FRNP-RPT-0074

Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2018 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

FOUR RIVERS NUCLEAR PARTNERSHIP, LLC

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Date Issued—June 2019

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

Prepared by
FOUR RIVERS NUCLEAR PARTNERSHIP, LLC,
managing the
Deactivation and Remediation Project at the
Paducah Gaseous Diffusion Plant
under Contract DE-EM0004895

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ACRONYMS

DOE	U.S. Department of Energy
FRNP	Four Rivers Nuclear Partnership, LLC
MCL	maximum contaminant level
MW	monitoring well
OREIS	Oak Ridge Environmental Information System
PEGASIS	PPPO Environmental Geographic Analytical Spatial Information System
PGDP	Paducah Gaseous Diffusion Plant
PPPO	Portsmouth/Paducah Project Office
RGA	Regional Gravel Aquifer
SWMU	solid waste management unit

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1. INTRODUCTION

Four Rivers Nuclear Partnership, LLC, (FRNP) has evaluated groundwater analytical data as of the end of calendar year 2018 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 2018. For wells that were not sampled in 2018, the most recent sample result from 2017 has been used. These plume maps are based on the most recent values for 2018 or 2017, thus they may not reflect the maximum or minimum value observed during the reporting period for all locations. An alternate interpretation showing the maximum values observed during 2017–2018 is available in Appendix A.

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. These maps show the full extent of the TCE and Tc-99 plumes, with plots of isoconcentration lines and measured contaminant levels. Maps of TCE degradation products are not included because their detection often is masked by higher TCE concentrations in PGDP groundwater samples and because the plumes of TCE degradation products are overlain by the TCE plumes. TCE breakdown products typically are not seen in groundwater samples in areas of the plumes away from the plant. Any calculation of human health risk estimates based upon mapped contaminant levels should be performed by a qualified risk assessor because of the uncertainties in the levels of TCE breakdown products, some of which are unknown due to the inability to measure these levels in areas where TCE concentrations are very high.

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 (https://eic.pad.pppo.gov).

The maps and data tables (including charts of TCE and Tc-99 sampling results collected for the last 10 years) used to generate maps presented in this document are included in the Appendices. All TCE and Tc-99 analyses of groundwater samples collected by DOE in Paducah OREIS, including qualified data, not rejected during data validation and verification, were used in development of this report. These analyses are generated following the Quality Assurance Project Plan in the applicable DOE Environmental Monitoring Plan (FPDP 2017a; FRNP 2018a; FRNP 2018b). 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 2018. Appendix B contains the most recent 2018 and

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

2017 values from PGDP RGA monitoring wells (MWs) used to develop the plume maps. Appendix C provides large-scale maps of the 2018 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 2017 and 2018. The magnitude and distribution of contamination within the plumes will vary slightly over time based on contaminant trends and variations in hydrologic influences.

The Kentucky Division of Waste Management conducts independent environmental monitoring activities at the Paducah Site under a DOE Agreement in Principle grant. Agreement in Principle data are used semiquantitatively in the preparation of the report. In general, the MW and residential well sampling conducted under the Agreement in Principle program has produced results that are similar to those obtained by DOE. For the reporting period, the Agreement in Principle program sampled 7 MWs for TCE and 6 MWs for Tc-99 not sampled by DOE. The Tc-99 analyses of MW257 (not sampled by DOE) with a latest result for the reporting period of 961 pCi/L, are an example of Agreement in Principle data significantly influencing the interpretation of the plumes.

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 long-term repository of environmental data (measurements and geographic) for Paducah projects. (See Table B.1 in Appendix B for the 2017/2018 TCE and Tc-99 results in RGA wells used to create the 2018 TCE and Tc-99 plume maps.) Data collected by DOE contractors, following consistent quality assurance and sampling protocols, are used so that data are comparable to previous reports. Data are made available to the public through the U.S. Department of Energy's (DOE's) Portsmouth/Paducah Project Office (PPPO) Environmental Geographic Analytical Spatial Information System (PEGASIS) Web site at https://pegasis.pad.pppo.gov/. The maps for calendar year 2018 are based on analytical results from the most recent sampling event (primarily January–December 2018). Where co-located MWs (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. For wells that were not sampled in 2018, the most recent data from 2017 have been used.

Mapping involved first plotting the selected data on Geographic Information System-generated maps and then comparing those data to the contouring performed for the 2016 TCE and Tc-99 plume maps. Plume contours were adjusted to accommodate more recent data. The impact of the changes from 2016 to 2018 is discussed in Section 4. On the 2018 plume maps shown in Section 4 of the main text, dashed lines show the contour lines from the 2016 plume maps for comparison. On the 2018 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. 2018 PLUME MAPS

As identified in the column "Screened Zone" of the "Well Program Inventory," Appendix B, in the Environmental Monitoring Plan, there are 285 active MWs and piezometers, plus extraction wells and 14 residential wells that can be used to monitor the RGA (FRNP 2018). The PGDP deactivation and remediation prime contractor monitored a subset of this well network in 2018, as discussed below, in accordance with the Environmental Monitoring Plan (FPDP 2017a; FRNP 2018a; FRNP 2018b).

Figures C.1 and C.2 of Appendix C provide the 2018 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, plume lengths outside the DOE property and plume areas are approximated.

Table 1. PGDP Groundwater Plumes, CY 2018

Plume	Approximate Maximum Contaminant Levels Outside PGDP Boundary[c]	Approximate Maximum Contaminant Levels Off DOE Property	Off DOE Property Plume Length	Approximate Total Area[a]
		Trichloroethene		
Northwest	526 µg/L	84.6 µg/L	2.0 miles	662 acres
C-746-S&T Area	17.1 µg/L	N/A[b]	N/A[b]	102 acres
Northeast	417 µg/L	99.6 µg/L	1.7 miles	892 acres
Southwest	< 5 µg/L	< 5 µg/L	N/A	89 acres
		Technetium-99		
Northwest	< 900 pCi/L	< 900 pCi/L	N/A	18 acres

[a] The approximate total areas are the areas of the respective plumes inside and outside the PGDP boundary and DOE property.
[b] The C-746-S&T plume does not leave DOE property as currently interpreted.
[c] For purposes of this report, the "PGDP boundary" is defined as the revised 229 Boundary, per *Fed. Reg.*, Notices, Vol. 83, No. 213, dated November 2, 2018.

3.1 TRICHLOROETHENE

During the reporting period of 2017-2018, 233 RGA MWs[3] and 13 residential wells were sampled by DOE and analyzed for TCE and included in the development of the revised groundwater TCE plume map. Of the 233 RGA MWs included in the development of the TCE plume map, 185 were sampled most recently in 2018. Of the 13 residential wells included in the development of the TCE plume map, all 13 were sampled in 2018. The sample collection was based on the applicable Environmental Monitoring Plan, which governs the compliance sampling and sampling by other regulatory programs being conducted at the site (FPDP 2017a; FRNP 2018a; FRNP 2018b). These results are supplemented by 48 RGA MWs sampled and analyzed for TCE in 2017, but not sampled in 2018 (FPDP 2016; FPDP 2017a). A summary of the approximate maximum levels of TCE off DOE property in RGA wells is shown in Table 1. Appendix B lists the most recent sample data that was used to develop the 2018 plume maps.

[2] EPA derived the 900 pCi/L value from the 4 mrem/yr MCL for Tc-99, a beta emitter in 1976, but never has promulgated 900 pCi/L of Tc-99 as an MCL (EPA 1976).
[3] Of these RGA MWs, some have multiple sampling ports.

Appendix C contains the 2018 TCE plume map (Figure C.1). Generally, the plume interpretation is based on the following:

- A total of 1,329 groundwater samples was collected by DOE from RGA MWs and residential wells and analyzed for TCE in 2017–2018.
- TCE results from 2017/2018 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 2018, 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.
- The results are posted as reported by the laboratory, with "U" and "J" laboratory qualifiers, if applicable.[4]
- 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 2018, but sampled in 2017, TCE results from 2017 were used to develop the plume map using the same rules as for the 2018 TCE results. These results and the date sampled are posted on the map.
- 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.

3.2 TECHNETIUM-99

During the reporting period of 2017-2018, 224 RGA MWs[5] and 13 residential wells were sampled by DOE and analyzed for Tc-99 and included in the development of the revised groundwater Tc-99 plume map. Of the 224 RGA MWs included in the development of the Tc-99 plume map, 176 were sampled most recently in 2018. Of the 13 residential wells included in the development of the Tc-99 plume map, 6 were sampled most recently in 2018. The sample collection was based on the applicable Environmental Monitoring Plan, which governs the compliance sampling and sampling by regulatory programs being conducted at the site (FPDP 2017a; FRNP 2018a; FRNP 2018b). These results are supplemented by 48 RGA MWs and 7 residential wells sampled and analyzed for Tc-99 in 2017, but not sampled in 2018. Tc-99 was not detected above 900 pCi/L outside the PGDP boundary in either 2017 or 2018. The highest

[4] A "U" qualifier indicates a result is not detected at a reporting limit of 1 µg/L. A "J" qualifier indicates a result is reported at a value less than the reporting limit.
[5] Of these RGA MWs, some have multiple sampling ports.

Tc-99 concentration in RGA wells outside the PGDP boundary was 391 pCi/L at MW503. Appendix B lists the most recent sample data that were used to develop the 2018 plume maps.

Appendix C contains the 2018 Tc-99 plume map (Figure C.2). Generally, the plume interpretation is based upon the following:

- A total of 1,233 groundwater samples was collected by DOE from RGA MWs and residential wells and analyzed for Tc-99 in 2017–2018.
- Tc-99 results from 2018 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 results are posted as reported by the laboratory, with "U" laboratory qualifiers, if applicable.[6]
- For some wells that were not sampled in 2018, but sampled in 2017, the Tc-99 results from 2017 used to develop the plume map were selected using the same rules as for the 2018 Tc-99 results. These results and the date sampled are posted on the map.
- The contour intervals selected were 900 pCi/L and 3,790[7] 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.

4. CHANGES FROM 2016 PLUME MAPS

PGDP groundwater plume maps for 2012–2018 are presented in Figures 1 and 2 for TCE and Tc-99, respectively. The previous comprehensive plume maps summarized data collected through 2016 (FPDP 2017b). In an effort to understand the changes in the plume areas and contaminant concentrations at PGDP, FRNP compared the 2018 maps with the 2016 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 2018 TCE plume overlaid with the 2016 plume isoconcentration lines. Similarly, the last figure in Section 4, 2018 Tc-99 Plume—Regional Gravel Aquifer, shows the 2018 Tc-99 plume overlaid with the 900 pCi/L and 3,790 pCi/L contours from the 2016 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

[6] A "U" qualifier indicates a result is reported less than the minimum detectable activity and/or total propagated uncertainty. Negative results may be reported due to a statistical determination of the counts seen by a detector, minus a background count.

[7] 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.

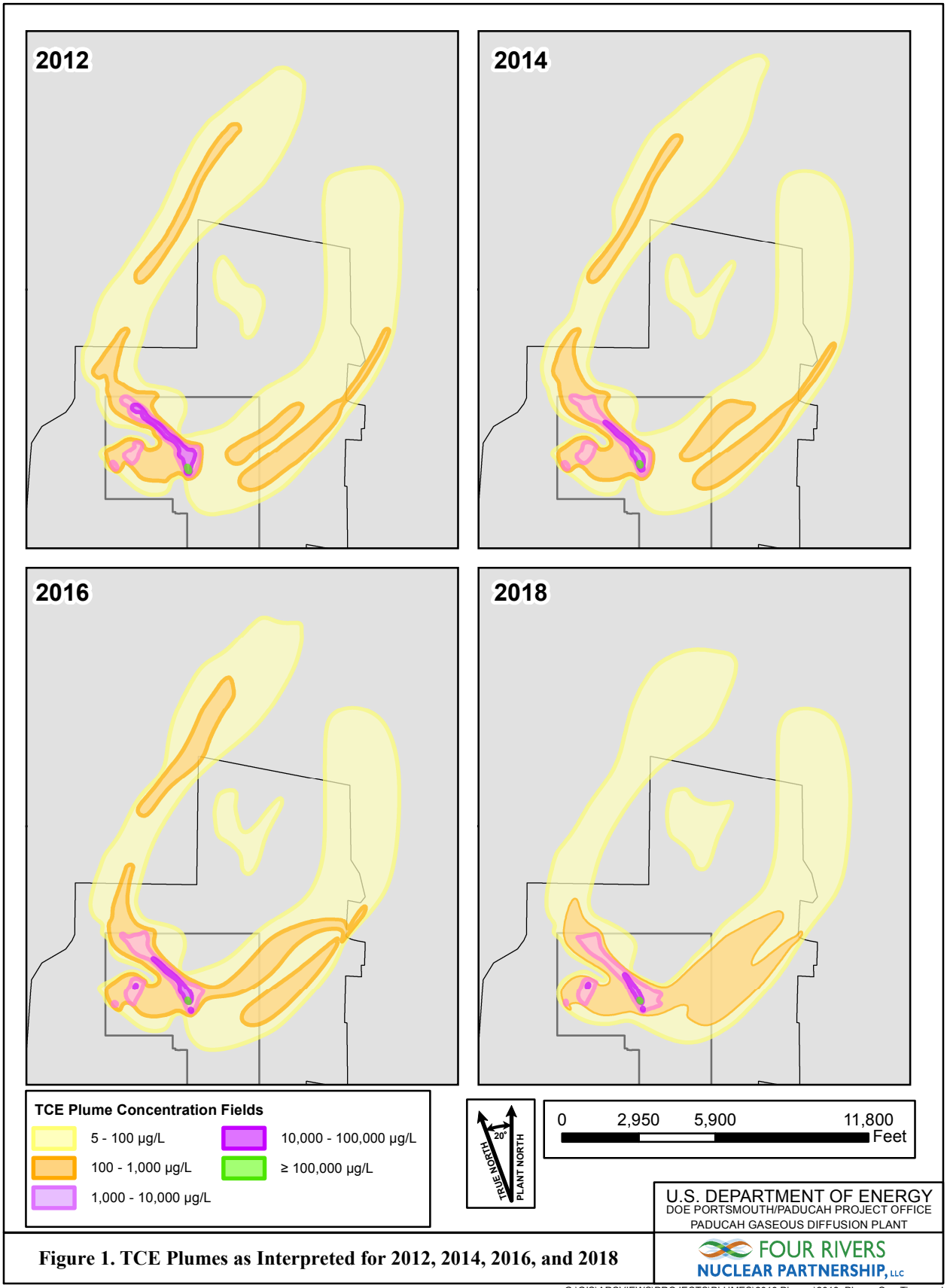


Figure 1. TCE Plumes as Interpreted for 2012, 2014, 2016, and 2018

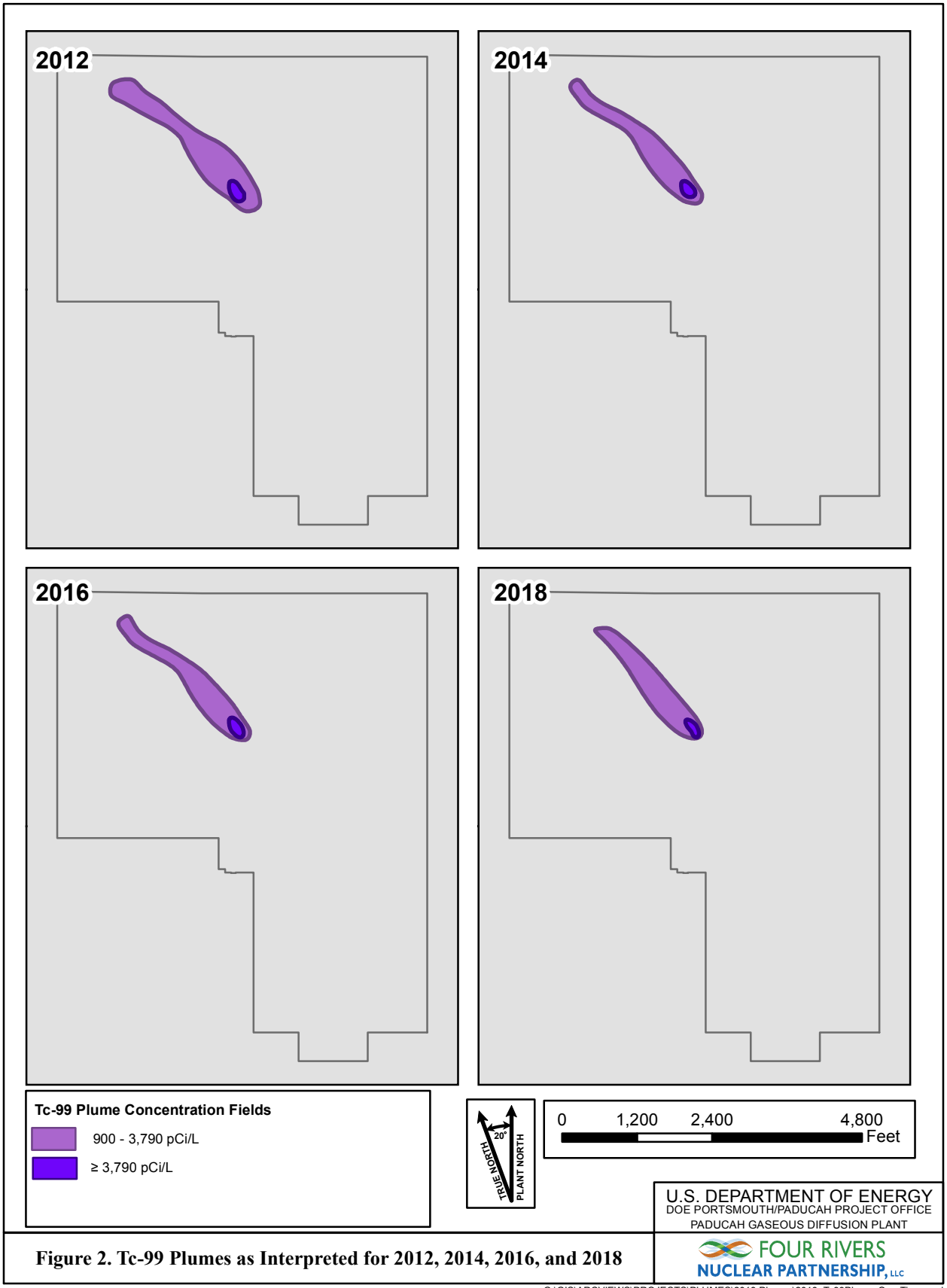


Figure 2. Tc-99 Plumes as Interpreted for 2012, 2014, 2016, and 2018

2016 and 2018 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 3 provides an enlargement of the north portion of the Northwest Plume, including TCE 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 3 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 now is defined by well cluster MW442/MW443/MW444, in which TCE was not detected above 5 µg/L. TCE analyses for MW152, the most downgradient well, were 1.39 µg/L in the May 2018 sampling event and 0.6 µg/L in the August 2018 sampling event.

