

**SIXTH FIVE-YEAR REVIEW REPORT FOR  
LAKEWOOD-PONDERS CORNER SUPERFUND SITE  
PIERCE COUNTY, WASHINGTON**



**SEPTEMBER 6, 2017**

**Prepared by**

**U.S. Environmental Protection Agency  
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## Table of Contents

LIST OF ABBREVIATIONS & ACRONYMS.....	3
I. INTRODUCTION.....	4
Site Background.....	4
FIVE-YEAR REVIEW SUMMARY FORM .....	5
II. RESPONSE ACTION SUMMARY.....	7
Basis for Taking Action .....	7
Response Actions .....	7
Systems Operations/Operation & Maintenance .....	10
III. PROGRESS SINCE THE LAST REVIEW .....	12
IV. FIVE-YEAR REVIEW PROCESS .....	13
Community Notification, Involvement & Site Interviews .....	14
Data Review .....	14
Site Inspection.....	17
V. TECHNICAL ASSESSMENT .....	18
QUESTION A: Is the remedy functioning as intended by the decision documents? .....	18
QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection still valid?.....	19
QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?.....	20
VI. ISSUES/RECOMMENDATIONS .....	20
VII. PROTECTIVENESS STATEMENTS .....	22
VIII. NEXT REVIEW .....	22
APPENDIX A – REFERENCE LIST .....	A-1
APPENDIX B – SITE CHRONOLOGY .....	B-1
APPENDIX C – SITE BACKGROUND .....	C-1
APPENDIX D – LAKEWOOD URBAN GROWTH AREA .....	D-1
APPENDIX E – PRESS NOTICE .....	E-1
APPENDIX F – INTERVIEW FORMS .....	F-1
APPENDIX G – DATA REVIEW SUPPORTING DOCUMENTATION .....	G-1
APPENDIX H – SITE INSPECTION CHECKLIST .....	H-1
APPENDIX I – SITE INSPECTION PHOTOS.....	I-1
APPENDIX J – DETAILED ARARs REVIEW .....	J-1
APPENDIX K – DETAILED TOXICITY REVIEW .....	K-1
APPENDIX L – VAPOR INTRUSION SCREENING .....	L-1

## Tables

Table 1: COCs by Media.....	7
Table 2: Groundwater COC Cleanup Goals.....	8
Table 3: Summary of Planned and/or Implemented Institutional Controls (ICs).....	9
Table 4: Updated Groundwater Monitoring Schedule <sup>a</sup> .....	10
Table 5: Protectiveness Determinations/Statements from the 2012 FYR.....	12
Table 6: Status of Recommendations from the 2012 FYR.....	12
Table 7: PCE in Select Wells, 2012-2016.....	15
Table B-1: Site Chronology.....	B-1
Table G-1: Ecology Historical Groundwater Data.....	G-6
Table G-2: EPA Water Quality Results for April 2016.....	G-12
Table G-3: EPA Water Quality Results for June 2016.....	G-12
Table G-4: EPA Water Quality Results for July 2016.....	G-12
Table G-5: EPA Water Quality Results for September 2016.....	G-13
Table G-6: EPA Water Quality Results for November 2016.....	G-13
Table J-1: Previous and Current ARARs for Groundwater COCs.....	J-1
Table K-1: Screening-Level Risk Evaluation of the 1992 Soil Cleanup Goal.....	K-1
Table L-1: Vapor Intrusion (VI) Screening, MW-20B – Commercial.....	L-1
Table L-2: VI Screening, MW-20B – Residential.....	L-2
Table L-3: VI Screening, LPMW-2 – Residential.....	L-3

## Figures

Figure 1: Site Vicinity Map.....	6
Figure 2: Site Map.....	11
Figure 3: PCE Concentrations in MW-16A, 1991-2016.....	16
Figure 4: PCE Concentrations in MW-20B, 1991-2016.....	16
Figure G-1: Groundwater Flow Conceptual Site Model When H1 & H2 Are Pumping (1985).....	G-1
Figure G-2: Groundwater Elevations, April 2016.....	G-2
Figure G-3: MW-31 Groundwater Elevations, March 15 through December 20, 2016.....	G-3
Figure G-4: MW-28AR Groundwater Elevations, March 8 through December 20, 2016.....	G-3
Figure G-5: MW-20A and MW-20B Groundwater Elevations, April 28 through December 20, 2016.....	G-4
Figure G-6: MW-16A and MW-16B Groundwater Elevations, March 8 through December 20, 2016.....	G-4
Figure G-7: MW-20A and MW-20B Groundwater Elevations, June 25 through July 16, 2016.....	G-5

## LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Cis-1,2-DCE	Cis-1,2-Dichloroethene
COC	Contaminant of Concern
CSM	Conceptual Site Model
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FS	Feasibility Study
ft	Feet
FYR	Five-Year Review
gpm	Gallons per Minute
HI	Hazard Index
HQ	Hazard Quotient
I-5	Interstate 5
IC	Institutional Control
IRM	Interim Remedial Measure
JBLM	Joint Base Lewis/McChord
µg/L	Micrograms per Liter
MCL	Maximum Contaminant Level
mg/kg	Milligram per Kilogram
MTCA	Model Toxics Control Act
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PCE	Tetrachloroethylene
PFAS	Polyfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
PRP	Potentially Responsible Party
RAOs	Remedial Action Objectives
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RSL	Regional Screening Level
SVE	Soil Vapor Extraction
TBC	To-Be-Considered
TCE	Trichloroethylene
UU/UE	Unlimited Use and Unrestricted Exposure
VI	Vapor Intrusion
VISL	Vapor Intrusion Screening Level
VOCs	Volatile Organic Compounds

## I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), consistent with the National Contingency Plan (NCP), Title 40 of the Code of Federal Regulations (CFR), Section 300.430(f)(4)(ii), and considering EPA policy.

This is the sixth FYR for the Lakewood-Ponders Corner Superfund site (the Site). The triggering action for this policy review is the completion date of the previous FYR. The FYR has been prepared because hazardous substances, pollutants or contaminants remain in the groundwater at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of two operable units (OU). OU1 addresses groundwater and OU2 addresses soil. This FYR addresses the groundwater OU (OU1). The soil OU (OU2) is not addressed in this FYR because it has been cleaned up to UU/UE.

EPA remedial project manager (RPM) Tracy Chellis led the FYR process. Participants included Bernie Zavala, EPA hydrogeologist, and Andrew Smith, P.E., LHG of the Washington Department of Ecology (Ecology). Skeo, an EPA contractor, provided support for the FYR. The review began on 1/24/2017.

### **Site Background**

The Site is located south of Tacoma in the city of Lakewood in Pierce County, Washington (Figure 1). The Site consists of the former Plaza Cleaners property and groundwater contamination resulting from historical operations of the Plaza Cleaners dry cleaning and laundry business. An electrical supply and lighting company now operates at the former dry cleaning business property, located at 12511 Pacific Highway Southwest in Lakewood, in a commercial and light industrial area. Interstate 5 (I-5), a six-lane highway, borders the property to the south. Residential areas are located south of I-5 and about one-tenth of a mile north and northwest of the former dry cleaning property. McChord Air Force Base (part of what is now called Joint Base Lewis/McChord, or JBLM) is located about a quarter mile south and upgradient of the former Plaza Cleaners.

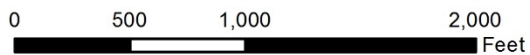
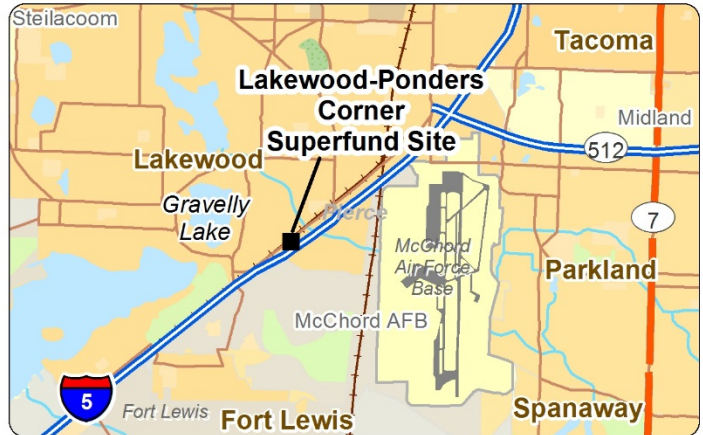
The groundwater underlying the Site is a drinking water source. Residents and businesses in the area rely on water from the Lakewood Water District public water supply, which obtains some of its water from supply wells H1 and H2. Wellhead treatment at H1 and H2 continues to remove contamination from groundwater prior to distribution. There are no known private drinking water wells near the Site. Regional groundwater flow is generally to the west-northwest towards Gravelly Lake; however, localized groundwater flow at the Site is influenced by pumping of Lakewood Water District drinking water supply wells H1 and H2.

Appendix A lists references reviewed for this FYR. Appendix B provides a site chronology table. Appendix C includes additional site background information, including more information on the hydrogeological units at the Site.

**FIVE-YEAR REVIEW SUMMARY FORM**

<b>SITE IDENTIFICATION</b>		
<b>Site Name:</b> Lakewood-Ponders Corner		
<b>EPA ID:</b> WAD050075662		
<b>Region:</b> 10	<b>State:</b> Washington	<b>City/County:</b> Lakewood/Pierce
<b>SITE STATUS</b>		
<b>NPL Status:</b> Final, Deleted (Soil OU only)		
<b>Multiple OUs?</b> Yes	<b>Has the site achieved construction completion?</b> Yes	
<b>REVIEW STATUS</b>		
<b>Lead agency:</b> EPA		
<b>Author name:</b> Tracy Chellis, with additional support provided by Skeo		
<b>Author affiliation:</b> EPA Region 10		
<b>Review period:</b> 1/24/2017 – 9/24/2017		
<b>Date of site inspection:</b> 4/5/2017		
<b>Type of review:</b> Policy		
<b>Review number:</b> 6		
<b>Triggering action date:</b> 9/24/2012		
<b>Due date</b> ( <i>five years after triggering action date</i> ): 9/24/2017		

**Figure 1: Site Vicinity Map**



Sources: Final Lakewood/Ponders Corner Superfund Site Well Installation Trip Report 2016, Esri, DeLorme, AND, Tele Atlas, First American, UNEP-WCMC, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo and the GIS User Community.

**Legend**

- Lakewood Water District Water Supply Well



**Lakewood-Ponders Corner Superfund Site**  
City of Lakewood, Pierce County, Washington

Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

## II. RESPONSE ACTION SUMMARY

### Basis for Taking Action

In 1981, EPA sampled the Lakewood Water District drinking water supply wells H1 and H2, located about 800 feet south of the former dry cleaning facility. Tests indicated that wells H1 and H2 were contaminated with tetrachloroethylene (PCE) and other volatile organic compounds (VOCs). EPA confirmed the source of contamination as Plaza Cleaners. Dumping of dry cleaning process solvent into three bottomless septic tanks behind Plaza Cleaners and disposal of sludge onto the ground surface contaminated soil and groundwater at the Site. EPA added the Site to the National Priorities List (NPL) on September 8, 1983. EPA's 1984 Record of Decision (ROD) for an interim remedial measure (IRM) (hereinafter referred to as the Interim ROD) concluded that untreated water from wells H1 and H2 was a threat to human health if used for drinking water.

A human health risk assessment included in the final ROD, signed in 1985, found potentially unacceptable risks for a construction worker who may inhale contaminated dust and vapor during soil excavation activities. The risk assessment did not identify unacceptable risks for any of the other exposure pathways evaluated. However, the risk assessment did not evaluate risks associated with ingestion of untreated water from H1 and H2 because the water was being treated at that time.

Table 1 summarizes site contaminants of concern (COCs) identified in the 1985 ROD and a 1992 Explanation of Significant Differences (ESD). The Response Actions section below describes remedy components in the RODs and other decision documents, including remedy modifications documented in the 1992 ESD.

**Table 1: COCs by Media**

COCs	Media
PCE, trichloroethylene (TCE), cis-1,2-dichloroethene (cis-1,2- DCE)	Groundwater
PCE	Soil

### Response Actions

The Lakewood Water District temporarily removed supply wells H1 and H2 from service in August 1981 after EPA identified VOC contamination in the wells. Ecology and Plaza Cleaners reached an agreement for remedial action in September 1983. Plaza Cleaners agreed to discontinue its prior solvent disposal practices, install a system for reclaiming cleaning solvents, send stored drummed waste water and contaminated soil to a suitable off-site disposal facility, and cooperate in the immediate cleanup of the sludge disposal areas. Plaza Cleaners successfully fulfilled the terms of the agreement.

In June 1984, EPA issued an Interim ROD to select groundwater treatment via air stripping at Lakewood Water District supply wells H1 and H2 as an IRM for the Site. EPA implemented the IRM to address the most immediate threats to public health. The 1984 Interim ROD defined the following primary objectives of the IRM:

- Restrict the spread of contamination in the aquifer to reduce ultimate cleanup needs and to protect the quality of other wells' water supply.
- Restore full water service to the area of the Lakewood Water District that is adversely affected by the shutdown of wells H1 and H2.
- Initiate groundwater treatment as soon as practical.

By November 1984, EPA implemented the IRM, and two air strippers began operating to treat pumped groundwater from wells H1 and H2.

EPA conducted a remedial investigation/feasibility study (RI/FS) between August 1984 and July 1985 to further determine the extent of groundwater contamination at the Site, test the soil at Plaza Cleaners for remaining



contaminants and determine whether other sources were contributing to the groundwater contamination. Based on the results, EPA issued a ROD in September 1985 to select a final remedy for the Site. EPA modified the selected final remedy with a November 1986 ROD Amendment and a September 1992 ESD.

The 1985 Final ROD defined the following remedial action objectives (RAOs) for the Site’s remedy:

- Evaluate the potential health risks associated with the no-action alternative, which assumes the status quo of stripping towers operation continued.
- Reduce potential health risks associated with on-site excavation and use of contaminated groundwater below those for the no-action alternative.
- Meet requirements of other environmental regulations.
- Increase the efficiency of the existing IRM, to reduce energy requirements and thereby reduce costs.

The selected remedy components in the 1985 Final ROD consisted of the following:

- Continued operation of the H1 and H2 wellhead treatment system.
- Installation of higher efficiency equipment or modification of existing equipment used in the treatment system.
- Installation of additional monitoring wells, upgrade of existing wells and continued sampling of the aquifer to monitor progress and provide early warning of potential new contaminants.
- Excavation and removal of septic tanks and drain field piping on the Plaza Cleaners property to reduce the risks associated with uncontrolled excavation.
- Placement of administrative restrictions on the installation and use of groundwater wells and on excavation into contaminated soils.

The 1986 ROD Amendment modified the soil component of the selected remedy with the following changes:

- Cleanout of the three existing septic tanks at the Plaza Cleaners property. The septic tanks were found to be bottomless, and, therefore, they were not removed as called for in the 1985 ROD.
- Construction of a soil vapor extraction (SVE) system concentrated along the utility and drain field lines.
- Soil and vapor analysis until soil treatment is complete.

The 1992 ESD modified the remedy with the following changes:

- Excavation of remaining PCE-contaminated sludge/soil after implementation of SVE.
- Establishment of site-specific cleanup goals for contaminants in soil and groundwater.
- Elimination of land use restrictions at the Plaza Cleaners property.
- Maintenance of current groundwater use restrictions and elimination of future groundwater use restrictions.

The 1992 ESD established groundwater cleanup goals for the Site (Table 2). The 1992 ESD also established a PCE soil cleanup goal of 500 micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ). The ESD stated that this cleanup goal is consistent with the Washington Model Toxics Control Act (MTCA) Cleanup Regulation, Method A levels for PCE in both residential and industrial soils, is within EPA’s acceptable risk range of  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$ , and is also protective of groundwater.

**Table 2: Groundwater COC Cleanup Goals**

COC	Cleanup Goal (micrograms per liter, $\mu\text{g}/\text{L}$ )	Basis
PCE	5	Federal Maximum Contaminant Level (MCL)
TCE	5	MCL
cis-1,2-DCE	70	MCL
<i>Notes:</i> Cleanup goals established in the 1992 ESD.		

**Status of Implementation**

Treatment of groundwater at Lakewood Water District supply wells H1 and H2 has been ongoing since November 1984. Upgrades to the treatment system were completed. Monitoring of the treatment system and contaminated aquifer has been ongoing since operations began. Figure 2 shows the location of the current monitoring network at the Site.

EPA completed the remedial design for the soil component of the remedy in September 1987 and began the remedial action shortly thereafter. EPA removed contaminated solids and water from within three septic tanks located behind Plaza Cleaners for off-site disposal. However, not all the solids could be excavated from one of the bottomless septic tanks. Therefore, EPA decided to address remaining contamination with SVE.

The SVE system operated intermittently between 1988 and April 1989. Follow-up soil sampling conducted in October 1990 indicated elevated concentrations of PCE at about 10 to 12 feet below ground surface within septic tank 1. Based on the uncertainty of reducing PCE concentrations in the septic tank sludge below the 500 µg/kg cleanup goal using SVE, EPA decided to excavate the contaminated sludge and soil from within and around septic tank 1 for off-site disposal. Excavation was complete by July 1992. With soil remediation complete, EPA decommissioned and dismantled the SVE system. In September 1996, EPA announced in the Federal Register, its intent to delete the soil unit of the Site (OU2) from the NPL. In November 1996, EPA announced the Site’s partial deletion from the NPL.

The 1992 ESD removed the requirement for land use controls at the former Plaza Cleaners property because EPA cleaned up soil to UU/UE levels. The 1992 ESD also clarified that the only groundwater use restrictions required were written reminders indicating the limitations of current groundwater usage to the appropriate parties (property owners, real estate offices and drilling contractors). The 1992 ESD indicated that administrative controls in the form of public outreach and education, combined with ongoing groundwater treatment and monitoring, were adequate measures for the protection of human health and the environment. Residents whose properties overlie the existing groundwater contaminant plume currently obtain drinking water from the Lakewood Water District public water supply. Table 3 summarizes institutional controls for the Site.

**Table 3: Summary of Planned and/or Implemented Institutional Controls (ICs)**

<b>Media, engineered controls, and areas that do not support UU/UE based on current conditions</b>	<b>ICs Needed</b>	<b>ICs Called for in the Decision Documents</b>	<b>Impacted Parcel(s)</b>	<b>IC Objective</b>	<b>Title of IC Instrument Implemented and Date (or planned)</b>
Groundwater	Yes	Yes	Parcels that overlie groundwater contamination	Restrict groundwater use until cleanup goals are met	Public outreach and education
Groundwater	Yes	No	Parcels that overlie groundwater contamination	Restrict installation of private wells	Tacoma-Pierce County Health Department Environmental Health Code Chapter 3, Water Regulations, dated April 1, 2015

Although not a decision document requirement, the Tacoma-Pierce County Health Department set forth its own restrictions on installation of private wells. Environmental Health Code Chapter 3, Water Regulations, dated April 1, 2015, states that if an existing lot of record or a proposed lot is inside an urban growth area or within the service area of a Group A public water system (such as the Lakewood Water District), then it may not use a private well. On September 11, 2007, Ecology issued a letter to EPA stating that anyone seeking permission from the Tacoma-Pierce County Health Department to install a drinking water well near the Site would be denied because the groundwater is contaminated and the Site is in the urban growth area. Figure D-1 in Appendix D shows the incorporated area of Lakewood and the unincorporated urban growth area in relation to the Site.

