	< 0.2
3/11/03	3.5	< 0.2	< 0.2	< 0.2	4.2	0.84	2	< 0.2
9/9/03	8.8	< 0.2	< 0.2	< 0.2	6.8	1.1	3	< 0.2
3/9/04	3.1	0.59	< 0.2	< 0.2	0.23	< 0.2	0.59	< 0.2
10/5/04	1.9	< 0.2	< 0.2	< 0.2	5.4	0.69	2.2	< 0.2
3/15/05	2.8	< 0.2	< 0.2	< 0.2	5	0.71	2.2	< 0.2
10/11/05	REJ				REJ			
12/13/05	3.7	0.59	0.32	< 0.2	6.3	0.66	0.29	< 0.2
4/18/06	0.21	0.35	1.2	< 0.2	4.3	0.54	0.68	< 0.2
10/17/06	6.6	0.27	< 0.2	< 0.2	5	0.76	2.6	< 0.2
4/17/07	2	< 0.2	< 0.2	< 0.2	4.1	0.52	1.4	< 0.2
10/16/07	7.8	< 0.2	< 0.2	< 0.2	6	0.6	1.3	< 0.2
4/15/08	1.8	< 0.2	< 0.2	< 0.2	3.4	0.48	1.7	< 0.2
10/13/08	6.1	1 U	1 U	0.2 U	5.9	1 U	1 U	0.2 U
4/7/09	1.3	1 U	1 U	0.2 U	4.8	0.64 J	4.2	0.2 U
10/5/09	7.5	1 U	1 U	0.2 U	6.1	1 U	1.4	0.2 U
4/19/10	1.9	1 U	1 U	0.2 U	3.9	1 U	1 U	0.2 U
6/7/11	2.7	1 U	1 U	0.2 U	5.7	1 U	1	0.2 U
10/11/11	3.8	0.2 U	0.2 U	0.2 U	4.8	0.39	0.46	0.2 U
4/24/12	1.1	0.2 U	0.2 U	0.2 U	3.2	0.61	2.3	0.2 U
10/10/12	3.5	0.21	0.2 U	0.2 U	3	0.26	0.87	0.2 U
5/2013	1.5	1 U	1 U	1 U	3	0.52 J	3.1	1 U
10/2013	5.9	1 U	1 U	1 U	6.5	1 U	0.62 J	1 U

ND: Analyte was not detected.
U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
REJ: Rejected. Result considered suspect due to possible cross-contamination. Well re-sampled in December 2005.
Bold: Analyte was detected.
Shade: Values are greater than MTCA cleanup levels.

Table C-6: Summary of Analytical Results (ug/L) for Cameron Yakima, Inc., December 1997 to October 2013.

	CYI-MW-102S				CYI-MW-103S				CYI-MW-103D			
Date	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
12/2/97	11	0.47 J	2 U	2 U	26	1.2 J	2.6	2 U	2.6	2 U	2 U	2 U
3/3/98	11	0.5 J	0.2 J	1 U	91 E	3.8	16	1 U	3.3	1 U	1 U	1 U
6/1/98	11	0.66 J	1.7	1 U	64 E	4.1	90 E	1 U	5	0.11 J	0.23 J	1 U
8/31/98	70 E	4.9 J	45	2 UJ	118 E	4 J	26 J	1 UJ	3.9 J	1 UJ	1 UJ	1 UJ
6/2/99	15.3	0.93 J	3.61	ND	55.3	3.9	31.3	ND	5.23	0.25 J	ND	0.23 J
9/8/99	71.6	3.4	12.6	ND	139	4.54	17	ND	4.85	ND	ND	ND
12/7/99	--	--	--	--	--	--	--	--	--	--	--	--
3/7/00	--	--	--	--	--	--	--	--	--	--	--	--
6/7/00	6.3	0.35	ND	ND	27	ND	2.6	ND	5.1	ND	ND	ND
8/30/00	16	0.55	ND	ND	6.8	0.27	0.55	ND	4.3	ND	ND	ND
12/12/00	17	0.48	ND	ND	30	1	1.1	ND	5	ND	ND	ND
3/6/01	12	0.48	ND	ND	57	2.5	4.4	ND	4.4	ND	ND	ND
9/10/01	13	0.49	< 0.2	< 0.2	33	1.2	0.98	< 0.2	4.1	< 0.2	< 0.2	< 0.2
3/4/02	7.9	0.33	< 0.2	< 0.2	31	1.6	1.6	< 0.2	3.7	< 0.2	< 0.2	< 0.2
9/9/02	12	0.41	< 0.2	< 0.2	21	0.76	0.57	< 0.2	--	--	--	--
3/11/03	6.8	0.29	< 0.2	< 0.2	26	1.2	0.92	< 0.2	4	< 0.2	< 0.2	< 0.2
9/9/03	12	0.42	< 0.2	< 0.2	16	0.57	< 0.2	< 0.2	4.4	< 0.2	< 0.2	< 0.2
3/9/04	8.6	0.32	< 0.2	< 0.2	25	0.8	0.69	< 0.2	3.7	0.2	< 0.2	< 0.2
10/5/04	--	--	--	--	15	0.35	< 0.2	< 0.2	3.8	< 0.2	< 0.2	< 0.2
3/15/05	11	0.47	< 0.2	< 0.2	18	0.8	0.71	< 0.2	3.8	< 0.2	< 0.2	< 0.2
10/11/05	15	0.29	0.2 U	0.2 U	16	0.32	0.2 U	0.2 U	4	0.2 U	0.2 U	0.2 U
12/13/05	--	--	--	--	--	--	--	--	--	--	--	--
4/18/06	6.6	0.28	< 0.2	< 0.2	13	0.52	0.44	< 0.2	3.3	< 0.2	< 0.2	< 0.2
10/17/06	8.3	0.24	0.2 U	0.2 U	9.7	0.26	< 0.2	< 0.2	3	0.2 U	0.2 U	0.2 U
4/17/07	5.2	0.22	0.2 U	0.2 U	13	0.52	0.47	0.2 U	3.5	0.2 U	0.2 U	0.2 U
10/16/07	9.3	0.27	0.2 U	0.2 U	9	0.26	0.2 U	0.2 U	3	0.2 U	0.2 U	0.2 U
4/15/08	5.1	< 0.2	< 0.2	< 0.2	10	0.38	0.38	< 0.2	2.3	< 0.2	< 0.2	< 0.2
10/13/08	6.3	1 U	1 U	0.2 U	5.9	1 U	1 U	0.2 U	2.7	1 U	1 U	0.2 U
4/7/09	5.8	1 U	1 U	0.2 U	12	1 U	2.7	0.2 U	3.1	1 U	1 U	0.2 U
10/8/09	11	1 U	1 U	0.2 U	12	1 U	1 U	0.2 U	3	1 U	1 U	0.2 U
4/19/10	8	1 U	1 U	1 U	7.2	1 U	1 U	1 U	2.5	1 U	1 U	1 U
6/7/11	7.7	1 U	1 U	0.2 U	3.6	1 U	1 U	0.2 U	4.8	1 U	1 U	0.2 U
10/11/11	8.5	0.22	0.2 U	0.2 U	8.3	0.37	0.2 U	0.2 U	2.3	0.2 U	0.2 U	0.2 U
4/24/12	5.8	0.24	0.2 U	0.2 U	8.7	0.44	0.23	0.2 U	1.9	0.2 U	0.2 U	0.2 U
10/10/12	9.3	0.2 U	0.2 U	0.2 U	7.9	0.3	0.2 U	0.2 U	2.6	0.2 U	0.2 U	0.2 U
5/2013	4.6	1 U	1 U	1 U	12	0.63 J	0.63 J	1 U	3.1	1 U	1 U	1 U
10/2013	11	1 U	1 U	1 U	10	1 U	1 U	1 U	2.9	1 U	1 U	1 U