- Also of note is the seep that is sampled in Little Bayou Creek. LBCSP5 has declined from 47.5 µg/L TCE in June 2014 to 1.14 µg/L in its most recent sampling event (November 2018). 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.

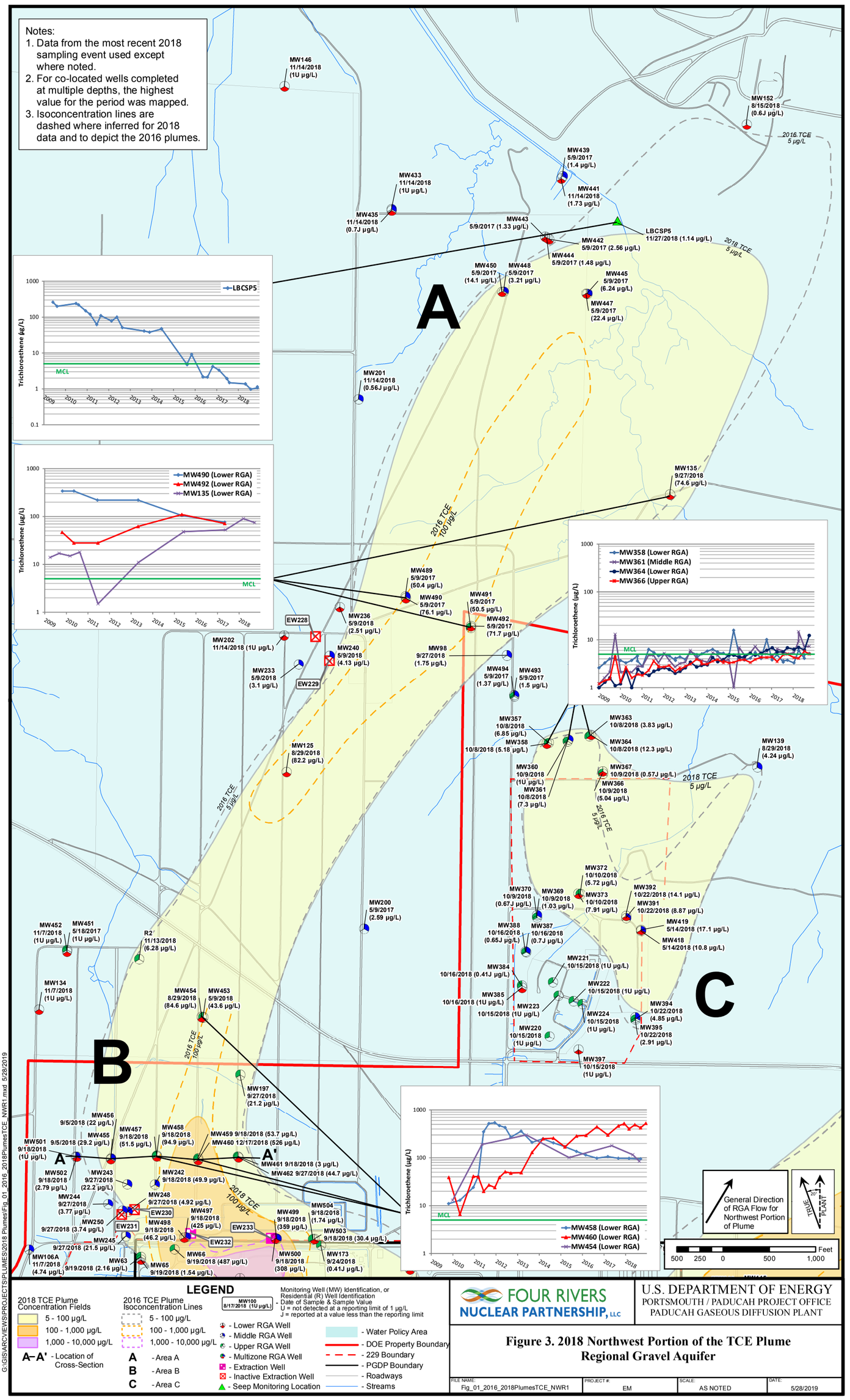
- TCE trends in MW491/MW492 and MW135 have fallen below 100 µg/L in the 2017–2018 time frame. The 100 µg/L TCE contour has been removed in this area.

- The western boundary of the Northwest Plume was adjusted in the vicinity of the former northern extraction well field, EW228 and EW229, based on results for MW236 (2.51 µg/L in May 2018).

Area B

In August 2010, extraction wells EW232 and EW233 began operations. Because EW232 and EW233 are located slightly upgradient and crossgradient of the former extraction wells, EW230 and EW231, 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 direction of groundwater 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. Figure 4 provides a cross section showing the interpretation of TCE concentrations within the RGA along this transect, which is denoted as A-A' on Figure 3. During this reporting period, TCE concentrations varied from nondetect to 526 µg/L along this transect. The highest TCE concentrations along this transect continue to shift to the east from well MW458 (a lower RGA well in which TCE has declined from 540 µg/L in 2011 to just below 100 µg/L in the most recent sampling in September 2018) to well MW460 (a lower RGA well, which recorded its highest TCE concentration in December 2018 at 526 µg/L).


Notes:
1. Data from the most recent 2018 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 2018 data and to depict the 2016 plumes.
A
B
C
A
A'
LBCSP5
MW490 (Lower RGA)
MW492 (Lower RGA)
MW135 (Lower RGA)
MW358 (Lower RGA)
MW361 (Middle RGA)
MW364 (Lower RGA)
MW366 (Upper RGA)
MW458 (Lower RGA)
MW460 (Lower RGA)
MW454 (Lower RGA)
Trichloroethene (µg/L)
MCL
2016 TCE 5 µg/L
2016 TCE 100 µg/L
2018 TCE 5 µg/L
2018 TCE 100 µg/L
MW146 11/14/2018 (1U µg/L)
MW152 8/15/2018 (0.6J µg/L)
MW439 5/9/2017 (1.4 µg/L)
MW441 11/14/2018 (1.73 µg/L)
MW433 11/14/2018 (1U µg/L)
MW435 11/14/2018 (0.7J µg/L)
MW443 5/9/2017 (1.33 µg/L)
LBCSP5 11/27/2018 (1.14 µg/L)
MW442 5/9/2017 (2.56 µg/L)
MW444 5/9/2017 (1.48 µg/L)
MW450 5/9/2017 (14.1 µg/L)
MW448 5/9/2017 (3.21 µg/L)
MW445 5/9/2017 (6.24 µg/L)
MW447 5/9/2017 (22.4 µg/L)
MW201 11/14/2018 (0.56J µg/L)
MW135 9/27/2018 (74.6 µg/L)
MW489 5/9/2017 (50.4 µg/L)
MW490 5/9/2017 (76.1 µg/L)
MW491 5/9/2017 (50.5 µg/L)
MW492 5/9/2017 (71.7 µg/L)
MW236 5/9/2018 (2.51 µg/L)
EW228
MW202 11/14/2018 (1U µg/L)
MW240 5/9/2018 (4.13 µg/L)
EW229
MW233 5/9/2018 (3.1 µg/L)
MW98 9/27/2018 (1.75 µg/L)
MW494 5/9/2017 (1.37 µg/L)
MW493 5/9/2017 (1.5 µg/L)
MW125 8/29/2018 (82.2 µg/L)
MW357 10/8/2018 (6.85 µg/L)
MW358 10/8/2018 (5.18 µg/L)
MW363 10/8/2018 (3.83 µg/L)
MW364 10/8/2018 (12.3 µg/L)
MW139 8/29/2018 (4.24 µg/L)
MW360 10/9/2018 (1U µg/L)
MW361 10/8/2018 (7.3 µg/L)
MW367 10/9/2018 (0.57J µg/L)
MW366 10/9/2018 (5.04 µg/L)
MW372 10/10/2018 (5.72 µg/L)
MW370 10/9/2018 (0.67J µg/L)
MW369 10/9/2018 (1.03 µg/L)
MW373 10/10/2018 (7.91 µg/L)
MW392 10/22/2018 (14.1 µg/L)
MW391 10/22/2018 (8.87 µg/L)
MW200 5/9/2017 (2.59 µg/L)
MW388 10/16/2018 (0.65J µg/L)
MW387 10/16/2018 (0.7J µg/L)
MW419 5/14/2018 (17.1 µg/L)
MW418 5/14/2018 (10.8 µg/L)
MW452 11/7/2018 (1U µg/L)
MW451 5/18/2017 (1U µg/L)
R2 11/13/2018 (6.28 µg/L)
MW221 10/15/2018 (1U µg/L)
MW384 10/16/2018 (0.41J µg/L)
MW222 10/15/2018 (1U µg/L)
MW134 11/7/2018 (1U µg/L)
MW454 8/29/2018 (84.6 µg/L)
MW453 5/9/2018 (43.6 µg/L)
MW385 10/16/2018 (1U µg/L)
MW223 10/15/2018 (1U µg/L)
MW224 10/15/2018 (1U µg/L)
MW394 10/22/2018 (4.85 µg/L)
MW220 10/15/2018 (1U µg/L)
MW395 10/22/2018 (2.91 µg/L)
MW397 10/15/2018 (1U µg/L)
MW197 9/27/2018 (21.2 µg/L)
MW456 9/5/2018 (22 µg/L)
MW455 9/5/2018 (29.2 µg/L)
MW457 9/18/2018 (51.5 µg/L)
MW458 9/18/2018 (94.9 µg/L)
MW459 9/18/2018 (53.7 µg/L)
MW460 12/17/2018 (526 µg/L)
MW501 9/18/2018 (1U µg/L)
MW461 9/18/2018 (3 µg/L)
MW462 9/27/2018 (44.7 µg/L)
MW502 9/18/2018 (2.79 µg/L)
MW243 9/27/2018 (22.2 µg/L)
MW242 9/18/2018 (49.9 µg/L)
MW244 9/27/2018 (3.77 µg/L)
MW248 9/27/2018 (4.92 µg/L)
EW230
MW497 9/18/2018 (425 µg/L)
MW499 9/18/2018 (359 µg/L)
MW504 9/18/2018 (1.74 µg/L)
EW231
MW498 9/18/2018 (46.2 µg/L)
EW233
MW503 9/18/2018 (30.4 µg/L)
MW250 9/27/2018 (3.74 µg/L)
EW232
MW245 9/27/2018 (21.5 µg/L)
MW106A 11/7/2018 (4.74 µg/L)
MW63 9/19/2018 (2.16 µg/L)
MW65 9/19/2018 (1.54 µg/L)
MW66 9/19/2018 (487 µg/L)
MW500 9/18/2018 (308 µg/L)
MW173 9/24/2018 (0.41J µg/L)
General Direction of RGA Flow for Northwest Portion of Plume
TRUE NORTH
Feet
500 250 0 500 1,000
LEGEND
2018 TCE Plume Concentration Fields
5 - 100 µg/L
100 - 1,000 µg/L
1,000 - 10,000 µg/L
A–A' - Location of Cross-Section
2016 TCE Plume Isoconcentration Lines
5 - 100 µg/L
100 - 1,000 µg/L
1,000 - 10,000 µg/L
A - Area A
B - Area B
C - Area C
MW100 8/17/2018 (1U µg/L) - Monitoring Well (MW) Identification, or Residential (R) Well Identification - Date of Sample & Sample Value
U = not detected at a reporting limit of 1 µg/L
J = reported at a value less than the reporting limit
- Lower RGA Well
- Middle RGA Well
- Upper RGA Well
- Multizone RGA Well
- Extraction Well
- Inactive Extraction Well
- Seep Monitoring Location
- Water Policy Area
- DOE Property Boundary
- 229 Boundary
- PGDP Boundary
- Roadways
- Streams
FOUR RIVERS NUCLEAR PARTNERSHIP, LLC
U.S. DEPARTMENT OF ENERGY
PORTSMOUTH / PADUCAH PROJECT OFFICE
PADUCAH GASEOUS DIFFUSION PLANT
Figure 3. 2018 Northwest Portion of the TCE Plume
Regional Gravel Aquifer
FILE NAME: Fig_01_2016_2018PlumesTCE_NWR1
PROJECT #: EM
SCALE: AS NOTED
DATE: 5/28/2019
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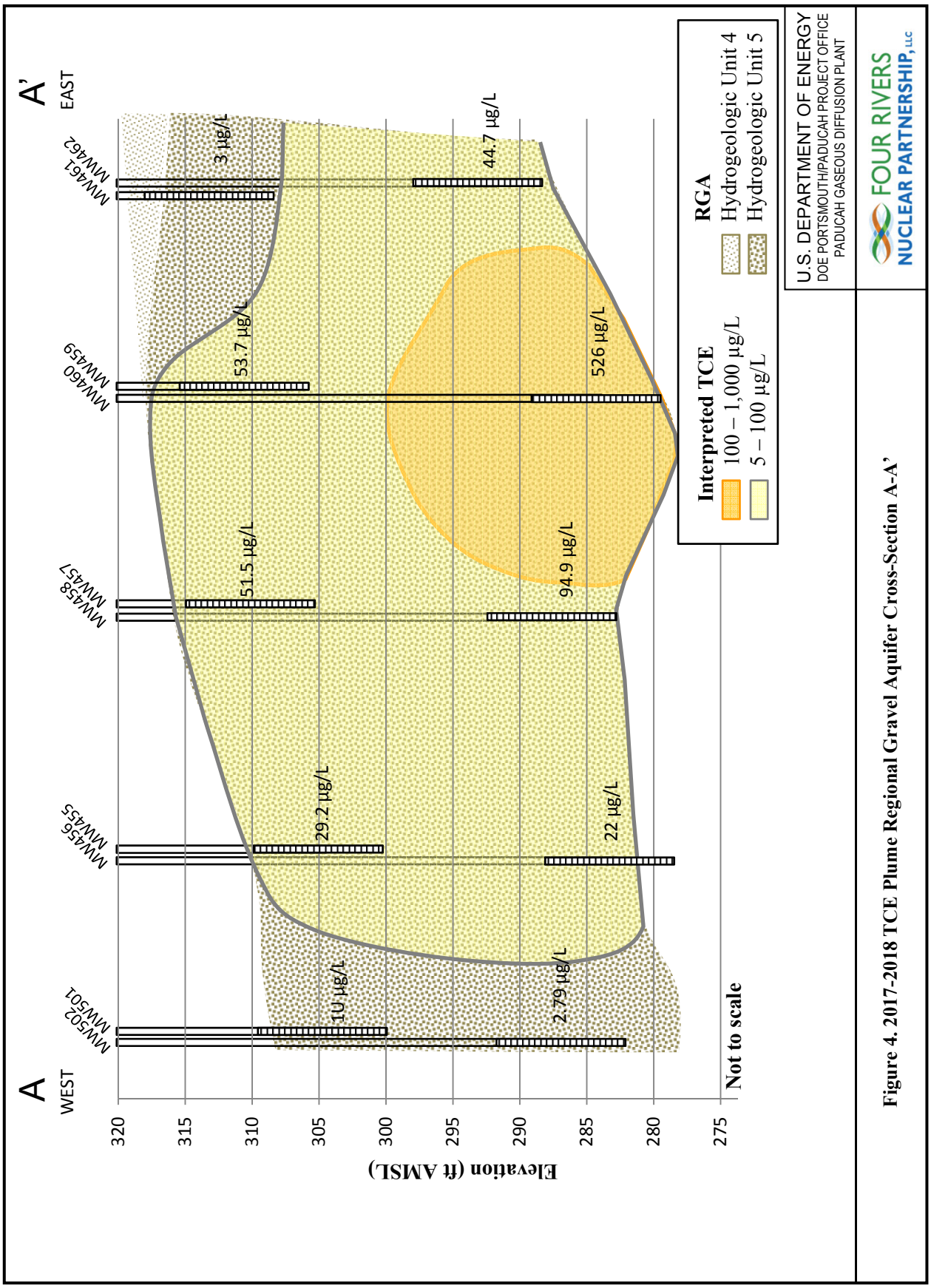

Figure 4. 2017-2018 TCE Plume Regional Gravel Aquifer Cross-Section A-A'

While TCE was not detected in MW134 (located west of the mapped plume) in the most recent sample (November 2018), a detection of 5.83 µg/L in November 2017 should be noted.

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.

- During 2018, TCE concentrations in MW366 rose above 5 µg/L. Consequently, the 5 µg/L contour was extended eastward. MW395, at the southern end of this area, and the most recent sample from MW139, at the northeastern end of this area, no longer have TCE concentrations above 5 µg/L, so the contour has been retracted from these wells.

4.2 NORTHEAST PLUME

Figure 5 provides an enlargement of the Northeast Plume. Three areas are described in this subsection: (D) the northern distal margin; (E) the area in the vicinity of the former Northeast Plume Pump-and-Treat extraction wells; and (F) the vicinity of the industrial site. Figure 5 also includes temporal TCE concentration plots for selected wells to illustrate the observations made in this subsection.