**Systems Operations/Operation & Maintenance**

In October 1985, the Lakewood Water District assumed all operation and maintenance (O&M) responsibilities associated with the air stripping towers at wells H1 and H2. This included influent/effluent water sampling and analysis, pump maintenance and inspection, general equipment observations and maintenance of data records. In 1992 Ecology assumed O&M responsibilities related to site-wide groundwater monitoring.

Lakewood Water District personnel collect influent samples at H1 and H2 and treated effluent samples quarterly for VOCs. Lakewood Water District has consistently met effluent treatment standards during this FYR period. The Lakewood Water District has not reported significant problems regarding the routine O&M of the treatment system during this FYR period that could call into question the current protectiveness of the remedy. However, Lakewood Water District personnel noted that the air strippers are over 30 years old and nearing the end of their useful service life. System upgrades are planned.

Ecology currently conducts routine groundwater monitoring at the Site for VOCs. Groundwater monitoring has been modified over the years to focus primarily on wells in the immediate vicinity of the former Plaza Cleaners. Currently there are eight monitoring wells and two drinking water supply wells (H1 and H2) in the monitoring program. Primary wells (MW-16A, MW-20A, MW-20B, LPMW-2 and H1/H2) were sampled on an annual basis and monitoring well MW-33 was sampled on a bi-annual basis between 2012 and 2014.<sup>1</sup> Beginning in 2015, Ecology changed the frequency of sampling for the primary wells to an 18-month monitoring cycle to capture seasonal variation in the contaminant concentrations. Ecology also changed the frequency of sampling for monitoring well MW-33 to once every three years. Monitoring wells MW-19A, MW-31 and MW-32 continue to be sampled every five years.

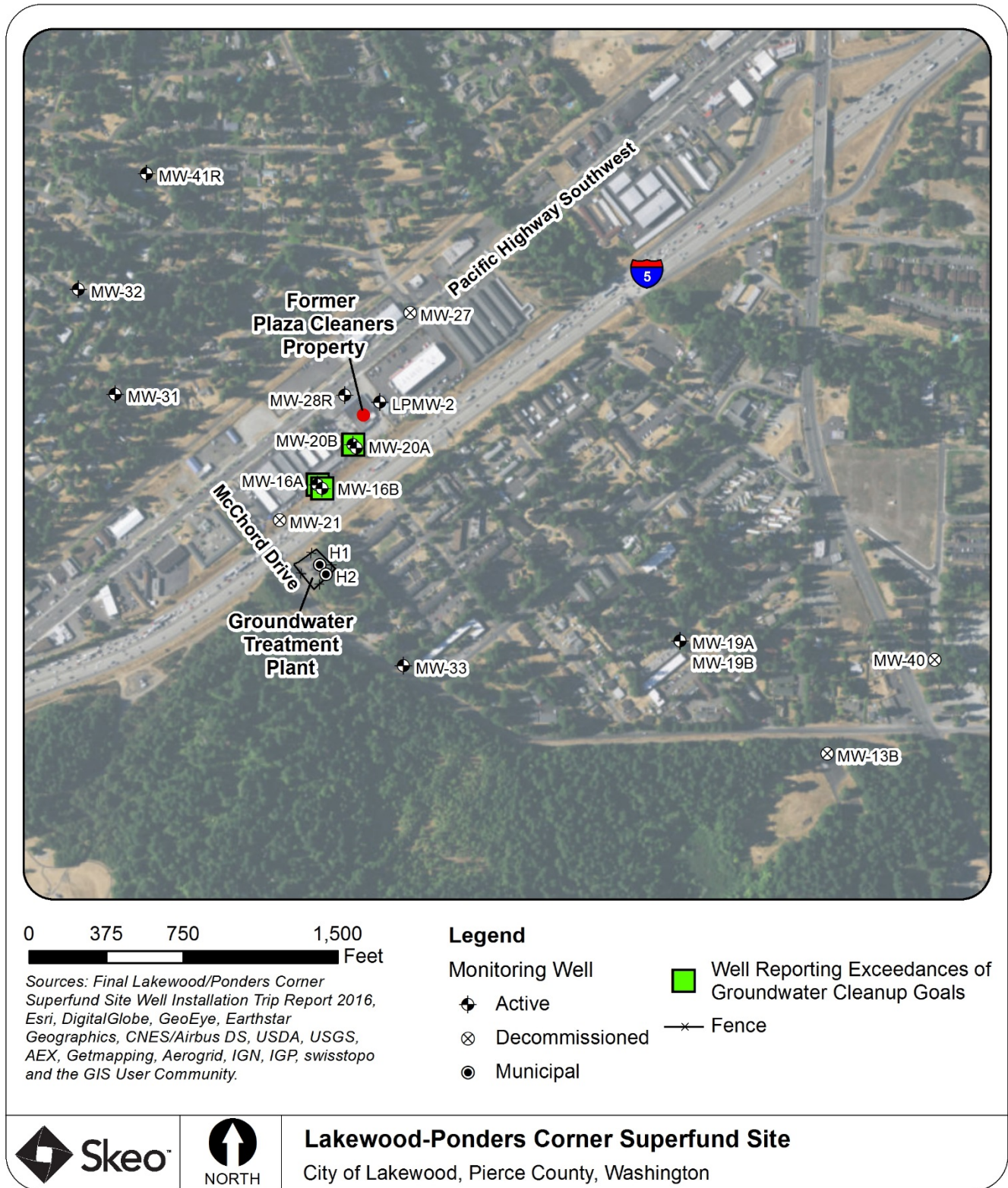
EPA’s hydrogeologist recently reviewed Ecology’s sampling schedule and proposed changes to the schedule and wells monitored. Table 4 summarizes the new monitoring schedule, set to begin April 2018. EPA’s hydrogeologist also recommended that an additional monitoring well be installed at the corner of Pacific Highway Southwest and New York Avenue Southwest (also known as McChord Drive Southwest) and sampled on an 18-month frequency for the targeted VOCs.

**Table 4: Updated Groundwater Monitoring Schedule<sup>a</sup>**

<b>Monitoring Well (Groundwater Quality)<sup>b</sup></b>	<b>Laboratory Analysis</b>	<b>Frequency</b>
MW-16A, MW-20B, MW-31, MW-32, proposed new monitoring well	Targeted VOCs <sup>c</sup>	18 months starting April 2018
MW-19A, MW-28R, MW-33	Targeted VOCs	36 months
MW-41R	Targeted VOCs	5 years
<i>Notes:</i>		
a) Updated groundwater monitoring schedule included in EPA’s Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, April – November 2016, dated May 3, 2017.		
b) Hydraulic monitoring (i.e., groundwater elevation measurements) should be conducted during every groundwater quality monitoring event for the following wells: MW-16A and MW-16B, MW-19A and MW-19B, MW-20A and MW-20B, MW-28R, MW-31, MW-32, MW-41R, MW-33, and the proposed new well at the corner of Pacific Highway Southwest and New York Avenue Southwest (McChord Drive Southwest).		
c) Targeted VOCs are PCE, TCE, 1,2-DCE and vinyl chloride.		

<sup>1</sup> Well LPMW-2 is one of three wells installed by an adjacent property owner as part of a state voluntary cleanup action. Ecology obtained permission to sample the well in May 2006. The well has been included in the Site’s monitoring program since that time.

**Figure 2: Monitoring Well Location Map**



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

### III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the last FYR (Table 5) as well as the recommendations from the last FYR and the status of those recommendations (Table 6).

**Table 5: Protectiveness Determinations/Statements from the 2012 FYR**

OU #	Protectiveness Determination	Protectiveness Statement
Sitewide	Short-term Protective	The remedy at the Lakewood/Ponders Corner Superfund Site is considered protective of human health and the environment in the short-term because exposure pathways that could result in unacceptable risks are being controlled through the treatment of groundwater to concentrations below MCLs for public consumption and the locality maintains restrictions prohibiting the installation of new water wells within this area. To optimize the remedy and ensure it is protective in the long-term, an evaluation is required to determine the pump and treat system capture zone, the full extent of the contaminant plume in the till layer, and if additional treatment would facilitate accelerating the restoration of the aquifer. The results of this evaluation would determine whether additional actions are required.

**Table 6: Status of Recommendations from the 2012 FYR**

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
OU1- Groundwater	Determine the current capture zone in the Advance outwash sands for H1 and H2 at the current pumping rates.	Develop a target capture zone based on the current monitoring well network and PCE concentrations. Use the six steps for systematic evaluation of capture zones, EPA 600/R-08/003 January 2008.	Completed	EPA conducted groundwater sampling and hydraulic monitoring at the Site between April and November 2016. EPA determined that hydraulic capture cannot be maintained at all times because the H1 and H2 supply wells are not pumping continuously. EPA presented the findings in the Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, April – November 2016 (Technical Memorandum), dated July 20, 2017. See Recommendation 1 for further details of the investigation.	5/2/2017
OU1- Groundwater	LPMW-2 has low concentrations of PCE screened in the Steilacoom gravels near the original source zone. A determination of the fate and transport of this	Evaluate existing information on groundwater flow direction in the Steilacoom gravels at LPMW-2. Install a downgradient monitoring well from LPMW-2 and sample for VOCs.	Completed	EPA installed well MW-28R downgradient from LPMW-2 and sampled the well for VOCs five times in 2016. VOCs were not detected above reporting limits in MW-28R.	11/3/2015

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
	dissolved PCE in this monitoring well is needed to determine whether it is significant.				
OU1- Groundwater	Aging air stripper system with significant expenditures for repairs and replacement, and seismic design need to be evaluated.	Evaluate optimization of the treatment facility to operating one air stripper at a time, and reducing blower airflow rates with smaller units or variable speed motors. Check air stripper design for seismic stress.	Completed	A contractor for the Lakewood Water District prepared a Treatment Alternatives Evaluation in July 2015. The evaluation found that the least cost, highest rated alternative is to continue with the pump and treat program at the Ponders wellfield. The report recommended that a new air stripping facility be constructed to replace the aging system.  The state recently appropriated partial funding to begin replacing the air stripping facility.	7/30/2015
OU1- Groundwater	Time for restoration of the aquifer (greater than 100 years) is anticipated to exceed the ROD estimates, due to leaching of PCE from the Vashon till unit.	Evaluate restoration time frame for the aquifer and alternatives to accelerate restoration if necessary.	Considered But Not Implemented	The Lakewood Water District plans to replace the air stripping facility within the next year, provided that State funding is received. The new system would be designed to treat groundwater at a 40 percent increase over the current production rate with both wells operating. The increase in pumping will likely reduce the restoration time frame. The recommendation may be revisited once the new system is operating.	Not Applicable

#### Recommendation 1

- EPA conducted groundwater sampling and hydraulic monitoring at the Site between April and November 2016. In support of the investigation, EPA installed two replacement monitoring wells, sampled 10 monitoring wells for VOC analysis in April, June, July, September and November 2016, and collected groundwater elevation measurements. EPA determined that hydraulic capture cannot be maintained at all times because the H1 and H2 supply wells are not pumping continuously. EPA also noted that it is uncertain whether or not contaminant capture is occurring downgradient of MW-16A in the direction of natural groundwater flow (northwest) until an additional monitoring well is installed. However, EPA also found that the flow vectors around Plaza Cleaners appeared to be flowing toward H1 and H2 in all five sampling events conducted in 2016. Even though pumping has not been continuous, VOC data from wells installed downgradient of source area wells (e.g., MW-16A) in the direction of natural groundwater flow

(northwest), are not impacted with COCs above MCLs. EPA presented the findings in the July 20, 2017 Technical Memorandum.

## **IV. FIVE-YEAR REVIEW PROCESS**

### **Community Notification, Involvement & Site Interviews**

EPA published a public notice in *The News Tribune* on 4/22/2017, stating that there was a FYR and inviting the public to submit any comments to EPA. No public comments were received during the public notice period. The FYR report will be made available to the public once it has been finalized. Copies of this document will be placed on the EPA and Ecology websites for the Site and made available at the Ecology document repository at 300 Desmond Dr. Southeast, Lacey, Washington and the EPA Superfund Record Center at 1200 Sixth Avenue, Suite 900, Seattle. Appendix E includes a copy of the public notice.

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date. The results of these interviews are summarized below. Appendix F includes the completed interview forms.

Andrew Smith of Ecology indicated that the performance of the remedy in place is sufficient, but that the cleanup timeframe was grossly underestimated in the ROD. Ecology accepted responsibility for site O&M based on the original estimate. However, Ecology did not anticipate having to replace the treatment system when accepting responsibility of the Site. He noted that the Lakewood Water District has requested that the groundwater treatment system be replaced soon. Ecology is funding design and partial purchase of a replacement treatment system. Ecology also conducts annual groundwater monitoring at the Site. Mr. Smith indicated that he is comfortable with the status of institutional controls at the Site.

Dave Hall of the Lakewood Water District indicated that the groundwater treatment system is working well to clean up contamination but the system is aging out of its useful life. He noted that PCE is detected intermittently above the MCL from samples collected prior to treatment. Lakewood Water District staff visit the treatment system about three days a week. Alarms are also in place to notify Lakewood Water District of any problems or system failures. The system has recently had starter issues and there has been steadily increasing maintenance due to the system's aging components. Lakewood Water District is trying to keep the system running until its expected replacement. It has received partial funding from the State to purchase most of the materials needed for a new system. Funding for construction is pending. Mr. Hall noted that he hopes new construction will start in fall 2017, when water demand is lower.

### **Data Review**

Data evaluated in this FYR include routine groundwater monitoring data originally presented in the 2012-2015 Data Summary Reports, prepared by Ecology, as well as groundwater monitoring data presented in EPA's 2017 Technical Memorandum. This FYR also addresses the hydraulic monitoring data included in the 2017 Technical Memorandum. Figure 2 depicts groundwater monitoring well locations.

There are four hydrogeological units of interest under the Site. These units include the Steilacoom gravels (about 0 to 30 feet (ft) below ground surface (bgs)), the semi-confining silt and clay-rich Vashon till (about 30 to 75 ft bgs), the Advance outwash sands that form the primary aquifer (about 75 to 110 ft bgs) and the generally less permeable Colvos sand that grades to a clayey sand or blue clay at its base (beyond 110 feet bgs) (Figure G-1 in Appendix G). Groundwater contamination at the Site has been detected in the Vashon till (referred to as Zone B) and deeper Advance outwash sands (Zone A).

### ***Groundwater Sampling Results***

PCE and TCE are the only COCs to exceed groundwater cleanup goals during this FYR period. Cis-1,2-DCE and trans-1,2-DCE were also detected sporadically in monitoring well MW-20B, a well screened in the Vashon till, but concentrations were well below MCLs. No other VOCs, including vinyl chloride, have been detected above

reporting limits during the FYR period. Appendix G includes summaries of Ecology’s historical data for the Site and EPA’s 2016 data.

Groundwater monitoring results report detections of PCE above the cleanup goal of 5 micrograms per liter (µg/L) in monitoring wells MW-16A (screened in the Advance outwash) and MW-20B during every monitoring event conducted during this FYR period, with the highest concentrations reported in MW-20B (Table 7). PCE was also detected above the cleanup goal twice in MW-16B in 2016 and once in supply well H1 prior to treatment. TCE was detected above its cleanup goal of 5 µg/L in a single well (MW-20B) during this FYR period. TCE exceeded its cleanup goal in October 2015 and in July, September and November 2016 at concentrations ranging from 5.4 to 7.3 µg/L. All three monitoring wells that reported PCE or TCE above MCLs (MW-16A, MW-16B, and MW-20B) are located within the zone of contribution or the capture zone area of H1 and H2 (Figure G-2, Appendix G).

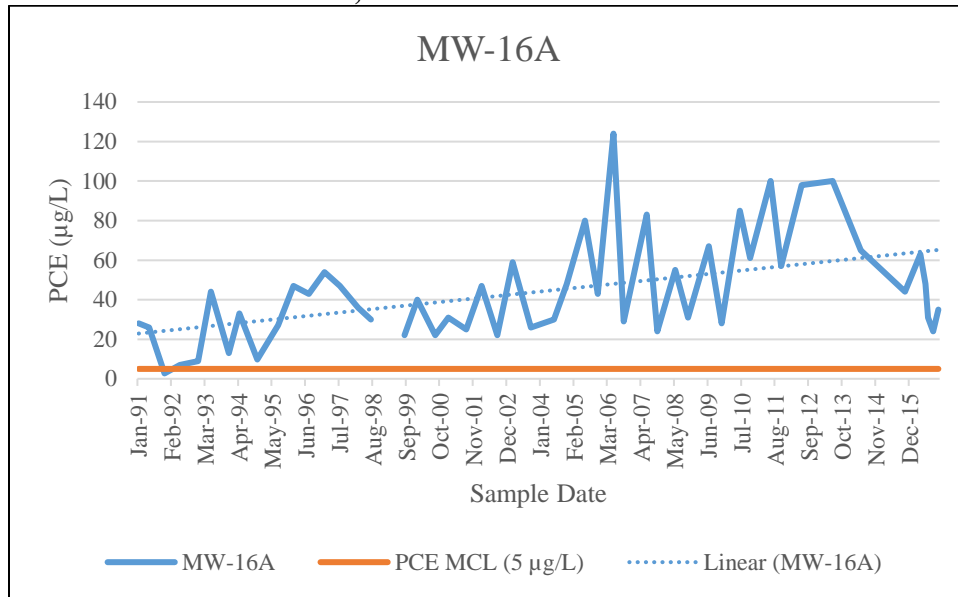
**Table 7: PCE in Select Wells, 2012-2016**

Sample Date	MW-16A	MW-16B (shallow)	MW-20A	MW-20B (shallow)	MW-33	LPMW-2	H1	PCE MCL
<i>Ecology Sampling Results (µg/L)</i>								
Jun-12	<b>98</b>	NS <sup>a</sup>	1.0 U	<b>140</b>	NS	2.4	<b>5.2</b>	5
Jun-13	<b>100</b>	NS	1.0 U	<b>170</b>	1.0 U	2.2	4.9	
May-14	<b>65</b>	NS	1.0 U	<b>130</b>	NS	2.7	2.9	
Oct-15	<b>44</b>	NS	0.2 J	<b>340</b>	1.0 U	NS <sup>b</sup>	1.8	
<i>EPA Sampling Results (µg/L)</i>								
Apr-16	<b>63/57</b>	<b>5.9</b>	1.0 U	<b>74</b>	NS <sup>c</sup>	NS <sup>c</sup>	NS <sup>c</sup>	5
Jun-16	<b>48</b>	2.7	1.0 U	<b>150</b>	NS	NS	NS	
Jul-16	<b>31/34</b>	<b>6.1</b>	1.0 U	<b>260</b>	NS	NS	NS	
Sep-16	<b>24</b>	1.2	1.0 U	<b>410/430</b>	NS	NS	NS	
Nov-16	<b>35</b>	2.3	1.0 U	<b>220/250</b>	NS	NS	NS	
<p><i>Notes:</i></p> <p>a) Well MW-16B is not included in Ecology’s current groundwater monitoring program.</p> <p>b) Well LPMW-2 was not sampled in 2015 because there was insufficient water to collect a sample.</p> <p>c) Wells MW-33, LPMW-2 and H1 were not included in EPA’s 2016 investigation.</p> <p><b>Bold</b> results indicate the detected concentration exceeds the PCE MCL.  NS – Not Sampled  U – The analyte was not detected at or above the reported value.  J – Estimated concentration  XX/XX – Depict primary and duplicate sample results</p>								