Table C-6: Continued.

	CYI-MW-106S				CYI-MW-107S				CYI-MW-108S			
Date	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
12/2/97	27 J	1.2 J	2.6	2 U	--	--	--	--	--	--	--	--
3/3/98	12	0.43 J	0.2 J	1 U	--	--	--	--	--	--	--	--
6/1/98	8.8	0.35 J	1.7	1 UJ	--	--	--	--	--	--	--	--
8/31/98	8.3 J	0.36 J	7.4 J	1 UJ	18 J	0.02 J	0.06 J	1 UJ	7.8 J	1 UJ	1 UJ	1 UJ
6/2/99	7.79	0.43 J	ND	ND	27	0.81 J	1.02	ND	2.88	ND	ND	ND
9/8/99	19	0.4 J	ND	ND	17.3	0.55 J	ND	ND	5.29	ND	ND	ND
12/7/99	--	--	--	--	--	--	--	--	--	--	--	--
3/7/00	--	--	--	--	--	--	--	--	--	--	--	--
6/7/00	6.2	0.28	ND	ND	10	0.22	ND	ND	1.4	ND	ND	ND
8/30/00	20	0.7	ND	ND	14	0.48	0.22	ND	3.8	ND	ND	ND
12/12/00	12	0.35	ND	ND	16	0.39	ND	ND	3	ND	ND	ND
3/6/01	11	0.3	ND	ND	12	0.35	ND	ND	0.97	ND	ND	ND
9/10/01	13	0.4	< 0.2	< 0.2	9.2	0.27	< 0.2	< 0.2	3.7	< 0.2	< 0.2	< 0.2
3/4/02	6.9	0.24	< 0.2	< 0.2	8.3	0.27	< 0.2	< 0.2	0.89	< 0.2	< 0.2	< 0.2
9/9/02	12	0.31	< 0.2	< 0.2	8.4	< 0.2	< 0.2	< 0.2	3.3	< 0.2	< 0.2	< 0.2
3/11/03	5.4	< 0.2	< 0.2	< 0.2	7.7	0.21	< 0.2	< 0.2	1.3	< 0.2	< 0.2	< 0.2
9/9/03	13	0.31	< 0.2	< 0.2	9.5	< 0.2	< 0.2	< 0.2	3.5	< 0.2	< 0.2	< 0.2
3/9/04	8.3	0.26	< 0.2	< 0.2	9.5	0.36	< 0.2	< 0.2	0.96	< 0.2	< 0.2	< 0.2
10/5/04	11	0.26	< 0.2	< 0.2	7	< 0.2	< 0.2	< 0.2	3.4	< 0.2	< 0.2	< 0.2
3/15/05	9.4	0.27	< 0.2	< 0.2	9.2	0.28	< 0.2	< 0.2	0.8	< 0.2	< 0.2	< 0.2
10/11/05	15	0.29	0.2 U	0.2 U	15	0.2 U	0.2 U	0.2 U	5.9	0.2 U	0.2 U	0.2 U
12/13/05	--	--	--	--	--	--	--	--	--	--	--	--
4/18/06	4.4	< 0.2	< 0.2	< 0.2	6.6	< 0.2	< 0.2	< 0.2	0.6	< 0.2	< 0.2	< 0.2
10/17/06	8.4	0.24	0.2 U	0.2 U	5	0.2 U	0.2 U	0.2 U	2.2	< 0.2	< 0.2	< 0.2
4/17/07	3.2	0.22	0.2 U	0.2 U	6.6	0.2 U	0.2 U	0.2 U	0.43	0.2 U	0.2 U	0.2 U
10/16/07	8.9	0.24	0.2 U	0.2 U	4.4	0.2 U	0.2 U	0.2 U	2.2	0.2 U	0.2 U	0.2 U
4/15/08	3.1	< 0.2	< 0.2	< 0.2	5.9	< 0.2	< 0.2	< 0.2	0.48	< 0.2	< 0.2	< 0.2
10/13/08	6.4	1 U	1 U	0.2 U	2.4	1 U	1 U	0.2 U	2.3	1 U	1 U	0.2 U
4/7/09	3.5	1 U	1 U	0.2 U	5.6	1 U	1 U	0.2 U	0.13 J	1 U	1 U	0.2 U
10/8/09	9.3	1 U	1 U	0.2 U	5.9	1 U	1 U	0.2 U	3.2	1 U	1 U	0.2 U
4/19/10	4.8	1 U	1 U	1 U	7.6	1 U	1 U	1 U	3.6	1 U	1 U	1 U
6/7/11	4	1 U	1 U	0.2 U	8.7	1 U	1 U	0.2 U	5.8	1 U	1 U	0.2 U
10/11/11	6.5	0.21	0.2 U	0.2 U	4.8	0.2 U	0.2 U	0.2 U	2.8	0.2 U	0.2 U	0.2 U
4/24/12	2.9	0.2 U	0.2 U	0.2 U	4.9	0.2 U	0.2 U	0.2 U	2.6	0.2 U	0.2 U	0.2 U
10/10/12	5.6	0.2 U	0.2 U	0.2 U	4.9	0.2 U	0.2 U	0.2 U	3.1	0.2 U	0.2 U	0.2 U
5/2013	3.6	1 U	1 U	1 U	3.4	1 U	1 U	1 U	3.5	1 U	1 U	1 U
10/2013	7.8	1 U	1 U	1 U	6.2	1 U	1 U	1 U	4.1	1 U	1 U	1 U