Area D

- No significant changes were made to the northern extent of the 5 µg/L TCE isoconcentration contour from 2016. 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 MW469/MW470, with the most recent groundwater TCE concentrations below and near the laboratory detection limit, defines the eastern edge of the plume.

- TCE analyses for MW463 (99.6 µg/L) in the upper RGA and for MW464 (85.6 µg/L) in the lower RGA identify a higher concentration field within the north end of the Northeast Plume.

Area E

- With cessation of pumping in EW331 and EW332 as part of the Northeast Plume Optimization project, the western lobe of > 100 µg/L TCE no longer hooks eastward, but dissipates near its former northern extent.

- Analyses for 2018 continue to show an overall decline in TCE concentration since 2011 at MW253, which is located north of the old extraction wells that currently are in standby.

- TCE concentrations have significantly increased in the east side of the former extraction well field, EW331 and EW332. In MW126, TCE concentrations increased to 96.7 µg/L. In MW293A, which previously appeared to have decreasing TCE concentrations over the period of 2009 through 2015, TCE concentrations rebounded from a low of 82 to a high of 152 µg/L during late 2017 and 2018. These trends reflect flow of residual TCE, downgradient of the current extraction wells, through a high hydraulic conductivity zone in the RGA.

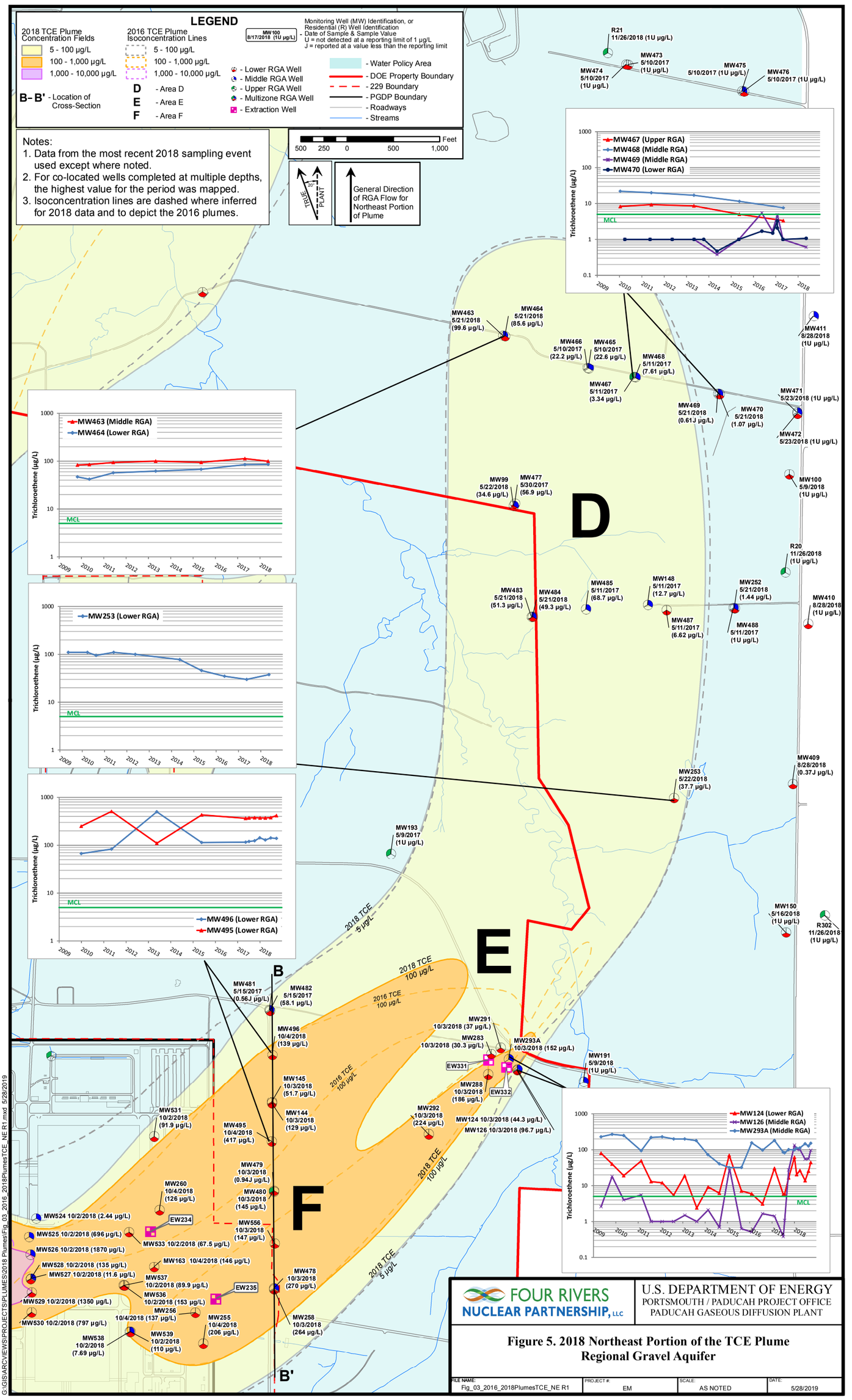

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Figure 5. 2018 Northeast Portion of the TCE Plume Regional Gravel Aquifer

FILE NAME:	PROJECT #:	SCALE:	DATE:
Fig_03_2016_2018PlumesTCE_NE R1	EM	AS NOTED	5/28/2019

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Area F

- The 100–1,000 µg/L boundary in this area, similar to the 2016 interpretation, is split into two separate concentration fields downgradient of the MW478—MW481 transect. A cross section showing the interpretation of TCE concentrations within the RGA along this transect is shown in Figures 5 and 6 and is denoted as B-B'.

- TCE concentrations are highest along the south end of the B-B' transect (264 µg/L in MW258 and 270 µg/L in MW478) and within the lower half of the RGA (notably 417 µg/L in MW495).

4.3 CENTRAL SITE AREA INCLUDING SOUTHWEST PLUME

TCE

The TCE plume in the industrialized section of the PGDP site is presented in Figure 7. The overall footprint in 2018 is similar to previous years; differences are noted below. In addition, Figure 7 includes temporal TCE concentration plots for selected wells illustrating the observations made in this subsection.

- The extent of the Southwest Plume north of Solid Waste Management Unit (SWMU 4) includes a small, isolated 10,000 µg/L contour that is indicated by TCE values in MW333 that were greater than 10,000 µg/L in January and June 2015 and January 2016. The most recent value for MW333, 4,520 µg/L in July 2018, is shown on the map (area designated as G on Figure 7).

- The 1,000 µg/L contour in the SWMU 1 area was revised to reflect a TCE decrease in MW161 and MW545. In MW161 (lower RGA), TCE concentrations declined from a high of 12,200 µg/L in 2016 to 785 µg/L in December 2018 (area designated as G on Figure 7).

- The second area (designated as H on Figure 7) 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. Overall, TCE concentrations have declined since 2016, as illustrated by the dashed contour lines.

- 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 2018. 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 conceptual site 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 8. (The location of the cross section is denoted as C-C' on Figure 7.)

- The area near the southeast corner of C-400 has been subject to remedial action using electrical resistance heating in the Upper Continental Recharge System 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 from 2012 to 2018. Most notably, TCE in MW408-PRT5 has decreased from its high of 1,400,000 µg/L in September 2012, to its most recent 2018 value of 41.2 µg/L.

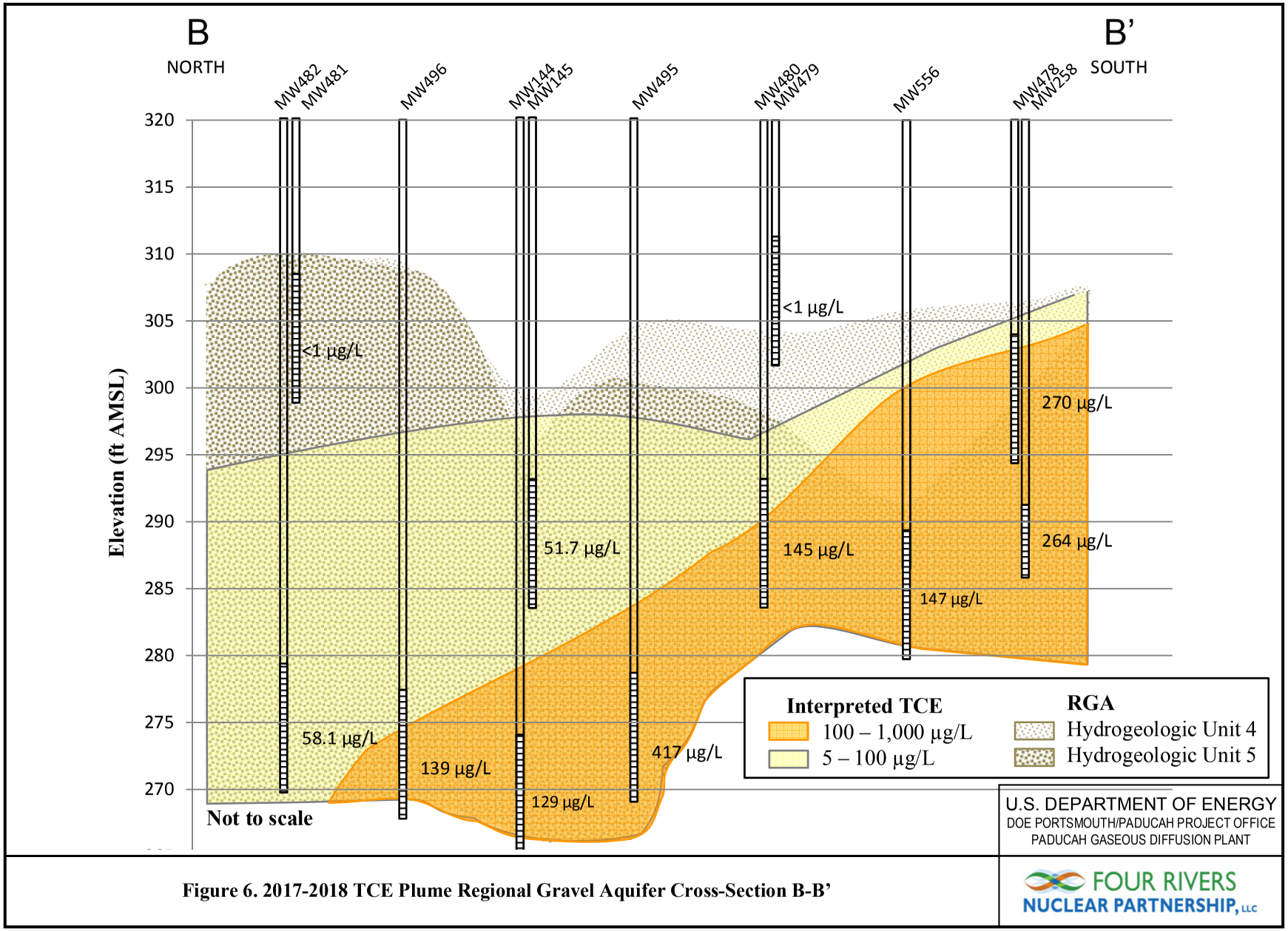


Figure 6. 2017-2018 TCE Plume Regional Gravel Aquifer Cross-Section B-B'

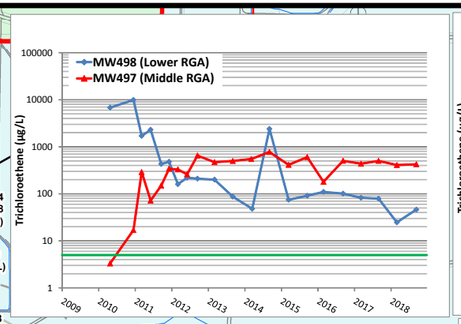
Notes:
1. Data from the most recent 2018 sampling event used except where noted.
2. For co-located wells completed at multiple depths, the highest value for the period was mapped.
3. Isoconcentration lines are dashed where inferred for 2018 data and to depict the 2016 plumes.

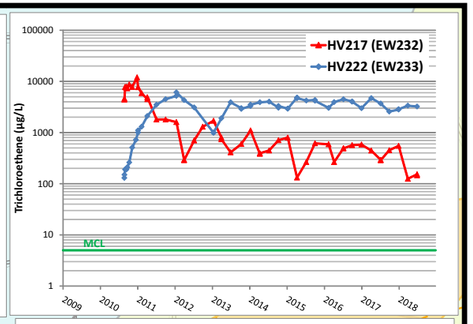
TRUE NORTH
PLANT NORTH

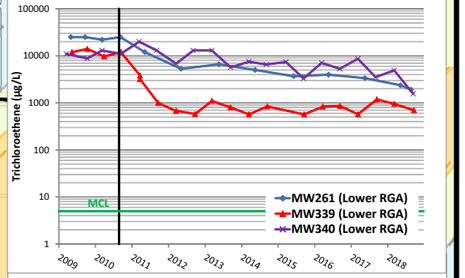
500 250 0 500 1,000 Feet

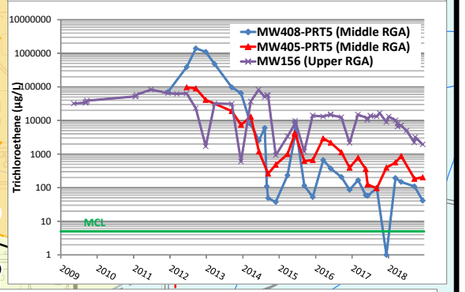
MW194 11/7/2018 (1U µg/L)
R53 11/13/2018 (0.55J µg/L)
MW106A 11/7/2018 (4.74 µg/L)
MW426 11/7/2018 (2.68 µg/L)
MW427 11/7/2018 (1.8 µg/L)
MW428 9/27/2018 (3.32 µg/L)
MW354 12/19/2018 (4.92 µg/L)
MW429A 9/5/2018 (1U µg/L)
MW430 9/5/2018 (1.44 µg/L)
MW431 12/19/2018 (2.24 µg/L)
MW432 11/14/2018 (0.56J µg/L)
MW501 9/18/2018 (1U µg/L)
MW502 9/18/2018 (2.79 µg/L)
MW455 9/5/2018 (29.2 µg/L)
MW456 9/5/2018 (22 µg/L)
MW458 9/18/2018 (94.9 µg/L)
MW457 9/18/2018 (51.5 µg/L)
MW459 9/18/2018 (53.7 µg/L)
MW461 9/18/2018 (3 µg/L)
MW460 9/18/2018 (425 µg/L)
MW462 9/27/2018 (44.7 µg/L)
MW197 9/27/2018 (21.2 µg/L)
MW504 9/18/2018 (1.74 µg/L)
MW503 9/18/2018 (30.4 µg/L)
MW242 9/18/2018 (49.9 µg/L)
MW243 9/27/2018 (22.2 µg/L)
MW250 9/27/2018 (3.74 µg/L)
MW244 9/27/2018 (3.77 µg/L)
EW230
EW231
MW498 9/18/2018 (46.2 µg/L)
MW497 9/18/2018 (425 µg/L)
MW500 9/18/2018 (308 µg/L)
MW499 9/18/2018 (359 µg/L)
MW173 9/24/2018 (0.41J µg/L)
MW248 9/27/2018 (4.92 µg/L)
MW245 9/27/2018 (21.5 µg/L)
EW232
EW233
MW66 9/19/2018 (487 µg/L)
MW65 9/19/2018 (1.54 µg/L)
MW63 9/19/2018 (2.16 µg/L)
MW340 9/19/2018 (1560 µg/L)
MW339 9/26/2018 (697 µg/L)
MW261 8/29/2018 (1910 µg/L)
MW355 9/24/2018 (5.91 µg/L)
MW165A 9/24/2018 (0.45J µg/L)
MW169 5/23/2017 (433 µg/L)
MW262 5/23/2017 (593 µg/L)
MW168 5/23/2017 (75.6 µg/L)
MW205 5/23/2017 (1.74 µg/L)
MW86 7/12/2018 (1990 µg/L)
MW84 8/20/2018 (5260 µg/L)
MW67 7/11/2018 (1370 µg/L)
MW338 7/12/2018 (584 µg/L)
MW337 7/12/2018 (1340 µg/L)
MW87 8/20/2018 (1690 µg/L)
MW89 7/11/2018 (56.9 µg/L)
MW90A 8/20/2018 (53.3 µg/L)
MW548 6/26/2017 (6830 µg/L)
MW333 7/11/2018 (4520 µg/L)
MW415 5/19/2017 (924 µg/L)
MW414 5/19/2017 (673 µg/L)
MW403-PRT3 12/19/2018 (3.16 µg/L)
MW404-PRT4 5/18/2017 (3.81 µg/L)
MW329 5/18/2017 (0.4J µg/L)
MW328 5/18/2017 (1.09 µg/L)
MW417 5/19/2017 (80.2 µg/L)
MW416 5/19/2017 (148 µg/L)
MW92 7/12/2018 (3.3 µg/L)
MW76 7/11/2018 (262 µg/L)
MW420 8/20/2018 (476 µg/L)
MW226 7/11/2018 (226 µg/L)
MW95A 7/11/2018 (2370 µg/L)
MW227 7/11/2018 (76.9 µg/L)
MW93 8/20/2018 (1000 µg/L)
MW549 7/11/2018 (4240 µg/L)
MW550 6/28/2017 (4240 µg/L)
MW551 6/28/2017 (2890 µg/L)
MW425 9/26/2018 (2350 µg/L)
MW342 9/26/2018 (2610 µg/L)
MW175 9/26/2018 (3960 µg/L)
MW405-PRT5 12/18/2018 (204 µg/L)
MW203 8/29/2018 (62.8 µg/L)
MW71 5/15/2018 (23.7 µg/L)
MW505/MW506/MW507 12/18/2018 (9370 µg/L)
MW341 12/18/2018 (5220 µg/L)
MW178 12/19/2018 (63.9 µg/L)
MW343 9/25/2018 (21800 µg/L)
MW423 9/25/2018 (34400 µg/L)
MW422 9/24/2018 (29100 µg/L)
MW421 9/24/2018 (43600 µg/L)
MW424 9/25/2018 (14700 µg/L)
MW524 10/2/2018 (2.44 µg/L)
MW525 10/2/2018 (696 µg/L)
MW526 10/2/2018 (1870 µg/L)
MW528 10/2/2018 (135 µg/L)
MW527 10/2/2018 (11.6 µg/L)
MW529 10/2/2018 (1350 µg/L)
MW530 10/2/2018 (797 µg/L)
MW531 10/2/2018 (91.9 µg/L)
MW533 10/2/2018 (67.5 µg/L)
MW537 10/2/2018 (89.9 µg/L)
MW536 10/2/2018 (153 µg/L)
MW539 10/2/2018 (110 µg/L)
MW538 10/2/2018 (7.69 µg/L)
MW155 12/18/2018 (3550 µg/L)
MW156 12/18/2018 (1940 µg/L)
MW406-PRT5 12/18/2018 (4370 µg/L)
MW407-PRT4 12/18/2018 (97.1 µg/L)
MW408-PRT5 12/18/2018 (41.2 µg/L)
MW161 12/17/2018 (785 µg/L)
MW545 12/17/2018 (1.39 µg/L)
MW542 12/17/2018 (14 µg/L)
MW547 12/17/2018 (716 µg/L)
MW543 12/17/2018 (25.9 µg/L)
MW546 12/17/2018 (431 µg/L)
MW544 12/17/2018 (415 µg/L)

