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August 29, 2023

Mr. David Ruckstuhl, Prime Contracts Manager
Four Rivers Nuclear Partnership, LLC
5511 Hobbs Road
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PPPO-02-10024130-23D

Dear Mr. Ruckstuhl:

DE-EM0004895: APPROVAL OF DELIVERABLE NO. 81, ERRATA SHEET AND COMPLETE CORRECTED DOCUMENT FOR TRICHLOROETHENE AND TECHNETIUM-99 GROUNDWATER CONTAMINATION IN THE REGIONAL GRAVEL AQUIFER FOR CALENDAR YEAR 2022

Reference: Letter from M. Redfield to M. Fultz, "Four Rivers Nuclear Partnership, LLC—For Approval—Deliverable No.81—Errata Sheet and Complete Corrected Document for *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2022 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FRNP-RPT-0273," (FRNP-23-7525), dated August 16, 2023

The U.S. Department of Energy (DOE) has reviewed the referenced document and has no further comments. DOE approves the document as submitted.

If you have any questions or require additional information, please contact Rich Bonczek at (859) 321-7127.

Sincerely,

MARCIA FULTZ
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ERRATA SHEET

Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2022 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, FRNP-RPT-0273, issued August 2023

The following three corrections should be incorporated into the document.

1. Cover Page: The cover was modified to indicate errata were issued for this report.

2. Title Page: The title page was modified to indicate errata were issued for this report on the date specified.

3. Figure 5 has been updated.

FRNP-RPT-0273 Errata

Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2022 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

FOUR RIVERS NUCLEAR PARTNERSHIP, LLC

This document is approved for public release per review by:

FRNP Classification Support _____ Date _____

FRNP-RPT-0273 Errata

Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2022 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—June 2023

Errata Issued—August 2023

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

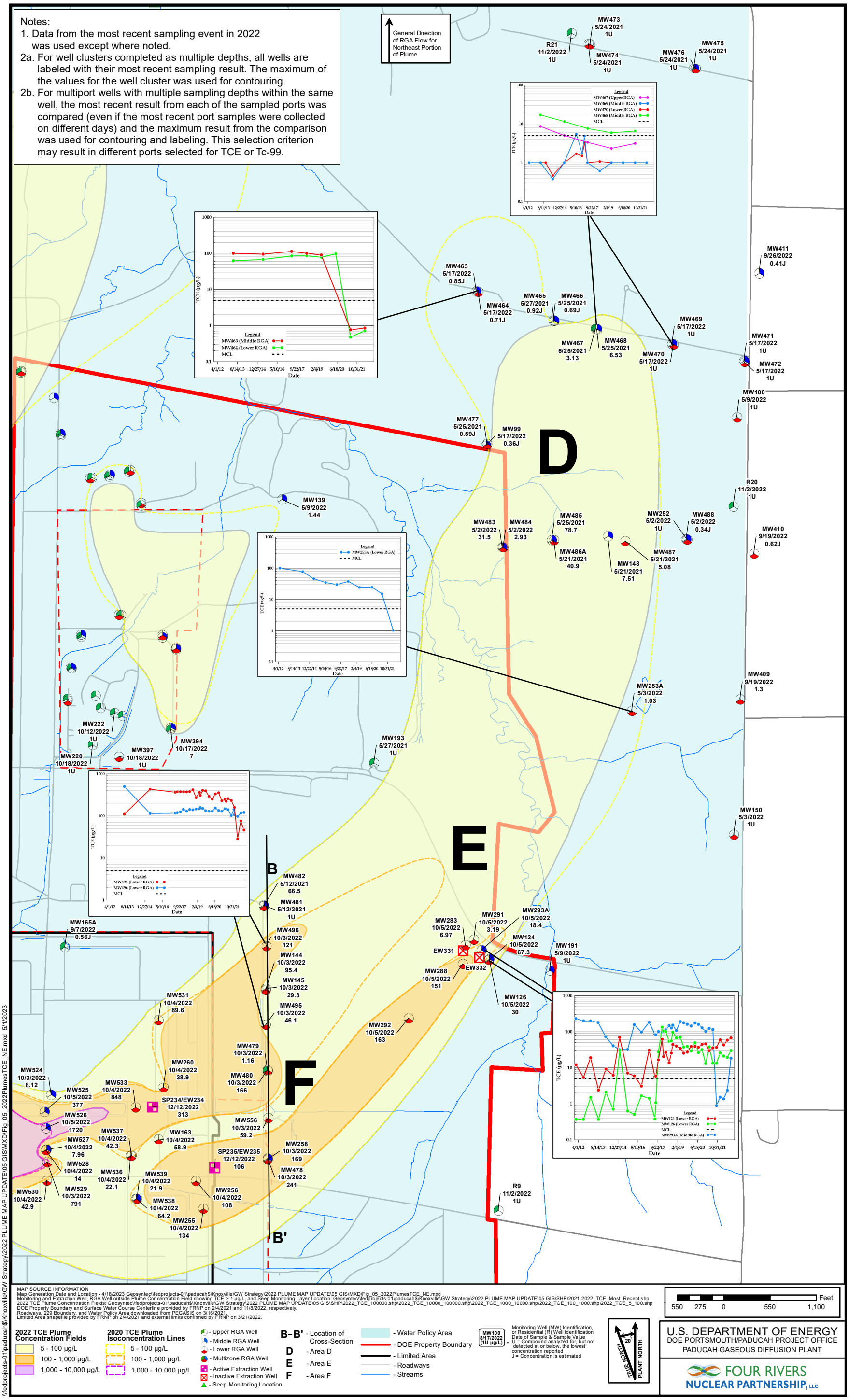

Figure 5. 2022 Northeast Portion of the TCE Plume Regional Gravel Aquifer

FRNP-RPT-0273 Errata

Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2022 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

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FRNP-RPT-0273 Errata

Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2022 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

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ACRONYMS

AIP	agreement in principle
amsl	above mean sea level
CSM	conceptual site model
CY	calendar year
DOE	U.S. Department of Energy
EMP	environmental monitoring plan
EPA	U.S. Environmental Protection Agency
EW	extraction well
FR	*Federal Register*
FRNP	Four Rivers Nuclear Partnership, LLC
KDEP	Kentucky Department for Environmental Protection
MCL	maximum contaminant level
MW	monitoring well
N/A	not applicable
NEPCS	Northeast Plume Containment System
OREIS	Oak Ridge Environmental Information System
OU	operable unit
PEGASIS	Portsmouth/Paducah Project Office Environmental Geographic Analytical Spatial Information System
PGDP	Paducah Gaseous Diffusion Plant
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 (CY) 2022 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 (DOE) 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 CY 2022. For wells that were not sampled in 2022, the most recent sample result from 2021 has been used. Because these plume maps are based on the most recent values for 2022 or 2021, 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 2021 to 2022 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) within the plumes.[1] These maps show plots of isoconcentration lines and measured contaminant concentrations. Maps of TCE degradation products are not included because their detection often is masked by higher TCE concentrations in groundwater samples and the plumes of TCE degradation products are overlain by the TCE plumes. In the 2021–2022 dataset, no TCE degradation product was detected at a concentration above its MCL outside the area overlain by the TCE plumes. Any calculation of human health risk estimates based upon mapped contaminant concentrations should be performed by a qualified risk assessor because of the uncertainties in the concentrations of TCE breakdown products, some of which are unknown due to the inability to measure these concentrations in areas where TCE concentrations are very high.

The PGDP groundwater plume maps are revised every two years to: (i) provide a basis for timely incorporation of routine groundwater monitoring and characterization data, (ii) demonstrate the progress of groundwater cleanup to date, and (iii) facilitate planning to optimize the site groundwater cleanup. The plume maps also complement the reporting of environmental monitoring plan (EMP) results 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 DOE Environmental Information Center (i.e., https://eic.pad.pppo.gov).

The 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. TCE and Tc-99 analyses of groundwater samples collected by DOE that were rejected during data validation, verification, or

[1] For Tc-99, 900 pCi/L defines the lower plume limit. The value derived by the U.S. Environmental Protection Agency (EPA) from the 4 mrem/year MCL for Tc-99 is 900 pCi/L (see https://www.epa.gov/system/files/documents/2021-08/compliance-radionuclidesindw.pdf). An alternate value derived by the EPA from the 4 mrem/year MCL is 3,790 pCi/L and was proposed in the July 18, 1991, *Federal Register (FR)*, http://nepis.epa.gov (document number 570-Z-91-049). Table A.9 of the *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plan, Paducah, Kentucky, Volume 1, Human Health* includes the Tc-99 dose-based groundwater screening levels resulting in a 4 mrem/year dose based upon more recent dosimetry (DOE 2022).

assessment were not used in development of this report. These analyses are generated following the quality assurance project plan in the applicable EMP (FRNP 2020, FRNP 2021a). Appendix A contains tables and trend charts of TCE and Tc-99 sampling results collected for the last 10 years and plume maps showing the maximum values observed during 2021 and 2022. Appendix B contains the most recent TCE and Tc-99 values from 2021 and 2022 from PGDP RGA monitoring wells (MWs). These concentrations were used to develop Figure 1 through Figure 10 as well as the large-scale maps of the 2022 plume maps showing most recent concentrations in 2021 and 2022 provided in Appendix C.

The isoconcentration contours of contaminant concentrations depicted on the maps presented in Section 4 and the large scale plume maps in Appendix C are based on the distribution of contaminant concentrations most recently observed in 2021 and 2022 and knowledge of the site conceptual model. 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 (AIP) grant. AIP data are used semiquantitatively in the preparation of the report. In general, the MW and residential well sampling conducted under the AIP program has produced results that are similar to those obtained by DOE. For the reporting period, the AIP program sampled ten MWs for TCE and four seeps and six MWs for Tc-99 that were not sampled by DOE. The AIP data from 2021–2022 are generally consistent with results from samples collected by DOE from nearby MWs; therefore, no adjustment has been made to the interpretation of the plumes based on the AIP data. To support interpretation of plume geometries, potentiometric surface maps for the RGA were developed using synoptic water level measurements collected in August 2021 and August 2022 to evaluate groundwater flow direction. These potentiometric maps are presented in Section 5.

2. DATA ANALYSIS METHODOLOGY

The TCE and Tc-99 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 (i.e., measurements, geographic) for Paducah projects. See Table B.1 in Appendix B for the 2021 to 2022 TCE and Tc-99 results in RGA wells used to create the 2022 TCE and Tc-99 plume maps. Data collected by DOE contractors, following consistent quality assurance and sampling protocols, are used so that the data are comparable to previous reports. Data are made available to the public through the DOE Portsmouth/Paducah Project Office Environmental Geographic Analytical Spatial Information System (PEGASIS) (i.e., https://pegasis.pad.pppo.gov/). The maps for CY 2022 are based on analytical results from the most recent sampling event (primarily January 2022–December 2022). For co-located MWs (i.e., clustered wells, multiport wells), where analytical results for the CY are available from screened intervals at multiple elevations within the RGA (e.g., upper, middle, and/or lower RGA), these data are displayed and used for contouring as follows:

- For well clusters completed at multiple depths, all wells are labeled with their most recent sampling result. The maximum values for the well clusters were used for contouring.

- For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days) and the maximum result from the comparison was used for contouring and labeling. This selection criterion may result in different ports selected for TCE or Tc-99.

For wells that were not sampled in 2022, the most recent data from 2021 were used.

Mapping involved first plotting the selected data on Geographic Information System (ArcGIS)-generated maps and then comparing those data to the contouring performed for the 2020 TCE and Tc-99 plume maps. Plume contours were adjusted to accommodate more recent data. The impact of the changes from 2020 to 2022 is discussed in Section 4. On the 2022 plume maps shown in Section 4 of the main text, dashed lines show the contour lines from the 2020 plume maps for comparison.

For TCE, the Safe Drinking Water Act MCL of 5 micrograms per liter (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 and consideration of the conceptual site model (CSM). For Tc-99, 900 picocuries per liter (pCi/L) defines the plume limit.[2] Subsequent isoconcentration contours of 1,930 pCi/L and 3,790 pCi/L are provided based on concentration data for the period and consideration of the CSM.

3. 2022 PLUME MAPS

As identified in the "Screened Zone" column of Appendix B, Well Program Inventory, in the 2022 EMP, there are 235 active wells including MWs, piezometers, and 34 residential wells that can be used to monitor the RGA (FRNP 2021a). The dataset considered in this document also includes results for Little Bayou Creek Seep 5 and the four operating extraction wells (EWs). The PGDP deactivation and remediation prime contractor monitored a subset of this well network in 2021 and 2022, as discussed below, in accordance with the associated EMPs (FRNP 2020, FRNP 2021a).

Figures C.1 and C.2 of Appendix C provide the 2022 TCE and Tc-99 plume maps, respectively. Section 4 includes an explanation for the interpretation of these maps. Table 1 presents a summary of some characteristics of these plumes in areas outside the PGDP boundary and off DOE property.[3] Because these plumes are based on interpretation, plume lengths outside the DOE property and plume areas are approximate.

[2] For Tc-99, 900 pCi/L defines the lower plume limit. The value derived by the EPA from the 4 mrem/year MCL for Tc-99 is 900 pCi/L (see https://www.epa.gov/system/files/documents/2021-08/compliance-radionuclidesindw.pdf). An alternate value derived by the EPA from the 4 mrem/year MCL is 3,790 pCi/L and was proposed in the July 18, 1991, *FR*, http://nepis.epa.gov (document number 570-Z-91-049). Table A.9 of the *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plan, Paducah, Kentucky, Volume 1. Human Health* includes the Tc-99 dose-based groundwater screening levels resulting in a 4 mrem/year dose based upon more recent dosimetry (DOE 2022).

[3] For purposes of this report, the "PGDP boundary" is defined as the revised 229 Boundary per *FR* notices, Vol. 83, No. 213, dated November 2, 2018.

Table 1. PGDP Groundwater Plumes, CY 2022

Plume	Approximate Maximum Contaminant Concentrations Outside PGDP Boundary	Approximate Maximum Contaminant Concentrations Off DOE Property	Off DOE Property Plume Length	Approximate Total Area[a]
		TCE		
Northwest	1,290 µg/L	42.5 µg/L	1.8 miles	456 acres
C-746-S&T area	27.5 µg/L	not applicable (N/A)	N/A[b]	67 acres
Northeast	241 µg/L	75.2 µg/L	1.5 miles	751 acres
Southwest	5.42 µg/L	< 5 µg/L	N/A	86 acres
		Tc-99		
Northwest	< 900 pCi/L	< 900 pCi/L	N/A	25 acres

[a] The approximate total areas are the areas of the respective plumes inside and outside the PGDP boundary and off DOE property.
[b] The C-746-S&T plume does not leave DOE property as currently interpreted.

3.1 TRICHLOROETHENE

During the reporting period of 2021 to 2022, 241 RGA MWs, 4 EWs, and 36 residential wells were sampled by DOE, analyzed for TCE, and included in the development of the revised groundwater TCE plume map.[4] Of the 241 RGA MWs included in the development of the TCE plume map, 202 were sampled most recently in 2022. The four EWs also were sampled in 2022. Of the residential wells used for monitoring the RGA, 26 residential wells were sampled in 2022 for TCE, and the results were included in the development of the TCE plume map. The sample collection was based on the applicable EMP, which summarizes the compliance sampling and sampling by other regulatory programs conducted at the site (FRNP 2020, FRNP 2021a). These results are supplemented by 49 RGA MWs and residential wells sampled and analyzed for TCE in 2021, but were not sampled in 2022. A summary of the approximate maximum concentrations of TCE outside the PGDP boundary and 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 2022 plume maps.

Appendix C contains the 2022 TCE plume map (Figure C.1). Generally, the plume interpretation is based on the following:

- In 2021 and 2022, 1,828 groundwater samples were collected by DOE from RGA MWs, EWs, and residential wells and analyzed for TCE.

- TCE results from 2021 to 2022 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 2022, the sample result is posted.

  — If the well was sampled multiple times, the most recent result was posted. If the most recent data are from duplicate samples or include more than one sample per day, then the result was selected using the following:

[4] Of these RGA MWs, some have multiple sampling ports.

  - If there was a detection in both samples, the higher concentration was selected;
  - If there was a detection in one sample but not the other, the detected concentration was selected; or
  - If there was not a detection in either sample, the lowest reported value was selected.

- For well clusters completed at multiple depths, all wells are labeled with their most recent sampling result. The maximum of the values for the well cluster was used for contouring.
- For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days), and the maximum result from the comparison was used for contouring and labeling. This selection criterion may result in different ports selected for TCE or Tc-99.

- The results are posted as reported by the laboratory, with "UJ," "U," and "J" laboratory, assessment, or validation qualifiers, if applicable.[5]
- Groundwater EW locations are labeled on the map, and the concentrations from the EWs are posted.
- For some wells that were not sampled in 2022 but sampled in 2021, TCE results from 2021 were used to develop the plume map using the same rules as for the 2022 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.
- Residential wells R10 and R40 located along Ogden Landing Road were sampled in 2021 and 2022. The TCE results from these wells were below 5 µg/L. Because these wells are located outside the extentof the map, the results from these wells are not shown on the plume maps. TCE concentrations are provided in Appendix A.

3.2 TECHNETIUM-99

During the reporting period of 2021 to 2022, 209 RGA MWs, 4 EWs, and 10 residential wells were sampled by DOE, analyzed for Tc-99, and included in the development of the revised groundwater Tc-99 plume map.[6] Of the 209 RGA MWs included in the development of the Tc-99 plume map, 177 were sampled most recently in 2022. The four EWs were sampled in 2022 for Tc-99. Of the residential wells used for monitoring the RGA, 10 residential wells were sampled in 2022 for Tc-99 and the results were included in the development of the Tc-99 plume map. The sample collection was based on the applicable EMP, which

[5] For presentation of data in figures and tables included herein, any qualifier (i.e., laboratory, assessment, validation) that contains both "U" and "J" is simplified as "UJ," any qualifier that contains "U" is simplified as "U," and any qualifier that contains "J" is simplified as "J." A "U" qualifier indicates a compound was analyzed for, but not detected at or below, the lowest concentration reported. A "J" qualifier indicates an estimated value. Full details on qualifiers for posted results are available in PEGASIS.
[6] Of these RGA MWs, some have multiple sampling ports.

summarizes the compliance sampling and sampling by regulatory programs being conducted at the site (FRNP 2020, FRNP 2021a). These results are supplemented by 32 RGA MWs sampled and analyzed for Tc-99 in 2021, but were not sampled in 2022. Tc-99 was not detected above 900 pCi/L outside the PGDP boundary in either 2021 or 2022. The highest Tc-99 concentration in RGA wells outside the PGDP boundary was 451 pCi/L at EW233. Appendix B lists the most recent sample data that were used to develop the 2022 plume maps.

Appendix C contains the 2022 Tc-99 plume map (i.e., Figure C.2). Generally, the plume interpretation is based upon the following:

- A total of 1,669 groundwater samples was collected by DOE from RGA MWs and residential wells and analyzed for Tc-99 from 2021 to 2022.

- Tc-99 results from 2022 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.[7]

- For some wells that were not sampled in 2022, but were sampled in 2021, the Tc-99 results from 2021 used to develop the plume map were selected using the same rules as for the 2022 Tc-99 results. These results and the date sampled are posted on the map.

- The contour intervals selected were 900 pCi/L, 1,930 pCi/L, and 3,790 pCi/L.[8] The interval selection is based on EPA's 1976 and 1991 derived MCL activities of 900 pCi/L and 3,790 pCi/L, respectively, and the dose-based groundwater screening level of 1,930 pCi/L (DOE 2022). 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 2020 PLUME MAPS

PGDP groundwater plume maps for 2016 to 2022 are presented in Figures 1 and 2 for TCE and Tc-99, respectively. The previous comprehensive plume maps summarized the TCE and Tc-99 data collected through 2020 (FRNP 2021b). In an effort to understand the changes in the plume areas and contaminant concentrations at PGDP, FRNP compared the 2022 maps with the 2020 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 2022 TCE plume overlaid with the 2020 plume isoconcentration lines. Similarly, a figure showing the 2022 Tc-99 Plume overlaid with the

[7] For presentation of data in figures and tables included herein, any qualifier (i.e., laboratory, assessment, validation) "U" is simplified as "U." 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.

[8] For Tc-99, 900 pCi/L defines the lower plume limit. The value derived by the EPA from the 4 mrem/year MCL for Tc-99 is 900 pCi/L (see https://www.epa.gov/system/files/documents/2021-08/compliance-radionuclidesindw.pdf). An alternate value derived by the EPA from the 4 mrem/year MCL is 3,790 pCi/L and was proposed in the July 18, 1991, *FR* [http://nepis.epa.gov (document number 570-Z-91-049)]. Table A.9 of the *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plan, Paducah, Kentucky, Volume 1. Human Health* includes the Tc-99 dose-based groundwater screening levels resulting in a 4 mrem/year dose based upon more recent dosimetry (DOE 2022).

2020 plume isoconcentration lines is also included in this report. 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 2020 and 2022 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: the northern distal margin (Area A), the area in the vicinity of EWs of the Northwest Plume Pump-and-Treat System (Area B), and the vicinity of the C-746-S&T landfills (Area C). In addition, Figure 3 includes temporal TCE concentration plots for selected wells illustrating the observations made in this subsection.

Figure 1. TCE Plumes as Interpreted for 2016, 2018, 2020, and 2022

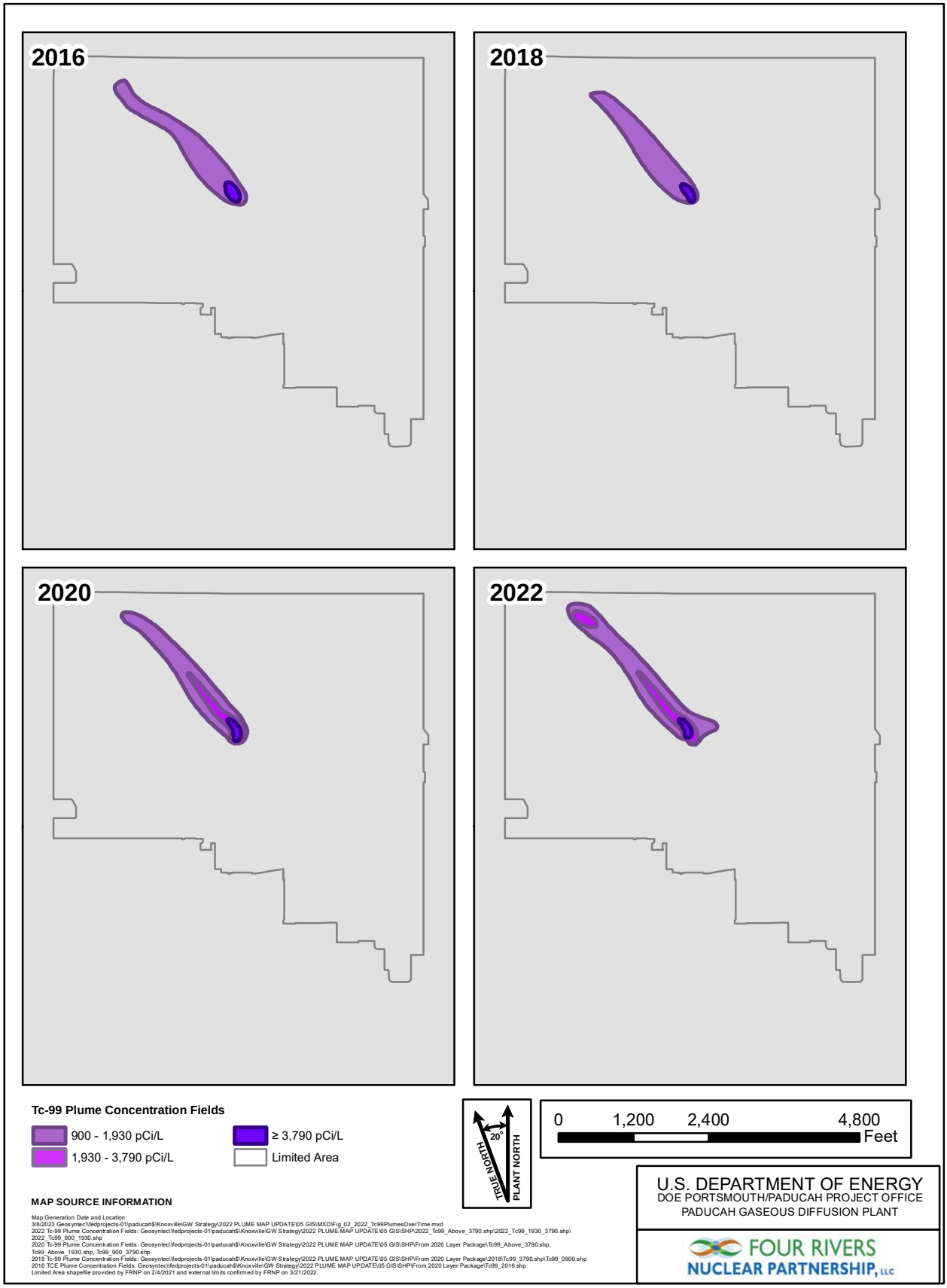

Figure 2. Tc-99 Plumes as Interpreted for 2016, 2018, 2020, and 2022

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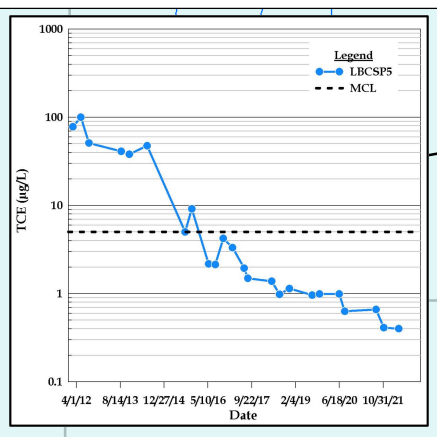
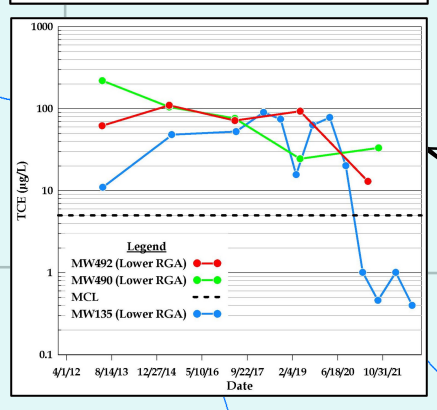
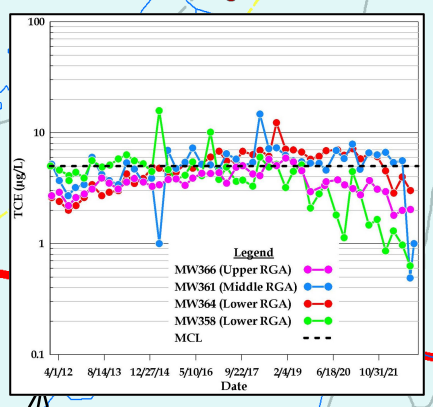
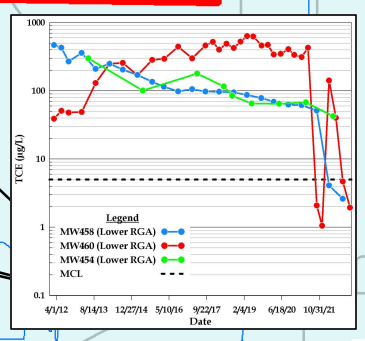
Notes:
1. Data from the most recent sampling event in 2022 was used except where noted.
2a. For well clusters completed as multiple depths, all wells are labeled with their most recent sampling result. The maximum of the values for the well cluster was used for contouring.
2b. For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days) and the maximum result from the comparison was used for contouring and labeling. This selection criterion may result in different ports selected for TCE or Tc-99.

General Direction of RGA Flow for Northwest Portion of Plume









MW441 11/1/2022 1.39
MW439 5/20/2021 0.88J
MW433 11/1/2022 1U
MW435 11/1/2022 0.96J
MW444 5/21/2021 1.03
MW443 5/21/2021 0.91J
LBCSP5 4/28/2022 0.4J
MW442 5/21/2021 2.52
MW450 5/21/2021 7.73
MW448 5/21/2021 1.33
MW447 5/20/2021 0.67J
MW445 5/20/2021 0.65J
MW201 11/1/2022 0.84J
A
MW135 9/21/2022 0.4J
MW489 9/15/2021 41.8
MW236 5/2/2022 4.53
MW490 9/15/2021 33.3
MW491 5/20/2021 6.38
MW202 11/1/2022 1U
MW240 5/2/2022 1.69
EW228
EW229
MW492 5/20/2021 13
MW98 9/20/2022 1.27
MW494 5/27/2021 1.22J
MW493 5/27/2021 1.05J
MW125 5/2/2022 24.4
MW358 10/6/2022 0.63J
MW363 10/10/2022 1U
MW357 10/6/2022 2.84
MW364 10/10/2022 3.01
MW360 10/6/2022 0.61J
MW361 11/17/2022 1U
MW366 10/10/2022 2.03
MW367 10/10/2022 1U
MW139 5/9/2022 1.44
MW372 10/11/2022 2.78
MW370 10/11/2022 1.68
MW369 10/11/2022 1.02
MW373 10/11/2022 4.13
MW391 10/17/2022 3.44
MW388 10/13/2022 1U
MW387 10/13/2022 0.63J
MW392 10/17/2022 12.2
MW418 5/9/2022 6.53
MW419 5/9/2022 27.5
MW200 5/24/2021 1.04
MW452 11/1/2022 1U
MW451 5/24/2021 0.37J
R2 11/2/2022 3.98
MW385 10/13/2022 1U
MW384 10/13/2022 0.53J
MW223 10/12/2022 1U
MW221 10/12/2022 1U
MW222 10/12/2022 1U
MW224 10/18/2022 1U
MW395 10/17/2022 5.62
MW394 10/17/2022 7
MW220 10/18/2022 1U
MW397 10/18/2022 1U
C
MW134 11/1/2022 1U
MW454 5/2/2022 42.5
MW453 5/2/2022 28.9
MW197 9/20/2022 32.5
B
MW456 12/13/2022 8.56
MW458 9/7/2022 2.62
MW459 9/8/2022 3.75
MW502 9/8/2022 1.94
MW501 9/8/2022 1U
MW455 12/13/2022 1.61
MW457 9/7/2022 1.37
MW460 12/13/2022 1.94
MW461 9/7/2022 14.9
MW462 9/7/2022 31.8
A
A'
MW243 9/7/2022 15.4
MW244 9/7/2022 2.14
MW248 9/7/2022 1.94
MW242 9/7/2022 3.44
MW250 9/7/2022 2.52
EW230
EW231
MW106A 11/1/2022 3.42
MW498 9/6/2022 658
HV217/EW232 10/4/2022 388
MW497 9/6/2022 88.7
MW500 9/6/2022 477
MW504 9/6/2022 2.02
MW173 9/8/2022 1U
HV222/EW233 10/4/2022 1290
MW499 9/6/2022 638
MW503 9/6/2022 11
MW245 9/7/2022 2.91
MW63 9/6/2022 13.6
MW66 9/19/2022 314
MW65 9/6/2022 7.35
MW339 12/12/2022 667
MW340 12/12/2022 3650
MW261 5/10/2022 2070
MW355 9/6/2022 7.01
MW165A 9/7/2022 0.56J
MW482 5/12/2021 66.5
MW481 5/12/2021 1U
MW496 10/3/2022 121
MW144 10/3/2022 95.4
MW145 10/3/2022 29.3
MW432 11/1/2022 1.45

MAP SOURCE INFORMATION
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Monitoring and Extraction Well, RGA Well outside Plume Concentration Field showing TCE > 1 µg/L, and Seep Monitoring Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100000.shp\2022_TCE_10000_100000.shp\2022_TCE_1000_10000.shp\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.

