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SEP 22 2017

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Ms. Julie Corkran
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Dear Mr. Begley and Ms. Corkran:

**TRANSMITTAL OF THE DOCUMENT CONCERNING TRICHLOROETHENE AND
TECHNETIUM-99 GROUNDWATER CONTAMINATION IN THE REGIONAL
GRAVEL AQUIFER FOR CALENDAR YEAR 2016 AT THE PADUCAH GASEOUS
DIFFUSION PLANT PADUCAH, KENTUCKY (FPDP-RPT-0079)**

Please find enclosed a courtesy copy of the subject document, *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2016 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FPDP-RPT-0079. This report presents the methodology used to develop the trichloroethene (TCE) and technetium-99 (Tc-99) groundwater plume maps from groundwater sampling data from wells completed in the Regional Gravel Aquifer (RGA) and collected through the end of Calendar Year 2016. The report also discusses changes that occurred in the footprint of the plumes and the contaminant distribution within the plumes since the 2014 plume maps report. The plume maps reports are used to depict and better understand the progress of groundwater cleanup and optimize planning of groundwater cleanup at the Paducah Gaseous Diffusion Plant.

Generally, the footprint of the plumes and the contaminant distribution in the 2016 report were similar to those seen in the 2014 report. However, there are two anomalous observations of note in the 2016 report.

First, the concentration of TCE in water samples from two wells (MW106A and MW426) located in Area C (central portion of the site on DOE property along the western boundary) slightly exceeded the TCE MCL (5 µg/L) in samples collected in 2016. The presence of TCE above the MCL in these wells is inconsistent with their location relative to Southwest TCE Plume sources, groundwater flow from these sources based upon the potentiometric surface of the RGA, and concentrations of TCE in water samples from wells downgradient from the

Southwest TCE Plume sources but upgradient from MW106A and MW426. These wells were sampled in 2017 and trends in TCE concentrations will be developed to further evaluate this observation.

Second, the concentration of TCE in a water sample from a well (MW146) located in Area B (the leading edge of the Northwest TCE Plume) was slightly below the TCE MCL at 4.82 ug/L. This is an anomalous result because TCE was not detected in water samples from any other well located between MW146 and the 5 ug/L isoconcentration line defining the leading edge of the Northwest TCE plume. Also, the concentration of TCE in water samples collected from MW146 the previous 10 years were nondetect or near the 1 µg/L detection limit. This well was sampled in 2017 and results will be reviewed to further evaluate this anomalous result.

If you have any questions or require additional information, please contact David Dollins at (270) 441-6819.

Sincerely,



Tracey Duncan
Federal Facility Agreement Manager
Portsmouth/Paducah Project Office

Enclosure:

TCE and Tc-99 Groundwater Contamination in the Regional Gravel Aquifer for CY16

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**Trichloroethene and Technetium-99 Groundwater
Contamination in the Regional Gravel Aquifer for
Calendar Year 2016 at the
Paducah Gaseous Diffusion Plant,
Paducah, Kentucky**

This document is approved for public release per review by:

R.H. Watson
FPDP Classification Support

7-26-17
Date

**Trichloroethene and Technetium-99 Groundwater
Contamination in the Regional Gravel Aquifer for
Calendar Year 2016 at the
Paducah Gaseous Diffusion Plant,
Paducah, Kentucky**

Date Issued—July 2017

Prepared for the
U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Prepared by
FLUOR FEDERAL SERVICES, INC.,
Paducah Deactivation Project
managing the
Deactivation Project at the
Paducah Gaseous Diffusion Plant
under Task Order DE-DT0007774

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ACRONYMS

FFS	Fluor Federal Services, Inc.
FPDP	Fluor Federal Services, Inc., Paducah Deactivation Project
MCL	maximum contaminant level
MW	monitoring well
OREIS	Oak Ridge Environmental Information System
PGDP	Paducah Gaseous Diffusion Plant
RGA	Regional Gravel Aquifer

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1. INTRODUCTION

Fluor Federal Services, Inc. (FFS), Paducah Deactivation Project (FPDP) has evaluated groundwater analytical data as of the end of calendar year 2016 to produce revised groundwater plume maps for both trichloroethene (TCE) and technetium-99 (Tc-99) within the Regional Gravel Aquifer (RGA), associated with the U.S. Department of Energy's Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky. The two primary groundwater plume constituents are TCE and Tc-99. This report presents the analytical data sets taken from the Paducah Oak Ridge Environmental Information System (OREIS) data system, methods used to develop these maps, and changes to the contaminant plumes over time. These plume maps are intended to show the most recent sample result from each location as of the end of calendar year 2016. For wells that were not sampled in 2016, the most recent data from 2015 have been used. These plume maps are based on the most recent values for 2016 or 2015, thus they may not reflect the maximum or minimum value observed during the reporting period for all locations.

The plume maps depict the general footprint of the TCE and Tc-99 contamination in the RGA and convey the general magnitude and distribution of contamination at or above the TCE and Tc-99 maximum contaminant levels (MCLs)¹ within the plumes. The PGDP groundwater plume maps are revised every two years to provide a basis for timely incorporation of routine groundwater monitoring and characterization data, demonstrate the progress of groundwater cleanup to date, and facilitate planning to optimize the site groundwater cleanup. The plume maps also complement reporting of results of environmental monitoring programs and activities in the Paducah Site Annual Site Environmental Report. These plume maps are used, along with additional information, to further evaluate specific areas of groundwater contamination at PGDP in more detail for decision-making purposes based on individual project needs. More specific project evaluations are discussed in applicable documents, which are available through the U.S. Department of Energy's Environmental Information Center (www.paducaeic.com).

The maps and data tables (including charts of TCE and Tc-99 sampling results collected for the last 10 years) used to generate maps referenced in this document are included in the Appendices. Appendix A contains tables and charts of TCE and Tc-99 sampling results collected for the last 10 years, which would include the minimum and the maximum values observed during 2016. Appendix B contains the most recent 2016 and 2015 values from PGDP RGA monitoring wells (MWs) used to develop the plume maps. Appendix C provides large-scale maps of the interpretation of the 2016 plume maps.

The isoconcentration contours of contaminant levels that appear on the maps have been depicted based on the most recently observed distribution of contaminant concentrations and knowledge of the site conceptual model. The isoconcentration contours span the most recent results over the years 2015 and 2016. The magnitude and distribution of contamination within the plumes will vary slightly from year to year based on contaminant trends and variations in hydrologic influences.

2. BASIS OF ANALYSIS

All data used in these maps were extracted from the Paducah OREIS database. Paducah OREIS is the centralized, standardized, quality assured, and configuration-controlled data management system that is the

¹ For Tc-99, 900 pCi/L defines the plume limit. EPA derived the 900 pCi/L value from the 4 mrem/yr MCL for Tc-99, a beta emitter in 1976, but has never promulgated 900 pCi/L of Tc-99 as an MCL (EPA 1976).

long-term repository of environmental data (measurements and geographic) for Paducah projects. (See Table B.1 in Appendix B for the 2016 TCE and Tc-99 results in RGA wells and the data used to create the 2016 TCE and Tc-99 plume maps.) Data are made available to the public through the PPPO Environmental Geographic Analytical Spatial Information System (PEGASIS) Web site at <http://pegasis.ffspaducah.com/>. The maps for calendar year 2016 are based on analytical results from the most recent sampling event (primarily January–December 2016). Where co-located monitoring wells (i.e., clustered wells or multiport wells) provide analytical results for the calendar year from screened intervals at multiple elevations within the RGA (e.g., upper, middle, and/or lower RGA), the maps use the value from the interval that has the highest concentration. Data from sampling in 2015 have been used, as necessary, to supplement the 2016 information and aid in plume delineation.

Mapping involved first plotting the selected data on Geographic Information System-generated maps and then comparing those data to the contouring performed for the 2014 TCE and Tc-99 plume maps. Plume contours were adjusted to accommodate more recent data, and the impact of the changes from 2014 to 2016 are discussed in Section 4. On the 2016 plume maps shown in Section 4 of the main text, dashed lines show the contour lines from the 2014 plume maps for comparison. On the 2016 plume maps shown in Appendix C, dashed lines represent approximate contour locations for areas where spatially limited TCE and Tc-99 data were available.

For TCE, the Safe Drinking Water Act MCL of 5 µg/L is the isoconcentration contour that defines the limit of the plume. Subsequent isoconcentration contours of 100 µg/L, 1,000 µg/L, 10,000 µg/L, and 100,000 µg/L are provided based on concentration data for the period. For Tc-99, 900 pCi/L defines the plume limit.²

3. 2016 PLUME MAPS

According to the “Well Program Inventory” in the Environmental Monitoring Plan, there are 257 active MWs, plus piezometers and extraction wells, and 16 residential wells that can be used to monitor the RGA (FPDP 2016). The PGDP environmental remediation prime contractor monitored a subset of this well network in 2016, as discussed below, in accordance with the Environmental Monitoring Plan (FPDP 2016; FPDP 2017).

Figures C.1 and C.2 of Appendix C provide the 2016 TCE and Tc-99 plume maps. Section 4 includes an explanation of the interpretation of these maps. Table 1 presents a summary of these plumes. Because these plumes are based on interpretation, off-site³ plume length and areas are approximated.

² EPA derived the 900 pCi/L value from the 4 mrem/yr MCL for Tc-99, a beta emitter in 1976, but has never promulgated 900 pCi/L of Tc-99 as an MCL (EPA 1976).

³ For purposes of this report, off-site indicates area outside the limited area, or the PGDP boundary shown on maps.

Table 1. PGDP Groundwater Plumes, CY 2016

Plume	Approximate Maximum Off-Site^a Contaminant Levels	Off-Site^a Plume Length	Approximate Total Area^b
<i>Trichloroethene</i>			
Northwest	400 µg/L	2.6 miles	751 acres
C-746-S&T Area	30 µg/L	0.62 miles	79 acres
Northeast	400 µg/L	2.3 miles	945 acres
Southwest	10 µg/L	0.047 miles	100 acres
<i>Technetium-99</i>			
Northwest	<900 pCi/L	N/A	19 acres

^a Maximum concentration shown on the respective plume map at locations outside limited area (i.e., PGDP boundary shown on maps).

^b The approximate total areas is the area of the respective plume inside and outside the limited area (i.e., PGDP boundary shown on maps).

TRICHLOROETHENE

During 2016, 169⁴ RGA MWs and 13 residential wells were sampled and analyzed for TCE. The sample collection was based on the Environmental Monitoring Plan, which schedules the compliance sampling and sampling by other regulatory programs being conducted at the site (FPDP 2016; FPDP 2017). These results are supplemented by 66 RGA MWs and 2 residential wells sampled and analyzed for TCE in 2015, but not sampled in 2016 (LATA Kentucky 2015a; FPDP 2016). A summary of the approximate maximum off-site levels of TCE in RGA wells is shown in Table 1.

Appendix C contains the 2016 TCE plume map (Figure C.1). Generally, the plume interpretation is based on the following:

- A total of 1,037 groundwater samples was collected and analyzed for TCE from 250 wells in 2015–2016.
- TCE results from 2016 used to develop the plume maps, along with the date sampled, are posted adjacent to the well label. The basis for data posting is as follows:
 - If the well was sampled only once in 2016, the resulting analysis is posted.
 - If the well was sampled multiple times, the most recent result was posted. If the most recent data are from duplicate samples, the higher concentration value of the two was posted.
 - For well clusters with completions screened in the upper, middle, and lower horizons of the RGA, each value is posted where practical and space allows for legibility.
- Groundwater extraction well locations are labeled on the map, but the concentrations from the wells are not posted.
- For some wells that were not sampled in 2016, but sampled in 2015, TCE results from 2015 used to develop the plume map were selected using the same rules as for the 2016 TCE results. These results and the date sampled are posted on the map.

⁴ Of these RGA MWs, 5 have 3 sampling ports each. Each sampling port is counted as a separate monitoring location.

- The contour intervals selected were 5 µg/L, 100 µg/L, 1,000 µg/L, 10,000 µg/L, and 100,000 µg/L. This order of magnitude interval approach for contour interval selection is consistent with the contour interval selection used in the prior mapping for the site.
- Contouring was produced by hand, using interpolation between observed concentrations. The contouring also incorporated historical source information and previous plume interpretations.

Exceptions to this basis are discussed in Section 4.

TECHNETIUM-99

During 2016, 160⁵ RGA MWs and 13 residential wells were sampled and analyzed for Tc-99. The sample collection was based on the Environmental Monitoring Plan, which schedules the compliance sampling and sampling by other regulatory programs being conducted at the site (FPDP 2016; FPDP 2017). These results are supplemented by 66 RGA MWs and 2 residential wells sampled and analyzed for Tc-99 in 2015, but not sampled in 2016. Tc-99 was not detected in either 2015 or 2016 above 900 pCi/L outside the PGDP boundary. The highest Tc-99 concentration in RGA wells outside the PGDP boundary was 509 pCi/L at MW503.