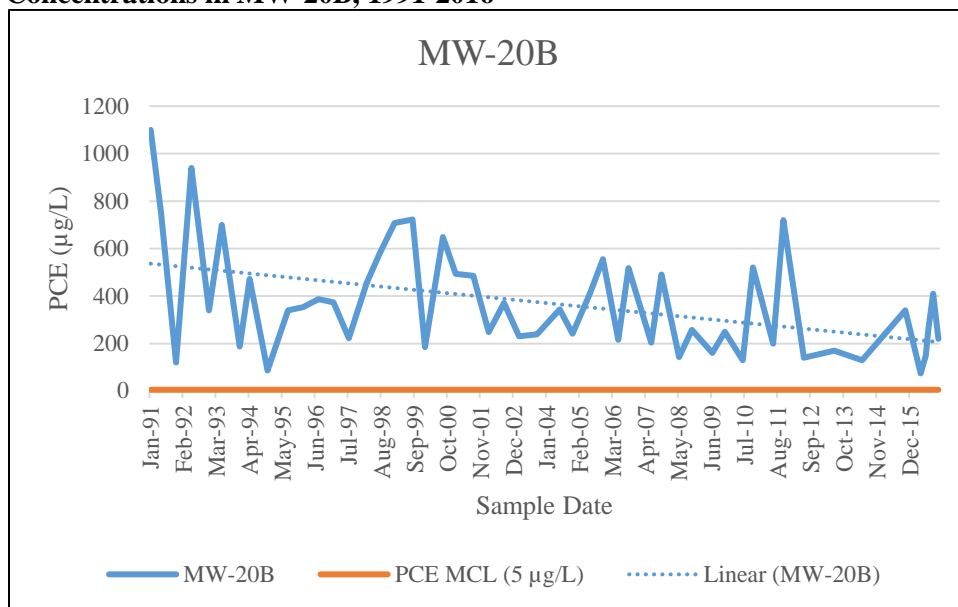
Well MW-16A is a deep well screened in the Advance outwash sands, the primary water-supply aquifer for the area, and is located near the former source area. PCE concentrations in MW-16A show an increasing trend since sampling began in 1991; however, PCE concentrations appear to be decreasing during this FYR period (Figure 3). Well MW-20B is a shallow well screened in the Vashon till near the former source area. PCE concentrations in MW-20B have declined since sampling began in 1991 but remain well above the PCE cleanup goal (Table 7, Figure 4). PCE concentrations also appear to report seasonal variations, with highest concentrations reported in spring and early summer.



**Figure 3: PCE Concentrations in MW-16A, 1991-2016**



**Figure 4: PCE Concentrations in MW-20B, 1991-2016**



### *Hydraulic Monitoring Data*

During its investigation in 2016, EPA collected groundwater level data to evaluate changes in groundwater elevations and to determine groundwater flow direction in Zone A – the Advance outwash sand unit, the primary aquifer. EPA installed transducers in six monitoring wells and recorded groundwater elevations on an hourly basis between March and December 2016. EPA also collected manual groundwater elevation measurements with a water level indicator during each of its five groundwater sampling events for comparison purposes.

Results indicate that groundwater elevations at the Site are strongly influenced by seasonal changes. Groundwater elevations are up to 15-20 feet higher during winter and early spring than in the summer and early fall in some wells, and may reflect natural rainfall patterns, a higher pumping rate at H1 and H2 during the summer months, or a combination of both. Figures G-3 through G-8 in Appendix G show the elevation changes over the study period for wells with transducers: MW-31, MW-28AR, MW-20A, MW-20B, MW-16A and MW-16B, as originally presented in the 2017 Technical Memorandum. Figure G-5 also shows an upward vertical gradient for the months of May through November near monitoring well MW-20B, which as previously noted, contains elevated concentrations of PCE. This finding differs from the Site's previous conceptual site model (CSM), which identified a downward vertical gradient from Zone B to Zone A. It should be noted that EPA's 2016 data collection ended in late December. EPA's hydrogeologist hypothesizes that conditions could change seasonally where the vertical gradient could reverse to a downward gradient when the groundwater table is higher and recharge increases (i.e., during the winter months).

When a downward gradient is observed, vertical migration gradient of contaminants from the low permeability Vashon till (Zone B) is the likely cause for ongoing impacts to groundwater in Zone A or the Advance outwash sands. This is evidenced by concentrations of PCE in MW-16A when groundwater is moving towards pumping wells H1 and H2. When a seasonal upward vertical gradient occurs, it likely limits PCE from entering the Zone A Advance outwash sands.

Regional groundwater flow in Zone A – the Advance outwash sand unit - is generally to the west-northwest toward Gravelly Lake. Figure G-2 in Appendix G includes potentiometric contours from EPA's April 2016 monitoring event. Groundwater flow direction is also influenced by the pumping of supply wells H1 and H2 when in operation. Groundwater elevation data collected by EPA during its five monitoring events in 2016 show that groundwater at the former Plaza Cleaners property was moving towards H1 and H2 during those times.

### **Site Inspection**

The site inspection took place on 4/5/2017. In attendance were Tracy Chellis, EPA RPM; Bernie Zavala, EPA hydrogeologist; Andrew Smith, P.E., LHG of Ecology; and Johnny Zimmerman-Ward and Jill Billus of Skeo (EPA FYR contractor). The purpose of the inspection was to assess the protectiveness of the remedy. Appendix H includes the completed site inspection checklist, which was supplemented with information provided by the Lakewood Water District. Appendix I includes photographs from the site inspection.

Site inspection participants met in the parking lot of Rainier Lighting and Electric Supply, located at 12511 Pacific Highway SW, Tacoma, Washington 98499. Rainier Lighting and Electric Supply now occupies the former dry cleaning and laundry facility. The EPA hydrogeologist provided a summary of recent activities at the Site, which included decommissioning of wells MW-27, MW-28 and MW-41, installation of replacement wells MW-28R and MW-41R, survey of all new and existing wells, sampling of select wells and evaluation of the capture zone of Lakewood District wells H1 and H2.

Site inspection participants then drove through a mixed business and residential area to observe the locations of several wells, including MW-19A, MW-19B, MW-28R, MW-31, MW-32 and MW-41R. All wells were locked; stickups and pads appeared in good condition. Site inspection participants also traveled to the Lakewood District Water supply wells and treatment system facility, located adjacent to Interstate 5. Lakewood District Water personnel were unable to attend the site inspection; therefore, site inspection participants observed the facility from outside the locked fence. The grounds and fencing appeared in good condition.

## V. TECHNICAL ASSESSMENT

**QUESTION A:** Is the remedy functioning as intended by the decision documents?

### **Question A Summary:**

Yes, the remedy is functioning as intended by the decision documents. Excavation and operation of an SVE system removed sludge and soil contamination from the former Plaza Cleaners property. Following successful cleanup, EPA deleted the soil operable unit component of the Site from the NPL in November 1996.

The groundwater treatment system at the Lakewood Water District supply wells H1 and H2 continues to operate and effectively treats extracted groundwater to levels below MCLs before its distribution into the drinking water supply.

PCE and TCE are the only COCs to exceed groundwater cleanup goals at site monitoring wells during this FYR period. Monitoring wells MW-16A and MW-20B report most of the exceedances. PCE is the COC detected most often and at the highest concentrations. It is expected that contamination in the upper Zone B (Vashon till) will continue to leach to the lower Zone A unit (Advance outwash sand) when seasonal downward hydraulic gradients are observed. Pumping of Lakewood Water District supply wells H1 and H2 continues on a modified schedule with only one well operating at a time due to head limitations. Based on EPA's evaluation, the wells can provide hydraulic control when in operation. All three monitoring wells that reported PCE or TCE above MCLs are within the zone of contribution or the capture zone of H1 and H2. However, it is uncertain whether or not contaminant capture is occurring downgradient of MW-16A. An additional monitoring well should be installed downgradient of MW-16A, at the corner of Pacific Highway Southwest and New York Avenue Southwest (McChord Drive Southwest) to better determine the extent of capture.

EPA also determined that hydraulic control cannot be maintained at all times because the H1 and H2 supply wells are not pumping continuously. Although continuous hydraulic control has not been maintained as called for in the ROD, groundwater monitoring results indicate that only a limited area of groundwater contamination is present. Results from monitoring wells considered to be downgradient of the source area under non-pumping conditions (MW-28R and MW-41R) did not detect COCs above reporting limits, which suggests that the plume has not migrated far beyond its current area of impact. The proposed additional monitoring well downgradient of MW-16A will better determine the extent of impact closest to the source area.

The air strippers at the groundwater treatment facility have been operating since 1984 with no major upgrades or repairs. The Lakewood Water District and Ecology are working together to replace and upgrade the groundwater treatment system. The upgraded system is expected to be constructed in accordance with current design standards, which take into account seismic stress. Work on the new water treatment facility is expected to begin once funding is in place.

New wells were installed in 2015 as part of EPA's hydrogeologic investigation. EPA's hydrogeologist has proposed modifications to Ecology's groundwater monitoring program to incorporate the new wells on the schedule outlined in Table 4. Current O&M of the air strippers is adequate; however, an updated O&M plan may be necessary after installation of a new treatment system.

Implemented institutional controls include public outreach and education to inform the public of contaminated groundwater associated with the Site; however, the frequency needed for these efforts has not been made clear. The 1992 ESD removed the requirement for proprietary land and groundwater use restrictions. Residents whose properties overlie the existing groundwater contaminant plume currently obtain drinking water from the Lakewood Water District public water supply. Although not required by site decision documents, the Tacoma-Pierce County Health Department sets forth its own restrictions on installation of private wells on and near the Site. The restrictions ensure that the public does not drink contaminated groundwater.

**QUESTION B:** Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

**Question B Summary:**

Yes, the exposure assumptions, toxicity data, cleanup levels and RAOs are still valid. The 1992 ESD identified the federal MCLs and state drinking water standards as the cleanup goals for the three groundwater COCs. As shown in Appendix J, the evaluation of applicable or relevant and appropriate requirements (ARARs), there have been no changes to the MCLs or state drinking water standards since the 1992 ESD. Vinyl chloride, although not identified as a COC in decision documents, continues to be monitored since it is a degradation product of PCE. Vinyl chloride is consistently below MCLs.

According to the 1992 ESD, the cleanup goal for PCE in soil was based on the protection of groundwater and was also demonstrated to be protective of industrial and residential land use. To determine if the cleanup goal for PCE in soil remains protective for residential and industrial land use, the cleanup goal was compared to EPA's 2016 regional screening levels (RSLs). The RSLs incorporate current toxicity values and standard default exposure factors (Appendix K). The residential evaluation demonstrates that the PCE soil cleanup level is well below EPA's risk management range of  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$  and below the noncancer hazard quotient (HQ) threshold of 1.0. Since the cleanup goal based on residential exposure remains valid, the cleanup goal would also be valid for a less frequent exposure assumed under an industrial use.

The exposure pathways for groundwater evaluated in the 1985 human health risk assessment remain valid. Residents obtain treated drinking water from the Lakewood Water District public water supply and there are no known private drinking water wells within the contaminated aquifer. The exposure pathways for soil evaluated in the 1985 risk assessment are no longer valid because soil remediation has effectively reduced soil contamination below cleanup levels.

The vapor intrusion pathway was not evaluated in the 1985 human health risk assessment. To address this, in the 2012 FYR, EPA evaluated the potential for vapor intrusion to indoor air and found that vapor intrusion is unlikely to pose an unacceptable risk for workers above the groundwater contaminant plume.

A screening-level vapor intrusion evaluation using EPA's Vapor Intrusion Screening Level (VISL) calculator was conducted for this FYR to determine if the 2012 vapor intrusion conclusions remain valid for a commercial worker. A second evaluation was conducted using a residential exposure scenario because land use at the former Plaza Cleaners property is not restricted to commercial use. The most current data from shallow well MW-20B, collected in November 2016, was used in the assessment. MW-20B is screened in the Vashon till approximately 50 feet below ground surface. As shown in Appendix L, using commercial exposure assumptions, the November 2016 VOC concentrations at MW-20B are within EPA's acceptable risk management range of  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$ . The noncancer hazard index (HI) is 1.3, which slightly exceeds EPA's target hazard quotient of 1. The hazard quotients for TCE (0.3) and PCE (1) contributed to the HI greater than 1.

An evaluation based on conservative residential exposure assumptions indicates the same November 2016 VOC concentrations at MW-20B are equivalent to a cancer risk of  $2.3 \times 10^{-5}$  and noncancer HI of 5.6. This cancer risk is within EPA's acceptable risk management range. The noncancer HI is greater than the target HI of 1 for noncarcinogens. The hazard quotients for TCE (1.3) and PCE (4.3) contributed to the HI greater than 1. Currently, no residences are located in the area with elevated VOC concentrations.

Using data from MW-20B, which reports the maximum detected concentrations at the Site, likely overestimates potential risk from vapor intrusion potential because MW-20B is not screened in the uppermost water bearing unit. LPMW-2, although not installed by EPA or the State, is screened within the Steilacoom gravel unit within 20 feet of the ground surface. LPMW-2 was last sampled in 2014 and reported 2.7  $\mu\text{g/L}$  of PCE. The 2014 detected concentration of PCE results in cancer risk below EPA's acceptable risk range and below an HI of 1 for

residential and commercial exposure scenarios. Based on this evaluation, the vapor intrusion pathway is not a concern at this time.

Ecological risks have not been evaluated for the Site. The Site is within an area of mixed industrial, commercial and residential use. I-5 is located between the former source area and the water treatment facility. Therefore, ecological risks are not anticipated due to lack of suitable habitat.

Since the time of the ROD, site conditions and surrounding land use have not changed significantly. Land use has remained commercial/industrial in the area of the former cleaners. Rainier Lighting and Electric Supply currently occupies the former Plaza Cleaners property. The current land use around the area of the groundwater treatment facility is residential and military. No changes in land use are anticipated in the near future.

The remedy is progressing towards meeting RAOs, although the time frame for cleanup is longer than originally anticipated in the ROD. In the ROD, it was estimated that the pump and treat operation would clean up the groundwater in 10 to 15 years. However, the Responsiveness Summary of the ROD indicated that “The estimated times were found to be unrealistically short and, at best, can only be used as absolute minimum cleanup times.” The 2012 FYR also raised this issue. A risk assessment conducted as part of the 1985 ROD shows that health risks associated with the use of treated water were below EPA’s acceptable risk range. Soil remediation is complete. Institutional controls are in place to restrict use of groundwater and to inform the public of the potential effects of using contaminated groundwater. Implemented institutional controls include public outreach and education to inform the public of contaminated groundwater associated with the Site and Tacoma-Pierce County Health Department restrictions on installation of private wells. Construction of a new groundwater treatment system to replace the aging system will occur in the near future. The upgraded groundwater treatment system is expected to improve efficiency and restrict the spread of contamination in the aquifer to reduce ultimate cleanup needs and to protect the quality of the water supply.

**QUESTION C:** Has any other information come to light that could call into question the protectiveness of the remedy?

EPA recently learned that JBLM has detected perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in groundwater beneath the installation located adjacent to the site. PFOS/PFOA are included in a class of chemicals known as polyfluoroalkyl substances (PFAS). PFASs are emerging contaminants of concern that were historically used in firefighting foam at airfields. Due to the close proximity of the Site to JBLM, the Lakewood Water District sampled supply wells H1 and H2 for PFAS in spring 2017. Perfluorohexanesulfonic acid (PFHxS) was detected at 0.0220 µg/L and 0.0192 µg/L. PFOS was detected at 0.0465 µg/L and 0.0505 µg/L. All detections were below EPA’s 0.07 µg/L lifetime health advisory level for PFOS. JBLM is also a Superfund site. EPA is working with the Army to develop a PFAS monitoring program in nearby water supply wells including Lakewood.

## VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations	
<b>OU(s) without Issues/Recommendations Identified in the FYR:</b>	
None	
<b>Issues and Recommendations Identified in the FYR:</b>	
<b>OU(s):</b> OU1	<b>Issue Category:</b> Monitoring

		<p><b>Issue:</b> The long-term groundwater monitoring program does not include the newly-installed wells and other key monitoring points. Also, there are no wells located west of MW-16A where PCE concentrations are above the MCL.</p>		
		<p><b>Recommendation:</b> Revise the groundwater monitoring program as specified in Table 4 of this FYR. Consider installation of a new well at the corner of Pacific Highway Southwest and New York Avenue Southwest (McChord Drive Southwest), west of MW-16A, and sample this well on an 18-month frequency. The new well should monitor the A-zone similar to MW-20A and MW-28R. The approximate depth of the new well should be 90 to 100 feet bgs.</p>		
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	State	EPA	4/1/2018

OU(s): OU1		<p><b>Issue Category: Remedy Performance</b></p>		
		<p><b>Issue:</b> PCE and TCE continue to exceed groundwater cleanup goals. Limitations of the current treatment system limit pumping capacity of the wells. The treatment system is also nearing the end of its useful life.</p>		
		<p><b>Recommendation:</b> Replace and upgrade the groundwater treatment system to allow pumping rates that can maintain hydraulic control of the groundwater contaminant plume.</p>		
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	State	EPA	4/1/2018

OU(s): OU1		<p><b>Issue Category: Institutional Controls</b></p>		
		<p><b>Issue:</b> The 1992 ESD requires public outreach and education as institutional controls to restrict groundwater use at the Site, but it is unclear how often and by what means these administrative tools should be implemented to inform the public of the potential risks associated with groundwater use in the area. Decision documents did not require groundwater use restrictions implemented by the Tacoma-Pierce County Health Department.</p>		
		<p><b>Recommendation:</b> Clarify how often and by what means the groundwater institutional controls for the Site will be implemented. Consider whether a decision document is needed to incorporate Tacoma-Pierce County Health Department restrictions on installation of private wells on and near the Site as part of the remedy.</p>		
Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	EPA	EPA	4/1/2018

OU(s): OU1		<p><b>Issue Category: Other</b></p>		
		<p><b>Issue:</b> PFOS/PFOA have been detected in groundwater at the nearby Joint Base Lewis/McChord. Recent sampling of the Lakewood Water District supply wells H1 and H2 did not detect PFAS above health advisory levels.</p>		
		<p><b>Recommendation:</b> Coordinate with Joint Base Lewis/McChord on PFAS monitoring program in nearby water supply wells including Lakewood.</p>		

Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
No	Yes	State	EPA	4/1/2018

## VII. PROTECTIVENESS STATEMENTS

<b>Sitewide Protectiveness Statement</b>
<p><i>Protectiveness Determination:</i> Short-term Protective</p>
<p><i>Protectiveness Statement:</i> The OU1 groundwater remedy is currently protective of human health and the environment because exposure pathways that could result in unacceptable risks are being controlled through the treatment of groundwater to concentrations below MCLs, and institutional controls are in place to prevent exposure to, or the ingestion of, contaminated groundwater.</p> <p>For the remedy to be protective in the long-term, the following actions need to be taken: Revise the groundwater monitoring program as specified in Table 4 of this FYR. Install a new well at the corner of Pacific Highway Southwest and New York Avenue Southwest (McChord Drive Southwest), west of MW-16A, and sample this well on an 18-month frequency. The new well must monitor the A-zone similar to MW-20A and MW-28R. The approximate depth of the new well should be 90 to 100 feet bgs. Replace and upgrade the groundwater treatment system to allow pumping rates that can maintain hydraulic control of the groundwater contaminant plume. Clarify how often and by what means the groundwater institutional controls for the Site will be implemented. Consider whether a decision document is needed to incorporate Tacoma-Pierce County Health Department restrictions on installation of private wells on and near the Site as part of the remedy. Coordinate with Joint Base Lewis/McChord to continue monitoring for PFAS.</p>

## VIII. NEXT REVIEW

The next FYR Report for the Lakewood-Ponders Corner Superfund site is required five years from the completion date of this review.