2022 TCE Plume Concentration Fields
- 5 - 100 µg/L
- 100 - 1,000 µg/L
- 1,000 - 10,000 µg/L

2020 TCE Plume Isoconcentration Lines
- 5 - 100 µg/L
- 100 - 1,000 µg/L
- 1,000 - 10,000 µg/L

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

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

- Water Policy Area
- DOE Property Boundary
- Limited Area
- Roadways
- Streams

MW100 8/17/2022 (1U µg/L) - Monitoring Well (MW) Identification, or Residential (R) Well Identification
Date of Sample & Sample Value
U = Compound analyzed for, but not detected at or below, the lowest concentration reported
J = Concentration is estimated

TRUE NORTH 20° PLANT NORTH

Feet
500 250 0 500 1,000

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\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_03_2022PlumesTCE_NW.mxd 5/1/2023

Figure 3. 2022 Northwest Portion of the TCE Plume Regional Gravel Aquifer

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Area A

- The northern extent of the 5 µg/L TCE isoconcentration contour continues to be defined by well cluster MW445/MW447, in which TCE was not detected above 5 µg/L during this reporting period. TCE analyses for MW439/MW441, the most downgradient wells, were 1.39 µg/L in the February 2021 sampling event and 1.39 µg/L in the November 2022 sampling event at MW441. The May 2021 TCE concentration in MW439 was lower than the TCE concentrations in MW441 during the reporting period.

- Also of note is the seep that is sampled in Little Bayou Creek. LBCSP5 has declined from 47.5 µg/L of TCE in June 2014 to 0.4 J µg/L in its most recent sampling event in April 2022. The plume contours have not been defined based on seep data because they are not as repeatable as MW data; however, the declining TCE trend at the seeps support shrinking the plume length.

- TCE concentrations in MW135 declined from 20.2 µg/L in September 2020 (the last TCE result for MW135 above 5 µg/L) to below 5 µg/L during the four monitoring events in 2021 and 2022. As such, the northeastern boundary of the Northwest Plume was adjusted based on these results for MW135.

- TCE concentrations in MW491 declined from the maximum TCE concentration of 85.9 µg/L in May 2019 to 6.38 µg/L in May 2021. Similarly, TCE concentrations in MW492 declined from 93.2 µg/L in May 2019 to 13 µg/L in May 2021.

- MW236 and MW240, which are along the western boundary of the Northwest Plume, have remained below 5 µg/L during this reporting period.

Area B

In August 2010, EW232 and EW233 began operations. Because EW232 and EW233 are located slightly upgradient and crossgradient of the former 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 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 EW 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. Based on the most recent result from each of these wells, TCE concentrations varied from nondetect at 1 µg/L to 31.8 µg/L along this transect.

- The western boundary of the Northwest Plume was adjusted to the northwest of the EW field as TCE concentrations in MW457 and MW458 declined to below 5 µg/L during the March 2022 and September 2022 monitoring events. Similarly, TCE concentrations in MW459 declined to below 5 µg/L during the September 2022 monitoring event. TCE concentrations in MW460 also declined to below 5 µg/L during the September 2022 event and remained below the 5 µg/L in December 2022. TCE concentrations in MW456 have been fluctuating above and below the 5 µg/L during the monitoring period and the most recent sampling result in December 2022 of 8.56 µg/L was above the 5 µg/L; therefore, the TCE plume was drawn to include MW456.

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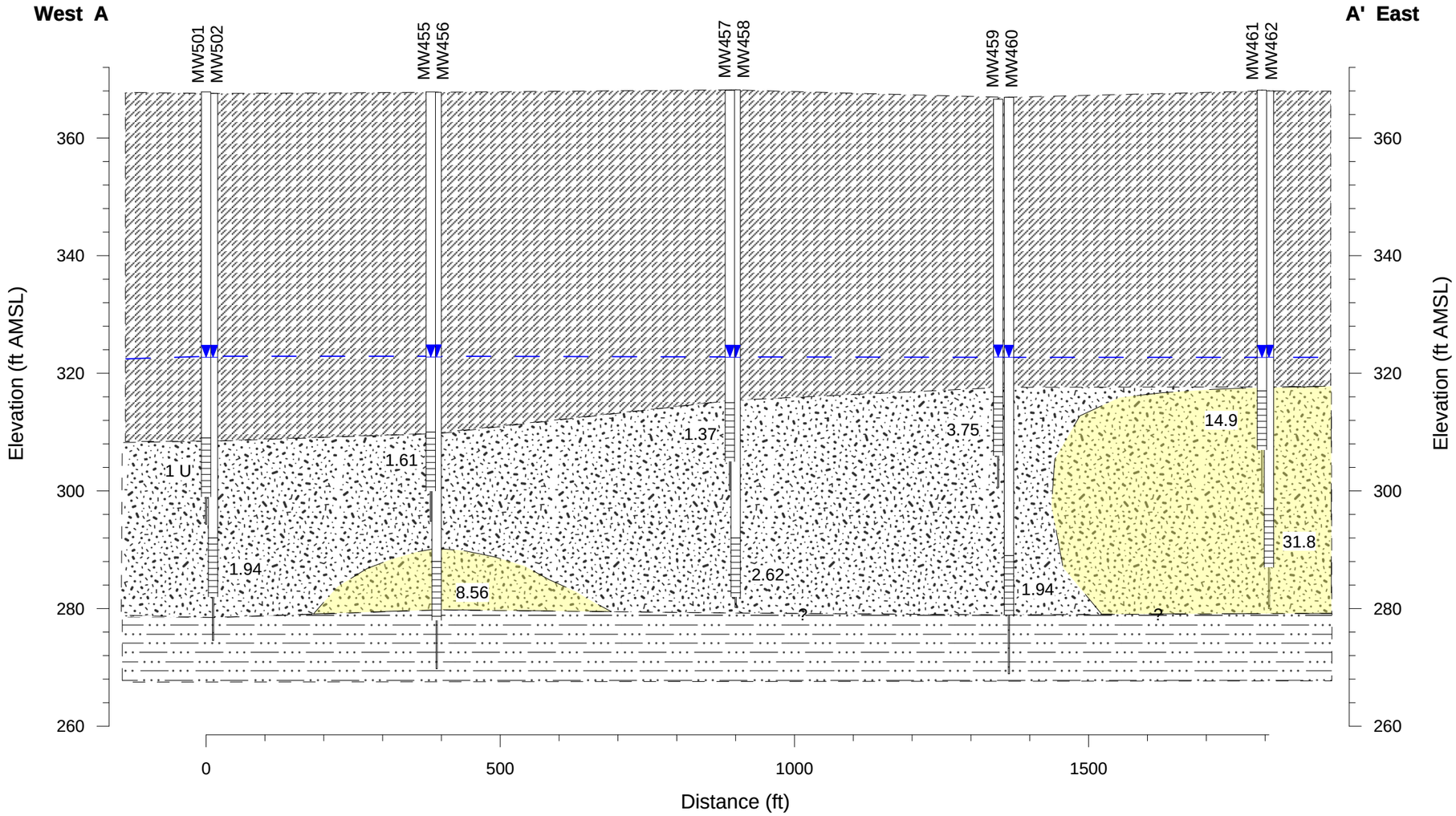

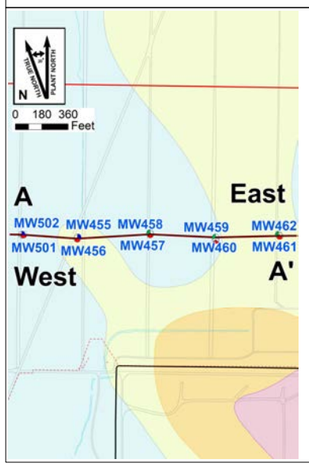

Legend

- Upper RGA Well
- Middle RGA Well
- Lower RGA Well
- Hydrogeologic Cross-Section Line
- DOE Property Boundary
- Surface Water Course Centerline
- Roadways
- 229 Boundary
- Limited Area
- Water Policy Area

2022 TCE Plume Concentration Fields

- 5 - 100 µg/L
- 100 - 1,000 µg/L
- 1,000 - 10,000 µg/L

2022 TCE Plume Concentration Fields
5 - 100 µg/L

Hydrogeologic Unit
UCRS RGA McNairy

Monitoring Well Location
- Casing
- Water Level (November 2022)
- Screen Interval
- Most recent TCE concentration (in µg/L)
- Boring

- November 2022 Potentiometric Surface

Vertical Exaggeration = 10X.
U = Compound analyzed for but not detected at or below the lowest concentration reported.
For monitoring wells not sampled in calendar year 2022, results from the 2021 monitoring have been used.

TCE Plume Regional Gravel Aquifer Cross Section A-A'

MAP SOURCE INFORMATION

Map Generation Date and Location - 03/22/2023; Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater
Map Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater\Figure 4. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section A-A'.sdg
Shapefile for Geologic Cross-Sections: \\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\Cross_Section_Lines.shp
Monitoring Well Layer Location: Geosyntec\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.
Northing and easting of wells obtained from Pegasis, downloaded on 6/14/2022.
Groundwater elevation was based on the 11/14/2022 - 11/16/2022 measurements.
Hydrogeologic boundary and screen intervals are approximate, and were based on boring logs obtained from Pegasis, downloaded on 1/31/2023. Subsurface lithologic elevations between borings were interpreted based on available information and should be considered approximate.
Trichloroethene concentration data was provided by FRNP.

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Figure 4. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section A-A'

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- 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 470 µg/L in 2012 to 2.62 µg/L in the most recent sampling in September 2022) to well MW462 (a lower RGA well, which recorded its highest TCE concentration during the monitoring period in November 2021 at 33.7 µg/L).

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 C-764-U landfills.

The most recent TCE concentrations in MW361 and MW364 were below 5 µg/L. Consequently, the 5 µg/L contour delineating the north boundary of the plume was retracted southward. MW139, located at the northeastern end of this plume, remained below 5 µg/L during the monitoring period and the northeastern extent of the plume was moved closer to the landfills. Along the western edge of the plume, TCE concentrations in MW372 have remained below 5 µg/L during the current reporting period. TCE concentrations in MW373 were slightly greater than 5 µg/L during April 2021 (5.74 µg/L), October 2021 (5.91 µg/L), January 2022 (5.37 µg/L), and April 2022 (5.06 µg/L); however, results have remained below 5 µg/L during the two most recent sampling events in July 2022 (4.84 µg/L) and October 2022 (4.13 µg/L). TCE concentrations in MW394/MW395, located at the southern end of this plume, increased to slightly above 5 µg/L during the most recent sampling event; therefore, the 5 µg/L contour delineating the plume extent in this area has been extended to the south.

4.2 NORTHEAST PLUME

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

Area D

Wells MW463 through MW476 provide definition of the northern extent of the 5 µg/L TCE isoconcentration contour. The interpreted distal extent is south of well cluster MW465 and MW466 and slightly north of well cluster MW467 and MW468. In 2021 and 2022, TCE concentrations in MW463/MW464 declined to below 5 µg/L (and also below the laboratory detection limit of 1 µg/L). Consequently, the contour defining the northwestern extent of the 5 µg/L TCE isoconcentration contour from 2020 was retracted. Well cluster MW469/MW470, with the most recent groundwater TCE concentrations below 5 µg/L (and also below the laboratory detection limit of 1 µg/L), defines the eastern edge of the plume. MW467 and MW468 define the northern extent of the plume. MW468, screened in the middle RGA, is the northernmost well within the plume. MW467, in the upper RGA, has been below 5 µg/L since May 2017.

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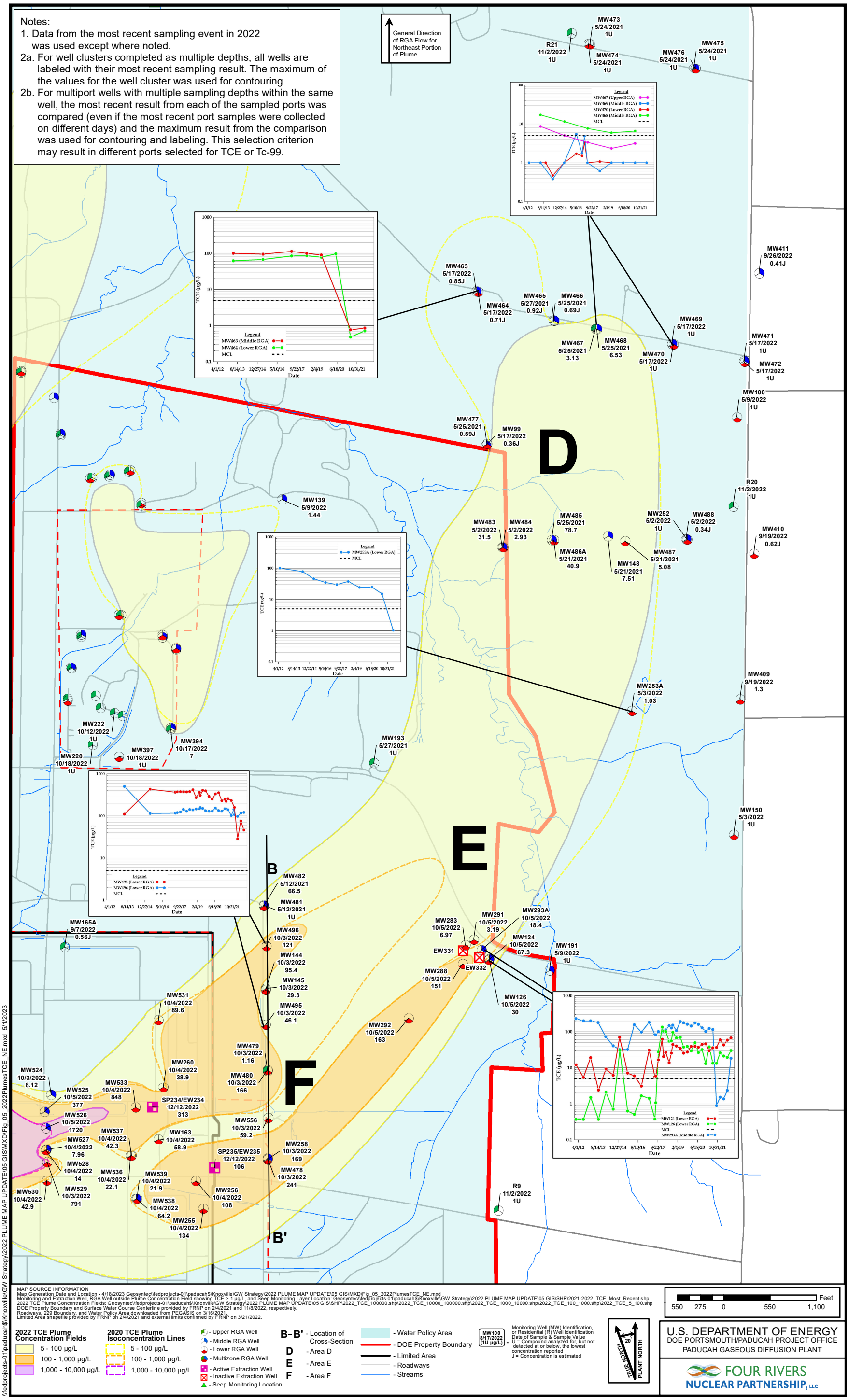

Figure 5. 2022 Northeast Portion of the TCE Plume Regional Gravel Aquifer

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Area E

- With cessation of pumping in EW331 and EW332 as part of the Northeast Plume Optimization project, the western lobe of greater than 100 µg/L TCE has contracted to near the PGDP boundary.[9]

- Results of the 2022 monitoring continue to show an overall decline in TCE concentrations since 2012 at MW253 and its replacement well MW253A, which are located north of the old EWs that currently are in standby. The TCE concentration in MW253A declined to below 5 µg/L in 2022. As such, the extent of the plume retracted westward.

- TCE concentrations in the east side of the former EW field, EW331 and EW332, were stable or decreased during the monitoring period. TCE concentrations in MW126 and MW283 have generally declined slightly during the monitoring period compared to the 2020 monitoring results. In MW126, TCE concentrations have fluctuated during the monitoring period, but have consistently been below 100 µg/L, with a maximum concentration of 37.9 µg/L during the monitoring period. Similarly, TCE concentrations in MW283 have fluctuated during the monitoring period but have consistently been below 100 µg/L, with a maximum concentration of 39.7 µg/L during the monitoring period. TCE concentrations in MW124 increased from 44.9 µg/L in October 2020 (i.e., the last sampling event of the 2020 plume map update) to 67.3 µg/L in October 2022 but have consistently remained below 100 µg/L. TCE concentrations in MW291 decreased to below 5 µg/L during the last five monitoring events in 2021 and 2022. Similarly, TCE concentrations in MW293A declined to below 100 µg/L during the last five monitoring events in 2021 and 2022. Consequently, the 100 µg/L contour was retracted toward the southwest.

Area F

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

- Along the north end of the B-B' transect, TCE concentrations in MW144 decreased from 101 µg/L in January 2021 to less than 100 µg/L during seven monitoring events in 2021 and 2022. Similarly, TCE concentrations in MW495 declined to less than 100 µg/L during the past three monitoring events; therefore, the 100 µg/L contour was retracted toward the southwest.

- TCE concentrations are highest along the south end of the B-B' transect (i.e., 169 µg/L in MW258, 241 µg/L in MW478). A zone of 5 to 100 µg/L is depicted around MW556, which continued to decrease from 82.4 µg/L in October 2020 to 59.2 µg/L in October 2022.

[9] EW331 and EW332 are currently inactive but are being kept in good working condition until the Federal Facility Agreement parties agree that maintenance no longer is necessary, and final disposition (including well abandonment) has been determined.

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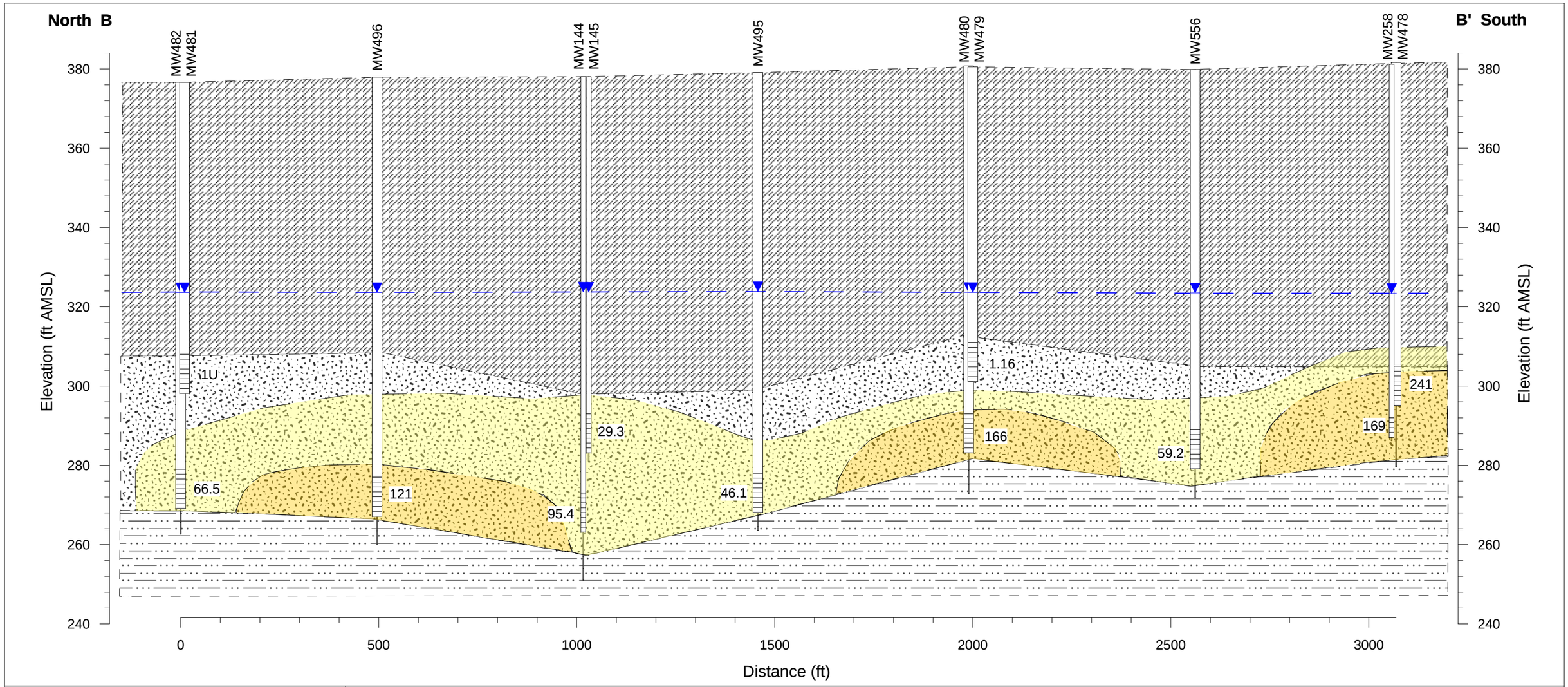

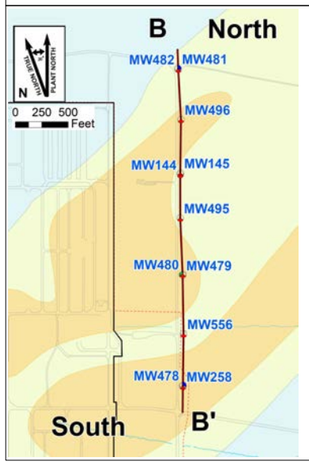

Key Map

Legend

- Upper RGA Well
- Middle RGA Well
- Lower RGA Well
- Hydrogeologic Cross-Section Line
- DOE Property Boundary
- Surface Water Course Centerline
- Roadways
- 229 Boundary
- Limited Area
- Water Policy Area

2022 TCE Plume Concentration Fields

- 5 - 100 µg/L
- 100 - 1,000 µg/L

2022 TCE Plume Concentration Fields

- 5 - 100 µg/L
- 100 - 1,000 µg/L

Hydrogeologic Unit

UCRS RGA McNairy

Monitoring Well Location

- Casing
- Water Level (November 2022)
- Screen Interval
- Most recent TCE concentration (in µg/L)
- Boring

- November 2022 Potentiometric Surface

Vertical Exaggeration = 10X.

U = Compound analyzed for but not detected at or below the lowest concentration reported. For monitoring wells not sampled in calendar year 2022, results from the 2021 monitoring have been used.

TCE Plume Regional Gravel Aquifer, Cross Section B-B'

MAP SOURCE INFORMATION

Map Generation Date and Location - 03/22/2023; Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater
Map Layer Location: Geosyntec\\\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater\Figure 6. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section B-B'.sdg
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Monitoring Well Layer Location: Geosyntec\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.
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Hydrogeologic boundary and screen intervals are approximate, and were based on boring logs obtained from Pegasis, downloaded on 1/31/2023. Subsurface lithologic elevations between borings were interpreted based on available information and should be considered approximate.
Trichloroethene concentration data was provided by FRNP.

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Figure 6. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section B-B'

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4.3 CENTRAL SITE AREA INCLUDING SOUTHWEST PLUME

TCE

The TCE plume in the industrialized section of the PGDP is presented in Figure 7. The overall footprint in 2022 is similar to previous years; differences are noted below. 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 included a small, isolated 10,000 µg/L contour indicated by TCE values in MW333 that were greater than 10,000 µg/L in January 2015, June 2015, and January 2016. The most recent value for MW333 (i.e., 2,210 µg/L in July 2022) is shown on the map (designated as Area G on Figure 7).

- TCE concentrations in MW416 have decreased from a maximum of 1,010 µg/L in May 2019 to less than 1,000 µg/L in May 2021 and December 2021; therefore, the 1,000 µg/L contour line has retracted to the northeast.

- TCE concentrations in MW337 have increased from 452 µg/L in July 2020 (i.e., the last sampling event of the 2020 plume map update) to 1,780 µg/L in July 2022; therefore, the 1,000 µg/L contour line has expanded to the southwest to include this well.

- TCE concentrations in MW547 have declined from 1,190 µg/L in December 2020 (i.e., the last sampling event of the 2020 plume map update) to less than 1,000 µg/L during four measurements in 2021 and 2022; therefore, the 1,000 µg/L contour has been eliminated in SWMU 1 (see inset at lower left of Figure 7). In MW161 (i.e., lower RGA), TCE concentrations have continued to decline from a high of 12,200 µg/L in May 2016 to 77.9 µg/L in December 2022 (designated as Area G on Figure 7). TCE concentration reductions in this area are likely reflective of the source area remediation performed at SWMU 1 in 2015.

- The second area (designated as Area H on Figure 7) is on the northern margin of the industrial footprint. The highest concentrations of TCE extend from C-400 Cleaning Building toward the Northwest Plume groundwater EW. Overall, TCE concentrations in this area have remained stable since 2018.

- The 100,000 µg/L contour previously was drawn around the C-400 Cleaning Building source area based on historical data [e.g., MW156, which recorded up to 360,000 µg/L in 1991 (CH2M HILL 1992); Waste Area Grouping 6 angled boring, which recorded over 100,000 µg/L beneath C-400 in 1997 (DOE 1999)] and consideration of the CSM. Groundwater MWs installed during the C-400 investigation in 2020 and 2021 provided additional information on the extent of the 100,000 µg/L contour. A TCE concentration exceeding 100,000 µg/L was measured in MW407-PRT2 at 272,000 µg/L in April 2021. Generally, the TCE concentrations indicate flow to the northwest from the north and west areas of the C-400 Complex Operable Unit (OU) and flow to the east from the south and central areas of the C-400 Complex OU. A cross section showing the interpretation of TCE concentrations within the RGA along this transect is in Figure 8. The location of the cross section is denoted as C-C’ on Figure 7.

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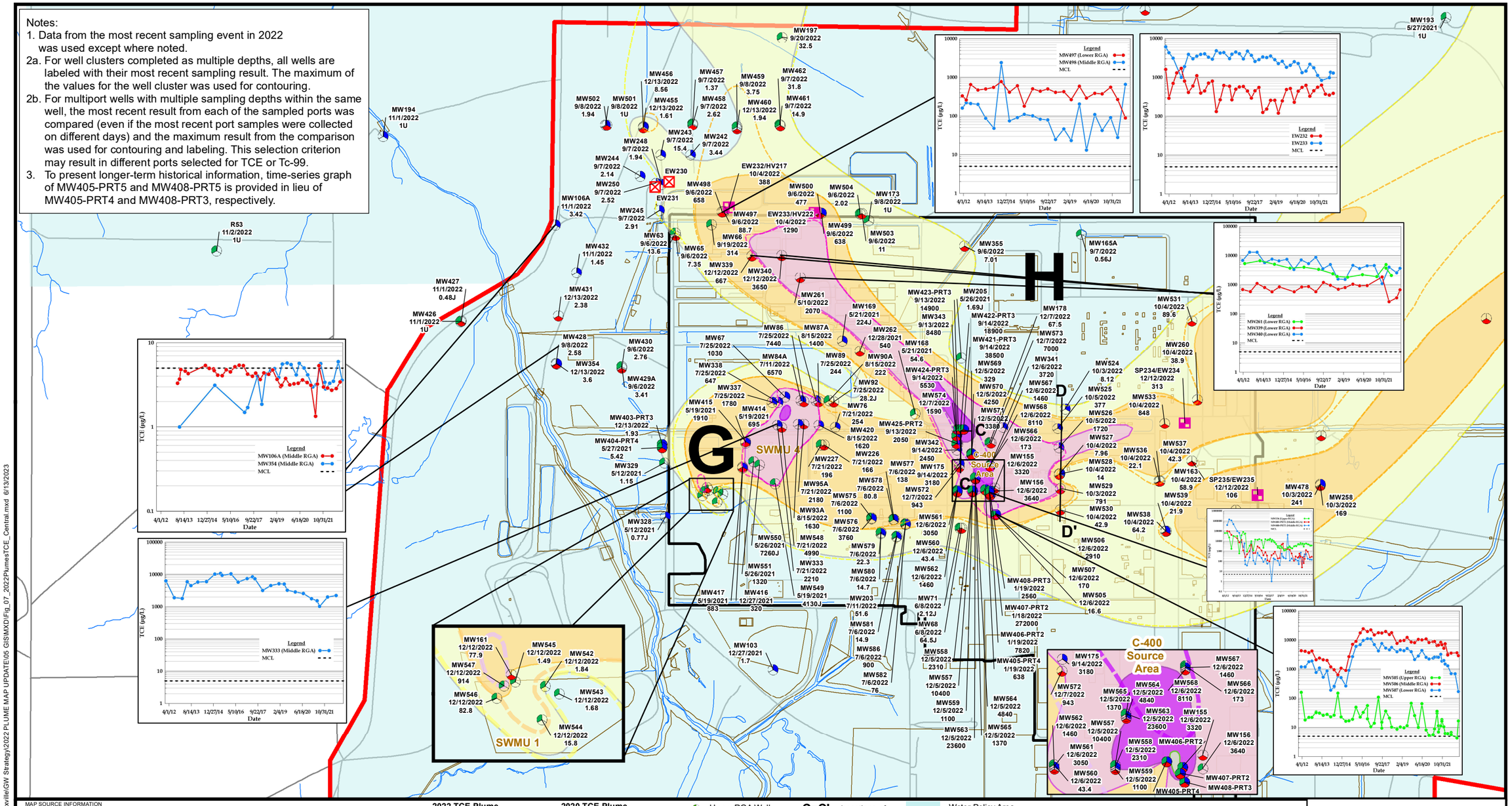
Notes:
1. Data from the most recent sampling event in 2022 was used except where noted.
2a. For well clusters completed as multiple depths, all wells are labeled with their most recent sampling result. The maximum of the values for the well cluster was used for contouring.
2b. For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days) and the maximum result from the comparison was used for contouring and labeling. This selection criterion may result in different ports selected for TCE or Tc-99.
3. To present longer-term historical information, time-series graph of MW405-PRT5 and MW408-PRT5 is provided in lieu of MW405-PRT4 and MW408-PRT3, respectively.