Table C-6: Continued.

	CYI-MW-109S				CYI-MW-110S				CYI-MW-111S			
Date	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
12/2/97	--	--	--	--	--	--	--	--	--	--	--	--
3/3/98	--	--	--	--	--	--	--	--	--	--	--	--
6/1/98	--	--	--	--	--	--	--	--	--	--	--	--
8/31/98	7.1 J	1 UJ	1 UJ	1 UJ	8.3 J	1 UJ	1 UJ	1 UJ	9.4 J	0.19 J	1 UJ	1 UJ
6/2/99	3.77	ND	ND	ND	4.52	ND	ND	ND	6.1	ND	ND	ND
9/8/99	4.96	ND	ND	ND	5.86	ND	ND	ND	8.57	ND	ND	ND
12/7/99	--	--	--	--	--	--	--	--	--	--	--	--
3/7/00	--	--	--	--	--	--	--	--	--	--	--	--
6/7/00	2	ND	ND	ND	2.3	ND	ND	ND	3.9	ND	ND	ND
8/30/00	4	ND	ND	ND	5.6	ND	ND	ND	6.5	ND	ND	ND
12/12/00	3.8	ND	ND	ND	4.4	ND	ND	ND	5.1	ND	ND	ND
3/6/01	1.4	ND	ND	ND	2.2	ND	ND	ND	2.3	ND	ND	ND
9/10/01	3.6	< 0.2	< 0.2	< 0.2	4.3	< 0.2	< 0.2	< 0.2	5.7	< 0.2	< 0.2	< 0.2
3/4/02	1.1	< 0.2	< 0.2	< 0.2	1.7	< 0.2	< 0.2	< 0.2	1.5	< 0.2	< 0.2	< 0.2
9/9/02	2.9	< 0.2	< 0.2	< 0.2	3.6	< 0.2	< 0.2	< 0.2	5.4	< 0.2	< 0.2	< 0.2
3/11/03	1.7	< 0.2	< 0.2	< 0.2	2.4	< 0.2	< 0.2	< 0.2	2.2	< 0.2	< 0.2	< 0.2
9/9/03	--	--	--	--	--	--	--	--	5.8	< 0.2	< 0.2	< 0.2
3/9/04	--	--	--	--	--	--	--	--	1.7	< 0.2	< 0.2	< 0.2
10/5/04	--	--	--	--	--	--	--	--	0.65	< 0.2	< 0.2	< 0.2
3/15/05	1.2	< 0.2	< 0.2	< 0.2	--	--	--	--	1.7	< 0.2	< 0.2	< 0.2
10/11/05	REJ				4.1	0.2 U	0.2 U	0.2 U	4.4	0.2 U	0.2 U	0.2 U
12/13/05	1.4	0.2 U	0.2 U	0.2 U	--	--	--	--	--	--	--	--
4/18/06	0.62	< 0.2	< 0.2	< 0.2	1.2	< 0.2	< 0.2	< 0.2	0.4	< 0.2	< 0.2	< 0.2
10/17/06	2.3	0.2 U	0.2 U	0.2 U	3	0.2 U	0.2 U	0.2 U	2.2	0.2 U	0.2 U	0.2 U
4/17/07	0.55	0.2 U	0.2 U	0.2 U	0.96	0.2 U	0.2 U	0.2 U	0.68	0.2 U	0.2 U	0.2 U
10/16/07	2.9	0.2 U	0.2 U	0.2 U	3.7	0.2 U	0.2 U	0.2 U	3.3	0.2 U	0.2 U	0.2 U
4/15/08	0.5	< 0.2	< 0.2	< 0.2	0.75	< 0.2	< 0.2	< 0.2	0.6	< 0.2	< 0.2	< 0.2
10/13/08	1.8	1 U	1 U	0.2 U	1.9	1 U	1 U	0.2 U	1.8	1 U	1 U	0.2 U
4/7/09	0.29 J	1 U	1 U	0.2 U	0.59 J	1 U	1 U	0.2 U	0.43 J	1 U	1 U	0.2 U
10/8/09	3.3	1 U	1 U	0.2 U	3.7	1 U	1 U	0.2 U	5.5	1 U	1 U	0.2 U
4/19/10	4.2	1 U	1 U	1 U	5.2	1 U	1 U	1 U	1.3	1 U	1 U	1 U
6/7/11	4	1 U	1 U	0.2 U	5.8	1 U	1 U	0.2 U	1 U	1 U	1 U	0.2 U
10/11/11	--	--	--	--	3.4	0.2 U	0.2 U	0.2 U	4.4	0.2 U	0.2 U	0.2 U
4/24/12	--	--	--	--	1.3	0.2 U	0.2 U	0.2 U	0.52	0.2 U	0.2 U	0.2 U
10/10/12	--	--	--	--	3.9	0.2 U	0.2 U	0.2 U	2.3	0.2 U	0.2 U	0.2 U
5/2013	4.1	1 U	1 U	1 U	4.5	1 U	1 U	1 U	1.2	1 U	1 U	1 U
10/2013	4.2	1 U	1 U	1 U	--	--	--	--	0.93 J	1 U	1 U	1 U

