FIFTH FIVE-YEAR REVIEW REPORT FOR SAEGERTOWN INDUSTRIAL AREA SUPERFUND SITE CRAWFORD COUNTY, PENNSYLVANIA

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Prepared by

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Date

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LIST OF ABBREVIATIONS & ACRONYMS

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
COC	Contaminant of Concern
DCE	Dichloroethylene
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-Year Review
GATX	General American Transportation Corporation
HQ	Hazard Quotient
IC	Institutional Control
IUR	Inhalation Unit Risk
LORD	LORD Corporation
µg/L	Micrograms per Liter
mg/kg	Milligrams per Kilogram
MCL	Maximum Contaminant Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PA DEP	Pennsylvania Department of Environmental Protection
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethylene (aka, “perchloroethylene”)
PRG	Preliminary Remediation Goal
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RSL	Regional Screening Level
RZ	Reactive Zone
SCI	Spectrum Controls Incorporated
SMC	Saegertown Manufacturing Corporation
SDWA	Safe Drinking Water Act
TBC	To-Be-Considered
TCA	Trichloroethane
TCE	Trichloroethylene
VOC	Volatile Organic Compound
UU/UE	Unlimited Use and Unrestricted Exposure

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 the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the fifth FYR for the Saegertown Industrial Area Superfund Site (Site). The triggering action for this statutory review is the completion date of the previous FYR, September 12, 2012. The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

The Site currently consists of one operable unit (OU), the LORD Corporation property, which will be addressed in this FYR. As discussed below, four neighboring properties had been part of the Site, but were deleted from the Site in 1997.

The FYR was led by Stephen Tyahla, EPA's Remedial Project Manager (RPM), and initiated on September 21, 2016.

Appendix A includes a list of documents reviewed for this FYR. Appendix B includes a Site chronology. Appendix C includes Site figures.

Site Background

The 30-acre Site is in Saegertown, Crawford County, Pennsylvania (Appendix C, Figure C-1). The current Site consists of the LORD property (Figures 1 and C-2), which produces adhesives, urethane coatings and rubber chemicals. Current site features include the active LORD manufacturing facility and open space immediately south of the facility. Site land use is expected to remain industrial. Land use in the immediate vicinity of the Site is varied (Figure C-1). Railroad tracks, French Creek and the "Knuth Komplex" property, which is a multi-use building, border the Site to the west. The Knuth property is located between the Site and French Creek. Fire department facilities, wetlands, vacant land and industrial properties border the Site to the north and south. Woodcock Creek is south of the Site. Vacant land and open space border the Site to the east.

The Site originally consisted of about 100 acres and included properties owned by four separate companies: the LORD Corporation (LORD); Saegertown Manufacturing Corporation (SMC); Spectrum Controls Incorporated (SCI); and General American Transportation Company (GATX). Past operations at these facilities contaminated groundwater, soil and sediment with hazardous chemicals. The previous FYRs and the 1993 Record of Decision (ROD) contain additional background information on the SMC, SCI and GATX properties. EPA deleted these properties from the Superfund program's National Priorities List (NPL) in 1997 and has determined they no longer require FYRs.

Groundwater at the Site is present in the alluvial aquifer in three zones: shallow, intermediate and deep, (about 10 feet below ground surface [bgs] through 40 feet bgs) and within the Venango Formation (50 to 60 feet bgs). Groundwater in both aquifers flows west-southwest with shallow groundwater flowing toward French Creek and deeper groundwater flowing beneath the creek. Groundwater is the sole source of drinking water in western Crawford County. Saegertown residents receive potable water from seven public supply wells, five of which are located within one mile of the Site. These wells are upgradient of the Site and, in accordance with federal and state Safe Drinking Water Act regulations for public water systems, are regularly tested for contamination prior to distribution. Testing of the Saegertown public supply wells includes Site-related constituents and none of these

constituents have been detected in the wells during this five-year review period (2012-2017). There are several private drinking water wells west of French Creek (PW7, PW20A and PW19), which have been routinely monitored.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Saegertown Industrial Area		
EPA ID: PAD980692487		
Region: 3	**State:** Pennsylvania	**City/County:** Saegertown/Crawford
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name: Stephen Tyahla, with additional support provided by Skeo		
Author affiliation: EPA Region 3		
Review period: 9/21/2016 – 9/12/2017		
Date of site inspection: 2/28/2017		
Type of review: Statutory		
Review number: 5		
Triggering action date: 9/12/2012		
Due date *(five years after triggering action date)*: 9/12/2017		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

In 1980, the Pennsylvania Department of Environmental Resources, now PA DEP, discovered volatile organic compounds (VOCs) in a Saegertown Municipal Water Authority well about 400 feet west of the Site. The Borough of Saegertown removed the well from service and PA DEP investigated several potential sources of VOCs in the industrial area east of the well, including the LORD, SMC, SCI, and GATX properties (Figure C-2).

In 1984, EPA conducted a site inspection and identified VOCs and polycyclic aromatic hydrocarbons (PAHs) in sediment and soil and VOCs in groundwater. In 1990, the Site's PRPs - LORD, SMC, SCI and GATX - signed an Administrative Order on Consent (AOC) with EPA to conduct a Remedial Investigation/Feasibility Study (RI/FS). EPA listed the Site on the NPL in 1990.

A failed LORD sump tank, RG-1, is believed to be the primary source of groundwater contamination beneath the LORD property. Other possible sources included past releases near the building, tank farm and unloading areas. During the RI/FS, EPA confirmed groundwater contamination beneath the LORD property and soil and sludge contamination at the GATX pond area (Figure C-2). EPA determined these areas were the primary areas of concern. EPA concluded that groundwater at the LORD property posed an unacceptable risk to future on-site residents via ingestion, inhalation and dermal contact. EPA also concluded that the former GATX pond, sludge bed and lagoon areas posed an unacceptable risk to future on-site residents through ingestion of soil contaminants. Analysis of surface water samples from French Creek detected no contaminants of concern (COCs) associated with Site contamination. The RI/FS was completed in 1992.

EPA concluded that potential ingestion, inhalation or dermal contact with contaminants in soil at the SMC and SCI properties would not pose an unacceptable risk to human health or the environment. Groundwater beneath the SMC and SCI properties was not impacted.

Table 1: COC by Media - Site COCs were identified during the RI and presented in the 1993 ROD.

COC	Media
VOCs PCBs Metals PAHs	Sludge and soil
TCE PCE 1,2-DCE Vinyl Chloride	Groundwater
Notes: PCB = polychlorinated biphenyl TCE = trichloroethylene PCE = tetrachloroethylene DCE = dichloroethylene Source: 1993 ROD, page 37	

Response Actions

EPA selected the Site's remedy in a 1993 ROD, and later modified it with two Explanations of Significant Differences (ESDs) in 1995 and 1996, and a ROD Amendment in 2002. The 1993 ROD selected excavation and on-site incineration for sludge and contaminated soil on the former GATX property, and extraction and treatment of groundwater and vacuum extraction in the source area at the LORD property. The 1995 and 1996 ESDs modified the original remedy to allow off-site thermal treatment of GATX wastes. The 2002 ROD Amendment modified the original groundwater remedy to replace groundwater extraction and treatment with in situ enhanced bioremediation of VOCs in groundwater at the LORD property.

In 1996 and 1997, prior to the issuance of the 2002 ROD Amendment, LORD conducted a Pre-Remedial Design investigation to evaluate site hydrogeology and assess groundwater quality. During this investigation, private well PW7, west of French Creek, was found to contain vinyl chloride above the federal drinking water maximum contaminant level (MCL). LORD immediately began providing bottled water to the affected residence and installed a domestic treatment system as required by the Unilateral Administrative Order issued by EPA in February 1997. The PW7 treatment system has been effectively operating since May 1997.

During the Pre-Remedial Design investigation, the PRPs also discovered a second VOC source area at the West Tank Farm on the LORD property in 1996. Under direction from PA DEP, LORD excavated about 800 cubic yards of soil and placed it in an aboveground engineered soil pile for enhanced biological treatment. The PA DEP established cleanup levels, which were attained within one year, and the pile was closed. An in situ bioventing system was installed to address residual VOCs in soil that was left below the West Tank Farm foundations. In less than one year, the system showed an average decrease of about 98 percent in soil vapor concentrations. In October

2016, PA DEP certified the biopile for use as clean fill on the LORD property. If the soil is to be moved off site, the PA DEP will reevaluate. Additional details on this removal were provided in the 2007 FYR report.

The Remedial Action Objectives (RAOs) provided in the 1993 ROD and the 2002 ROD Amendment included:

- Provide adequate protection against:
    1) human consumption of water containing carcinogens and non-carcinogens in excess of the Safe Drinking Water Act (SDWA) MCLs;
    2) a total cancer risk for all carcinogens greater than 1×10^{-4}; and
    3) a total hazard index greater than 1.
- Restore aquifer to conform to Applicable or Relevant and Appropriate Requirements (ARARs).
- Prevent migration of contaminated groundwater to French and Woodcock Creeks.
- Reduce or eliminate migration of subsurface contaminants to groundwater.

The Site's final remedy, as revised by the two ESDs and the 2002 ROD Amendment, consisted of the following components:

- Excavation and off-site incineration of the contaminated soil and sludge from the lagoon, sludge bed and pond areas on the former GATX property.
- Restoration or replacement of the pond and wetland area on the former GATX property.
- Long-term groundwater monitoring on the former GATX property.
- Delineation of the groundwater plume in the vicinity of the LORD property.
- Enhanced bioremediation of VOCs in groundwater using a molasses-based carbon source and analysis of bioattenuation parameters and water quality to monitor performance at the LORD property.
- Ongoing operation and maintenance of the PW7 domestic well treatment system.
- A provision for additional residential treatment systems, if determined necessary.
- Institutional controls, in the form of safety and health management planning and groundwater use restrictions at the LORD property.

The 1993 ROD established a cleanup level for the GATX sludge and soil of 1.0 milligram per kilogram (mg/kg) for total carcinogenic PAHs as benzo(a)pyrene equivalents.

The 2002 ROD Amendment updated the groundwater cleanup standards to SDWA MCLs and slightly revised the list of Site groundwater COCs. Preliminary Remediation Goals (PRGs) were established for several contaminants at levels below the SDWA MCLs to ensure the risk does not exceed EPA guidelines (cancer risk more than 1×10^{-4} or a Hazard Index greater than 1). The groundwater COCs and associated cleanup standards established by the 2002 ROD Amendment are provided in Table 2.

Table 2: Groundwater COC Cleanup Standards

Groundwater COC	2002 ROD Amdt. Cleanup Standard (µg/L)
1,1-DCE	3[b]
Cis-1,2-DCE	50[b]
Trans-1,2-DCE	100[a]
Ethylbenzene	100[b]
Toluene	100[b]
TCE	5[a]
PCE	5[a]
Vinyl Chloride	2[a]

Groundwater COC	2002 ROD Amdt. Cleanup Standard (µg/L)
2-Chlorotoluene	200[c]

Notes:
µg/L = micrograms per liter
a = SDWA MCL
b = PRG established below SDWA MCL to ensure risk does not exceed EPA guidelines
c = A performance standard was established to 200 µg/L to ensure a Hazard Index of less than 1. No federal or state ARAR exists for this COC.

Status of Implementation

The PRPs started remedial action at the GATX property in August 1995 and completed it in July 1997. Cleanup included the removal and off-site incineration of 32,000 tons of soil and sludge from the former lagoon, sludge bed area and the pond area. The PRPs achieved the performance standard in all excavation areas and then backfilled, graded and vegetated the excavated areas. Groundwater monitoring at the GATX property was conducted for one year and then EPA determined additional groundwater monitoring was not necessary. In October 1997, EPA removed the SMC, SCI and GATX properties from the definition of the Site through a partial NPL deletion.

The PRPs completed the remedial action at the LORD property in September 2003. Remedial action construction activities included:

- Installation of 22 carbon source introduction wells within three reactive zones (RZs).
- Construction of two additional monitoring wells.
- Abandonment of 13 monitoring wells/piezometers.
- Construction of a trailer-mounted carbon source solution introduction system.

The location of the three reactive zones (RZ-1, RZ-2 and RZ-3) (Figure 2) were determined based on the groundwater flow at the Site and the location of source areas.

Two modifications were made in 2005 including:

- Installation of four additional introduction wells.
- Adjustment of the concentration and volume of molasses solution to achieve the maximum distribution of carbon-source solution in the subsurface environment.

The PRPs performed molasses solution introductions about nine times per year since implementation of the full-scale remedial system in November 2003. Injections in RZ-2 and RZ-3 were discontinued in June 2010; injections at RZ-1 were discontinued in December 2010 (Figure 2). In December 2013, LORD submitted a bioremediation summary report recommending no further carbon introductions to allow for continued biodegradation of source and daughter contaminants. EPA concurred with the assessment. On February 5, 2017, EPA agreed with the conclusions and recommendations of LORD's "2015 Annual Groundwater Monitoring Report, Saegertown, PA" submitted to EPA on 10 August 2016 that also called for and specified continued groundwater quality monitoring to assess the effectiveness of the bioremediation. In consultation with EPA, LORD will assess the need for further molasses substrate introductions.