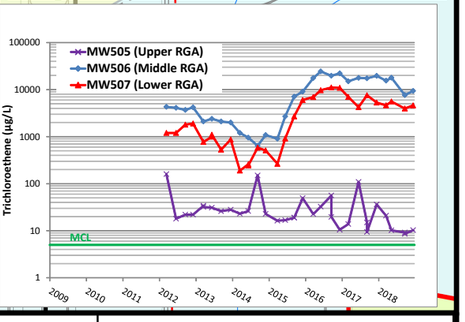
SWMU 4
SWMU 1
G
H
C
D
C'
D'

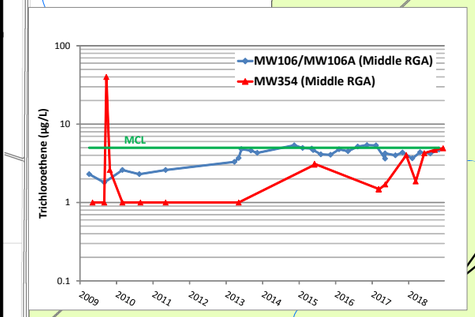


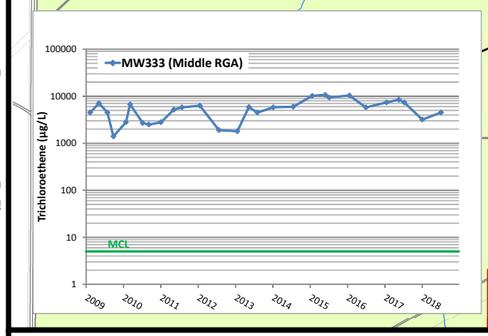












LEGEND

2018 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

2016 TCE Plume Isoconcentration Lines
- 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

- Lower RGA Well
- Middle RGA Well
- Upper RGA Well
- Multizone RGA Well

MW100 8/17/2018 (1U µg/L) - Monitoring Well (MW) Identification, or Residential (R) Well Identification; Date of Sample & Sample Value; U = not detected at a reporting limit of 1 µg/L; J = reported at a value less than the reporting limit

- Extraction Well
- Inactive Extraction Well

C–C' D–D' E–E' - Locations of Cross-Sections

G - Area G
H - Area H

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

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Figure 7. 2018 Central Portion of the TCE Plume Regional Gravel Aquifer

FILE NAME:	PROJECT #:	SCALE:	DATE:
Fig_05_2016-2018PlumesTCE_CentralR1	EM	AS NOTED	5/28/2019

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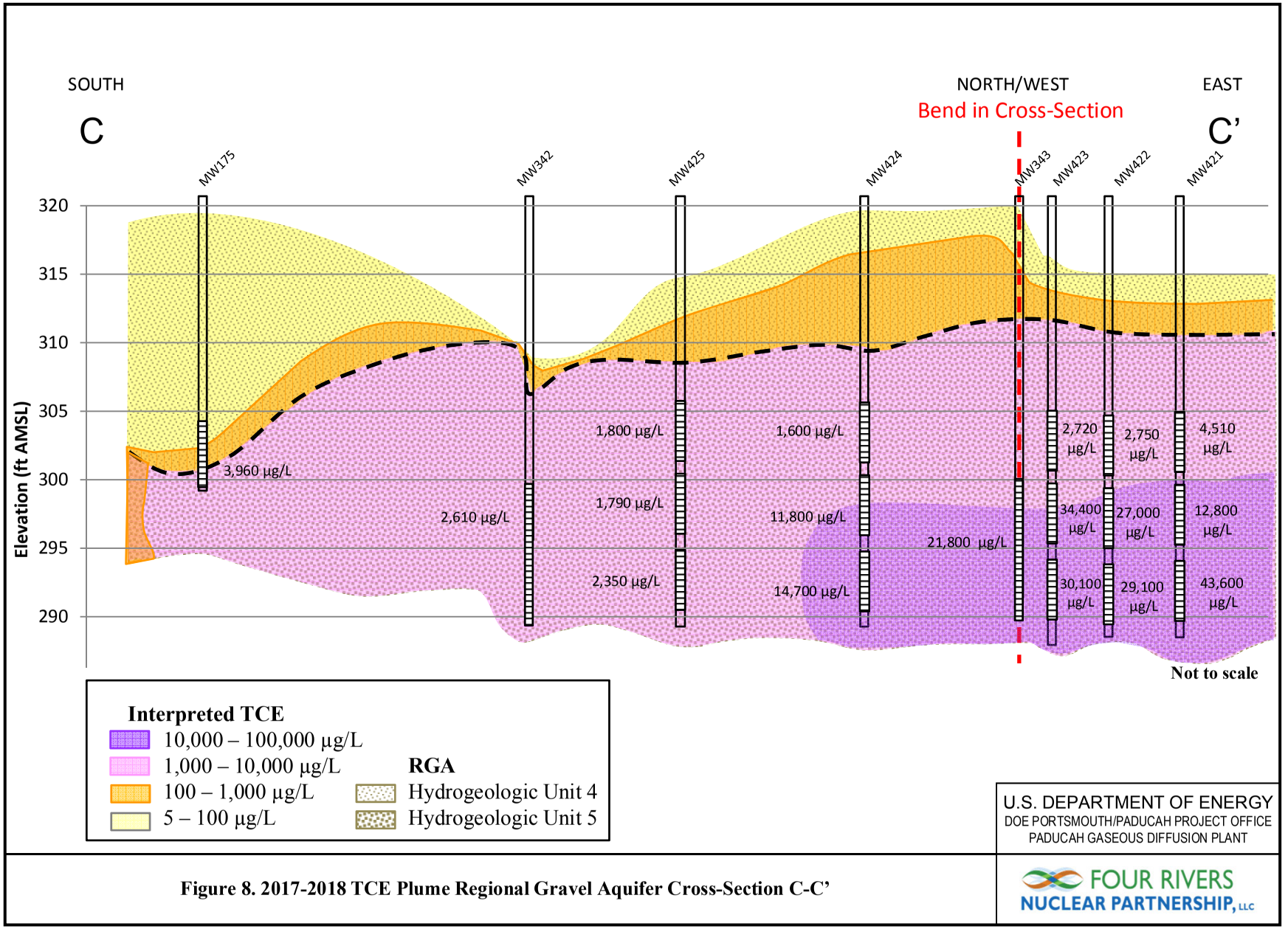

Figure 8. 2017-2018 TCE Plume Regional Gravel Aquifer Cross-Section C-C'

- The 10,000 µg/L contour to the south of the C-400 Building source area has been migrated northward. All of the most recent samples from the MW505/MW506/MW507 well nest contained TCE concentrations that were less than 10,000 µg/L.

- A cross section (Figure 9) shows the 5 and 1,000 µg/L concentration field in the MW524–MW530 line of wells, which is connected with similar concentrations east of the C-400 Building. The location of the cross section is denoted as D-D' on Figure 7.

- Wells MW354 and MW106A have observed TCE concentrations near 5 µg/L. These wells are not directly downgradient of the Southwest Plume source area (designated as G on Figure 7) based on the potentiometric surface in the RGA (Figures 11 and 12). The source responsible for the trend of increasing TCE in MW354 and MW106A is uncertain.

Tc-99

There were 1,233 analyses for Tc-99 in RGA groundwater at PGDP in 2017 and 2018, with only 52 results above 900 pCi/L. Figure 10 presents the results of Tc-99 analyses near the central area of the plant, where the groundwater samples collected in 2018 (and supplemented with samples collected in 2017) 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 lies within the TCE footprint on Figure 7 (i.e., the area encompassed by the 1,000–10,000 µg/L isocontour), with the exception of MW168. From the 2016 interpreted contour, the 900 pCi/L contour was moved southward. Tc-99 levels in MW340 decreased from 1,150 pCi/L in late 2016 to 382 pCi/L in 2018. Tc-99 activities in nearby MW261 and MW339 remained below 900 pCi/L.

The highest level of Tc-99 occurs in the area of MW422 through MW425. This is consistent with historical releases at the C-400 Building. The 3,790 pCi/L isoconcentration contour was moved slightly to the east to include MW421, whose Tc-99 activity increased from 1,750 pCi/L in September 2016 to 4,500 pCi/L in September 2018.

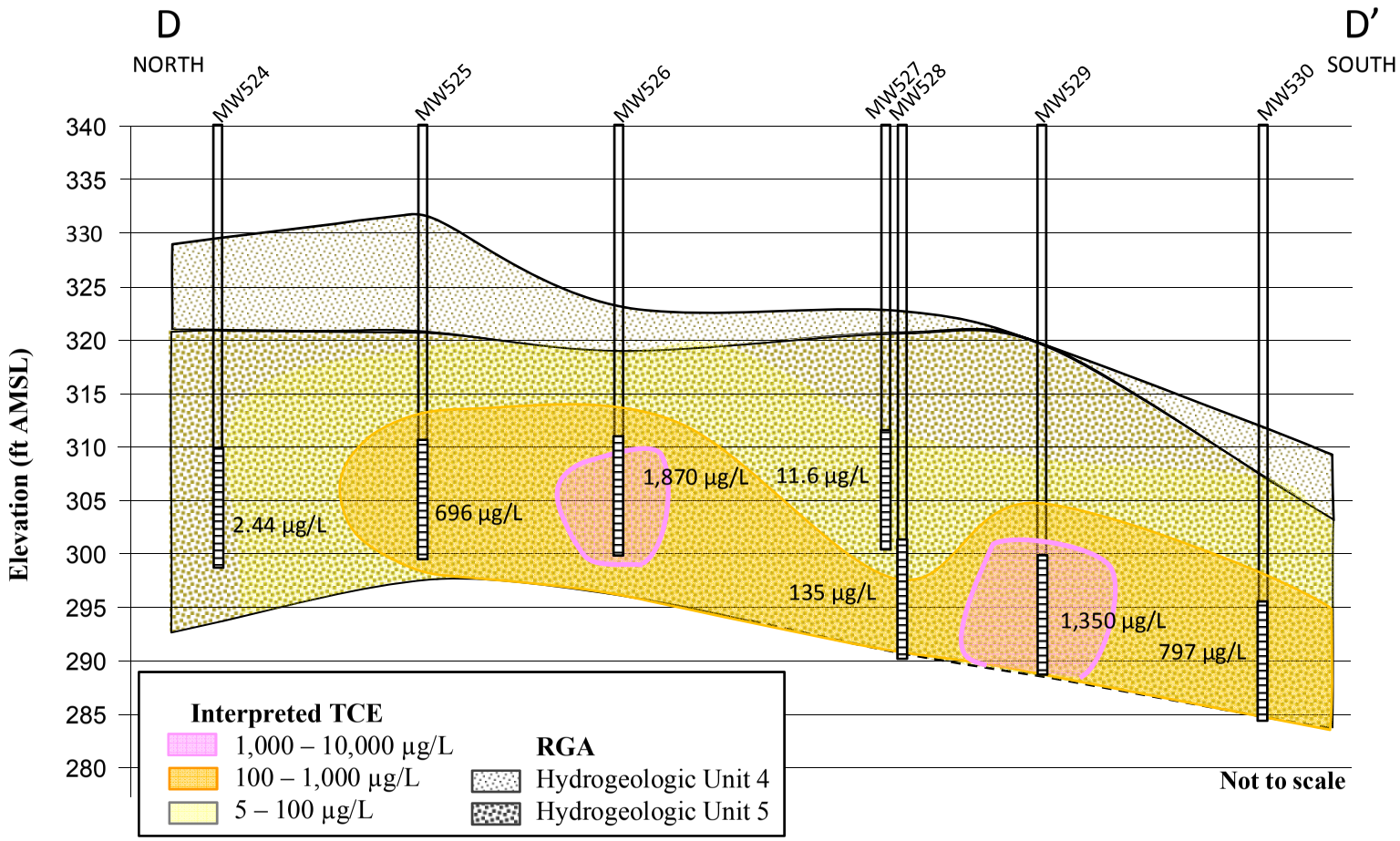

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Figure 9. 2017-2018 TCE Plume Regional Gravel Aquifer Cross Section D-D'

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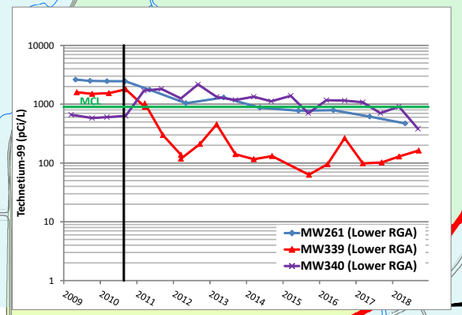
General Direction of RGA Flow for Tc-99 Plume

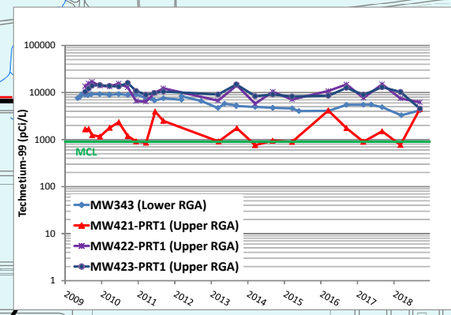
TRUE 20° PLANT

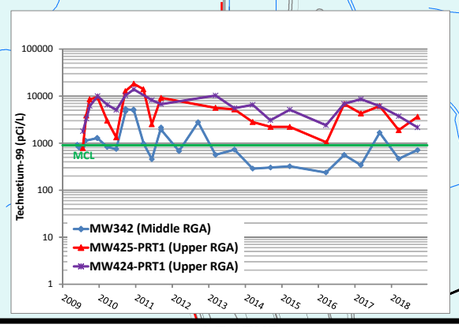
Notes:
1. Data from the most recent 2018 sampling event used except where noted.
2. For co-located wells completed at multiple depths, the highest value for the period was mapped.