Table C-6: Continued.

	CYI-MW-112S				CYI-MW-113S				CYI-MW-113D			
Date	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
12/2/97	--	--	--	--	--	--	--	--	--	--	--	--
3/3/98	--	--	--	--	--	--	--	--	--	--	--	--
6/1/98	--	--	--	--	--	--	--	--	--	--	--	--
8/31/98	15 J	0.02 J	0.45 J	1 UJ	21 J	0.2 J	1.2 J	1 UJ	5 J	1 UJ	1 UJ	1 UJ
6/2/99	18.9	0.71 J	1.47	ND	--	--	--	--	5.34	ND	ND	ND
9/8/99	17.1	0.56 J	0.71 J	ND	--	--	--	--	5.46	ND	ND	ND
12/7/99	--	--	--	--	--	--	--	--	--	--	--	--
3/7/00	--	--	--	--	--	--	--	--	--	--	--	--
6/7/00	9.6	0.28	ND	ND	--	--	--	--	5.8	ND	ND	ND
8/30/00	11	0.37	ND	ND	--	--	--	--	5.1	ND	ND	ND
12/12/00	13	0.38	ND	ND	--	--	--	--	5.2	ND	ND	ND
3/6/01	6.5	0.24	ND	ND	--	--	--	--	4.4	ND	ND	ND
9/10/01	8.6	0.27	< 0.2	< 0.2	--	--	--	--	4.7	< 0.2	< 0.2	< 0.2
3/4/02	3.9	< 0.2	< 0.2	< 0.2	--	--	--	--	3.5	< 0.2	< 0.2	< 0.2
9/9/02	4	< 0.2	< 0.2	< 0.2	--	--	--	--	4.5	< 0.2	< 0.2	< 0.2
3/11/03	4.6	0.21	< 0.2	< 0.2	--	--	--	--	3.9	< 0.2	< 0.2	< 0.2
9/9/03	--	--	--	--	--	--	--	--	--	--	--	--
3/9/04	--	--	--	--	--	--	--	--	--	--	--	--
10/5/04	--	--	--	--	--	--	--	--	--	--	--	--
3/15/05	3.7	< 0.2	< 0.2	< 0.2	--	--	--	--	4	< 0.2	< 0.2	< 0.2
10/11/05	8.8	0.2 U	0.2 U	0.2 U	9.9	0.2 U	0.2 U	0.2 U	4.8	< 0.2	< 0.2	< 0.2
12/13/05	--	--	--	--	--	--	--	--	--	--	--	--
4/18/06	3	< 0.2	< 0.2	< 0.2	--	--	--	--	3.8	< 0.2	< 0.2	< 0.2
10/17/06	4.6	0.2 U	0.2 U	0.2 U	5.5	0.2 U	0.2 U	0.2 U	3.6	0.2 U	0.2 U	0.2 U
4/17/07	2.7	0.2 U	0.2 U	0.2 U	2.8	0.2 U	0.2 U	0.2 U	3.5	0.2 U	0.2 U	0.2 U
10/16/07	4.7	0.2 U	0.2 U	0.2 U	5.5	0.2 U	0.2 U	0.2 U	3.2	0.2 U	0.2 U	0.2 U
4/15/08	2	< 0.2	< 0.2	< 0.2	--	--	--	--	2.7	< 0.2	< 0.2	< 0.2
10/13/08	3.2	1 U	1 U	0.2 U	3.7	1 U	1 U	0.2 U	2.8	1 U	1 U	0.2 U
4/7/09	1.8	1 U	1 U	0.2 U	1.8	1 U	1 U	0.2 U	3	1 U	1 U	0.2 U
10/8/09	7.9	1 U	1 U	0.2 U	8.6	1 U	1 U	0.2 U	4.2	1 U	1 U	0.2 U
4/19/10	6.2	1 U	1 U	1 U	14	1 U	1 U	1 U	3.4	1 U	1 U	1 U
6/7/11	8.5	1 U	1 U	0.2 U	12	1 U	1 U	0.2 U	6.1	1 U	1 U	0.2 U
10/11/11	4.7	0.2 U	0.2 U	0.2 U	9	0.22	0.2 U	0.2 U	3.1	0.2 U	0.2 U	0.2 U
4/24/12	7.3	0.28	0.2 U	0.2 U	8.5	0.36	0.2 U	0.2 U	2.8	0.2 U	0.2 U	0.2 U
10/10/12	6.1	0.2 U	0.2 U	0.2 U	8.8	0.25	0.2 U	0.2 U	2.9	0.2 U	0.2 U	0.2 U
5/2013	9	0.44 J	0.45 J	1 U	12	0.58 J	0.51 J	1 U	4	1 U	1 U	1 U
10/2013	11	1 U	1 U	1 U	13	1 U	1 U	1 U	4.5	1 U	1 U	1 U