## **APPENDIX A – REFERENCE LIST**

Amended Record of Decision, Remedial Alternative Selection, Ponders Corner, Washington. EPA Region 10. November 1986.

City of Lakewood Comprehensive Plan. July 2000. Revised December 2014.

Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, April – November 2016. From Bernie Zavala, Hydrogeologist, Office of Environment Review and Assessment, EPA Region 10, to Tracy Chellis, Remedial Project Manager, Office of Environmental Cleanup. July 2017.

Explanation of Significant Differences for the Lakewood Superfund Site. EPA Region 10. August 1992.

Fifth Five-Year Review Report for Lakewood/Ponders Corner Superfund Site, Lakewood, Washington, United States Army Corps of Engineers. September 2012.

Final Lakewood/Ponders Corner Superfund Site, Well Installation Trip Report. Ecology and Environment, Inc. January 2016.

Fourth Five-Year Review Report for Lakewood/Ponders Corner Superfund Site, Tacoma, Pierce County, Washington. EPA Region 10. September 2007.

Lakewood Plaza Cleaners, Groundwater Monitoring Results, June 2012: Data Summary Report. State of Washington Department of Ecology. March 2013.

Lakewood Plaza Cleaners, Groundwater Monitoring Results, June 2013: Data Summary Report. State of Washington Department of Ecology. December 2013.

Lakewood Plaza Cleaners, Groundwater Monitoring Results, May 2014: Data Summary Report. State of Washington Department of Ecology. March 2015.

Lakewood Plaza Cleaners, Groundwater Monitoring Results, October 2015: Data Summary Report. State of Washington Department of Ecology. February 2016.

Lakewood Water District Ponders Wells Treatment Alternatives Evaluation. Kennedy/Jenks Consultants. July 2015.

Record of Decision, Ponders Corner Site, WA (IRM), EPA Region 10. June 1984.

Record of Decision, Ponders Corner, WA (Second Remedial Action, 09/30/85), EPA Region 10. September 1985.

Third Five-Year Review Report for Lakewood/Ponders Corner Superfund Site, Tacoma, Washington. Washington State Department of Ecology, Toxics Cleanup Program. September 2002.



## APPENDIX B – SITE CHRONOLOGY

**Table B-1: Site Chronology**

Event	Date
EPA identified PCE, TCE and cis-1,2-DCE contamination in Lakewood Water District drinking water supply wells H1 and H2	July 1981
Lakewood Water District temporarily took wells H1 and H2 out of service while monitoring wells were installed	August 1981
EPA proposed the Site for listing on the NPL	December 1982
EPA listed the Site on the NPL	September 1983
Ecology and Plaza Cleaners reach a stipulated agreement for remedial action	September 1983
EPA conducted removal actions which included soil cleanup and removal of drummed sludge, liquid and contaminated solids from septic tanks	1983-1987
EPA began the RI/FS	March 1984
EPA completed a focused feasibility study identifying an Initial Remedial Action	May 1984
EPA issued an interim ROD selecting the air stripping remedy for contaminated groundwater	June 1984
Lakewood Water District installed two air strippers for drinking water supply wells H1 and H2 to treat contaminated groundwater	November 1984
EPA completed the RI/FS; EPA issued a second ROD selecting continued operation of the air strippers, installation of additional groundwater monitoring wells, excavation of septic tanks and the drain field, excavation of contaminated soils, and the placement of administrative restrictions on wells	September 1985
EPA began the remedial design	May 1986
EPA issued an amended ROD for modifications to the soils unit cleanup. The amended remedy included installation of an SVE system for treatment of soils in place, reduction in the amount of septic tank contents to be removed and treated off site, and continued soil and vapor testing until soil treatment was deemed complete.	November 1986
EPA completed the remedial design and began the remedial action for the soil component of the remedy	September 1987
EPA completed a potentially responsible party (PRP) search; no viable PRPs were identified	December 1989
EPA excavated additional soil from the Site	June-July 1992
EPA issued an ESD to establish site-specific cleanup levels for contaminants in soil and groundwater; to eliminate the requirement to implement institutional controls on land and groundwater use; and to document revisions to the remedial action necessary to remove the source of contamination at the Site	September 1992
EPA issued the first FYR	September 1992
EPA signed the preliminary close-out report	September 1992
EPA completed the remedial action for the soil cleanup	May 1993
EPA announced, in the Federal Register, the partial deletion of the Lakewood site "soil unit" from the NPL	November 1996
EPA sent letters to residences, realtors and well drillers regarding administrative control restrictions	February 1997
EPA transferred O&M responsibilities to the State (Ecology) as a part of the ongoing long-term response action	July 1997
EPA issued the second FYR	September 1997
EPA issued the third FYR, prepared by the State	September 2002

Event	Date
EPA sent letters to residences, realtors and well drillers regarding administrative control restrictions. EPA also sent notices to trade magazines (for well drillers) and realtors	March 2007
EPA prepared the fourth FYR	September 2007
EPA sent letters to realtors and well drillers regarding administrative control restrictions	March 2008
EPA sent out fact sheets notifying homeowners, realtors and well drillers about administrative control restrictions and providing site information	May 2012
Ecology decommissioned three monitoring wells	July 2012
EPA signed the fifth FYR, prepared by the United States Army Corps of Engineers	September 2012
EPA began a supplemental investigation at the Site, which included installation of two monitoring wells, sampling of 10 monitoring wells and hydraulic monitoring with transducers	August 2015
EPA's hydrogeologist issued a Technical Memorandum to document the results of the supplemental investigation	May 2017

## APPENDIX C – SITE BACKGROUND

### Physical Characteristics

The Site is located in Pierce County, Washington, south of the city of Tacoma on Pacific Highway Southwest. The Site includes the former Plaza Cleaners property and groundwater contamination migrating from the property. An electrical supply and lighting company now operates at the former Plaza Cleaners property, located at 12511 Pacific Highway Southwest in Lakewood, in a commercial and light industrial area. I-5, a six-lane highway, borders the property to the south. Residential areas are located south of I-5 and about one-tenth of a mile north and northwest of the former drying cleaning property.

Lakewood Water District has two of its drinking water supply wells (H1 and H2) within a fenced area south of the former Plaza Cleaners, across I-5. Residential property lies to the east and McChord Air Force Base lies to the southeast of these wells (Figure 1). The supply wells are operated in rotation. Well H1 is pumped at 1,400 gallons per minute (gpm) during the summer months and H2 is pumped at 1,100 gpm for the rest of the year.

The Site is situated on an upland drift plain that slopes gently to the northwest, terminating at Puget Sound. The area around Ponders Corner has a maritime climate with cool, wet winters and warm, dry summers. Average annual precipitation is 40 inches, 85 percent of which falls during the months of September through April. Mean lake evaporation is about 23 inches per year. Most of the evaporation occurs during the months with the lowest precipitation, indicating a strong seasonal trend for groundwater recharge and surface runoff. Local annual recharge for the open area immediately behind the former Plaza Cleaners is estimated to be about 17 inches, or about 40 percent of the total precipitation. Recharge in areas adjacent to the former Plaza Cleaners will be less because much of the area is paved and drained to storm sewers.

The four hydrogeological units of interest which underlie the Ponders Corner area include:

- The permeable sands and gravels of the recessional outwash deposits, known as the Steilacoom gravels. This unit typically ranges from 0 to 30 ft bgs.
- The semi-confining silt and clay-rich Vashon till that contains lenses of clean gravel in places. This unit typically ranges from 30 to 75 feet bgs and is referred to as Zone B in site documents.
- The highly stratified, yet permeable, Advance outwash deposits that form the primary aquifer. This unit typically ranges from 75 to 110 feet bgs and is referred to as Zone A in site documents.
- The generally less permeable Colvos sand that grades to a clayey sand or blue clay at its base. This unit is typically observed beyond 110 feet bgs.

The Steilacoom gravels are typically unsaturated, except in an area east of the former Plaza Cleaners and near wells H1 and H2. In these areas perched, saturated zones several feet thick can exist. These zones are capable of yielding several tens of gallons per minute.

The underlying Vashon till is highly variable in thickness. It is thickest to the north and west of the former Plaza Cleaners and becomes quite thin, and possibly discontinuous, southeast of wells H1 and H2. At least one of the gravel layers is present over a fairly large area, including the Plaza Cleaners. This permeable interval appears to be hydraulically interconnected with the Steilacoom gravels. While the upper portion of the till is generally unsaturated, saturated zones can be found elsewhere, particularly near the bottom of the till and in gravel lenses found in this zone. Little is known about the hydrologic properties of the Vashon till.

Underneath the Vashon till are highly permeable sands and gravels of the Advance outwash. Most monitoring wells are screened in this aquifer, primarily in the basal portion at depths of 80 to 120 feet bgs. This basal portion tends to be the most permeable part. Horizontal hydraulic conductivities vary from 400 to 2,000 feet per day. Linear flow velocities range from 2.7 feet/day to 100 feet/day.

## **History of Contamination**

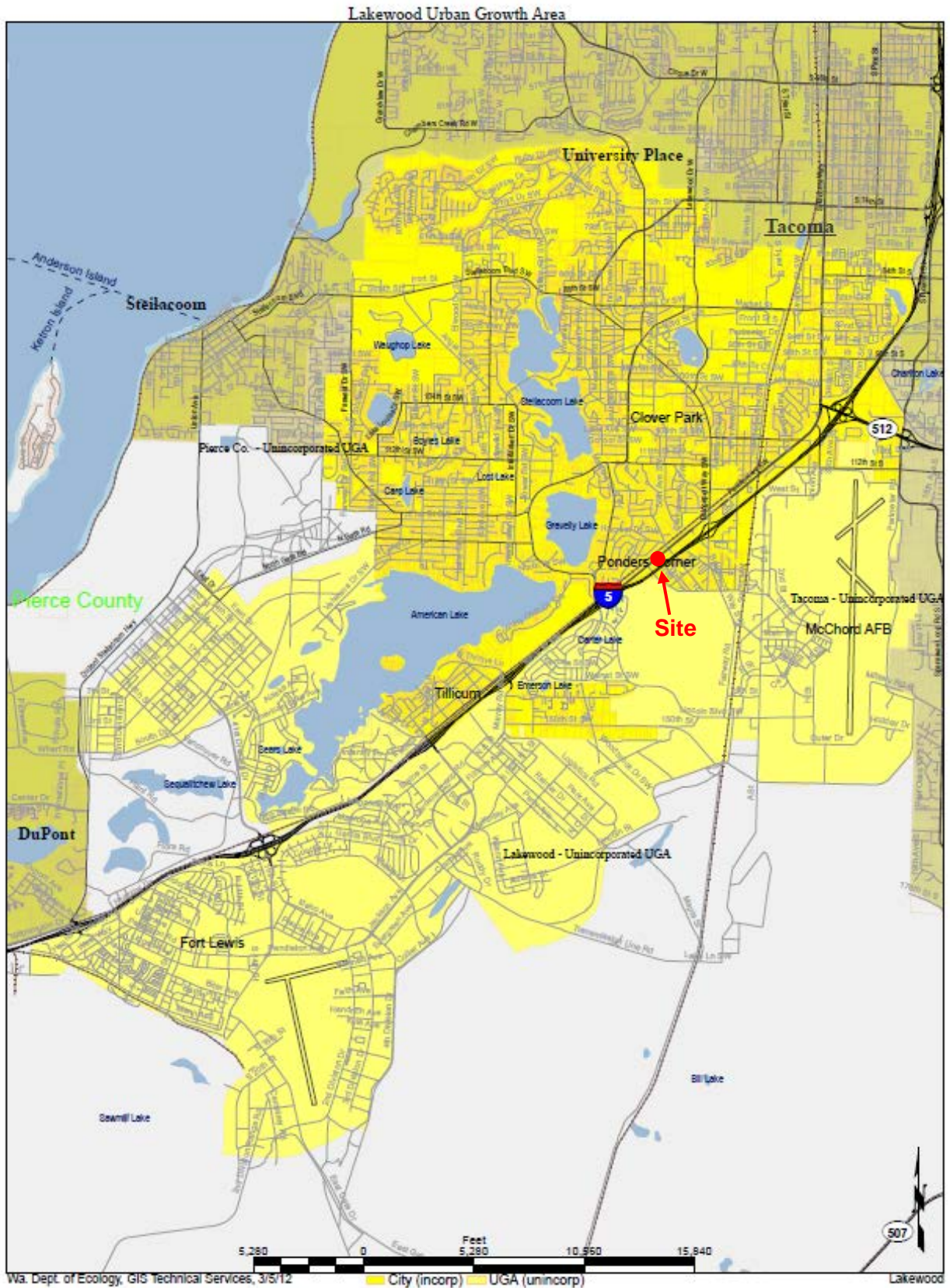
In July 1981, EPA sampled drinking water wells in the Tacoma area for VOC contamination. Sample results indicated that the Lakewood Water District's drinking water supply wells H1 and H2 were contaminated with TCE, PCE and cis-1,2-DCE.

In August 1981, Lakewood Water District temporarily discontinued use of supply wells H1 and H2. During the same time period, Ecology inspected several businesses near the drinking water supply wells for potential sources of contamination. Plaza Cleaners, across the freeway and about 800 feet away from the supply wells, was the only business identified as a potential source of contamination. Plaza Cleaners operated a dry cleaning and laundry business with three dry cleaning machines, two reclaimers (dryers), and five commercial washing machines. Solvent used in the dry cleaning process was discharged into the cleaner's septic tank system. Other wastes containing solvent were deposited on the ground outside the building.

EPA proposed the Site to the NPL in December 1982 and formally listed the Site on the NPL in September 1983.


# APPENDIX D – FIGURE D-1 LAKEWOOD URBAN GROWTH AREA

Source: Adapted from City of Lakewood Comprehensive Plan, dated December 2014.



## APPENDIX E – PRESS NOTICE

Published in *The News Tribune* on April 22, 2017

 <p>United States Environmental Protection Agency</p>	<h3>Announcing Start of the Sixth Five Year Review for Lakewood/Ponders Corner Site</h3>
<p><b>Site visit completed April 2017</b> The Environmental Protection Agency has started the latest review of the Lakewood/Ponders Corner Superfund Site. EPA assesses the site every five years to make sure the cleanup continues to be protective of human health and the environment. As part of the Sixth Five-Year Review, a site visit was conducted on April 5, 2017. The Sixth Five-Year Review Report will be completed by September 2017.</p>	
<p><b>About the site</b> The Site is south of Tacoma, near McChord Air Force Base and Gravelly Lake, in Lakewood, Washington. In 1981, EPA discovered volatile organic contamination in two Lakewood Water District drinking water supply wells. The Washington Department of Ecology inspected several businesses near the supply wells and identified a local dry cleaning and laundry business as the source of the contamination. Soils and ground-water had become contaminated from solvents used by the dry cleaners. As a result of these findings, EPA listed the Lakewood/ Ponders Corner Site on the Superfund Program's National Priorities List in 1983.</p>	
<p><b>What was done</b> By 1996, contaminated soils and sludge had been removed from the Site, completing this part of the cleanup. Contaminated ground-water, which is spread out in a large fan-shaped area, continues to be treated and monitored. Because private drinking water wells are not allowed in the area, there is no risk that anyone will drink this contaminated water.</p>	
<p><b>We want to hear from you</b> As someone interested in or living close to the Site, we want to keep you informed. If you have information or concerns about the Lakewood/ Ponders Corner Site that you'd like us to consider during our review, contact <b>Tracy Chellis</b>, EPA Project Manager, no later than <b>May 31, 2017</b> at <a href="mailto:chellis.tracy@epa.gov">chellis.tracy@epa.gov</a> or <b>206-553-6326</b>.</p>	
<p><b>For more information, please visit:</b> EPA site page: <a href="https://www.epa.gov/superfund/lakewood">https://www.epa.gov/superfund/lakewood</a> WA Dept. of Ecology site page: <a href="http://www.ecy.wa.gov/programs/eap/groundwater/LakewoodCleaners.html">http://www.ecy.wa.gov/programs/eap/groundwater/LakewoodCleaners.html</a></p>	
<p><b>TDD/TTY users may call the Federal Relay Service at 800-877-8339. Then give the operator Trach Chellis's phone number: 206-553-6326.</b></p>	

## APPENDIX F – INTERVIEW FORMS

Lakewood-Ponders Corner Superfund Site Five-Year Review Interview Form			
<b>Site Name:</b>	Lakewood-Ponders Corner	<b>EPA ID No.:</b>	WAD050075662
<b>Subject Name:</b>	Andrew Smith	<b>Subject Affiliation:</b>	Washington Department of Ecology
<b>Time:</b>	11:30 a.m.	<b>Date:</b>	4/17/2017
<b>Interview Location:</b>	Electronically Submitted		
<b>Interview Format:</b>	In Person	Phone	Mail      Other: <u>Email</u>
<b>Interview Category:</b>	State Agency		

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?  
Cleanup timeframe was grossly underestimated.
2. What is your assessment of the current performance of the remedy in place at the Site?  
Sufficient.
3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities from residents in the past five years?  
Lakewood Water District has requested the treatment system be replaced soon.
4. Has your office conducted any site-related activities or communications in the past five years? If so, please describe the purpose and results of these activities.  
Our agency conducts annual groundwater monitoring. Also, our agency is funding design and partial purchase of a replacement treatment system for Lakewood Water District.
5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy?  
No.
6. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues?  
Yes.
7. Are you aware of any changes in projected land use(s) at the Site?  
No.
8. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?  
It is anticipated that this treatment system will be needed for longer than was estimated in the Record of Decision for this project. Ecology accepted responsibility of the operation and maintenance of the Site based on that estimate. However, Ecology did not anticipate having to replace the treatment system when accepting responsibility of the Site.
9. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?  
Yes.