Appendix C contains the 2016 Tc-99 plume map (Figure C.2). Generally, the plume interpretation is based upon the following:

- A total of 1,018 groundwater samples was collected and analyzed for Tc-99, from 241 wells in 2015–2016.
- Tc-99 results from 2016 used to develop the plume map, along with the date sampled, are posted adjacent to the well. The logic for data posting was the same as described for TCE in Section 3.1.
- The posted data are rounded to the nearest whole number for presentation purposes.
- For some wells that were not sampled in 2016, but sampled in 2015, the Tc-99 results from 2015 used to develop the plume map were selected using the same rules as for the 2016 Tc-99 results. These results and the date sampled are posted on the map.
- The contour intervals selected were 900 pCi/L and 3,790⁶ pCi/L. The interval selection is based on EPA’s 1976 and 1991 derived MCL activities of 900 pCi/L and 3,790 pCi/L, respectively. This contour interval selection is consistent with the contour interval selection used in recent mapping for the site.
- Contouring was produced by hand, using interpolation between observed concentrations. The contouring also incorporated historical source information and previous plume interpretations.

⁵ Of these RGA MWs, 5 have 3 sampling ports each. Each sampling port is counted as a separate monitoring location.

⁶ The contour value of 3,790 pCi/L is used for consistency with historical plume maps. It (3,790 pCi/L) was derived as the equivalent of 4 mrem/yr by EPA and was proposed, but not promulgated, as the MCL for Tc-99 in 1991 (56 *Fed. Reg.* 33121). In 2011, DOE published the “DOE Standard: Derived Concentration Technical Standard,” which provides concentration standards for public consumption of drinking water that equate to an effective dose of 100 mrem/yr (DOE 2011a). The 2011 standards are based on guidance found in International Committee on Radiation Protection Publication 72 (ICRP 1995), Publication 89 (ICRP 2002), and Publication 107 (ICRP 2008). The published derived concentration standard for Tc-99 in drinking water is 44,000 pCi/L, at an effective dose of 100 mrem/yr from the ingestion of drinking water. The value to yield an effective dose of 4 mrem/yr is 1,760 pCi/L.

4. CHANGES FROM 2014 PLUME MAPS

The most recent comprehensive plume maps summarized data collected through 2014 (LATA Kentucky 2015b). In an effort to understand the changes in the plume areas and contaminant concentrations at PGDP, FPDP compared the 2016 maps with the 2014 plume maps for both TCE and Tc-99. For discussion purposes, the plumes have been divided into Northwest, Northeast, and Central portions, including the Southwest Plume. Figures in this section show the 2016 TCE plume overlaid with the 2014 plume isoconcentration lines. Similarly, the last figure in this section shows the 2016 Tc-99 plume overlaid with the 900 pCi/L and 3,790 pCi/L contours from the 2014 plume map. The Tc-99 plume, as defined by the 900 pCi/L activity level, is limited to the central part of the site and is discussed in that subsection. A comparison of isoconcentration contours for the 2014 and 2016 plumes indicates that the footprints for each plume are generally similar. Exceptions to the general observation are discussed in the following sections.

4.1 NORTHWEST PLUME

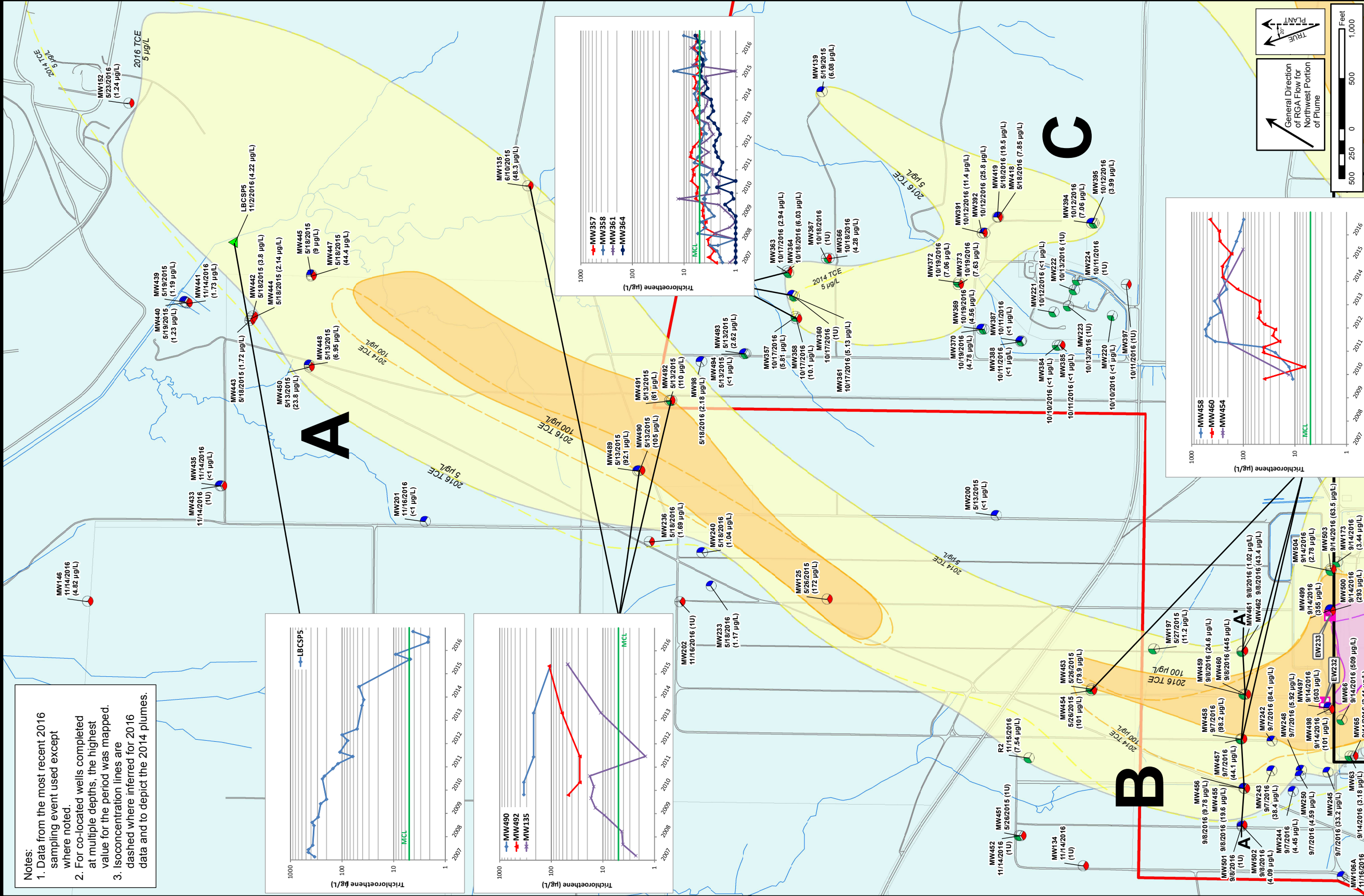
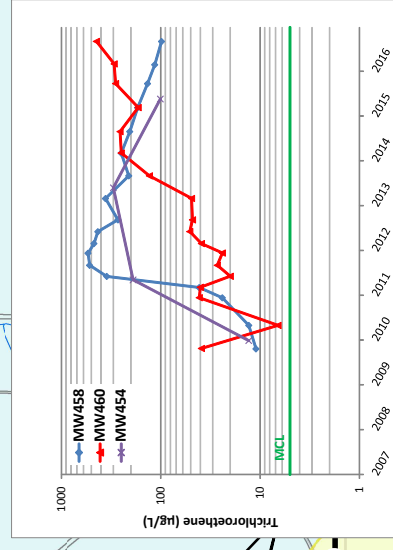
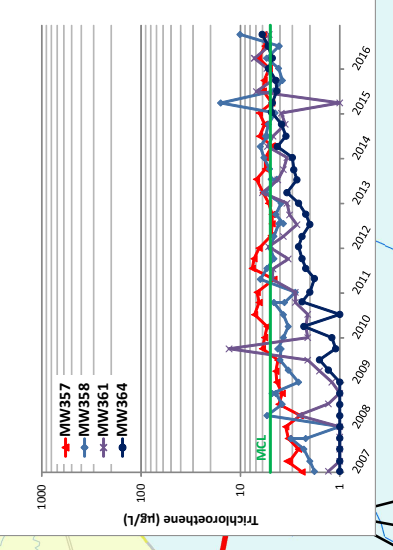
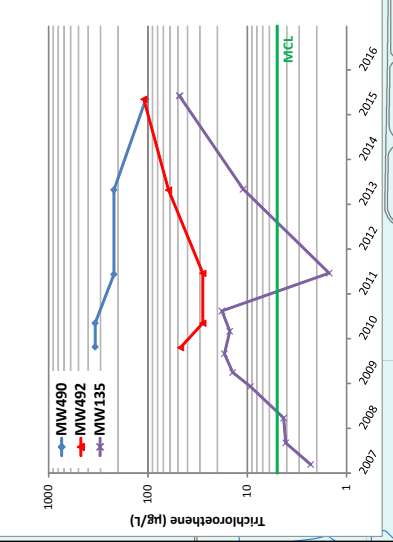
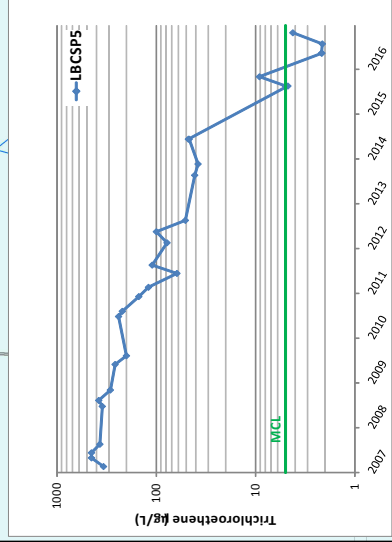
Figure 1 provides an enlargement of the north portion of the Northwest Plume, including contamination found in the vicinity of the C-746-S&T Landfills, which is not part of the Northwest Plume and is discussed here for convenience. Three areas are described in this subsection: (A) the northern distal margin, (B) the area in the vicinity of extraction wells of the Northwest Plume Pump-and-Treat System, and (C) the vicinity of the C-746-S&T Landfills. In addition, Figure 1 includes temporal TCE concentration plots for selected wells illustrating the observations made in this subsection.

Area A

- The northern extent of the 5 µg/L TCE isoconcentration contour continues to be defined by MW439, MW440, and MW441, in which TCE was not detected above 5 µg/L. The leading edge, however, has been moved farther south because the most recent TCE analyses for MW152 have dropped below 5 µg/L (1.24 µg/L in the most recent sampling event, which was May 2016, and 0.8 µg/L in the May 2015 sampling event).
- Also of note is the seep that is sampled in Little Bayou Creek. LCBSP5 has declined from 47.5 µg/L TCE in June 2014 to 4.22 µg/L at its most recent sampling event (November 2016). The plume contours have not been defined based on seep data, because they are not as reliable as MW data, but the declining TCE trend at the seeps supports shrinking the plume length.

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Notes:
 1. Data from the most recent 2016 sampling event used except where noted.
 2. For co-located wells completed at multiple depths, the highest value for the period was mapped.
 3. Isoconcentration lines are dashed where inferred for 2016 data and to depict the 2014 plumes.



LEGEND

Monitoring Well (MW) Identification, or Residential (R) Well Identification
 - Date of Sample & Sample Value
 -<1 indicates detected at a value less than the reporting limit

2016 TCE Plume Concentration Fields
 5 - 100 µg/L
 100 - 1,000 µg/L
 1,000 - 10,000 µg/L

2014 TCE Plume Isoconcentration Lines
 5 - 100 µg/L
 100 - 1,000 µg/L
 1,000 - 10,000 µg/L

A-A' - Location of Cross-Section
 B - Area A
 C - Area B

Water Policy Area
 DOE Property Boundary
 Roadways
 Streams
 Extraction Well
 Sleep Monitoring Location
 PGDP Boundary

FLUOR

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 PADUCAH GASEOUS DIFFUSION PLANT

Figure 1. 2016 Northwest Portion of the TCE Plume Regional Gravel Aquifer

FILE NAME: Fig_01_2016 PlumesTCE_NW PROJECT #: EM SCALE: AS NOTED DATE: 6/8/2017

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- The leading edge of the 100 µg/L TCE contour has moved to the east due to the increasing TCE trends in MW491/MW492 and MW135. While the most recent TCE in MW146 is near 5 µg/L (i.e., 4.82 µg/L), the result appears to be an anomalous detection, isolated from the Northwest Plume by < 1 µg/L TCE analyses in MW433 and MW435. Previous TCE results in MW146 have been nondetect or near the 1 µg/L detection limit for the last 10 years.
- The western boundary of the Northwest Plume was adjusted in the vicinity of the former northern extraction well field pump-and-treat system based on results for MW236 (1.69 µg/L in May 2016). MW125 is used to help define the southern extent of the 100 µg/L TCE isoconcentration. MW125 TCE concentration has been decreasing steadily since 2008 and was 172 µg/L in May 2015.