Institutional Control Review

The 2002 ROD Amendment required institutional controls to minimize the potential for future exposure to VOCs in groundwater during the remediation period. In the 2002 ROD Amendment, EPA required that LORD maintain its ongoing health and safety program to ensure that proper supervision, monitoring and use of personal protective equipment is continued during any future excavation activities at the Site where groundwater may be encountered. The Borough of Saegertown established a well restriction ordinance in 1979 (Ordinance Number 4, Series 1979) to prohibit construction of groundwater wells within the Borough. This ordinance is specifically identified in the

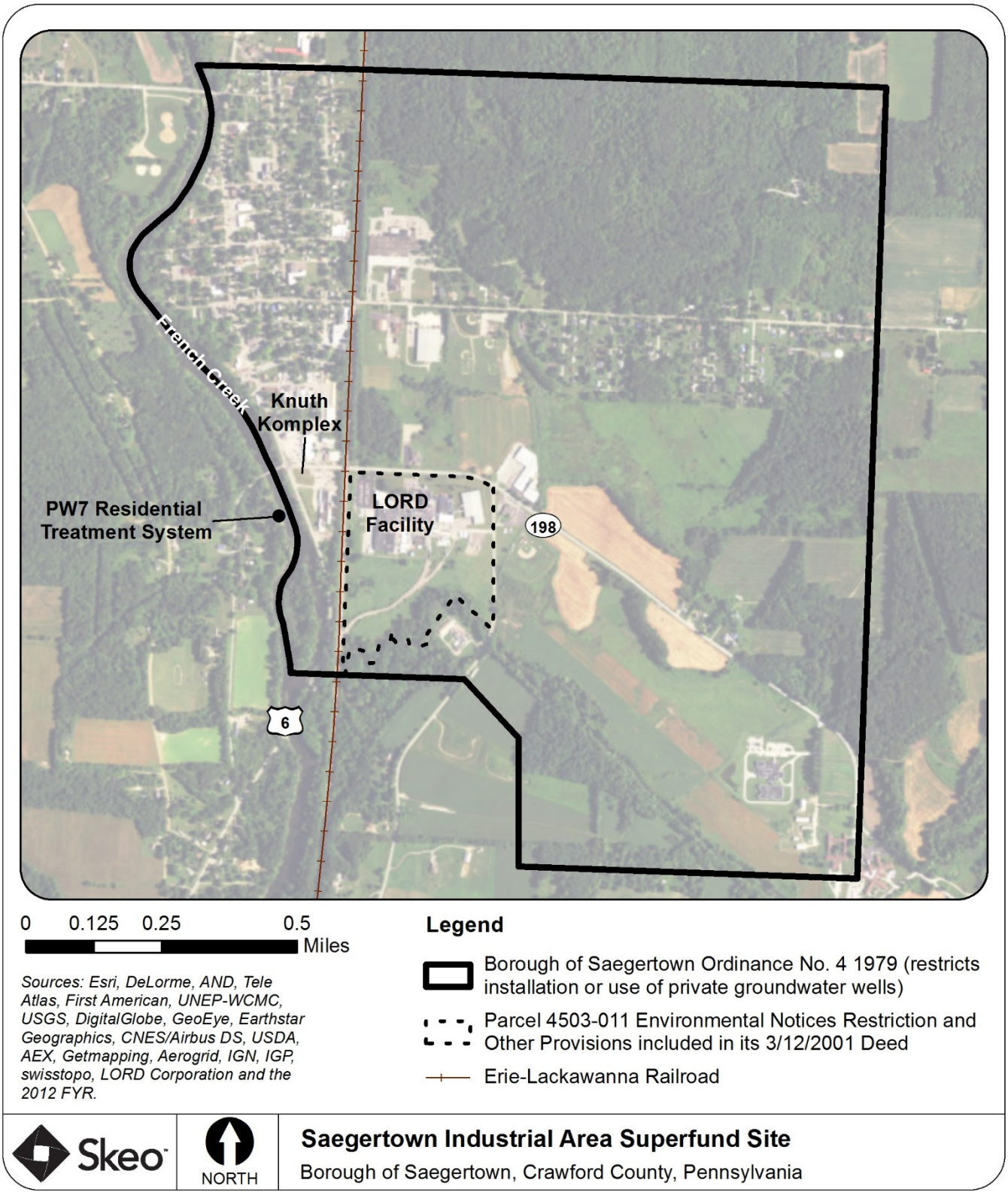
2002 ROD Amendment as a Site institutional control that serves to prevent exposure to potentially impacted groundwater at the Site and between the LORD property and French Creek, which includes the Knuth property (Figure 1). The Borough is responsible for enforcing this ordinance, although there is no formal enforcement process. While not considered an official institutional control, a 2003 Borough ordinance (Ordinance Number 01-2003) makes it mandatory to connect to the public water supply system. It also states that no property owner shall construct, operate, utilize and/or maintain a private well or water system.

The March 2001 deed for the LORD property (parcel number 4503-011) includes Environmental Notices, Restrictions and Other Provisions that restrict groundwater use, limit land use to industrial uses and restrict excavation or disturbance of soils. Groundwater contamination extends to the Knuth property (parcel number 4520-003-2), which is immediately west of the Site. This property does not have a deed restriction; however, it is protected from the installation of wells by the Borough Ordinance, as required in the 2002 ROD Amendment. LORD conducted a well survey in 1997 which indicated there are no wells on the Knuth property.

Table 3: Summary of Implemented Institutional Controls (ICs)

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date
Groundwater	Yes	Yes	4503-011 (LORD property)	Prohibits use of site groundwater for any purpose without PA DEP approval	Environmental Notices, Restriction and Other Provisions in Deed (2001)
				Ensure proper supervision, monitoring and use of personal protective equipment is used during excavation activities where groundwater could be encountered	LORD Site-Specific Health and Safety Plan (2008)
			4520-002-3 (Knuth Property)	Prohibits the construction, drilling, operation or maintenance of private water wells or systems within the Borough of Saegertown	Borough of Saegertown Ordinance Number 4, Series (1979)
Soil	Yes	Yes	4503-011 (LORD Property)	Prohibits residential use and limits land use to industrial. Prohibits excavation or disturbance of surface or subsurface soils, unless under the conditions of an approved health and site safety plan.	Environmental Notices, Restriction and Other Provisions in Deed (2001)

Figure 1: Institutional Control 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.

Systems Operations/Operation & Maintenance (O&M)

The PRP's (LORD's) contractor, Arcadis, performs semi-annual and annual groundwater monitoring. Samples are analyzed for Site COCs and biogeochemical parameters. The remedy in the 2002 ROD Amendment also required the ongoing operation and maintenance of the PW7 water treatment system. In January 2017, EPA approved LORD's request to modify the maintenance schedule for the PW7 treatment system and the sampling frequency for private well PW7 and private wells PW20A and PW19, which are located north and south of PW7, respectively (Figure 2). As of January 2017, Arcadis began quarterly maintenance of the PW7 treatment system and quarterly sampling of well PW7. Quarterly maintenance of the PW7 groundwater treatment system involves maintenance of cartridge filters and the shallow tray air stripper. However, the water softener is still being maintained and system checked on a monthly basis to ensure it is operational. In January 2017, EPA also approved the discontinuation of monitoring for private wells PW19 and PW20A. See the end of the Data Review section for additional information.

The O&M costs during this FYR period are summarized in Table 4. The estimated annual O&M costs presented in the 2002 ROD Amendment for post-enhanced bioremediation monitored natural attenuation and maintenance of the PW7 treatment system was $82,700 per year for 20 years.

Table 4: O&M Costs Over the FYR Period

Date	Total Cost
2012	$178,000
2013	$131,000
2014	$152,000
2015	$121,000
2016	$112,000

III. PROGRESS SINCE THE PREVIOUS REVIEW

This section includes the protectiveness determinations and statements from the previous FYR as well as the recommendations from the previous FYR and the current status of those recommendations.

Table 5: Protectiveness Determinations/Statements from the 2012 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Short-term Protective	The remedy currently protects human health and the environment because soil contamination has been removed, ground water remediation and monitoring is ongoing and there is no exposure to ground water contamination. The following actions have been implemented, in order for the remedy to be protective in the long term, the following actions were taken or will be taken in the future: • Sampling of site monitoring wells is performed pursuant to the 2003 Remedial Design/Work Plan. EPA evaluated a request from Arcadis, consultant for Lord Corporation, to reduce quarterly sampling and initiate semi-annual sampling (twice a year) instead. Quarterly sampling of three private wells west of French Creek and monthly monitoring of PW7 private residential well will continue. • A report will be provided to EPA by November 30, 2013 to summarize all past bioremediation monitoring groundwater data, provide trend diagrams and groundwater figures including historical data and evaluating if more molasses injections are needed and/or if the current treatment areas are sufficient, or if

		they need to be expanded and lastly if any other enhancements with other media need to be injected.

Table 6: Status of Recommendation from the 2012 FYR

OU #	Issue	Recommendation	Current Status	Current Implementation Status Description	Completion Date
1	The in situ bioremediation of ground water has been stopped to evaluate the effectiveness of the groundwater treatment.	The Responsible Party will assess the resulting effects and make a decision regarding whether the in situ bioremediation should be started again in the future or is sufficient and submit a Bioremediation Summary Report that will be provided to EPA by 11/30/2013.	Completed	LORD provided the Bioremediation Summary Report to EPA in November 2013. Arcadis concluded in the report that additional carbon source introductions were not recommended "…at this time." EPA agreed.	11/30/2013

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On June 30, 2017, EPA published a public notice in the Meadville Tribune stating that there was a FYR and inviting the public to submit any Site-related information to EPA. The results of the review and this report will be made available at the Site's information repository, located at Saegertown Area Library, 325 Broad Street, Saegertown, Pennsylvania.

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.

Mr. George Kickel from LORD indicated that he has a very good overall impression of the remedy progress in reducing the size of the groundwater plume and concentrations of contaminants. Mr. Kickel also feels LORD has an excellent working relationship with the Borough of Saegertown and EPA. The PRP contractor representative, Jason Manzo, feels the remedy is effective and performing as expected. The groundwater quality data indicate continued reduction of the VOC source mass. He also reported that concentrations of cis-1,2-DCE and vinyl chloride are persisting, but may be reduced when the environment shifts from anaerobic to aerobic. Mr. Manzo indicated they are optimizing the O&M activities by discontinuing quarterly residential well sampling for private wells PW19 and PW20A, and reducing the monthly monitoring and maintenance of the PW7 system to quarterly.

PA DEP representative John Morettini indicated the PA DEP is satisfied with the progress and current status of the Site. Mr. Morettini mentioned one concern in regards to the remedy resulting in the breakdown of contaminants to vinyl chloride and progress stalling. Overall, he is pleased with LORD's work and communications with the Borough.

Charles Lawrence, Borough manager, feels very well informed of the site status and cleanup. Mr. Lawrence indicated he is vigilant of the institutional controls and groundwater use restrictions within the Borough.

A representative of the homeowner with the PW7 treatment system was also interviewed. The representative reported the homeowner is satisfied with the frequency and content of information received. He reported no vandalism, trespassing or other issues with the treatment system.

Data Review

The PRP contractor conducted in situ bioremediation for groundwater contamination at the Site from 2005 to 2010. Concentrations of COCs, specifically PCE and TCE, decreased significantly in the sources areas. This data review section summarizes groundwater data from 2012-2016 for monitoring wells located on the LORD property and private wells located west of the LORD property.

During this FYR period, the PRP contractor collected annual and semi-annual groundwater data from on-site wells, quarterly samples from the private wells west of French Creek, and monthly samples from the PW7 well treatment system. Arcadis, on behalf of the PRP (LORD), submits monitoring reports to EPA annually. They submitted the most recent report summarizing the 2016 groundwater data in July 2017.

Semi-annual and Annual Groundwater Monitoring

The PRP's contractor, Arcadis, monitors groundwater quality in two aquifer zones: shallow/intermediate and deep. The semi-annual event targets 10 shallow wells and five deep wells. The annual event targets the same 15 wells and an additional 17 wells including one intermediate, four deep, and 12 substrate (molasses) injection wells. Samples are analyzed for site COCs, biogeochemical analytical parameters and field parameters.

In the shallow portion of the aquifer (well depths above 15 feet bgs), COC concentrations in several wells exceeded the cleanup standards during this FYR period (Table 7). Exceedances were observed in nine out of ten shallow wells. The only well without an exceedance was GM-15S (off site on the Knuth property). Generally, exceedances were observed for PCE, TCE, cis-1,2-DCE and vinyl chloride in every reactive zone, as well as side gradient of the source area. All other COCs were not detected above cleanup standards during this FYR period. The 2016 Annual Report provided statistical trend analysis using data from 2011 to 2016. For the shallow portion of the aquifer, no statistically significant trends were observed for any well or COC that exceeded the cleanup standard. The yearly maximum detected concentrations for each well with a COC exceedance in the shallow aquifer zone are shown in Table 7.

One of the RAOs for the Site is to prevent migration of contaminated groundwater to French and Woodcock Creeks. In addition to ensuring stable populations of aquatic biota, the remedy needs to protect individual endangered mussels which are present in both creeks near the site. As shown on Figure E-1, no monitoring wells exist on the western side of the railroad tracks in the southwest direction of shallow groundwater flow. To evaluate the worst case scenario, EPA compared maximum groundwater concentrations in wells on the east side of the railroad tracks to ecological screening values for surface water. While contaminated groundwater may be discharging to surface water, the 2016 maximum concentrations would not pose a risk to aquatic biota.