<b>Site Name:</b>	Lakewood-Ponders Corner	<b>EPA ID No.:</b>	WAD050075662
<b>Interviewer Name:</b>	Johnny Zimmerman-Ward	<b>Interviewer Affiliation:</b>	Skeo
<b>Subject Name:</b>	Dave Hall	<b>Subject Affiliation:</b>	Lakewood Water District
<b>Time:</b>	12:30 p.m.	<b>Date:</b>	4/18/2017
<b>Interview Location:</b>	Phone		
<b>Interview Format:</b>	In Person	Phone	Mail Other:
<b>Interview Category:</b>	O&M Contractor		

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

The overall intent worked well at the time it was designed and it is still working well removing TCE. We haven't had a positive test for TCE or trans-dichloroethylene for probably more than a decade. It's worked well at cleaning up two of three contaminants. The third is a lingering issue. We are presently designing a replacement for it. If we're not going to get PCE consistently below levels, we'll have to continue pumping and treating. We have had success with the aeration system and will replace it with a new system as soon as funding is available.
2. What is your assessment of the current performance of the remedy in place at the Site?

It is doing the job it was designed to do, but the system is aging out.
3. What are the findings from the monitoring data? What are the key trends in contaminant levels that are being documented over time at the Site?

Still getting intermittent levels of PCE over the MCL from the influent sample. Specifically, in the winter (pumping is greater in the summer).
4. Is there a continuous on-site O&M presence? If so, please describe staff responsibilities and activities. Alternatively, please describe staff responsibilities and the frequency of site inspections and activities if there is not a continuous on-site O&M presence.

Recently staff are there on average three days a week. There are alarm systems in place for problems at the Site (e.g., pump failures) and we get immediate alarms for failures. When we are on site we monitor the chlorine system and the re-lift motors. We recently have had starter issues. We are trying to keep the system going without replacing much until the rebuild is completed.
5. Have there been any significant changes in site O&M requirements, maintenance schedules or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

The system is old and, as a result, we have had steadily increasing maintenance of the system.
6. Have there been unexpected O&M difficulties or costs at the Site since start-up or in the last five years? If so, please provide details.

We have had issues with aging components and are trying not to spend any additional money. We are in a holding pattern until new construction is complete.
7. Have there been opportunities to optimize O&M activities or sampling efforts? Please describe changes and any resulting or desired cost savings or improved efficiencies.

These will come with the new system.
8. Do you have any comments, suggestions or recommendations regarding O&M activities and schedules at the Site?

We will adjust once we're guaranteed funding from the State to proceed. We've already pre-purchased the vast majority of material on last year's budget. We're now waiting on construction funding. I would like to

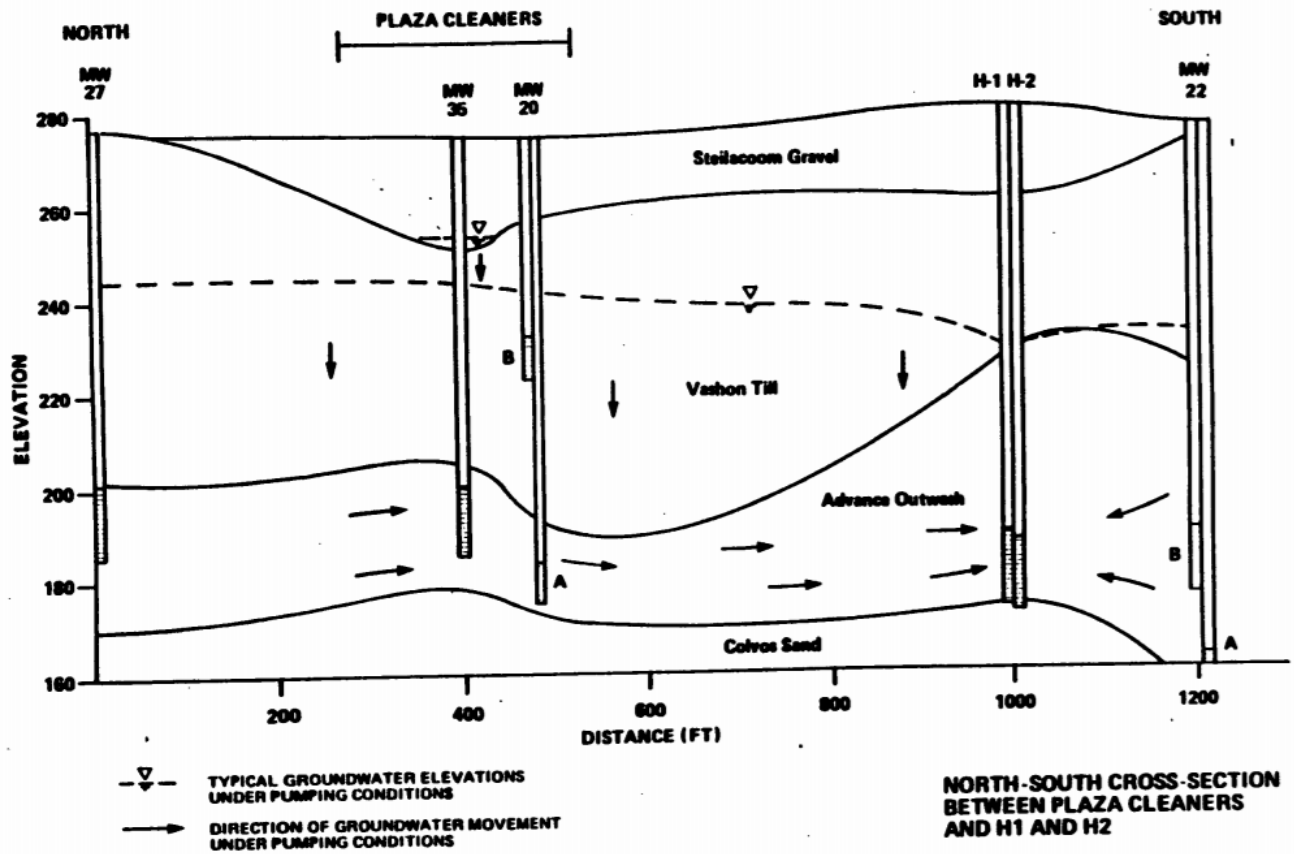


see us start sometime in the fall as it's easier to take the Site offline in winter, when demand is less, while building the new one.

9. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?  
Yes.

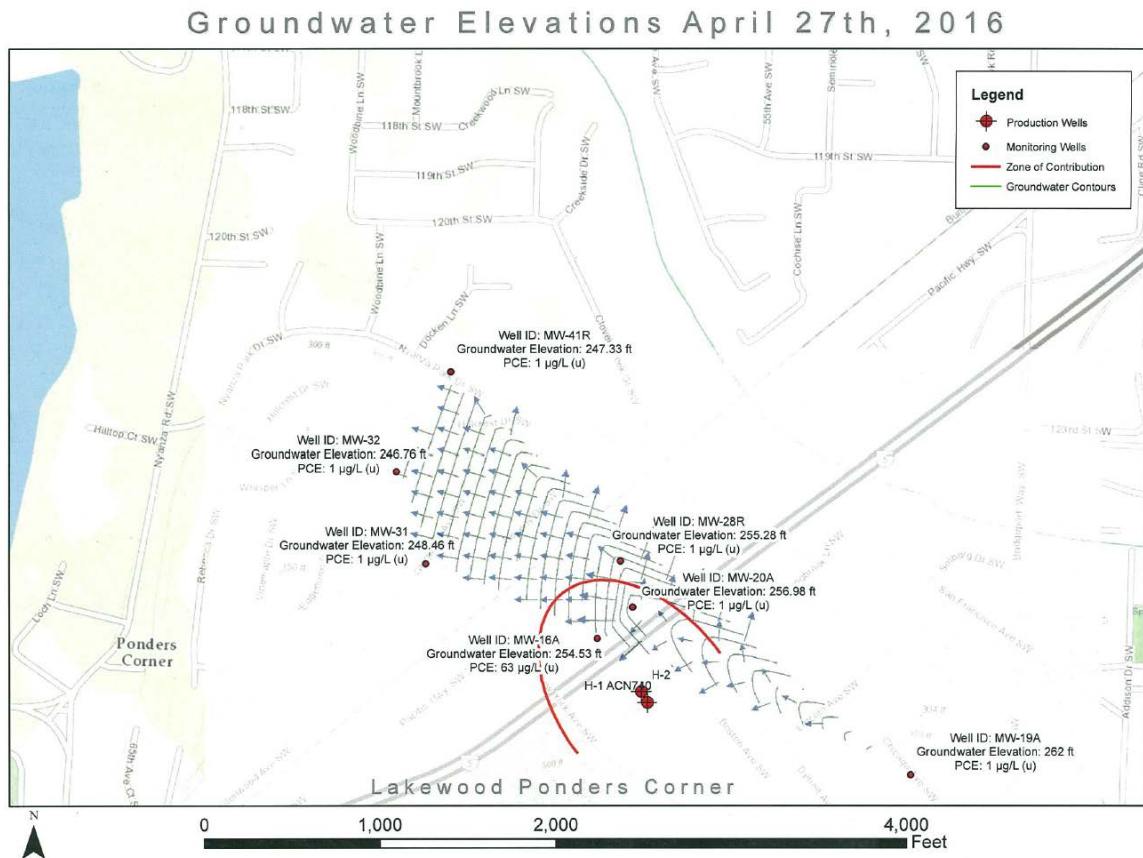
# APPENDIX G – DATA REVIEW SUPPORTING DOCUMENTATION

Figure G-1: Groundwater Flow Conceptual Site Model When H1 & H2 Are Pumping (1985)  
 Source: 1985 ROD.



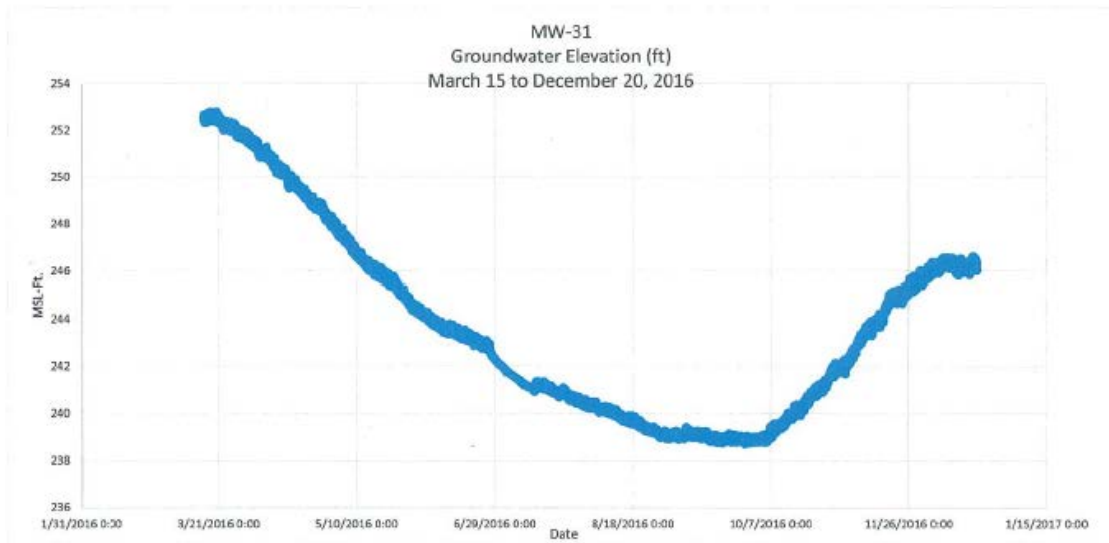
**Figure G-2: Groundwater Elevations, April 2016**

Source: Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, prepared by EPA Region 10, May 2017.



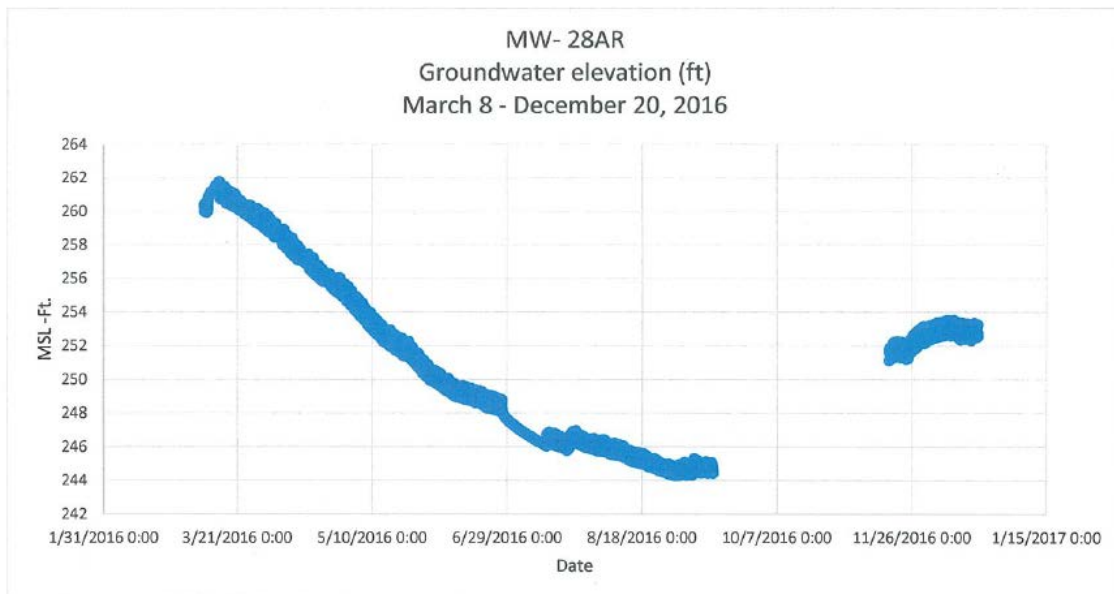
**Figure G-3: MW-31 Groundwater Elevations, March 15 through December 20, 2016**

Source: Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, prepared by EPA Region 10, May 2017.

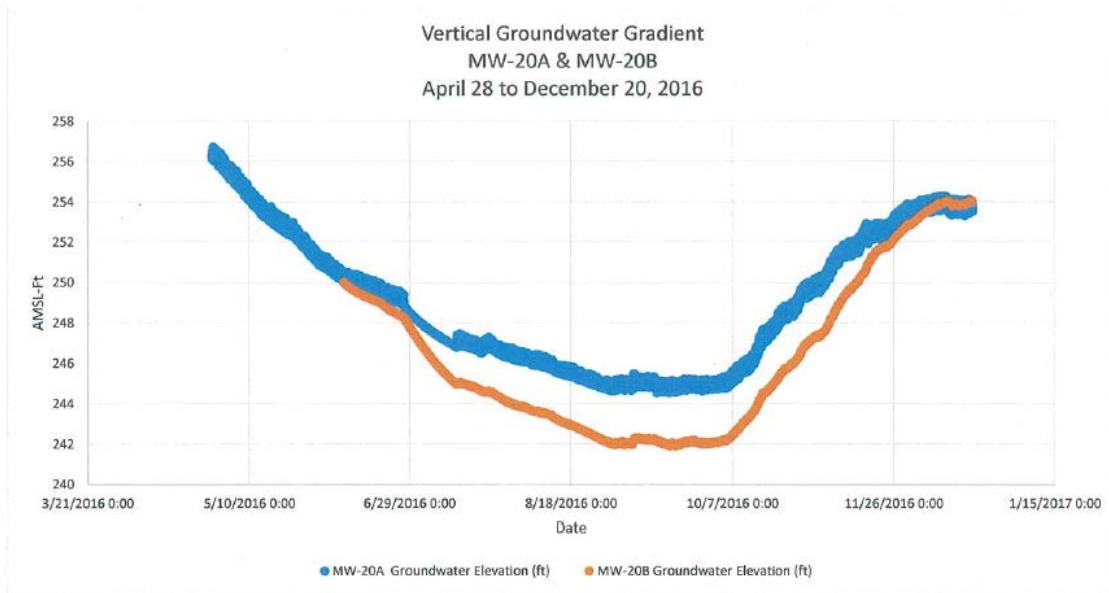


**Figure G-4: MW-28AR Groundwater Elevations, March 8 through December 20, 2016**

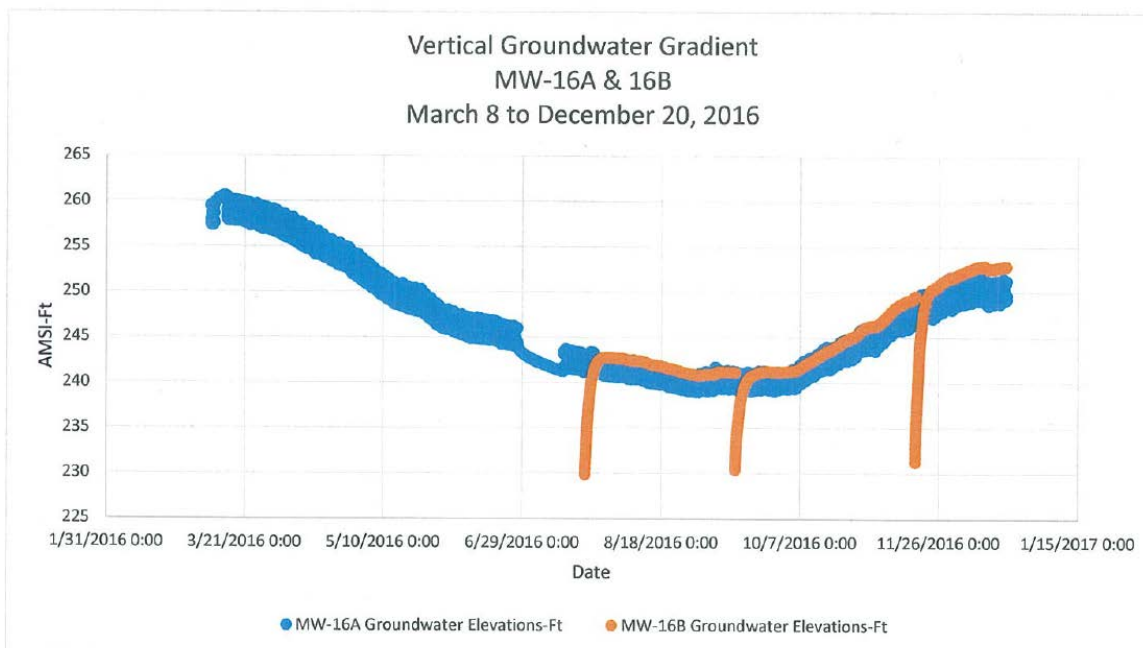
Source: Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, prepared by EPA Region 10, May 2017.