Area B

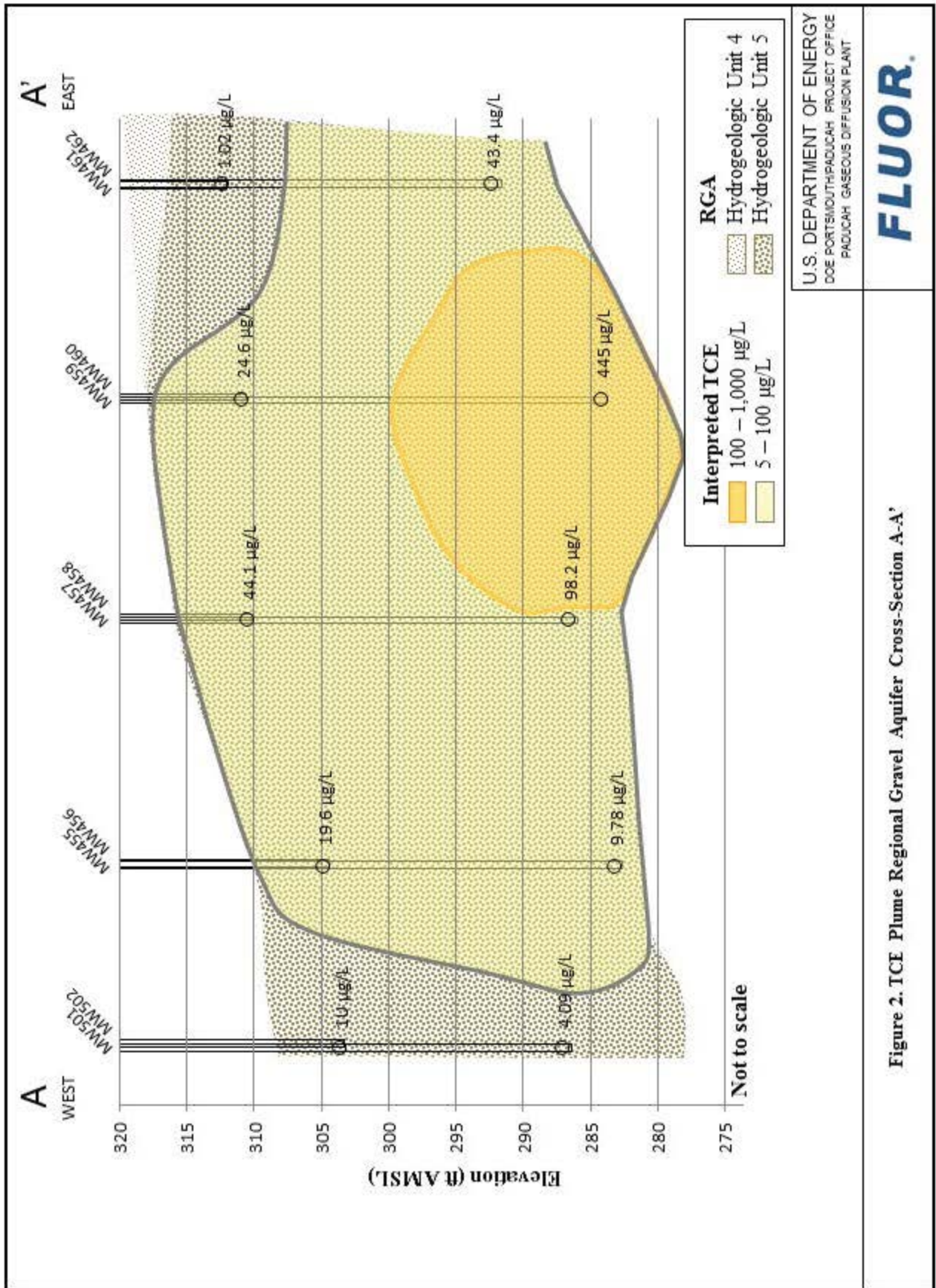
In August 2010, extraction wells EW232 and EW233 began operations. Because the EW232 and EW233 are located slightly upgradient and crossgradient of the former extraction wells, changes in TCE concentrations at some downgradient locations continue to reflect trends associated with changes in pumping stress in the area. Observations related to changes in dissolved-phase TCE distribution within the plume and plume configuration for this area are as follows:

- MW455 through MW462, MW501, and MW502 were installed and sampling began in 2009. These wells form a transect perpendicular to the longitudinal axis of the plume (the direction of flow), downgradient of the current extraction well field for the Northwest Plume Pump-and-Treat System, and provide a monitoring network to evaluate the efficacy of the pump-and-treat system. A cross section showing the interpretation of TCE concentrations within the RGA along this transect is shown in Figure 2. (The location of the cross section is denoted as A-A' on Figure 1.) TCE was detected at concentrations varying from 1U to 445 µg/L. The TCE concentrations along this transect continue to shift to the east from well MW458 (which contained TCE above 100 µg/L until the most recent sampling in September 2016) to well MW460 (which recorded its highest TCE concentration in September 2016 at 445 µg/L). The TCE concentrations along this transect continue to change, due to extraction at EW232 and EW233.

Area C

Area C is located in the vicinity of the C-746-S&T and C-746-U Landfills and is not a part of the Northwest Plume. These locations are monitored frequently to support the solid waste permit for the C-746-S, -T, and -U Landfills.

- The 2016 TCE footprint is very similar to that interpreted in 2014.
- During 2016, TCE concentrations in MW364 rose above 5 µg/L. Consequently, the 5 µg/L contour was extended in this area to include this well. The highest TCE concentration in this footprint is 22.8 µg/L in MW395.



4.2 NORTHEAST PLUME

Figure 3 provides an enlargement of the northeast portion of the plume. Three areas are described in this subsection: (D) the northern distal margin; (E) the area in the vicinity of the Northeast Plume Pump-and-Treat extraction wells; and (F) the vicinity of the industrial site. Figure 3 also includes temporal TCE concentration plots for selected wells to illustrate the observations made in this subsection.

Area D

- No changes were made to the northern extent of the 5 µg/L TCE isoconcentration contour from 2014. Wells MW463 through MW476 provide definition of the plume. The interpreted distal extent is between well clusters MW463 through MW468 and clusters MW473 through MW476. Well cluster MW471/MW472, with groundwater TCE concentrations below the laboratory detection limit, defines the eastern edge of the plume.
- The well samples for 2016 document that TCE concentrations near the distal end of the Northeast Plume are below 100 µg/L (94.6 µg/L) in the upper RGA (MW463). The TCE concentrations in the lower RGA (MW464) are 67.5 µg/L.

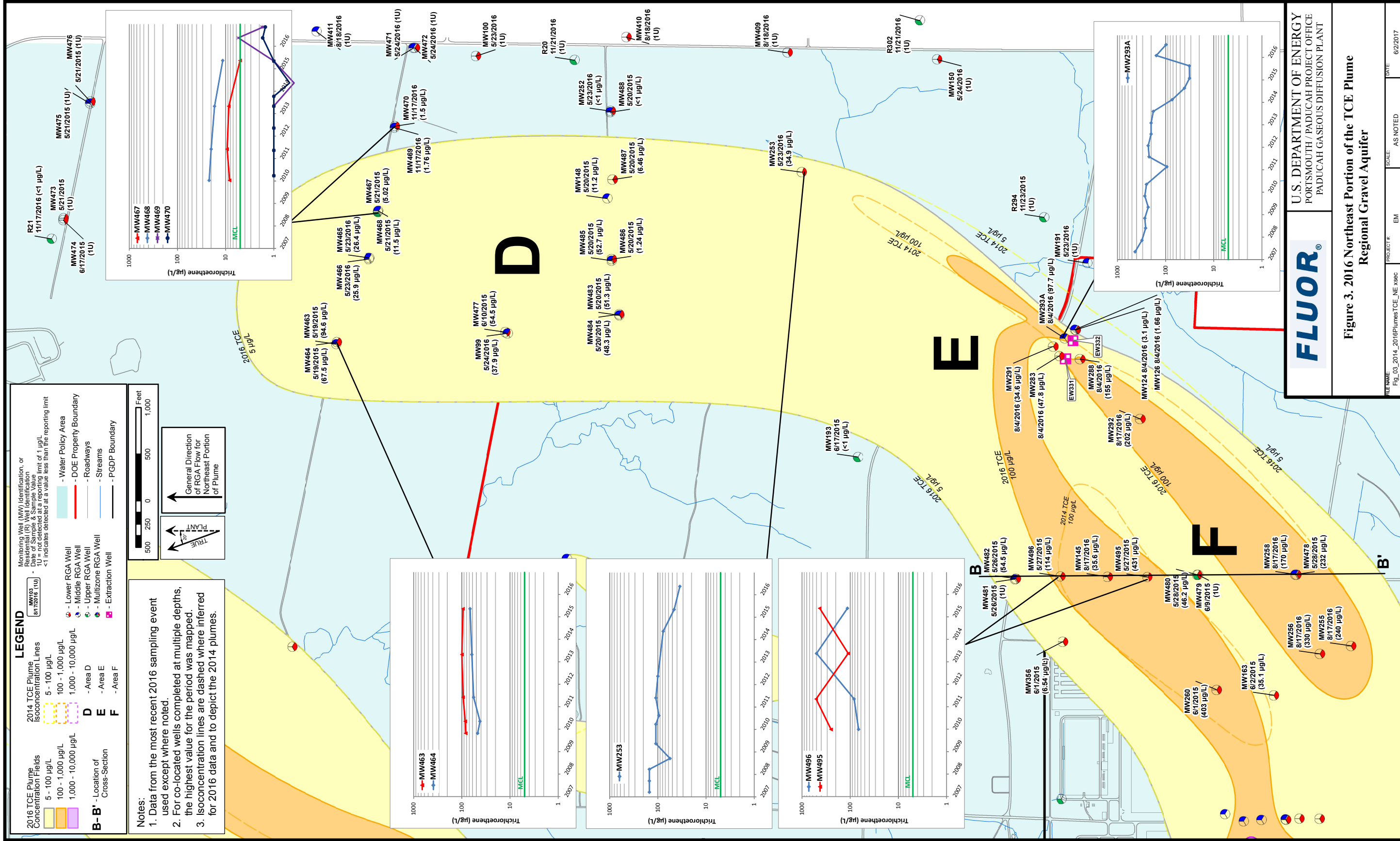
Area E

- Analyses for 2016, continue to show a decline in TCE concentration at MW253. In 2014, the 100 µg/L TCE contour was shortened when the MW253 TCE concentration dropped below 100 µg/L. Because of the continued decrease, the 100 µg/L TCE contour was shortened even more.
- Based on modeling results from the recently completed Groundwater Site Model, the northwestern lobe of the 100–1,000 µg/L TCE contour field is shown migrating into the extraction well field, near MW293A.

Area F

- The 100–1,000 µg/L boundary in this area is similar to the 2014 interpretation, in that it remains interpreted as two separate concentration fields. A cross section showing the interpretation of TCE concentrations within the RGA along this transect is shown in Figure 4. (The location of the cross section is denoted as B-B' on Figure 3.) MW145, MW495, and MW496 are in an area where the thickness of the RGA is nearly uniform. TCE concentrations in MW495 and MW 496 range from 114 µg/L to 431 µg/L, but a clear trend cannot be established. TCE analyses of samples collected from MW145 remain less than 100 µg/L, but this well is screened higher in the lower RGA than MW495 and MW496 are screened.

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Figure 3. 2016 Northeast Portion of the TCE Plume Regional Gravel Aquifer

FILE NAME	PROJECT #	EM	SCALE	AS NOTED	DATE
Fig_03_2014_2016PlumesTCE_NE_xsec					6/22/2017