MAP SOURCE INFORMATION
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Monitoring and Extraction Well, RGA Well outside Plume Concentration Field showing TCE > 1 µg/L, and Seep Monitoring Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100000.shp\2022_TCE_10000_100000.shp\2022_TCE_1000_10000.shp\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.

Feet
1,000 500 0 1,000

2022 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

2020 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

Note: Contours defining plume cores are based on historical records.

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

C–C' - Locations of Cross-Sections
D–D'
G - Area G
H - Area H

- Water Policy Area
- SWMU
- DOE Property Boundary
- 229 Boundary
- Limited Area
- Roadways
- Streams

MW428 11/1/2022 1U - Monitoring Well (MW) Identification, or Residential (R) Well Identification
Date of Sample & Sample Value
U = Compound analyzed for, but not detected at or below, the lowest concentration reported
J = Concentration is estimated

TRUE NORTH
PLANT

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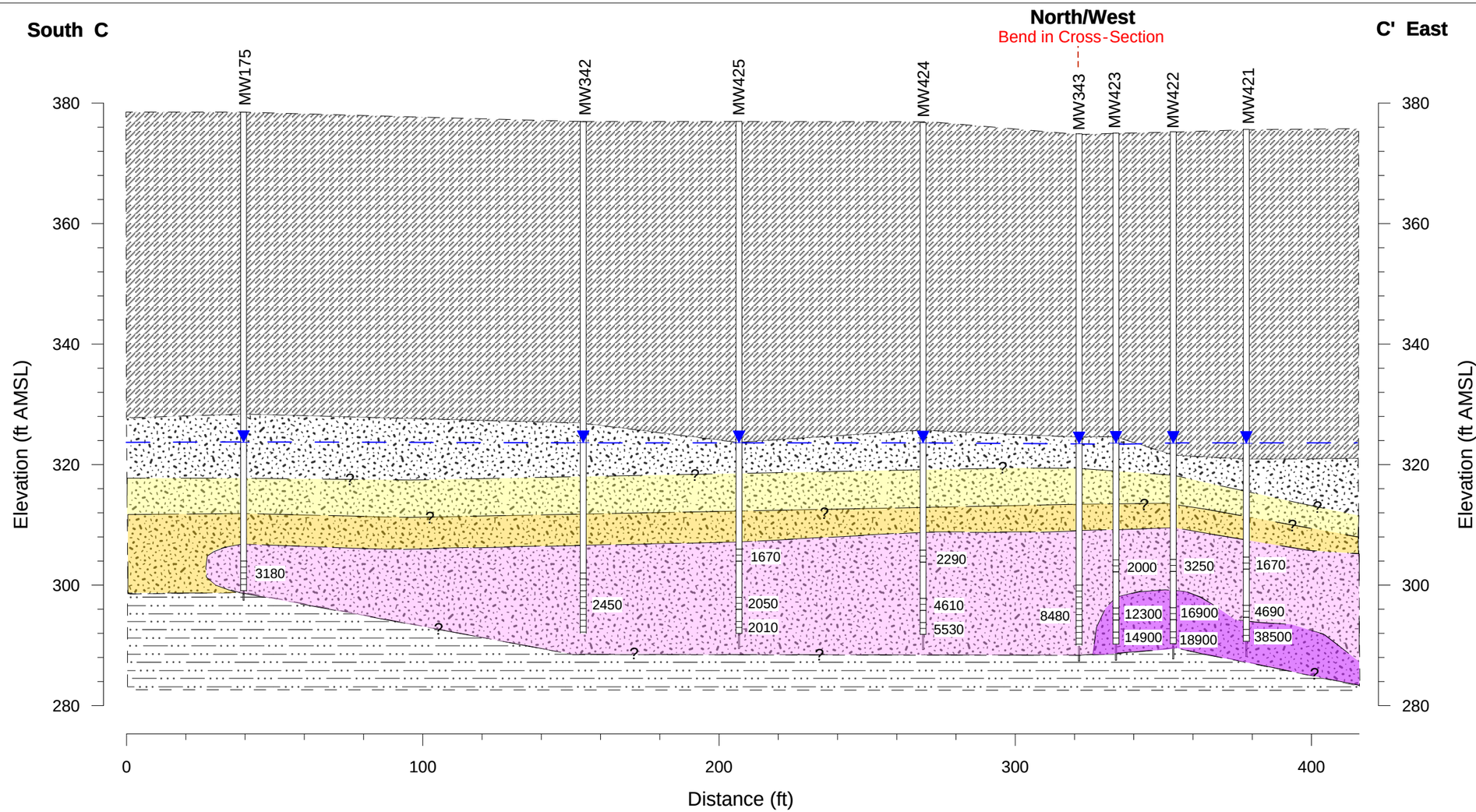
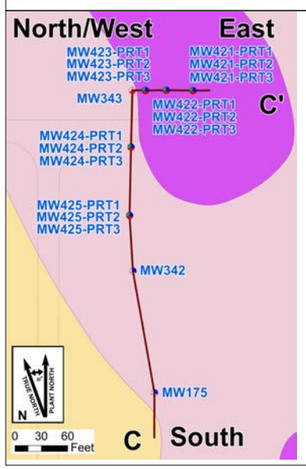
\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_07_2022PlumesTCE_Central.mxd 6/13/2023

Figure 7. 2022 Central Portion of the TCE Plume Regional Gravel Aquifer





Legend

- Lower RGA Well
- Middle RGA Well
- Multizone RGA Well
- Hydrogeologic Cross-Section Line
- Roadways

2022 TCE Plume Concentration Fields

- 100 - 1,000 µg/L
- 1,000 - 10,000 µg/L
- 10,000 - 100,000 µg/L

2022 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

Hydrogeologic Unit

UCRS RGA McNairy

Monitoring Well Location

- Casing
- Water Level (November 2022)
- Screen Interval
- Most recent TCE concentration (in µg/L)
- Boring

- November 2022 Potentiometric Surface

Vertical Exaggeration = 2.5X.
For monitoring wells not sampled in calendar year 2022, results from the 2021 monitoring have been used.

TCE Plume Regional Gravel Aquifer Cross Section C-C'

MAP SOURCE INFORMATION

Map Generation Date and Location - 03/08/2023; Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater
Map Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater\Figure 8. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section C-C'.sdg
Shapefile for Geologic Cross-Sections: \\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\Cross_Section_Lines.shp
Monitoring Well Layer Location: Geosyntec\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
Roadways downloaded from PEGASIS on 3/16/2021.
Northing and easting of wells obtained from Pegasis, downloaded on 6/14/2022.
Groundwater elevation was based on the 11/14/2022 - 11/16/2022 measurements.
Hydrogeologic boundary and screen intervals are approximate, and were based on boring logs obtained from Pegasis, downloaded on 1/31/2023. Subsurface lithologic elevations between borings were interpreted based on available information and should be considered approximate.
Trichloroethene concentration data was provided by FRNP.

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Figure 8. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section C-C'

- The northern extent of the 10,000 µg/L contour on the south side of the C-400 Cleaning Building is bounded by MW569/MW570/MW571, with the highest recent TCE concentration for this group of wells of 4,250 µg/L detected in MW570 in December 2022 (Figure C.1 Inset B). This southern 10,000 µg/L contour is bounded by MW566/MW567/MW568 to the northeast and by MW155 and MW156 in the southeast. The southern limit of the 10,000 µg/L contour is defined by MW408. A second 10,000 µg/L TCE concentration contour is present to the northwest side of C-400, which is identified by MW421, MW422, and MW423. The 10,000 µg/L TCE concentration contour was previously interpreted to be one contiguous area, but the results for MW569/MW570/MW571 resulted in a new interpretation as two areas.

- 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 2011, 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 overall declines in TCE concentrations from 2012 to 2022. Most notably, TCE in MW408-PRT5 has decreased from its high of 1,400,000 µg/L in September 2012 to 141 µg/L in December 2022. Similarly, TCE concentrations in MW156 declined from a maximum concentration of 81,800 µg/L in June 2014 to 3,640 µg/L in December 2022. In MW405-PRT5, TCE concentrations rebounded from below 1,000 µg/L to 4,470 µg/L in March 2019 and 5,530 µg/L in May 2019; however, concentrations overall declined steadily to 296 µg/L by December 2020 (i.e., the last sampling event of the 2020 plume map update) and have remained fairly stable in 2021 to 2022, with the most recent TCE concentration of 279 µg/L in December 2022.

- To the south of the C-400 Cleaning Building source area, all of the most recent samples from the MW505/MW506/MW507 well nest contained TCE concentrations below 10,000 µg/L. The December 2022 sampling data indicated only MW506 contained a TCE concentration above 1,000 µg/L. TCE concentrations in MW505 and 507 were below 1,000 µg/L.

- A cross section in Figure 9 shows the 5 µg/L, 100 µg/L, and 1,000 µg/L concentration fields in the MW524–MW530 transect line of wells between the Northwest Plume and Northeast Plume, which are connected with similar concentration contours east of the C-400 Cleaning Building. The location of the cross section is denoted as D-D' on Figure 7. A figure that includes TCE concentration time-series graphs in monitoring wells MW524-MW530, as presented during the Routine Paducah Groundwater Update meeting on March 16, 2023, and attended by representatives from EPA and the Kentucky Department for Environmental Protection (KDEP) is provided in Appendix D. Based on evaluation of the time-series graphs, there is no migration of TCE source material from the C-400 Cleaning Building source area in the direction of the Northeast Plume Containment System (NEPCS) extraction field.

- Wells MW354 and MW106A each had one observed TCE concentration above 5 µg/L during the monitoring period, although the remainder of the results were below 5 µg/L, and the most recent result for each well was below 5 µg/L. Because the most recent results for each well are below 5 µg/L, these wells are not included within the 5 µg/L contour delineating the western portion of the southwest plume. Additionally, 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, shown in Figures 11 and 12 (see Section 5). The location of the source responsible for the detections of TCE in MW354 and MW106A is uncertain.

Tc-99

There were 1,699 analyses for Tc-99 in RGA groundwater at PGDP in 2021 and 2022, with only 21 results above 900 pCi/L and 14 results above 1,930 pCi/L. Figure 10 presents the results of Tc-99 analyses near the central area of the plant, where the groundwater samples collected in 2022 (supplemented with samples

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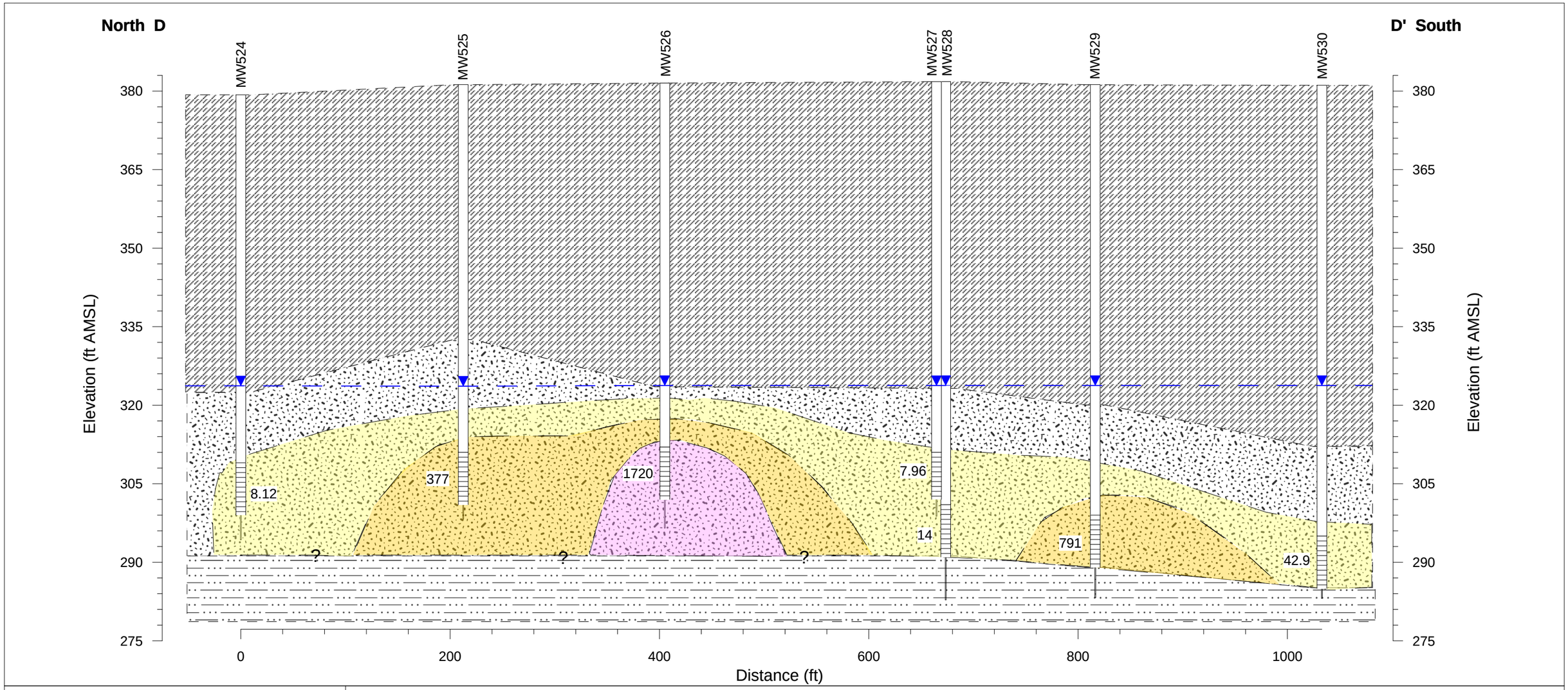

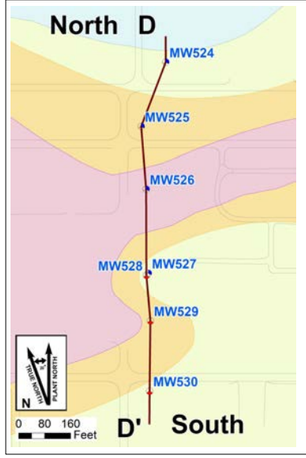

Key Map

Legend
- Lower RGA Well
- Middle RGA Well
- Hydrogeologic Cross-Section Line
- Roadways

2022 TCE Plume Concentration Fields
- 5 - 100 µg/L
- 100 - 1,000 µg/L
- 1,000 - 10,000 µg/L

Hydrogeologic Unit
UCRS RGA McNairy

Monitoring Well Location
- Casing
- Water Level (November 2022)
- Screen Interval
- Most recent TCE concentration (in µg/L)
- Boring

- November 2022 Potentiometric Surface

Vertical Exaggeration = 5X.
For monitoring wells not sampled in calendar year 2022, results from the 2021 monitoring have been used.

TCE Plume Regional Gravel Aquifer Cross Section D-D'

MAP SOURCE INFORMATION

Map Generation Date and Location - 03/22/2023; Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater
Map Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater\Figure 9. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section D-D'.sdg
Shapefile for Geologic Cross-Sections: \\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\Cross_Section_Lines.shp
Monitoring Well Layer Location: Geosyntec\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
Roadways downloaded from PEGASIS on 3/16/2021.
Northing and easting of wells obtained from Pegasis, downloaded on 6/14/2022.
Groundwater elevation was based on the 11/14/2022 - 11/16/2022 measurements.
Hydrogeologic boundary and screen intervals are approximate, and were based on boring logs obtained from Pegasis, downloaded on 1/31/2023. Subsurface lithologic elevations between borings were interpreted based on available information and should be considered approximate.
Trichloroethene concentration data was provided by FRNP.

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Figure 9. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section D-D'

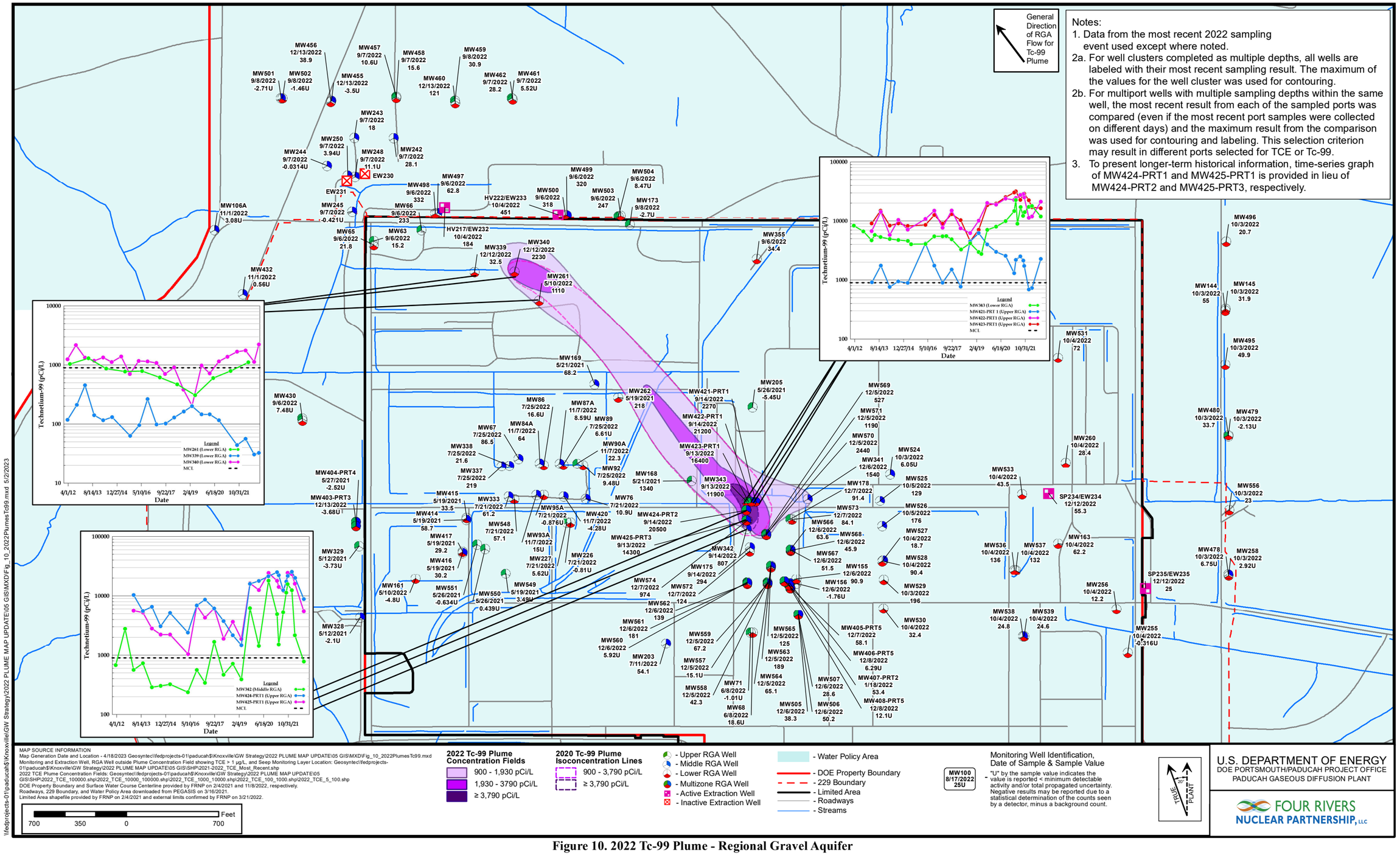


Figure 10. 2022 Tc-99 Plume - Regional Gravel Aquifer

collected in 2021) contained Tc-99 at activities greater than 900 pCi/L and 1,930 pCi/L. Figure 10 also presents 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). From the 2020 interpreted contour, the 900 pCi/L contour was expanded to the east to include MW341, which increased from 555 pCi/L in December 2020 (i.e., the last sampling event of the 2020 plume map update) to 1,540 pCi/L in December 2022 (Figure 10). A 1,930–3,790 pCi/L contour was added at the northwestern extent of the plume to include MW340 because the Tc-99 concentrations in MW340 increased from 1,150 pCi/L in September 2020 (i.e., the last sampling event of the 2020 plume map update) to 2,230 pCi/L in December 2022. The 900 pCi/L contour in this area was expanded to accommodate this change, as well as MW261 because the Tc-99 activity increased from 601 pCi/L in May 2020 (i.e., the last sampling event of the 2020 plume map update) to 1,110 pCi/L in May 2022. Tc-99 activities in nearby MW339 remained below 900 pCi/L.

The highest concentration level of Tc-99 occurred in the area of MW422 through MW425 (which are located downgradient of the Tc-99 source area at the C-400 Cleaning Building) during the 2021 and 2022 monitoring period. This is consistent with historical releases at the C-400 Cleaning Building. The southern extent of the 3,790 pCi/L isoconcentration contour was moved slightly to the north to exclude MW342, where the Tc-99 activity decreased from 18,200 pCi/L in September 2020 (i.e., the maximum concentration for this MW and the last sampling event of the 2020 plume map update) to 807 pCi/L in September 2022. MW425-PRT1 and MW424-PRT1 showed overall increases in Tc-99 activity since 2019, but the Tc-99 activity in these wells declined during the last sampling event in September 2022 (Figure 10).

The 1,930 pCi/L isocontour, not defined prior to the 2020 Plume Map, is a dose-based groundwater screening level that equates to an effective dose of 4 millirem (mrem)/year (DOE 2022). The northwestern extent of the area exceeding 1,930 pCi/L and 900 pCi/L is delineated by downgradient wells MW497/MW498/EW232 and MW499/MW500/EW233, where the activity was below 900 pCi/L in all samples collected in 2022.

The southern extent of the Tc-99 plume is delineated by MW175 and MW566/MW567/MW568, with reported Tc-99 activity for all samples collected in 2022 of less than 900 pCi/L.

Northeast Plume transect wells, MW524 to MW530, installed as part of the Northeast Plume Optimization project, all contain less than 900 pCi/L of Tc-99 (ranging from nondetect to 196 pCi/L during the most recent monitoring event in October 2022). A figure including Tc-99 concentration time-series graphs in monitoring wells MW524 to MW530, as presented during the Routine Paducah Groundwater Update meeting on March 16, 2023, and attended by representatives from EPA and KDEP, is included in Appendix D. Based on evaluation of the time-series graphs, the Tc-99 activity that is migrating into the NEPCS extraction field is below 900 pCi/L, and thus, below a concentration which would require Tc-99 treatment as part of the NEPCS.

5. POTENTIOMETRIC MAPS

Synoptic water level measurements were collected in August 2021 and August 2022 to evaluate groundwater flow direction. In 2021, water level measurements in wells screened in the RGA were made in 297 EWs, MWs, residential wells, and piezometers during a 3-day period between August 23, 2021, and August 25, 2021. Similarly, in 2022, groundwater level measurements were conducted in 312 EWs, MWs and piezometers during a 4-day period between August 22, 2022, and August 25, 2022. These water level

measurements (Table 2) are the basis for the August 2021 and August 2022 potentiometric surface maps of the RGA, presented as Figures 11 and 12, respectively. The contours of the potentiometric surface map define lines of equal hydraulic potential. The local direction of hydraulic gradient is perpendicular to the hydraulic potential lines. These potentiometric surface contours help explain the plume geometries. In addition to groundwater flow direction, 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; near-field recharge effects; recharge sources not associated with the PGDP; and advection, dispersion, and natural attenuation of the contaminants.

Table 2. RGA Water Levels Measurement Events during CY 2021 and 2022

Event Dates	Number of Wells/Piezometers	Ohio River Stage (ft amsl)	Barometric Pressure (in/Hg)	Rainfall during the event (inches)
August 23–25, 2021	297	301.8	30.05	0.0
August 22–25, 2022	312	301.6	30.01	0.0

Notes: Ohio River elevation was estimated as the average of elevations measured by the U.S. Geological Survey at Paducah Station USGS 0361100 and Olmsted, IL Station USGS 03612600. Rainfall data was obtained from the Paducah, Barkley Regional Airport office of the National Weather Service (i.e., https://w1.weather.gov/data/obhistory/KPAH.html).

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 2021, the Ohio River stage near the Paducah Site was approximately 301.8 ft above mean sea level (amsl); in August 2022, the stage of the Ohio River was approximately 301.6 ft amsl. In addition, the Northeast Plume and Northwest Plume Pump-and-Treat Systems form local cones of depression in the RGA potentiometric surface.

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 and will impact the river stage during the operational life of the dam. As such, the August 2021 and August 2022 maps documented RGA hydraulic potential contours during a higher river stage (301.8 ft amsl and 301.6 ft amsl, respectively) compared with the August 2017 and August 2018 maps (290 ft amsl and 298 ft amsl, respectively).

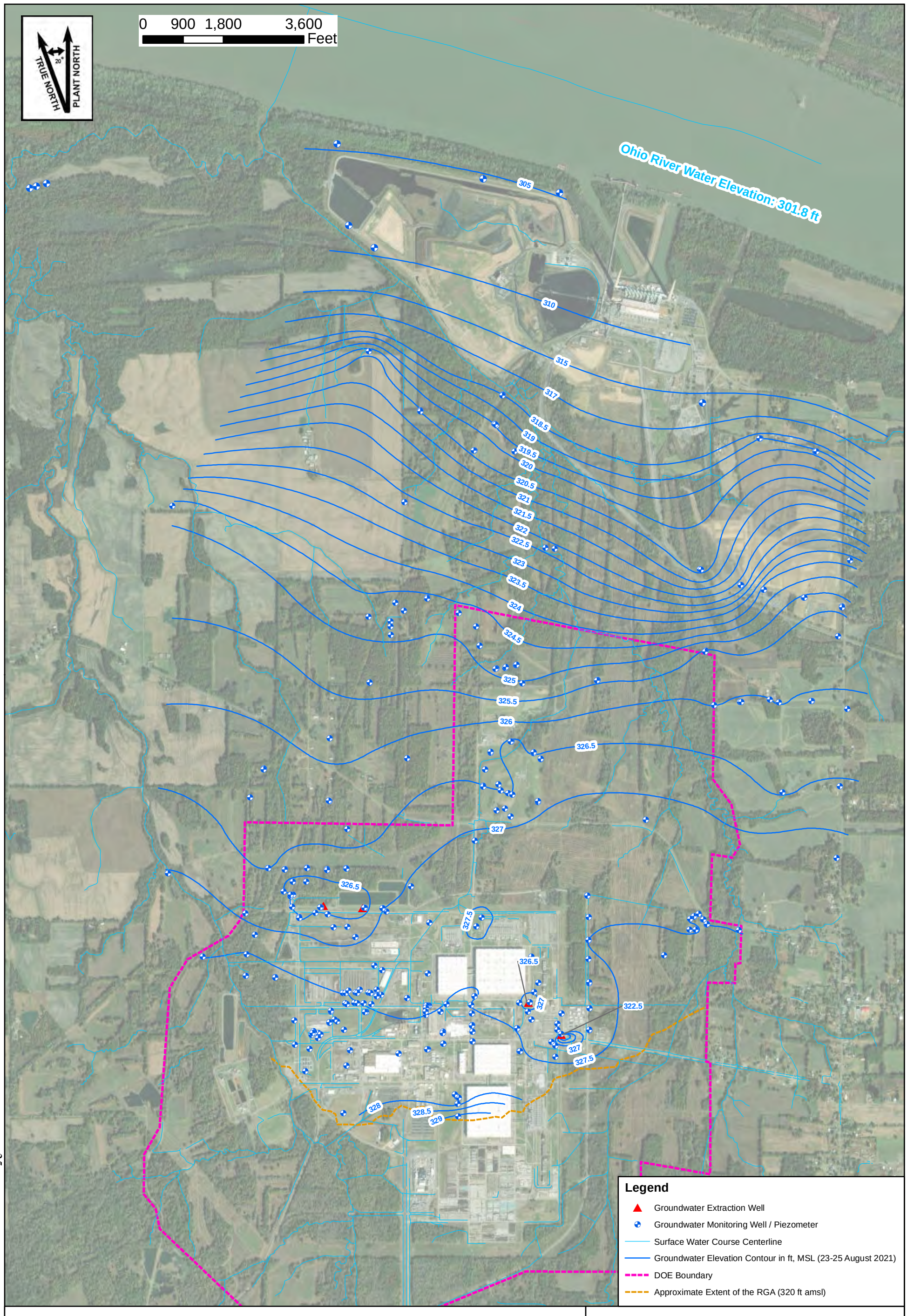
RGA water level measurements were converted to elevation and corrected to a standard barometric pressure that was common during the period of the water level measurements: 30.05 inches of mercury for the August 2021 measurements and 30.01 inches of mercury for the August 2022 measurements. Rainfall was minimal during both periods of water level measurements: 0.0 inches of precipitation during both August 2021 and August 2022 water level measurements.

A data quality review of the RGA water level measurements identified a few measurements that were rejected for mapping the RGA potentiometric surface (Table 3).[10] In the August 2021 data set, 22 out of 297 measurements were rejected. In the August 2022 data set, 23 out of 312 measurements were rejected.

Table 3. RGA Water Levels Measurements (Total and Useable) from Events during CY 2021 and 2022

Event	Total Number of Measurements	Number of acceptable measurements
August 23–25, 2021	297	275
August 22–25, 2022	312	289

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



MAP SOURCE INFORMATION

Map Generation Date and Location - 12/1/2021 Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\GIS\MXDs\2020-2021 Potentiometric Surface Maps
Map Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\GIS\MXDs\2020-2021 Potentiometric Surface Maps\August 2021 Potentiometric Surface Map.mxd
Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Shapefile for Surface Water Course Centerline was obtained from Pegasis (https://pegasis.pad.pppo.gov/), downloaded on 12/1/2021.
DOE Property Boundary provided by FRNP 2/4/2021.
Northing and easting of wells obtained from Pegasis, downloaded on 10/5/2021. Northing and easting of SHF and TVAGW series wells obtained from OREIS on 10/15/2021.
Ohio River elevation was estimated as the average of elevations measured by the USGS at Paducah Station USGS 0361100 and Olmsted, IL Station (USGS 03612600) between August 23-25, 2021.