Table 7: Maximum Detected Concentrations in Shallow Aquifer Zone (2012-2016)

Well Location		Sample Date	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
Cleanup Standard			5	5	50	2
On site – RZ-1 Area	GM-12S	2012	< 2.5	< 2.5	4.1	**7.5**
		2013	< 2.0	0.35 J	8.3	**13**
		2014	< 1.0	0.68 J	1.5	**2.0**
		2015	1.9	0.92 J	3.3	0.44 J
		2016	1.2	0.84 J	5.2	**3.4**
	GM-17S	2012	0.47 J	0.28 J	2.2	**7.6**
		2013	1.1	4.2	27	**20**

Well Location		Sample Date	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
		2014	**30 J**	**25 J**	**590**	**220**
		2015	1.7	2.6	26	**5.0**
		2016	1.4	2.2	13	**3.9**
On site – RZ-2 Area	GMT-1	2012	< 4.0	< 4.0	46	**74**
		2013	< 1.0	< 1.0	0.39 J	0.42 J
		2014	< 1.0	< 1.0	< 1.0	1.1
		2015	< 1.0	< 1.0	< 1.0	0.90 J
		2016	< 1.0	< 1.0	< 1.0	1.9
	W11S	2012	< 29	**8.7 J**	**950**	**630**
		2013	< 20	< 20	**630**	**250**
		2014	< 50	< 50	**900**	**440**
		2015	< 50	< 50	**1,200**	**550**
		2016	< 100	<100	**1,600**	**490**
Western Property Boundary - RZ-3 Area	W7S	2012	0.51 J	1.1 J	**92**	**62**
		2013	0.60 J	< 1.0	1.5	< 1.0
		2014	1.7	< 1.0	0.71 J	< 1.0
		2015	0.85 J	0.85 J	4.5	0.50 J
		2016	0.61 J	1.2	7.2	0.64 J
	GM-13S	2012	< 25	< 25	**120**	**110**
		2013	< 13	2.7 J	**360**	**320**
		2014	< 17	< 17	**270**	**300**
		2015	< 6.7	< 6.7	**150**	**64**
		2016	<33	<33	**530**	**260**
	GM-23S	2012	**9.8**	**7.3**	**54**	0.52 J
		2013	3.7	2.9	48	**8.8**
		2014	**22**	**7.4**	**53**	< 2.0
		2015	4.5	**6.7**	**74**	**3.3**
		2016	**6.8**	2.2	38	1.5 J
Side-gradient Property Boundary	W8S	2012	NS	NS	NS	NS
		2013	**6.9**	1.3	0.85 J	<1.0
		2014	3.7	0.95 J	0.57 J	< 1.0
		2015	4.6	1.0	0.75 J	< 1.0
		2016	**5.2**	0.98 J	1.1	<1.0
	GM-14S	2012	NS	NS	NS	NS
		2013	**19**	0.76 J	0.65 J	< 1.0
		2014	**13**	0.45 J	< 1.0	< 1.0
		2015	**14**	0.60 J	0.26 J	< 1.0
		2016	**14**	0.50 J	0.44 J	<1.0
Off-site Downgradient (East of French	GM-15S	2012	NS	NS	NS	NS
		2013	0.43 J	< 1.0	< 1.0	< 1.0
		2014	0.40 J	0.36 J	1.1	< 1.0
		2015	0.49 J	0.36 J	< 1.0	< 1.0

Well Location		Sample Date	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
		2016	0.55 J	0.50 J	0.30 J	<1.0

Notes:
ND = Not detected, detection limit not specified
NS = Not sampled
J = Estimated concentration
Bold = Exceeds the cleanup standard

During this FYR period, the shallow wells with the highest VOC concentrations were GM-17S, W11S, GM-13S, GM-23S and GM-14S. Wells GM-13S (at the western property boundary) and W11S (RZ-2 area) have the highest concentrations of cis-1,2-DCE and vinyl chloride, which are degradation products of PCE and TCE. COC concentrations at GM-13S and W11S fluctuate seasonally, with higher concentrations in the spring and lower concentrations in the fall (Table C-1 in the 2016 Annual Report). After the cessation of the molasses injections in 2010, cis-1,2-DCE and vinyl chloride concentrations increased and have remained elevated in these wells indicating ongoing degradation of PCE and TCE.

Wells GM-23S (located at the western property boundary) and GM-14S (located at the southwestern property boundary) have the highest consistent concentrations of PCE during this FYR period. PCE and TCE concentrations at wells W11S and GM-13S were not detected; however, detection limits were sometimes above the cleanup standards. Well GM-17S (RZ-1 area) had the highest concentration of PCE and TCE in 2014; however, the results were estimated due to high concentrations of other COCs. Concentrations returned to below PRGs in the next sampling event. Well W8S had two exceedances of the PCE PRG, once in 2013 and once in 2016. Well GM-23S has exceeded for PCE, TCE, cis-1,2-DCE and vinyl chloride during this FYR period. It is located along the western property boundary; however, monitoring well GM-15S, located on the Knuth property, is downgradient of well GM-23S. This well has concentrations below PRGs for all site COCs (Table C-1 in the 2016 Annual Report).

Side-gradient shallow monitoring well GM-14S has concentrations that have exceeded the PCE PRG since October 2007. This well is not within the reactive zones and is on the southern and western edge of the contamination. There is not another well downgradient of GM-14S (Appendix E, Figure E-1). PCE in this well increased above the cleanup standard in 2009 and has remained relatively stable over time. GM-14S is within the site boundaries and possibly represents a small residual source area.

Trend charts for select monitoring wells are provided in Appendix E for GM-12S, GM-17S, GMT-1, W11S and GM-23S (Figures E-2 through E-6).

In the intermediate portion of the aquifer (well depths between 15 and 40 feet bgs), there have been no exceedances of the cleanup standards in monitoring wells GM-20I and GM-22I. Well GM-22I was abandoned, with EPA approval, in 2015 due to interference with a Pennsylvania Department of Transportation roadway expansion project.

In the deep portion of the aquifer (well depths deeper than 40 feet bgs or screened at the bedrock interface), several wells have COC concentrations above PRGs during this FYR period (Table 8). Cleanup goal exceedances were observed in four wells. Statistical analysis of data from 2011 to 2016, included in the 2016 Annual Report, identified increasing trends in GM-11D (vinyl chloride) and GM13D (TCE and cis-1,2-DCE). Well GM-11D (on site) and GM-15D (off site at the Knuth property) had the highest concentrations of vinyl chloride (92 µg/L and 53 µg/L, respectively) and cis-1,2-DCE. Well GM-15D also has the highest concentrations of TCE (19 µg/L). Well GM-13D (at the western property boundary) has the highest concentrations of PCE (14 µg/L); concentrations of TCE and cis-1,2-DCE have increased since 2011. Well GM-20D has exceeded the vinyl chloride cleanup standard every year during this FYR period. This well is off the LORD property, near private well PW7. Based on the groundwater potentiometric surface maps from the most recent report, groundwater in

GM-20D, GM-15D and GM-13D in the deep portion of the aquifer is flowing toward French Creek and not further off the LORD property (Appendix E, Figure E-7).

Table 8: Maximum Detected Concentrations in Deep Aquifer Zone (2012-2016)

Well Location		Sample Date	PCE (µg/L)	TCE (µg/L)	Cis-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)
		Cleanup Standard	5	5	50	2
On site	GM-11D	2012	< 1.4	< 1.4	30	**21**
		2013	< 2.9	< 2.9	**81**	**90**
		2014	< 5.0	< 5.0	**86**	**70**
		2015	< 5.7	< 5.7	**140**	**99**
		2016	<4.0	<4.0	**85**	**92**
Western Property Boundary	GM-13D	2012	**10**	4.4	33	< 1.0
		2013	**10**	4.5	**79**	< 1.7
		2014	**6.7**	3.8	**72**	< 3.3
		2015	**7.3**	**5.1**	**92 J**	< 3.3
		2016	**14**	**12**	**170**	<5.0
Off site (West of French Creek)	GM-15D	2012	< 6.7	**28**	**170**	**26**
		2013	< 8.0	**39**	**200**	**29**
		2014	< 10	**26**	**170**	**17**
		2015	< 6.7	**21**	**150**	**41**
		2016	<8.0	**19**	**150**	**53**
	GM-20D	2012	< 1.0	< 1.0	6.6	**11**
		2013	< 1.0	< 1.0	4.8	**5.1**
		2014	< 1.0	< 1.0	4.1	**4.0**
		2015	< 1.0	< 1.0	4.6	**4.5**
		2016	<1.0	<1.0	5.2	**5.9**

Notes:
ND = Not detected, detection limit not specified
J = Estimated concentration
Bold = Exceeds the cleanup standard

During the semiannual and annual monitoring events, seven shallow wells are sampled to evaluate biogeochemical conditions of groundwater in the reactive zones. The key findings, as summarized in the 2016 Annual Report, indicate that conditions are mildly reducing with low total organic carbon under mildly anaerobic conditions. Detections of ethane and ethene in the groundwater indicate that the biological reductive dechlorination process is continuing.

Despite some indications of biodegradation (increases in ethane and ethene) in shallow well W11S (Appendix E, Figure E-2), concentrations of cis-1,2-DCE and vinyl chloride have remained elevated in this well. Other wells, including downgradient shallow and deep wells, have sustained elevated concentrations of COCs. Downgradient wells GM-13S and GM-13D and on-site well GM-11D appear to have increasing concentrations of COCs (Table 7 and 8). Due to the persistence of cis-1,2-DCE, vinyl chloride, PCE and TCE since cessation of molasses injections in 2010, the remedy should be closely monitored and optimized as needed. Optimization may include, but not be limited to, additional substrate (molasses) injections.

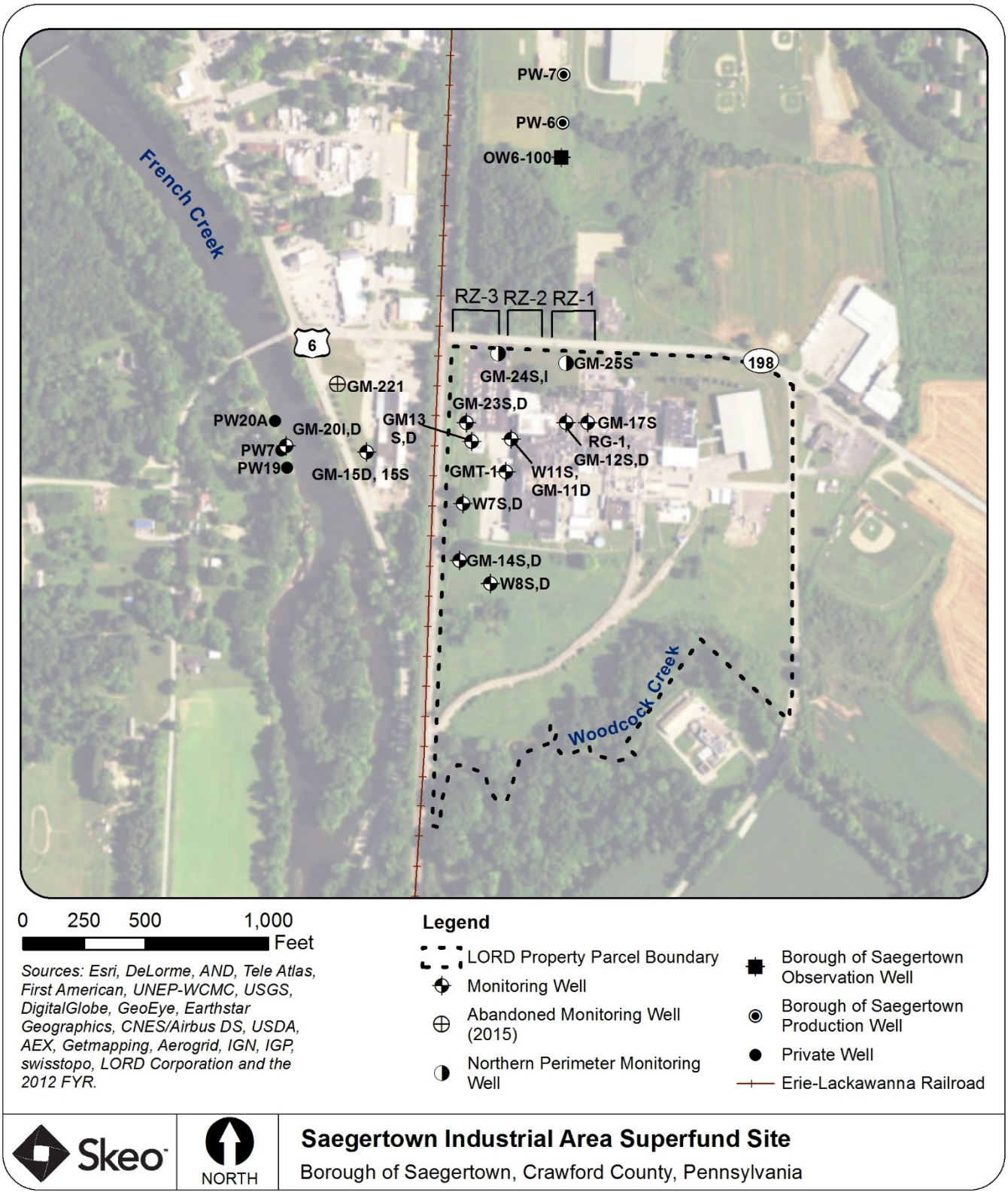
During this FYR period, the PRP contractor conducted private water supply sampling for wells PW7 and PW19. Results are compared to the MCLs.

Between the startup of the groundwater treatment system at PW7 in 1997 and January 2017, three system samples have been collected monthly (influent from well: SP-1, intermediate: SP-3, and effluent: SP-5) and analyzed for the COCs. Cis-1,2-DCE and vinyl chloride are frequently detected in the influent (SP-1); however, there have been no exceedances of the respective cleanup standards since 2013. No VOCs were detected above cleanup performance standards at SP-3 or SP-5 during this FYR period, indicating the treatment system is working properly.

The results of the quarterly monitoring at residential wells PW19 and PW20 indicated that concentrations of VOCs in groundwater in these wells were below laboratory reporting limits which were below the cleanup performance standards. VOCs have not been detected in private wells PW19 and PW20A since 2002.

On January 23, 2017, in response to LORD's request of December 20, 2016, EPA approved a reduced sampling and maintenance schedule for PW7 from monthly to quarterly and the discontinuation of sampling private wells PW19 and PW20A.