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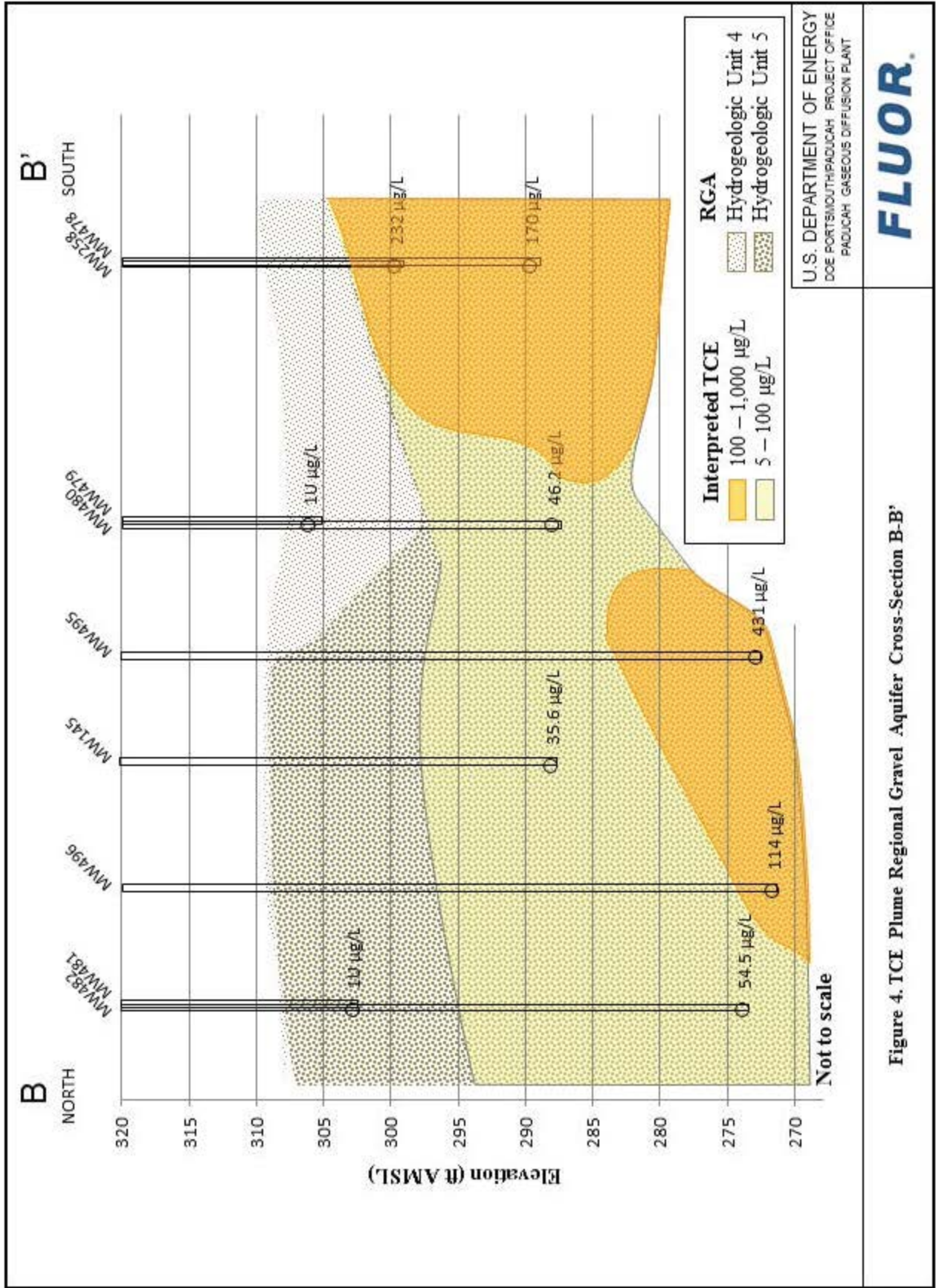


Figure 4. TCE Plume Regional Gravel Aquifer Cross-Section B-B'

- Based on results from the recently installed line of wells east of the C-400 Building, the northern lobe of the 100–1,000 µg/L concentration field has been connected with similar concentrations east of the C-400 Building (See Section 4.3).

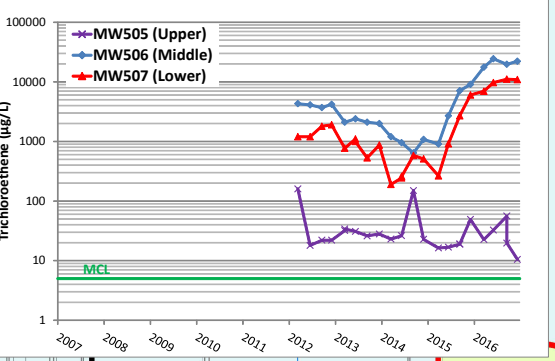
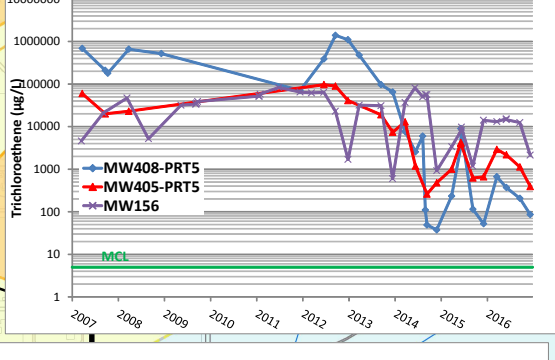
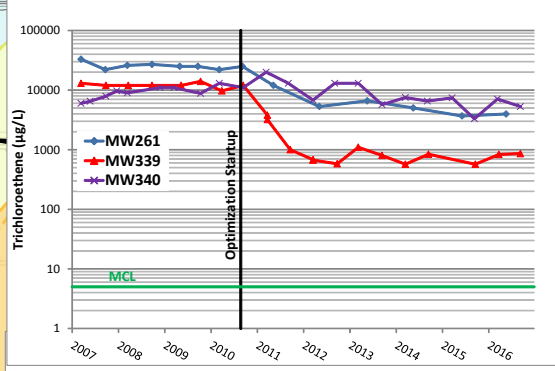
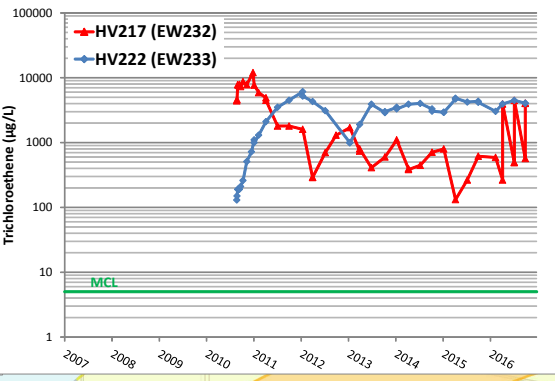
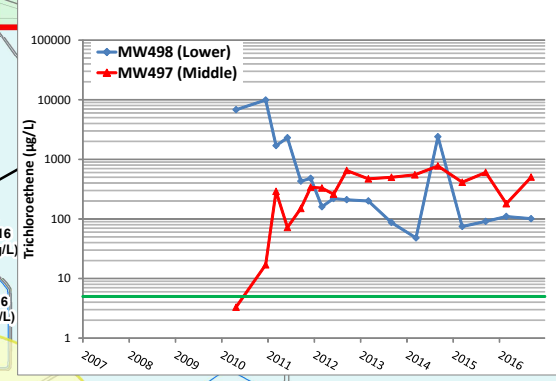
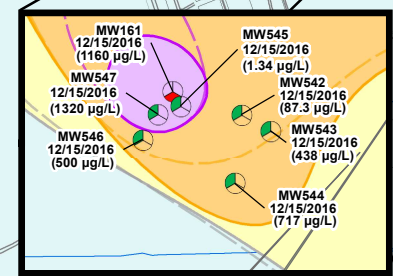
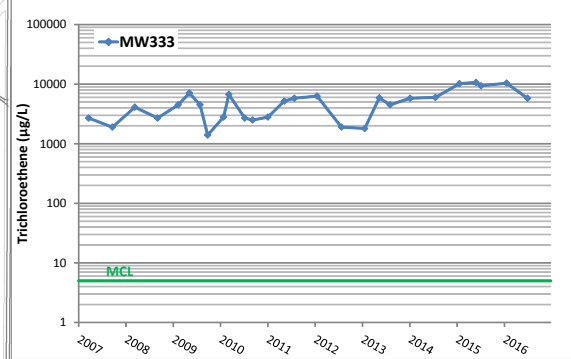
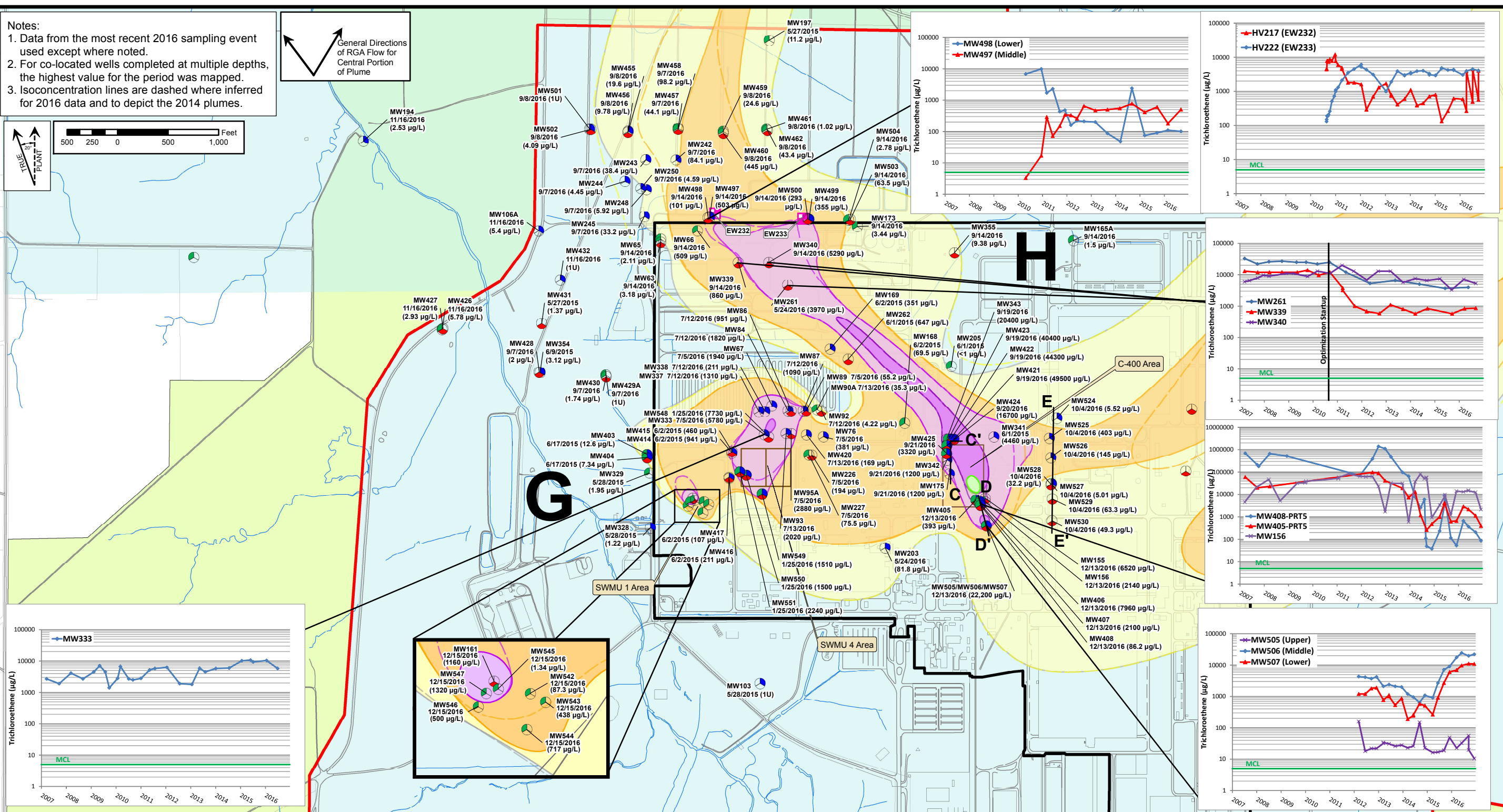
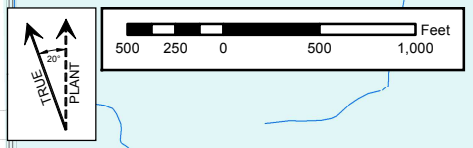
4.3 CENTRAL SITE AREA INCLUDING SOUTHWEST PLUME

TCE

The TCE plume in the industrialized section of the PGDP site is presented in Figure 5. The overall footprint in 2016 is similar to previous years; differences are noted below. In addition, Figure 5 includes temporal TCE concentration plots for selected wells illustrating the observations made in this subsection.

- The extent of the source area to the Southwest Plume north of SWMU 4 now includes a small 10,000 µg/L contour due to MW333 having detected TCE values greater than 10,000 µg/L in January and June 2015 and January 2016. The most recent value, 5,780 µg/L in July 2016, is shown on the map. The 1,000 µg/L contour was expanded and now includes MW549, MW550, and MW551, which were installed recently as part of the SWMU 4 Remedial Investigation.
- Several RGA MWs were added to the SWMU 1 area. These MWs, shown in an inset in order to label them more legibly, have not been sampled enough to provide any trending information.
- The second area (designated as H on Figure 5) is on the northern margin of the industrial footprint. The highest concentrations of TCE extend from C-400 Building toward the Northwest Plume groundwater extraction wells. The 1,000 µg/L contour remains similar to that of the map for 2014. Overall, TCE concentrations have declined since 2014.
- The C-400 Building source area shows a 100,000 µg/L contour, though none of the current MWs detected TCE in this range in 2016. The presence of this contour is based on historical data (e.g., MW156, which recorded up to 550,000 µg/L in 1991 and a Waste Area Grouping 6 angled boring, which recorded over 100,000 µg/L beneath C-400 in 1997) and consideration of the site conceptual model. The majority of the contamination at C-400 migrates to the northwest. A cross section showing the interpretation of TCE concentrations within the RGA along this transect is shown in Figure 6. (The location of the cross section is denoted as C-C' on Figure 5.)
- The area near the southeast corner of C-400 has been subject to remedial action using ERH in the UCRS and upper RGA (DOE 2011b; DOE 2013) and a steam treatability study in the RGA (DOE 2016). MW156, MW408-PRT5, and MW405-PRT5, located near the southeast corner of C-400, have shown declines in TCE concentration. Most notably, TCE in MW408-PRT5 has decreased from its high of 1,400,000 µg/L in September 2012, to its most recent 2016 value of 86.2 µg/L. An additional change in the C-400 Building source area is an extension of the 10,000 µg/L contour to the south to include the MW505/MW506/MW507 well nest, whose TCE concentrations began rising in the middle and lower RGA wells in 2015. The northwestern portion of this source area is shown in cross section in Figure 7. (The location of the cross section is denoted as D-D' on Figure 5.)
- A cross section (Figure 8) shows the 100–1,000 µg/L concentration field connecting a recently installed line of wells east of the C-400 Building as part of the Northeast Plume Optimization project (MW524—MW530) with similar concentrations east of the C-400 Building. The location of the cross section is denoted as E-E' on Figure 5.