700 350 0 700 Feet

MW194 8/13/2018 (-2.95U pCi/L)
MW501 9/18/2018 (-4.76U pCi/L)
MW502 9/18/2018 (-12.8U pCi/L)
MW456 9/5/2018 (24.5 pCi/L)
MW455 9/5/2018 (13.3U pCi/L)
MW457 9/18/2018 (5.72U pCi/L)
MW458 9/18/2018 (30.9 pCi/L)
MW460 12/17/2018 (166 pCi/L)
MW459 9/18/2018 (44.6 pCi/L)
MW461 9/18/2018 (6.15U pCi/L)
MW462 9/27/2018 (34 pCi/L)
MW243 9/27/2018 (22.2 pCi/L)
MW242 9/18/2018 (25.1 pCi/L)
MW244 9/27/2018 (6.8U pCi/L)
MW250 9/27/2018 (-0.378U pCi/L)
MW248 9/27/2018 (12.6U pCi/L)
EW231
EW230
MW245 9/27/2018 (0.567U pCi/L)
MW497 9/18/2018 (156 pCi/L)
MW498 9/18/2018 (5.59U pCi/L)
EW232
MW500 9/18/2018 (294 pCi/L)
MW499 9/18/2018 (263 pCi/L)
MW504 9/18/2018 (-4.05U pCi/L)
MW503 9/18/2018 (317 pCi/L)
MW106A 8/13/2018 (-3.18U pCi/L)
MW63 9/19/2018 (13.2U pCi/L)
MW65 9/19/2018 (14.1U pCi/L)
MW66 9/19/2018 (239 pCi/L)
EW233
MW339 9/26/2018 (163 pCi/L)
MW340 9/19/2018 (382 pCi/L)
MW173 9/24/2018 (2.99U pCi/L)
MW355 9/24/2018 (28.2 pCi/L)
MW432 11/14/2018 (-2.84U pCi/L)
MW261 5/14/2018 (470 pCi/L)
MW431 9/27/2018 (5.38U pCi/L)
MW426 8/13/2018 (-0.989U pCi/L)
MW427 8/13/2018 (-3.04U pCi/L)
MW169 5/23/2017 (109 pCi/L)
MW262 5/23/2017 (266 pCi/L)
MW205 5/23/2017 (16U pCi/L)
MW428 9/27/2018 (-1.2U pCi/L)
MW354 12/19/2018 (4.6U pCi/L)
MW430 9/5/2018 (5.69U pCi/L)
MW429A 9/5/2018 (-0.622U pCi/L)
MW84 8/20/2018 (11.8U pCi/L)
MW86 7/12/2018 (3.51U pCi/L)
MW87 8/20/2018 (4.44U pCi/L)
MW89 7/11/2018 (8.98U pCi/L)
MW90A 8/20/2018 (7.78U pCi/L)
MW92 7/12/2018 (12.6U pCi/L)
MW67 7/11/2018 (140 pCi/L)
MW338 7/12/2018 (36.1 pCi/L)
MW337 7/12/2018 (276 pCi/L)
MW548 6/26/2017 (55.8 pCi/L)
MW333 7/11/2018 (101 pCi/L)
MW93 8/20/2018 (4.61U pCi/L)
MW420 8/20/2018 (0.33U pCi/L)
MW76 7/11/2018 (13.5U pCi/L)
MW95A 7/11/2018 (12.3U pCi/L)
MW168 5/23/2017 (1480 pCi/L)
MW343 9/25/2018 (4180 pCi/L)
MW423 9/25/2018 (4530 pCi/L)
MW422 9/24/2018 (6210 pCi/L)
MW421 9/24/2018 (4500 pCi/L)
MW524 10/2/2018 (1.87U pCi/L)
MW341 12/18/2018 (122 pCi/L)
MW525 10/2/2018 (106 pCi/L)
EW234
MW533 10/2/2018 (67.5 pCi/L)
MW260 10/4/2018 (47.8 pCi/L)
MW403-PRT3 12/19/2018 (3.15U pCi/L)
MW404-PRT4 5/18/2017 (5.19U pCi/L)
MW329 5/18/2017 (9.89U pCi/L)
MW415 5/19/2017 (36.3 pCi/L)
MW414 5/19/2017 (48.5 pCi/L)
MW551 6/28/2017 (9.29U pCi/L)
MW417 5/19/2017 (0.172U pCi/L)
MW550 6/28/2017 (6.15U pCi/L)
MW416 5/19/2017 (16.2U pCi/L)
MW549 7/11/2018 (4.53U pCi/L)
MW161 8/29/2018 (12.5U pCi/L)
MW226 7/11/2018 (10U pCi/L)
MW227 7/11/2018 (4.79U pCi/L)
MW424 9/25/2018 (3530 pCi/L)
MW425 9/26/2018 (3640 pCi/L)
MW342 9/26/2018 (714 pCi/L)
MW175 9/26/2018 (360 pCi/L)
MW178 12/19/2018 (95.8 pCi/L)
MW155 12/18/2018 (89.2 pCi/L)
MW156 12/18/2018 (-1.65U pCi/L)
MW405-PRT5 12/18/2018 (4.42U pCi/L)
MW406-PRT5 12/18/2018 (-2.89U pCi/L)
MW71 5/15/2018 (7U pCi/L)
MW203 8/29/2018 (110 pCi/L)
MW407-PRT4 12/18/2018 (7.99U pCi/L)
MW408-PRT5 12/18/2018 (4.18U pCi/L)
MW505 12/18/2018 (57.1 pCi/L)
MW506 12/18/2018 (54.3 pCi/L)
MW507 12/18/2018 (45.4 pCi/L)
MW328 5/18/2017 (1.72U pCi/L)
MW527 10/2/2018 (32.3 pCi/L)
MW528 10/2/2018 (38.3 pCi/L)
MW529 10/2/2018 (193 pCi/L)
MW530 10/2/2018 (96.4 pCi/L)
MW536 10/2/2018 (80.2 pCi/L)
MW537 10/2/2018 (144 pCi/L)
MW163 10/4/2018 (30.5 pCi/L)
MW256 10/4/2018 (26.2 pCi/L)
EW235
MW538 10/2/2018 (15.6 pCi/L)
MW539 10/2/2018 (10.4 pCi/L)
MW255 10/4/2018 (-4.57U pCi/L)
MW531 10/2/2018 (73.6 pCi/L)
MW482 5/15/2017 (22.7 pCi/L)
MW481 5/15/2017 (3.64U pCi/L)
MW496 10/4/2018 (25.3 pCi/L)
MW145 10/3/2018 (48.7 pCi/L)
MW144 10/3/2018 (63 pCi/L)
MW495 10/4/2018 (48.3 pCi/L)
MW479 10/3/2018 (-8.4U pCi/L)
MW480 10/3/2018 (51 pCi/L)
MW556 10/3/2018 (61.3 pCi/L)
MW258 10/3/2018 (12.6U pCi/L)
MW478 10/3/2018 (-6.55U pCi/L)







LEGEND

2018 Tc-99 Plume Concentration Fields
- 900 - 3,790 pCi/L
- ≥ 3,790 pCi/L

2016 Tc-99 Plume Isoconcentration Lines
- 900 - 3,790 pCi/L
- ≥ 3,790 pCi/L

- Lower RGA Well
- Middle RGA Well
- Upper RGA Well
- Multizone RGA Well

MW100 8/17/2018 (25U pCi/L) - Monitoring Well Identification, Date of Sample & Sample Value "U" by the sample value indicates the value is reported < minimum detectable activity and/or total propagated uncertainty

- Active Extraction Well
- Inactive Extraction Well

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

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U.S. DEPARTMENT OF ENERGY
PORTSMOUTH / PADUCAH PROJECT OFFICE
PADUCAH GASEOUS DIFFUSION PLANT

Figure 10. 2018 Tc-99 Plume—Regional Gravel Aquifer

FILE NAME:	PROJECT #:	SCALE:	DATE:
Fig_10_2016_2018PlumesTc99	EM	AS NOTED	5/28/2019

G:\GIS\ARCVIEW\PROJECTS\PLUMES\2018 Plumes\Fig_10_2016_2018PlumesTc99.mxd 5/28/2019

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Northeast Plume transect wells, MW524—MW530, installed as part of the Northeast Plume Optimization project, all contain less than 900 pCi/L Tc-99 (ranging from nondetect to 193 pCi/L).

5. POTENTIOMETRIC MAP

A synoptic set of water level measurements was collected in August 2017 and August 2018. RGA water levels measurements were made in 278 RGA extraction wells, MWs, and piezometers during the 4-day period August 21, 2017–August 24, 2017, and in 271 wells and piezometers during the 4-day period August 20, 2018–August 23, 2018; these were supplemented with water level measurements in an additional 2 MWs on August 27, 2018. These water level measurements are the basis for the August 2017 and August 2018 potentiometric surface maps of the RGA (Figures 11 and 12). The contours of the potentiometric surface map define lines of equal hydraulic potential. Lines drawn perpendicular to the hydraulic potential contours mark the local direction of hydraulic gradient. These potentiometric surface contours help explain the plume geometries. Other factors affecting the plume geometries include temporal changes to the RGA hydraulic potential field; source zone characteristics, anisotropy of the hydraulic conductivity within the RGA; and advection, dispersion, and natural attenuation of the contaminants.

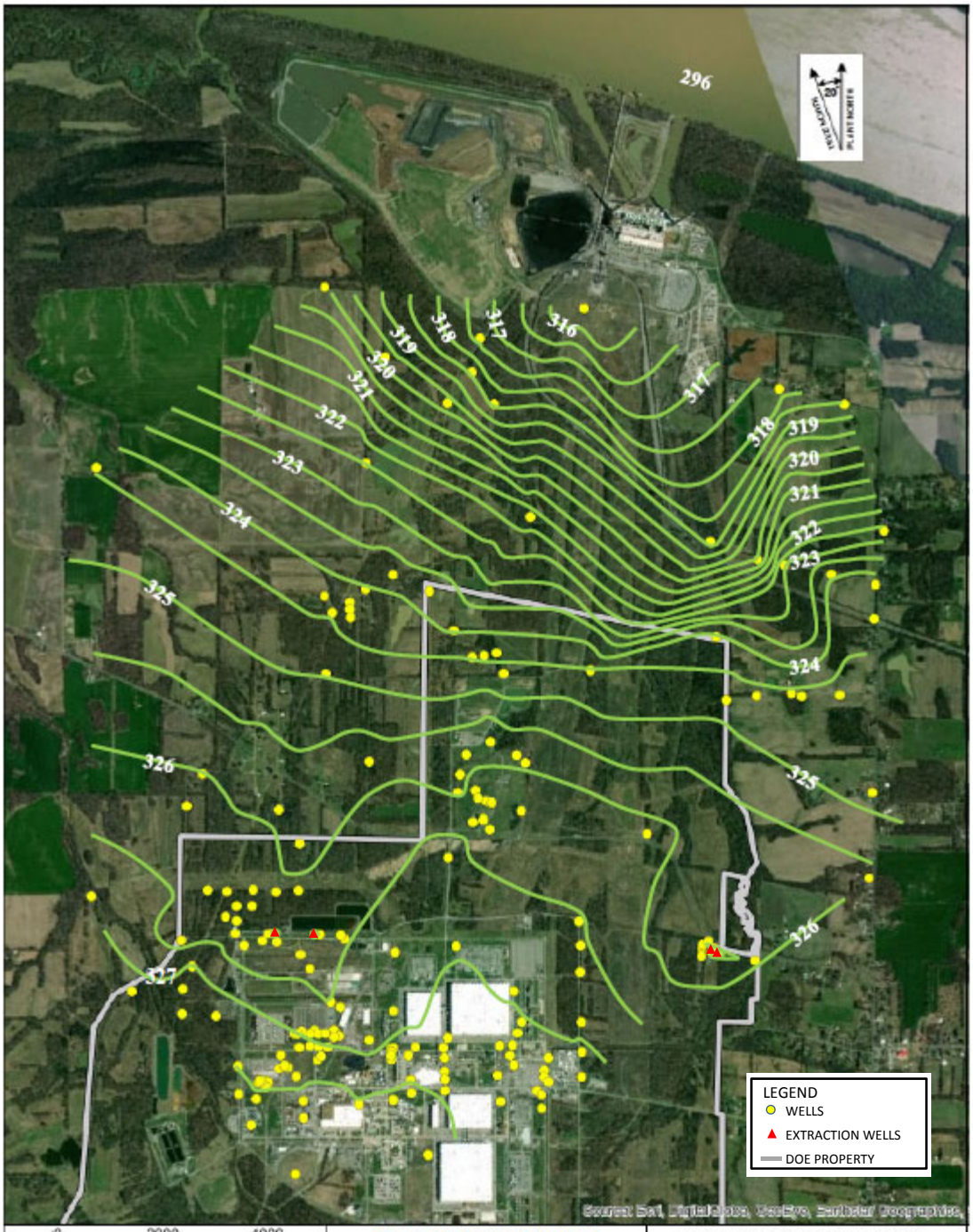
A dominant control on the hydraulic potential field of the RGA is the stage of the Ohio River, which is the primary discharge zone of the RGA. The Ohio River stage controls the base hydraulic potential in the RGA (e.g., water levels rise in the RGA when the river stage is high). During August 2017, the Ohio River stage near the Paducah Site was approximately 296 ft above mean sea level; in August 2018, the stage of the Ohio River was near its seasonal low for that year, approximately 298 ft above mean sea level. In addition, the Northeast Plume and Northwest Plume pump-and-treat system form local cones of depression in the RGA potentiometric surface. The August 2017 water level data set documents RGA hydraulic potential trends near the end of operations for the original Northeast Plume extraction wells, which ceased pumping on September 2, 2017. (The optimized Northeast Plume extraction well system began pumping on October 10, 2017.)

Operation of the Olmsted Locks and Dam on the Ohio River, located approximately 19 miles downstream of the Paducah Site, began in September 2018. The dam maintains a higher base level stage on the Ohio River. The August 2017 and August 2018 maps document RGA hydraulic potential trends during a low river stage that will not reoccur during the operational life of the Olmsted Dam.

RGA water level measurements were converted to elevation and corrected to a standard barometric pressure that was common during the period of the water level measurements: 30.05 inches of mercury for the August 2017 measurements and 30.02 inches of mercury for the 2018 measurements. Rainfall was minimal during both periods of water level measurements: 0.47 inches, primarily on August 22, during the 2017 water level measurements and 1.02 inches spread across the 2018 period of water level measurements.

A data quality review of the RGA water level measurements identified few measurements that were rejected for mapping the RGA potentiometric surface.[8] In the 2017 data set, 17 out of 278 measurements were rejected: in the 2018 data set, 7 out of 271 measurements were rejected. Where co-located MWs and piezometers occur (those located within 50-ft distance), a single map location was defined and assigned a

[8] A measurement was rejected when the derived elevation was inconsistent with other measurements in the area, and no explanation for the discrepancy was apparent.


296
316
317
318
319
320
321
322
323
324
325
326
327
LEGEND
WELLS
EXTRACTION WELLS
DOE PROPERTY
0
2000
4000
Figure 11. August 2017 RGA Potentiometric Surface Map
U. S. DEPARTMENT OF ENERGY

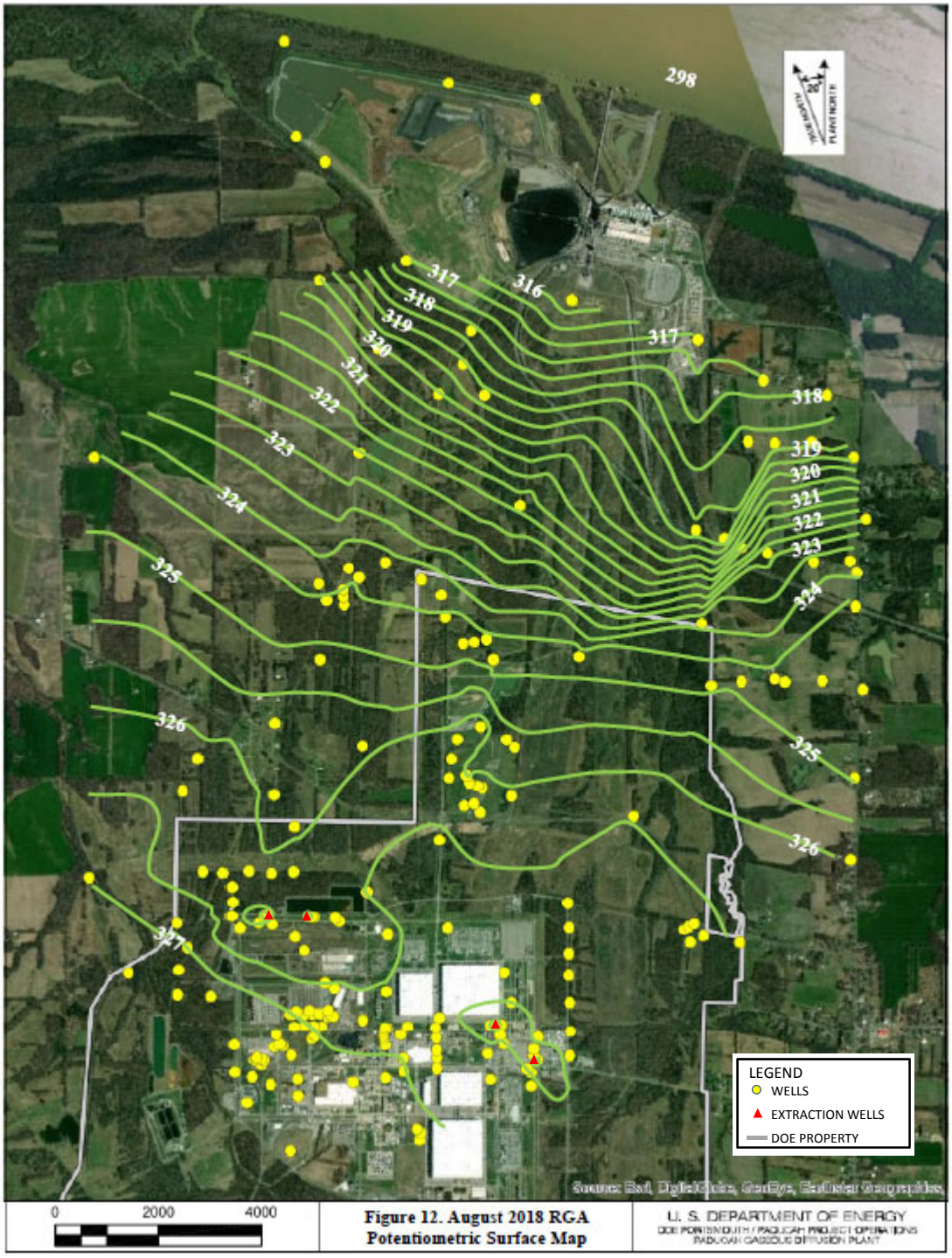


Figure 12. August 2018 RGA Potentiometric Surface Map

representative water level based on the co-located well and piezometer measurements. The resulting map data sets include RGA water level elevations for 180 wells, piezometers, co-located wells and piezometers, and 4 extraction wells for 2017 and 191 wells, piezometers, and co-located wells and piezometers, and 4 extraction wells for 2018.

The RGA hydraulic potential contours first were generated by computer using Carlson Survey Civil Suite 2019 software for engineering and surveying applications, and AutoCAD 2019 as the graphics engine and drawing editor. The software created contours directly from a triangulated irregular network (as a TIN file), based on the well coordinates and water level elevations of the August 2017 and August 2018 synoptic water measurements events. The resulting contours then were smoothed manually in PowerPoint 2010 where site knowledge provided bias to understanding the hydraulic potential field.

The available wells and piezometers for both the 2017 and 2018 data sets provide a robust monitoring network for defining the RGA hydraulic potential within the DOE property. For the region included in Figures 11 and 12, the primary areas of uncertainty are 1) the northwest corner, where no monitoring point is present; 2) the western edge of the contoured expanse, where few wells and piezometers are available to refine the contour spacing; and 3) the zone paralleling the Ohio River, which includes TVA's Shawnee Fossil Plant. It remains uncertain if the RGA hydraulic potential in the area adjacent to the Ohio River uniformly slopes to the Ohio River or steeply declines near the edge of recent Ohio River bank deposits.

6. INTERNAL REVIEW PROCESS

The map contours generated for 2018 plumes were developed by consensus by FRNP 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.