Figure 2: Detailed Site 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.

Site Inspection

The site inspection took place on February 28, 2017. In attendance were Stephen Tyahla (EPA RPM), Ryan Bower (EPA hydrogeologist), Martin Gehlhaus (EPA toxicologist), Cathleen Kennedy and Amanda Miles (EPA community involvement coordinators); Charles Tordella and John Morettini of the PA DEP; George Kickel, JR Nordstrom and Brad Gibson of LORD; Jason Manzo and Carolyn Grogan of Arcadis (LORD contractor); and Melissa Oakley and Alison Cattani from Skeo (EPA support contractor). The purpose of the inspection was to assess the protectiveness of the remedy.

Site inspection participants met in the LORD plant conference room at the start of the inspection. Arcadis and LORD representatives gave an overview of the history and current conditions at the Site. Site inspection participants then met with Brad Gibson, LORD Plant Manager, for a tour of the facility. Monitoring wells and injection wells were observed, as was the West Tank Farm area, the Courtyard Tank Farm area and the former RG-1 sump area. The on-site monitoring wells are located below grade beneath a steel cover. The steel cover on monitoring well GM-17S was observed underwater. The steel cover appears to be preventing water from pooling within the inner well enclosure. The injection wells are above-grade and were in good condition. The Site is surrounded by a security fence that was observed to be in good condition.

Site inspection participants then proceeded to the Saegertown Municipal Building to meet with Borough of Saegertown Manager Chuck Lawrence. Mr. Lawrence confirmed the well restriction ordinance is still in place. Regarding the enforcement of the ordinance, he indicated that due to the size of the town, he would be made aware if a private well were installed. Mr. Lawrence presented some information on the public water supply wells that service the Borough. Mr. Lawrence indicated that wells are sampled annually for VOCs. If there is a detection of an analyte, quarterly samples are collected from that well to ensure the contaminant does not persist. According to Mr. Lawrence, with the exception of one detected VOC (not a site COC) that may have been due to laboratory error, results have always been below detection for VOCs. Site participants then observed the public supply wells PW-6 and PW-7 and the Borough's water treatment system.

EPA CICs confirmed that site-related records and instructions on accessing the Administrative Record are in place at the site repository at the Saegertown Area Library.

V. TECHNICAL ASSESSMENT

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

Question A Summary:

Yes, the remedy is generally functioning as intended by the decision documents. There are no complete exposure pathways at the Site. Source area soil and sludge at the former GATX property were excavated and incinerated off site. Three private wells (located outside the Borough ordinance) have been sampled historically; one is still currently sampled. Private well PW7 has a treatment system that is effective at removing low levels of cis-1,2-DCE and vinyl chloride, which continue to decrease. VOCs have not been detected in private wells PW19 and PW20A since 2002.

The in situ molasses injections were conducted to remediate VOCs in groundwater on site. The injections were discontinued in 2010 and long-term groundwater monitoring is occurring. Based on 2016 groundwater data, concentrations of COCs remain above performance standards in nine groundwater monitoring wells located on LORD's property (GM-12S, GM-13S, GM-13D, GM-14S, GM-23S, GM-11D, W11S, W8S and GM-17S) and two groundwater monitoring wells located downgradient (GM-15D and GM-20D). Based on 2016 groundwater data, concentrations of cis-1,2-DCE and vinyl chloride (daughter products of PCE and TCE reductive dechlorination) remain above performance standards in several shallow and deep wells. Statistical analysis of data from 2011 to 2016, included in the 2016 Annual Report, identified increasing trends in COC concentrations at GM-11D (vinyl chloride) and GM13D (TCE and cis-1,2-DCE). Based on 2016 groundwater data, PCE remains

above its performance standard in wells GM-23S, GM-13D, GM-14S and W8S, and TCE remains above its performance standard in wells GM-13D and downgradient well GM-15D. Due to the persistence of cis-1,2-DCE, vinyl chloride, PCE and TCE, the remedy effectiveness should be closely monitored and optimized as needed.

Routine O&M is conducted regularly at the Site and is adequate. The institutional controls in place at the Site include deed restrictions on the Site property and Borough ordinances to restrict private wells. The ordinance to restrict private well installation is in place and active; however, there is no protocol in place to prevent well installation. While not considered an official institutional control, the 2003 Borough ordinance (Ordinance Number 01- 2003) makes it mandatory to connect to the public water supply system and further prohibits well installation.

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 pathways, cleanup levels and RAOs used at the time of the remedy selection are still valid. Although the toxicity values for some COCs have changed, these changes do not affect the protectiveness of the cleanup goals for groundwater as described below. Vinyl chloride concentrations at some on-site wells have increased and a vapor intrusion screening level risk assessment, performed as part of this FYR and discussed below, indicates that COCs are not likely present at concentrations that would pose a current risk for vapor intrusion at the LORD facility.

Changes in Exposure Pathways
The exposure pathways evaluated in decision documents included soil and groundwater exposure to future on-site residents and remain valid. The vapor intrusion pathway was evaluated in 2010 in a memo to the file. This exposure pathway also remains valid; however, some contaminant concentrations have increased near the buildings since 2010 (see Changes in Toxicity and Other Contaminant Concentrations below).

Changes in Standards and TBCs
The 2002 ROD Amendment established SDWA MCLs as groundwater ARARs. A detailed ARAR review was conducted by comparing the original ARARs to the current federal MCLs (Table D-1 in Appendix D). There have been no changes and these ARARs remain valid.

Changes in Toxicity and Other Contaminant Concentrations
This FYR included a screening-level risk evaluation of the groundwater cleanup goals by comparing the goals to residential Regional Screening Levels (RSLs) to determine whether they remain valid (Appendix F). Except for vinyl chloride, all cancer risks are within EPA's acceptable risk range. The cleanup goal for vinyl chloride is the MCL, which is equivalent to a cancer risk of 1.1×10^{-4} which is slightly above EPA's upper boundary for excess lifetime cancer risk of 1×10^{-4}. In addition, except for cis-1,2-DCE and TCE, all non-cancer hazard quotients (HQs) are below the non-cancer cumulative hazard index (HI) of 1.0. The cleanup goals for cis-1,2-DCE and TCE exceed the acceptable non-cancer HQ of 1 with HQs of 4.2 and 1.8, respectively, when accounting for target organ effects non-cancer (Appendix F, Table F-1).

Since the Site is still within the long-term monitoring period and there are several wells that exceed the current cleanup goals for cis-1,2-DCE, TCE, and vinyl chloride, these cleanup goals do not need to be reevaluated at this time. As groundwater quality improves and approaches cleanup goals, cleanup goals should be reassessed to ensure the Site-wide risk does not exceed EPA guidelines (cancer risk more than 1×10^{-4} or a Hazard Index greater than 1). COC concentrations at the private wells are compared to the current SDWA MCLs.

The soil cleanup level was for total carcinogenic PAHs. This FYR compared the soil cleanup goal to the residential RSL for benzo(a)pyrene (Appendix F). The results were within EPA's acceptable risk range (1×10^{-4} to 1×10^{-6}) (Appendix F, Table F-2). The soil cleanup level remains valid.

In 2010, EPA published a memo to the file pertaining to vapor intrusion at the former industrial building identified as the Knuth property (located immediately west of the LORD facility) and at the LORD facility. Vapor intrusion is not expected to be a concern at the residential properties west of French Creek because contamination in that areas is limited to the deep zone. Based on the groundwater monitoring data and indoor air monitoring at the LORD facility at that time, EPA concluded that further action for vapor intrusion was not warranted. Since 2010, some on-site groundwater COC concentrations have increased, such as vinyl chloride. Using 2016 groundwater monitoring data, a vapor intrusion screening-level risk assessment was performed as part of this FYR. The assessment focused on two areas: the Knuth property and the LORD facility. The screening-level risk assessment for the Knuth property indicated shallow groundwater that underlies the building does not currently exhibit site-related COC concentrations at levels of concern for vapor intrusion (Appendix F, Table F-5). The screening-level risk assessment for the LORD facility indicated that concentrations of vinyl chloride in shallow groundwater in monitoring well W11S, near but downgradient of the buildings, occur at levels that may pose a potential risk for vapor intrusion (Table F-3, Figure F-1). However, in 2016, the shallow reactive zone wells were also analyzed for VOCs. Two of these wells, RZ2-B and RZ2-C, are located between W11S and the building and do not exhibit vinyl chloride concentrations at levels of concern for vapor intrusion (Table F-4 and Figure F-1). In addition, the only COC detected during 2016 in well GMT-1 (Figures E-8 and F-1), the other RZ2 shallow monitoring well, was vinyl chloride at concentrations of 0.75J and 1.9 µg/L (very similar to the concentrations detected in wells RZ2-B and RZ2-C). Based on the most recent (2016) concentrations of vinyl chloride in the reactive zone wells located near the building, groundwater COCs in the wells closest to the building do not occur at levels that pose a current risk for vapor intrusion; however, the concentration of vinyl chloride in monitoring well W11S is such that vapors from this area, if migrating towards and intruding in the LORD facility, could present a future risk (See Table F-3). While groundwater quality is expected to improve, data collected from the ongoing groundwater monitoring program will continue to be reviewed for changes that may affect the potential for vapor intrusion.

As reported in the 1993 ROD, LORD used solvents in their manufacturing processes that included trichloroethane (TCA). An emerging contaminant, 1,4-dioxane, was often used as a stabilizer for TCA. As reported in the 2012 FYR report, RI groundwater sampling at the LORD facility detected 1,1,1-TCA. During this review, EPA inquired whether Site groundwater has been analyzed for 1,4-dioxane. LORD informed EPA that sampling for 1,4-dioxane had been performed in October 2003 at EPA's request with results included in a "Remedial System Installation and Groundwater Monitoring Report" prepared by Arcadis and issued to EPA in May 2004. EPA reviewed the report during this five-year review and requested information on the 1,4-dioxane reporting limits that were not specified in the 2004 report. LORD provided EPA with the relevant 2003 laboratory reports as well as a summary of the reporting and method detection limits for 1,4-dioxane. EPA reviewed the data and found that additional sampling for 1,4-dioxane was not necessary.

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

No other information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues and Recommendations Identified in the FYR:

OU(s): 1	**Issue Category: Remedy Performance**
	Issue: Certain COCs remain above remedy performance standards in nine groundwater monitoring wells located on LORD's property (GM-12S, GM-13S, GM-13D, GM-14S, GM-23S, GM-11D, W11S, W8S and GM-17S) and two groundwater monitoring wells located downgradient (GM-15D and GM-20D).

	Recommendation: The remedy's performance should be monitored and optimized as needed. Optimization may include, but not be limited to, additional substrate (molasses) injections.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2018

OTHER FINDINGS

The following recommendations were identified during the FYR but do not affect current or future protectiveness.

- *The institutional controls in place at the Site include deed restrictions for the site property and the 1979 and 2003 Borough ordinances. The 1979 ordinance prohibits the installation of private water supply wells. Enforcement of that Borough ordinance may be inadequate to prevent the installation of water supply wells. The use of an additional, informational institutional control should be considered, such as a letter to nearby well drillers informing them of the ordinance.*

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
Operable Unit: 1	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at the Site currently protects human health and the environment because soil contamination has been removed, groundwater remediation and monitoring are ongoing and there is no exposure to groundwater contamination. However, in order for the remedy to be protective over the long-term, the remedy's performance should be monitored and optimized as needed. Optimization may include, but not be limited to, additional substrate (molasses) injections.	

VIII. GOVERNMENT PERFORMANCE AND RESULTS ACT MEASURES

As part of this five-year review, the Government Performance and Results Act (GPRA) Measures have been reviewed. The GPRA Measures and their status are as follows:

Environmental Indicators
Human Health: Human Exposure Controlled and Protective Remedy in Place
Groundwater Migration: Contaminated Groundwater Migration Under Control

Sitewide Ready for Anticipated Use (SWRAU)
The Site has achieved SWRAU.

IX. NEXT REVIEW

The next FYR Report for the Saegertown Industrial Superfund site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

2003 Remedial Design/Work Plan, LORD Corporation, Saegertown Industrial Area Superfund Site, Saegertown, Pennsylvania, September 2003

2012 Remedial System Performance and Annual Groundwater Monitoring Report, LORD Corporation, Saegertown, Pennsylvania, May 9, 2013.

2013 Remedial System Performance and Annual Groundwater Monitoring Report, LORD Corporation, Saegertown, Pennsylvania, May 28, 2014.

2014 Remedial System Performance and Annual Groundwater Monitoring Report, LORD Corporation, Saegertown, Pennsylvania, April 24, 2015.

2015 Annual Groundwater Monitoring Report, LORD Corporation, Saegertown, Pennsylvania, August 10, 2016.

Bioremediation Summary Report, Saegertown, Pennsylvania, November 2013.

2016 Annual Groundwater Monitoring Report, LORD Corporation, Saegertown, Pennsylvania, July 7, 2017.

Borough of Saegertown, County of Crawford, Commonwealth of Pennsylvania, Ordinance No. 4, 1979.

Borough of Saegertown, County of Crawford, Commonwealth of Pennsylvania, Ordinance No. 01-2003.

EPA Superfund Record of Decision Amendment: Saegertown Industrial Area, EPA ID: PAD980692487, OU 01, Saegertown, PA, September 30, 2002.

EPA Superfund Record of Decision, Saegertown Industrial Area, EPA ID: PAD980692487 OU 01, Saegertown, PA, January 29, 1993.

Explanation of Significant Differences, Saegertown Industrial Area Site, March 9, 1995.

Five-Year Review Report, Saegertown Industrial Area Superfund Site, Saegertown, Pennsylvania, August 6, 1997.