Notes:
 1. Data from the most recent 2016 sampling event used except where noted.
 2. For co-located wells completed at multiple depths, the highest value for the period was mapped.
 3. Isoconcentration lines are dashed where inferred for 2016 data and to depict the 2014 plumes.



2016 TCE Plume Concentration Fields		2014 TCE Plume Isoconcentration Lines	
5 - 100 µg/L	5 - 100 µg/L	5 - 100 µg/L	5 - 100 µg/L
100 - 1,000 µg/L	100 - 1,000 µg/L	1,000 - 10,000 µg/L	1,000 - 10,000 µg/L
1,000 - 10,000 µg/L	10,000 - 100,000 µg/L	10,000 - 100,000 µg/L	≥ 100,000 µg/L
10,000 - 100,000 µg/L	≥ 100,000 µg/L		

LEGEND	
	Lower RGA Well
	Middle RGA Well
	Upper RGA Well
	Multizone RGA Well
	Monitoring Well (MW) Identification, or Residential (R) Well Identification
	Date of Sample & Sample Value
	1U = not detected at a reporting limit of 1 µg/L
	<1 indicates detected at a value less than the reporting limit
	Extraction Well

C-C'	- Locations of Cross-Sections	G	- Area G
D-D'	- Locations of Cross-Sections	H	- Area H
E-E'	- Locations of Cross-Sections		
	Water Policy Area		West Kentucky Wildlife Management Area
	DOE Property Boundary		Roadways
	Streams		PGDP Boundary

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Figure 5. 2016 Central Portion of the TCE Plume Regional Gravel Aquifer

FILE NAME: Fig_05_2014-2016PlumesTCE_Central	PROJECT #: EM	SCALE: AS NOTED	DATE: 6/9/2017
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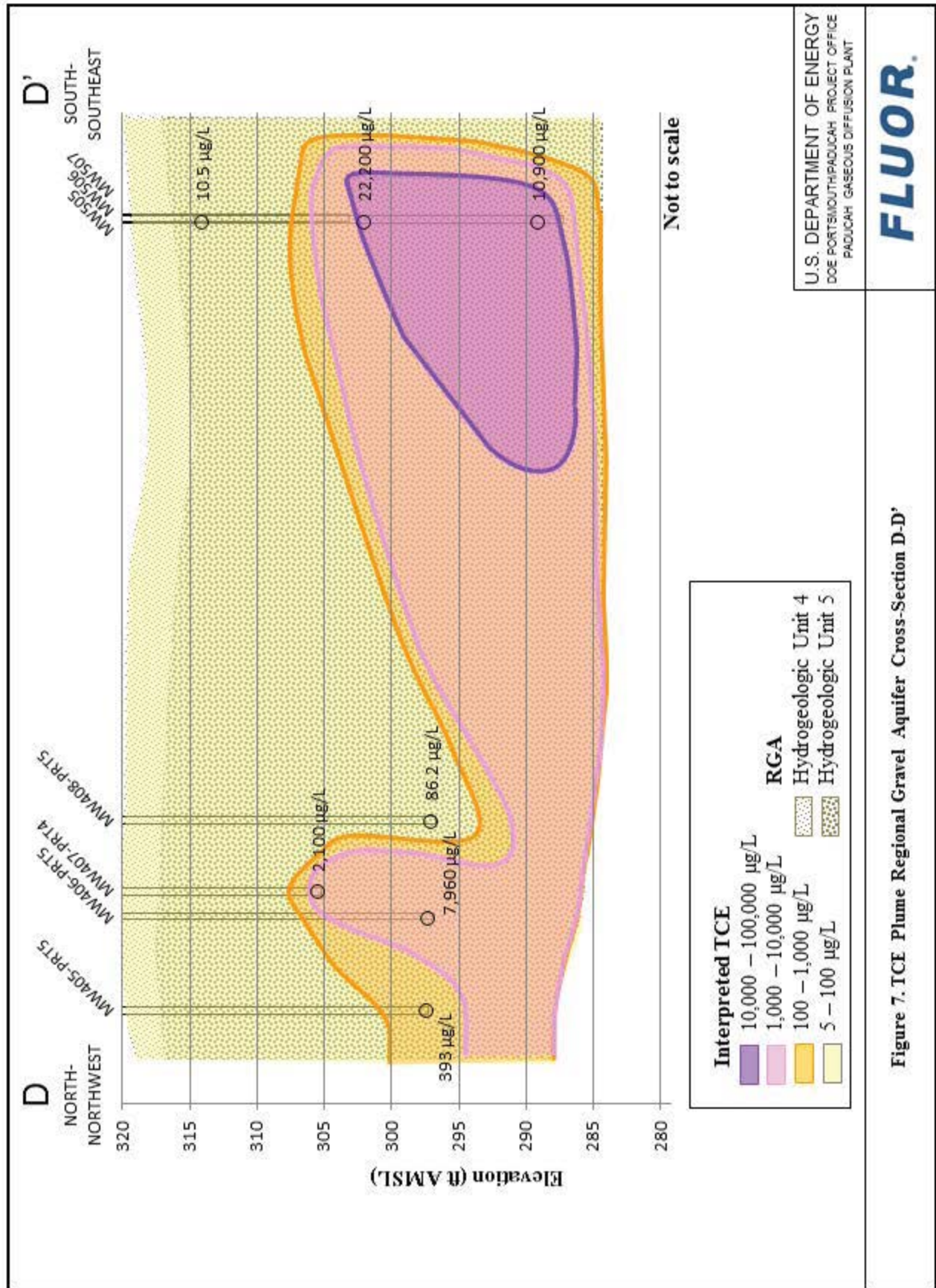
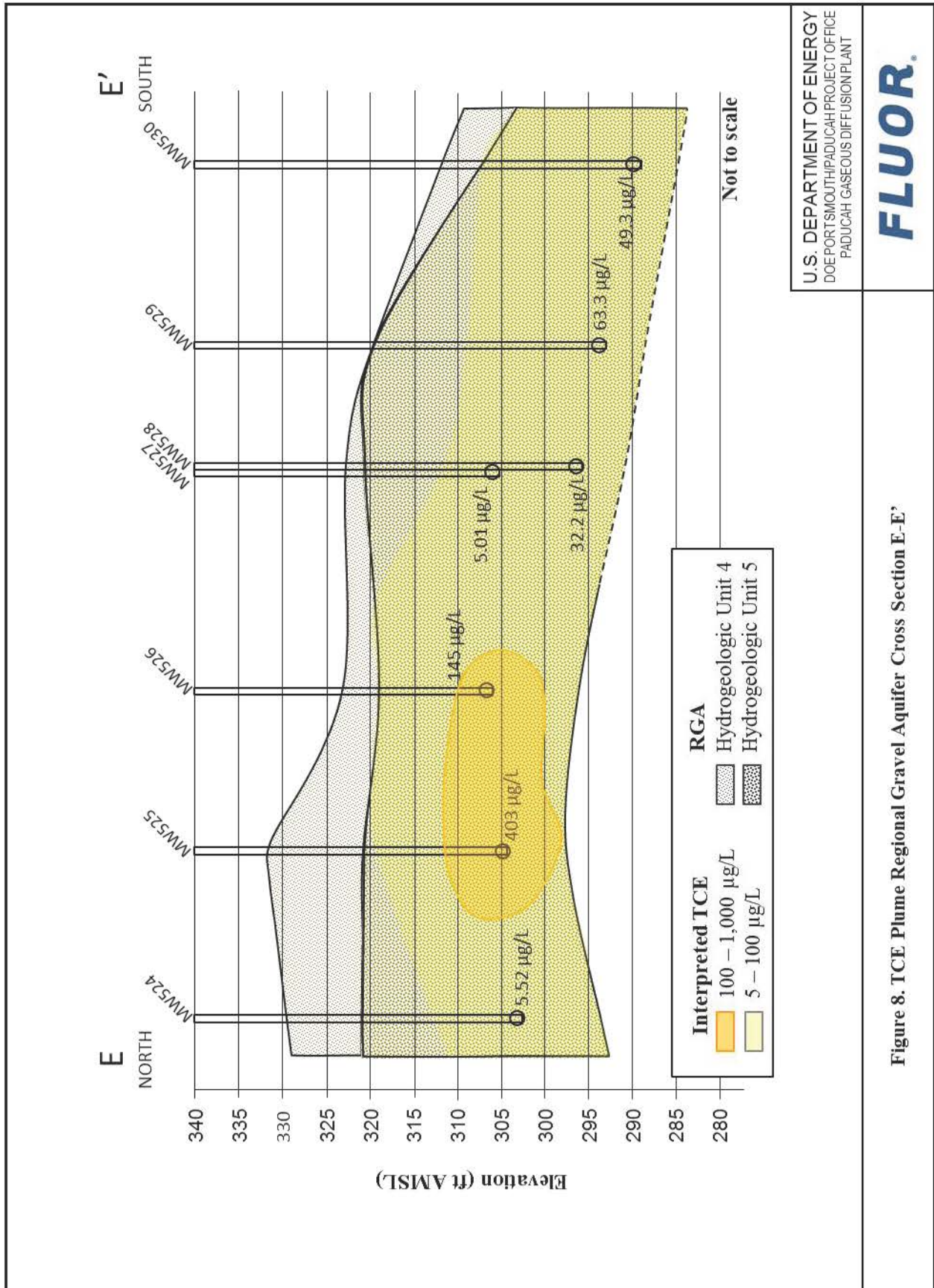


Figure 7. ICE Plume Regional Gravel Aquifer Cross-Section D-D'



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Figure 8. TCE Plume Regional Gravel Aquifer Cross Section E-E'

- Two wells, MW426 and MW106A (which replaced abandoned MW106 in 2014), recently have observed TCE concentrations exceeding 5 µg/L. These wells are not directly downgradient of the Southwest Plume source area (designated as G on Figure 5) based on the potentiometric surface in the RGA. As more recent data become available, results for wells in these areas will be assessed for an increasing TCE trend and changes to the monitoring frequency will be made as needed.

Tc-99

There were 1,018 analyses for Tc-99 in RGA groundwater at PGDP in 2015 and 2016, with only 41 results above 900 pCi/L. Figure 9 presents the results of Tc-99 analyses near the central area of the plant, where the groundwater samples collected in 2016 (and supplemented with samples collected in 2015) contained Tc-99 at activities greater than 900 pCi/L, and temporal concentration plots for selected wells illustrating the observations made in this subsection.

The area exceeding 900 pCi/L for Tc-99 coincides with the high-concentration TCE footprint on Figure 5 (i.e., the area encompassed by the 1,000–10,000 µg/L isocontour) with a few exceptions. From the 2014 interpreted contour, the 900 pCi/L contour was extended only slightly to encompass MW340, which increased to 1,150 pCi/L in 2016. Tc-99 activities in nearby MW261 and MW339 remain below 900 pCi/L.

The highest level of Tc-99 occurs in the area of MW422 through MW425. This is consistent with the location of the former Tc-99 storage tank, previously located near the northwestern portion of C-400 Building, which is near the expected source area of the Tc-99 plume. The 3,790 pCi/L isoconcentration contour was extended slightly to the south to include MW425, whose Tc-99 activity increased from 2,220 pCi/L in 2014 to 6,810 pCi/L to end 2016.