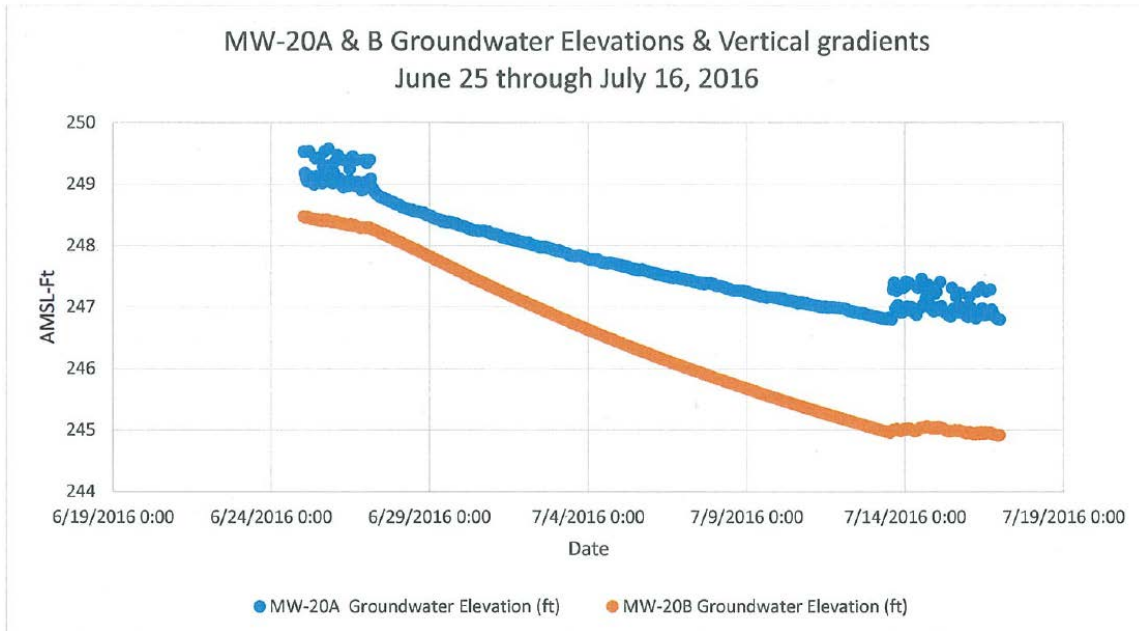
**Figure G-5: MW-20A and MW-20B Groundwater Elevations, April 28 through December 20, 2016**  
 Source: Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, prepared by EPA Region 10, May 2017.



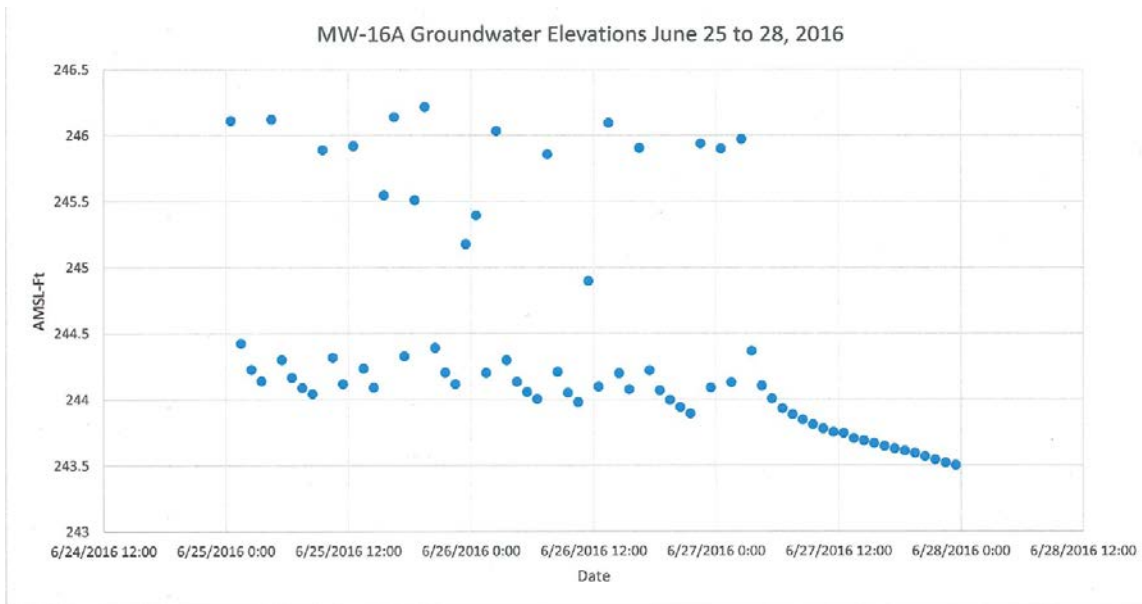
**Figure G-6: MW-16A and MW-16B Groundwater Elevations, March 8 through December 20, 2016**  
 Source: Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, prepared by EPA Region 10, May 2017.



**Figure G-7: MW-20A and MW-20B Groundwater Elevations, June 25 through July 16, 2016**  
 Source: Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, prepared by EPA Region 10, May 2017.



**Figure G-8: MW-16A Groundwater Elevations, June 25 through June 28, 2016**  
 Source: 2017 Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, prepared by EPA Region 10, May 2017.



**Table G-1: Ecology Historical Groundwater Data**

Source: Groundwater Monitoring Results, October 2015: Data Summary Report, prepared by Ecology, February 2016.

Units: µg/L

Date	MW-16A				MW-20A				MW-20B			
	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
1/1991	28	1 J	2.4 J	1 U	1 U	1 U	1 U	1 U	1100	18	33	1 U
5/1991	26	0.6 J	2	1 U	0.4 J	1 U	1 U	1 U	752	16	30	1 U
11/1991	2.7 J	1 U	0.6 J	1 U	0.4 NJ	1 U	1 U	1 U	120	2.6 J	6.7	1 U
5/1992	7	1 U	1	1 U	0.5 J	1 U	1 U	1 U	940	13	32	1 U
12/1992	9 J	0.3 J	0.8 J	1 UJ	0.8 J	1 UJ	1 UJ	1 UJ	340 J	14 J	20 J	5 UJ
5/1993	44	10 U	2 J	10 U	10 U	10 U	10 U	10 U	700	12	21	10 U
12/1993	13	0.3 J	0.7 J	1 U	0.3 J	1 U	1 U	1 U	187	50 U	8.2 J	50 U
4/1994	33	0.6	1.4	1 U	0.4	0.2 U	0.2 U	1 U	472	8.6 J	12.6	50 U
11/1994	9.7	0.3 J	0.5 J	1 U	0.3 J	1 U	1 U	1 U	86	50 U	3 J	50 U
7/1995	27	0.5 J	0.8 J	1 U	0.4 J	1 U	1 U	1 U	340	8.4	17	1 U
1/1996	47 E	0.8 J	1.5	2 U	0.2 J	1 U	1 U	2 U	353	7.2	15	2 U
7/1996	43	0.7 J	1.9	1 U	0.4 J	1 U	1 U	1 U	387	7.6	15	1 U
1/1997	54	1.1	3.1	1 U	0.4 J	1 U	1 U	1 U	373	100 U	6.4 J	100 U
7/1997	47	0.7 J	2.5	1 U	0.3 J	1 U	2 U	1 U	222	4	6.4	1 U
2/1998	36	0.7 J	2 J	5 U	0.4 J	1 U	1 U	1 U	456	7 J	12	10 U
7/1998	30	1 U	1.5	1 U	0.6 J	1 U	1 U	1 U	575	10	23	1 U
1/1999	--	--	--	--	1 U	2 U	1 U	1 U	708	5.2	12	1 U
8/1999	22	0.4 J	1.1	1 U	0.8 J	2 U	1 U	1 U	722	8.4 J	16 J	1 U
1/2000	40	0.7 J	1.9	1 U	0.2 NJ	2 U	1 U	1 U	184	6	13	1 U
8/2000	22	0.3 J	0.7	1 U	0.1 J	2 U	1 U	1 U	648	200 U	100 U	100 U
1/2001	31	0.4 J	1	1 U	0.2 J	1 U	1 U	1 U	493	6.6 J	12	10 U
8/2001	25	0.3 J	0.7 J	1 U	1 U	2 U	1 U	1 U	486	8.2	18	100 U
2/2002	47	0.8 J	2.3	1 UJ	--	--	--	--	248	200 U	100 U	100 UJ
8/2002	22	0.3 J	0.8 J	1 U	--	--	--	--	371	8.5	16	1 U
2/2003	59 J	0.2 J	2.4	1 U	1 U	1 U	1 U	1 U	230	100 U	100 U	100 U
9/2003	26	0.3 J	0.5 J	5 U	0.1 J	1 U	1 U	5 U	239	5.4 J	12	50 U
6/2004	30	0.4 J	0.8 J	1 U	0.2 J	1 U	1 U	1 U	344	6.5 J	15	10 U
11/2004	48	1 U	1.4	5 U	0.3 J	1 U	1 U	5 U	241	6.7	13	5 U
6/2005	80	1.3	2.8	5 U	1 U	1 U	1 U	2 U	413	6.6	12	5 U
11/2005	43	0.7 J	1 J	2 U	1 U	1 U	1 U	2 U	555	6.4	11	2 U
5/2006	124	1.8	4.6	5 U	1 U	1 U	1 U	5 U	216	4.2	6.6	5 U
9/2006	29	0.3 J	0.5 J	2 U	1 U	1 U	1 U	2 U	518	5.6	11	2 U
6/2007	83	1.2	2.5	2 U	2 U	2 U	2 U	2 U	204	4.4	7.8	2 U
10/2007	24	1 U	0.6 J	2 U	2 U	1 U	1 U	2 U	491	7.5	15	2 U
5/2008	55	1.2	2.8	1 U	1 U	1 U	1 U	1 U	143	5.5	12	1 U
10/2008	31	0.5 J	0.6 J	1 U	1 U	1 U	1 U	1 U	258	4.5	9	1 U
6/2009	67	0.9 J	2.2	1 U	1 U	1 U	1 U	1 U	160	4.1	7.4	1 U
11/2009	28	0.5 J	0.8 J	1 U	0.6 J	1 U	1 U	1 U	250	4.7	9.6	1 U
6/2010	85	1.3	1.6	1 U	1 U	1 U	1 U	1 U	130	3.7	6.3	1 U

Date	MW-16A				MW-20A				MW-20B			
	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
10/2010	61	0.9 J	1.2	1 U	2 U	1 U	1 U	1 U	520	5.8	10	1 U
6/2011	100	1.4	1.6	1 UJ	1 U	1 U	1 U	1 UJ	200	3.5	5.6	1 UJ
10/2011	57	0.8 J	1	2 U	1 U	1 U	1 U	2 U	720	4.8	7.9	2 U
6/2012	98	1.3	2.4	1 U	1 U	1 U	1 U	1 U	140	3.3	5.7	1 U
6/2013	100	1.3	2.6	1 U	1 U	1 U	1 U	1 U	170	3.9	7	1 U
5/2014	65	1.1	1.3	1 U	1 U	1 U	1 U	1 U	130	2.1	3	1 U
10/2015	44	0.5 J	0.6 J	1 U	0.2 J	1 U	1 U	1 U	340	5.4	12	1 U

U: The analyte was not detected at or above the reported result.  
J: The analyte was positively identified. The associated numerical result is an estimate.  
UJ: The analyte was not detected at or above the reported estimated result.  
NJ: The analyte that has been tentatively identified. The associated numerical result is an estimate.  
E: The concentration of the associated value exceeds the known calibration range.  
-- Not Sampled  
**Bold:** The analyte was positively identified.  
**Shade:** Values are greater than project cleanup levels.



Date	MW-27				H1/H2				LPMW-2			
	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
1/1991	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--
5/1991	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--
11/1991	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--
5/1992	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--
12/1992	1 UJ	1 UJ	1 UJ	1 UJ	--	--	--	--	--	--	--	--
5/1993	10 U	10 U	10 U	10 U	--	--	--	--	--	--	--	--
12/1993	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--
4/1994	0.2 U	0.2 U	0.2 U	1 U	--	--	--	--	--	--	--	--
11/1994	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--
7/1995	1 U	1 U	1 U	1 U	9	0.3 J	1 U	1 U	--	--	--	--
1/1996	1 U	1 U	1 U	2 U	8.4	0.2 J	0.2 J	2 U	--	--	--	--
7/1996	1 U	1 U	1 U	1 U	0.1 J	1 U	1 U	1 U	--	--	--	--
1/1997	1 U	1 U	1 U	1 U	18	0.4 J	0.4 J	1 U	--	--	--	--
7/1997	1 U	1 U	1 U	1 U	8.8	0.3 J	0.6 J	1 U	--	--	--	--
2/1998	1 U	1 U	1 U	1 U	11	0.4 J	0.3 J	1 U	--	--	--	--
7/1998	0.05 J	1 U	1 U	1 U	9.8	1 U	0.1 J	1 U	--	--	--	--
1/1999	1 U	2 U	1 U	1 U	1.5	1 U	1 U	1 U	--	--	--	--
8/1999	1 U	2 U	1 U	1 U	5.2	0.2 J	1 U	1 U	--	--	--	--
1/2000	1 U	2 U	1 U	1 U	10	2 U	1 U	1 U	--	--	--	--
8/2000	1 U	2 U	1 U	1 U	8.7	0.03 J	1 U	1 U	--	--	--	--
1/2001	1 U	1 U	1 U	1 U	11	0.2 J	1 U	1 U	--	--	--	--
8/2001	1 U	2 U	1 U	1 U	6.8	0.2 J	1 U	1 U	--	--	--	--
2/2002	1 U	2 U	1 U	1 UJ	12	0.2 J	0.2 J	1 UJ	--	--	--	--
8/2002	1 U	2 U	1 U	1 U	6.1	1 U	1 U	1 U	--	--	--	--
2/2003	1 U	1 U	1 U	1 U	1.3	1 U	1 U	1 U	--	--	--	--
9/2003	1 U	1 U	1 U	5 U	6.4	0.2 NJ	1 U	5 U	--	--	--	--
6/2004	1 U	1 U	1 U	1 U	7.9	0.2 J	0.1 J	1 U	--	--	--	--
11/2004	1 U	1 U	1 U	5 U	2.6	1 U	1 U	5 U	--	--	--	--
6/2005	1 U	1 U	1 U	2 U	14	0.3 J	1 U	2 U	--	--	--	--
11/2005	1 U	1 U	1 U	2 U	6.4	1 U	1 U	2 U	--	--	--	--
5/2006	1 U	1 U	1 U	5 U	7.3	0.2 J	1 U	5 U	9.9	1 U	1 U	5 U
9/2006	1 U	1 U	1 U	2 U	4.8	1 U	1 U	2 U	--	--	--	--
6/2007	2 U	2 U	2 U	2 U	5.2	2 U	2 U	2 U	4.8	1 U	1 U	2 U
10/2007	2 U	1 U	1 U	2 U	3.8	1 U	1 U	2 U	--	--	--	--
5/2008	1 U	1 U	1 U	1 U	9.6	1 U	1 U	1 U	2.5	1 U	1 U	1 U
10/2008	1 U	1 U	1 U	1 U	5.1	1 U	1 U	1 U	--	--	--	--
6/2009	1 U	1 U	1 U	1 U	6.8	1 U	1 U	1 U	4.1	1 U	1 U	1 U
11/2009	1 U	1 U	1 U	1 U	--	--	--	--	11	1 U	1 U	1 U
6/2010	1 U	1 U	1 U	1 U	4.3	1 U	1 U	1 U	4.4	1 U	1 U	1 U
10/2010	--	--	--	--	--	--	--	--	5	1 U	1 U	1 U

Date	MW-27				H1/H2				LPMW-2			
	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
6/2011	1 U	1 U	1 U	1 UJ	5.9	1 U	1 U	1 UJ	3.2	1 U	1 U	1 UJ
10/2011	1 U	1 U	1 U	2 U	1.4	1 U	1 U	2 U	--	--	--	--
6/2012					5.2	1 U	1 U	1 U	2.4	1 U	1 U	1 U
6/2013					4.9	1 U	1 U	1 U	2.2	1 U	1 U	1 U
5/2014					2.9	1 U	1 U	1 U	2.7	1 U	1 U	1 U
10/2015					1.8	0.2J	1 U	1 U	--	--	--	--

U: The analyte was not detected at or above the reported result.  
J: The analyte was positively identified. The associated numerical result is an estimate.  
UJ: The analyte was not detected at or above the reported estimated result.  
NJ: The analyte that has been tentatively identified. The associated numerical result is an estimate.  
-- Not Sampled  
**Bold:** The analyte was positively identified.  
**Shade:** Values are greater than project cleanup levels.

Date	MW-19A				MW-31				MW-33			
	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
1/1991	--	--	--	--	<b>1 J</b>	1 U	<b>1.9 J</b>	1 U	--	--	--	--
5/1991	--	--	--	--	<b>0.6 J</b>	1 U	<b>2</b>	1 U	--	--	--	--
11/1991	1 U	<b>0.5 NJ</b>	1 U	1 U	<b>0.9 NJ</b>	1 U	<b>2.2 J</b>	1 U	--	--	--	--
5/1992	--	--	--	--	<b>0.8 J</b>	1 U	<b>1</b>	1 U	--	--	--	--
12/1992	1 UJ	1 UJ	1 UJ	1 UJ	<b>0.5 J</b>	1 UJ	<b>0.9 J</b>	1 UJ	--	--	--	--
5/1993	--	--	--	--	10 U	10 U	10 U	10 U	--	--	--	--
12/1993	1 U	<b>0.4 J</b>	1 U	1 U	<b>0.8 J</b>	1 U	<b>1.2 J</b>	1 U	--	--	--	--
4/1994	0.2 U	<b>0.5</b>	0.2 U	1 U	<b>0.7</b>	0.2 U	<b>1</b>	1 U	--	--	--	--
11/1994	--	--	--	--	<b>0.8 J</b>	1 U	<b>1</b>	1 U	--	--	--	--
7/1995	1 U	<b>0.4 J</b>	1 U	1 U	<b>0.6 J</b>	1 U	<b>0.5 J</b>	1 U	1 U	1 U	1 U	1 U
1/1996	--	--	--	--	<b>0.6 J</b>	1 U	<b>0.7 J</b>	2 U	--	--	--	--
7/1996	--	--	--	--	--	--	--	--	1 U	1 U	1 U	1 U
7/1997	1 U	<b>0.3 J</b>	2 U	1 U	<b>0.9 J</b>	1 U	<b>0.9 J</b>	1 U	1 U	1 U	2 U	1 U
7/1998	--	--	--	--	--	--	--	--	1 U	1 U	1 U	1 U
8/1999	1 U	<b>0.4 J</b>	1 U	1 U	<b>0.9 J</b>	2 U	<b>0.4 J</b>	1 U	1 U	2 U	1 U	1 U
8/2000	--	--	--	--	--	--	--	--	1 U	2 U	1 U	1 U
8/2001	1 U	<b>0.3 J</b>	1 U	1 U	<b>0.4 J</b>	2 U	<b>0.3 J</b>	1 U	1 U	2 U	1 U	1 U
8/2002	--	--	--	--	--	--	--	--	1 U	1 U	1 U	1 U
9/2003	1 U	<b>0.4 NJ</b>	1 U	5 U	<b>0.5 J</b>	1 U	<b>0.1 NJ</b>	5 U	1 U	1 U	1 U	5 U
6/2004	--	--	--	--	--	--	--	--	--	--	--	--
6/2005	1 U	<b>0.6 J</b>	1 U	2 U	<b>0.5 J</b>	1 U	1 U	2 U	1 U	1 U	1 U	2 U
5/2006	--	--	--	--	--	--	--	--	1 U	1 U	1 U	5 U
6/2007	2 U	<b>1.2 J</b>	2 U	2 U	<b>1.6 J</b>	2 U	2 U	2 U	2 U	2 U	2 U	2 U
5/2008	--	--	--	--	--	--	--	--	1 U	1 U	1 U	1 U
6/2009	1 U	1 U	1 U	1 U	--	--	--	--	1 U	1 U	1 U	1 U
6/2010	--	--	--	--	--	--	--	--	1 U	1 U	1 U	1 U
6/2011	--	--	--	--	--	--	--	--	--	--	--	--
10/2011	1 U	<b>0.4 J</b>	1 U	2 U	<b>0.7 J</b>	1 U	1 U	2 U	1 U	1 U	1 U	2 U
6/2013	--	--	--	--	--	--	--	--	1 U	1 U	1 U	1 U
10/2015	--	--	--	--	--	--	--	--	1 U	<b>0.2 J</b>	1 U	1 U

U: The analyte was not detected at or above the reported result.  
J: The analyte was positively identified. The associated numerical result is an estimate.  
UJ: The analyte was not detected at or above the reported estimated result.  
NJ: The analyte that has been tentatively identified. The associated numerical result is an estimate.  
-- Not Sampled  
**Bold:** The analyte was positively identified.