Table C-6: Continued.

	CYI-MW-114S			
Date	PCE	TCE	Cis-DCE	VC
12/2/97	--	--	--	--
3/3/98	--	--	--	--
6/1/98	--	--	--	--
8/31/98	15 J	0.03 J	0.72 J	1 UJ
6/2/99	19.1	0.65 J	1.59	ND
9/8/99	15.8	0.63 J	0.84 J	ND
12/7/99	--	--	--	--
3/7/00	--	--	--	--
6/7/00	9.9	0.28	0.2	ND
8/30/00	7.9	0.32	ND	ND
12/12/00	13	0.34	ND	ND
3/6/01	8.6	0.33	ND	ND
9/10/01	7.8	0.27	< 0.2	< 0.2
3/4/02	5.5	0.25	< 0.2	< 0.2
9/9/02	4.9	< 0.2	< 0.2	< 0.2
3/11/03	6.3	< 0.2	< 0.2	< 0.2
9/9/03	--	--	--	--
3/9/04	--	--	--	--
10/5/04	--	--	--	--
3/15/05	6.2	0.31	< 0.2	< 0.2
10/11/05	7.2	0.2 U	0.2 U	0.2 U
12/13/05	--	--	--	--
4/18/06	2.5	< 0.2	< 0.2	< 0.2
10/17/06	4.8	0.2 U	0.2 U	0.2 U
4/17/07	2.5	0.2 U	0.2 U	0.2 U
10/16/07	5	0.2 U	0.2 U	0.2 U
4/15/08	3.4	< 0.2	< 0.2	< 0.2
10/13/08	3.4	1 U	1 U	0.2 U
4/7/09	4.4	1 U	2.4	0.2 U
10/8/09	7.9	1 U	1 U	0.2 U
4/19/10	13	1 U	1 U	1 U
6/7/11	12	1 U	1 U	0.2 U
10/11/11	9.5	0.27	0.2 U	0.2 U
4/24/12	8.9	0.34	0.2 U	0.2 U
10/10/12	8.9	0.28	0.2 U	0.2 U
5/2013	12	0.41 J	0.46 J	1 U
10/2013	12	1 U	1 U	1 U

U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
(Continued on next page)

UJ: The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately measure the analyte in the sample.
E: Reported result is an estimate because it exceeds the calibration range.
ND: Analyte was not detected.
REJ: Rejected. Result considered suspect due to possible cross-contamination. Well re-sampled in December 2005.
Bold: Analyte was detected.
Shade: Values are greater than MTCA cleanup levels.
-- Not Sampled.

Table C-7: Summary of Analytical Results (ug/L) for YRRA Remedial Investigation Wells, June 1999 to October 2013.