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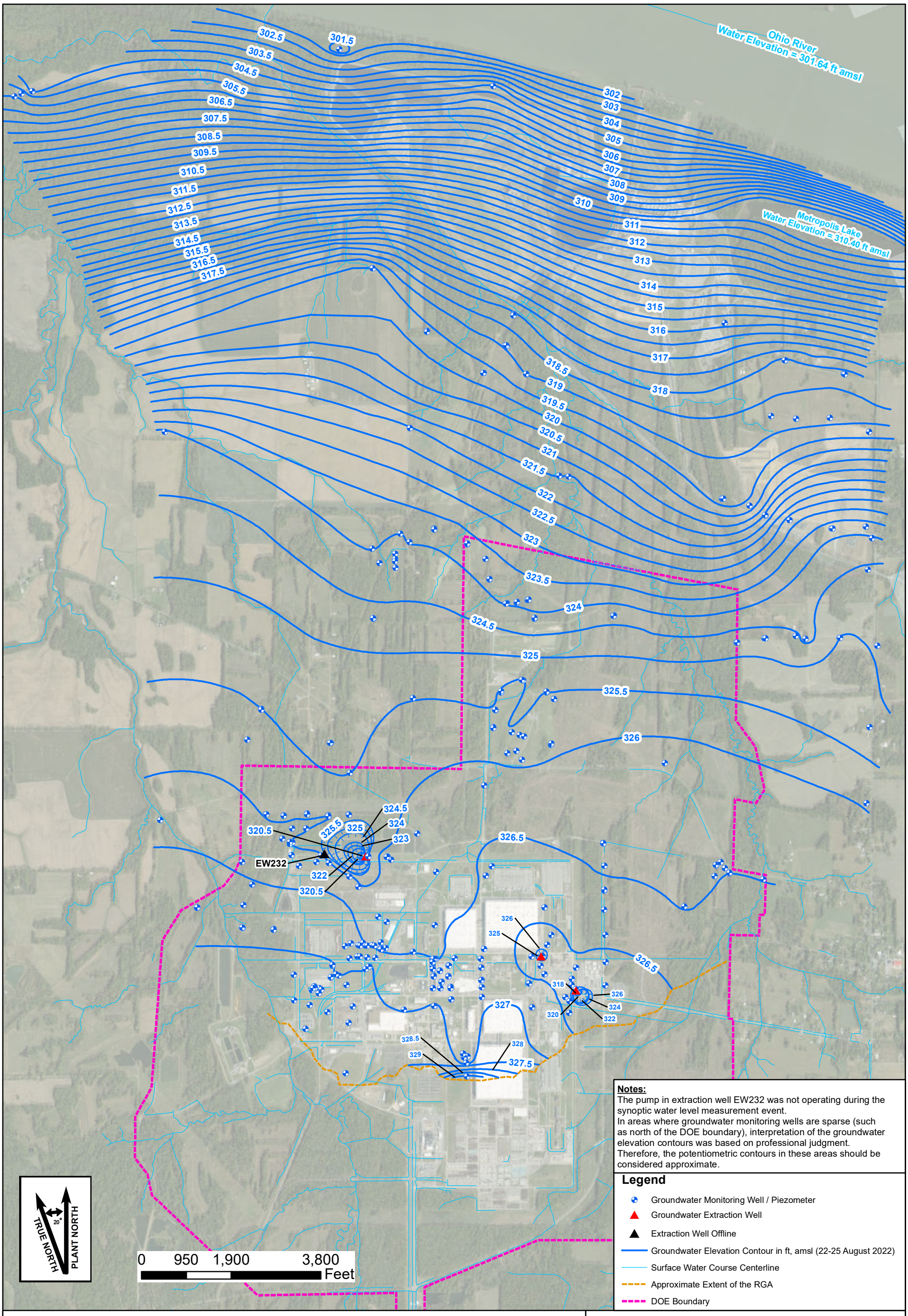
Figure 11. August 2021 RGA Potentiometric Surface Map



MAP SOURCE INFORMATION

Map Generation Date and Location - 10/11/2022 Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\GIS\MXDs\2021-2022 Potentiometric Surface Maps
Map Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\GIS\MXDs\2021-2022 Potentiometric Surface Maps\August 2022 Potentiometric Surface Map 9_28_22.mxd
Image Source: Aerial 2021: http://pegasis.pad.pppo.gov:6080/arcgis/services; and
Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
Shapefile for Surface Water Course Centerline was obtained from Pegasis (https://pegasis.pad.pppo.gov/), downloaded on 6/27/2022.
DOE Property Boundary provided by FRNP 2/4/2021.
Northing and easting of wells obtained from Pegasis, downloaded on 6/14/2022.
Groundwater elevation was based on the 8/22/2022 - 8/25/2022 measurements. Ohio River elevation was estimated as the average of elevations measured by the USGS at Paducah Station USGS 0361100 and Olmsted, IL Station (USGS 03612600) between 8/22/2022 - 8/25/2022.
Groundwater elevation for the TVA wells were provided by the Kentucky Division of Waste Management on 9/1/2022. Water elevation at Metropolis Lake was provided by FRNP on 8/30/2022.
amsl = above mean sea level

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Figure 12. August 2022 RGA Potentiometric Surface Map

The RGA hydraulic potential contours first were generated by computer using a Surfer® software (i.e., version 12.8.1009 from 2015) and ArcGIS (i.e., version 10.8). The Surfer® software created contours using kriging, based on the well coordinates and water level elevations of the August 2021 and August 2022 synoptic water measurements events. The resulting contours then were exported into ArcGIS for the presentation of the contours together, with relevant site features and smoothed manually in ArcGIS where site knowledge provided bias to understanding the hydraulic potential field.

The available wells and piezometers for both the August 2021 and 2022 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 parallel to the Ohio River, which includes the Tennessee Valley Authority 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 2022 plumes were developed by consensus by FRNP subject matter experts and were reviewed by hydrogeologists familiar with the site. DOE subsequently reviewed, provided comments and, after resolution of comments, concurred on the maps.

7. REFERENCES

CH2M HILL 1992. *Results of the Site Investigation, Phase II at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, KY/SUB/13B-97777C P-03/1991/1, U.S. Department of Energy, Paducah, KY, April.

DOE (U.S. Department of Energy) 1999. *Remedial Investigation Report for Waste Area Grouping 6 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1727&D2, Volumes 1-6, U.S. Department of Energy, Paducah, KY, May.

DOE 2011. *Technical Performance Evaluation for Phase I of the C-400 Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1260&D1, U.S. Department of Energy, Paducah, KY, August.

DOE 2013. *Remedial Action Work Plan for Phase IIa of the Interim Remedial Action for the Volatile Organic Compound Contamination at the C-400 Cleaning Building at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1271&D2/R3, U.S. Department of Energy, Paducah, KY, October.

DOE 2016. *Treatability Study Report for the C-400 Interim Remedial Action Phase IIb Steam Injection Treatability Study at Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2202&D2, U.S. Department of Energy, Paducah, KY, May.

DOE 2022. *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant Paducah, Kentucky Volume 1. Human Health*, DOE/LX/07-0107&D2/R13/V1, U.S. Department of Energy, Paducah, KY, June.

FRNP (Four Rivers Nuclear Partnership, LLC) 2020. *Environmental Monitoring Plan Fiscal Year 2021 Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-0006/FR6, Four Rivers Nuclear Partnership, LLC, Paducah, KY, October.

FRNP 2021a. *Environmental Monitoring Plan Fiscal Year 2022 Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-0006/FR7, Four Rivers Nuclear Partnership, LLC, Paducah, KY, October.

FRNP 2021b. *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2020 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FRNP-RPT-0175, Four Rivers Nuclear Partnership, LLC, Paducah, KY, July.

APPENDIX A

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

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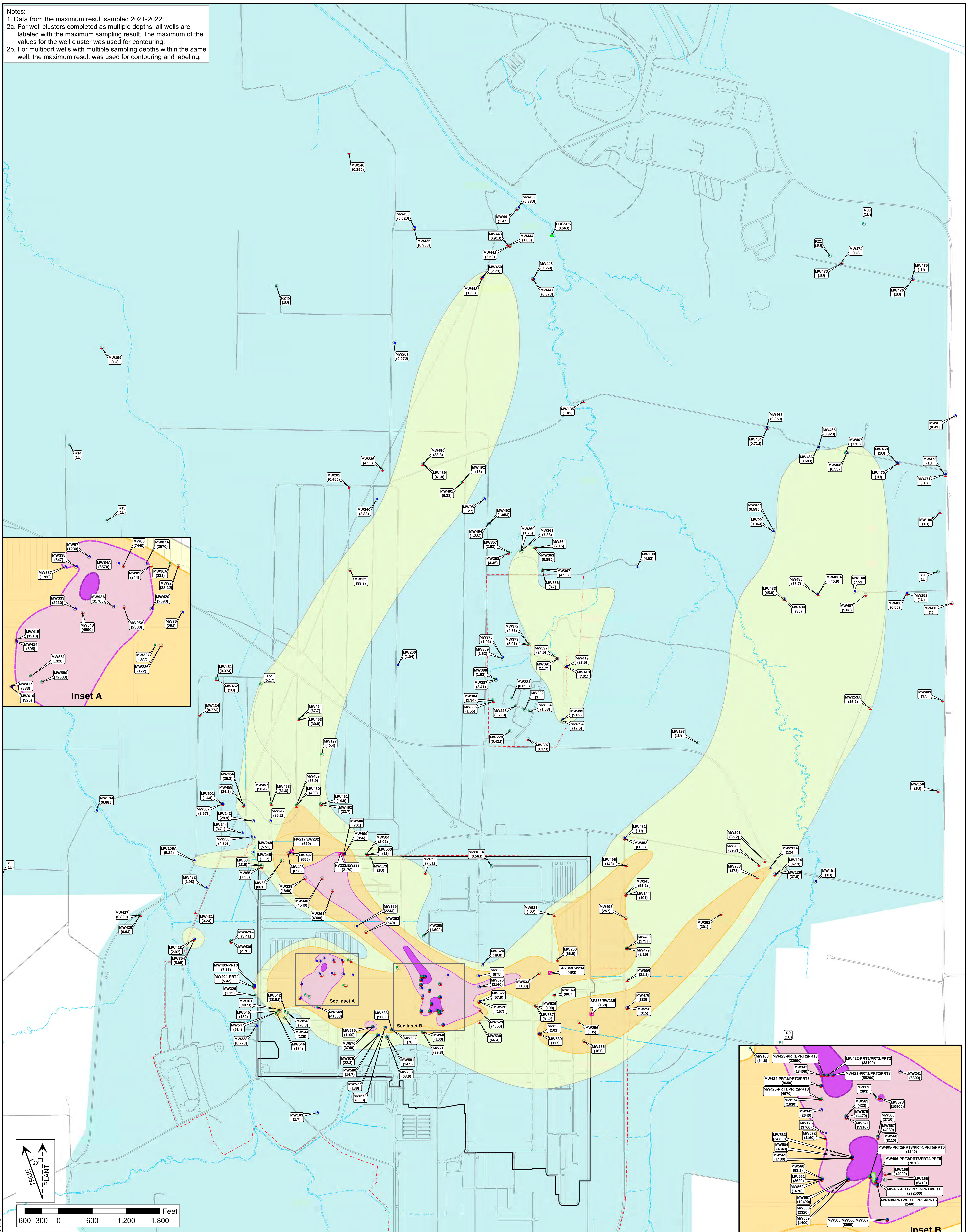
APPENDIX A

ELECTRONIC COPIES OF TABLES AND GRAPHS (CD)



2022 TCE MAX Plume Concentration Fields Interpretation Using Maximum Concentrations
- 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

2022 TCE Plume Concentration Fields (Figure C.1)
- 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

- Upper RGA Well
- Middle RGA Well
- Lower RGA Well
- Multizone RGA Well
- Extraction Well
- Seep Monitoring Location

- Surface Water Course Centerline
- DOE Property Boundary
- Roadways
- 229 Boundary
- Limited
- Water Policy

MW100 (1U) — Monitoring Well Identification, Sample Value (TCE Concentration in µg/L)
J = Concentration is estimated
U = Compound analyzed for but not detected at or below, the lowest concentration reported

Note: Contours defining >10,000 µg/L used historical records in addition to recent groundwater monitoring results.

MAP SOURCE INFORMATION
Map Generation Date and Location - 3/8/2023 Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_A1_2022PlumesTCE_MAXR1.mxd
Monitoring and Extraction Well, and Seep Monitoring Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_MAX.shp
2022 Maximum TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_MAX_100000.shp\2022_MAX_TCE_10000_100000.shp\2022_MAX_TCE_1000_10000.shp\2022_MAX_TCE_100_1000.shp\2022_MAX_TCE_5_100.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100000.shp\2022_TCE_10000_100000.shp\2022_TCE_1000_10000.shp\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Figure 6REMOVE "Limited Area" from the sentence "Roadways, 229 Boundary, Limited Area Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.

\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_A1_2022PlumesTCE_MAXR1.mxd 6/13/2023

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Figure A.1. 2022 TCE Plume–Regional Gravel Aquifer Alternate Interpretation Using Maximum Values

Notes:
1. Data from the maximum result sampled 2021-2022.
2a. For well clusters completed as multiple depths, all wells are labeled with the maximum sampling result. The maximum of the values for the well cluster was used for contouring.
2b. For multiport wells with multiple sampling depths within the same well, the maximum result was used for contouring and labeling.

Ohio River

MW146 (12.2U)
MW441 (10.5U)
MW433 (5.45U)
MW435 (10.8U)
MW442 (4.77U)
MW444 (3.32U)
MW443 (5.9U)
MW450 (13.6U)
MW445 (-0.05U)
MW448 (10.3U)
MW447 (2.83U)
R245 (3.75U)
MW199 (4.27U)
MW201 (9.93U)
MW135 (80.8)
R14 (9.46U)
MW490 (19U)
MW489 (10.3U)
MW492 (56)
MW202 (11U)
MW236 (7.65U)
MW240 (0.05U)
MW491 (58.7)
MW98 (59)
MW493 (21U)
MW494 (32.6)
MW360 (28.3)
MW361 (55.5)
MW364 (61.7)
MW357 (53.6)
MW363 (14.9U)
MW358 (55.8)
MW367 (63.9)
MW366 (72.5)
MW139 (10.6U)
MW488 (6.61U)
R13 (4.59U)
MW125 (38.1)
MW67 (111)
MW86 (31.5)
MW338 (52)
MW87A (11.6U)
MW337 (230)
MW84A (722)
MW89 (6.61U)
MW90A (34.4)
MW92 (17.8)
MW333 (82.3)
MW420 (12.4U)
MW415 (33.5)
MW93A (26.9)
MW95A (15.7U)
MW548 (57.1)
MW76 (10.9U)
MW414 (58.7)
MW227 (5.62U)
MW417 (29.2)
MW226 (1.16U)
MW551 (-0.63U)
MW550 (0.44U)
MW416 (30.2)
Inset A
MW200 (19.4)
MW372 (79.4)
MW373 (17.5U)
MW370 (58.8)
MW391 (11.4U)
MW369 (67.7)
MW419 (1.82U)
MW387 (476)
MW392 (10.2U)
MW418 (5.75U)
MW388 (112)
MW221 (12.1U)
MW384 (49.9)
MW222 (10.8U)
MW224 (13.6U)
MW385 (48.5)
MW223 (12.5U)
MW395 (17.4U)
MW394 (11.4U)
MW220 (21.3U)
MW397 (23)
MW451 (2.99U)
R2 (9.9U)
MW452 (4.52U)
MW134 (5.66U)
MW454 (29.9)
MW453 (13.8U)
MW197 (114)
MW457 (27.1)
MW456 (38.9)
MW458 (31.1)
MW455 (7.91U)
MW459 (87.2)
MW460 (150)
MW502 (5.41U)
MW461 (9.51U)
MW501 (1.83U)
MW243 (18)
MW242 (28.1)
MW462 (46.5)
MW244 (6.7U)
MW500 (363)
MW499 (356)
MW250 (7.82U)
HV222/EW233 (451)
MW248 (11.1U)
HV217/EW232 (195)
MW504 (8.47U)
MW106A (11U)
MW245 (4.22U)
MW497 (164)
MW503 (252)
MW355 (46.9)
MW165A (21.2)
MW63 (40.3)
MW498 (332)
MW65 (21.8)
MW66 (438)
MW339 (56.3)
MW173 (1.62U)
MW340 (2230)
MW261 (1110)
MW262 (218)
MW432 (7.18U)
MW426 (5.5U)
MW427 (6.69UJ)
MW205 (-5.45U)
MW169 (68.2)
MW428 (3.96U)
MW429A (5.66U)
MW354 (19U)
MW430 (7.48U)
MW524 (48.1)
MW260 (44.7)
MW525 (146)
MW533 (67.6)
SP234/EW234 (82.4)
MW526 (221)
MW163 (66.6)
MW403-PRT3 (9.22U)
MW329 (-3.73U)
MW404-PRT4 (-2.52U)
MW527 (59.6)
MW536 (136)
SP235/EW235 (42.9)
MW528 (90.4)
MW537 (157)
MW256 (23.8)
MW529 (213)
MW538 (25.8)
MW255 (4.53U)
MW530 (50.6)
MW539 (25.2)
MW549 (3.49U)
MW161 (-1.38U)
MW328 (-2.1U)
MW203 (102)
MW71 (10.3)
MW68 (40.8)
MW103 (-5.08U)
See Inset A
See Inset B
MW481 (-2.36U)
MW482 (11.8U)
MW496 (25.1)
MW145 (35)
MW144 (61.2)
MW495 (56.7)
MW531 (92.3)
MW480 (48.1)
MW479 (2.2U)
MW556 (28.6)
MW478 (12.9U)
MW258 (7.11U)
MW291 (8.42U)
MW283 (12.5U)
MW293A (5.46U)
MW288 (28.6)
MW124 (6.41U)
MW126 (12.3U)
MW292 (15.5)
MW150 (3.35U)
MW194 (3.54U)
R53 (5.29U)
MW168 (1340)
MW422-PRT1/PRT2/PRT3 (28500)
MW423-PRT1/PRT2/PRT3 (31700)
MW421-PRT1/PRT2/PRT3 (2510)
MW343 (22600)
MW341 (1710)
MW424-PRT1/PRT2/PRT3 (25400)
MW178 (101)
MW425-PRT1/PRT2/PRT3 (26900)
MW573 (96)
MW574 (974)
MW569 (607)
MW342 (15700)
MW570 (16500)
MW571 (8390)
MW566 (68.3)
MW567 (63.7)
MW568 (63.8)
MW175 (306)
MW572 (148)
MW563 (189)
MW564 (111)
MW405-PRT2/PRT3/PRT4/PRT5/PRT6 (59.7)
MW560 (26.3)
MW565 (131)
MW155 (119)
MW561 (201)
MW156 (7.73U)
MW562 (185)
MW557 (63.4)
MW406-PRT2/PRT3/PRT4/PRT5 (6.29U)
MW558 (56.9)
MW407-PRT2/PRT3/PRT4/PRT5 (53.4)
MW559 (120)
MW408-PRT2/PRT3/PRT4/PRT5 (6.46)
MW505/MW506/MW507 (81)
Inset B

TRUE
20°
PLANT

Feet
600 300 0 600 1,200 1,800

2022 Tc-99 Plume Concentration Fields Interpretation Using Maximum Concentrations
- 900 - 1,930 pCi/L
- 1,930 - 3790 pCi/L
- ≥ 3790 pCi/L

2022 Tc-99 Plume Concentration Fields (Figure C.2)
- 900 - 1,930 pCi/L
- 1,930 - 3790 pCi/L
- ≥ 3790 pCi/L

- Upper RGA Well
- Middle RGA Well
- Lower RGA Well
- Multizone RGA Well
- Extraction Well
- Surface Water Course Centerline
- DOE Property Boundary
- Roadways
- 229 Boundary
- Limited Area
- Water Policy Area

MW242 (28.1) - Monitoring Well Identification
Sample Value (TCE Concentration in µg/L)
U = Compound analyzed for but not detected at or below the lowest concentration reported
UJ = Not detected and result estimated

MAP SOURCE INFORMATION
Map Generation Date and Location - 3/9/2023 Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_A2_2022PlumesTc99_MAXR1.mxd
Monitoring and Extraction Well Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_Tc-99_MAX.shp
2022 Maximum Tc-99 Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_Tc99_MAX_Above_3790.shp\2022_Tc99_MAX_1930_3790.shp\2022_Tc99_MAX_900_1930.shp
2022 Tc-99 Plume Concentration Fields : Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_Tc99_Above_3790.shp\2022_Tc99_1930_3790.shp\2022_Tc99_900_1930.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.

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Figure A.2. 2022 Tc-99 Plume–Regional Gravel Aquifer Alternate Interpretation Using Maximum Values

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APPENDIX B

TABLE OF DATA USED TO PREPARE THE 2022 PLUME MAPS

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Table B.1. 2021 and 2022 TCE and Tc-99 Data Used to Create Plume Maps

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Most Recent Date TCE Sample Collected[b]	TCE (µg/L)[c]	Most Recent Date Tc-99 Sample Collected[b]	Tc-99 (pCi/L)[d]	Notes
MW100	Lower	283–293	5/9/2022	1U	Not Sampled		
MW103	Middle	293–303	12/27/2021	1.7	5/12/2021	-5.08U	
MW106A	Middle	295–305	11/1/2022	3.42	11/1/2022	3.08U	
MW124	Lower	270–280	10/5/2022	67.3	10/5/2022	3.78U	
MW125	Lower	285–295	5/2/2022	24.4	5/2/2022	25.5	
MW126	Middle	298–308	10/5/2022	30	10/5/2022	2.22U	
MW134	Lower	272–282	11/1/2022	1U	11/1/2022	2.22U	
MW135	Lower	283–293	9/21/2022	0.4J	9/21/2022	58.4	
MW139	Middle	294–304	5/9/2022	1.44	5/9/2022	3.15U	
MW144	Lower	263–273	10/3/2022	95.4	10/3/2022	55	
MW145	Lower	283–293	10/3/2022	29.3	10/3/2022	31.9	
MW146	Lower	283–293	11/1/2022	1U	11/1/2022	-2.41U	
MW148[e]	Middle	281–311	5/21/2021	7.51	Not Sampled		
MW150[e]	Lower	278–308	5/3/2022	1U	5/3/2022	-10.1U	
MW155	Lower	287–292	12/6/2022	3320	12/6/2022	90.9	
MW156	Upper	310–317	12/6/2022	3640	12/6/2022	-1.76U	
MW161	Lower	289–294	12/12/2022	77.9	5/10/2022	-4.8U	
MW163	Lower	285–290	10/4/2022	58.9	10/4/2022	62.2	
MW165A	Upper	310–315	9/7/2022	0.56J	9/7/2022	5.3U	
MW168	Upper	307–312	5/21/2021	54.6	5/21/2021	1340	
MW169	Middle	301–306	5/21/2021	224J	5/21/2021	68.2	
MW173	Upper	314–319	9/8/2022	1U	9/8/2022	-2.7U	
MW175	Middle	299–304	9/14/2022	3180	9/14/2022	294	
MW178	Upper	309–314	12/7/2022	67.5	12/7/2022	91.4	
MW191	Middle	297–302	5/9/2022	1U	Not Sampled		
MW193	Upper	298–303	5/27/2021	1U	Not Sampled		
MW194	Middle	302–307	11/1/2022	1U	11/1/2022	-9.9U	
MW197	Upper	303–308	9/20/2022	32.5	9/20/2022	39	
MW199[e]	Lower	292–297	11/1/2022	1U	11/1/2022	-3.46U	
MW200	Middle	298–303	5/24/2021	1.04	5/24/2021	19.4	
MW201	Middle	297–302	11/1/2022	0.84J	11/1/2022	-1.15U	
MW202	Lower	289–294	11/1/2022	1U	11/1/2022	0.216U	
MW203	Middle	299–304	7/11/2022	51.6	7/11/2022	54.1	
MW205	Upper	307–312	5/26/2021	1.69J	5/26/2021	-5.45U	
MW220	Upper	310–320	10/18/2022	1U	10/18/2022	21.3U	
MW221	Upper	304–314	10/12/2022	1U	10/12/2022	12.1U	
MW222	Upper	314–324	10/12/2022	1U	10/12/2022	10.8U	
MW223	Upper	309–319	10/12/2022	1U	10/12/2022	11.2U	
MW224	Upper	310–320	10/18/2022	1U	10/18/2022	0.623U	
MW226	Lower	287–297	7/21/2022	166	7/21/2022	-0.81U	
MW227	Upper	301–311	7/21/2022	196	7/21/2022	5.62U	
MW236	Lower	290–300	5/2/2022	4.53	5/2/2022	4.67U	
MW240	Middle	290–300	5/2/2022	1.69	5/2/2022	-5.62U	
MW242	Middle	295–305	9/7/2022	3.44	9/7/2022	28.1	
MW243	Middle	293–303	9/7/2022	15.4	9/7/2022	18	
MW244	Middle	291–301	9/7/2022	2.14	9/7/2022	-0.0314U	
MW245	Middle	294–304	9/7/2022	2.91	9/7/2022	-0.421U	
MW248	Middle	289–299	9/7/2022	1.94	9/7/2022	11.1U	
MW250	Middle	293–303	9/7/2022	2.52	9/7/2022	3.94U	
MW252[e]	Lower	283–288	5/2/2022	1U	Not Sampled		
MW253A[e,f]	Lower	268–273	5/3/2022	1.03	Not Sampled		
MW255	Lower	286–291	10/4/2022	134	10/4/2022	-0.316U	
MW256	Lower	279–284	10/4/2022	108	10/4/2022	12.2	
MW258	Lower	287–292	10/3/2022	169	10/3/2022	2.92U	
MW260	Lower	284–289	10/4/2022	38.9	10/4/2022	28.4	
MW261	Lower	276–281	5/10/2022	2070	5/10/2022	1110	
MW262	Lower	278–283	12/28/2021	540	5/19/2021	218	
MW283	Lower	288–298	10/5/2022	6.97	10/5/2022	3.34U	
MW288	Lower	280–290	10/5/2022	151	10/5/2022	25.2	
MW291	Lower	288–298	10/5/2022	3.19	10/5/2022	3.8U	
MW292	Lower	276–286	10/5/2022	163	10/5/2022	9.77	
MW293A	Middle	289–299	10/5/2022	18.4	10/5/2022	5.46U	
MW328	Middle	301–306	5/12/2021	0.77J	5/12/2021	-2.1U	
MW329	Upper	303–308	5/12/2021	1.15	5/12/2021	-3.73U	
MW333	Middle	296–305	7/21/2022	2210	7/21/2022	61.2	
MW337	Middle	297–307	7/25/2022	1780	7/25/2022	219	
MW338	Middle	298–308	7/25/2022	647	7/25/2022	21.6	
MW339	Lower	277–286	12/12/2022	667	12/12/2022	32.5	
MW340	Lower	277–286	12/12/2022	3650	12/12/2022	2230	
MW341	Middle	293–303	12/6/2022	3720	12/6/2022	1540	
MW342	Middle	292–302	9/14/2022	2450	9/14/2022	807	
MW343	Lower	290–300	9/13/2022	8480	9/13/2022	11900	