Date	MW-32				MW-40				MW-41			
	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
1/1991	<b>1 J</b>	1 U	<b>1.1 J</b>	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
5/1991	<b>1</b>	1 U	<b>2</b>	1 U	--	--	--	--	1 U	1 U	1 U	1 U
11/1991	<b>0.6 NJ</b>	1 U	<b>0.6 J</b>	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
5/1992	<b>0.7 J</b>	1 U	<b>1</b>	1 U	--	--	--	--	1 U	1 U	1 U	1 U
12/1992	<b>0.7 J</b>	1 UJ	<b>0.5 J</b>	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
5/1993	10 U	10 U	10 U	10 U	--	--	--	--	10 U	10 U	10 U	10 U
12/1993	<b>0.7 J</b>	1 U	<b>0.6 J</b>	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4/1994	<b>0.7</b>	0.2 U	<b>0.6</b>	1 U	0.2 U	0.2 U	0.2 U	1 U	0.2 U	0.2 U	0.2 U	1 U
11/1994	<b>0.6 J</b>	1 U	<b>0.5 J</b>	1 U	--	--	--	--	--	--	--	--
7/1995	<b>0.7 J</b>	1 U	<b>0.5 J</b>	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1/1996	<b>0.8 J</b>	1 U	<b>0.6 J</b>	2 U	--	--	--	--	1 U	1 U	1 U	2 U
7/1996	--	--	--	--	--	--	--	--	--	--	--	--
8/2000	<b>0.8 J</b>	2 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	2 U	1 U	1 U
6/2005	<b>1.4</b>	1 U	1 U	2 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	2 U
6/2010	<b>1.8</b>	1 U	1 U	1 U	--	--	--	--	1 U	1 U	1 U	1 U
10/2011	--	--	--	--	1 U	1 U	1 U	2 U	--	--	--	--

U: The analyte was not detected at or above the reported result.

J: The analyte was positively identified. The associated numerical result is an estimate.

UJ: The analyte was not detected at or above the reported estimated result.

NJ: The analyte that has been tentatively identified. The associated numerical result is an estimate.

-- Not Sampled

**Bold:** The analyte was positively identified.

**Table G-2: EPA Water Quality Results for April 2016**

Source: Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, prepared by EPA Region 10, May 2017.

Date	Monitoring Well No.	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
4/27/2016	MW-28R(A)	1.0 U	1.0 U	1.0 U	1.0 U
4/28/2016	MW-16A	<b>63</b>	1.1	1.4	1.0 U
4/28/2016	MW-16B	<b>5.9</b>	1.0 U	1.0 U	1.0 U
4/27/2016	MW-19A	1.0 U	1.0 U	1.0 U	1.0 U
4/27/2016	MW-19B	1.0 U	1.0 U	1.0 U	1.0 U
4/27/2016	MW-20A	1.0 U	1.0 U	1.0 U	1.0 U
4/27/2016	MW-20B	<b>74</b>	1.5	2.1	1.0 U
4/28/2016	MW-31	1.0 U	1.0 U	1.0 U	1.0 U
4/28/2016	MW-32	1.0 U	1.0 U	1.0 U	1.0 U
4/28/2016	MW-41R (A)	1.0 U	1.0 U	1.0 U	1.0 U
4/28/2016	MW-16A (duplicate)	<b>57</b>	1.1	1.3	1.0 U

*Notes:*

Bold detections above the MCLs.

U- The analyte was not detected at or above the reported value.

**Table G-3: EPA Water Quality Results for June 2016**

Source: Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, prepared by EPA Region 10, May 2017.

Date	Monitoring Well No.	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
6/8/2016	MW-28R(A)	1.0 U	1.0 U	1.0 U	1.0 U
6/8/2016	MW-16A	<b>48</b>	1.0 U	1.1	1.0 U
6/8/2016	MW-16B	2.7	1.0 U	1.0 U	1.0 U
6/9/2016	MW-19A	1.0 U	1.0 U	1.0 U	1.0 U
6/9/2016	MW-19B	1.0 U	1.0 U	1.0 U	1.0 U
6/8/2016	MW-20A	1.0 U	1.0 U	1.0 U	1.0 U
6/8/2016	MW-20B	<b>150</b>	3.5	5.5	1.0 U
6/9/2016	MW-31	1.0 U	1.0 U	1.0 U	1.0 U
6/9/2016	MW-32	1.1	1.0 U	1.0 U	1.0 U
6/9/2016	MW-41R(A)	1.0 U	1.0 U	1.0 U	1.0 U
6/9/2016	MW-19A (duplicate)	1.0 U	1.0 U	1.0 U	1.0 U

*Notes:*

Bold detections above the MCLs.

U- The analyte was not detected at or above the reported value.

**Table G-4: EPA Water Quality Results for July 2016**

Source: Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, prepared by EPA Region 10, May 2017.

Date	Monitoring Well No.	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
7/21/2016	MW-28R(A)	1.0 U	1.0 U	1.0 U	1.0 U
7/21/2016	MW-16A	<b>31</b>	1.0 U	1.0 U	1.0 U
7/21/2016	MW-16B	<b>6.1</b>	1.0 U	1.0 U	1.0 U
7/20/2016	MW-19A	1.0 U	1.0 U	1.0 U	1.0 U
7/20/2016	MW-19B	1.0 U	1.0 U	1.0 U	1.0 U
7/21/2016	MW-20A	1.0 U	1.0 U	1.0 U	1.0 U
7/21/2016	MW-20B	<b>260</b>	<b>5.9</b>	11	1.0 U
7/21/2016	MW-31	1.0 U	1.0 U	1.0 U	1.0 U

Date	Monitoring Well No.	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
7/20/2016	MW-32	1.0 U	1.0 U	1.0 U	1.0 U
7/20/2016	MW-41R(A)	1.0 U	1.0 U	1.0 U	1.0 U
7/21/2016	MW-16A (duplicate)	<b>34</b>	1.0 U	1.0 U	1.0 U

*Notes:*  
 Bold detections above the MCLs.  
 U- The analyte was not detected at or above the reported value.

**Table G-5: EPA Water Quality Results for September 2016**

Source: Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, prepared by EPA Region 10, May 2017.

Date	Monitoring Well No.	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
9/13/2016	MW-28R(A)	1.0 U	1.0 U	1.0 U	1.0 U
9/13/2016	MW-16A	<b>24</b>	1.0 U	1.0 U	1.0 U
9/13/2016	MW-16B	1.2	1.0 U	1.0 U	1.0 U
9/13/2016	MW-20A	1.0 U	1.0 U	1.0 U	1.0 U
9/13/2016	MW-20B	<b>410</b>	<b>7.3</b>	12	1.0 U
9/14/2016	MW-31	1.0 U	1.0 U	1.0 U	1.0 U
9/14/2016	MW-32	1.0 U	1.0 U	1.0 U	1.0 U
9/14/2016	MW-41R(A)	1.0 U	1.0 U	1.0 U	1.0 U
9/13/2016	MW-20B	<b>430</b>	<b>7.3</b>	13	1.0 U

*Notes:*  
 Bold detections above the MCLs.  
 U- The analyte was not detected at or above the reported value.

**Table G-6: EPA Water Quality Results for November 2016**

Source: Draft Technical Memorandum, Groundwater Sampling and Hydraulic Monitoring at Ponders Corner/Lakewood Superfund Site, prepared by EPA Region 10, May 2017.

Date	Monitoring Well No.	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
11/17/2016	MW-28R(A)	1.0 U	1.0 U	1.0 U	1.0 U
11/17/2016	MW-16A	<b>35</b>	1.0 U	1.0 U	1.0 U
11/17/2016	MW-16B	2.3	1.0 U	1.0 U	1.0 U
11/17/2016	MW-20A	1.0 U	1.0 U	1.0 U	1.0 U
11/17/2016	MW-20B	<b>220</b>	<b>6.7</b>	14	1.0 U
11/18/2016	MW-31	1.0 U	1.0 U	1.0 U	1.0 U
11/18/2016	MW-32	1.1	1.0 U	1.0 U	1.0 U
11/18/2016	MW-41R(A)	1.0 U	1.0 U	1.0 U	1.0 U
11/17/2016	MW-20B (duplicate)	<b>250</b>	<b>6.8</b>	14	1.0 U

*Notes:*  
 Bold detections above the MCLs.  
 U- The analyte was not detected at or above the reported value.



2.	<b>Site-Specific Health and Safety Plan</b>	<input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input type="checkbox"/> Contingency plan/emergency response plan	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: _____				
3.	<b>O&amp;M and OSHA Training Records</b>	<input checked="" type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input type="checkbox"/> N/A
Remarks: _____				
4.	<b>Permits and Service Agreements</b>			
	<input type="checkbox"/> Air discharge permit	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	<input type="checkbox"/> Effluent discharge	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	<input type="checkbox"/> Waste disposal, POTW	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	<input type="checkbox"/> Other permits: _____	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: <u>Air effluent from the air strippers is vented to the atmosphere. Monitoring is not conducted or required. Treated water (effluent) is sampled quarterly for VOCs. Effluent consistently meets drinking water standards.</u>				
5.	<b>Gas Generation Records</b>	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: _____				
6.	<b>Settlement Monument Records</b>	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: _____				
7.	<b>Groundwater Monitoring Records</b>	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
Remarks: _____				
8.	<b>Leachate Extraction Records</b>	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: _____				
9.	<b>Discharge Compliance Records</b>			
	<input type="checkbox"/> Air	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
	<input type="checkbox"/> Water (effluent)	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: <u>The Lakewood Water District is not required to submit discharge compliance records to EPA or the State.</u>				
10.	<b>Daily Access/Security Logs</b>	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date	<input checked="" type="checkbox"/> N/A
Remarks: _____				
<b>IV. O&amp;M COSTS</b>				
1.	<b>O&amp;M Organization</b>			
	<input checked="" type="checkbox"/> State in-house	<input type="checkbox"/> Contractor for state		
	<input type="checkbox"/> PRP in-house	<input type="checkbox"/> Contractor for PRP		
	<input type="checkbox"/> Federal facility in-house	<input type="checkbox"/> Contractor for Federal facility		
<input checked="" type="checkbox"/> <u>Lakewood Water District conducts O&amp;M of the air strippers and pumping wells; the State conducts O&amp;M for the remainder of the Site.</u>				
2.	<b>O&amp;M Cost Records</b>			
	<input type="checkbox"/> Readily available	<input type="checkbox"/> Up to date		





2.	<b>Adequacy</b>	<input checked="" type="checkbox"/> ICs are adequate	<input type="checkbox"/> ICs are inadequate	<input type="checkbox"/> N/A
Remarks: _____				
<b>D. General</b>				
1.	<b>Vandalism/Trespassing</b>	<input type="checkbox"/> Location shown on site map	<input checked="" type="checkbox"/> No vandalism evident	
Remarks: _____				
2.	<b>Land Use Changes On Site</b>	<input type="checkbox"/> N/A		
Remarks: <u>None. Rainier Light and Electric currently occupies the former dry cleaners property.</u>				
3.	<b>Land Use Changes Off Site</b>	<input type="checkbox"/> N/A		
Remarks: <u>None.</u>				
<b>VI. GENERAL SITE CONDITIONS</b>				
<b>A. Roads</b>				
<input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A				
1.	<b>Roads Damaged</b>	<input type="checkbox"/> Location shown on site map	<input type="checkbox"/> Roads adequate	<input type="checkbox"/> N/A
Remarks: _____				
<b>B. Other Site Conditions</b>				
Remarks: _____				
<b>VII. LANDFILL COVERS</b>				
<input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A				
<b>VIII. VERTICAL BARRIER WALLS</b>				
<input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A				
<b>IX. GROUNDWATER/SURFACE WATER REMEDIES</b>				
<input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A				
<b>A. Groundwater Extraction Wells, Pumps and Pipelines</b>				
<input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A				
1.	<b>Pumps, Wellhead Plumbing and Electrical</b>			
<input type="checkbox"/> Good condition <input checked="" type="checkbox"/> All required wells properly operating <input checked="" type="checkbox"/> Needs maintenance <input type="checkbox"/> N/A				
Remarks: <u>Access to inspect the treatment system was unavailable on the day of the site inspection. According to Lakewater Water District personnel, the current system is more than 30 years old and needs to be replaced.</u>				
2.	<b>Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances</b>			
<input type="checkbox"/> Good condition <input checked="" type="checkbox"/> Needs maintenance				
Remarks: <u>Access to inspect the treatment system was unavailable on the day of the site inspection. According to Lakewater Water District personnel, the current system is more than 30 years old and needs to be replaced.</u>				
3.	<b>Spare Parts and Equipment</b>			
<input type="checkbox"/> Readily available <input type="checkbox"/> Good condition <input checked="" type="checkbox"/> Requires upgrade <input type="checkbox"/> Needs to be provided				
Remarks: <u>Access to inspect the treatment system was unavailable on the day of the site inspection. According to Lakewater Water District personnel, the current system is more than 30 years old and needs to be replaced.</u>				
<b>B. Surface Water Collection Structures, Pumps and Pipelines</b>				
<input type="checkbox"/> Applicable <input checked="" type="checkbox"/> N/A				
1.	<b>Collection Structures, Pumps and Electrical</b>			
<input type="checkbox"/> Good condition <input type="checkbox"/> Needs maintenance				
Remarks: _____				
2.	<b>Surface Water Collection System Pipelines, Valves, Valve Boxes and Other Appurtenances</b>			

<input type="checkbox"/> Good condition <input type="checkbox"/> Needs maintenance Remarks: _____
<b>3. Spare Parts and Equipment</b> <input type="checkbox"/> Readily available <input type="checkbox"/> Good condition <input type="checkbox"/> Requires upgrade <input type="checkbox"/> Needs to be provided Remarks: _____
<b>C. Treatment System</b> <input checked="" type="checkbox"/> Applicable <input type="checkbox"/> N/A
<b>1. Treatment Train</b> (check components that apply) <input type="checkbox"/> Metals removal <input type="checkbox"/> Oil/water separation <input type="checkbox"/> Bioremediation <input checked="" type="checkbox"/> Air stripping <input type="checkbox"/> Carbon adsorbers <input type="checkbox"/> Filters: _____ <input type="checkbox"/> Additive (e.g., chelation agent, flocculent): _____ <input type="checkbox"/> Others: _____ <input type="checkbox"/> Good condition <input type="checkbox"/> Needs maintenance <input type="checkbox"/> Sampling ports properly marked and functional <input type="checkbox"/> Sampling/maintenance log displayed and up to date <input type="checkbox"/> Equipment properly identified <input type="checkbox"/> Quantity of groundwater treated annually: _____ <input type="checkbox"/> Quantity of surface water treated annually: _____  Remarks: <u>Access to inspect the treatment system was unavailable on the day of the site inspection. According to Lakewood Water District personnel, the treatment system consists of two pump houses for each supply well and two air strippers that are run in series. The stripper media consists of 2-inch balls. The stripper effluent flows into a wet well in the treatment building. Chlorination occurs in-line prior to entering the wet well. Water in the wet well is then pumped into the Lakewood Water District distribution system.</u>
<b>2. Electrical Enclosures and Panels</b> (properly rated and functional) <input type="checkbox"/> N/A <input type="checkbox"/> Good condition <input checked="" type="checkbox"/> Needs maintenance Remarks: <u>Access to inspect the treatment system was unavailable on the day of the site inspection. According to Lakewood Water District personnel, the treatment system is dated and needs to be replaced.</u>
<b>3. Tanks, Vaults, Storage Vessels</b> <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Proper secondary containment <input type="checkbox"/> Needs maintenance Remarks: _____
<b>4. Discharge Structure and Appurtenances</b> <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Good condition <input type="checkbox"/> Needs maintenance Remarks: <u>Access to treatment system was unavailable during the site inspection.</u>
<b>5. Treatment Building(s)</b> <input type="checkbox"/> N/A <input checked="" type="checkbox"/> Good condition (esp. roof and doorways) <input type="checkbox"/> Needs repair <input type="checkbox"/> Chemicals and equipment properly stored Remarks: <u>Inspected from outside the locked gate only.</u>