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APPENDIX A

ELECTRONIC COPIES OF TABLES AND GRAPHS AND ALTERNATE INTERPRETATION OF PLUMES WITH MAXIMUM RESULTS (CD)

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APPENDIX A

ELECTRONIC COPIES OF TABLES AND GRAPHS (CD)

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APPENDIX B

TABLE OF DATA USED TO PREPARE THE 2018 PLUME MAPS

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Table B.1. 2017 and 2018 TCE and Tc-99 Data Used to Create Plume Maps

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Date TCE Sample Collected	TCE (µg/L)[b]	Date Tc-99 Sample Collected	Tc-99 (pCi/L)[c]	Notes
MW100	Lower	283–293	5/9/2018	1U	5/9/2018	-5.73U	
MW106A	Middle	295–305	11/7/2018	4.74	8/13/2018	-3.18U	
MW108	Middle	286–316	6/28/2017	1.93	6/28/2017	24.8	
MW124	Lower	270–280	10/3/2018	44.3	10/3/2018	-11.6U	
MW125	Lower	285–295	8/29/2018	82.2	5/9/2018	53.7	
MW126	Middle	298–308	10/3/2018	96.7	10/3/2018	-9.14U	
MW134	Lower	272–282	11/7/2018	1U	8/13/2018	0.83U	
MW135	Lower	283–293	9/27/2018	74.6	9/27/2018	72.5	
MW139	Middle	294–304	8/29/2018	4.24	5/9/2018	-1.81U	
MW144	Lower	263–273	10/3/2018	129	10/3/2018	63	
MW145	Lower	283–293	10/3/2018	51.7	10/3/2018	48.7	
MW146	Lower	283–293	11/14/2018	1U	8/14/2018	-4.65U	
MW148	Middle	281–311	5/11/2017	12.7	5/11/2017	12.8U	
MW150	Lower	278–308	5/16/2018	1U	5/16/2018	1.75U	
MW152	Lower	277–307	8/15/2018	0.6J	5/21/2018	119	
MW155	Lower	287–292	12/18/2018	3550	12/18/2018	89.2	
MW156	Upper	310–317	12/18/2018	1940	12/18/2018	-1.65U	
MW161	Lower	289–294	12/17/2018	785	5/14/2018	12.5U	
MW163	Lower	285–290	10/4/2018	146	10/4/2018	30.5	
MW165A	Upper	310–315	9/24/2018	0.45J	9/24/2018	32.9	
MW168	Upper	307–312	5/23/2017	75.6	5/23/2017	1480	
MW169	Middle	301–306	5/23/2017	433	5/23/2017	109	
MW173	Upper	314–319	9/24/2018	0.41J	9/24/2018	2.99U	
MW175	Middle	299–304	9/26/2018	3960	9/26/2018	360	
MW178	Upper	309–314	12/19/2018	63.9	12/19/2018	95.8	
MW191	Middle	297–302	5/9/2018	1U	5/9/2018	-8.54U	
MW193	Upper	298–303	5/9/2017	1U	5/9/2017	2.09U	
MW194	Middle	302–307	11/7/2018	1U	8/13/2018	-2.95U	
MW197	Upper	303–308	9/27/2018	21.2	9/27/2018	17.6U	
MW199	Lower	292–297	11/7/2018	1U	8/13/2018	-0.664U	
MW200	Middle	298–303	5/9/2017	2.59	5/9/2017	52	
MW201	Middle	297–302	11/14/2018	0.56J	8/14/2018	3.9U	
MW202	Lower	289–294	11/14/2018	1U	8/13/2018	0.54U	
MW203	Middle	299–304	8/29/2018	62.8	5/14/2018	110	
MW205	Upper	307–312	5/23/2017	1.74	5/23/2017	16U	
MW220	Upper	310–320	10/15/2018	1U	10/15/2018	20.8	
MW221	Upper	304–314	10/15/2018	1U	10/15/2018	7.17U	
MW222	Upper	314–324	10/15/2018	1U	10/15/2018	3.63U	
MW223	Upper	309–319	10/15/2018	1U	10/15/2018	3.91U	
MW224	Upper	310–320	10/15/2018	1U	10/15/2018	3.72U	
MW226	Lower	287–297	7/11/2018	226	7/11/2018	10U	
MW227	Upper	301–311	7/11/2018	76.9	7/11/2018	4.79U	
MW233	Middle	291–301	5/9/2018	3.1	5/9/2018	-3.77U	
MW236	Lower	290–300	5/9/2018	2.51	5/9/2018	-3.01U	
MW240	Middle	290–300	5/9/2018	4.13	5/9/2018	-5.81U	
MW242	Middle	295–305	9/18/2018	49.9	9/18/2018	25.1	
MW243	Middle	293–303	9/27/2018	22.2	9/19/2018	22.2	
MW244	Middle	291–301	9/27/2018	3.77	9/19/2018	6.8U	
MW245	Middle	294–304	9/27/2018	21.5	9/27/2018	0.567U	

Table B.1. 2017 and 2018 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Date TCE Sample Collected	TCE (µg/L)[b]	Date Tc-99 Sample Collected	Tc-99 (pCi/L)[c]	Notes
MW248	Middle	289–299	9/27/2018	4.92	9/19/2018	12.6U	
MW250	Middle	293–303	9/27/2018	3.74	9/19/2018	-0.378U	
MW252	Lower	283–288	5/21/2018	1.44	5/21/2018	5.47U	
MW253	Lower	268–273	5/22/2018	37.7	5/22/2018	-4.8U	
MW255	Lower	286–291	10/4/2018	206	10/4/2018	-4.57U	
MW256	Lower	279–284	10/4/2018	137	10/4/2018	26.2	
MW258	Lower	287–292	10/3/2018	264	10/3/2018	-7.22U	
MW260	Lower	284–289	10/4/2018	126	10/4/2018	47.8	
MW261	Lower	276–281	8/29/2018	1910	5/14/2018	470	
MW262	Lower	278–283	5/23/2017	593	5/23/2017	266	
MW283	Lower	288–298	10/3/2018	30.3	10/3/2018	-7.88U	
MW288	Lower	280–290	10/3/2018	186	10/3/2018	46.7	
MW291	Lower	288–298	10/3/2018	37	10/3/2018	-6.33U	
MW292	Lower	276–286	10/3/2018	224	10/3/2018	42.3	
MW293A	Middle	289–299	10/3/2018	152	10/3/2018	-6.35U	
MW328	Middle	301–306	5/18/2017	1.09	5/18/2017	1.72U	
MW329	Upper	303–308	5/18/2017	0.4J	5/18/2017	9.89U	
MW333	Middle	296–305	7/11/2018	4520	7/11/2018	101	
MW337	Middle	297–307	7/12/2018	1340	7/12/2018	276	
MW338	Middle	298–308	7/12/2018	584	7/12/2018	36.1	
MW339	Lower	277–286	9/26/2018	697	9/26/2018	163	
MW340	Lower	277–286	9/19/2018	1560	9/19/2018	382	
MW341	Middle	293–303	12/18/2018	5220	12/18/2018	122	
MW342	Middle	292–302	9/26/2018	2610	9/26/2018	714	
MW343	Lower	290–300	9/25/2018	21800	9/25/2018	4180	
MW354	Middle	301–306	12/19/2018	4.92	12/19/2018	4.6U	
MW355	Lower	285–290	9/24/2018	5.91	9/24/2018	28.2	
MW356	Lower	257–262	5/23/2017	0.91J	5/23/2017	12.9U	
MW357	Upper	304–314	10/8/2018	6.85	10/8/2018	42.5	
MW358	Lower	285–295	10/8/2018	5.18	10/8/2018	46.5	
MW360	Upper	310–320	10/9/2018	1U	10/9/2018	-2.92U	
MW361	Middle	294–304	10/8/2018	7.3	10/8/2018	48.6	
MW363	Upper	301–311	10/8/2018	3.83	10/8/2018	-1.97U	
MW364	Lower	283–293	10/8/2018	12.3	10/8/2018	56.9	
MW366	Upper	304–314	10/9/2018	5.04	10/9/2018	55.9	
MW367	Lower	284–294	10/9/2018	0.57J	10/9/2018	0.449U	
MW369	Upper	311–321	10/9/2018	1.03	10/9/2018	55	
MW370	Middle	292–302	10/9/2018	0.67J	10/9/2018	114	
MW372	Upper	301–311	10/10/2018	5.72	10/10/2018	158	
MW373	Lower	288–298	10/10/2018	7.91	10/10/2018	20.3U	
MW384	Upper	287–297	10/16/2018	0.41J	10/16/2018	168	
MW385	Lower	303–313	10/16/2018	1U	10/16/2018	91.9	
MW387	Upper	304–314	10/16/2018	0.7J	10/16/2018	223	
MW388	Middle	291–301	10/16/2018	0.65J	10/16/2018	117	
MW391	Middle	297–307	10/22/2018	8.87	10/22/2018	12.5U	
MW392	Lower	273–283	10/22/2018	14.1	10/22/2018	5.15U	
MW394	Upper	302–312	10/22/2018	4.85	10/22/2018	13.4U	
MW395	Middle	295–305	10/22/2018	2.91	10/22/2018	13.2U	

Table B.1. 2017 and 2018 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Date TCE Sample Collected	TCE (µg/L)[b]	Date Tc-99 Sample Collected	Tc-99 (pCi/L)[c]	Notes
MW397	Lower	290–300	10/15/2018	1U	10/15/2018	18.3	
MW403	Multizone[d]	272–274	12/19/2018	3.16	12/19/2018	3.15U	
MW404	Multizone[e]	284–286	5/18/2017	3.81	5/18/2017	5.19U	
MW405	Multizone[f]	296–298	12/18/2018	204	12/18/2018	4.42U	
MW406	Multizone[g]	296–298	12/18/2018	4370	12/18/2018	-2.89U	
MW407	Multizone[h]	304–306	12/18/2018	97.1	12/18/2018	7.99U	
MW408	Multizone[i]	296–298	12/18/2018	41.2	12/18/2018	4.18U	
MW409	Lower	280–290	8/28/2018	0.37J	Not Sampled		
MW410	Lower	278–288	8/28/2018	1U	Not Sampled		
MW411	Middle	294–304	8/28/2018	1U	Not Sampled		
MW414	Middle	297–307	5/19/2017	873	5/19/2017	48.5	
MW415	Lower	273–283	5/19/2017	924	5/19/2017	36.3	
MW416	Middle	300–310	5/19/2017	148	5/19/2017	16.2U	
MW417	Lower	272–282	5/19/2017	80.2	5/19/2017	0.172U	
MW418	Middle	296–306	5/14/2018	10.8	5/14/2018	6.01U	
MW419	Lower	281–291	5/14/2018	17.1	5/14/2018	8.93U	
MW420	Middle	299–309	8/20/2018	476	8/20/2018	0.33U	
MW421	Multizone[j]	291–305	9/24/2018	43600	9/24/2018	4500	
MW422	Multizone[j]	290–304	9/24/2018	29100	9/24/2018	6210	
MW423	Multizone[j]	290–305	9/25/2018	34400	9/25/2018	4530	
MW424	Multizone[j]	292–306	9/25/2018	14700	9/25/2018	3530	
MW425	Multizone[j]	292–306	9/26/2018	2350	9/26/2018	3640	
MW426	Upper	304–314	11/7/2018	2.68	8/13/2018	-0.989U	
MW427	Lower	273–283	11/7/2018	1.8	8/13/2018	-3.04U	
MW428	Lower	277–287	9/27/2018	3.32	9/19/2018	-1.2U	
MW429A	Upper	302–312	9/5/2018	1U	9/5/2018	-0.622U	
MW430	Lower	281–291	9/5/2018	1.44	9/5/2018	5.69U	
MW431	Lower	285–295	12/19/2018	2.24	9/27/2018	5.38U	
MW432	Middle	292–302	11/14/2018	0.56J	11/14/2018	-2.84U	
MW433	Middle	302–305	11/14/2018	1U	8/14/2018	-5.16U	
MW435	Lower	274–284	11/14/2018	0.7J	8/14/2018	0.0772U	
MW439	Middle	295–297	5/9/2017	1.4	5/9/2017	7.51U	
MW441	Lower	277–279	11/14/2018	1.73	8/14/2018	4.18U	
MW442	Lower	288–291	5/9/2017	2.56	5/9/2017	9.41U	
MW443	Lower	274–277	5/9/2017	1.33	5/9/2017	4.29U	
MW444	Lower	259–264	5/9/2017	1.48	5/9/2017	13.9U	
MW445	Middle	297–300	5/9/2017	6.24	5/9/2017	8.65U	
MW447	Lower	261–266	5/9/2017	22.4	5/9/2017	11.7U	
MW448	Middle	303–305	5/9/2017	3.21	5/9/2017	8.22U	
MW450	Lower	276–286	5/9/2017	14.1	5/9/2017	16.3U	
MW451	Upper	304–314	5/18/2017	1U	5/18/2017	9.5U	
MW452	Lower	280–290	11/7/2018	1U	8/14/2018	-4.54U	
MW453	Upper	306–316	5/9/2018	43.6	5/9/2018	33.5	
MW454	Lower	284–294	8/29/2018	84.6	5/9/2018	51.4	
MW455	Middle	300–310	9/5/2018	29.2	9/5/2018	13.3U	
MW456	Lower	278–288	9/5/2018	22	9/5/2018	24.5	
MW457	Upper	305–315	9/18/2018	51.5	9/18/2018	5.72U	
MW458	Lower	282–292	9/18/2018	94.9	9/18/2018	30.9	

Table B.1. 2017 and 2018 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Date TCE Sample Collected	TCE (µg/L)[b]	Date Tc-99 Sample Collected	Tc-99 (pCi/L)[c]	Notes
MW459	Upper	306–316	9/18/2018	53.7	9/18/2018	44.6	
MW460	Lower	279–289	12/17/2018	526	12/17/2018	166	
MW461	Upper	307–317	9/18/2018	3	9/18/2018	6.15U	
MW462	Lower	287–297	9/27/2018	44.7	9/19/2018	34	
MW463	Middle	298–308	5/21/2018	99.6	5/21/2018	8.02U	
MW464	Lower	267–277	5/21/2018	85.6	5/21/2018	5.16U	
MW465	Middle	302–307	5/10/2017	22.6	5/10/2017	5.49U	
MW466	Middle	295–300	5/10/2017	22.2	5/10/2017	8.39U	
MW467	Upper	300–310	5/11/2017	3.34	5/11/2017	12.2U	
MW468	Middle	294–299	5/11/2017	7.61	5/11/2017	9.98U	
MW469	Middle	297–307	5/21/2018	0.61J	5/21/2018	8.44U	
MW470	Lower	292–297	5/21/2018	1.07	5/21/2018	1.61U	
MW471	Middle	292–302	5/23/2018	1U	5/23/2018	2.15U	
MW472	Lower	286–291	5/23/2018	1U	5/23/2018	5.93U	
MW473	Lower	289–299	5/10/2017	1U	5/10/2017	8.18U	
MW474	Lower	275–285	5/10/2017	1U	5/10/2017	5.07U	
MW475	Middle	293–303	5/10/2017	1U	5/10/2017	14.6U	
MW476	Lower	267–277	5/10/2017	1U	5/10/2017	4.29U	
MW477	Lower	282–292	5/30/2017	56.9	5/30/2017	7.12U	
MW478	Middle	295–305	10/3/2018	270	10/3/2018	-6.55U	
MW479	Upper	301–311	10/3/2018	0.94J	10/3/2018	-8.4U	
MW480	Lower	283–293	10/3/2018	145	10/3/2018	51	
MW481	Middle	298–308	5/15/2017	0.56J	5/15/2017	3.64U	
MW482	Lower	269–279	5/15/2017	58.1	5/15/2017	22.7	
MW483	Middle	294–304	5/21/2018	51.3	5/21/2018	5.38U	
MW484	Lower	278–288	5/21/2018	49.3	5/21/2018	0.6U	
MW485	Middle	295–305	5/11/2017	68.7	5/11/2017	-1.33U	
MW487	Lower	282–292	5/11/2017	6.62	5/11/2017	0.178U	
MW488	Middle	299–309	5/11/2017	1U	5/11/2017	-6.83U	
MW489	Middle	300–310	5/9/2017	50.4	5/9/2017	28.8	
MW490	Lower	290–300	5/9/2017	76.1	5/9/2017	14.7U	
MW491	Upper	301–311	5/9/2017	50.5	5/9/2017	88.1	
MW492	Lower	286–296	5/9/2017	71.7	5/9/2017	84.4	
MW493	Upper	302–312	5/9/2017	1.5	5/9/2017	52.8	
MW494	Middle	290–300	5/9/2017	1.37	5/9/2017	59.5	
MW495	Lower	268–278	10/4/2018	417	10/4/2018	48.3	
MW496	Lower	267–277	10/4/2018	139	10/4/2018	25.3	
MW497	Middle	300–310	9/18/2018	425	9/18/2018	156	
MW498	Lower	276–286	9/18/2018	46.2	9/18/2018	5.59U	
MW499	Middle	297–307	9/18/2018	359	9/18/2018	263	
MW500	Lower	278–288	9/18/2018	308	9/18/2018	294	
MW501	Middle	299–309	9/18/2018	1U	9/18/2018	-4.76U	
MW502	Lower	282–292	9/18/2018	2.79	9/18/2018	-12.8U	
MW503	Lower	282–287	9/18/2018	30.4	9/18/2018	317	
MW504	Upper	315–320	9/18/2018	1.74	9/18/2018	-4.05U	
MW505	Upper	312–317	12/18/2018	10.3	12/18/2018	57.1	
MW506	Middle	300–305	12/18/2018	9370	12/18/2018	54.3	
MW507	Lower	287–292	12/18/2018	4620	12/18/2018	45.4	