Fourth Five-Year Review Report, Saegertown Industrial Area Superfund Site, LORD Corporation property, Borough of Saegertown, Crawford County, Pennsylvania, EPA ID: PAD980692487, September 12, 2012.

Memo to file regarding vapor intrusion evaluation for Saegertown Industrial Area Site, from Mitch Cron, EPA RPM, September 13, 2010.

Revised Interim Remedial Action Report, LORD Corporation, Saegertown, Pennsylvania, September 2005.

Second Five-Year Review Report, Saegertown Area Industrial Superfund Site, Borough of Saegertown, Crawford County, Pennsylvania, September 19, 2002.

Superfund Preliminary Close Out Report, Saegertown Industrial Area Superfund Site, Saegertown, Crawford County, Pennsylvania, March 15, 2004.

Third Five-Year Review Report, Saegertown Industrial Area Superfund Site, LORD Corporation property, Borough of Saegertown, Crawford County, Pennsylvania, EPA ID: PAD980692487, September 19, 2007.

Well Study Report, LORD Corporation, Saegertown, Pennsylvania, July 1997.

Remedial System Installation and Groundwater Monitoring Report, LORD Corporation, Saegertown, Pennsylvania, Arcadis, May 2004.

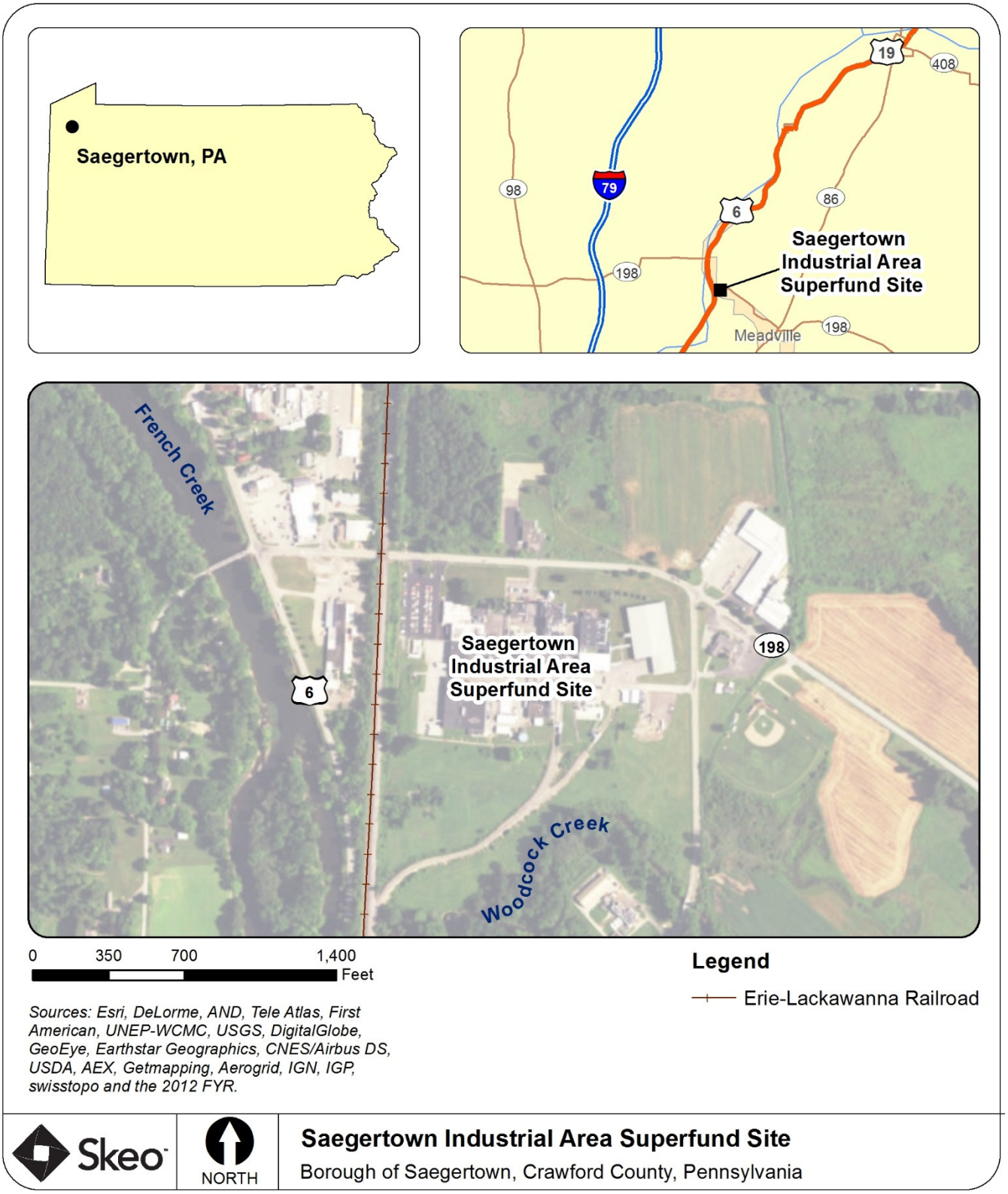
APPENDIX B – SITE CHRONOLOGY

Table B-1: Site Chronology

Event	Date
Initial discovery of groundwater contamination	June 1980
State analysts discovered VOCs in a Saegertown Municipal Water Authority well (Well #2)	July 1980
EPA performed Site Inspection: testing identified VOCs and PAHs in on-site pond sediments and soil	July 1984
Site proposed to the NPL	June 24, 1988
LORD, SMC, SCI and GATX signed an AOC with EPA to conduct a RI/FS	January 31, 1990
EPA listed the Site on the NPL	February 21, 1990
EPA completed the RI/FS	October 13, 1992
EPA signed the ROD	January 29, 1993
EPA issued Consent Decree	March 15, 1994
PRP started Remedial Design for GATX property	September 27, 1994
EPA issued first ESD	March 9, 1995
EPA issued Consent Decree	July 31, 1995
PRP completed Remedial Design for GATX property PRP started Remedial Action for GATX property	August 8, 1995
EPA issued second ESD	March 1, 1996
EPA issued Unilateral Administrative Order requiring LORD to install a domestic well treatment system	February 13, 1997
PRP completed Remedial Action for GATX property	July 8, 1997
EPA issued the first FYR	August 6, 1997
Notice of Partial Deletion for SMC, SCI and GATX properties	October 6, 1997
EPA issued the second FYR	September 19, 2002
EPA issued a ROD Amendment for the Site's LORD property	September 30, 2002
PRP completed construction of the physical features of the in situ groundwater bioremediation system at the LORD property	September 2003
EPA issued a Preliminary Closeout Report	March 15, 2004
PRP installed four additional introduction wells at the LORD property and discontinued use of subsurface "Courtyard Area Lateral" pipes (located downgradient from the Courtyard Tank Farm) as carbon source solution introduction points	July 2005
PRP adjusted concentration and volumes of molasses solution to achieve maximum distribution of carbon-source solution in the subsurface environment	October 2005
EPA issued the third FYR	September 18, 2007
PRP discontinued in situ molasses solution injections on two reactive zones (RZ-2 and RZ-3)	June 2010
PRP discontinued in situ molasses solution injections on the last reactive zone (RZ-1)	December 2010
EPA issued the fourth FYR	September 12, 2012

APPENDIX C – SITE MAPS

Figure C-1: Site Vicinity Map

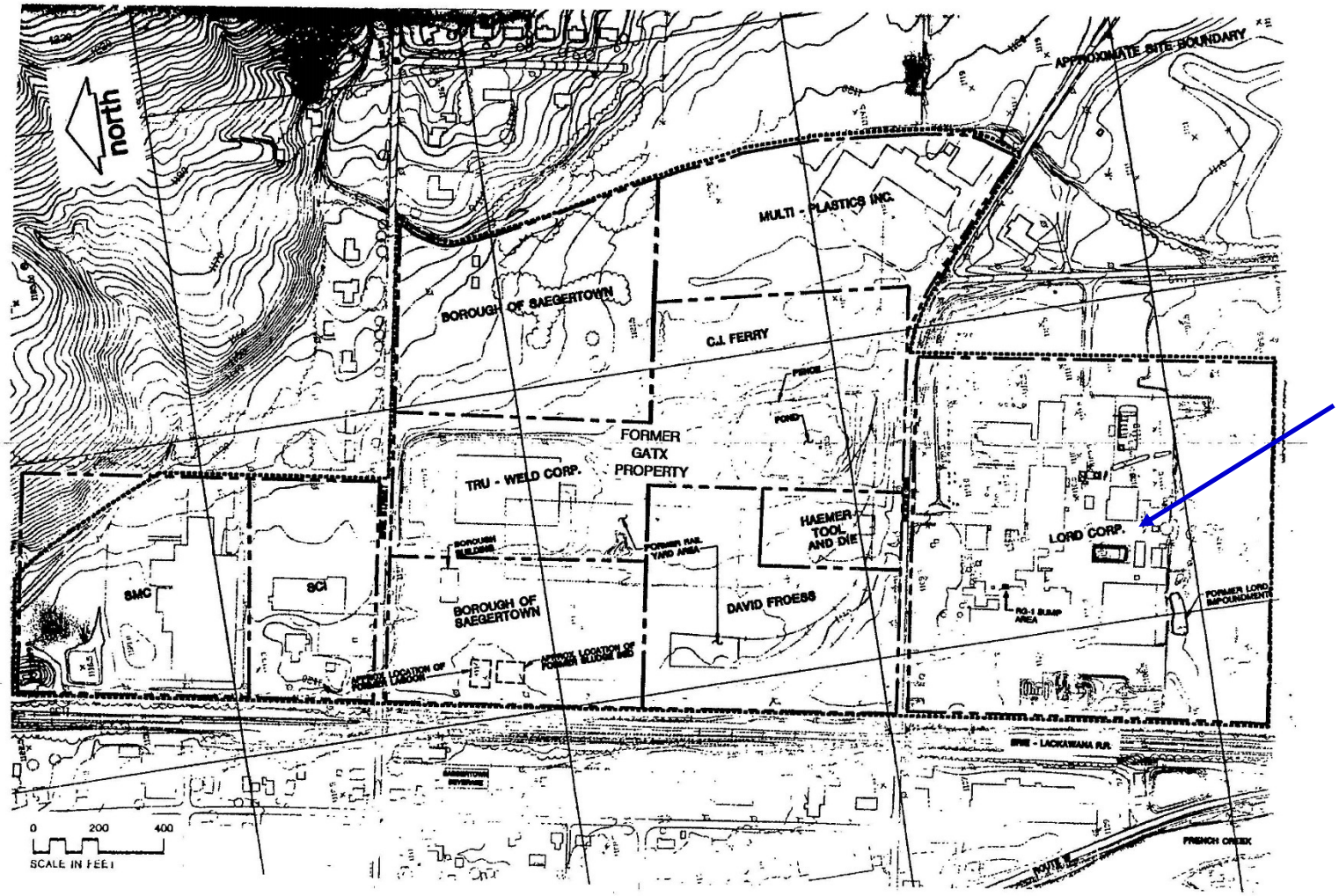


Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site.

Figure C-2: Historic Site Properties[1]

Figure 3

SAEGERTOWN INDUSTRIAL AREA SITE MAP



[1] 1993 ROD, Figure 3

APPENDIX D – DETAILED ARARs REVIEW TABLE

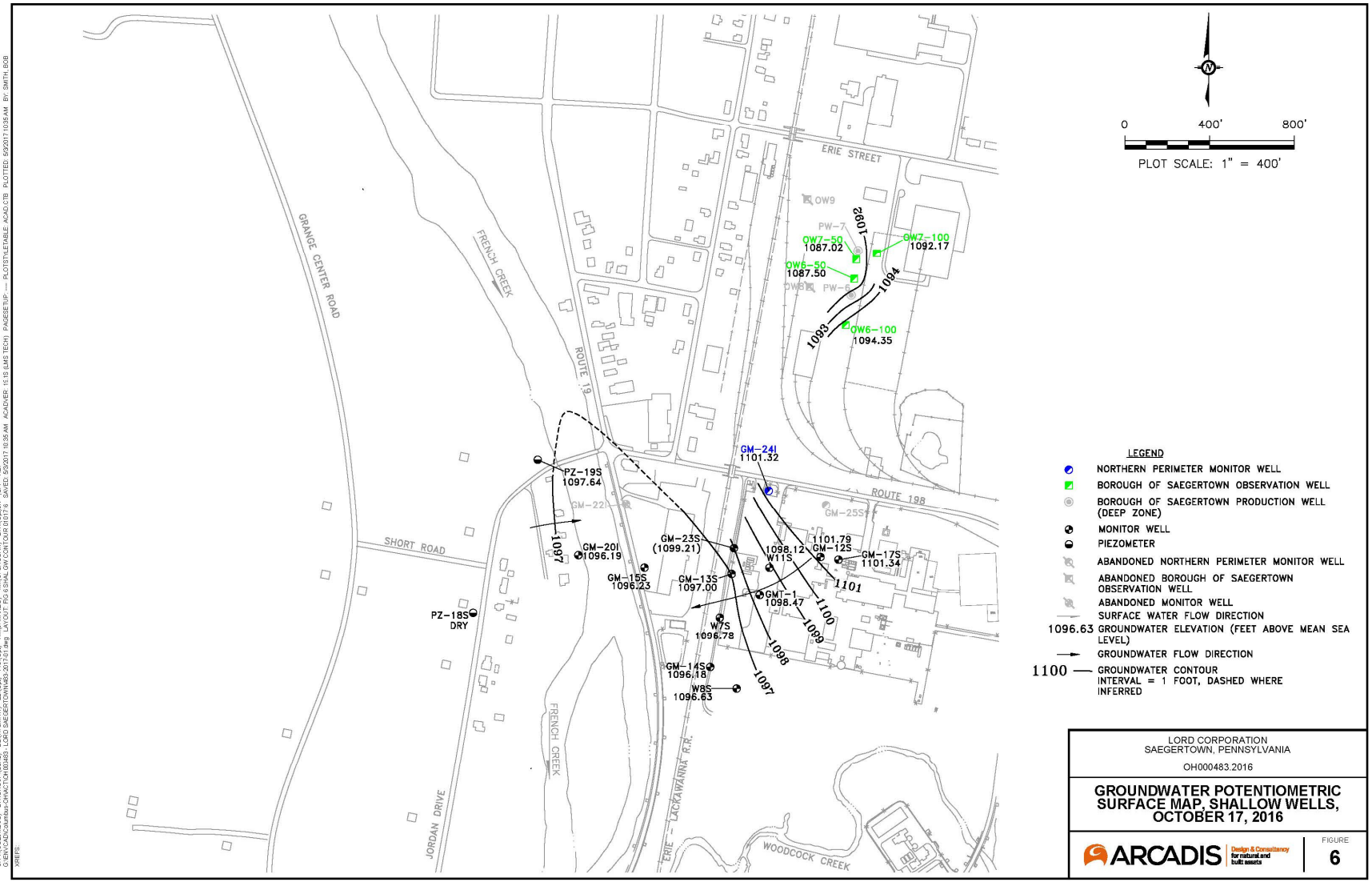
Table D-1: Groundwater COC ARARs Review

Groundwater COC [a]	2002 SDWA MCL (µg/L)	2002 ROD Amendment Performance Standard (µg/L)	Current MCL [b] (µg/L)
1,1-DCE	7	3	7
Cis-1,2-DCE	70	50	70
Trans-1,2-DCE	100	100	100
Ethylbenzene	700	100	700
Toluene	1,000	100	1,000
TCE	5	5	5
PCE	5	5	5
Vinyl chloride	2	2	2
2-Chlorotoluene	--	200	--