Table B.1. 2021 and 2022 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Most Recent Date TCE Sample Collected[b]	TCE (µg/L)[c]	Most Recent Date Tc-99 Sample Collected[b]	Tc-99 (pCi/L)[d]	Notes
MW354	Middle	301–306	12/13/2022	3.6	12/13/2022	19U	
MW355	Lower	285–290	9/6/2022	7.01	9/6/2022	34.4	
MW356	McNairy[g]	257–262	Not Sampled		Not Sampled		
MW357	Upper	304–314	10/6/2022	2.84	10/6/2022	35.2	
MW358	Lower	285–295	10/6/2022	0.63J	10/6/2022	17.5	
MW360	Upper	310–320	10/6/2022	0.61J	10/6/2022	3.53U	
MW361	Middle	294–304	11/17/2022	1U	10/6/2022	45.1	
MW363	Upper	301–311	10/10/2022	1U	10/10/2022	-7.61U	
MW364	Lower	283–293	10/10/2022	3.01	10/10/2022	35	
MW366	Upper	304–314	10/10/2022	2.03	10/10/2022	54.9	
MW367	Lower	284–294	10/10/2022	1U	10/10/2022	-14.3 UJ	
MW369	Upper	311–321	10/11/2022	1.02	10/11/2022	56.4	
MW370	Middle	292–302	10/11/2022	1.68	10/11/2022	20.9	
MW372	Upper	301–311	10/11/2022	2.78	10/11/2022	69.7	
MW373	Lower	288–298	10/11/2022	4.13	10/11/2022	-1.78U	
MW384	Upper	287–297	10/13/2022	0.53J	10/13/2022	49.9	
MW385	Lower	303–313	10/13/2022	1U	10/13/2022	47.5	
MW387	Upper	304–314	10/13/2022	0.63J	10/13/2022	14.5U	
MW388	Middle	291–301	10/13/2022	1U	10/13/2022	90.5	
MW391	Middle	297–307	10/17/2022	3.44	10/17/2022	11.4U	
MW392	Lower	273–283	10/17/2022	12.2	10/17/2022	4.19U	
MW394	Upper	302–312	10/17/2022	7	10/17/2022	11.1U	
MW395	Middle	295–305	10/17/2022	5.62	10/17/2022	8.43U	
MW397	Lower	290–300	10/18/2022	1U	10/18/2022	23	
MW403-PRT3	Multiport[h]	272–274	12/13/2022	1.93	12/13/2022	-3.68U	
MW404-PRT4	Multiport[i]	284–286	5/27/2021	5.42	5/27/2021	-2.52U	
MW405	Multiport[j]	271-319	1/19/2022	638 (PRT4)	12/7/2022	58.1 (PRT5)	
MW406	Multiport[k]	296-342	1/19/2022	17800 (PRT1)	12/8/2022	6.29U (PRT5)	
MW407	Multiport[l]	296-342	4/27/2021	645000 (PRT1)	1/18/2022	53.4 (PRT2)	
MW408	Multiport[m]	298-320	1/19/2022	2560 (PRT3)	12/8/2022	12.1U (PRT5)	
MW409[e]	Lower	280–290	9/19/2022	1.3	Not Sampled		
MW410[e]	Lower	278–288	9/19/2022	0.62J	Not Sampled		
MW411[e]	Middle	294–304	9/26/2022	0.41J	Not Sampled		
MW414	Middle	297–307	5/19/2021	695	5/19/2021	58.7	
MW415	Lower	273–283	5/19/2021	1910	5/19/2021	33.5	
MW416	Middle	300–310	12/27/2021	320	5/19/2021	30.2	
MW417	Lower	272–282	5/19/2021	883	5/19/2021	29.2	
MW418	Middle	296–306	5/9/2022	6.53	5/9/2022	-11.8U	
MW419	Lower	281–291	5/9/2022	27.5	5/9/2022	-2.51U	
MW420	Middle	299–309	8/15/2022	1620	11/7/2022	-4.28U	
MW421	Multiport[n]	291–305	9/14/2022	38500 (PRT3)	9/14/2022	2270 (PRT1)	
MW422	Multiport[n]	290–304	9/14/2022	18900 (PRT3)	9/14/2022	21200 (PRT1)	
MW423	Multiport[n]	290–305	9/13/2022	14900 (PRT3)	9/13/2022	16400 (PRT1)	
MW424	Multiport[n]	292–306	9/14/2022	5530 (PRT3)	9/14/2022	20500 (PRT2)	
MW425	Multiport[n]	292–306	9/13/2022	2050 (PRT2)	9/13/2022	14300 (PRT3)	
MW426	Upper	304–314	11/1/2022	1U	11/1/2022	5.5U	
MW427	Lower	273–283	11/1/2022	0.48J	11/1/2022	-0.519U	
MW428	Lower	277–287	9/8/2022	2.58	9/8/2022	-0.651U	
MW429A	Upper	302–312	9/6/2022	3.41	9/6/2022	5.66U	
MW430	Lower	281–291	9/6/2022	2.76	9/6/2022	7.48U	
MW431	Lower	285–295	12/13/2022	2.38	Not Sampled		
MW432	Middle	292–302	11/1/2022	1.45	11/1/2022	0.56U	
MW433	Middle	302–305	11/1/2022	1U	11/1/2022	1.46U	
MW435	Lower	274–284	11/1/2022	0.96J	11/1/2022	3.67U	
MW439	Middle	295–297	5/20/2021	0.88J	Not Sampled		
MW441	Lower	277–279	11/1/2022	1.39	11/1/2022	4.23U	
MW442	Lower	288–291	5/21/2021	2.52	5/21/2021	4.77U	
MW443	Lower	274–277	5/21/2021	0.91J	5/21/2021	5.9U	
MW444	Lower	259–264	5/21/2021	1.03	5/21/2021	3.32U	
MW445	Middle	297–300	5/20/2021	0.65J	5/20/2021	-0.0544U	
MW447	Lower	261–266	5/20/2021	0.67J	5/20/2021	2.83U	
MW448	Middle	303–305	5/21/2021	1.33	5/21/2021	10.3U	
MW450	Lower	276–286	5/21/2021	7.73	5/21/2021	13.6U	
MW451	Upper	304–314	5/24/2021	0.37J	5/24/2021	2.99U	
MW452	Lower	280–290	11/1/2022	1U	11/1/2022	-0.67U	
MW453	Upper	306–316	5/2/2022	28.9	5/2/2022	13.8U	
MW454	Lower	284–294	5/2/2022	42.5	5/2/2022	8.09U	
MW455	Middle	300–310	12/13/2022	1.61	12/13/2022	-3.5U	
MW456	Lower	278–288	12/13/2022	8.56	12/13/2022	38.9	
MW457	Upper	305–315	9/7/2022	1.37	9/7/2022	10.6U	

Table B.1. 2021 and 2022 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Most Recent Date TCE Sample Collected[b]	TCE (µg/L)[c]	Most Recent Date Tc-99 Sample Collected[b]	Tc-99 (pCi/L)[d]	Notes
MW458	Lower	282–292	9/7/2022	2.62	9/7/2022	15.6	
MW459	Upper	306–316	9/8/2022	3.75	9/8/2022	30.9	
MW460	Lower	279–289	12/13/2022	1.94	12/13/2022	121	
MW461	Upper	307–317	9/7/2022	14.9	9/7/2022	5.52U	
MW462	Lower	287–297	9/7/2022	31.8	9/7/2022	28.2	
MW463	Middle	298–308	5/17/2022	0.85J	Not Sampled		
MW464	Lower	267–277	5/17/2022	0.71J	Not Sampled		
MW465	Middle	302–307	5/27/2021	0.92J	Not Sampled		
MW466	Middle	295–300	5/25/2021	0.69J	Not Sampled		
MW467	Upper	300–310	5/25/2021	3.13	Not Sampled		
MW468	Middle	294–299	5/25/2021	6.53	Not Sampled		
MW469	Middle	297–307	5/17/2022	1U	Not Sampled		
MW470	Lower	292–297	5/17/2022	1U	Not Sampled		
MW471	Middle	292–302	5/17/2022	1U	Not Sampled		
MW472	Lower	286–291	5/17/2022	1U	Not Sampled		
MW473[e]	Lower	289–299	5/24/2021	1U	Not Sampled		
MW474[e]	Lower	275–285	5/24/2021	1U	Not Sampled		
MW475[e]	Middle	293–303	5/24/2021	1U	Not Sampled		
MW476[e]	Lower	267–277	5/24/2021	1U	Not Sampled		
MW477	Lower	282–292	5/25/2021	0.59J	Not Sampled		
MW478	Middle	295–305	10/3/2022	241	10/3/2022	6.75U	
MW479	Upper	301–311	10/3/2022	1.16	10/3/2022	-2.13U	
MW480	Lower	283–293	10/3/2022	166	10/3/2022	33.7	
MW481	Middle	298–308	5/12/2021	1U	5/12/2021	-2.36U	
MW482	Lower	269–279	5/12/2021	66.5	5/12/2021	11.8U	
MW483[e]	Middle	294–304	5/2/2022	31.5	Not Sampled		
MW484[e]	Lower	278–288	5/2/2022	2.93	Not Sampled		
MW485[e]	Middle	295–305	5/25/2021	78.7	Not Sampled		
MW486A[c]	RGA	311-314	5/21/2021	40.9	Not Sampled		
MW487[e]	Lower	282–292	5/21/2021	5.08	Not Sampled		
MW488[e]	Middle	299–309	5/2/2022	0.34J	5/2/2022	-10.5U	
MW489	Middle	300–310	9/15/2021	41.8	5/24/2021	10.3U	
MW490	Lower	290–300	9/15/2021	33.3	5/24/2021	19U	
MW491	Upper	301–311	5/20/2021	6.38	5/20/2021	58.7	
MW492	Lower	286–296	5/20/2021	13	5/20/2021	56	
MW493	Upper	302–312	5/27/2021	1.05J	5/27/2021	21U	
MW494	Middle	290–300	5/27/2021	1.22J	5/27/2021	32.6	
MW495	Lower	268–278	10/3/2022	46.1	10/3/2022	49.9	
MW496	Lower	267–277	10/3/2022	121	10/3/2022	20.7	
MW497	Middle	300–310	9/6/2022	88.7	9/6/2022	62.8	
MW498	Lower	276–286	9/6/2022	658	9/6/2022	332	
MW499	Middle	297–307	9/6/2022	638	9/6/2022	320	
MW500	Lower	278–288	9/6/2022	477	9/6/2022	318	
MW501	Middle	299–309	9/8/2022	1U	9/8/2022	-2.71U	
MW502	Lower	282–292	9/8/2022	1.94	9/8/2022	-1.46U	
MW503	Lower	282–287	9/6/2022	11	9/6/2022	247	
MW504	Upper	315–320	9/6/2022	2.02	9/6/2022	8.47U	
MW505	Upper	312–317	12/6/2022	16.6	12/6/2022	38.3	
MW506	Middle	300–305	12/6/2022	2910	12/6/2022	50.2	
MW507	Lower	287–292	12/6/2022	170	12/6/2022	28.6	
MW524	Middle	299–309	10/3/2022	8.12	10/3/2022	6.05U	
MW525	Middle	301–311	10/5/2022	377	10/5/2022	129	
MW526	Middle	302–312	10/5/2022	1720	10/5/2022	176	
MW527	Middle	302–311	10/4/2022	7.96	10/4/2022	18.7	
MW528	Lower	291–301	10/4/2022	14	10/4/2022	90.4	
MW529	Lower	289–299	10/3/2022	791	10/3/2022	196	
MW530	Lower	285–295	10/4/2022	42.9	10/4/2022	32.4	
MW531	Lower	267–277	10/4/2022	89.6	10/4/2022	72	
MW533	Lower	282–292	10/4/2022	848	10/4/2022	43.5	
MW536	Lower	288–298	10/4/2022	22.1	10/4/2022	136	
MW537	Lower	277–287	10/4/2022	42.3	10/4/2022	132	
MW538	Middle	294–304	10/4/2022	64.2	10/4/2022	24.8	
MW539	Lower	281–291	10/4/2022	21.9	10/4/2022	24.6	
MW542	Upper	305–310	12/12/2022	1.84	Not Sampled		
MW543	Upper	304–309	12/12/2022	1.68	Not Sampled		
MW544	Upper	308–313	12/12/2022	15.8	Not Sampled		
MW545	Upper	309–314	12/12/2022	1.49	Not Sampled		
MW546	Upper	305–310	12/12/2022	82.8	Not Sampled		
MW547	Upper	305–310	12/12/2022	914	Not Sampled		
MW548	Lower	287–297	7/21/2022	4990	7/21/2022	57.1	
MW549	Upper	303–313	5/19/2021	4130J	5/19/2021	3.49U	

Table B.1. 2021 and 2022 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Most Recent Date TCE Sample Collected[b]	TCE (µg/L)[c]	Most Recent Date Tc-99 Sample Collected[b]	Tc-99 (pCi/L)[d]	Notes
MW550	Upper	297–307	5/26/2021	7260J	5/26/2021	0.439U	
MW551	Upper	298–308	5/26/2021	1320	5/26/2021	-0.634U	
MW556	Lower	279–289	10/3/2022	59.2	10/3/2022	23	
MW557	Upper	314-310	12/5/2022	10400	12/5/2022	15.1U	
MW558	Middle	303-298	12/5/2022	2310	12/5/2022	42.3	
MW559	Lower	292-287	12/5/2022	1100	12/5/2022	67.2	
MW560	Upper	312-307	12/6/2022	43.4	12/6/2022	5.92U	
MW561	Middle	301-297	12/6/2022	3050	12/6/2022	181	
MW562	Lower	290-285	12/6/2022	1460	12/6/2022	139	
MW563	Upper	314-310	12/5/2022	23600	12/5/2022	189	
MW564	Middle	305-301	12/5/2022	4840	12/5/2022	65.1	
MW565	Lower	296-292	12/5/2022	1370	12/5/2022	125	
MW566	Upper	319-314	12/6/2022	173	12/6/2022	63.6	
MW567	Middle	309-304	12/6/2022	1460	12/6/2022	51.5	
MW568	Lower	299-294	12/6/2022	8110	12/6/2022	45.9	
MW569	Upper	314-309	12/5/2022	329	12/5/2022	527	
MW570	Middle	306-302	12/5/2022	4250	12/5/2022	2440	
MW571	Lower	295-290	12/5/2022	3380	12/5/2022	1190	
MW572	Lower	296-291	12/7/2022	943	12/7/2022	124	
MW573	Lower	297-292	12/7/2022	7000	12/7/2022	84.1	
MW574	Upper	314-309	12/7/2022	1590	12/7/2022	974	
MW575	Upper	309-304	7/6/2022	1100	Not Sampled		
MW576	Middle	304-299	7/6/2022	3760	Not Sampled		
MW577	Upper	309-304	7/6/2022	138	Not Sampled		
MW578	Middle	304-299	7/6/2022	80.8	Not Sampled		
MW579	Upper	309-304	7/6/2022	22.3	Not Sampled		
MW580	Middle	304-299	7/6/2022	14.7	Not Sampled		
MW581	Upper	310-305	7/6/2022	14.9	Not Sampled		
MW582	Upper	310-305	7/6/2022	76	Not Sampled		
MW586	Middle	305-300	7/6/2022	900	Not Sampled		
MW63	Upper	307–312	9/6/2022	13.6	9/6/2022	15.2	
MW65	Lower	279–284	9/6/2022	7.35	9/6/2022	21.8	
MW66	Upper	308–313	9/19/2022	314	9/6/2022	233	
MW67	Middle	302–307	7/25/2022	1030	7/25/2022	86.5	
MW68	Lower	275–280	6/8/2022	64.5J	6/8/2022	18.6U	
MW71	Upper	306-310	6/8/2022	2.12J	6/8/2022	-1.01U	
MW76	Middle	295–305	7/21/2022	254	7/21/2022	10.9U	
MW84A	Middle	297–307	7/11/2022	6570	11/7/2022	64	
MW84	Middle	296–307	Not Sampled		Not Sampled		abandoned 2019
MW86	Lower	287–298	7/25/2022	7440	7/25/2022	16.6U	
MW87A	RGA	298–308	8/15/2022	1400	11/7/2022	8.59U	
MW87	Middle	298–309	Not Sampled		Not Sampled		abandoned 2019
MW89	Lower	285–295	7/25/2022	244	7/25/2022	6.61U	
MW90A	Upper	301–311	8/15/2022	222	11/7/2022	22.3	
MW92	Lower	282–293	7/25/2022	28.2J	7/25/2022	9.48U	
MW93A	RGA	296–306	8/15/2022	1630	11/7/2022	15U	
MW93	Middle	295–305	Not Sampled		Not Sampled		abandoned 2019
MW95A	Lower	288–298	7/21/2022	2180	7/21/2022	-0.876U	
MW98	Middle	293–303	9/20/2022	1.27	9/20/2022	36.7	
MW99	Middle	295–305	5/17/2022	0.36J	Not Sampled		
R114[e]	Unknown[o]	—	11/2/2022	1U	Not Sampled		East of map extent
R13[e]	Unknown[o]	—	11/3/2022	1U	11/3/2022	4.59U	
R10	Unknown[o]	—	11/3/2022	1U	—	—	West of map extent
R14[e]	Unknown[o]	—	11/3/2022	1U	11/3/2022	7.99U	
R20[e]	RGA[o]	—	11/2/2022	1U	Not Sampled		
R21[e]	Unknown[p]	—	11/2/2022	1U	Not Sampled		
R245[e]	Unknown[p]	—	11/2/2022	1U	11/2/2022	-2.75U	
R26[e]	Unknown[p]	—	11/3/2022	1U	11/3/2022	1.41U	West of map extent
R2[e]	Unknown[p]	—	11/2/2022	3.98	11/2/2022	5.43U	
R40	Unknown[p]	—	12/19/2022	1U	—	—	West of map extent
R424[e]	RGA-Multiport[p]	304–306	12/19/2022	2.24 (PRT1)	12/19/2022	9.82U (PRT1)	
R53[e]	Unknown[o]	—	11/2/2022	1U	11/2/2022	0.543U	
R83[e]	Unknown[o]	—	11/2/2022	1U	Not Sampled		
R90[e]	Unknown[o]	—	11/2/2022	1U	Not Sampled		East of map extent
R9[e]	Unknown[o]	—	11/2/2022	1U	Not Sampled		
R302[e]	RGA[o]	—	11/2/2022	1U	Not Sampled		
SP234/EW234	Extraction Well[q]	286-301	12/12/2022	313	12/12/2022	55.3	
SP235/EW235	Extraction Well[q]	283-298	12/12/2022	106	12/12/2022	25	
HV217/EW232	Extraction Well[q]	283-303	10/4/2022	388	10/4/2022	184	

Table B.1. 2021 and 2022 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Most Recent Date TCE Sample Collected[b]	TCE (µg/L)[c]	Most Recent Date Tc-99 Sample Collected[b]	Tc-99 (pCi/L)[d]	Notes
HV222/EW233	Extraction Well[q]	276-296	10/4/2022	1290	10/4/2022	451	
LBCSP5[r]	Surface Water Seep	—	4/28/2022	0.4J	Not Sampled		

Notes

[a] Screened intervals are approximate.

[b] For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days) and the maximum result from the comparison is presented in this table. This selection criterion may result in different ports select for TCE or Tc-99.

[c] TCE results of "1U" indicate the compound analyzed for, but not detected at or below, the lowest concentration reported; J indicates the concentration is estimated.

[d] Tc-99 results with "U" indicate "U" the value is reported < 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.

[e] Location designated as 'Private-Residential' or Residential Well in annual Environmental Monitoring Plans.

[f] MW253A RGA monitored zone and screened interval zone are assumed to be the same as the original well, MW253.

[g] MW initial lithologic log indicated well was completed in the RGA; however, the lithology has been reinterpreted to show a higher top of McNairy.

[h] MW403 was sampled from Port 3 during 2021–2022. Port 3 screen interval is shown.

[i] MW404 was sampled from Port 4 during 2021–2022. Port 4 screen interval is shown.

[j] MW405 was sampled from Ports 2 through 6 during 2021–2022. The screen interval shown encompasses Ports 2 through 6.

[k] MW406 was sampled from Ports 1 through 5 during 2021–2022. The screen interval shown encompasses all five ports.

[l] MW407 was sampled from Ports 1 through 5 during 2021–2022. The screen interval shown encompasses all five ports.

[m] MW408 was sampled from Ports 2 through 5 during 2021–2022. The screen interval shown encompasses Ports 2 through 5.

[n] MW421–MW425 were sampled from all three ports during 2021–2022. The screen interval shown encompasses all three ports.

[o] Residential wells are assumed to be completed in the Upper RGA unless known to be otherwise.

[p] R424 was sampled from Ports 1 and 3 during 2021–2022. The screen interval shown encompasses Ports 1 through 3.

[q] Extraction wells are screened across the RGA.

[r] LBCSP5 = Little Bayou Creek Surface Water Seep

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APPENDIX C

2022 PLUME MAPS

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FIGURES

C.1. 2022 TCE Plume—Regional Gravel Aquifer C-5
C.2. 2022 Tc-99 Plume—Regional Gravel Aquifer C-6

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Notes:
1. Data from the most recent 2022 sampling event used except where noted.
2a. For well clusters completed as multiple depths, all wells are labeled with their most recent sampling result. The maximum of the values for the well cluster was used for contouring.
2b. For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days) and the maximum result from the comparison was used for contouring and labeling. This selection criterion may result in different ports selected for TCE or Tc-99.

Ohio River

MW146 11/1/2022 (1U)
MW439 5/20/2021 (0.88J)
MW433 11/1/2022 (1U)
MW441 11/1/2022 (1.39)
MW435 11/1/2022 (0.96J)
LBCSP5 4/28/2022 (0.4J)
MW443 5/21/2021 (0.91J)
MW442 5/21/2021 (2.52)
MW444 5/21/2021 (1.03)
MW450 5/21/2021 (7.73)
MW445 5/20/2021 (0.65J)
MW448 5/21/2021 (1.33)
MW447 5/20/2021 (0.67J)
R83 11/2/2022 (1U)
R21 11/2/2022 (1U)
MW474 5/24/2021 (1U)
MW473 5/24/2021 (1U)
MW475 5/24/2021 (1U)
MW476 5/24/2021 (1U)
R245 11/2/2022 (1U)
MW199 11/1/2022 (1U)
MW201 11/1/2022 (0.84J)
MW135 9/21/2022 (0.4J)
MW463 5/17/2022 (0.85J)
MW464 5/17/2022 (0.71J)
MW465 5/27/2021 (0.92J)
MW467 5/25/2021 (3.13)
MW466 5/25/2021 (0.69J)
MW468 5/25/2021 (6.53)
MW469 5/17/2022 (1U)
MW470 5/17/2022 (1U)
MW471 5/17/2022 (1U)
MW472 5/17/2022 (1U)
MW411 9/26/2022 (0.41J)
R14 11/3/2022 (1U)
MW236 5/2/2022 (4.53)
MW489 9/15/2021 (41.8)
MW490 9/15/2021 (33.3)
MW492 5/20/2021 (13)
MW491 5/20/2021 (6.38)
MW202 11/1/2022 (1U)
MW240 5/2/2022 (1.69)
MW98 9/20/2022 (1.27)
MW493 5/27/2021 (1.05J)
R13 11/3/2022 (1U)
MW494 5/27/2021 (1.22J)
MW361 11/17/2022 (1U)
MW360 10/6/2022 (0.61J)
MW364 10/10/2022 (3.01)
MW357 10/6/2022 (2.84)
MW363 10/10/2022 (1U)
MW358 10/6/2022 (0.63J)
MW139 5/9/2022 (1.44)
MW477 5/25/2021 (0.59J)
MW99 5/17/2022 (0.36J)
MW100 5/9/2022 (1U)
MW125 5/2/2022 (24.4)
MW367 10/10/2022 (1U)
MW366 10/10/2022 (2.03)
MW486A 5/21/2021 (40.9)
MW485 5/25/2021 (78.7)
MW148 5/21/2021 (7.51)
R20 11/2/2022 (1U)
MW483 5/2/2022 (31.5)
MW484 5/2/2022 (2.93)
MW487 5/21/2021 (5.08)
MW488 5/2/2022 (0.34J)
MW252 5/2/2022 (1U)
MW410 9/19/2022 (0.62J)
MW373 10/11/2022 (4.13)
MW370 10/11/2022 (1.68)
MW372 10/11/2022 (2.78)
MW392 10/17/2022 (12.2)
MW369 10/11/2022 (1.02)
MW200 5/24/2021 (1.04)
MW388 10/13/2022 (1U)
MW391 10/17/2022 (3.44)
MW419 5/9/2022 (27.5)
MW418 5/9/2022 (6.53)
MW387 10/13/2022 (0.63J)
MW452 11/1/2022 (1U)
R2 11/2/2022 (3.98)
MW451 5/24/2021 (0.37J)
MW384 10/13/2022 (0.53J)
MW221 10/12/2022 (1U)
MW385 10/13/2022 (1U)
MW253A 5/3/2022 (1.03)
MW409 9/19/2022 (1.3)
MW134 11/1/2022 (1U)
MW454 5/2/2022 (42.5)
MW453 5/2/2022 (28.9)
MW223 10/12/2022 (1U)
MW395 10/17/2022 (5.62)
MW222 10/12/2022 (1U)
MW394 10/17/2022 (7)
MW224 10/18/2022 (1U)
MW220 10/18/2022 (1U)
MW193 5/27/2021 (1U)
MW197 9/20/2022 (32.5)
MW397 10/18/2022 (1U)
MW150 5/3/2022 (1U)
MW456 12/13/2022 (8.56)
MW455 12/13/2022 (1.61)
MW458 9/7/2022 (2.62)
MW459 9/8/2022 (3.75)
MW501 9/8/2022 (1U)
MW457 9/7/2022 (1.37)
MW460 12/13/2022 (1.94)
MW502 9/8/2022 (1.94)
MW461 9/7/2022 (14.9)
MW194 11/1/2022 (1U)
MW243 9/7/2022 (15.4)
MW462 9/7/2022 (31.8)
MW242 9/7/2022 (3.44)
MW244 9/7/2022 (2.14)
MW498 9/6/2022 (658)
MW500 9/6/2022 (477)
MW248 9/7/2022 (1.94)
MW499 9/6/2022 (638)
MW481 5/12/2021 (1U)
MW250 9/7/2022 (2.52)
MW504 9/6/2022 (2.02)
MW482 5/12/2021 (66.5)
MW291 10/5/2022 (3.19)
MW106A 11/1/2022 (3.42)
HV217/EW232 10/4/2022 (388)
MW165A 9/7/2022 (0.56J)
MW293A 10/5/2022 (18.4)
MW283 10/5/2022 (6.97)
MW245 9/7/2022 (2.91)
MW497 9/6/2022 (88.7)
MW503 9/6/2022 (11)
MW496 10/3/2022 (121)
MW126 10/5/2022 (30)
R53 11/2/2022 (1U)
MW63 9/6/2022 (13.6)
HV222/EW233 10/4/2022 (1290)
MW173 9/8/2022 (1U)
MW355 9/6/2022 (7.01)
MW124 10/5/2022 (67.3)
MW432 11/1/2022 (1.45)
MW65 9/6/2022 (7.35)
MW145 10/3/2022 (29.3)
MW191 5/9/2022 (1U)
MW66 9/19/2022 (314)
MW144 10/3/2022 (95.4)
MW288 10/5/2022 (151)
MW339 12/12/2022 (667)
MW531 10/4/2022 (89.6)
MW495 10/3/2022 (46.1)
MW292 10/5/2022 (163)
MW426 11/1/2022 (1U)
MW340 12/12/2022 (3650)
MW169 5/21/2021 (224J)
MW427 11/1/2022 (0.48J)
MW431 12/13/2022 (2.38)
MW262 12/28/2021 (540)
MW205 5/26/2021 (1.69J)
MW261 5/10/2022 (2070)
MW429A 9/6/2022 (3.41)
MW480 10/3/2022 (166)
MW428 9/8/2022 (2.58)
MW430 9/6/2022 (2.76)
MW524 10/3/2022 (8.12)
MW260 10/4/2022 (38.9)
MW533 10/4/2022 (848)
MW479 10/3/2022 (1.16)
MW354 12/13/2022 (3.6)
SP234/EW234 12/12/2022 (313)
MW525 10/5/2022 (377)
MW556 10/3/2022 (59.2)
MW403-PRT3 12/13/2022 (1.93)
MW526 10/5/2022 (1720)
MW404-PRT4 5/27/2021 (5.42)
MW163 10/4/2022 (58.9)
MW329 5/12/2021 (1.15)
MW542 12/12/2022 (1.84)
MW527 10/4/2022 (7.96)
SP235/EW235 12/12/2022 (106)
MW478 10/3/2022 (241)
MW161 12/12/2022 (77.9)
MW528 10/4/2022 (14)
MW536 10/4/2022 (22.1)
MW258 10/3/2022 (169)
MW545 12/12/2022 (1.49)
MW537 10/4/2022 (42.3)
MW547 12/12/2022 (914)
MW529 10/3/2022 (791)
MW256 10/4/2022 (108)
MW543 12/12/2022 (1.68)
MW539 10/4/2022 (21.9)
MW544 12/12/2022 (15.8)
MW530 10/4/2022 (42.9)
MW328 5/12/2021 (0.77J)
MW538 10/4/2022 (64.2)
MW255 10/4/2022 (134)
MW546 12/12/2022 (82.8)
MW582 7/6/2022 (76)
MW68 6/8/2022 (64.5J)
MW576 7/6/2022 (3760)
MW586 7/6/2022 (900)
MW71 6/8/2022 (2.12J)
MW575 7/6/2022 (1100)
MW203 7/11/2022 (51.6)
MW579 7/6/2022 (22.3)
MW581 7/6/2022 (14.9)
MW580 7/6/2022 (14.7)
MW578 7/6/2022 (80.8)
MW577 7/6/2022 (138)
MW103 12/27/2021 (1.7)
R9 11/2/2022 (1U)

See Inset A
See Inset B

Inset A
MW67 7/25/2022 (1030)
MW84A 7/11/2022 (6570)
MW86 7/25/2022 (7440)
MW338 7/25/2022 (647)
MW87A 8/15/2022 (1400)
MW337 7/25/2022 (1780)
MW89 7/25/2022 (244)
MW90A 8/15/2022 (222)
MW92 7/25/2022 (28.2J)
MW333 7/21/2022 (2210)
MW420 8/15/2022 (1620)
MW548 7/21/2022 (4990)
MW93A 8/15/2022 (1630)
MW76 7/21/2022 (254)
MW95A 7/21/2022 (2180)
MW415 5/19/2021 (1910)
MW414 5/19/2021 (695)
MW227 7/21/2022 (196)
MW551 5/26/2021 (1320)
MW226 7/21/2022 (166)
MW550 5/26/2021 (7260J)
MW417 5/19/2021 (883)
MW416 12/27/2021 (320)

Inset B
MW168 5/21/2021 (54.6)
MW422-PRT3 9/14/2022 (18900)
MW341 12/6/2022 (3720)
MW423-PRT3 9/13/2022 (14900)
MW343 9/13/2022 (8480)
MW421-PRT3 9/14/2022 (38500)
MW178 12/7/2022 (67.5)
MW424-PRT3 9/14/2022 (5530)
MW573 12/7/2022 (7000)
MW425-PRT2 9/13/2022 (2050)
MW569 12/5/2022 (329)
MW570 12/5/2022 (4250)
MW574 12/7/2022 (1590)
MW342 9/14/2022 (2450)
MW571 12/5/2022 (3380)
MW567 12/6/2022 (1460)
MW175 9/14/2022 (3180)
MW566 12/6/2022 (173)
MW568 12/6/2022 (8110)
MW572 12/7/2022 (943)
MW563 12/5/2022 (23600)
MW406-PRT2 1/19/2022 (7820)
MW564 12/5/2022 (4840)
MW155 12/6/2022 (3320)
MW565 12/5/2022 (1370)
MW156 12/6/2022 (3640)
MW560 12/6/2022 (43.4)
MW561 12/6/2022 (3050)
MW407-PRT2 1/18/2022 (272000)
MW562 12/6/2022 (1460)
MW408-PRT5 1/19/2022 (2560)
MW557 12/5/2022 (10400)
MW405-PRT4 1/19/2022 (638)
MW558 12/5/2022 (2310)
MW505 12/6/2022 (16.6)
MW559 12/5/2022 (1100)
MW506 12/6/2022 (2910)
MW507 12/6/2022 (170)

N
TRUE
20°
PLANT
Feet
600 300 0 600 1,200 1,800

2022 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

- Upper RGA Well
- Middle RGA Well
- Lower RGA Well
- Multizone RGA Well
- Extraction Well
- Seep Monitoring Location

- RGA Well outside Plume Concentration Field showing TCE > 1 µg/L
- Surface Water Course Centerline
- DOE Property Boundary
- Roadways
- 229 Boundary

- Limited
- Water Policy

MW100 5/9/2022 (1U) - Monitoring Well Identification
Date of Sample and Sample Value (TCE Concentration in µg/L)
U = Compound analyzed for, but not detected at or below, the lowest concentration reported
J = Concentration is estimated

Note: Contours defining >10,000 µg/L used historical records in addition to recent groundwater monitoring results.