	RI-3S				RI-4S				RI-4D			
Date	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
12/2/97	--	--	--	--	--	--	--	--	--	--	--	--
3/3/98	--	--	--	--	--	--	--	--	--	--	--	--
6/1/98	--	--	--	--	--	--	--	--	--	--	--	--
8/31/98	--	--	--	--	--	--	--	--	--	--	--	--
6/2/99	0.72 J	ND	ND	ND	15.4	ND	ND	ND	ND	ND	ND	ND
9/8/99	1.72	ND	ND	ND	13.7	ND	ND	ND	0.61 J	ND	ND	ND
12/7/99	2.43	ND	ND	ND	12.7	0.32 J	ND	ND	1.72	0.34 J	ND	ND
3/7/00	0.33 J	ND	ND	ND	12.2	ND	ND	ND	0.34 J	ND	ND	ND
6/7/00	2	0.34	0.54	ND	17	ND	ND	ND	1.1	ND	ND	ND
8/30/00	2.2	0.39	0.69	ND	11	ND	ND	ND	0.38	ND	ND	ND
12/12/00	1.7	0.24	0.83	ND	15	ND	ND	ND	0.52	ND	ND	ND
3/6/01	0.30	ND	ND	ND	14	ND	ND	ND	0.78	ND	ND	ND
9/10/01	1.7	0.39	0.36	<0.2	11	<0.2	<0.2	<0.2	0.98	<0.2	<0.2	<0.2
3/4/02	1.2	0.24	0.4	<0.2	15	<0.2	<0.2	<0.2	1	<0.2	<0.2	<0.2
9/9/02	1.1	0.22	0.32	<0.2	11	<0.2	<0.2	<0.2	1	<0.2	<0.2	<0.2
3/11/03	0.68	<0.2	0.35	<0.2	13	<0.2	<0.2	<0.2	1.1	<0.2	<0.2	<0.2
9/9/03	1.6	0.26	<0.2	<0.2	14	<0.2	<0.2	<0.2	1.3	<0.2	<0.2	<0.2
3/9/04	0.21	<0.2	<0.2	<0.2	17	<0.2	<0.2	<0.2	1.4	<0.2	<0.2	<0.2
10/5/04	0.92	0.23	<0.2	<0.2	14	<0.2	<0.2	<0.2	1.4	<0.2	<0.2	<0.2
3/15/05	4.7	<0.2	<0.2	<0.2	16	<0.2	<0.2	<0.2	3.2	<0.2	<0.2	<0.2
10/11/05	REJ				18	<0.2	<0.2	<0.2	1.8	<0.2	<0.2	<0.2
12/13/05	1	<0.2	<0.2	<0.2	--	--	--	--	--	--	--	--
4/18/06	0.25	<0.2	<0.2	<0.2	14	<0.2	<0.2	<0.2	1.4	<0.2	<0.2	<0.2
10/17/06	0.75	<0.2	<0.2	<0.2	11	<0.2	<0.2	<0.2	1.3	<0.2	<0.2	<0.2
4/17/07	1.4	0.22	0.29	<0.2	13	<0.2	<0.2	<0.2	1.4	<0.2	<0.2	<0.2
10/16/07	0.61	<0.2	<0.2	<0.2	11	<0.2	<0.2	<0.2	1.2	<0.2	<0.2	<0.2
4/15/08	0.29	<0.2	<0.2	<0.2	13	<0.2	<0.2	<0.2	1.3	<0.2	<0.2	<0.2
10/14/08	1.2	1 U	1 U	0.2 U	11	1 U	1 U	0.2 U	1.6	1 U	1 U	0.2 U
4/7/09	1.2	1 U	1 U	0.2 U	18	1 U	1 U	0.2 U	1.3	1 U	1 U	0.2 U
10/6/09	1 U	1 U	1 U	0.2 U	13	1 U	1 U	0.2 U	2	1 U	1 U	0.2 U
4/21/10	1 U	1 U	1 U	1 U	19	1 U	1 U	1 U	1 U	1 U	1 U	1 U
6/7/11	2.5	1 U	1 U	0.2 U	25	1 U	1 U	0.2 U	2.1	1 U	1 U	0.2 U
10/11/11	0.59	0.2 U	0.2 U	0.2 U	15	0.2 U	0.2 U	0.2 U	0.73	0.2 U	0.2 U	0.2 U
4/23/12	0.2 U	0.2 U	0.2 U	0.2 U	11	0.2 U	0.2 U	0.2 U	0.64	0.2 U	0.2 U	0.2 U
10/11/12	0.47	0.2 U	0.2 U	0.2 U	13	0.2 U	0.2 U	0.2 U	0.89	0.2 U	0.2 U	0.2 U
5/2013	1 U	1 U	1 U	1 U	18	1 U	1 U	1 U	1	1 U	1 U	1 U
10/2013	0.88 J	1 U	1 U	1 U	18	1 U	1 U	1 U	1.1	1 U	1 U	1 U

Table C-7: Continued.