Notes:
a = Groundwater COC list established by the 2002 ROD Amendment.
b = EPA National Primary Drinking Water Regulations MCL obtained from:
https://www.epa.gov/sites/production/files/2016-06/documents/npwdr_complete_table.pdf
(accessed 1/26/2017)
-- ARAR not established/no MCL.
µg/L = micrograms per liter

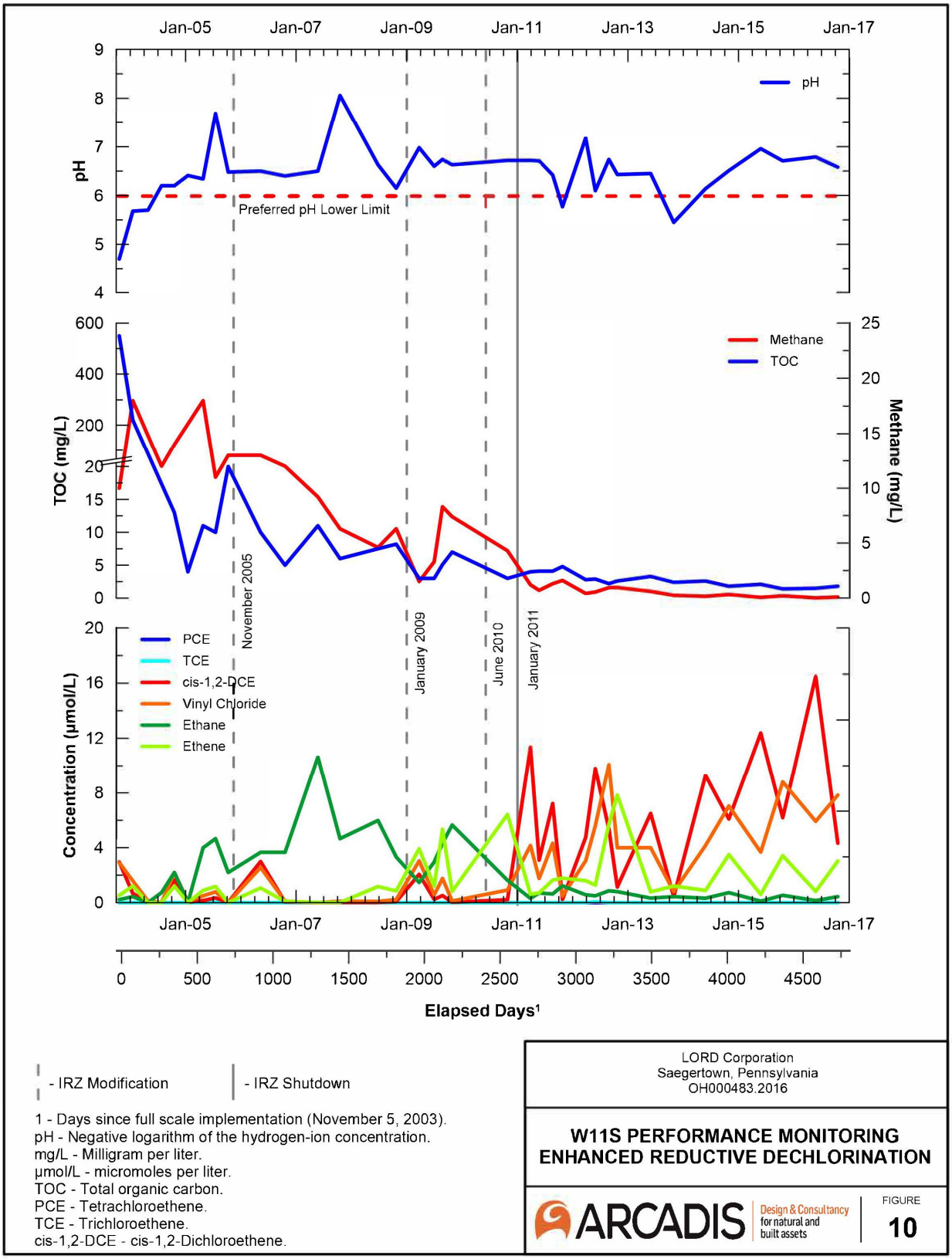
APPENDIX E – DATA ANALYSIS FIGURES[2]

Figure E-1: Groundwater Potentiometric Surface Map, Shallow Wells, October 2016



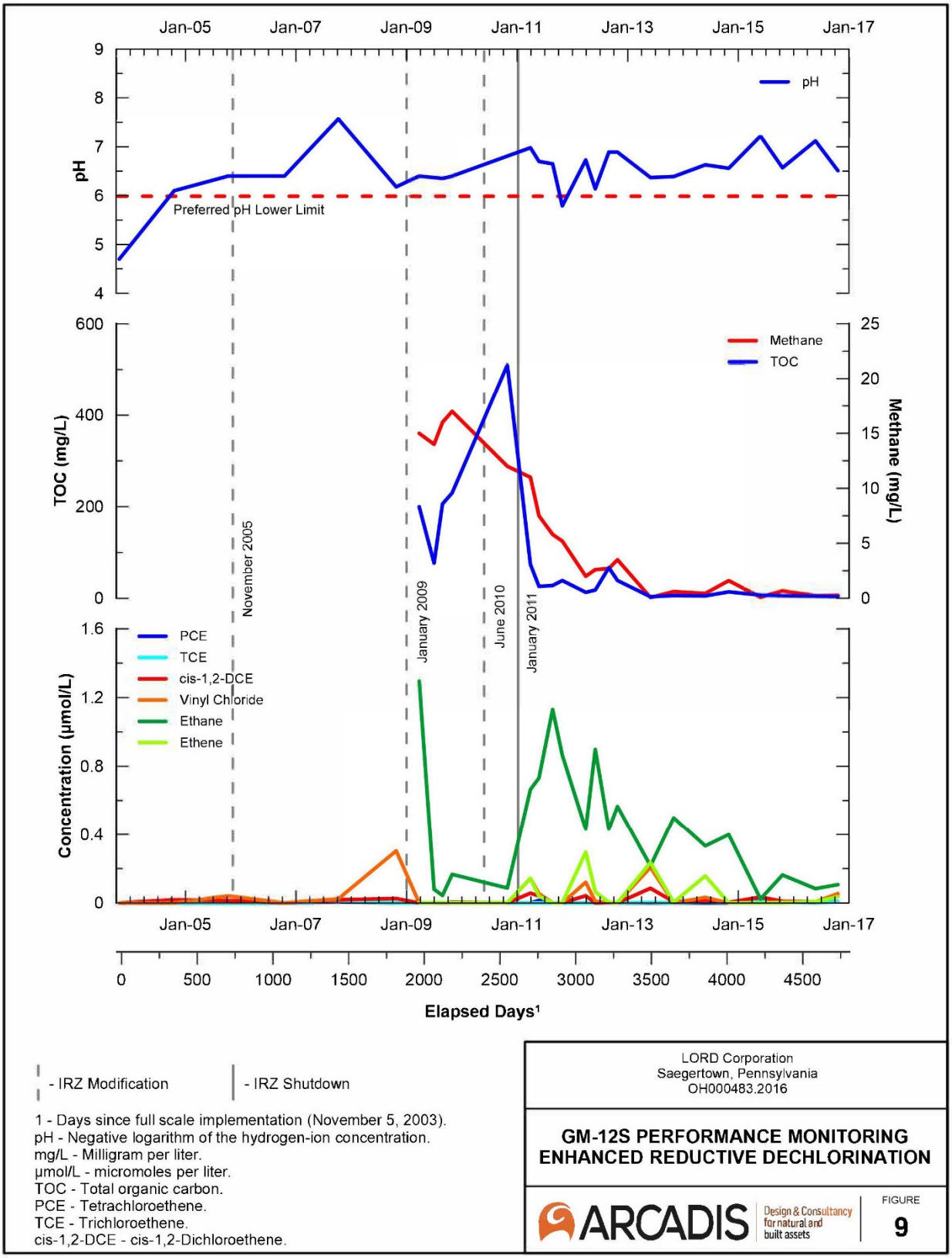
[2] Source: 2016 Annual Groundwater Monitoring Report (Arcadis, July 7, 2017)

Figure E-2: W11S Performance Monitoring Enhanced Reductive Dechlorination[3]



[3] Source: 2016 Annual Groundwater Monitoring Report (Arcadis, July 7, 2017)

Figure E-3: GM-12S Performance Monitoring Enhanced Reductive Dechlorination[4]



[4] Source: 2016 Annual Groundwater Monitoring Report (Arcadis, July 7, 2017)

Figure E-4: GM-17S Performance Monitoring Enhanced Reductive Dechlorination[5]