<p>6. <b>Monitoring Wells</b> (pump and treatment remedy)</p> <p><input checked="" type="checkbox"/> Properly secured/locked    <input checked="" type="checkbox"/> Functioning    <input checked="" type="checkbox"/> Routinely sampled    <input checked="" type="checkbox"/> Good condition</p> <p><input checked="" type="checkbox"/> All required wells located    <input type="checkbox"/> Needs maintenance    <input type="checkbox"/> N/A</p> <p>Remarks: _____</p>
<p><b>D. Monitoring Data</b></p>
<p>1. <b>Monitoring Data</b></p> <p><input checked="" type="checkbox"/> Is routinely submitted on time    <input checked="" type="checkbox"/> Is of acceptable quality</p>
<p>2. <b>Monitoring Data Suggests:*</b></p> <p><input type="checkbox"/> Groundwater plume is effectively contained    <input type="checkbox"/> Contaminant concentrations are declining</p> <p>*This FYR will evaluate current groundwater data.</p>
<p><b>E. Monitored Natural Attenuation</b></p>
<p>1. <b>Monitoring Wells</b> (natural attenuation remedy)</p> <p><input type="checkbox"/> Properly secured/locked    <input type="checkbox"/> Functioning    <input type="checkbox"/> Routinely sampled    <input type="checkbox"/> Good condition</p> <p><input type="checkbox"/> All required wells located    <input type="checkbox"/> Needs maintenance    <input checked="" type="checkbox"/> N/A</p> <p>Remarks: _____</p>
<p style="text-align: center;"><b>X. OTHER REMEDIES</b></p> <p style="text-align: center;">The SVE system has been dismantled and removed from the Site.</p>
<p style="text-align: center;"><b>XI. OVERALL OBSERVATIONS</b></p>
<p><b>A. Implementation of the Remedy</b></p> <p>Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions).</p> <p><u>Excavation at the former dry cleaning property effectively removed contaminated soil from the Site. The groundwater remedy is designed to extract and treat contaminated groundwater to meet MCLs. Lakewood Water District supply wells H1 and H2 currently pump groundwater, and air strippers treat the groundwater to acceptable levels. Treated groundwater consistently meets MCLs. The remedy is effective and functioning as designed. As a means to provide hydraulic control of the groundwater plume, the water wells do not operate 24 hours, 7 days a week. In the winter, one well may operate up to 4 hours per day; in the summer, one well may operate 12-18 hours per day. Reduced pumping rates affect the time frame for treatment. The 1984 ROD originally estimated a treatment period of 10-12 years; however, treatment has been ongoing for nearly 33 years.</u></p>
<p><b>B. Adequacy of O&amp;M</b></p> <p>Describe issues and observations related to the implementation and scope of O&amp;M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.</p> <p><u>New wells were installed in 2015 as part of EPA's hydrogeologic investigation. The groundwater monitoring program should be updated to incorporate the new wells, as necessary. Current O&amp;M of the air strippers is adequate; however, an updated O&amp;M plan may be necessary after the expected installation of a new treatment system.</u></p>
<p><b>C. Early Indicators of Potential Remedy Problems</b></p> <p>Describe issues and observations such as unexpected changes in the cost or scope of O&amp;M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.</p> <p><u>The current extraction and treatment system is more than 30 years old and does not have the capacity to pump at the rates assumed in the 1984 ROD. Well operation varies by the season (lower in the winter, higher in the summer.) Also, due to the loss of head within the air strippers, only one well can be operated at a time and requires the use of a wet well. The reduced pumping at H1 and H2 affects the time frame for treatment and the potential loss of hydraulic control. The Lakewood Water District plans to update the treatment system, pending receipt of funding from the State. Replacement of the air strippers may involve some downtime and a potential loss in hydraulic control.</u></p>

<b>D. Opportunities for Optimization</b>
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Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. <u>This FYR will evaluate opportunities for optimization. Additionally, a planned replacement of the current treatment system is expected to optimize the remedy.</u>
---

**Site Inspection Participants:**

Tracy Chellis, EPA RPM

Bernie Zavala, EPA hydrogeologist

Andrew Smith, P.E., LHG of the Washington State Department of Ecology

Johnny Zimmerman-Ward, Skeo (EPA FYR contractor)

Jill Billus, Skeo





Groundwater treatment facility at wells H1 and H2.



MW-19A and B.



MW-28R in Rainier Electric parking lot.



MW-41R in right of way in residential area.



## APPENDIX J – DETAILED ARARs REVIEW

### ARARs Review

Section 121 (d)(2)(A) of CERCLA specifies that Superfund remedial actions must meet any federal standards, requirements, criteria or limitations that are determined to be ARARs. ARARs are those standards, criteria or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site. To-Be-Considered (TBC) criteria are non-promulgated advisories and guidance that are not legally binding, but should be considered in determining the necessary level of cleanup for protection of human health or the environment. While TBCs do not have the status of ARARs, EPA's approach to determining if a remedial action is protective of human health and the environment involves consideration of TBC criteria along with ARARs.

Chemical-specific ARARs are specific numerical quantity restrictions on individually listed contaminants in specific media. An example of chemical-specific ARARs are the MCLs specified under the Safe Drinking Water Act. The remedy selected for this Site was designed to meet or exceed all chemical-specific ARARs and meet location- and action-specific ARARs.

### *Groundwater*

The 1992 ESD identified federal and state drinking water standards for three groundwater COCs. As shown in Table J-1 there have been no changes to the MCLs since the 1992 ESD, which established groundwater cleanup goals.

**Table J-1: Previous and Current ARARs for Groundwater COCs**

COC	1992 ESD MCL (µg/L) <sup>a</sup>	Current Federal MCL (µg/L) <sup>b</sup>	Current State MCL (µg/L) <sup>c</sup>	ARAR Change
PCE	5	5	5	None
TCE	5	5	5	None
Cis-1,2-DCE	70	70	70	None
<i>Notes:</i> a. Obtained from 1992 ESD. b. Based on the Safe Drinking Water Act MCLs. Current MCLs can be found at <a href="https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants">https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants</a> (accessed 3/27/2017). c. Washington State MCLs located at: <a href="https://fortress.wa.gov/ecy/clarc/FocusSheets/Groundwater%20Methods%20B%20and%20A%20and%20ARARs.pdf">https://fortress.wa.gov/ecy/clarc/FocusSheets/Groundwater%20Methods%20B%20and%20A%20and%20ARARs.pdf</a> (accessed 3/27/2017).				

### *Soil*

Federal ARARs were not available for PCE in soil; however, the 1992 ESD established the Washington MTCA Method A cleanup goal of 500 µg/kg for PCE. The cleanup goals established under MTCA Method A are state ARARs. The current MTCA Method A soil cleanup goals were reviewed and the Method A soil cleanup goal of 500 µg/kg has not changed.<sup>2</sup>

<sup>2</sup> Available at: <https://fortress.wa.gov/ecy/clarc/FocusSheets/Soil%20Methods%20B%20and%20A%20unrestricted.pdf> (accessed 3/27/2017).

## APPENDIX K – DETAILED TOXICITY REVIEW

According to the 1992 ESD, the cleanup goal for PCE in soil was based on the protection of groundwater and was also demonstrated to be protective of industrial and residential land use. To determine if the cleanup goal for PCE in soil remains protective for residential and industrial land use, the cleanup goal was compared to EPA’s 2016 RSLs, since the RSLs incorporate current toxicity values and standard default exposure factors.

The residential evaluation demonstrates that the cleanup level is well below EPA’s risk management range of  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$  and below the noncancer HQ threshold of 1.0 (Table K-1). Since the cleanup goal based on residential exposure remains valid, the cleanup goal would also be valid for a less frequent exposure assumed under an industrial use.

**Table K-1: Screening-Level Risk Evaluation of the 1992 Soil Cleanup Goal**

COC	1992 ESD Cleanup Goal (mg/kg)	Residential RSL <sup>a</sup> (mg/kg)		Cancer Risk <sup>b</sup>	Noncancer HQ <sup>c</sup>
		1 x 10 <sup>-6</sup> Risk	HQ=1.0		
PCE	0.5	24	81	2 x 10 <sup>-8</sup>	0.006
<p><i>Notes:</i></p> <p>a) Current EPA RSLs, dated May 2016, are available at <a href="http://www2.epa.gov/risk/risk-based-screening-table-generic-tables">http://www2.epa.gov/risk/risk-based-screening-table-generic-tables</a> (accessed 3/27/2017).</p> <p>b) The cancer risks were calculated using the following equation, based on the fact that RSLs are derived based on 1 x 10<sup>-6</sup> risk:  Cancer risk = (Cleanup level ÷ cancer-based RSL) × 10<sup>-6</sup></p> <p>c) The noncancer HQ was calculated using the following equation:  HQ = Cleanup level ÷ noncancer-based RSL</p> <p>HQ = hazard quotient  mg/kg = milligrams per kilogram</p>					

# APPENDIX L – VAPOR INTRUSION SCREENING

**Table L-1: Vapor Intrusion (VI) Screening, MW-20B – Commercial**

EPA-OLEM VAPOR INTRUSION ASSESSMENT  
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.5.1 (May 2016 RSLs)  
MW-20B (November 2016)

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (°C)	Tgw	25	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration	Calculated Indoor Air Concentration	VI Carcinogenic Risk	VI Hazard	Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator
		C <sub>gw</sub> (ug/L)	C <sub>ia</sub> (ug/m <sup>3</sup> )	CR	HQ	IUR (ug/m <sup>3</sup> ) <sup>-1</sup>		RfC (mg/m <sup>3</sup> )		i
127-18-4	Tetrachloroethylene	2.5E+02	1.81E+02	3.8E-06	1.0E+00	2.60E-07	I	4.00E-02	I	
79-01-6	Trichloroethylene	6.8E+00	2.74E+00	9.2E-07	3.1E-01	see note	I	2.00E-03	I	TCE
		<b>Totals</b>		4.7E-06	1.31E+00					

**Notes:**

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential		Commercial		Selected (based on scenario)	
		Symbol	Value	Symbol	Value	Symbol	Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	ATnc_GW	25
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	25
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	250
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	8

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Units	Residential		Commercial		Selected (based on scenario)	
		Symbol	Value	Symbol	Value	Symbol	Value
Groundwater	(-)	AFgw R_GW	0.001	AFgw C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss R_GW	0.03	AFss C_GW	0.03	AFss_GW	0.03

(3) **Formulas**  
 $C_{ia, target} = \min(C_{ia,c}; C_{ia,nc})$   
 $C_{ia,c} (ug/m^3) = TCR \times ATc \times (365 \text{ days/yr}) \times (24 \text{ hrs/day}) / (ED \times EF \times ET \times IUR)$   
 $C_{ia,nc} (ug/m^3) = THQ \times ATnc \times (365 \text{ days/yr}) \times (24 \text{ hrs/day}) \times RFC \times (1000 \text{ ug/mg}) / (ED \times EF \times ET)$

(4) **Special Case Chemicals**

Chemical	Residential		Commercial		Selected (based on scenario)	
	Symbol	Value	Symbol	Value	Symbol	Value
Trichloroethylene	mIURTCE_R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	0.00E+00
	IURTCE_R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	4.10E-06

**Mutagenic Chemicals**

The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below.

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.

Age Cohort	Exposure Duration	Age-dependent adjustment factor
0 - 2 years	2	10
2 - 6 years	4	3
6 - 16 years	10	3
16 - 26 years	10	1

**Mutagenic-mode-of-action (MMOA) adjustment factor** 25 This factor is used in the equations for mutagenic chemicals.

**Vinyl Chloride**

See the Navigation Guide equation for C<sub>ia,c</sub> for vinyl chloride.

**Notation:**

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: <http://www.epa.gov/iris/subst/index.html>  
P = PPRTV: EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: <http://hhpprtv.epa.gov/pprtv.shtml>  
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs). Available online at: <http://www.atsdr.cdc.gov/mrls/index.html>  
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: <http://www.oehha.ca.gov/risk/ChemicalDB/index.asp>  
H = HEAST: EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: <http://epa-heast.epa.gov/heast.shtml>  
S = See RSL User Guide, Section 5  
X = PPRTV Appendix  
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).  
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).  
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).

Yellow highlighting indicates site-specific parameters that may be edited by the user.

Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

**Table L-2: VI Screening, MW-20B – Residential**

EPA-OLEM VAPOR INTRUSION ASSESSMENT  
 Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.5.1 (May 2016 RSLs)  
 MW-20B (November 2016)

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (°C)	Tgw	25	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration	Calculated Indoor Air Concentration	VI Carcinogenic Risk	VI Hazard
		Cgw (ug/L)	Cia (ug/m <sup>3</sup> )	CR	HQ
127-18-4	Tetrachloroethylene	2.5E+02	1.81E+02	1.7E-05	4.3E+00
79-01-6	Trichloroethylene	6.8E+00	2.74E+00	5.7E-06	1.3E+00
		<b>Totals</b>		<b>2.3E-05</b>	<b>5.60E+00</b>

Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator
IUR (ug/m <sup>3</sup> ) <sup>-1</sup>		RFC (mg/m <sup>3</sup> )		I
2.60E-07	I	4.00E-02	I	
see note	I	2.00E-03	I	TCE

**Notes:**

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential		Commercial		Selected (based on scenario)	
		Symbol	Value	Symbol	Value	Symbol	Value
Averaging time for carcinogens	(yrs)	ATc_R_GW	70	ATc_C_GW	70	ATc_GW	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_GW	26	ATnc_C_GW	25	ATnc_GW	26
Exposure duration	(yrs)	ED_R_GW	26	ED_C_GW	25	ED_GW	26
Exposure frequency	(days/yr)	EF_R_GW	350	EF_C_GW	250	EF_GW	350
Exposure time	(hr/day)	ET_R_GW	24	ET_C_GW	8	ET_GW	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors	Units	Residential		Commercial		Selected (based on scenario)	
		Symbol	Value	Symbol	Value	Symbol	Value
Groundwater	(-)	AFgw_R_GW	0.001	AFgw_C_GW	0.001	AFgw_GW	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R_GW	0.03	AFss_C_GW	0.03	AFss_GW	0.03

(3) **Formulas**

Cia, target = MIN( Cia,c; Cia,nc)  
 Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)  
 Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RFC x (1000 ug/mg) / (ED x EF x ET)

(4) **Special Case Chemicals**

Chemical	Residential		Commercial		Selected (based on scenario)	
	Symbol	Value	Symbol	Value	Symbol	Value
Trichloroethylene	mIURTCE_R_GW	1.00E-06	IURTCE_C_GW	0.00E+00	mIURTCE_GW	1.00E-06
	IURTCE_R_GW	3.10E-06	IURTCE_C_GW	4.10E-06	IURTCE_GW	3.10E-06

**Mutagenic Chemicals**

The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.	Age Cohort	Exposure Duration	Age-dependent adjustment factor
	0 - 2 years	2	10
	2 - 5 years	4	3
	5 - 15 years	10	3
	15 - 25 years	10	1

**Mutagenic-mode-of-action (MMOA) adjustment factor** 72 This factor is used in the equations for mutagenic chemicals.

**Vinyl Chloride**

See the Navigation Guide equation for Cia,c for vinyl chloride.

**Notation:**

- I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: <http://www.epa.gov/iris/subst/index.html>
- P = PPRTV: EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: <http://hhpprtv.cerl.gov/pprtv.shtm>
- A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: <http://www.atsdr.cdc.gov/mrls/index.html>
- CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: <http://www.oehha.ca.gov/risk/ChemicalDB/index.asp>
- H = HEAST: EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: <http://epa-heast.cerl.gov/heast.shtm>
- S = See RSL User Guide, Section 5
- X = PPRTV Appendix

Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).

VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).

TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).

Yellow highlighting indicates site-specific parameters that may be edited by the user.

Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.

Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

**Table L-3: VI Screening, LPMW-2 – Residential**

EPA-OLEM VAPOR INTRUSION ASSESSMENT  
Groundwater Concentration to Indoor Air Concentration (GWC-IAC) Calculator Version 3.5.1 (May 2016 RSLs)

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ	1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)
Average Groundwater Temperature (°C)	Tgw	25	Enter average of the stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

CAS	Chemical Name	Site Groundwater Concentration	Calculated Indoor Air Concentration	VI Carcinogenic Risk	VI Hazard	Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator
		Cgw (ug/L)	Cia (ug/m <sup>3</sup> )	CR	HQ	(ug/m <sup>3</sup> ) <sup>-1</sup>		(mg/m <sup>3</sup> )		I
127-18-4	Tetrachloroethylene	2.7E+00	1.95E+00	1.8E-07	4.7E-02	2.60E-07	I	4.00E-02	I	

Notes:

(1)	<b>Inhalation Pathway Exposure Parameters (RME):</b>	Units	Residential	Commercial	Selected (based on scenario)
	Exposure Scenario		Symbol	Symbol	Symbol
	Averaging time for carcinogens	(yrs)	ATc_R_GW 70	ATc_C_GW 70	ATc_GW 70
	Averaging time for non-carcinogens	(yrs)	ATnc_R_GW 26	ATnc_C_GW 26	ATnc_GW 26
	Exposure duration	(yrs)	ED_R_GW 26	ED_C_GW 26	ED_GW 26
	Exposure frequency	(days/yr)	EF_R_GW 350	EF_C_GW 250	EF_GW 350
	Exposure time	(hr/day)	ET_R_GW 24	ET_C_GW 8	ET_GW 24
(2)	<b>Generic Attenuation Factors:</b>		Residential	Commercial	Selected (based on scenario)
	Source Medium of Vapors	(-)	Symbol	Symbol	Symbol
	Groundwater	(-)	AFgw_R_GW 0.001	AFgw_C_GW 0.001	AFgw_GW 0.001
	Sub-Slab and Exterior Soil Gas	(-)	AFss_R_GW 0.03	AFss_C_GW 0.03	AFss_GW 0.03
(3)	<b>Formulas</b>		Residential	Commercial	Selected (based on scenario)
	Cia, target = MIN( Cia,c; Cia,nc)		Symbol	Symbol	Symbol
	Cia,c (ug/m <sup>3</sup> ) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)		mIURTCE_R_GW 1.00E-06	IURTCE_C_GW 0.00E+00	mIURTCE_GW 1.00E-06
	Cia,nc (ug/m <sup>3</sup> ) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RFC x (1000 ug/mg) / (ED x EF x ET)		IURTCE_R_GW 3.10E-06	IURTCE_C_GW 4.10E-06	IURTCE_GW 3.10E-06
(4)	<b>Special Case Chemicals</b>		Residential	Commercial	Selected (based on scenario)
	Trichloroethylene		Symbol	Symbol	Symbol
			mIURTCE_R_GW 1.00E-06	IURTCE_C_GW 0.00E+00	mIURTCE_GW 1.00E-06
			IURTCE_R_GW 3.10E-06	IURTCE_C_GW 4.10E-06	IURTCE_GW 3.10E-06

Mutagenic Chemicals

The exposure durations and age-dependent adjustment factors for mutagenic-mode-of-action are listed in the table below:

Note: This section applies to trichloroethylene and other mutagenic chemicals, but not to vinyl chloride.	Age Cohort	Exposure Duration	Age-dependent adjustment factor
	0 - 2 years	2	10
	2 - 6 years	4	3
	6 - 16 years	10	3
	16 - 26 years	10	1

Mutagenic-mode-of-action (MMOA) adjustment factor 72 This factor is used in the equations for mutagenic chemicals.

Vinyl Chloride

See the Navigation Guide equation for Cia,c for vinyl chloride.

Notation:

- I - IRIS: EPA Integrated Risk Information System (IRIS). Available online at: <http://www.epa.gov/iris/subst/index.html>
- P - PPRTV: EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: <http://hhpprtv.ornl.gov/pprtv.shtml>
- A - Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: <http://www.atsdr.cdc.gov/mrls/index.html>
- CA - California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: <http://www.ohha.ca.gov/risk/ChemicalDB/index.asp>
- H - HEAST: EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: <http://epa-heast.ornl.gov/heast.shtml>
- S - See RSL User Guide, Section 5
- X - PPRTV Appendix
- Mut - Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
- VC - Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
- TCE - Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
- Yellow highlighting indicates site-specific parameters that may be edited by the user.
- Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
- Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).