	RI-5S				RI-5D				RI-6S			
Date	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
12/2/97	--	--	--	--	--	--	--	--	--	--	--	--
3/3/98	--	--	--	--	--	--	--	--	--	--	--	--
6/1/98	--	--	--	--	--	--	--	--	--	--	--	--
8/31/98	--	--	--	--	--	--	--	--	--	--	--	--
6/2/99	0.8 J	ND	ND	ND	ND	ND	ND	ND	2.04	ND	ND	ND
9/8/99	0.59 J	ND	ND	ND	ND	ND	ND	ND	4.72	ND	ND	ND
12/7/99	1.84	ND	ND	ND	0.92 J	ND	ND	ND	3.66	ND	ND	ND
3/7/00	1.47	ND	ND	ND	0.62 J	ND	ND	ND	2.19	ND	ND	ND
6/7/00	0.87	ND	ND	ND	0.55	ND	ND	ND	3.1	ND	ND	ND
8/30/00	0.66	ND	ND	ND	0.43	ND	ND	ND	3.8	ND	ND	ND
12/12/00	1.1	ND	ND	ND	0.51	ND	ND	ND	3.8	ND	ND	ND
3/6/01	1.2	ND	ND	ND	0.51	ND	ND	ND	2.8	ND	ND	ND
9/10/01	0.74	<0.2	<0.2	<0.2	0.41	<0.2	<0.2	<0.2	4.3	<0.2	<0.2	<0.2
3/4/02	1.2	<0.2	<0.2	<0.2	0.46	<0.2	<0.2	<0.2	2.9	<0.2	<0.2	<0.2
9/9/02	0.5	<0.2	<0.2	<0.2	0.46	<0.2	<0.2	<0.2	4	<0.2	<0.2	<0.2
3/11/03	1.2	<0.2	<0.2	<0.2	0.5	<0.2	<0.2	<0.2	2.5	<0.2	<0.2	<0.2
9/9/03	0.89	<0.2	<0.2	<0.2	0.59	<0.2	<0.2	<0.2	5.3	<0.2	<0.2	<0.2
3/9/04	1.4	<0.2	<0.2	<0.2	0.61	<0.2	<0.2	<0.2	3.7	<0.2	<0.2	<0.2
10/5/04	0.97	<0.2	<0.2	<0.2	0.68	<0.2	<0.2	<0.2	6	<0.2	<0.2	<0.2
3/15/05	1.6	<0.2	<0.2	<0.2	2.1	<0.2	<0.2	<0.2	3.5	<0.2	<0.2	<0.2
10/11/05	REJ				1.9	<0.2	<0.2	<0.2	REJ			
12/13/05	0.66	<0.2	<0.2	<0.2	--	--	--	--	4.1	<0.2	<0.2	<0.2
4/18/06	0.61	<0.2	<0.2	<0.2	0.61	<0.2	<0.2	<0.2	3.3	<0.2	<0.2	<0.2
10/17/06	0.76	<0.2	<0.2	<0.2	0.57	<0.2	<0.2	<0.2	4.9	<0.2	<0.2	<0.2
4/17/07	0.76	<0.2	<0.2	<0.2	0.60	<0.2	<0.2	<0.2	3.4	<0.2	<0.2	<0.2
10/16/07	1.1	<0.2	<0.2	<0.2	0.61	<0.2	<0.2	<0.2	6	<0.2	<0.2	<0.2
4/15/08	1.3	<0.2	<0.2	<0.2	0.55	<0.2	<0.2	<0.2	2.9	<0.2	<0.2	<0.2
10/14/08	1.3	1 U	1 U	0.2 U	1	1 U	1 U	0.2 U	5.9	1 U	1 U	0.2 U
4/7/09	1 U	1 U	1 U	0.2 U	0.48 J	1 U	1 U	0.2 U	3.9	1 U	1 U	0.2 U
10/6/09	1 U	1 U	1 U	0.2 U	1 U	1 U	1 U	0.2 U	6.9	1 U	1 U	0.2 U
4/21/10	2.4	1 U	1 U	1 U	1	1 U	1 U	1 U	3.9	1 U	1 U	1 U
6/7/11	2.4	1 U	1 U	0.2 U	1.7	1 U	1 U	0.2 U	4.4	1 U	1 U	0.2 U
10/11/11	1.6	0.2 U	0.2 U	0.2 U	0.78	0.2 U	0.2 U	0.2 U	6.1	0.2 U	0.2 U	0.2 U
4/23/12	2	0.2 U	0.2 U	0.2 U	0.69	0.2 U	0.2 U	0.2 U	2.7	0.2 U	0.2 U	0.2 U
10/11/12	1.4	0.2 U	0.2 U	0.2 U	0.77	0.2 U	0.2 U	0.2 U	5.7	0.2 U	0.2 U	0.2 U
5/2013	2.4	1 U	1 U	1 U	1.1	1 U	1 U	1 U	3.8	1 U	1 U	1 U
10/2013	2.1	1 U	1 U	1 U	1.2	1 U	1 U	1 U	8.2	1 U	1 U	1 U

Table C-7: Continued.