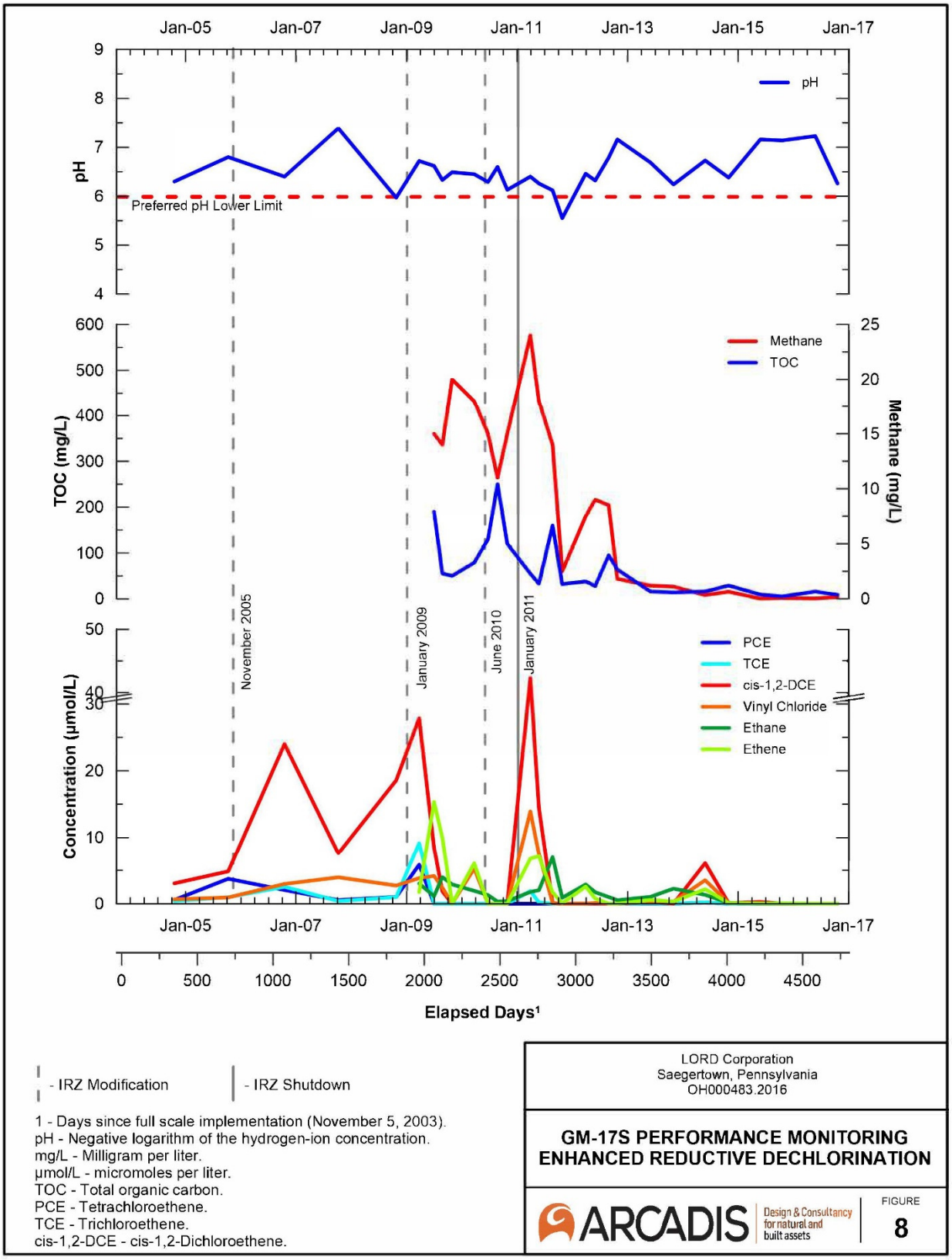
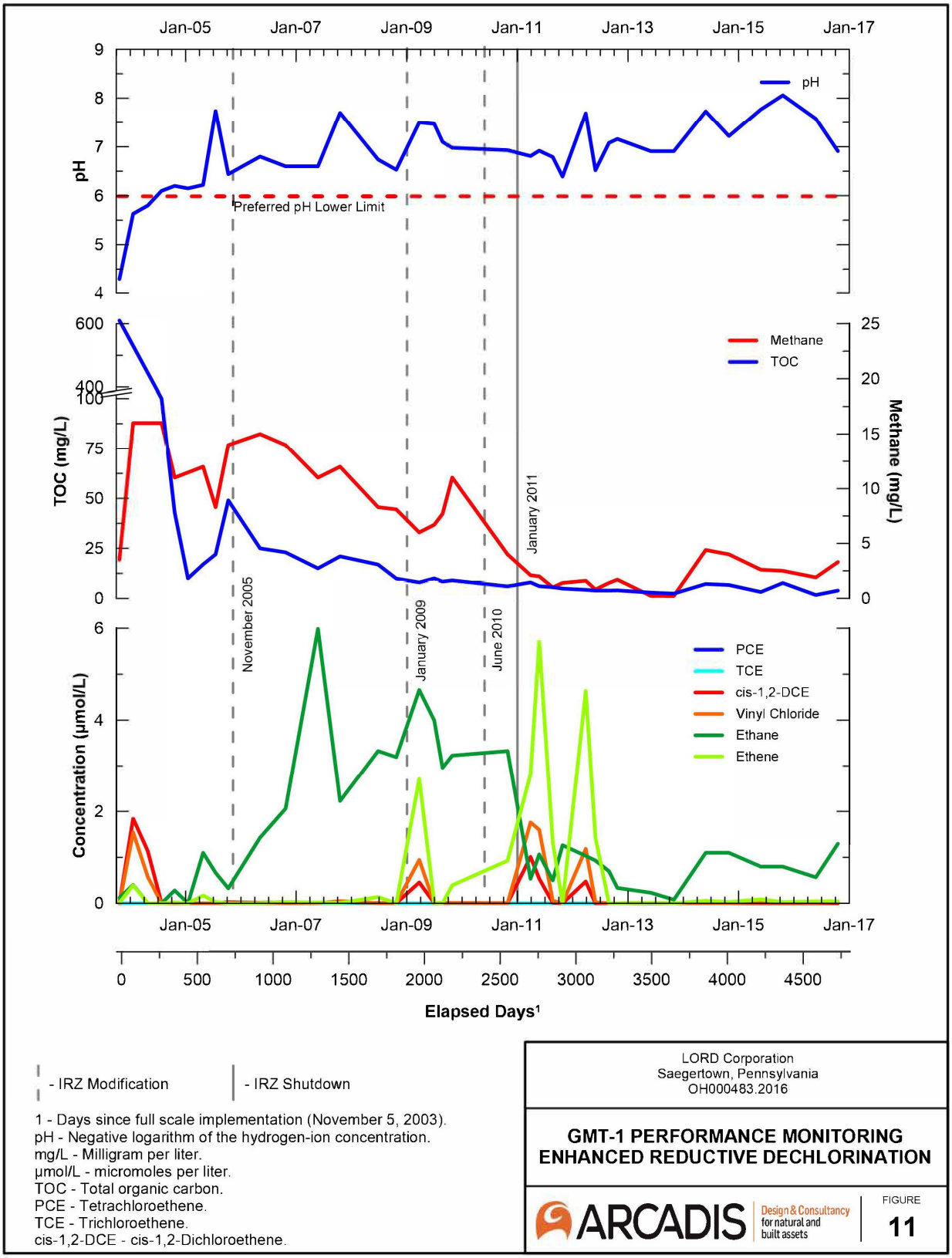
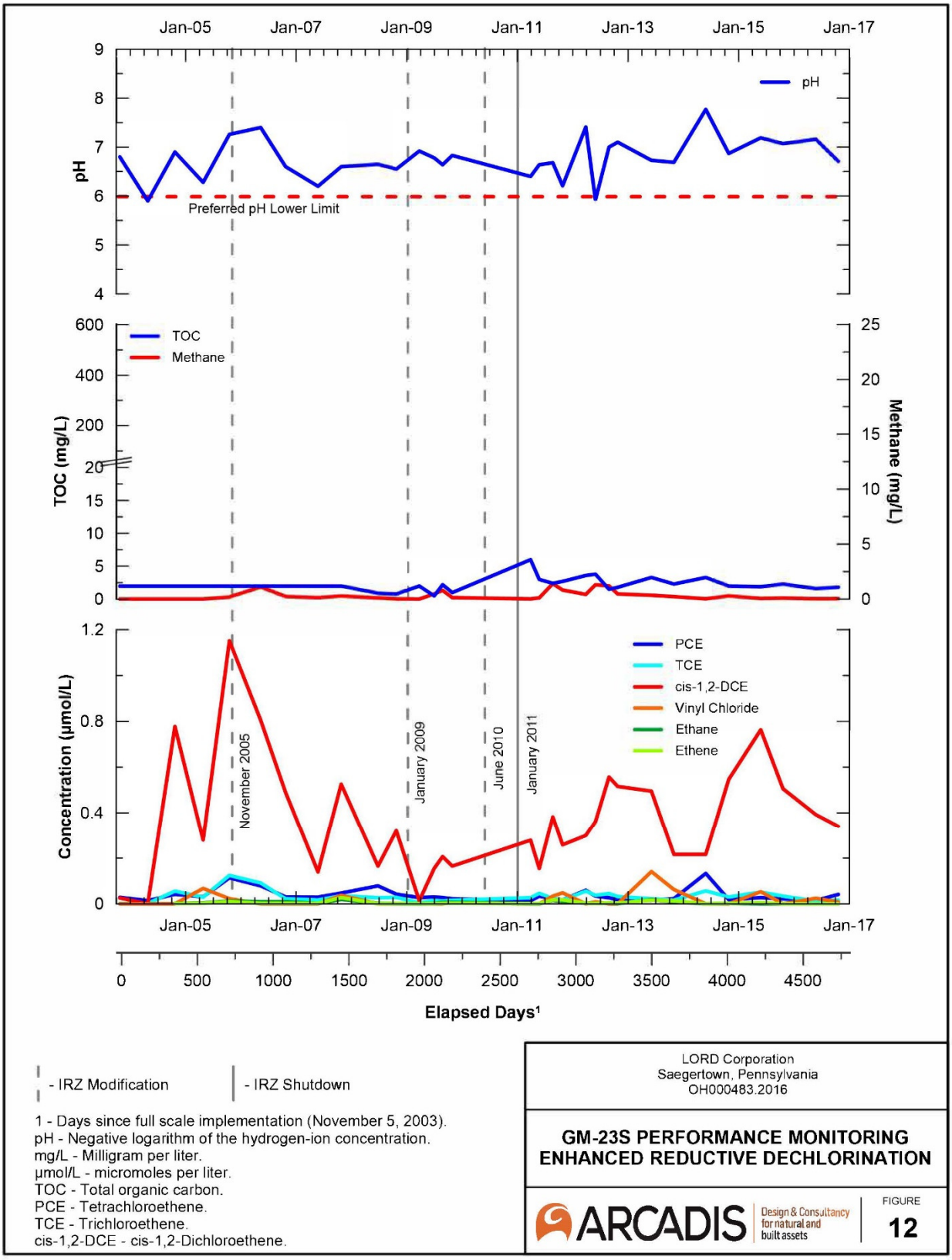


Figure E-5: GMT-1 Performance Monitoring Enhanced Reductive Dechlorination



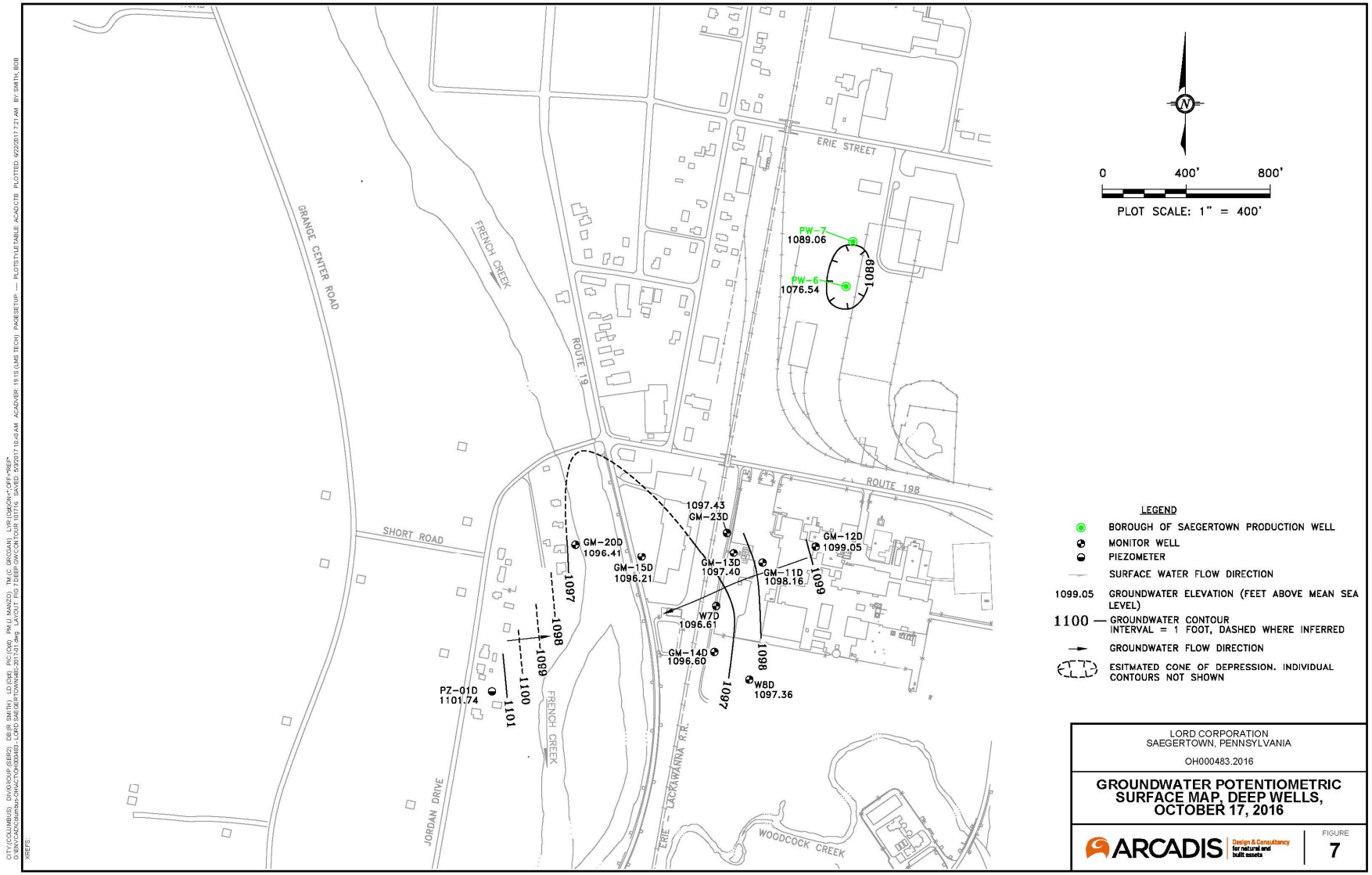
[5] Source: 2016 Annual Groundwater Monitoring Report (Arcadis, July 7, 2017)

Figure E-6: GM-23S Performance Monitoring Enhanced Reductive Dechlorination[6]