Table B.1. 2017 and 2018 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Date TCE Sample Collected	TCE (µg/L)[b]	Date Tc-99 Sample Collected	Tc-99 (pCi/L)[c]	Notes
MW524	Middle	299–309	10/2/2018	2.44	10/2/2018	1.87U	
MW525	Middle	301–311	10/2/2018	696	10/2/2018	106	
MW526	Middle	302–312	10/2/2018	1870	10/2/2018	122	
MW527	Middle	302–311	10/2/2018	11.6	10/2/2018	32.3	
MW528	Lower	291–301	10/2/2018	135	10/2/2018	38.3	
MW529	Lower	289–299	10/2/2018	1350	10/2/2018	193	
MW530	Lower	285–295	10/2/2018	797	10/2/2018	96.4	
MW531	Lower	267–277	10/2/2018	91.9	10/2/2018	73.6	
MW533	Lower	282–292	10/2/2018	67.5	10/2/2018	67.5	
MW536	Lower	288–298	10/2/2018	153	10/2/2018	80.2	
MW537	Lower	277–287	10/2/2018	89.9	10/2/2018	144	
MW538	Middle	294–304	10/2/2018	7.69	10/2/2018	15.6	
MW539	Lower	281–291	10/2/2018	110	10/2/2018	10.4	
MW542	Upper	305–310	12/17/2018	14	Not Sampled		
MW543	Upper	304–309	12/17/2018	25.9	Not Sampled		
MW544	Upper	308–313	12/17/2018	415	Not Sampled		
MW545	Upper	309–314	12/17/2018	1.39	Not Sampled		
MW546	Upper	305–310	12/17/2018	431	Not Sampled		
MW547	Upper	305–310	12/17/2018	716	Not Sampled		
MW548	Lower	287–297	6/26/2017	6830	6/26/2017	55.8	
MW549	Upper[k]	303–313	7/11/2018	4240	7/11/2018	4.53U	
MW550	Upper[k]	297–307	6/28/2017	4240	6/28/2017	6.15U	
MW551	Upper[k]	298–308	6/28/2017	2890	6/28/2017	9.29U	
MW556	Lower	279–289	10/3/2018	147	10/3/2018	61.3	
MW63	Upper	307–312	9/19/2018	2.16	9/19/2018	13.2U	
MW65	Lower	279–284	9/19/2018	1.54	9/19/2018	14.1U	
MW66	Upper	308–313	9/19/2018	487	9/19/2018	239	
MW67	Middle	302–307	7/11/2018	1370	7/11/2018	140	
MW71	Upper	306-310	5/15/2018	23.7	5/15/2018	7U	
MW76	Middle	295–305	7/11/2018	262	7/11/2018	13.5U	
MW84	Middle	296–307	8/20/2018	5260	8/20/2018	11.8U	
MW86	Lower	287–298	7/12/2018	1990	7/12/2018	3.51U	
MW87	Middle	298–309	8/20/2018	1690	8/20/2018	4.44U	
MW89	Lower	285–295	7/11/2018	56.9	7/11/2018	8.98U	
MW90A	Upper	301–311	8/20/2018	53.3	8/20/2018	7.78U	
MW92	Lower	282–293	7/12/2018	3.3	7/12/2018	12.6U	
MW93	Middle	295–305	8/20/2018	1000	8/20/2018	4.61U	
MW95A	Lower	288–298	7/11/2018	2370	7/11/2018	12.3U	
MW98	Middle	293–303	9/27/2018	1.75	9/27/2018	54.6	
MW99	Middle	295–305	5/22/2018	34.6	5/22/2018	9.58U	
R114	Residential[l]	—	11/26/2018	1U	11/14/2017	-3.9U	East of map extent
R13	Residential[l]	—	11/13/2018	1U	8/28/2018	-2.67U	
R14	Residential[l]	—	11/13/2018	1U	8/28/2018	0.0951U	
R2	Residential[l]	—	11/13/2018	6.28	8/14/2018	1.67U	
R20	Residential[l]	—	11/26/2018	1U	11/14/2017	2.66U	
R21	Residential[l]	—	11/26/2018	1U	11/14/2017	2.98U	
R245	Residential[l]	—	11/13/2018	1U	8/28/2018	1.23U	
R26	Residential[l]	—	11/13/2018	1U	8/28/2018	-5.2U	West of map extent

Table B.1. 2017 and 2018 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Date TCE Sample Collected	TCE (µg/L)[b]	Date Tc-99 Sample Collected	Tc-99 (pCi/L)[c]	Notes
R302	Residential[l]	—	11/26/2018	1U	11/14/2017	-2.98U	
R53	Residential[l]	—	11/13/2018	0.55J	8/28/2018	-2.09U	
R83	Residential[l]	—	11/26/2018	1U	11/14/2017	-0.386U	
R9	Residential[l]	—	11/26/2018	1U	11/14/2017	-6.04U	
R90	Residential[l]	—	11/26/2018	1U	11/14/2017	-6.21U	East of map extent

[a] Screened intervals are approximate.
[b] TCE results of "1U" indicate the sample was analyzed and not detected at a reporting level of 1 µg/L; J indicates the reported value was detected at less than the reporting limit.
[c] Tc-99 results with "U" indicate the samples was analyzed, but is reported at a level less than the minimum detectable activity and/or total propagated uncertainty.
[d] MW403 was sampled from Port 3 during 2017–2018. Port 3 screen interval is shown.
[e] MW404 was sampled from Port 4 during 2017–2018. Port 4 screen interval is shown.
[f] MW405 was sampled from Port 5 during 2017–2018. Port 5 screen interval is shown.
[g] MW406 was sampled from Port 5 during 2017–2018. Port 5 screen interval is shown.
[h] MW407 was sampled from Port 4 during 2017–2018. Port 4 screen interval is shown.
[i] MW408 was sampled from Port 5 during 2017–2018. Port 5 screen interval is shown.
[j] MW422–MW425 were sampled from all three ports during 2017–2018. The screen interval shown encompasses all three ports.
[k] MW549–MW551 were sampled from the uppermost port during 2017–2018. The uppermost screen interval is shown.
[l] Residential wells are assumed to be completed in the Upper RGA.

APPENDIX C

2018 PLUME MAPS

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FIGURES

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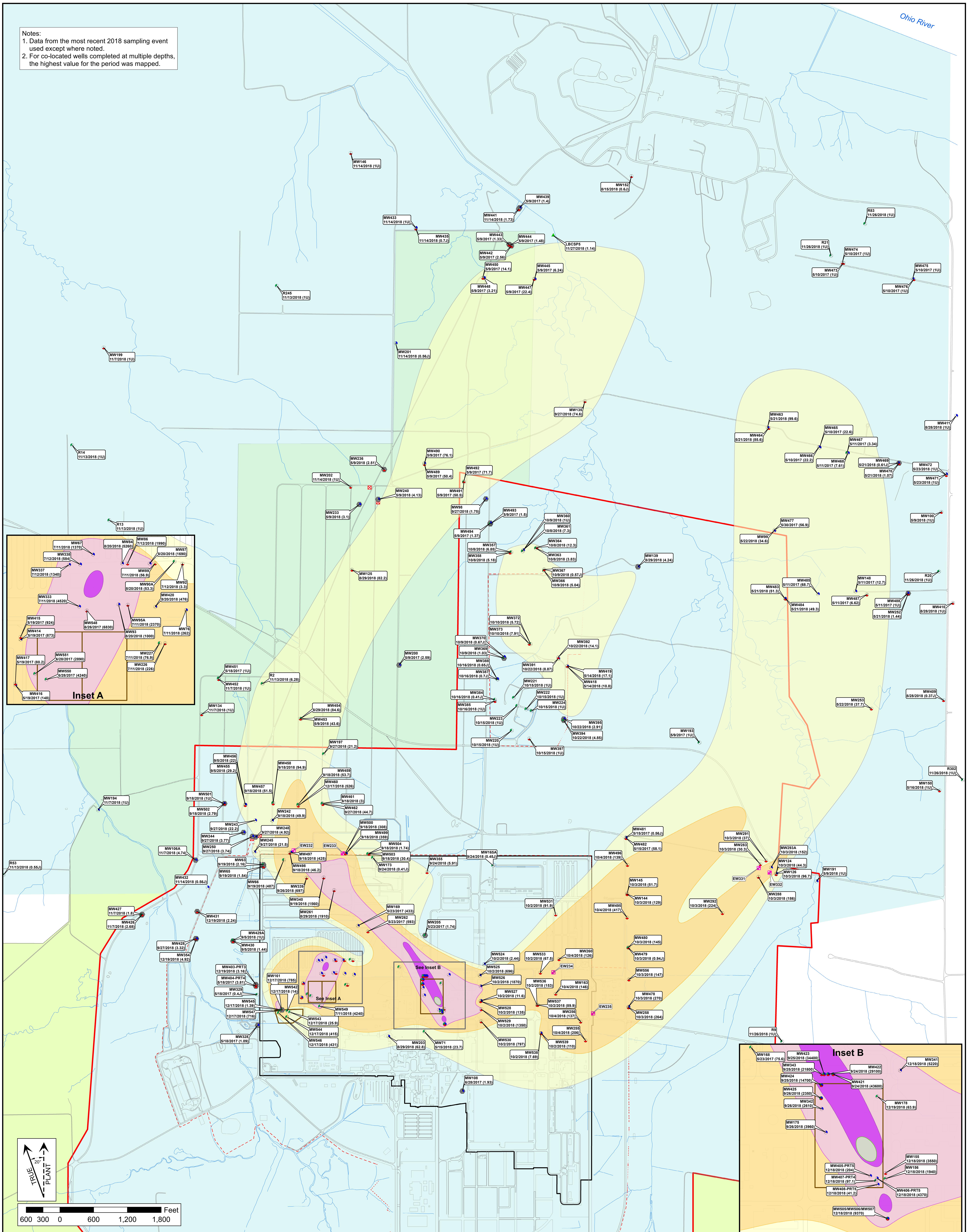
Notes:
1. Data from the most recent 2018 sampling event used except where noted.
2. For co-located wells completed at multiple depths, the highest value for the period was mapped.
Ohio River
MW146 11/14/2018 (1U)
MW152 8/15/2018 (0.6J)
MW439 5/9/2017 (1.4)
MW441 11/14/2018 (1.73)
MW433 11/14/2018 (1U)
MW435 11/14/2018 (0.7J)
MW443 5/9/2017 (1.33)
MW444 5/9/2017 (1.48)
MW442 5/9/2017 (2.56)
LBCSP5 11/27/2018 (1.14)
MW450 5/9/2017 (14.1)
MW445 5/9/2017 (6.24)
MW448 5/9/2017 (3.21)
MW447 5/9/2017 (22.4)
R83 11/26/2018 (1U)
R21 11/26/2018 (1U)
MW474 5/10/2017 (1U)
MW473 5/10/2017 (1U)
MW475 5/10/2017 (1U)
MW476 5/10/2017 (1U)
R245 11/13/2018 (1U)
MW199 11/7/2018 (1U)
MW201 11/14/2018 (0.56J)
MW135 9/27/2018 (74.6)
MW463 5/21/2018 (99.6)
MW464 5/21/2018 (85.6)
MW465 5/10/2017 (22.6)
MW466 5/10/2017 (22.2)
MW467 5/11/2017 (3.34)
MW468 5/11/2017 (7.61)
MW469 5/21/2018 (0.61J)
MW470 5/21/2018 (1.07)
MW472 5/23/2018 (1U)
MW471 5/23/2018 (1U)
MW411 8/28/2018 (1U)
R14 11/13/2018 (1U)
MW490 5/9/2017 (76.1)
MW489 5/9/2017 (50.4)
MW236 5/9/2018 (2.51)
MW202 11/14/2018 (1U)
MW492 5/9/2017 (71.7)
MW491 5/9/2017 (50.5)
MW240 5/9/2018 (4.13)
MW98 9/27/2018 (1.75)
MW233 5/9/2018 (3.1)
MW493 5/9/2017 (1.5)
MW494 5/9/2017 (1.37)
MW360 10/9/2018 (1U)
MW361 10/8/2018 (7.3)
MW357 10/8/2018 (6.85)
MW358 10/8/2018 (5.18)
MW364 10/8/2018 (12.3)
MW363 10/8/2018 (3.83)
MW100 5/9/2018 (1U)
MW477 5/30/2017 (56.9)
MW99 5/22/2018 (34.6)
R13 11/13/2018 (1U)
MW139 8/29/2018 (4.24)
MW125 8/29/2018 (82.2)
MW367 10/9/2018 (0.57J)
MW366 10/9/2018 (5.04)
MW485 5/11/2017 (68.7)
MW483 5/21/2018 (51.3)
MW484 5/21/2018 (49.3)
MW148 5/11/2017 (12.7)
MW487 5/11/2017 (6.62)
MW488 5/11/2017 (1U)
MW252 5/21/2018 (1.44)
R20 11/26/2018 (1U)
MW410 8/28/2018 (1U)
MW372 10/10/2018 (5.72)
MW373 10/10/2018 (7.91)
MW370 10/9/2018 (0.67J)
MW369 10/9/2018 (1.03)
MW388 10/16/2018 (0.65J)
MW387 10/16/2018 (0.7J)
MW392 10/22/2018 (14.1)
MW391 10/22/2018 (8.87)
MW419 5/14/2018 (17.1)
MW418 5/14/2018 (10.8)
MW200 5/9/2017 (2.59)
MW221 10/15/2018 (1U)
MW222 10/15/2018 (1U)
MW224 10/15/2018 (1U)
MW384 10/16/2018 (0.41J)
MW385 10/16/2018 (1U)
MW223 10/15/2018 (1U)
MW395 10/22/2018 (2.91)
MW394 10/22/2018 (4.85)
MW220 10/15/2018 (1U)
MW397 10/15/2018 (1U)
MW193 5/9/2017 (1U)
MW253 5/22/2018 (37.7)
MW409 8/28/2018 (0.37J)
MW451 5/18/2017 (1U)
MW452 11/7/2018 (1U)
R2 11/13/2018 (6.28)
MW134 11/7/2018 (1U)
MW454 8/29/2018 (84.6)
MW453 5/9/2018 (43.6)
MW197 9/27/2018 (21.2)
R302 11/26/2018 (1U)
MW150 5/16/2018 (1U)
MW67 7/11/2018 (1370)
MW84 8/20/2018 (5260)
MW86 7/12/2018 (1990)
MW87 8/20/2018 (1690)
MW338 7/12/2018 (584)
MW337 7/12/2018 (1340)
MW89 7/11/2018 (56.9)
MW90A 8/20/2018 (53.3)
MW92 7/12/2018 (3.3)
MW420 8/20/2018 (476)
MW333 7/11/2018 (4520)
MW548 6/26/2017 (6830)
MW95A 7/11/2018 (2370)
MW415 5/19/2017 (924)
MW414 5/19/2017 (873)
MW93 8/20/2018 (1000)
MW76 7/11/2018 (262)
MW227 7/11/2018 (76.9)
MW226 7/11/2018 (226)
MW417 5/19/2017 (80.2)
MW551 6/28/2017 (2890)
MW550 6/28/2017 (4240)
MW416 5/19/2017 (148)
Inset A
MW456 9/5/2018 (22)
MW455 9/5/2018 (29.2)
MW458 9/18/2018 (94.9)
MW459 9/18/2018 (53.7)
MW460 12/17/2018 (526)
MW457 9/18/2018 (51.5)
MW501 9/18/2018 (1U)
MW502 9/18/2018 (2.79)
MW194 11/7/2018 (1U)
MW461 9/18/2018 (3)
MW462 9/27/2018 (44.7)
MW242 9/18/2018 (49.9)
MW243 9/27/2018 (22.2)
MW248 9/27/2018 (4.92)
MW244 9/27/2018 (3.77)
MW245 9/27/2018 (21.5)
MW250 9/27/2018 (3.74)
MW500 9/18/2018 (308)
MW499 9/18/2018 (359)
MW504 9/18/2018 (1.74)
MW503 9/18/2018 (30.4)
MW173 9/24/2018 (0.41J)
EW232
EW233
MW497 9/18/2018 (425)
MW498 9/18/2018 (46.2)
MW106A 11/7/2018 (4.74)
MW63 9/19/2018 (2.16)
MW65 9/19/2018 (1.54)
MW165A 9/24/2018 (0.45J)
MW355 9/24/2018 (5.91)
R53 11/13/2018 (0.55J)
MW432 11/14/2018 (0.56J)
MW66 9/19/2018 (487)
MW339 9/26/2018 (697)
MW340 9/19/2018 (1560)
MW261 8/29/2018 (1910)
MW481 5/15/2017 (0.56J)
MW482 5/15/2017 (58.1)
MW496 10/4/2018 (139)
MW291 10/3/2018 (37)
MW283 10/3/2018 (30.3)
MW293A 10/3/2018 (152)
MW124 10/3/2018 (44.3)
MW126 10/3/2018 (96.7)
MW191 5/9/2018 (1U)
EW331
EW332
MW288 10/3/2018 (186)
MW145 10/3/2018 (51.7)
MW144 10/3/2018 (129)
MW292 10/3/2018 (224)
MW531 10/2/2018 (91.9)
MW495 10/4/2018 (417)
MW427 11/7/2018 (1.8)
MW426 11/7/2018 (2.68)
MW431 12/19/2018 (2.24)
MW169 5/23/2017 (433)
MW262 5/23/2017 (593)
MW205 5/23/2017 (1.74)
MW429A 9/5/2018 (1U)
MW430 9/5/2018 (1.44)
MW428 9/27/2018 (3.32)
MW354 12/19/2018 (4.92)
MW480 10/3/2018 (145)
MW479 10/3/2018 (0.94J)
MW524 10/2/2018 (2.44)
MW533 10/2/2018 (67.5)
MW260 10/4/2018 (126)
EW234
MW525 10/2/2018 (696)
MW526 10/2/2018 (1870)
MW536 10/2/2018 (153)
MW163 10/4/2018 (146)
MW556 10/3/2018 (147)
MW527 10/2/2018 (11.6)
MW537 10/2/2018 (89.9)
MW256 10/4/2018 (137)
EW235
MW478 10/3/2018 (270)
MW258 10/3/2018 (264)
MW528 10/2/2018 (135)
MW529 10/2/2018 (1350)
MW255 10/4/2018 (206)
MW539 10/2/2018 (110)
MW530 10/2/2018 (797)
MW538 10/2/2018 (7.69)
R9 11/26/2018 (1U)
MW403-PRT3 12/19/2018 (3.16)
MW404-PRT4 5/18/2017 (3.81)
MW329 5/18/2017 (0.4J)
MW161 12/17/2018 (785)
MW542 12/17/2018 (14)
MW545 12/17/2018 (1.39)
MW547 12/17/2018 (716)
See Inset A
MW549 7/11/2018 (4240)
MW543 12/17/2018 (25.9)
MW544 12/17/2018 (415)
MW546 12/17/2018 (431)
MW328 5/18/2017 (1.09)
See Inset B
MW203 8/29/2018 (62.8)
MW71 5/15/2018 (23.7)
MW108 6/28/2017 (1.93)
Inset B
MW168 5/23/2017 (75.6)
MW423 9/25/2018 (34400)
MW343 9/25/2018 (21800)
MW422 9/24/2018 (29100)
MW341 12/18/2018 (5220)
MW424 9/25/2018 (14700)
MW421 9/24/2018 (43600)
MW425 9/26/2018 (2350)
MW342 9/26/2018 (2610)
MW178 12/19/2018 (63.9)
MW175 9/26/2018 (3960)
MW155 12/18/2018 (3550)
MW156 12/18/2018 (1940)
MW405-PRT5 12/18/2018 (204)
MW407-PRT4 12/18/2018 (97.1)
MW408-PRT5 12/18/2018 (41.2)
MW406-PRT5 12/18/2018 (4370)
MW505/MW506/MW507 12/18/2018 (9370)
TRUE
PLANT
20°
Feet
600 300 0 600 1,200 1,800

LEGEND

2018 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

MW100 8/17/2018 (1U) - Monitoring Well Identification, Date of Sample, and Sample Value (in µg/L)
1U = not detected at a reporting limit of 1 µg/L
J indicates detected at a value less than the reporting limit.