	RI-9S				RI-10S				RI-11S			
Date	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
12/2/97	--	--	--	--	--	--	--	--	--	--	--	--
3/3/98	--	--	--	--	--	--	--	--	--	--	--	--
6/1/98	--	--	--	--	--	--	--	--	--	--	--	--
8/31/98	--	--	--	--	--	--	--	--	--	--	--	--
6/2/99	1.86	ND	ND	ND	2.53	ND	ND	ND	1.4	ND	ND	ND
9/8/99	1.44	ND	ND	ND	2.51	ND	ND	ND	1.63	ND	ND	ND
12/7/99	1.33	ND	ND	ND	2.33	ND	ND	ND	1.15	ND	ND	ND
3/7/00	1.18	ND	ND	ND	1.9	ND	ND	ND	1.01	ND	ND	ND
6/7/00	1.4	ND	ND	ND	2	ND	ND	ND	0.99	ND	ND	ND
8/30/00	1.4	ND	ND	ND	1.8	ND	ND	ND	1	ND	ND	ND
12/12/00	1.9	0.23	ND	ND	2.7	ND	ND	ND	1.6	ND	ND	ND
3/6/01	1.9	0.25	ND	ND	2.2	ND	ND	ND	1.1	ND	ND	ND
9/10/01	--	--	--	--	2.3	<0.2	<0.2	<0.2	1.1	<0.2	<0.2	<0.2
3/4/02	1.8	0.21	<0.2	<0.2	2	<0.2	<0.2	<0.2	1.2	<0.2	<0.2	<0.2
9/9/02	1.7	0.26	<0.2	<0.2	1.8	<0.2	<0.2	<0.2	1	<0.2	<0.2	<0.2
3/11/03	1.6	0.23	<0.2	<0.2	1.8	<0.2	<0.2	<0.2	1	<0.2	<0.2	<0.2
9/9/03	1.7	<0.2	<0.2	<0.2	2.8	<0.2	<0.2	<0.2	1.4	<0.2	<0.2	<0.2
3/9/04	2	0.25	<0.2	<0.2	1.9	<0.2	<0.2	<0.2	1.1	<0.2	<0.2	<0.2
10/5/04	1.5	<0.2	<0.2	<0.2	1.8	<0.2	<0.2	<0.2	0.78	<0.2	<0.2	<0.2
3/15/05	2.2	<0.2	<0.2	<0.2	1.9	<0.2	<0.2	<0.2	1.4	<0.2	<0.2	<0.2
10/11/05	REJ				REJ				REJ			
12/13/05	2.2	<0.2	<0.2	<0.2	1.6	<0.2	<0.2	<0.2	0.83	<0.2	<0.2	<0.2
4/18/06	2.1	0.21	<0.2	<0.2	1.8	<0.2	<0.2	<0.2	0.89	<0.2	<0.2	<0.2
10/17/06	--	--	--	--	1.7	<0.2	<0.2	<0.2	0.94	<0.2	<0.2	<0.2
4/17/07	1.9	<0.2	<0.2	<0.2	1.9	<0.2	<0.2	<0.2	1.1	<0.2	<0.2	<0.2
10/16/07	2.1	<0.2	<0.2	<0.2	1.9	<0.2	<0.2	<0.2	1.1	<0.2	<0.2	<0.2
4/15/08	1.4	<0.2	<0.2	<0.2	1.4	<0.2	<0.2	<0.2	0.71	<0.2	<0.2	<0.2
10/14/08	1.4	1 U	1 U	0.2 U	1.5	1 U	1 U	0.2 U	1.1	1 U	1 U	0.2 U
4/7/09	1.7	1 U	1 U	0.2 U	1.5	1 U	1 U	0.2 U	0.43 J	1 U	1 U	0.2 U
10/6/09	1 U	1 U	1 U	0.2 U	2	1 U	1 U	0.2 U	1 U	1 U	1 U	0.2 U
4/21/10	1.9	1 U	1 U	1 U	1.9	1 U	1 U	1 U	1 U	1 U	1 U	0.2 U
6/7/11	1 U	1 U	1 U	0.2 U	1.8	1 U	1 U	0.2 U	1.3	1 U	1 U	0.2 U
10/11/11	1.3	0.2 U	0.2 U	0.2 U	1.3	0.2 U	0.2 U	0.2 U	0.87	0.2 U	0.2 U	0.2 U
4/23/12	0.97	0.2 U	0.2 U	0.2 U	1.3	0.2 U	0.2 U	0.2 U	0.59	0.2 U	0.2 U	0.2 U
10/11/12	1.1	0.2 U	0.2 U	0.2 U	1.6	0.2 U	0.2 U	0.2 U	0.71	0.2 U	0.2 U	0.2 U
5/2013	1.4	1 U	1 U	1 U	1.7	1 U	1 U	1 U	0.83 J	1 U	1 U	1 U
10/2013	1.8	1 U	1 U	1 U	2.1	1 U	1 U	1 U	1	1 U	1 U	1 U

U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.
(Continued on next page)

ND: Analyte was not detected.
REJ: Rejected. Result considered suspect due to possible cross-contamination. Well re-sampled in December 2005.
Bold: Analyte was detected.
Shade: Values are greater than MTCA cleanup levels.
-- Not Sampled.

Appendix D. 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.

Method Detection Limit: This definition for detection was first formally advanced in 40CFR 136, October 26, 1984 edition. MDL is defined there as the minimum concentration of an analyte that, in a given matrix and with a specific method, has a 99% probability of being identified, and reported to be greater than zero. (Federal Register, October 26, 1984).

Parameter: Water quality constituent being measured (analyte). 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.

Reporting limit: The minimum value of the calibration range. Analyte detections between the method detection limit and the reporting limit are reported as having estimated concentrations.

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.

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

Cis-1,2-DCE	Cis-1,2-dichloroethene
FS	Feasibility study
Dup	Duplicate
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management database
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
LDPE	Low Density Polyethylene
MEL	Manchester Environmental Laboratory
MSL	Mean Sea Level
MTCA	Model Toxics Control Act

MW	Monitoring well
ORP	Oxidation-reduction potential
PCE	Tetrachloroethene
PVC	Polyvinyl chloride
RI	Remedial investigation
RPD	Relative percent difference
SOP	Standard operating procedure
TCE	Trichloroethene
USGS	U.S. Geological Survey
VC	Vinyl chloride
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compounds
WAC	Washington Administrative Code
YRRA	Yakima Railroad Area (the project area)

Units of Measurement

°C	degrees centigrade
ft	feet
mg/L	milligrams per liter
mV	milli volts
s.u.	standard units
ug/L	micrograms per liter (parts per billion)
umhos/cm	micromhos per centimeter
uS/cm	microsiemens per centimeter, a unit of conductivity