MAP SOURCE INFORMATION
Map Generation Date and Location - 4/18/2023 Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_C01_2022PlumesTCER1.mxd
Monitoring and Extraction Well, RGA Well outside Plume Concentration Field showing TCE > 1 µg/L, and Seep Monitoring Layer Location: Geosyntec\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100000.shp\2022_TCE_10000_100000.shp\2022_TCE_1000_10000.shp\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.

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

FOUR RIVERS NUCLEAR PARTNERSHIP, LLC

\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_C01_2022PlumesTCER1.mxd 4/18/2023

Figure C.1. 2022 TCE Plume–Regional Gravel Aquifer

Notes:
1. Data from the most recent 2022 sampling event used except where noted.
2a. For well clusters completed as multiple depths, all wells are labeled with their most recent sampling result. The maximum of the values for the well cluster was used for contouring.
2b. For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days) and the maximum result from the comparison was used for contouring and labeling. This selection criterion may result in different ports selected for TCE or Tc-99.

Ohio River

MW146 11/1/2022 (-2.41U)
MW441 11/1/2022 (4.23U)
MW433 11/1/2022 (1.46U)
MW435 11/1/2022 (3.67U)
MW444 5/21/2021 (3.32U)
MW443 5/21/2021 (5.9U)
MW442 5/21/2021 (4.77U)
MW450 5/21/2021 (13.6U)
MW445 5/20/2021 (-0.0544U)
MW448 5/21/2021 (10.3U)
MW447 5/20/2021 (2.83U)
R245 11/2/2022 (-2.75U)
MW199 11/1/2022 (-3.46U)
MW201 11/1/2022 (-1.15U)
MW135 9/21/2022 (58.4)
R14 11/3/2022 (7.99U)
MW489 5/24/2021 (10.3U)
MW202 11/1/2022 (0.216U)
MW236 5/2/2022 (4.67U)
MW490 5/24/2021 (19U)
MW492 5/20/2021 (56)
MW240 5/2/2022 (-5.62U)
MW491 5/20/2021 (58.7)
MW98 9/20/2022 (36.7)
MW493 5/27/2021 (21U)
MW360 10/6/2022 (3.53U)
MW494 5/27/2021 (32.6)
MW361 10/6/2022 (45.1)
MW364 10/10/2022 (35)
MW357 10/6/2022 (35.2)
MW363 10/10/2022 (-7.61U)
R13 11/3/2022 (4.59U)
MW358 10/6/2022 (17.5)
MW367 10/10/2022 (-14.3U)
MW139 5/9/2022 (3.15U)
MW366 10/10/2022 (54.9)
MW125 5/2/2022 (25.5)
MW488 5/2/2022 (-10.5U)
MW67 7/25/2022 (86.5)
MW84A 11/7/2022 (64)
MW86 7/25/2022 (16.6U)
MW87A 11/7/2022 (8.59U)
MW338 7/25/2022 (21.6)
MW337 7/25/2022 (219)
MW89 7/25/2022 (6.61U)
MW90A 11/7/2022 (22.3)
MW92 7/25/2022 (9.48U)
MW333 7/21/2022 (61.2)
MW420 11/7/2022 (-4.28U)
MW95A 7/21/2022 (-0.876U)
MW415 5/19/2021 (33.5)
MW548 7/21/2022 (57.1)
MW76 7/21/2022 (10.9U)
MW93A 11/7/2022 (15U)
MW414 5/19/2021 (58.7)
MW227 7/21/2022 (5.62U)
MW226 7/21/2022 (-0.81U)
MW417 5/19/2021 (29.2)
MW551 5/26/2021 (-0.634U)
MW550 5/26/2021 (0.439U)
MW416 5/19/2021 (30.2)
Inset A
MW373 10/11/2022 (-1.78U)
MW370 10/11/2022 (20.9)
MW372 10/11/2022 (69.7)
MW369 10/11/2022 (56.4)
MW391 10/17/2022 (11.4U)
MW200 5/24/2021 (19.4)
MW387 10/13/2022 (14.5U)
MW392 10/17/2022 (4.19U)
MW419 5/9/2022 (-2.51U)
MW388 10/13/2022 (90.5)
MW221 10/12/2022 (12.1U)
MW418 5/9/2022 (-11.8U)
MW451 5/24/2021 (2.99U)
R2 11/2/2022 (5.43U)
MW452 11/1/2022 (-0.67U)
MW384 10/13/2022 (49.9)
MW222 10/12/2022 (10.8U)
MW224 10/18/2022 (0.623U)
MW134 11/1/2022 (2.22U)
MW454 5/2/2022 (8.09U)
MW453 5/2/2022 (13.8U)
MW385 10/13/2022 (47.5)
MW223 10/12/2022 (11.2U)
MW395 10/17/2022 (8.43U)
MW394 10/17/2022 (11.1U)
MW220 10/18/2022 (21.3U)
MW397 10/18/2022 (23)
MW197 9/20/2022 (39)
MW456 12/13/2022 (38.9)
MW457 9/7/2022 (10.6U)
MW455 12/13/2022 (-3.5U)
MW458 9/7/2022 (15.6)
MW459 9/8/2022 (30.9)
MW460 12/13/2022 (121)
MW150 5/3/2022 (-10.1U)
MW194 11/1/2022 (-9.9U)
MW502 9/8/2022 (-1.46U)
MW461 9/7/2022 (5.52U)
MW501 9/8/2022 (-2.71U)
MW462 9/7/2022 (28.2)
MW242 9/7/2022 (28.1)
MW243 9/7/2022 (18)
MW500 9/6/2022 (318)
MW244 9/7/2022 (-0.0314U)
MW248 9/7/2022 (11.1U)
MW499 9/6/2022 (320)
MW250 9/7/2022 (3.94U)
HV217/EW232 10/4/2022 (184)
MW481 5/12/2021 (-2.36U)
MW245 9/7/2022 (-0.421U)
MW504 9/6/2022 (8.47U)
MW291 10/5/2022 (3.8U)
MW293A 10/5/2022 (5.46U)
MW106A 11/1/2022 (3.08U)
MW497 9/6/2022 (62.8)
MW503 9/6/2022 (247)
MW165A 9/7/2022 (5.3U)
MW355 9/6/2022 (34.4)
MW496 10/3/2022 (20.7)
MW482 5/12/2021 (11.8U)
MW283 10/5/2022 (3.34U)
MW63 9/6/2022 (15.2)
MW498 9/6/2022 (332)
HV222/EW233 10/4/2022 (451)
MW173 9/8/2022 (-2.7U)
R53 11/2/2022 (0.543U)
MW65 9/6/2022 (21.8)
MW145 10/3/2022 (31.9)
MW288 10/5/2022 (25.2)
MW126 10/5/2022 (2.22U)
MW124 10/5/2022 (3.78U)
MW432 11/1/2022 (0.56U)
MW66 9/6/2022 (233)
MW339 12/12/2022 (32.5)
MW144 10/3/2022 (55)
MW426 11/1/2022 (5.5U)
MW427 11/1/2022 (-0.519U)
MW340 12/12/2022 (2230)
MW495 10/3/2022 (49.9)
MW292 10/5/2022 (9.77)
MW261 5/10/2022 (1110)
MW531 10/4/2022 (72)
MW205 5/26/2021 (-5.45U)
MW428 9/8/2022 (-0.651U)
MW169 5/21/2021 (68.2)
MW429A 9/6/2022 (5.66U)
MW480 10/3/2022 (33.7)
MW262 5/19/2021 (218)
MW354 12/13/2022 (19U)
MW430 9/6/2022 (7.48U)
MW524 10/3/2022 (6.05U)
MW260 10/4/2022 (28.4)
MW479 10/3/2022 (-2.13U)
MW533 10/4/2022 (43.5)
SP234/EW234 12/12/2022 (55.3)
MW525 10/5/2022 (129)
MW556 10/3/2022 (23)
MW403-PRT3 12/13/2022 (-3.68U)
MW526 10/5/2022 (176)
MW404-PRT4 5/27/2021 (-2.52U)
MW329 5/12/2021 (-3.73U)
MW163 10/4/2022 (62.2)
See Inset A
MW527 10/4/2022 (18.7)
MW536 10/4/2022 (136)
MW478 10/3/2022 (6.75U)
SP235/EW235 12/12/2022 (25)
MW528 10/4/2022 (90.4)
MW256 10/4/2022 (12.2)
MW258 10/3/2022 (2.92U)
MW161 5/10/2022 (-4.8U)
MW549 5/19/2021 (3.49U)
MW537 10/4/2022 (132)
MW529 10/3/2022 (196)
See Inset B
MW538 10/4/2022 (24.8)
MW255 10/4/2022 (-0.316U)
MW530 10/4/2022 (32.4)
MW539 10/4/2022 (24.6)
MW328 5/12/2021 (-2.1U)
MW203 7/11/2022 (54.1)
MW71 6/8/2022 (-1.01U)
MW68 6/8/2022 (18.6U)
MW103 5/12/2021 (-5.08U)
MW168 5/21/2021 (1340)
MW422-PRT1 9/14/2022 (21200)
MW423-PRT1 9/13/2022 (16400)
MW421-PRT1 9/14/2022 (2270)
MW341 12/6/2022 (1540)
MW343 9/13/2022 (11900)
MW178 12/7/2022 (91.4)
MW424-PRT2 9/14/2022 (20500)
MW573 12/7/2022 (84.1)
MW425-PRT3 9/13/2022 (14300)
MW569 12/5/2022 (527)
MW574 12/7/2022 (974)
MW566 12/6/2022 (63.6)
MW570 12/5/2022 (2440)
MW342 9/14/2022 (807)
MW571 12/5/2022 (1190)
MW567 12/6/2022 (51.5)
MW572 12/7/2022 (124)
MW568 12/6/2022 (45.9)
MW175 9/14/2022 (294)
MW563 12/5/2022 (189)
MW405-PRT5 12/7/2022 (58.1)
MW564 12/5/2022 (65.1)
MW155 12/6/2022 (90.9)
MW560 12/6/2022 (5.92U)
MW565 12/5/2022 (125)
MW561 12/6/2022 (181)
MW156 12/6/2022 (-1.76U)
MW562 12/6/2022 (139)
MW406-PRT5 12/8/2022 (6.29U)
MW557 12/5/2022 (15.1U)
MW407-PRT2 1/18/2022 (53.4)
MW558 12/5/2022 (42.3)
MW408-PRT5 12/8/2022 (12.1U)
MW505 12/6/2022 (38.3)
MW559 12/5/2022 (67.2)
MW506 12/6/2022 (50.2)
MW507 12/6/2022 (28.6)
Inset B

N
600 300 0 600 1,200 1,800 Feet

2022 Tc-99 Plume Concentration Fields
- 900 - 1,930 pCi/L
- 1,930 - 3790 pCi/L
- ≥ 3790 pCi/L

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

- Surface Water Course Centerline
- DOE Property Boundary
- Roadways
- 229 Boundary

- Limited Area
- Water Policy Area

MW242 9/7/2022 (28.1) - Monitoring Well Identification; Date of Sample and Sample Value (Tc-99 Concentration in pCi/L)
U = Compound analyzed for but not detected at or below the lowest concentration reported
UJ = Not detected and result estimated

MAP SOURCE INFORMATION
Map Generation Date and Location - 3/2/2023 Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_C02_2022PlumesTc99R1.mxd
Monitoring and Extraction Well Layer Location: Geosyntecfedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_Tc-99_Most_Recent.shp
2022 Tc-99 Plume Concentration Fields : Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_Tc99_Above_3790.shp\2022_Tc99_1930_3790.shp\2022_Tc99_900_1930.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.

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

FOUR RIVERS NUCLEAR PARTNERSHIP, LLC

Figure C.2. 2022 Tc-99 Plume–Regional Gravel Aquifer

APPENDIX D

NORTHEAST PLUME TRANSECT WELL QUARTERLY SAMPLING RESULTS FOR TRICHLOROETHENE

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Box 2

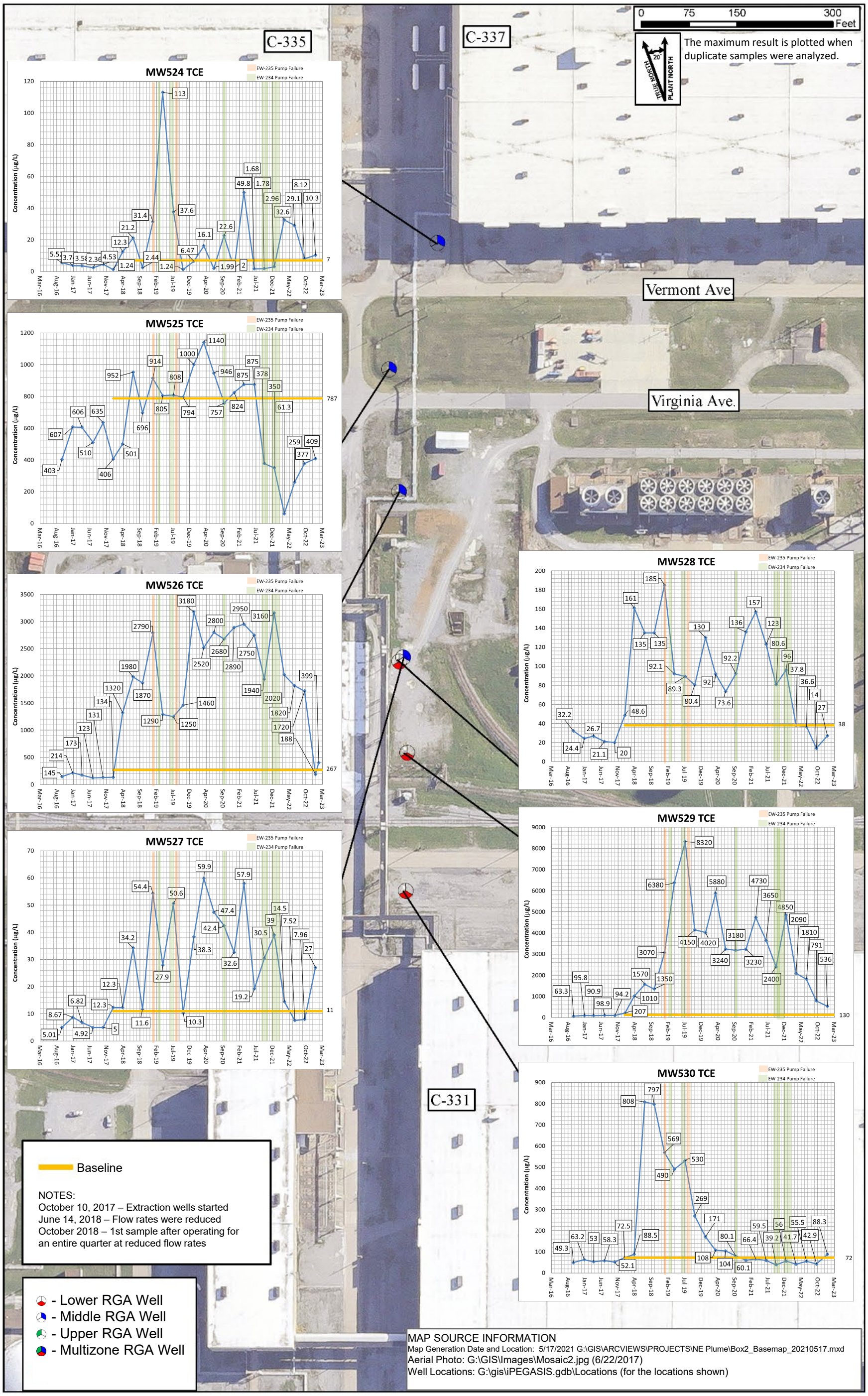

Figure D.1. Northeast Plume Transect Well Quarterly Sampling Results Trichloroethene

Box 2

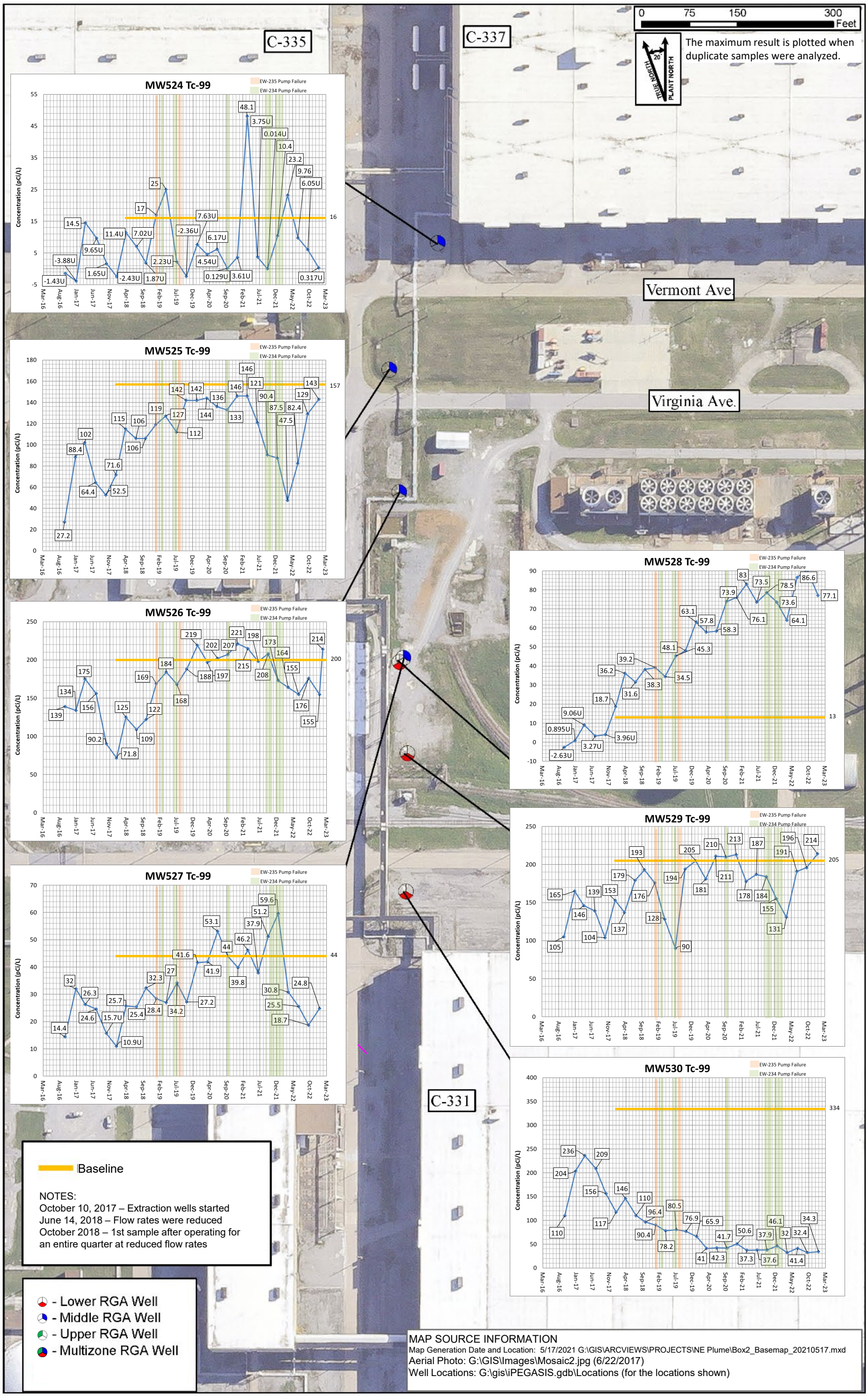

Figure D.2. Northeast Plume Transect Well Quarterly Sampling Results Technetium-99

FRNP-RPT-0273 Errata

Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2022 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

FOUR RIVERS NUCLEAR PARTNERSHIP, LLC

This document is approved for public release per review by:

FRNP Classification Support _____ Date _____

FRNP-RPT-0273 Errata

Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2022 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—June 2023

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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

AIP	agreement in principle
amsl	above mean sea level
CSM	conceptual site model
CY	calendar year
DOE	U.S. Department of Energy
EMP	environmental monitoring plan
EPA	U.S. Environmental Protection Agency
EW	extraction well
FR	*Federal Register*
FRNP	Four Rivers Nuclear Partnership, LLC
KDEP	Kentucky Department for Environmental Protection
MCL	maximum contaminant level
MW	monitoring well
N/A	not applicable
NEPCS	Northeast Plume Containment System
OREIS	Oak Ridge Environmental Information System
OU	operable unit
PEGASIS	Portsmouth/Paducah Project Office Environmental Geographic Analytical Spatial Information System
PGDP	Paducah Gaseous Diffusion Plant
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 (CY) 2022 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 (DOE) 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 CY 2022. For wells that were not sampled in 2022, the most recent sample result from 2021 has been used. Because these plume maps are based on the most recent values for 2022 or 2021, 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 2021 to 2022 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) within the plumes.[1] These maps show plots of isoconcentration lines and measured contaminant concentrations. Maps of TCE degradation products are not included because their detection often is masked by higher TCE concentrations in groundwater samples and the plumes of TCE degradation products are overlain by the TCE plumes. In the 2021–2022 dataset, no TCE degradation product was detected at a concentration above its MCL outside the area overlain by the TCE plumes. Any calculation of human health risk estimates based upon mapped contaminant concentrations should be performed by a qualified risk assessor because of the uncertainties in the concentrations of TCE breakdown products, some of which are unknown due to the inability to measure these concentrations in areas where TCE concentrations are very high.

The PGDP groundwater plume maps are revised every two years to: (i) provide a basis for timely incorporation of routine groundwater monitoring and characterization data, (ii) demonstrate the progress of groundwater cleanup to date, and (iii) facilitate planning to optimize the site groundwater cleanup. The plume maps also complement the reporting of environmental monitoring plan (EMP) results 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 DOE Environmental Information Center (i.e., https://eic.pad.pppo.gov).

The 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. TCE and Tc-99 analyses of groundwater samples collected by DOE that were rejected during data validation, verification, or

[1] For Tc-99, 900 pCi/L defines the lower plume limit. The value derived by the U.S. Environmental Protection Agency (EPA) from the 4 mrem/year MCL for Tc-99 is 900 pCi/L (see https://www.epa.gov/system/files/documents/2021-08/compliance-radionuclidesindw.pdf). An alternate value derived by the EPA from the 4 mrem/year MCL is 3,790 pCi/L and was proposed in the July 18, 1991, *Federal Register (FR)*, http://nepis.epa.gov (document number 570-Z-91-049). Table A.9 of the *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plan, Paducah, Kentucky, Volume 1, Human Health* includes the Tc-99 dose-based groundwater screening levels resulting in a 4 mrem/year dose based upon more recent dosimetry (DOE 2022).

assessment were not used in development of this report. These analyses are generated following the quality assurance project plan in the applicable EMP (FRNP 2020, FRNP 2021a). Appendix A contains tables and trend charts of TCE and Tc-99 sampling results collected for the last 10 years and plume maps showing the maximum values observed during 2021 and 2022. Appendix B contains the most recent TCE and Tc-99 values from 2021 and 2022 from PGDP RGA monitoring wells (MWs). These concentrations were used to develop Figure 1 through Figure 10 as well as the large-scale maps of the 2022 plume maps showing most recent concentrations in 2021 and 2022 provided in Appendix C.

The isoconcentration contours of contaminant concentrations depicted on the maps presented in Section 4 and the large scale plume maps in Appendix C are based on the distribution of contaminant concentrations most recently observed in 2021 and 2022 and knowledge of the site conceptual model. 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 (AIP) grant. AIP data are used semiquantitatively in the preparation of the report. In general, the MW and residential well sampling conducted under the AIP program has produced results that are similar to those obtained by DOE. For the reporting period, the AIP program sampled ten MWs for TCE and four seeps and six MWs for Tc-99 that were not sampled by DOE. The AIP data from 2021–2022 are generally consistent with results from samples collected by DOE from nearby MWs; therefore, no adjustment has been made to the interpretation of the plumes based on the AIP data. To support interpretation of plume geometries, potentiometric surface maps for the RGA were developed using synoptic water level measurements collected in August 2021 and August 2022 to evaluate groundwater flow direction. These potentiometric maps are presented in Section 5.

2. DATA ANALYSIS METHODOLOGY

The TCE and Tc-99 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 (i.e., measurements, geographic) for Paducah projects. See Table B.1 in Appendix B for the 2021 to 2022 TCE and Tc-99 results in RGA wells used to create the 2022 TCE and Tc-99 plume maps. Data collected by DOE contractors, following consistent quality assurance and sampling protocols, are used so that the data are comparable to previous reports. Data are made available to the public through the DOE Portsmouth/Paducah Project Office Environmental Geographic Analytical Spatial Information System (PEGASIS) (i.e., https://pegasis.pad.pppo.gov/). The maps for CY 2022 are based on analytical results from the most recent sampling event (primarily January 2022–December 2022). For co-located MWs (i.e., clustered wells, multiport wells), where analytical results for the CY are available from screened intervals at multiple elevations within the RGA (e.g., upper, middle, and/or lower RGA), these data are displayed and used for contouring as follows:

- For well clusters completed at multiple depths, all wells are labeled with their most recent sampling result. The maximum values for the well clusters were used for contouring.

- For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days) and the maximum result from the comparison was used for contouring and labeling. This selection criterion may result in different ports selected for TCE or Tc-99.

For wells that were not sampled in 2022, the most recent data from 2021 were used.

Mapping involved first plotting the selected data on Geographic Information System (ArcGIS)-generated maps and then comparing those data to the contouring performed for the 2020 TCE and Tc-99 plume maps. Plume contours were adjusted to accommodate more recent data. The impact of the changes from 2020 to 2022 is discussed in Section 4. On the 2022 plume maps shown in Section 4 of the main text, dashed lines show the contour lines from the 2020 plume maps for comparison.

For TCE, the Safe Drinking Water Act MCL of 5 micrograms per liter (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 and consideration of the conceptual site model (CSM). For Tc-99, 900 picocuries per liter (pCi/L) defines the plume limit.[2] Subsequent isoconcentration contours of 1,930 pCi/L and 3,790 pCi/L are provided based on concentration data for the period and consideration of the CSM.

3. 2022 PLUME MAPS

As identified in the "Screened Zone" column of Appendix B, Well Program Inventory, in the 2022 EMP, there are 235 active wells including MWs, piezometers, and 34 residential wells that can be used to monitor the RGA (FRNP 2021a). The dataset considered in this document also includes results for Little Bayou Creek Seep 5 and the four operating extraction wells (EWs). The PGDP deactivation and remediation prime contractor monitored a subset of this well network in 2021 and 2022, as discussed below, in accordance with the associated EMPs (FRNP 2020, FRNP 2021a).

Figures C.1 and C.2 of Appendix C provide the 2022 TCE and Tc-99 plume maps, respectively. Section 4 includes an explanation for the interpretation of these maps. Table 1 presents a summary of some characteristics of these plumes in areas outside the PGDP boundary and off DOE property.[3] Because these plumes are based on interpretation, plume lengths outside the DOE property and plume areas are approximate.

[2] For Tc-99, 900 pCi/L defines the lower plume limit. The value derived by the EPA from the 4 mrem/year MCL for Tc-99 is 900 pCi/L (see https://www.epa.gov/system/files/documents/2021-08/compliance-radionuclidesindw.pdf). An alternate value derived by the EPA from the 4 mrem/year MCL is 3,790 pCi/L and was proposed in the July 18, 1991, *FR*, http://nepis.epa.gov (document number 570-Z-91-049). Table A.9 of the *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plan, Paducah, Kentucky, Volume 1. Human Health* includes the Tc-99 dose-based groundwater screening levels resulting in a 4 mrem/year dose based upon more recent dosimetry (DOE 2022).

[3] For purposes of this report, the "PGDP boundary" is defined as the revised 229 Boundary per *FR* notices, Vol. 83, No. 213, dated November 2, 2018.

Table 1. PGDP Groundwater Plumes, CY 2022

Plume	Approximate Maximum Contaminant Concentrations Outside PGDP Boundary	Approximate Maximum Contaminant Concentrations Off DOE Property	Off DOE Property Plume Length	Approximate Total Area[a]
		TCE		
Northwest	1,290 µg/L	42.5 µg/L	1.8 miles	456 acres
C-746-S&T area	27.5 µg/L	not applicable (N/A)	N/A[b]	67 acres
Northeast	241 µg/L	75.2 µg/L	1.5 miles	751 acres
Southwest	5.42 µg/L	< 5 µg/L	N/A	86 acres
		Tc-99		
Northwest	< 900 pCi/L	< 900 pCi/L	N/A	25 acres

[a] The approximate total areas are the areas of the respective plumes inside and outside the PGDP boundary and off DOE property.
[b] The C-746-S&T plume does not leave DOE property as currently interpreted.

3.1 TRICHLOROETHENE

During the reporting period of 2021 to 2022, 241 RGA MWs, 4 EWs, and 36 residential wells were sampled by DOE, analyzed for TCE, and included in the development of the revised groundwater TCE plume map.[4] Of the 241 RGA MWs included in the development of the TCE plume map, 202 were sampled most recently in 2022. The four EWs also were sampled in 2022. Of the residential wells used for monitoring the RGA, 26 residential wells were sampled in 2022 for TCE, and the results were included in the development of the TCE plume map. The sample collection was based on the applicable EMP, which summarizes the compliance sampling and sampling by other regulatory programs conducted at the site (FRNP 2020, FRNP 2021a). These results are supplemented by 49 RGA MWs and residential wells sampled and analyzed for TCE in 2021, but were not sampled in 2022. A summary of the approximate maximum concentrations of TCE outside the PGDP boundary and 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 2022 plume maps.

Appendix C contains the 2022 TCE plume map (Figure C.1). Generally, the plume interpretation is based on the following:

- In 2021 and 2022, 1,828 groundwater samples were collected by DOE from RGA MWs, EWs, and residential wells and analyzed for TCE.

- TCE results from 2021 to 2022 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 2022, the sample result is posted.

  — If the well was sampled multiple times, the most recent result was posted. If the most recent data are from duplicate samples or include more than one sample per day, then the result was selected using the following:

[4] Of these RGA MWs, some have multiple sampling ports.

  - If there was a detection in both samples, the higher concentration was selected;
  - If there was a detection in one sample but not the other, the detected concentration was selected; or
  - If there was not a detection in either sample, the lowest reported value was selected.

- For well clusters completed at multiple depths, all wells are labeled with their most recent sampling result. The maximum of the values for the well cluster was used for contouring.
- For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days), and the maximum result from the comparison was used for contouring and labeling. This selection criterion may result in different ports selected for TCE or Tc-99.