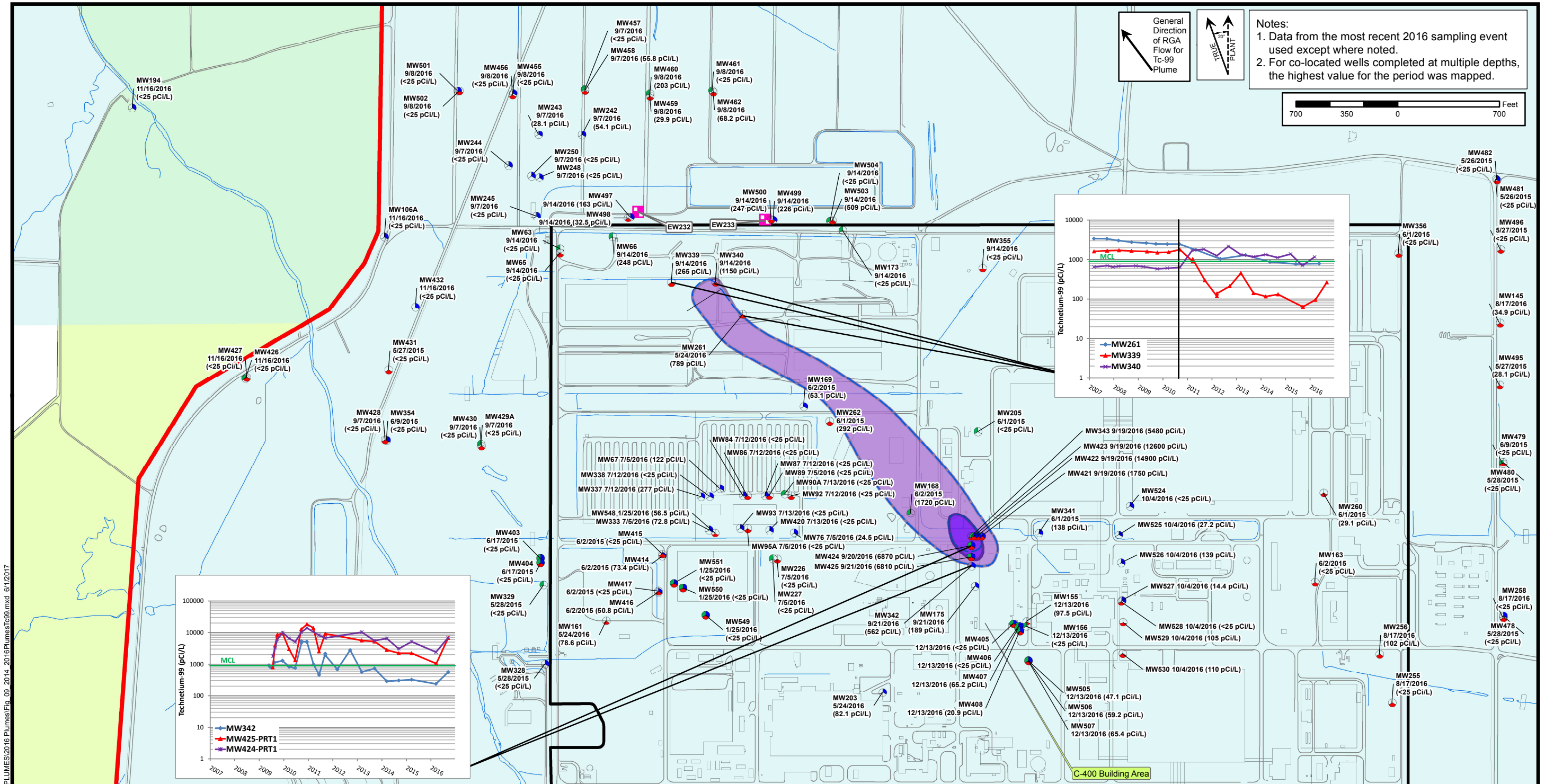
Northeast Plume transect wells, MW524—MW530, recently installed as part of the Northeast Plume Optimization project, all contain less than 900 pCi/L Tc-99.

5. POTENTIOMETRIC MAP

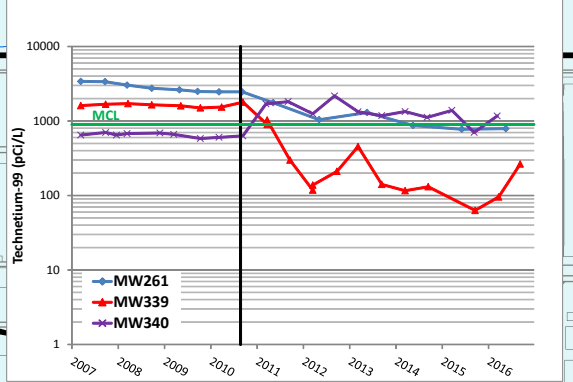
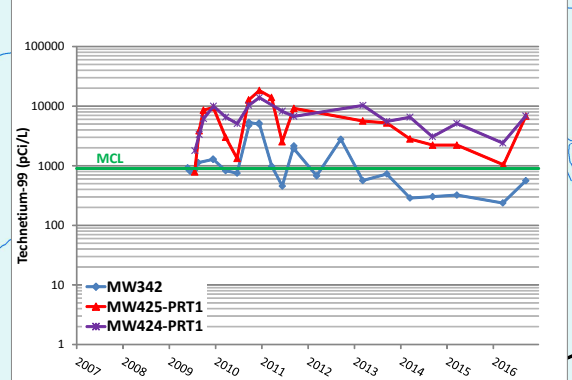
A potentiometric map for the RGA is presented for August 2016 data from the synoptic water level event (Figure 10). These potentiometric contours help explain plume geometries, although the ultimate plume locations are controlled by multiple factors.

6. INTERNAL REVIEW PROCESS

The map contours generated for 2016 plumes were developed by consensus by FPDP subject matter experts and reviewed by hydrogeologists familiar with the site. DOE subsequently reviewed, provided comments, and, after resolution of comments, concurred on the maps.



Notes:
 1. Data from the most recent 2016 sampling event used except where noted.
 2. For co-located wells completed at multiple depths, the highest value for the period was mapped.



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2016 Tc-99 Plume Concentration Fields
 900 - 3,790 pCi/L
 ≥ 3,790 pCi/L

2014 Tc-99 Plume Isoconcentration Lines
 900 - 3,790 pCi/L
 ≥ 3,790 pCi/L

LEGEND

- - Lower RGA Well
- - Middle RGA Well
- - Upper RGA Well
- - Multizone RGA Well
- MW103
8/17/2016 (25) - Monitoring Well Identification, Date of Sample & Sample Value
- - Extraction Well

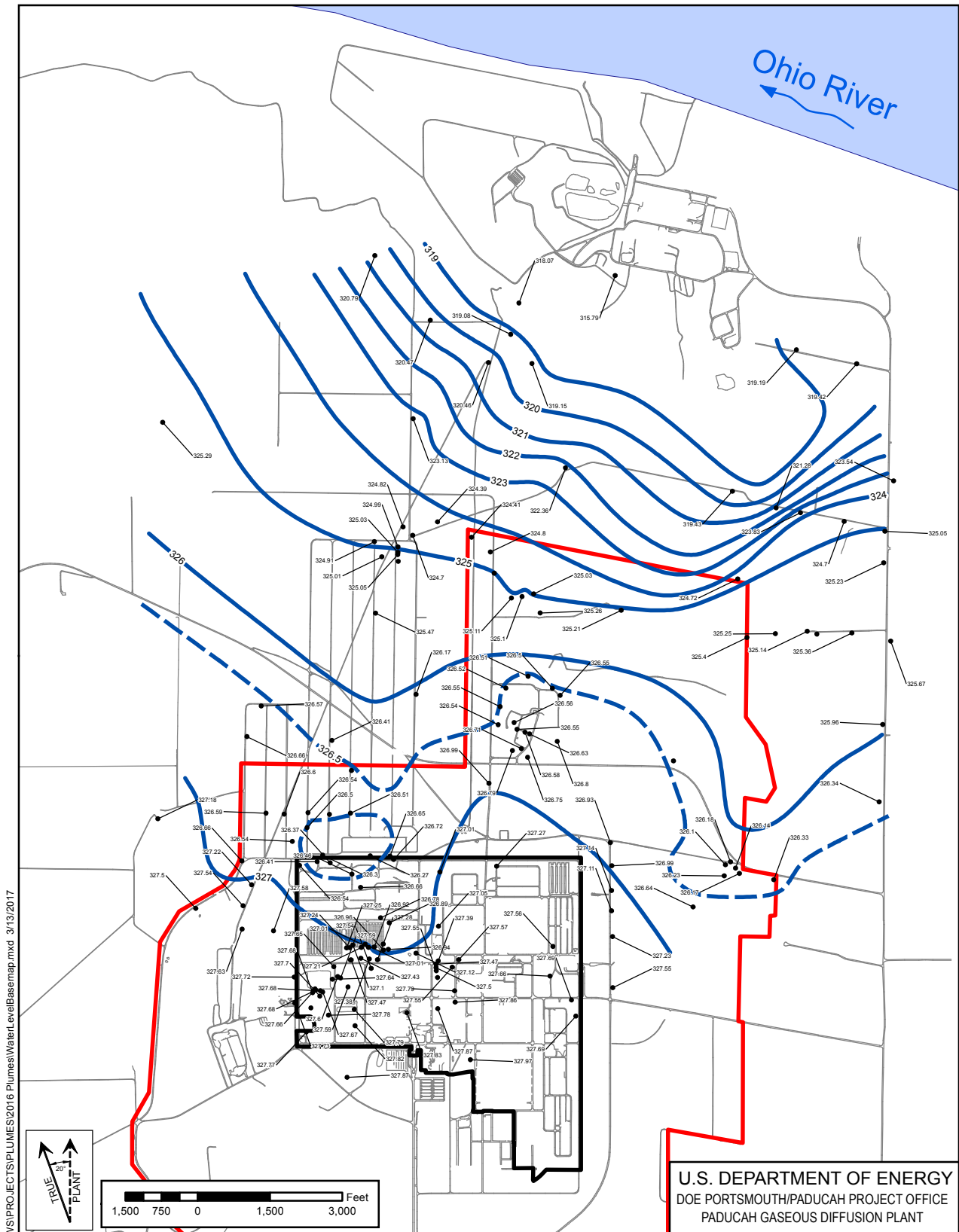
- Water Policy Area
- West Kentucky Wildlife Management Area
- DOE Property Boundary
- Roadways
- Streams
- PGDP Boundary

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Figure 9. 2016 Tc-99 Plume—Regional Gravel Aquifer

FILE NAME: Fig_09_2014_2016PlumesTc99	PROJECT #: EM	SCALE: AS NOTED	DATE: 6/1/2017
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FLUOR

Figure 10. Regional Gravel Aquifer Potentiometric Map (August 2016)

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APPENDIX A

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APPENDIX A

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APPENDIX B
TABLE OF DATA USED TO PREPARE
THE 2016 PLUME MAPS

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Table B.1. 2015 and 2016 TCE and Tc-99 Data Used to Create Plume Map

Station	RGA Monitored Zone	Date TCE Sample Collected	TCE (µg/L)	Date Tc-99 Sample Collected	Tc-99 (pCi/L)	Notes
MW100	Lower	5/23/2016	1U	5/23/2016	0.337	
MW103	Middle	5/28/2015	1U	5/28/2015	-1.77	
MW106A	Middle	11/16/2016	5.4	11/16/2016	6.12	
MW124	Lower	8/4/2016	3.1	8/4/2016	7.97	
MW125	Lower	5/26/2015	172	5/26/2015	75.5	
MW126	Middle	8/4/2016	1.66	8/4/2016	7.6	
MW134	Lower	11/14/2016	1U	11/14/2016	-4.47	
MW135	Lower	6/10/2015	48.3	6/10/2015	83.7	
MW139	Middle	5/19/2015	6.08	5/19/2015	1.17	
MW145	Lower	8/17/2016	35.6	8/17/2016	34.9	
MW146	Lower	11/14/2016	4.82	11/14/2016	-0.995	
MW148	Middle	5/20/2015	11.2	5/20/2015	10.8	
MW150	Lower	5/24/2016	1U	5/24/2016	-6.87	
MW152	Lower	5/23/2016	1.24	5/23/2016	109	
MW155	Lower	12/13/2016	6520	12/13/2016	97.5	
MW156	Upper	12/13/2016	2140	12/13/2016	-7.97	TCE dips in December
MW161	Lower	12/15/2016	1160	5/24/2016	78.6	
MW163	Lower	6/2/2015	35.1	6/2/2015	3.38	
MW165A	Upper	9/14/2016	1.5	9/14/2016	37.9	
MW168	Upper	6/2/2015	69.5	6/2/2015	1720	
MW169	Middle	6/2/2015	351	6/2/2015	53.1	
MW173	Upper	9/14/2016	3.44	9/14/2016	-1.45	
MW175	Middle	9/21/2016	1200	9/21/2016	189	
MW191	Middle	5/23/2016	1U	5/23/2016	6.39	
MW193	Upper	6/17/2015	0.3	6/17/2015	-3.34	
MW194	Middle	11/16/2016	2.53	11/16/2016	0.935	
MW197	Upper	5/27/2015	11.2	5/27/2015	12.1	
MW199	Lower	11/16/2016	0.68	11/16/2016	1.44	
MW200	Middle	5/13/2015	0.97	5/13/2015	18.6	
MW201	Middle	11/16/2016	0.55	11/16/2016	-0.83	
MW202	Lower	11/16/2016	1U	11/16/2016	-0.379	
MW203	Middle	5/24/2016	81.8	5/24/2016	82.1	
MW205	Upper	6/1/2015	0.33	6/1/2015	-6.24	
MW220	Upper	10/10/2016	0.63	10/10/2016	12.3	
MW221	Upper	10/12/2016	0.51	10/12/2016	18	
MW222	Upper	10/13/2016	1U	10/13/2016	0.0157	
MW223	Upper	10/13/2016	1U	10/13/2016	3.25	
MW224	Upper	10/11/2016	1U	10/11/2016	5.9	
MW226	Lower	7/5/2016	194	7/5/2016	10.7	
MW227	Upper	7/5/2016	75.5	7/5/2016	-4.03	
MW233	Middle	5/18/2016	1.17	5/18/2016	-1.63	
MW236	Lower	5/18/2016	1.69	5/18/2016	-3.93	
MW240	Middle	5/18/2016	1.04	5/18/2016	-0.498	
MW242	Middle	9/7/2016	84.1	9/7/2016	54.1	
MW243	Middle	9/7/2016	38.4	9/7/2016	28.1	
MW244	Middle	9/7/2016	4.45	9/7/2016	7.95	
MW245	Middle	9/7/2016	33.2	9/7/2016	6.92	
MW248	Middle	9/7/2016	5.92	9/7/2016	9.1	