- Lower RGA Well
- Middle RGA Well
- Upper RGA Well
- Multizone RGA Well
- Active Extraction Well
- Inactive 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
- 229 Boundary
- PGDP Boundary
- Seep Monitoring Location

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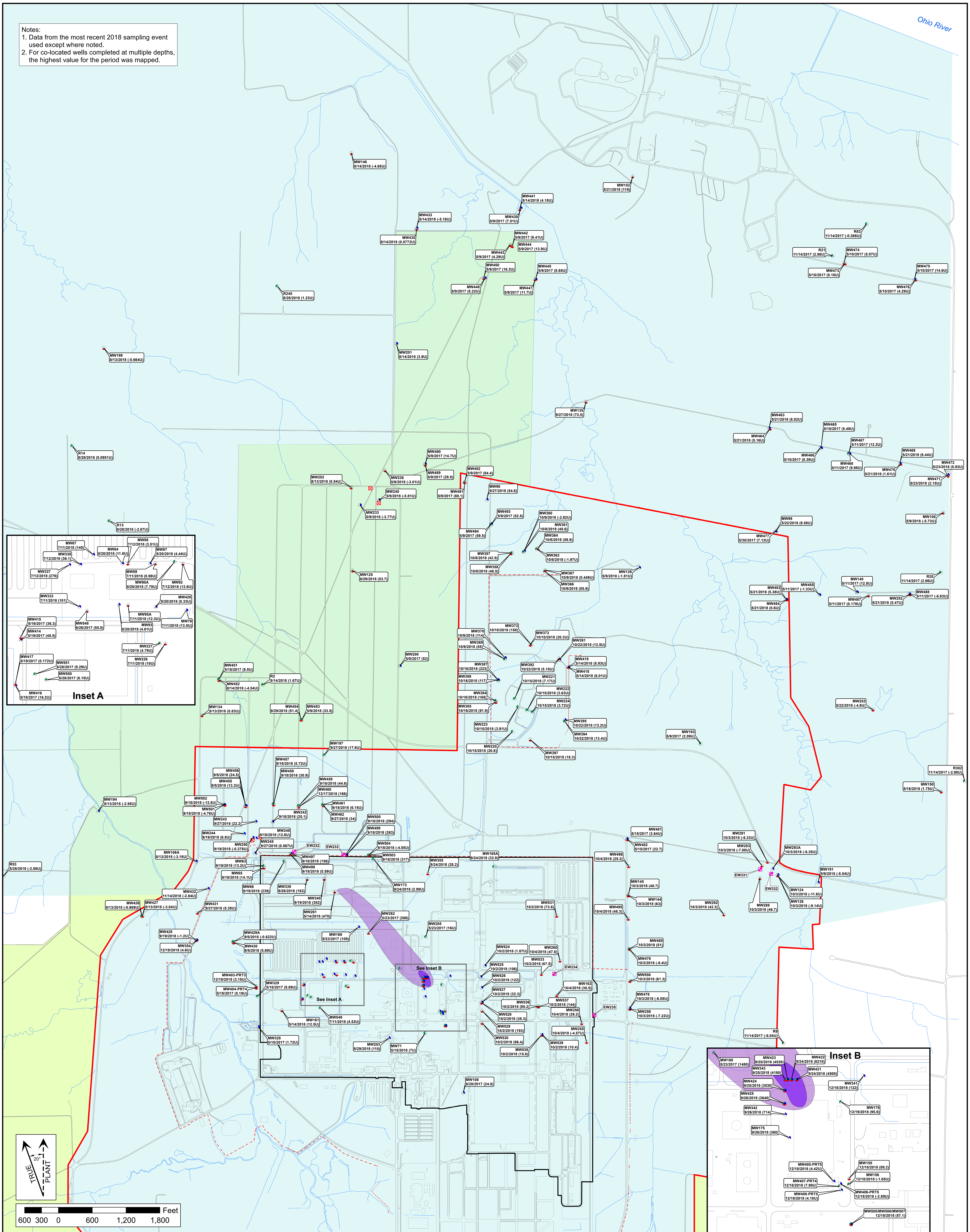
FOUR RIVERS NUCLEAR PARTNERSHIP, LLC

U.S. DEPARTMENT OF ENERGY
PORTSMOUTH / PADUCAH PROJECT OFFICE
PADUCAH GASEOUS DIFFUSION PLANT

Figure C.1. 2018 TCE Plume–Regional Gravel Aquifer

FILE NAME:	PROJECT #:	SCALE:	DATE:
Fig_C01_2018PlumesTCER1	EM	AS NOTED	5/28/2019



Notes:
1. Data from the most recent 2018 sampling event used except where noted.
2. For co-located wells completed at multiple depths, the highest value for the period was mapped.
Ohio River
MW146 8/14/2018 (-4.65U)
MW152 5/21/2018 (119)
MW441 8/14/2018 (4.18U)
MW439 5/9/2017 (7.51U)
MW433 8/14/2018 (-5.16U)
MW435 8/14/2018 (0.0772U)
MW442 5/9/2017 (9.41U)
MW444 5/9/2017 (13.9U)
MW443 5/9/2017 (4.29U)
MW450 5/9/2017 (16.3U)
MW445 5/9/2017 (8.65U)
MW448 5/9/2017 (8.22U)
MW447 5/9/2017 (11.7U)
R83 11/14/2017 (-0.386U)
R21 11/14/2017 (2.98U)
MW474 5/10/2017 (5.07U)
MW473 5/10/2017 (8.18U)
MW475 5/10/2017 (14.6U)
MW476 5/10/2017 (4.29U)
R245 8/28/2018 (1.23U)
MW199 8/13/2018 (-0.664U)
MW201 8/14/2018 (3.9U)
MW135 9/27/2018 (72.5)
MW463 5/21/2018 (8.02U)
MW464 5/21/2018 (5.16U)
MW465 5/10/2017 (5.49U)
MW466 5/10/2017 (8.39U)
MW467 5/11/2017 (12.2U)
MW468 5/11/2017 (9.98U)
MW469 5/21/2018 (8.44U)
MW470 5/21/2018 (1.61U)
MW472 5/23/2018 (5.93U)
MW471 5/23/2018 (2.15U)
R14 8/28/2018 (0.0951U)
MW490 5/9/2017 (14.7U)
MW489 5/9/2017 (28.8)
MW492 5/9/2017 (84.4)
MW491 5/9/2017 (88.1)
MW202 8/13/2018 (0.54U)
MW236 5/9/2018 (-3.01U)
MW240 5/9/2018 (-5.81U)
MW233 5/9/2018 (-3.77U)
MW98 9/27/2018 (54.6)
MW493 5/9/2017 (52.8)
MW360 10/9/2018 (-2.92U)
MW361 10/8/2018 (48.6)
MW364 10/8/2018 (56.9)
MW363 10/8/2018 (-1.97U)
MW494 5/9/2017 (59.5)
MW357 10/8/2018 (42.5)
MW358 10/8/2018 (46.5)
MW367 10/9/2018 (0.449U)
MW366 10/9/2018 (55.9)
MW139 5/9/2018 (-1.81U)
MW99 5/22/2018 (9.58U)
MW477 5/30/2017 (7.12U)
MW100 5/9/2018 (-5.73U)
R13 8/28/2018 (-2.67U)
MW125 8/29/2018 (53.7)
MW483 5/21/2018 (5.38U)
MW485 5/11/2017 (-1.33U)
MW484 5/21/2018 (0.6U)
MW148 5/11/2017 (12.8U)
MW487 5/11/2017 (0.178U)
R20 11/14/2017 (2.66U)
MW488 5/11/2017 (-6.83U)
MW252 5/21/2018 (5.47U)
MW67 7/11/2018 (140)
MW86 7/12/2018 (3.51U)
MW84 8/20/2018 (11.8U)
MW87 8/20/2018 (4.44U)
MW338 7/12/2018 (36.1)
MW337 7/12/2018 (276)
MW89 7/11/2018 (8.98U)
MW90A 8/20/2018 (7.78U)
MW92 7/12/2018 (12.6U)
MW333 7/11/2018 (101)
MW420 8/20/2018 (0.33U)
MW415 5/19/2017 (36.3)
MW548 6/26/2017 (55.8)
MW95A 7/11/2018 (12.3U)
MW93 8/20/2018 (4.61U)
MW76 7/11/2018 (13.5U)
MW414 5/19/2017 (48.5)
MW227 7/11/2018 (4.79U)
MW417 5/19/2017 (0.172U)
MW551 6/28/2017 (9.29U)
MW226 7/11/2018 (10U)
MW550 6/28/2017 (6.15U)
MW416 5/19/2017 (16.2U)
Inset A
MW372 10/10/2018 (158)
MW373 10/10/2018 (20.3U)
MW370 10/9/2018 (114)
MW369 10/9/2018 (55)
MW391 10/22/2018 (12.5U)
MW419 5/14/2018 (8.93U)
MW418 5/14/2018 (6.01U)
MW392 10/22/2018 (5.15U)
MW387 10/16/2018 (223)
MW388 10/16/2018 (117)
MW221 10/15/2018 (7.17U)
MW222 10/15/2018 (3.63U)
MW224 10/15/2018 (3.72U)
MW384 10/16/2018 (168)
MW385 10/16/2018 (91.9)
MW200 5/9/2017 (52)
MW451 5/18/2017 (9.5U)
R2 8/14/2018 (1.67U)
MW452 8/14/2018 (-4.54U)
MW134 8/13/2018 (0.83U)
MW454 8/29/2018 (51.4)
MW453 5/9/2018 (33.5)
MW253 5/22/2018 (-4.8U)
MW395 10/22/2018 (13.2U)
MW394 10/22/2018 (13.4U)
MW223 10/15/2018 (3.91U)
MW193 5/9/2017 (2.09U)
MW220 10/15/2018 (20.8)
MW397 10/15/2018 (18.3)
MW197 9/27/2018 (17.6U)
MW457 9/18/2018 (5.72U)
MW458 9/18/2018 (30.9)
MW456 9/5/2018 (24.5)
MW455 9/5/2018 (13.3U)
MW459 9/18/2018 (44.6)
MW460 12/17/2018 (166)
R302 11/14/2017 (-2.98U)
MW150 5/16/2018 (1.75U)
MW194 8/13/2018 (-2.95U)
MW502 9/18/2018 (-12.8U)
MW501 9/18/2018 (-4.76U)
MW461 9/18/2018 (6.15U)
MW242 9/18/2018 (25.1)
MW462 9/27/2018 (34)
MW243 9/27/2018 (22.2)
MW500 9/18/2018 (294)
MW499 9/18/2018 (263)
MW244 9/19/2018 (6.8U)
MW248 9/19/2018 (12.6U)
MW245 9/27/2018 (0.567U)
MW250 9/19/2018 (-0.378U)
EW232
EW233
MW504 9/18/2018 (-4.05U)
MW481 5/15/2017 (3.64U)
MW291 10/3/2018 (-6.33U)
MW482 5/15/2017 (22.7)
MW283 10/3/2018 (-7.88U)
MW293A 10/3/2018 (-6.35U)
MW106A 8/13/2018 (-3.18U)
MW497 9/18/2018 (156)
MW503 9/18/2018 (317)
MW165A 9/24/2018 (32.9)
MW355 9/24/2018 (28.2)
MW496 10/4/2018 (25.3)
R53 8/28/2018 (-2.09U)
MW63 9/19/2018 (13.2U)
MW498 9/18/2018 (5.59U)
EW331
EW332
MW191 5/9/2018 (-8.54U)
MW65 9/19/2018 (14.1U)
MW145 10/3/2018 (48.7)
MW66 9/19/2018 (239)
MW339 9/26/2018 (163)
MW173 9/24/2018 (2.99U)
MW124 10/3/2018 (-11.6U)
MW432 11/14/2018 (-2.84U)
MW340 9/19/2018 (382)
MW144 10/3/2018 (63)
MW126 10/3/2018 (-9.14U)
MW292 10/3/2018 (42.3)
MW288 10/3/2018 (46.7)
MW426 8/13/2018 (-0.989U)
MW427 8/13/2018 (-3.04U)
MW431 9/27/2018 (5.38U)
MW531 10/2/2018 (73.6)
MW495 10/4/2018 (48.3)
MW261 5/14/2018 (470)
MW262 5/23/2017 (266)
MW205 5/23/2017 (16U)
MW428 9/19/2018 (-1.2U)
MW429A 9/5/2018 (-0.622U)
MW169 5/23/2017 (109)
MW354 12/19/2018 (4.6U)
MW430 9/5/2018 (5.69U)
MW480 10/3/2018 (51)
MW524 10/2/2018 (1.87U)
MW260 10/4/2018 (47.8)
MW479 10/3/2018 (-8.4U)
MW525 10/2/2018 (106)
MW533 10/2/2018 (67.5)
EW234
See Inset B
MW403-PRT3 12/19/2018 (3.15U)
MW526 10/2/2018 (122)
MW556 10/3/2018 (61.3)
MW329 5/18/2017 (9.89U)
MW404-PRT4 5/18/2017 (5.19U)
See Inset A
MW527 10/2/2018 (32.3)
MW163 10/4/2018 (30.5)
MW537 10/2/2018 (144)
MW536 10/2/2018 (80.2)
MW478 10/3/2018 (-6.55U)
MW256 10/4/2018 (26.2)
EW235
MW258 10/3/2018 (-7.22U)
MW528 10/2/2018 (38.3)
MW161 5/14/2018 (12.5U)
MW549 7/11/2018 (4.53U)
MW529 10/2/2018 (193)
MW255 10/4/2018 (-4.57U)
R9 11/14/2017 (-6.04U)
MW530 10/2/2018 (96.4)
MW539 10/2/2018 (10.4)
MW328 5/18/2017 (1.72U)
MW538 10/2/2018 (15.6)
MW203 8/29/2018 (110)
MW71 5/15/2018 (7U)
MW108 6/28/2017 (24.8)
Inset B
MW168 5/23/2017 (1480)
MW423 9/25/2018 (4530)
MW422 9/24/2018 (6210)
MW343 9/25/2018 (4180)
MW421 9/24/2018 (4500)
MW424 9/25/2018 (3530)
MW341 12/18/2018 (122)
MW425 9/26/2018 (3640)
MW178 12/19/2018 (95.8)
MW342 9/26/2018 (714)
MW175 9/26/2018 (360)
MW405-PRT5 12/18/2018 (4.42U)
MW155 12/18/2018 (89.2)
MW156 12/18/2018 (-1.65U)
MW407-PRT4 12/18/2018 (7.99U)
MW406-PRT5 12/18/2018 (-2.89U)
MW408-PRT5 12/18/2018 (4.18U)
MW505/MW506/MW507 12/18/2018 (57.1)
TRUE
PLANT
20°
Feet
600 300 0 600 1,200 1,800

LEGEND

2018 Tc-99 Plume Concentration Fields
- 900 - 3,790 pCi/L
- ≥ 3,790 pCi/L

MW100 8/17/2018 (20U) - Monitoring Well Identification, Date of Sample, and Sample Value (in pCi/L)
"U" by the sample value indicates the value is reported < minimum detectable activity and/or total propagated uncertainty

- Lower RGA Well
- Middle RGA Well
- Upper RGA Well
- Multizone RGA Well
- Active Extraction Well
- Inactive Extraction Well

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

FOUR RIVERS NUCLEAR PARTNERSHIP, LLC

U.S. DEPARTMENT OF ENERGY
PORTSMOUTH / PADUCAH PROJECT OFFICE
PADUCAH GASEOUS DIFFUSION PLANT

Figure C.2. 2018 Tc-99 Plume–Regional Gravel Aquifer

FILE NAME:	PROJECT #:	SCALE:	DATE:
Fig_C02_2018PlumesTc99R1	EM	AS NOTED	5/28/2019