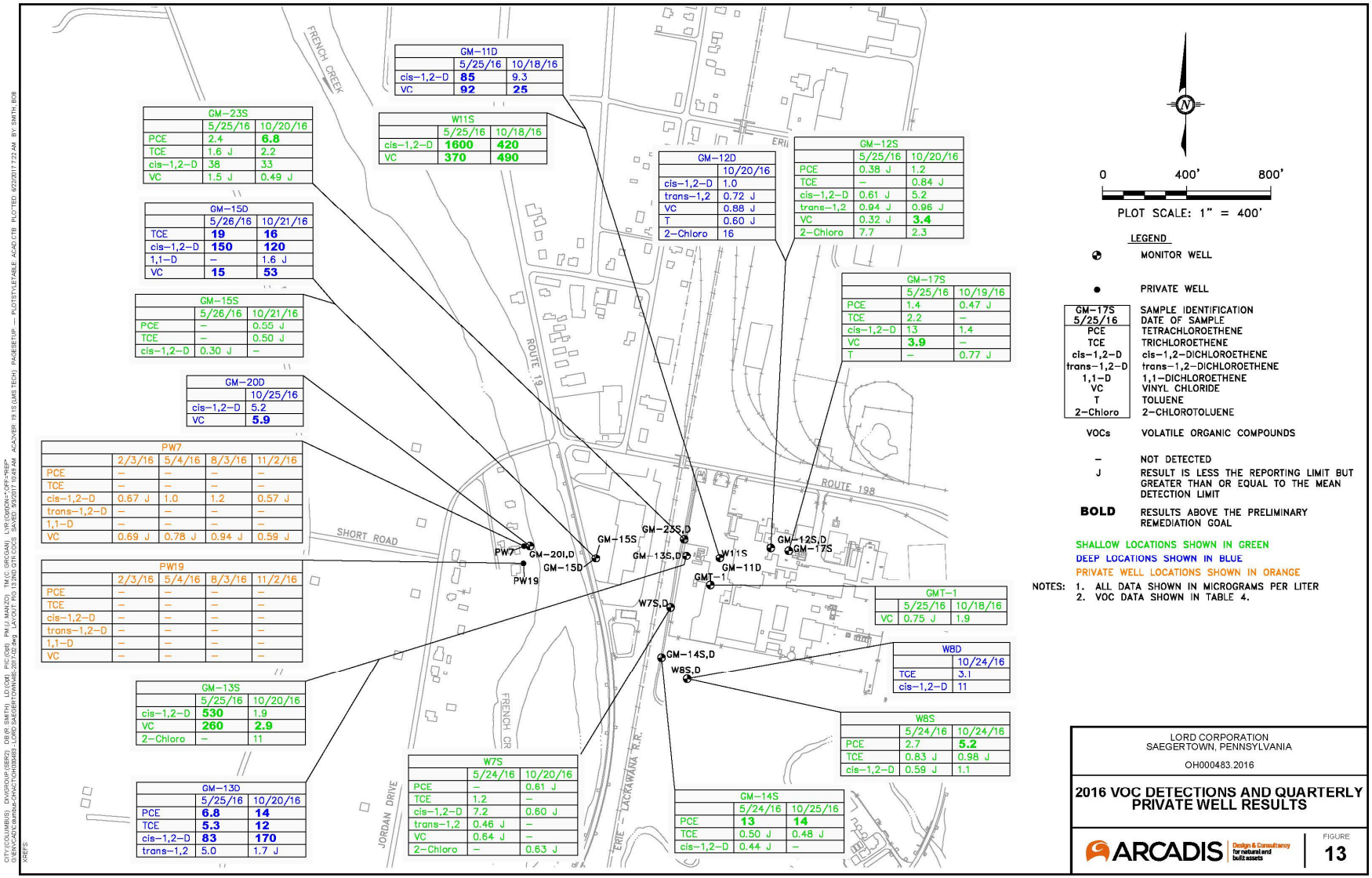
[6] Source: 2016 Annual Groundwater Monitoring Report (Arcadis, July 7, 2017)

Figure E-7: Groundwater Potentiometric Surface Map, Deep Wells, October 2016[7]



[7] Source: 2016 Annual Groundwater Monitoring Report (Arcadis, July 7, 2017)

Figure E-8: 2016 VOC Detections and Quarterly Private Well Results[8]



[8] Source: 2016 Annual Groundwater Monitoring Report (Arcadis, July 7, 2017)

APPENDIX F – DETAILED TOXICITY REVIEW

Table F-1: Screening-Level Risk Evaluation of Groundwater Cleanup Goals

COC[a]	2002 ROD Amdt. Performance Standard (µg/L)	EPA Residential Tapwater RSL[b] (µg/L)			Residential	
		1 x 10^{-6} Risk	HQ[c]	Target Organ[d]	Cancer Risk[e]	Non-cancer HQ[f]
1,1-DCE	3	NA	93 (280÷3)	Liver	NA	0.03
Cis-1,2-DCE	50	NA	12 (36÷3)	Kidney	NA	**4.2**
Trans-1,2-DCE	100	NA	360	Blood	NA	0.28
Ethylbenzene	100	1.5	270 (810÷3)	Liver/Kidney	6.7 x 10^{-5}	0.37
Toluene	100	NA	367 (1,100÷3)	Kidney	NA	0.27
TCE	5	0.49	2.8	Heart	1.0 x 10^{-5}	**1.8**
PCE	5	11	41	Nerves	4.5 x 10^{-7}	0.12
Vinyl Chloride	2	0.019	15 (44÷3)	Liver	**1.1 x 10^{-4}**	0.13
2-Chlorotoluene	200	NA	240	Body weight	NA	0.83

Notes:

a. Groundwater COCs established by the 2002 ROD Amendment.

b. Current RSLs, dated May 2016, are available at http://www.epa.gov/risk/risk-based-screening-table-generic-tables (accessed 2/8/2017).

c. Non-cancer RSL was based on the RSL divided by the number of chemicals with the same non-cancer target organ effect (Liver – 3 COCs, Kidney – 3 COC).

d. Non-cancer target organ effects for oral exposure were obtained from the EPA's Integrated Risk Information System and filtering for target organ effects at https://cfpub.epa.gov/ncea/iris/search/ (accessed 6/12/17)

e. Screening-level cancer risks were calculated using the following equation, based on the fact that RSLs are derived based on 1 x 10^{-6} risk:
Cancer risk = (remedial goal ÷ cancer RSL) × 10^{-6}

f. The screening-level non-cancer HQ was calculated using the following equation:
HQ = (remedial goal ÷ non-cancer RSL)

Bold = Cancer risk exceeds 1 x 10^{-4} or HQ greater than or equal to 1.

NA = COC has not been classified as a carcinogen.

Table F-2: Screening-Level Risk Evaluation of Soil Cleanup Goal

COC	1993 Soil Cleanup Goal (mg/kg)	EPA Resident RSL[a] (mg/kg)		Resident Risk Level	
		1 x 10^{-6} Risk	HQ = 1	Cancer Risk[b]	Non-cancer HQ[c]
Total PAHs[d]	1.0	0.016	NA	6.2 x 10^{-5}	NA

Notes:

a. Current RSLs, dated May 2016, are available at http://www.epa.gov/risk/risk-based-screening-table-generic-tables (accessed 2/8/2017).

b. Cancer risks were calculated using the following equation, based on the fact that RSLs are derived based on 1 x 10^{-6} risk:

COC	1993 Soil Cleanup Goal (mg/kg)	EPA Resident RSL[a] (mg/kg)		Resident Risk Level	
		1×10^{-6} Risk	HQ = 1	Cancer Risk[b]	Non-cancer HQ[c]

Cancer risk = (remedial goal ÷ cancer RSL) × 10^{-6}

c. The non-cancer HQ was calculated using the following equation:
HQ = (remedial goal ÷ non-cancer RSL)

d. Benzo(a)pyrene equivalent

NA = non-cancer toxicity value has not been established for this COC.

Table F-3: Screening-Level Vapor Intrusion Risk Evaluation Using Maximum Detected Groundwater Concentrations at W11S, GM-12S, GM-17S (LORD Facility)

Contaminant	2016 Maximum Detected Groundwater Concentrations (Shallow Wells) (µg/L)	Commercial/Industrial[a]	
		Cancer Risk	Non-cancer HQ
PCE	1.4 (GM-17S)	2.1×10^{-8}	0.0058
TCE	2.2 (GM-17S)	3.0×10^{-7}	0.1
cis-1,2-DCE	1,600 (W11S)	N/A	N/A
trans-1,2-DCE	0.96 J (GM-12S)	N/A	N/A
Vinyl chloride	490 (W11S)	**2.0×10^{-4}**	**1.3**
Toluene	0.77 J (GM-17S)	No IUR	0.0000095
2-Chlorotoluene	7.7 (GM-12S)	N/A	N/A

Notes:
Only COCs detected in 2016 are shown
Bold = Indicates vapor intrusion carcinogenic risk greater than 1×10^{-4} for carcinogens or vapor intrusion hazard greater than or equal to 1
J = Estimated concentration
IUR = Inhalation Unit Risk
N/A = No screening level available for this constituent

a. May 2016 VISL calculator version 3.51 at: https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-levels-visls (accessed 3/2/2017).

Table F-4: Screening-Level Vapor Intrusion Risk Evaluation Using Maximum Detected Groundwater Concentrations at RZ2-B and RZ2-C (Between W11S and LORD Facility Building)

Contaminant	2016 Groundwater Concentration (µg/L)	Commercial/Industrial[a]	
		Cancer Risk	Non-cancer HQ
Vinyl chloride – RZ2-B	1.9	7.7×10^{-7}	0.005
Vinyl chloride – RZ2-C	0.58 J	2.4×10^{-7}	0.0015

Notes:
Only COCs detected in 2016 are shown
Bold = Indicates vapor intrusion carcinogenic risk greater than 1×10^{-4} for carcinogens or vapor intrusion hazard greater than or equal to 1
J = Estimated concentration
IUR = Inhalation Unit Risk
N/A = No screening level available for this constituent

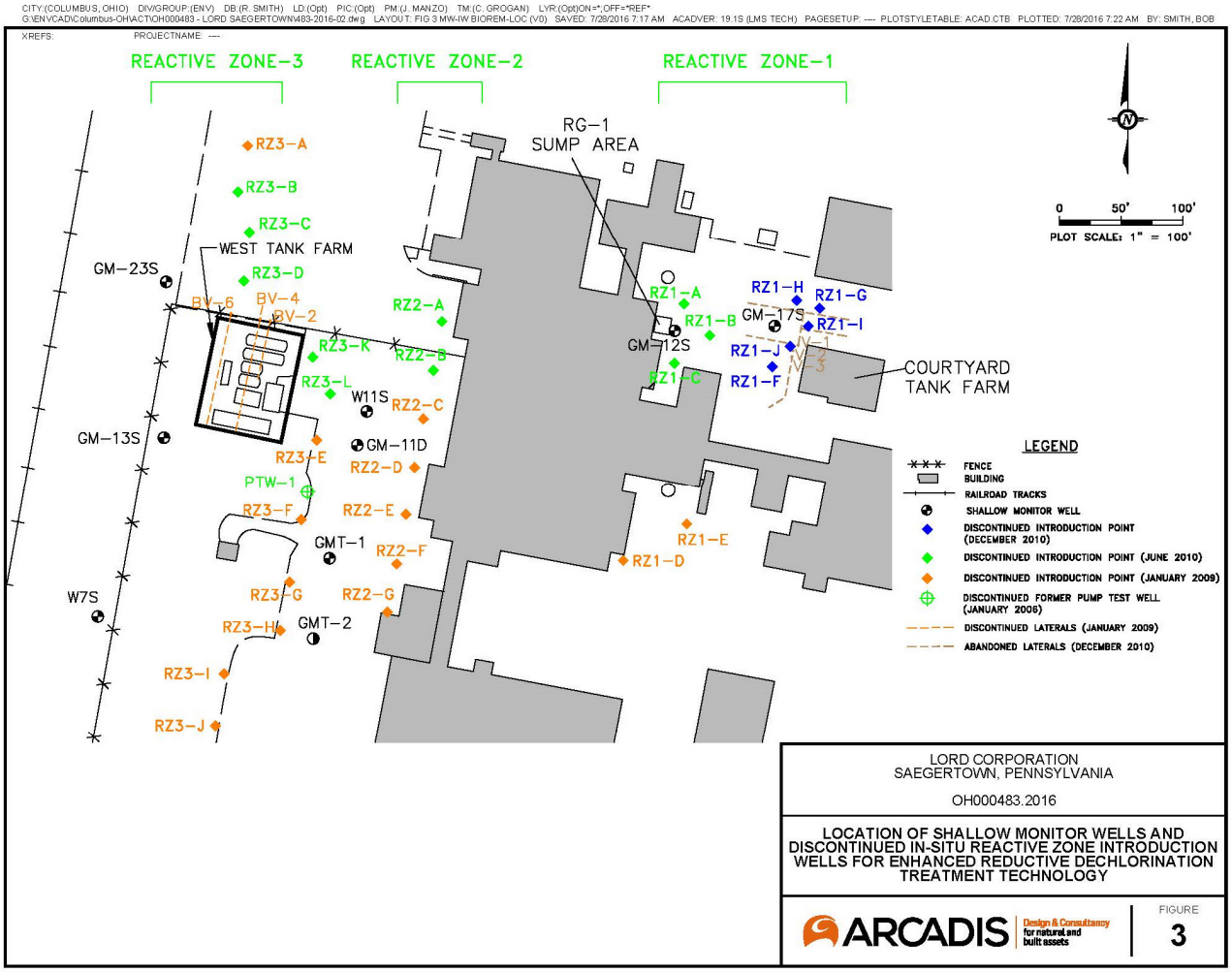
a. May 2016 VISL calculator version 3.51 at: https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-levels-visls (accessed 3/2/2017).

Table F-5: Screening-Level Vapor Intrusion Risk Evaluation Using Maximum Detected Groundwater Concentrations at GM-15S and GM-23S (Knuth Property)

Contaminant	2016 Maximum Detected Groundwater Concentrations (Shallow Wells) (µg/L)	Commercial/Industrial[a]	
		Cancer Risk	Non-cancer HQ
PCE	6.8 (GM-23S)	1.0×10^{-7}	0.028
TCE	2.2 (GM-23S)	3.0×10^{-7}	0.1
cis-1,2-DCE	38 (GM-23S)	N/A	N/A
Vinyl chloride	1.5 J (GM-23S)	6.1×10^{-7}	0.0039

Notes:
Only COCs detected in 2016 are shown
Bold = Indicates vapor intrusion carcinogenic risk greater than 1×10^{-4} for carcinogens or vapor intrusion hazard greater than or equal to 1
J = Estimated concentration
IUR = Inhalation Unit Risk
N/A = No screening level available for this constituent
a. May 2016 VISL calculator version 3.51 at: https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-levels-visls (accessed 3/2/2017).

Figure F-1: Well Locations for Screening Level Vapor Intrusion Risk Evaluation[9]



[9] Source: 2015 Annual Report