Table B.1. 2015 and 2016 TCE and Tc-99 Data Used to Create Plume Map (Continued)

Station	RGA Monitored Zone	Date TCE Sample Collected	TCE (µg/L)	Date Tc-99 Sample Collected	Tc-99 (pCi/L)	Notes
MW250	Middle	9/7/2016	4.59	9/7/2016	5.62	
MW252	Lower	5/23/2016	0.31	5/23/2016	-2.95	
MW253	Lower	5/23/2016	34.9	5/23/2016	-0.467	
MW255	Lower	8/17/2016	240	8/17/2016	7.27	
MW256	Lower	8/17/2016	330	8/17/2016	102	
MW258	Lower	8/17/2016	170	8/17/2016	11.4	
MW260	Lower	6/1/2015	403	6/1/2015	29.1	
MW261	Lower	5/24/2016	3970	5/24/2016	789	
MW262	Lower	6/1/2015	647	6/1/2015	292	
MW283	Lower	8/4/2016	47.8	8/4/2016	6.1	
MW288	Lower	8/4/2016	155	8/4/2016	50.8	
MW291	Lower	8/4/2016	34.6	8/4/2016	8.3	
MW292	Lower	8/17/2016	202	8/17/2016	44.1	
MW293A	Middle	8/4/2016	97.7	8/4/2016	3.76	
MW328	Middle	5/28/2015	1.22	5/28/2015	-6.2	
MW329	Upper	5/28/2015	1.95	5/28/2015	-12.6	
MW333	Middle	7/5/2016	5780	7/5/2016	72.8	
MW337	Middle	7/12/2016	1310	7/12/2016	277	
MW338	Middle	7/12/2016	211	7/12/2016	6.49	
MW339	Lower	9/14/2016	860	9/14/2016	265	
MW340	Lower	9/14/2016	5290	9/14/2016	1150	
MW341	Middle	6/1/2015	4460	6/1/2015	138	
MW342	Middle	9/21/2016	1200	9/21/2016	562	
MW343	Lower	9/19/2016	20400	9/19/2016	5480	
MW354	Middle	6/9/2015	3.12	6/9/2015	14.8	
MW355	Lower	9/14/2016	9.38	9/14/2016	16.8	
MW356	Lower	6/1/2015	6.54	6/1/2015	-2.12	
MW357	Upper	10/17/2016	5.81	10/17/2016	47.5	
MW358	Lower	10/17/2016	10.1	10/17/2016	39.3	
MW360	Upper	10/17/2016	1U	10/17/2016	5.64	
MW361	Middle	10/17/2016	5.13	10/17/2016	57.4	
MW363	Upper	10/17/2016	2.94	10/17/2016	24.4	
MW364	Lower	10/18/2016	6.03	10/18/2016	58.2	
MW366	Upper	10/18/2016	4.28	10/18/2016	68.8	
MW367	Lower	10/18/2016	1U	10/18/2016	13.4	
MW369	Upper	10/19/2016	4.56	10/19/2016	83.3	
MW370	Middle	10/19/2016	4.78	10/19/2016	31.7	
MW372	Upper	10/19/2016	7.06	10/19/2016	10.3	
MW373	Lower	10/19/2016	7.63	10/19/2016	19.9	
MW384	Upper	10/10/2016	0.54	10/10/2016	167	
MW385	Lower	10/11/2016	0.35	10/11/2016	147	
MW387	Upper	10/11/2016	0.79	10/11/2016	215	
MW388	Middle	10/11/2016	0.83	10/11/2016	162	
MW391	Middle	10/12/2016	11.4	10/12/2016	8.63	
MW392	Lower	10/12/2016	25.8	10/12/2016	1.55	
MW394	Upper	10/12/2016	7.06	10/12/2016	4.39	
MW395	Middle	10/12/2016	3.99	10/12/2016	2.15	
MW397	Lower	10/11/2016	1U	10/11/2016	9.1	
MW403	Multizone	6/17/2015	12.6	6/17/2015	4.15	

Table B.1. 2015 and 2016 TCE and Tc-99 Data Used to Create Plume Map (Continued)

Station	RGA Monitored Zone	Date TCE Sample Collected	TCE (µg/L)	Date Tc-99 Sample Collected	Tc-99 (pCi/L)	Notes
MW404	Multizone	6/17/2015	7.34	6/17/2015	7.08	
MW405	Multizone	12/13/2016	393	12/13/2016	13.9	
MW406	Multizone	12/13/2016	7960	12/13/2016	-0.0598	
MW407	Multizone	12/13/2016	2100	12/13/2016	65.2	
MW408	Multizone	12/13/2016	86.2	12/13/2016	20.9	
MW409	Lower	8/18/2016	1U			
MW410	Lower	8/18/2016	1U			
MW411	Middle	8/18/2016	1U			
MW414	Middle	6/2/2015	941	6/2/2015	73.4	
MW415	Lower	6/2/2015	460	6/2/2015	21.7	
MW416	Middle	6/2/2015	211	6/2/2015	50.8	
MW417	Lower	6/2/2015	107	6/2/2015	10	
MW418	Middle	5/18/2016	7.85	5/18/2016	1.02	
MW419	Lower	5/18/2016	19.5	5/18/2016	-3.59	
MW420	Middle	7/13/2016	169	7/13/2016	8.3	
MW421	Multizone	9/19/2016	49500	9/19/2016	1750	
MW422	Multizone	9/19/2016	44300	9/19/2016	14900	
MW423	Multizone	9/19/2016	40400	9/19/2016	12600	
MW424	Multizone	9/20/2016	16700	9/20/2016	6870	
MW425	Multizone	9/21/2016	3320	9/21/2016	6810	
MW426	Upper	11/16/2016	5.78	11/16/2016	3.07	
MW427	Lower	11/16/2016	2.93	11/16/2016	-1.8	
MW428	Lower	9/7/2016	2	9/7/2016	13.1	
MW429A	Upper	9/7/2016	1U	9/7/2016	-4.21	
MW430	Lower	9/7/2016	1.74	9/7/2016	4.12	
MW431	Lower	5/27/2015	1.37	5/27/2015	-11.5	
MW432	Middle	11/16/2016	1U	11/16/2016	-2.79	
MW433	Middle	11/14/2016	1U	11/14/2016	-0.909	
MW435	Lower	11/14/2016	0.55	11/14/2016	8.22	
MW439	Middle	5/19/2015	1.19	5/19/2015	5.83	
MW440	Lower	5/19/2015	1.23	5/19/2015	-1.28	
MW441	Lower	11/14/2016	1.73	11/14/2016	1.35	
MW442	Lower	5/18/2015	3.8	5/18/2015	3.82	
MW443	Lower	5/18/2015	1.72	5/18/2015	2.77	
MW444	Lower	5/18/2015	2.14	5/18/2015	5.68	
MW445	Middle	5/18/2015	9	5/18/2015	10.2	
MW447	Lower	5/18/2015	44.4	5/18/2015	19.5	
MW448	Middle	5/13/2015	6.95	5/13/2015	-10.2	
MW450	Lower	5/13/2015	23.8	5/13/2015	13.3	
MW451	Upper	5/26/2015	1U	5/26/2015	-5.31	
MW452	Lower	11/14/2016	1U	11/14/2016	2.7	
MW453	Upper	5/26/2015	79.9	5/26/2015	34.7	
MW454	Lower	5/26/2015	101	5/26/2015	30.1	
MW455	Middle	9/8/2016	19.6	9/8/2016	14.2	
MW456	Lower	9/8/2016	9.78	9/8/2016	4.72	
MW457	Upper	9/7/2016	44.1	9/7/2016	16.6	
MW458	Lower	9/7/2016	98.2	9/7/2016	55.8	
MW459	Upper	9/8/2016	24.6	9/8/2016	29.9	
MW460	Lower	9/8/2016	445	9/8/2016	203	

Table B.1. 2015 and 2016 TCE and Tc-99 Data Used to Create Plume Map (Continued)

Station	RGA Monitored Zone	Date TCE Sample Collected	TCE (µg/L)	Date Tc-99 Sample Collected	Tc-99 (pCi/L)	Notes
MW461	Upper	9/8/2016	1.02	9/8/2016	7.28	
MW462	Lower	9/8/2016	43.4	9/8/2016	68.2	
MW463	Middle	5/19/2015	94.6	5/19/2015	2.82	
MW464	Lower	5/19/2015	67.5	5/19/2015	2.5	
MW465	Middle	5/23/2016	26.4	5/23/2016	-0.297	
MW466	Middle	5/23/2016	25.9	5/23/2016	-2.69	
MW467	Upper	5/21/2015	5.02	5/21/2015	7.85	
MW468	Middle	5/21/2015	11.5	5/21/2015	6.42	
MW469	Middle	11/17/2016	1.76	5/24/2016	-0.468	
MW470	Lower	11/17/2016	1.5	5/24/2016	-1.29	
MW471	Middle	5/24/2016	1U	5/24/2016	-5.62	
MW472	Lower	5/24/2016	1U	5/24/2016	-4.82	
MW473	Lower	5/21/2015	1U	5/21/2015	6.39	
MW474	Lower	6/17/2015	1U	6/17/2015	-0.427	
MW475	Middle	5/21/2015	1U	5/21/2015	7.4	
MW476	Lower	5/21/2015	1U	5/21/2015	12.1	
MW477	Lower	6/10/2015	54.5	6/10/2015	-4.94	
MW478	Middle	5/28/2015	232	5/28/2015	-1.95	
MW479	Upper	6/9/2015	1U	6/9/2015	1.11	
MW480	Lower	5/28/2015	46.2	5/28/2015	5.85	
MW481	Middle	5/26/2015	1U	5/26/2015	2.29	
MW482	Lower	5/26/2015	54.5	5/26/2015	20.4	
MW483	Middle	5/20/2015	51.3	5/20/2015	13.9	
MW484	Lower	5/20/2015	48.3	5/20/2015	-1.16	
MW485	Middle	5/20/2015	52.7	5/20/2015	-2.45	
MW486	Lower	5/20/2015	1.24	5/20/2015	1.59	
MW487	Lower	5/20/2015	6.46	5/20/2015	5.16	
MW488	Middle	5/20/2015	0.81	5/20/2015	7.34	
MW489	Middle	5/13/2015	92.1	5/13/2015	46.8	
MW490	Lower	5/13/2015	105	5/13/2015	21.7	
MW491	Upper	5/13/2015	61	5/13/2015	95.7	
MW492	Lower	5/13/2015	110	5/13/2015	97.3	
MW493	Upper	5/13/2015	2.62	5/13/2015	34.8	
MW494	Middle	5/13/2015	0.86	5/13/2015	65.6	
MW495	Lower	5/27/2015	431	5/27/2015	28.1	
MW496	Lower	5/27/2015	114	5/27/2015	2.15	
MW497	Middle	9/14/2016	503	9/14/2016	163	
MW498	Lower	9/14/2016	101	9/14/2016	32.5	
MW499	Middle	9/14/2016	355	9/14/2016	226	
MW500	Lower	9/14/2016	293	9/14/2016	247	
MW501	Middle	9/8/2016	1U	9/8/2016	5.29	
MW502	Lower	9/8/2016	4.09	9/8/2016	1.9	
MW503	Lower	9/14/2016	63.5	9/14/2016	509	
MW504	Upper	9/14/2016	2.78	9/14/2016	-3.2	
MW505	Upper	12/13/2016	10.5	12/13/2016	47.1	
MW506	Middle	12/13/2016	22200	12/13/2016	59.2	
MW507	Lower	12/13/2016	10900	12/13/2016	65.4	
MW524	Middle	10/4/2016	5.52	10/4/2016	-1.43	
MW525	Middle	10/4/2016	403	10/4/2016	27.2	

Table B.1. 2015 and 2016 TCE and Tc-99 Data Used to Create Plume Map (Continued)