- The results are posted as reported by the laboratory, with "UJ," "U," and "J" laboratory, assessment, or validation qualifiers, if applicable.[5]
- Groundwater EW locations are labeled on the map, and the concentrations from the EWs are posted.
- For some wells that were not sampled in 2022 but sampled in 2021, TCE results from 2021 were used to develop the plume map using the same rules as for the 2022 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.
- Residential wells R10 and R40 located along Ogden Landing Road were sampled in 2021 and 2022. The TCE results from these wells were below 5 µg/L. Because these wells are located outside the extentof the map, the results from these wells are not shown on the plume maps. TCE concentrations are provided in Appendix A.

3.2 TECHNETIUM-99

During the reporting period of 2021 to 2022, 209 RGA MWs, 4 EWs, and 10 residential wells were sampled by DOE, analyzed for Tc-99, and included in the development of the revised groundwater Tc-99 plume map.[6] Of the 209 RGA MWs included in the development of the Tc-99 plume map, 177 were sampled most recently in 2022. The four EWs were sampled in 2022 for Tc-99. Of the residential wells used for monitoring the RGA, 10 residential wells were sampled in 2022 for Tc-99 and the results were included in the development of the Tc-99 plume map. The sample collection was based on the applicable EMP, which

[5] For presentation of data in figures and tables included herein, any qualifier (i.e., laboratory, assessment, validation) that contains both "U" and "J" is simplified as "UJ," any qualifier that contains "U" is simplified as "U," and any qualifier that contains "J" is simplified as "J." A "U" qualifier indicates a compound was analyzed for, but not detected at or below, the lowest concentration reported. A "J" qualifier indicates an estimated value. Full details on qualifiers for posted results are available in PEGASIS.
[6] Of these RGA MWs, some have multiple sampling ports.

summarizes the compliance sampling and sampling by regulatory programs being conducted at the site (FRNP 2020, FRNP 2021a). These results are supplemented by 32 RGA MWs sampled and analyzed for Tc-99 in 2021, but were not sampled in 2022. Tc-99 was not detected above 900 pCi/L outside the PGDP boundary in either 2021 or 2022. The highest Tc-99 concentration in RGA wells outside the PGDP boundary was 451 pCi/L at EW233. Appendix B lists the most recent sample data that were used to develop the 2022 plume maps.

Appendix C contains the 2022 Tc-99 plume map (i.e., Figure C.2). Generally, the plume interpretation is based upon the following:

- A total of 1,669 groundwater samples was collected by DOE from RGA MWs and residential wells and analyzed for Tc-99 from 2021 to 2022.

- Tc-99 results from 2022 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.[7]

- For some wells that were not sampled in 2022, but were sampled in 2021, the Tc-99 results from 2021 used to develop the plume map were selected using the same rules as for the 2022 Tc-99 results. These results and the date sampled are posted on the map.

- The contour intervals selected were 900 pCi/L, 1,930 pCi/L, and 3,790 pCi/L.[8] The interval selection is based on EPA's 1976 and 1991 derived MCL activities of 900 pCi/L and 3,790 pCi/L, respectively, and the dose-based groundwater screening level of 1,930 pCi/L (DOE 2022). 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 2020 PLUME MAPS

PGDP groundwater plume maps for 2016 to 2022 are presented in Figures 1 and 2 for TCE and Tc-99, respectively. The previous comprehensive plume maps summarized the TCE and Tc-99 data collected through 2020 (FRNP 2021b). In an effort to understand the changes in the plume areas and contaminant concentrations at PGDP, FRNP compared the 2022 maps with the 2020 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 2022 TCE plume overlaid with the 2020 plume isoconcentration lines. Similarly, a figure showing the 2022 Tc-99 Plume overlaid with the

[7] For presentation of data in figures and tables included herein, any qualifier (i.e., laboratory, assessment, validation) "U" is simplified as "U." 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.

[8] For Tc-99, 900 pCi/L defines the lower plume limit. The value derived by the EPA from the 4 mrem/year MCL for Tc-99 is 900 pCi/L (see https://www.epa.gov/system/files/documents/2021-08/compliance-radionuclidesindw.pdf). An alternate value derived by the EPA from the 4 mrem/year MCL is 3,790 pCi/L and was proposed in the July 18, 1991, *FR* [http://nepis.epa.gov (document number 570-Z-91-049)]. Table A.9 of the *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plan, Paducah, Kentucky, Volume 1. Human Health* includes the Tc-99 dose-based groundwater screening levels resulting in a 4 mrem/year dose based upon more recent dosimetry (DOE 2022).

2020 plume isoconcentration lines is also included in this report. 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 2020 and 2022 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: the northern distal margin (Area A), the area in the vicinity of EWs of the Northwest Plume Pump-and-Treat System (Area B), and the vicinity of the C-746-S&T landfills (Area C). In addition, Figure 3 includes temporal TCE concentration plots for selected wells illustrating the observations made in this subsection.

Figure 1. TCE Plumes as Interpreted for 2016, 2018, 2020, and 2022

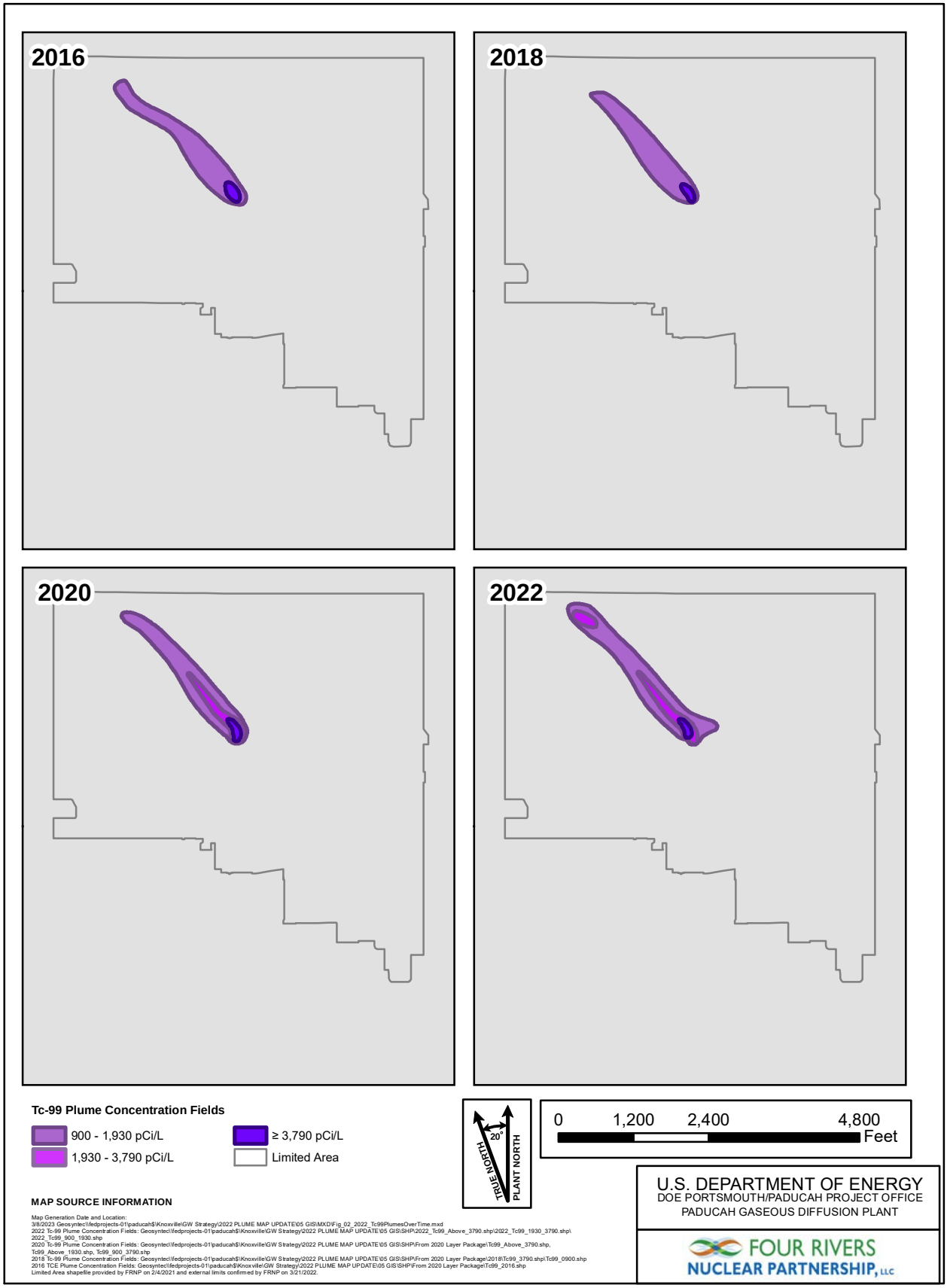

Figure 2. Tc-99 Plumes as Interpreted for 2016, 2018, 2020, and 2022

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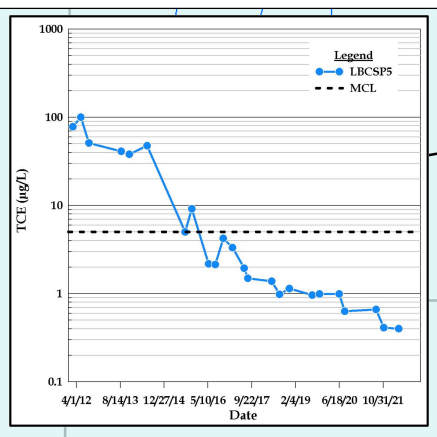
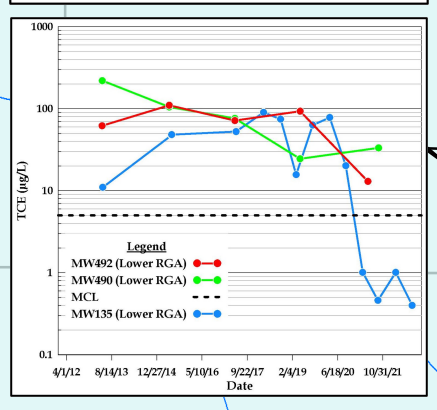
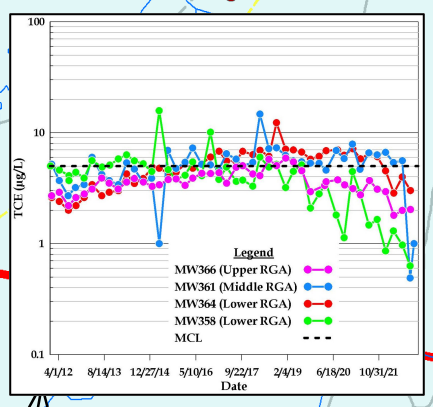
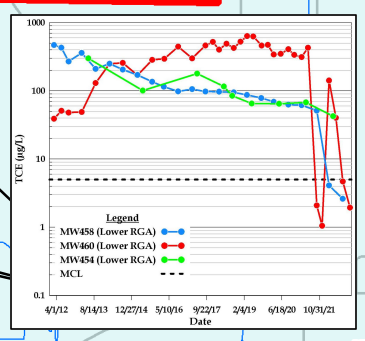
Notes:
1. Data from the most recent sampling event in 2022 was used except where noted.
2a. For well clusters completed as multiple depths, all wells are labeled with their most recent sampling result. The maximum of the values for the well cluster was used for contouring.
2b. For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days) and the maximum result from the comparison was used for contouring and labeling. This selection criterion may result in different ports selected for TCE or Tc-99.

General Direction of RGA Flow for Northwest Portion of Plume









MW441 11/1/2022 1.39
MW439 5/20/2021 0.88J
MW433 11/1/2022 1U
MW435 11/1/2022 0.96J
MW444 5/21/2021 1.03
MW443 5/21/2021 0.91J
LBCSP5 4/28/2022 0.4J
MW442 5/21/2021 2.52
MW450 5/21/2021 7.73
MW448 5/21/2021 1.33
MW447 5/20/2021 0.67J
MW445 5/20/2021 0.65J
MW201 11/1/2022 0.84J
A
MW135 9/21/2022 0.4J
MW489 9/15/2021 41.8
MW236 5/2/2022 4.53
MW490 9/15/2021 33.3
MW491 5/20/2021 6.38
MW202 11/1/2022 1U
MW240 5/2/2022 1.69
EW228
EW229
MW492 5/20/2021 13
MW98 9/20/2022 1.27
MW494 5/27/2021 1.22J
MW493 5/27/2021 1.05J
MW125 5/2/2022 24.4
MW358 10/6/2022 0.63J
MW363 10/10/2022 1U
MW357 10/6/2022 2.84
MW364 10/10/2022 3.01
MW360 10/6/2022 0.61J
MW361 11/17/2022 1U
MW366 10/10/2022 2.03
MW367 10/10/2022 1U
MW139 5/9/2022 1.44
MW372 10/11/2022 2.78
MW370 10/11/2022 1.68
MW369 10/11/2022 1.02
MW373 10/11/2022 4.13
MW391 10/17/2022 3.44
MW388 10/13/2022 1U
MW387 10/13/2022 0.63J
MW392 10/17/2022 12.2
MW418 5/9/2022 6.53
MW419 5/9/2022 27.5
MW200 5/24/2021 1.04
MW452 11/1/2022 1U
MW451 5/24/2021 0.37J
R2 11/2/2022 3.98
MW385 10/13/2022 1U
MW384 10/13/2022 0.53J
MW223 10/12/2022 1U
MW221 10/12/2022 1U
MW222 10/12/2022 1U
MW224 10/18/2022 1U
MW395 10/17/2022 5.62
MW394 10/17/2022 7
MW220 10/18/2022 1U
MW397 10/18/2022 1U
C
MW134 11/1/2022 1U
MW454 5/2/2022 42.5
MW453 5/2/2022 28.9
MW197 9/20/2022 32.5
B
MW456 12/13/2022 8.56
MW458 9/7/2022 2.62
MW459 9/8/2022 3.75
MW502 9/8/2022 1.94
MW501 9/8/2022 1U
MW455 12/13/2022 1.61
MW457 9/7/2022 1.37
MW460 12/13/2022 1.94
MW461 9/7/2022 14.9
MW462 9/7/2022 31.8
A
A'
MW243 9/7/2022 15.4
MW244 9/7/2022 2.14
MW248 9/7/2022 1.94
MW242 9/7/2022 3.44
MW250 9/7/2022 2.52
EW230
EW231
MW106A 11/1/2022 3.42
MW498 9/6/2022 658
HV217/EW232 10/4/2022 388
MW497 9/6/2022 88.7
MW500 9/6/2022 477
MW504 9/6/2022 2.02
MW173 9/8/2022 1U
HV222/EW233 10/4/2022 1290
MW499 9/6/2022 638
MW503 9/6/2022 11
MW245 9/7/2022 2.91
MW63 9/6/2022 13.6
MW66 9/19/2022 314
MW65 9/6/2022 7.35
MW339 12/12/2022 667
MW340 12/12/2022 3650
MW261 5/10/2022 2070
MW355 9/6/2022 7.01
MW165A 9/7/2022 0.56J
MW482 5/12/2021 66.5
MW481 5/12/2021 1U
MW496 10/3/2022 121
MW144 10/3/2022 95.4
MW145 10/3/2022 29.3
MW432 11/1/2022 1.45

MAP SOURCE INFORMATION
Map Generation Date and Location - 4/18/2023 Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_03_2022PlumesTCE_NW.mxd
Monitoring and Extraction Well, RGA Well outside Plume Concentration Field showing TCE > 1 µg/L, and Seep Monitoring Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100000.shp\2022_TCE_10000_100000.shp\2022_TCE_1000_10000.shp\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.

2022 TCE Plume Concentration Fields
- 5 - 100 µg/L
- 100 - 1,000 µg/L
- 1,000 - 10,000 µg/L

2020 TCE Plume Isoconcentration Lines
- 5 - 100 µg/L
- 100 - 1,000 µg/L
- 1,000 - 10,000 µg/L

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

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

- Water Policy Area
- DOE Property Boundary
- Limited Area
- Roadways
- Streams

MW100 8/17/2022 (1U µg/L) - Monitoring Well (MW) Identification, or Residential (R) Well Identification
Date of Sample & Sample Value
U = Compound analyzed for, but not detected at or below, the lowest concentration reported
J = Concentration is estimated

TRUE NORTH 20° PLANT NORTH

Feet
500 250 0 500 1,000

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\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_03_2022PlumesTCE_NW.mxd 5/1/2023

Figure 3. 2022 Northwest Portion of the TCE Plume Regional Gravel Aquifer

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Area A

- The northern extent of the 5 µg/L TCE isoconcentration contour continues to be defined by well cluster MW445/MW447, in which TCE was not detected above 5 µg/L during this reporting period. TCE analyses for MW439/MW441, the most downgradient wells, were 1.39 µg/L in the February 2021 sampling event and 1.39 µg/L in the November 2022 sampling event at MW441. The May 2021 TCE concentration in MW439 was lower than the TCE concentrations in MW441 during the reporting period.

- Also of note is the seep that is sampled in Little Bayou Creek. LBCSP5 has declined from 47.5 µg/L of TCE in June 2014 to 0.4 J µg/L in its most recent sampling event in April 2022. The plume contours have not been defined based on seep data because they are not as repeatable as MW data; however, the declining TCE trend at the seeps support shrinking the plume length.

- TCE concentrations in MW135 declined from 20.2 µg/L in September 2020 (the last TCE result for MW135 above 5 µg/L) to below 5 µg/L during the four monitoring events in 2021 and 2022. As such, the northeastern boundary of the Northwest Plume was adjusted based on these results for MW135.

- TCE concentrations in MW491 declined from the maximum TCE concentration of 85.9 µg/L in May 2019 to 6.38 µg/L in May 2021. Similarly, TCE concentrations in MW492 declined from 93.2 µg/L in May 2019 to 13 µg/L in May 2021.

- MW236 and MW240, which are along the western boundary of the Northwest Plume, have remained below 5 µg/L during this reporting period.

Area B

In August 2010, EW232 and EW233 began operations. Because EW232 and EW233 are located slightly upgradient and crossgradient of the former 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 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 EW 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. Based on the most recent result from each of these wells, TCE concentrations varied from nondetect at 1 µg/L to 31.8 µg/L along this transect.

- The western boundary of the Northwest Plume was adjusted to the northwest of the EW field as TCE concentrations in MW457 and MW458 declined to below 5 µg/L during the March 2022 and September 2022 monitoring events. Similarly, TCE concentrations in MW459 declined to below 5 µg/L during the September 2022 monitoring event. TCE concentrations in MW460 also declined to below 5 µg/L during the September 2022 event and remained below the 5 µg/L in December 2022. TCE concentrations in MW456 have been fluctuating above and below the 5 µg/L during the monitoring period and the most recent sampling result in December 2022 of 8.56 µg/L was above the 5 µg/L; therefore, the TCE plume was drawn to include MW456.

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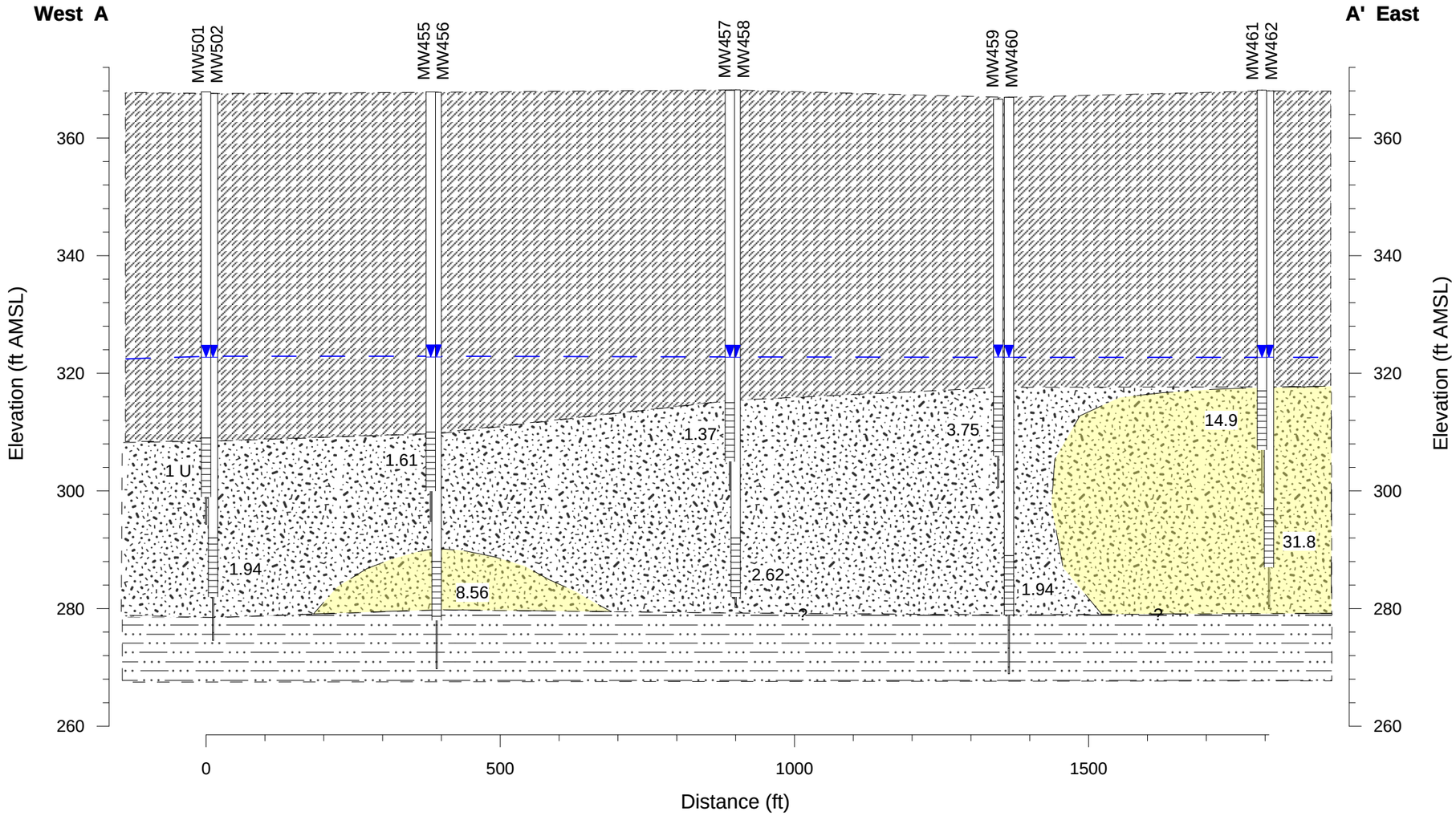

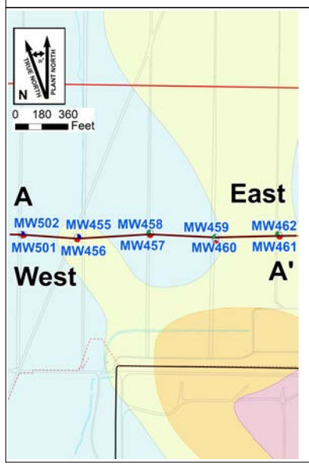

Legend

- Upper RGA Well
- Middle RGA Well
- Lower RGA Well
- Hydrogeologic Cross-Section Line
- DOE Property Boundary
- Surface Water Course Centerline
- Roadways
- 229 Boundary
- Limited Area
- Water Policy Area

2022 TCE Plume Concentration Fields

- 5 - 100 µg/L
- 100 - 1,000 µg/L
- 1,000 - 10,000 µg/L

2022 TCE Plume Concentration Fields
5 - 100 µg/L

Hydrogeologic Unit
UCRS RGA McNairy

Monitoring Well Location
- Casing
- Water Level (November 2022)
- Screen Interval
- Most recent TCE concentration (in µg/L)
- Boring

- November 2022 Potentiometric Surface

Vertical Exaggeration = 10X.
U = Compound analyzed for but not detected at or below the lowest concentration reported.
For monitoring wells not sampled in calendar year 2022, results from the 2021 monitoring have been used.

TCE Plume Regional Gravel Aquifer Cross Section A-A'

MAP SOURCE INFORMATION

Map Generation Date and Location - 03/22/2023; Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater
Map Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater\Figure 4. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section A-A'.sdg
Shapefile for Geologic Cross-Sections: \\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\Cross_Section_Lines.shp
Monitoring Well Layer Location: Geosyntec\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.
Northing and easting of wells obtained from Pegasis, downloaded on 6/14/2022.
Groundwater elevation was based on the 11/14/2022 - 11/16/2022 measurements.
Hydrogeologic boundary and screen intervals are approximate, and were based on boring logs obtained from Pegasis, downloaded on 1/31/2023. Subsurface lithologic elevations between borings were interpreted based on available information and should be considered approximate.
Trichloroethene concentration data was provided by FRNP.

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Figure 4. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section A-A'

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- 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 470 µg/L in 2012 to 2.62 µg/L in the most recent sampling in September 2022) to well MW462 (a lower RGA well, which recorded its highest TCE concentration during the monitoring period in November 2021 at 33.7 µg/L).

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 C-764-U landfills.

The most recent TCE concentrations in MW361 and MW364 were below 5 µg/L. Consequently, the 5 µg/L contour delineating the north boundary of the plume was retracted southward. MW139, located at the northeastern end of this plume, remained below 5 µg/L during the monitoring period and the northeastern extent of the plume was moved closer to the landfills. Along the western edge of the plume, TCE concentrations in MW372 have remained below 5 µg/L during the current reporting period. TCE concentrations in MW373 were slightly greater than 5 µg/L during April 2021 (5.74 µg/L), October 2021 (5.91 µg/L), January 2022 (5.37 µg/L), and April 2022 (5.06 µg/L); however, results have remained below 5 µg/L during the two most recent sampling events in July 2022 (4.84 µg/L) and October 2022 (4.13 µg/L). TCE concentrations in MW394/MW395, located at the southern end of this plume, increased to slightly above 5 µg/L during the most recent sampling event; therefore, the 5 µg/L contour delineating the plume extent in this area has been extended to the south.

4.2 NORTHEAST PLUME

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

Area D

Wells MW463 through MW476 provide definition of the northern extent of the 5 µg/L TCE isoconcentration contour. The interpreted distal extent is south of well cluster MW465 and MW466 and slightly north of well cluster MW467 and MW468. In 2021 and 2022, TCE concentrations in MW463/MW464 declined to below 5 µg/L (and also below the laboratory detection limit of 1 µg/L). Consequently, the contour defining the northwestern extent of the 5 µg/L TCE isoconcentration contour from 2020 was retracted. Well cluster MW469/MW470, with the most recent groundwater TCE concentrations below 5 µg/L (and also below the laboratory detection limit of 1 µg/L), defines the eastern edge of the plume. MW467 and MW468 define the northern extent of the plume. MW468, screened in the middle RGA, is the northernmost well within the plume. MW467, in the upper RGA, has been below 5 µg/L since May 2017.

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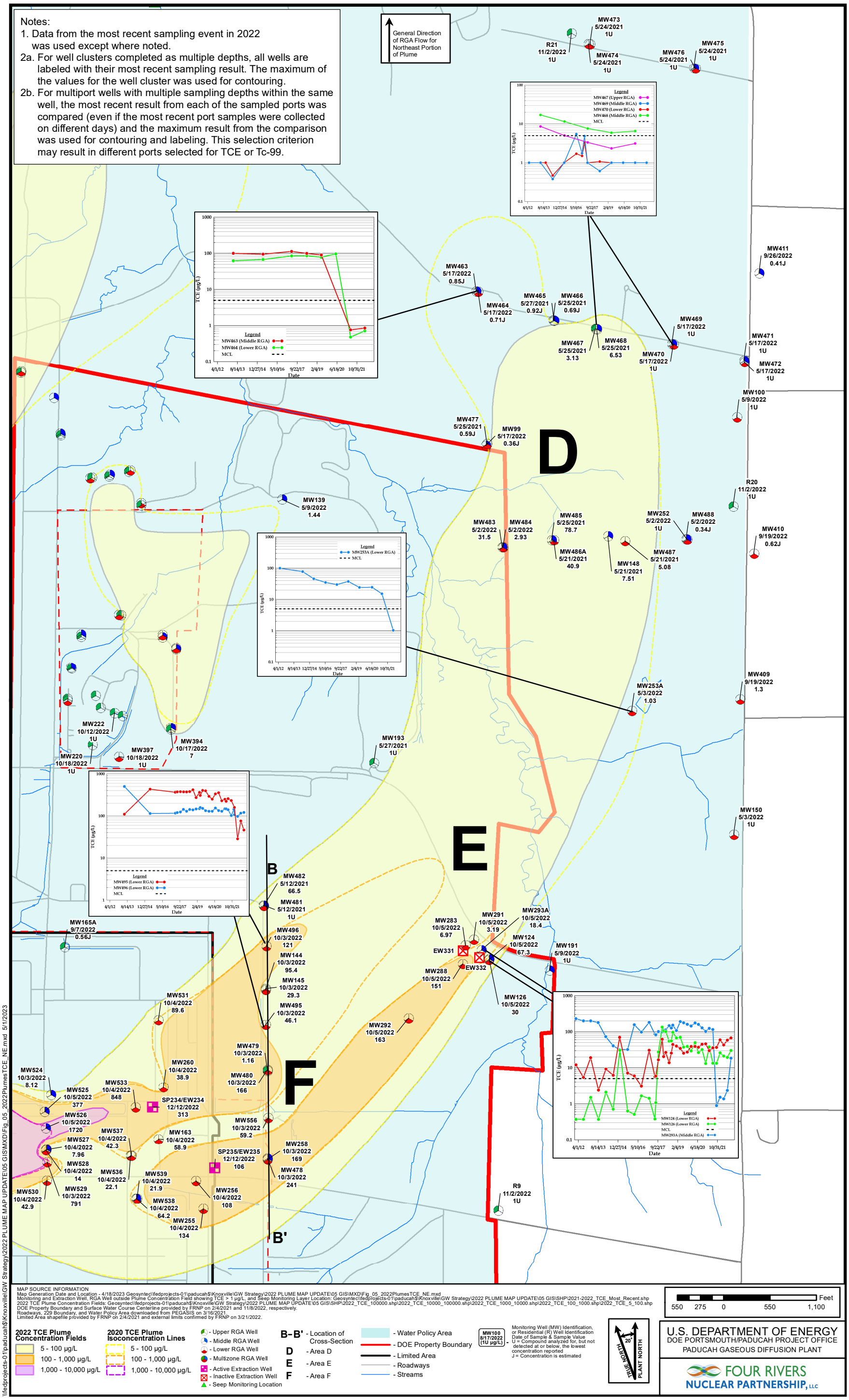

Figure 5. 2022 Northeast Portion of the TCE Plume Regional Gravel Aquifer

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Area E

- With cessation of pumping in EW331 and EW332 as part of the Northeast Plume Optimization project, the western lobe of greater than 100 µg/L TCE has contracted to near the PGDP boundary.[9]

- Results of the 2022 monitoring continue to show an overall decline in TCE concentrations since 2012 at MW253 and its replacement well MW253A, which are located north of the old EWs that currently are in standby. The TCE concentration in MW253A declined to below 5 µg/L in 2022. As such, the extent of the plume retracted westward.