Station	RGA Monitored Zone	Date TCE Sample Collected	TCE (µg/L)	Date Tc-99 Sample Collected	Tc-99 (pCi/L)	Notes
MW526	Middle	10/4/2016	145	10/4/2016	139	
MW527	Middle	10/4/2016	5.01	10/4/2016	14.4	
MW528	Lower	10/4/2016	32.2	10/4/2016	-2.63	
MW529	Lower	10/4/2016	63.3	10/4/2016	105	
MW530	Lower	10/4/2016	49.3	10/4/2016	110	
MW542	Upper	12/15/2016	87.3			
MW543	Upper	12/15/2016	438			
MW544	Upper	12/15/2016	717			
MW545	Upper	12/15/2016	1.34			
MW546	Upper	12/15/2016	500			
MW547	Upper	12/15/2016	1320			
MW548	Lower	1/25/2016	7730	1/25/2016	56.5	
MW549	Multizone	1/25/2016	1510	1/25/2016	0.364	
MW550	Multizone	1/25/2016	1500	1/25/2016	5.82	
MW551	Multizone	1/25/2016	2240	1/25/2016	21.9	
MW63	Upper	9/14/2016	3.18	9/14/2016	3.56	
MW65	Lower	9/14/2016	2.11	9/14/2016	10.4	
MW66	Upper	9/14/2016	509	9/14/2016	248	
MW67	Middle	7/5/2016	1940	7/5/2016	122	
MW76	Middle	7/5/2016	381	7/5/2016	24.5	
MW84	Middle	7/12/2016	1820	7/12/2016	1.19	
MW86	Lower	7/12/2016	951	7/12/2016	8.71	
MW87	Middle	7/12/2016	1090	7/12/2016	1.07	
MW89	Lower	7/5/2016	55.2	7/5/2016	5.53	
MW90A	Upper	7/13/2016	35.3	7/13/2016	-4.16	
MW92	Lower	7/12/2016	4.22	7/12/2016	-0.138	
MW93	Middle	7/13/2016	2020	7/13/2016	1.13	
MW95A	Lower	7/5/2016	2880	7/5/2016	-0.913	
MW98	Middle	5/18/2016	2.18	5/18/2016	53.9	
MW99	Middle	5/24/2016	37.9	5/24/2016	-3.32	
R114	Residential	11/21/2016	1U	11/21/2016	-2.62	
R13	Residential	11/15/2016	1.84	11/15/2016	-5.51	
R14	Residential	11/15/2016	1U	11/15/2016	-7.16	
R2	Residential	11/15/2016	7.54	11/15/2016	-0.781	
R20	Residential	11/21/2016	1U	11/21/2016	-0.564	
R21	Residential	11/17/2016	0.96	11/17/2016	5.41	
R245	Residential	11/15/2016	1U	11/15/2016	-8.49	
R26	Residential	11/15/2016	1U	11/15/2016	-4.3	
R294	Residential	11/23/2015	1U	11/23/2015	1.43	
R302	Residential	11/21/2016	1U	11/21/2016	-5.25	
R387	Residential	11/18/2015	1U	11/18/2015	-11.2	
R53	Residential	11/15/2016	1U	11/15/2016	-2.67	
R83	Residential	11/21/2016	1U	11/21/2016	4.67	
R9	Residential	11/21/2016	1U	11/21/2016	-2.64	
R90	Residential	11/21/2016	1U	11/21/2016	2.95	

Residential wells are assumed to be completed in the Upper RGA.

TCE Results of "1U" indicate sample was analyzed and not detected at a reporting level of 1 µg/L.

Blank cells indicate no result is available.

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APPENDIX C
2016 PLUME MAPS

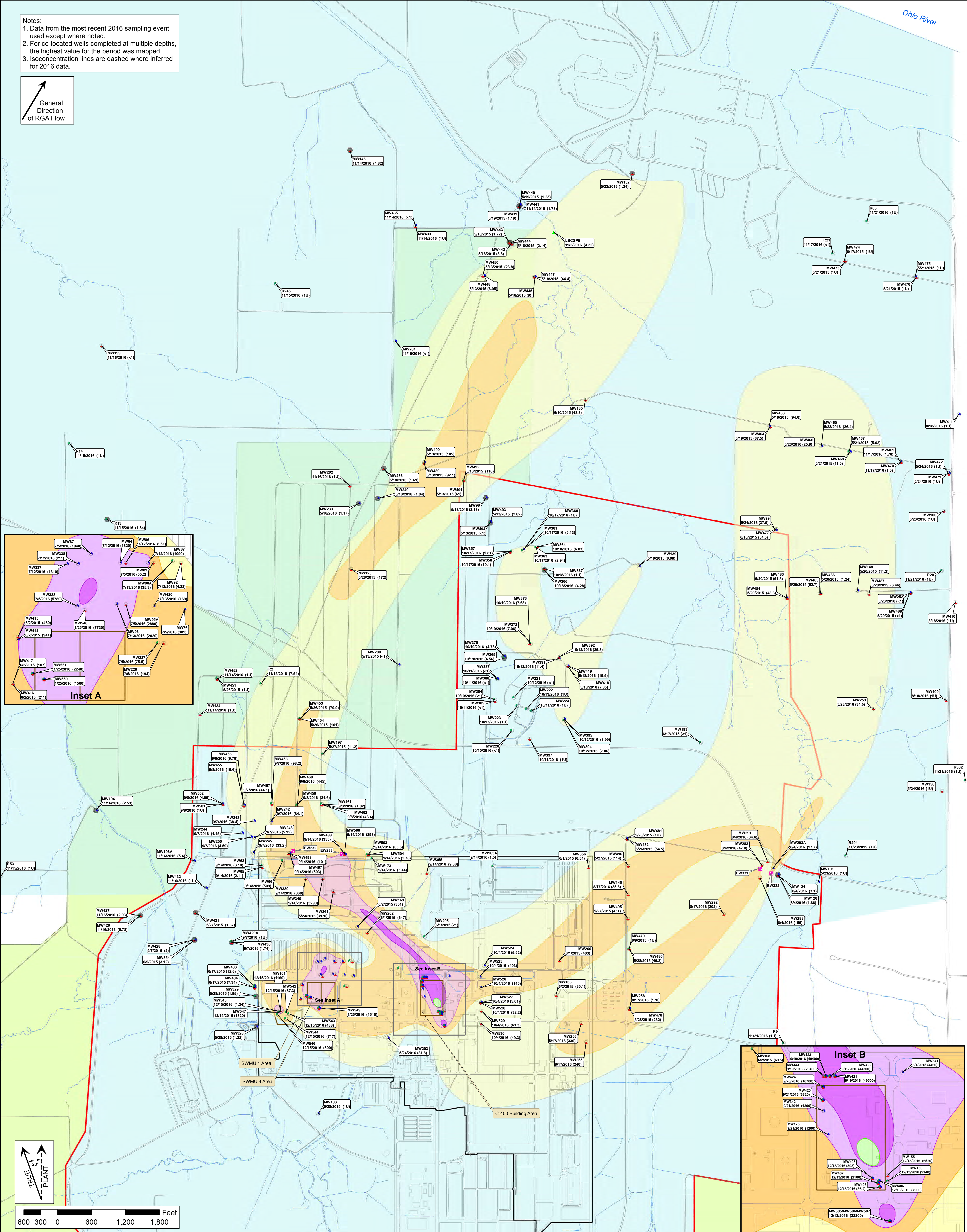
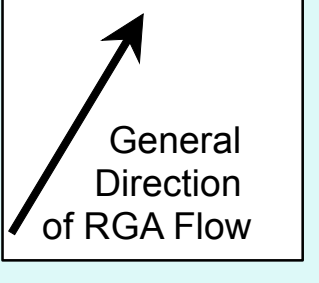
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FIGURES

C.1. 2016 TCE Plume—Regional Gravel Aquifer	C-5
C.2. 2016 Tc-99 Plume—Regional Gravel Aquifer	C-7

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Notes:
 1. Data from the most recent 2016 sampling event used except where noted.
 2. For co-located wells completed at multiple depths, the highest value for the period was mapped.
 3. Isoconcentration lines are dashed where inferred for 2016 data.



LEGEND

- Monitoring Well Identification
- Date of Sample, and Sample Value (in µg/L)
- 1U = not detected at a reporting limit of 1 µg/L
- <1 indicates detected at a value less than the reporting limit.
- Lower RGA Well
- Middle RGA Well
- Upper RGA Well
- Multizone RGA Well
- Extraction Well
- RGA Well outside Plume Concentration Field showing TCE > 1 µg/L
- Water Policy Area
- West Kentucky Wildlife Management Area
- DOE Property Boundary
- Roadways
- Streams
- PGDP Boundary

- 2016 TCE Plume Concentration Fields**
- 5 - 100 µg/L
 - 100 - 1,000 µg/L
 - 1,000 - 10,000 µg/L
 - 10,000 - 100,000 µg/L
 - ≥ 100,000 µg/L

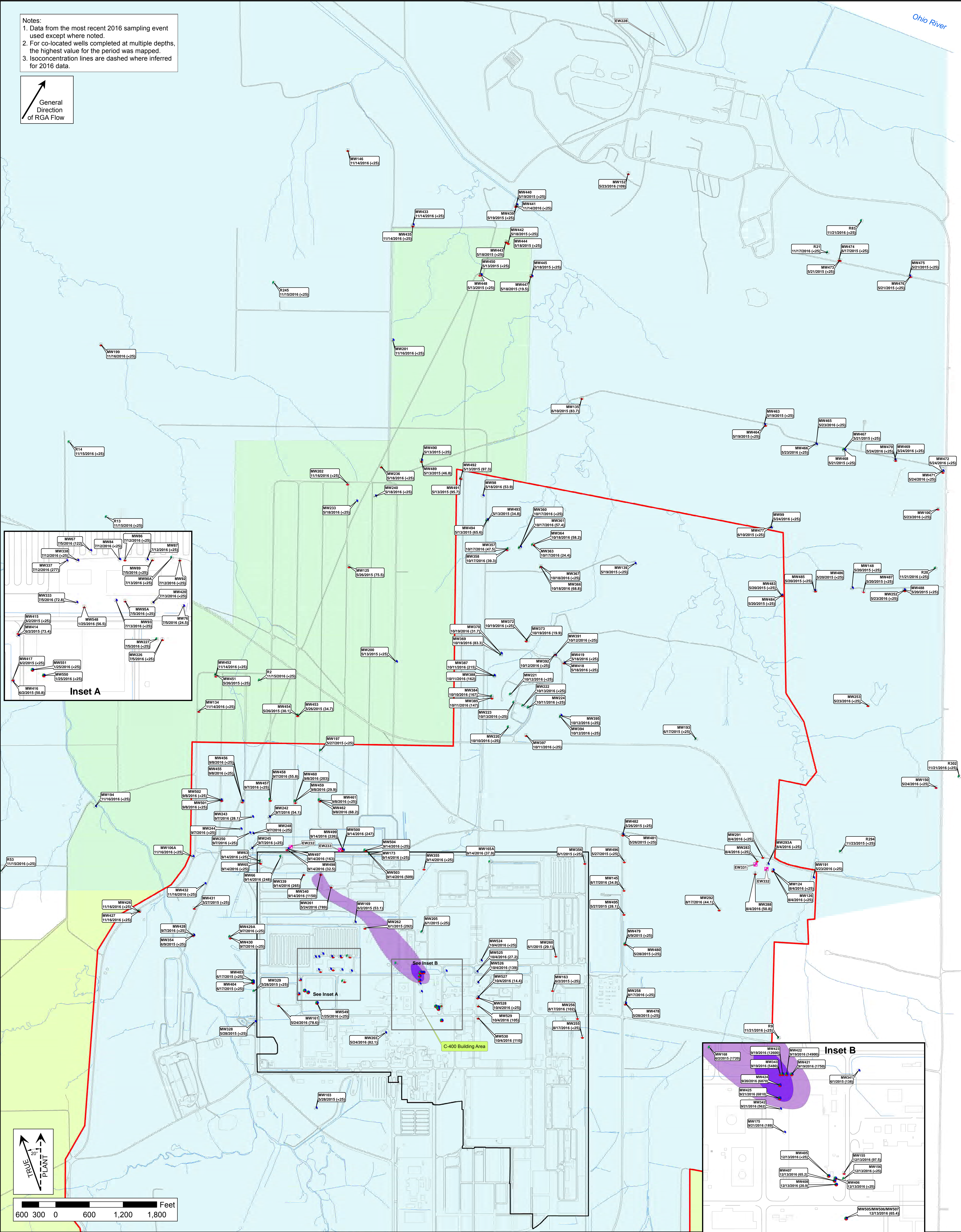
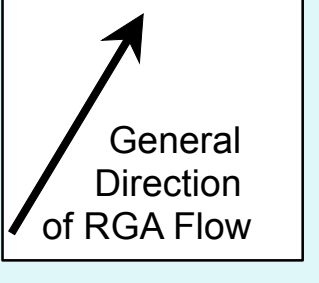


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Figure C.1. 2016 TCE Plume-Regional Gravel Aquifer

FILE NAME: Fig_C01_2016PlumesTCE	PROJECT #: EM	SCALE: AS NOTED	DATE: 4/28/2017
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Notes:
 1. Data from the most recent 2016 sampling event used except where noted.
 2. For co-located wells completed at multiple depths, the highest value for the period was mapped.
 3. Isoconcentration lines are dashed where inferred for 2016 data.



LEGEND

- | | | |
|---|---|---|
| <p>2016 Tc-99 Plume Concentration Fields</p> <ul style="list-style-type: none"> 900 - 3,790 pCi/L ≥ 3,790 pCi/L | <ul style="list-style-type: none"> MW103 (11/17/2016 (c-25)) - Monitoring Well Identification, Date of Sample, and Sample Value - Lower RGA Well - Middle RGA Well - Upper RGA Well - Multizone RGA Well - Extraction Well | <ul style="list-style-type: none"> - Water Policy Area - West Kentucky Wildlife Management Area - DOE Property Boundary - Roadways - Streams - PGDP Boundary |
|---|---|---|



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Figure C.2. 2016 Tc-99 Plume—Regional Gravel Aquifer

FILE NAME: Fig_C02_2016PlumesTc99	PROJECT #: EM	SCALE: AS NOTED	DATE: 4/28/2017
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