- TCE concentrations in the east side of the former EW field, EW331 and EW332, were stable or decreased during the monitoring period. TCE concentrations in MW126 and MW283 have generally declined slightly during the monitoring period compared to the 2020 monitoring results. In MW126, TCE concentrations have fluctuated during the monitoring period, but have consistently been below 100 µg/L, with a maximum concentration of 37.9 µg/L during the monitoring period. Similarly, TCE concentrations in MW283 have fluctuated during the monitoring period but have consistently been below 100 µg/L, with a maximum concentration of 39.7 µg/L during the monitoring period. TCE concentrations in MW124 increased from 44.9 µg/L in October 2020 (i.e., the last sampling event of the 2020 plume map update) to 67.3 µg/L in October 2022 but have consistently remained below 100 µg/L. TCE concentrations in MW291 decreased to below 5 µg/L during the last five monitoring events in 2021 and 2022. Similarly, TCE concentrations in MW293A declined to below 100 µg/L during the last five monitoring events in 2021 and 2022. Consequently, the 100 µg/L contour was retracted toward the southwest.

Area F

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

- Along the north end of the B-B' transect, TCE concentrations in MW144 decreased from 101 µg/L in January 2021 to less than 100 µg/L during seven monitoring events in 2021 and 2022. Similarly, TCE concentrations in MW495 declined to less than 100 µg/L during the past three monitoring events; therefore, the 100 µg/L contour was retracted toward the southwest.

- TCE concentrations are highest along the south end of the B-B' transect (i.e., 169 µg/L in MW258, 241 µg/L in MW478). A zone of 5 to 100 µg/L is depicted around MW556, which continued to decrease from 82.4 µg/L in October 2020 to 59.2 µg/L in October 2022.

[9] EW331 and EW332 are currently inactive but are being kept in good working condition until the Federal Facility Agreement parties agree that maintenance no longer is necessary, and final disposition (including well abandonment) has been determined.

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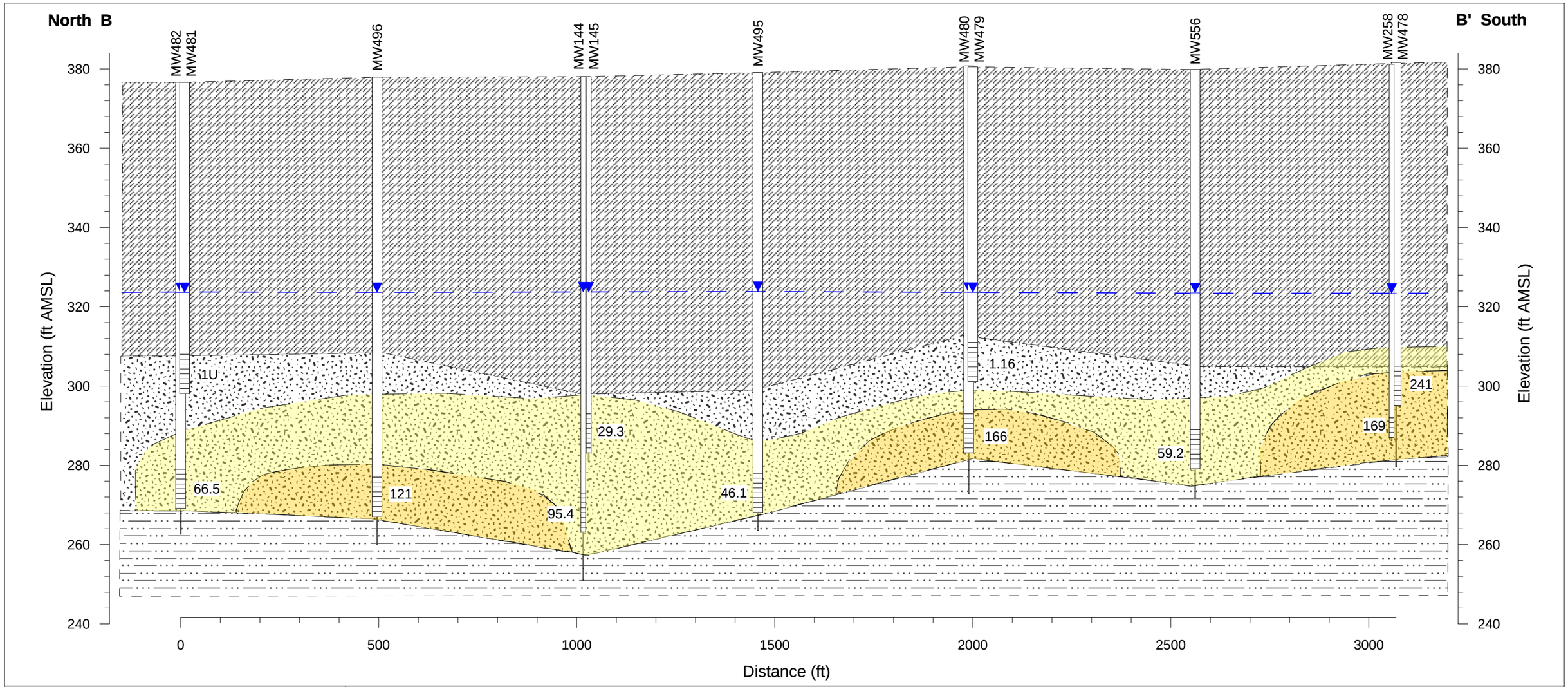

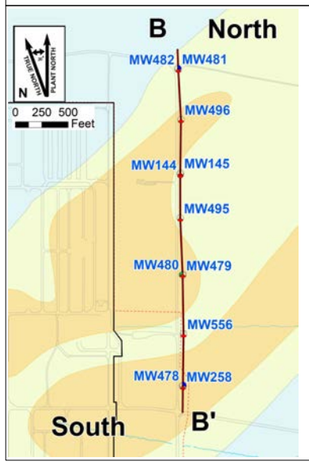

Key Map

Legend

- Upper RGA Well
- Middle RGA Well
- Lower RGA Well
- Hydrogeologic Cross-Section Line
- DOE Property Boundary
- Surface Water Course Centerline
- Roadways
- 229 Boundary
- Limited Area
- Water Policy Area

2022 TCE Plume Concentration Fields

- 5 - 100 µg/L
- 100 - 1,000 µg/L

2022 TCE Plume Concentration Fields

- 5 - 100 µg/L
- 100 - 1,000 µg/L

Hydrogeologic Unit

UCRS RGA McNairy

Monitoring Well Location

- Casing
- Water Level (November 2022)
- Screen Interval
- Most recent TCE concentration (in µg/L)
- Boring

- November 2022 Potentiometric Surface

Vertical Exaggeration = 10X.

U = Compound analyzed for but not detected at or below the lowest concentration reported. For monitoring wells not sampled in calendar year 2022, results from the 2021 monitoring have been used.

TCE Plume Regional Gravel Aquifer, Cross Section B-B'

MAP SOURCE INFORMATION

Map Generation Date and Location - 03/22/2023; Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater
Map Layer Location: Geosyntec\\\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater\Figure 6. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section B-B'.sdg
Shapefile for Geologic Cross-Sections: \\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\Cross_Section_Lines.shp
Monitoring Well Layer Location: Geosyntec\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.
Northing and easting of wells obtained from Pegasis, downloaded on 6/14/2022.
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Trichloroethene concentration data was provided by FRNP.

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Figure 6. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section B-B'

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4.3 CENTRAL SITE AREA INCLUDING SOUTHWEST PLUME

TCE

The TCE plume in the industrialized section of the PGDP is presented in Figure 7. The overall footprint in 2022 is similar to previous years; differences are noted below. 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 included a small, isolated 10,000 µg/L contour indicated by TCE values in MW333 that were greater than 10,000 µg/L in January 2015, June 2015, and January 2016. The most recent value for MW333 (i.e., 2,210 µg/L in July 2022) is shown on the map (designated as Area G on Figure 7).

- TCE concentrations in MW416 have decreased from a maximum of 1,010 µg/L in May 2019 to less than 1,000 µg/L in May 2021 and December 2021; therefore, the 1,000 µg/L contour line has retracted to the northeast.

- TCE concentrations in MW337 have increased from 452 µg/L in July 2020 (i.e., the last sampling event of the 2020 plume map update) to 1,780 µg/L in July 2022; therefore, the 1,000 µg/L contour line has expanded to the southwest to include this well.

- TCE concentrations in MW547 have declined from 1,190 µg/L in December 2020 (i.e., the last sampling event of the 2020 plume map update) to less than 1,000 µg/L during four measurements in 2021 and 2022; therefore, the 1,000 µg/L contour has been eliminated in SWMU 1 (see inset at lower left of Figure 7). In MW161 (i.e., lower RGA), TCE concentrations have continued to decline from a high of 12,200 µg/L in May 2016 to 77.9 µg/L in December 2022 (designated as Area G on Figure 7). TCE concentration reductions in this area are likely reflective of the source area remediation performed at SWMU 1 in 2015.

- The second area (designated as Area H on Figure 7) is on the northern margin of the industrial footprint. The highest concentrations of TCE extend from C-400 Cleaning Building toward the Northwest Plume groundwater EW. Overall, TCE concentrations in this area have remained stable since 2018.

- The 100,000 µg/L contour previously was drawn around the C-400 Cleaning Building source area based on historical data [e.g., MW156, which recorded up to 360,000 µg/L in 1991 (CH2M HILL 1992); Waste Area Grouping 6 angled boring, which recorded over 100,000 µg/L beneath C-400 in 1997 (DOE 1999)] and consideration of the CSM. Groundwater MWs installed during the C-400 investigation in 2020 and 2021 provided additional information on the extent of the 100,000 µg/L contour. A TCE concentration exceeding 100,000 µg/L was measured in MW407-PRT2 at 272,000 µg/L in April 2021. Generally, the TCE concentrations indicate flow to the northwest from the north and west areas of the C-400 Complex Operable Unit (OU) and flow to the east from the south and central areas of the C-400 Complex OU. A cross section showing the interpretation of TCE concentrations within the RGA along this transect is in Figure 8. The location of the cross section is denoted as C-C’ on Figure 7.

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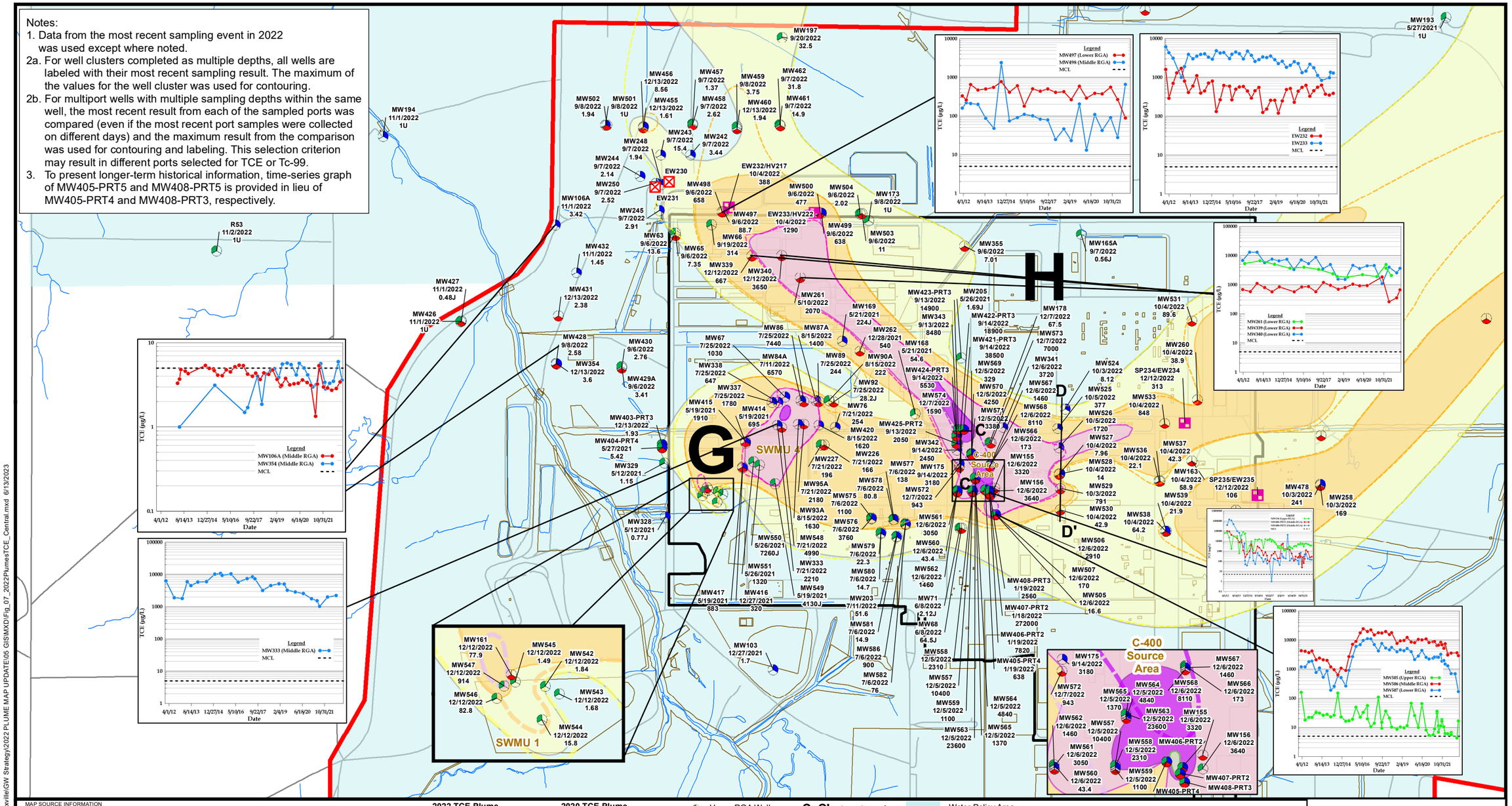
Notes:
1. Data from the most recent sampling event in 2022 was used except where noted.
2a. For well clusters completed as multiple depths, all wells are labeled with their most recent sampling result. The maximum of the values for the well cluster was used for contouring.
2b. For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days) and the maximum result from the comparison was used for contouring and labeling. This selection criterion may result in different ports selected for TCE or Tc-99.
3. To present longer-term historical information, time-series graph of MW405-PRT5 and MW408-PRT5 is provided in lieu of MW405-PRT4 and MW408-PRT3, respectively.



MAP SOURCE INFORMATION
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Monitoring and Extraction Well, RGA Well outside Plume Concentration Field showing TCE > 1 µg/L, and Seep Monitoring Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100000.shp\2022_TCE_10000_100000.shp\2022_TCE_1000_10000.shp\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.

Feet
1,000 500 0 1,000

2022 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

2020 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

Note: Contours defining plume cores are based on historical records.

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

C–C' - Locations of Cross-Sections
D–D'
G - Area G
H - Area H

- Water Policy Area
- SWMU
- DOE Property Boundary
- 229 Boundary
- Limited Area
- Roadways
- Streams

MW428 11/1/2022 1U - Monitoring Well (MW) Identification, or Residential (R) Well Identification
Date of Sample & Sample Value
U = Compound analyzed for, but not detected at or below, the lowest concentration reported
J = Concentration is estimated

TRUE NORTH
PLANT

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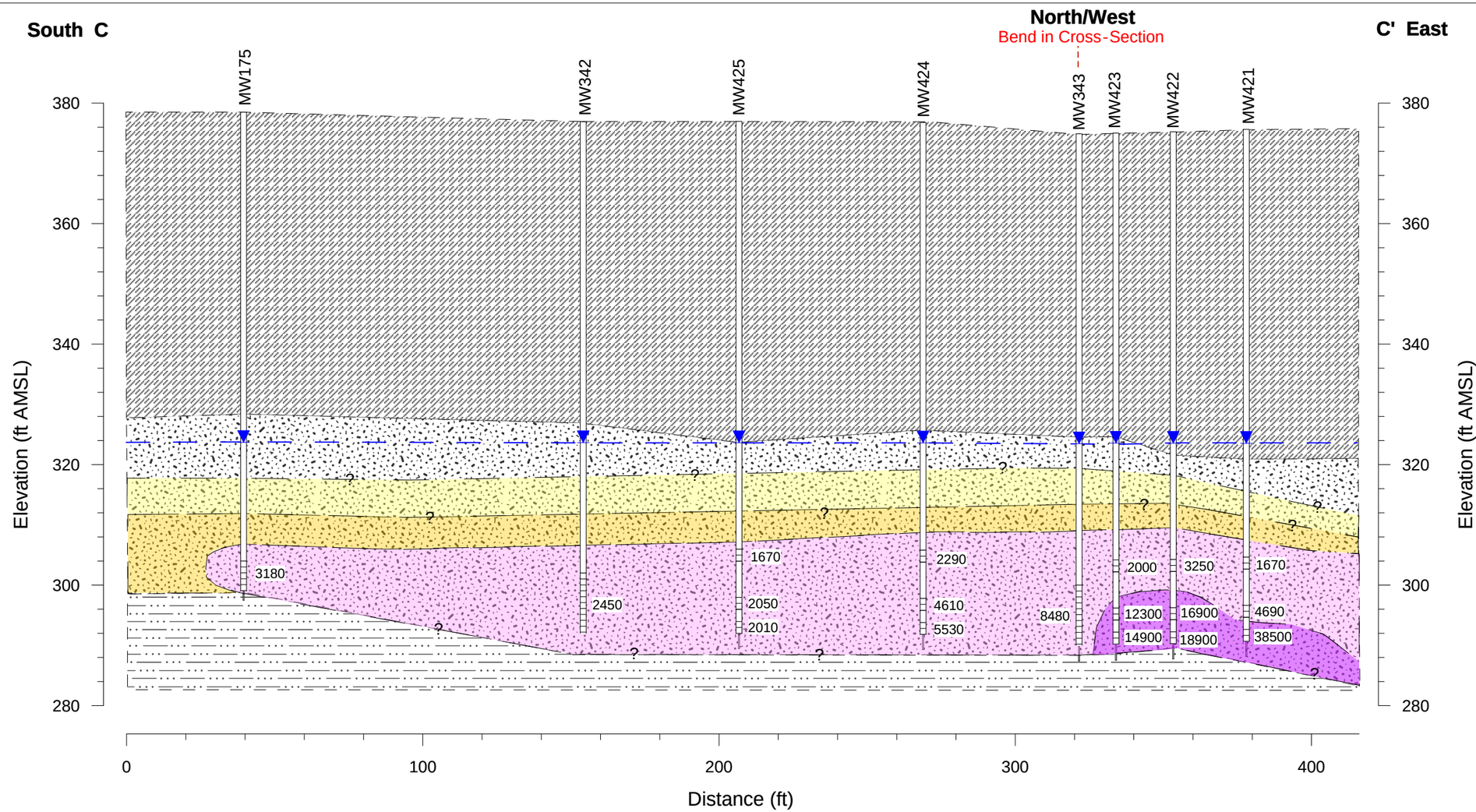
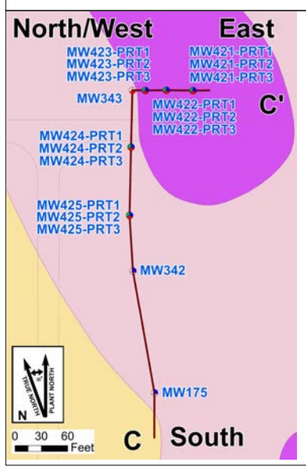
\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_07_2022PlumesTCE_Central.mxd 6/13/2023

Figure 7. 2022 Central Portion of the TCE Plume Regional Gravel Aquifer





Legend

- Lower RGA Well
- Middle RGA Well
- Multizone RGA Well
- Hydrogeologic Cross-Section Line
- Roadways

2022 TCE Plume Concentration Fields

- 100 - 1,000 µg/L
- 1,000 - 10,000 µg/L
- 10,000 - 100,000 µg/L

2022 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

Hydrogeologic Unit

UCRS RGA McNairy

Monitoring Well Location

- Casing
- Water Level (November 2022)
- Screen Interval
- Most recent TCE concentration (in µg/L)
- Boring

- November 2022 Potentiometric Surface

Vertical Exaggeration = 2.5X.
For monitoring wells not sampled in calendar year 2022, results from the 2021 monitoring have been used.

TCE Plume Regional Gravel Aquifer Cross Section C-C'

MAP SOURCE INFORMATION

Map Generation Date and Location - 03/08/2023; Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater
Map Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater\Figure 8. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section C-C'.sdg
Shapefile for Geologic Cross-Sections: \\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\Cross_Section_Lines.shp
Monitoring Well Layer Location: Geosyntec\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
Roadways downloaded from PEGASIS on 3/16/2021.
Northing and easting of wells obtained from Pegasis, downloaded on 6/14/2022.
Groundwater elevation was based on the 11/14/2022 - 11/16/2022 measurements.
Hydrogeologic boundary and screen intervals are approximate, and were based on boring logs obtained from Pegasis, downloaded on 1/31/2023. Subsurface lithologic elevations between borings were interpreted based on available information and should be considered approximate.
Trichloroethene concentration data was provided by FRNP.

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Figure 8. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section C-C'

- The northern extent of the 10,000 µg/L contour on the south side of the C-400 Cleaning Building is bounded by MW569/MW570/MW571, with the highest recent TCE concentration for this group of wells of 4,250 µg/L detected in MW570 in December 2022 (Figure C.1 Inset B). This southern 10,000 µg/L contour is bounded by MW566/MW567/MW568 to the northeast and by MW155 and MW156 in the southeast. The southern limit of the 10,000 µg/L contour is defined by MW408. A second 10,000 µg/L TCE concentration contour is present to the northwest side of C-400, which is identified by MW421, MW422, and MW423. The 10,000 µg/L TCE concentration contour was previously interpreted to be one contiguous area, but the results for MW569/MW570/MW571 resulted in a new interpretation as two areas.

- 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 2011, 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 overall declines in TCE concentrations from 2012 to 2022. Most notably, TCE in MW408-PRT5 has decreased from its high of 1,400,000 µg/L in September 2012 to 141 µg/L in December 2022. Similarly, TCE concentrations in MW156 declined from a maximum concentration of 81,800 µg/L in June 2014 to 3,640 µg/L in December 2022. In MW405-PRT5, TCE concentrations rebounded from below 1,000 µg/L to 4,470 µg/L in March 2019 and 5,530 µg/L in May 2019; however, concentrations overall declined steadily to 296 µg/L by December 2020 (i.e., the last sampling event of the 2020 plume map update) and have remained fairly stable in 2021 to 2022, with the most recent TCE concentration of 279 µg/L in December 2022.

- To the south of the C-400 Cleaning Building source area, all of the most recent samples from the MW505/MW506/MW507 well nest contained TCE concentrations below 10,000 µg/L. The December 2022 sampling data indicated only MW506 contained a TCE concentration above 1,000 µg/L. TCE concentrations in MW505 and 507 were below 1,000 µg/L.

- A cross section in Figure 9 shows the 5 µg/L, 100 µg/L, and 1,000 µg/L concentration fields in the MW524–MW530 transect line of wells between the Northwest Plume and Northeast Plume, which are connected with similar concentration contours east of the C-400 Cleaning Building. The location of the cross section is denoted as D-D' on Figure 7. A figure that includes TCE concentration time-series graphs in monitoring wells MW524-MW530, as presented during the Routine Paducah Groundwater Update meeting on March 16, 2023, and attended by representatives from EPA and the Kentucky Department for Environmental Protection (KDEP) is provided in Appendix D. Based on evaluation of the time-series graphs, there is no migration of TCE source material from the C-400 Cleaning Building source area in the direction of the Northeast Plume Containment System (NEPCS) extraction field.

- Wells MW354 and MW106A each had one observed TCE concentration above 5 µg/L during the monitoring period, although the remainder of the results were below 5 µg/L, and the most recent result for each well was below 5 µg/L. Because the most recent results for each well are below 5 µg/L, these wells are not included within the 5 µg/L contour delineating the western portion of the southwest plume. Additionally, 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, shown in Figures 11 and 12 (see Section 5). The location of the source responsible for the detections of TCE in MW354 and MW106A is uncertain.

Tc-99

There were 1,699 analyses for Tc-99 in RGA groundwater at PGDP in 2021 and 2022, with only 21 results above 900 pCi/L and 14 results above 1,930 pCi/L. Figure 10 presents the results of Tc-99 analyses near the central area of the plant, where the groundwater samples collected in 2022 (supplemented with samples

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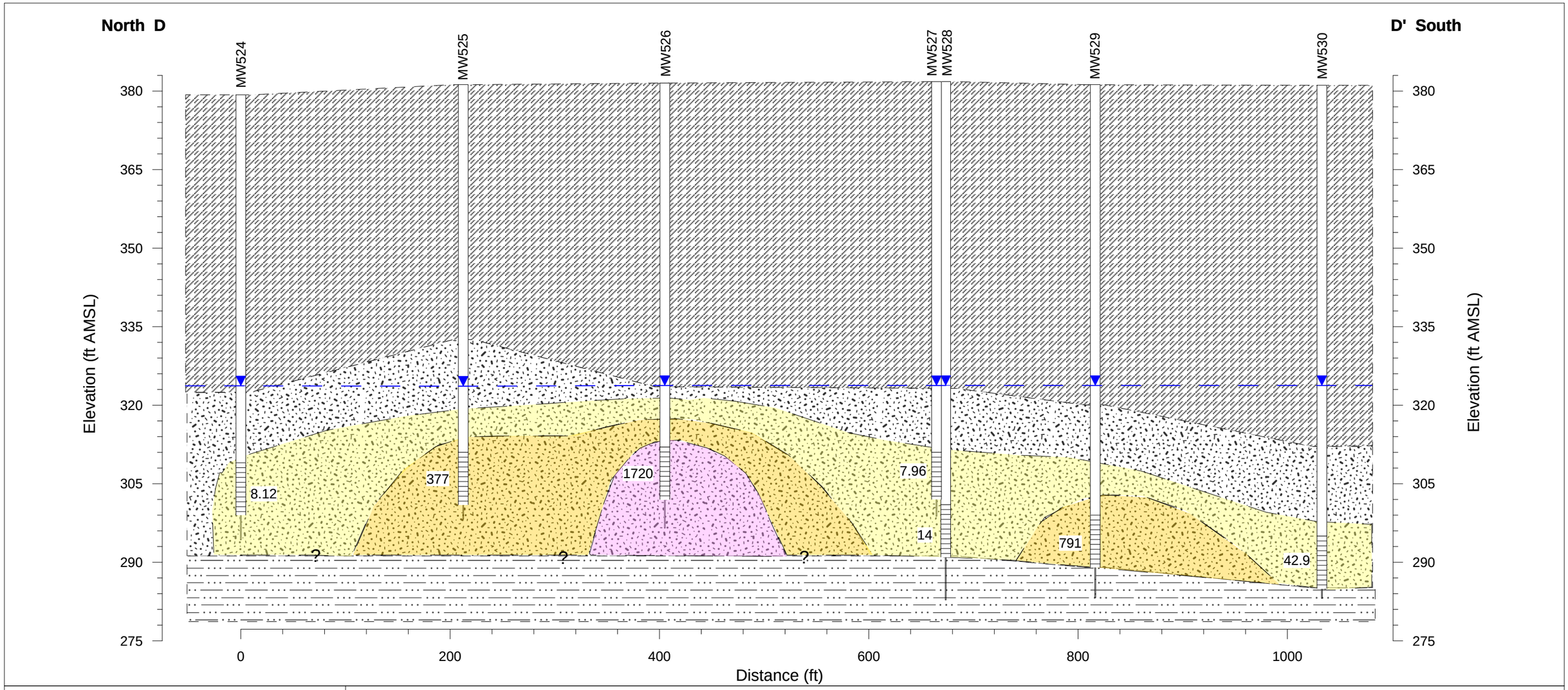

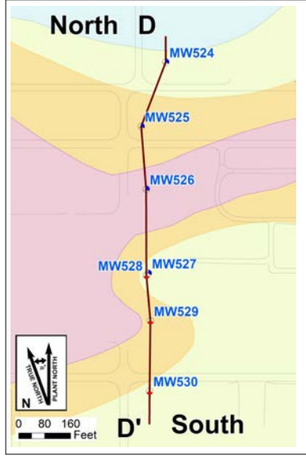

Key Map

Legend
- Lower RGA Well
- Middle RGA Well
- Hydrogeologic Cross-Section Line
- Roadways

2022 TCE Plume Concentration Fields
- 5 - 100 µg/L
- 100 - 1,000 µg/L
- 1,000 - 10,000 µg/L

Hydrogeologic Unit
UCRS RGA McNairy

Monitoring Well Location
- Casing
- Water Level (November 2022)
- Screen Interval
- Most recent TCE concentration (in µg/L)
- Boring

- November 2022 Potentiometric Surface

Vertical Exaggeration = 5X.
For monitoring wells not sampled in calendar year 2022, results from the 2021 monitoring have been used.

TCE Plume Regional Gravel Aquifer Cross Section D-D'

MAP SOURCE INFORMATION

Map Generation Date and Location - 03/22/2023; Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater
Map Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\06 Cross Section\Strater\Figure 9. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section D-D'.sdg
Shapefile for Geologic Cross-Sections: \\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\Cross_Section_Lines.shp
Monitoring Well Layer Location: Geosyntec\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
Roadways downloaded from PEGASIS on 3/16/2021.
Northing and easting of wells obtained from Pegasis, downloaded on 6/14/2022.
Groundwater elevation was based on the 11/14/2022 - 11/16/2022 measurements.
Hydrogeologic boundary and screen intervals are approximate, and were based on boring logs obtained from Pegasis, downloaded on 1/31/2023. Subsurface lithologic elevations between borings were interpreted based on available information and should be considered approximate.
Trichloroethene concentration data was provided by FRNP.

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Figure 9. 2021–2022 TCE Plume Regional Gravel Aquifer Cross Section D-D'

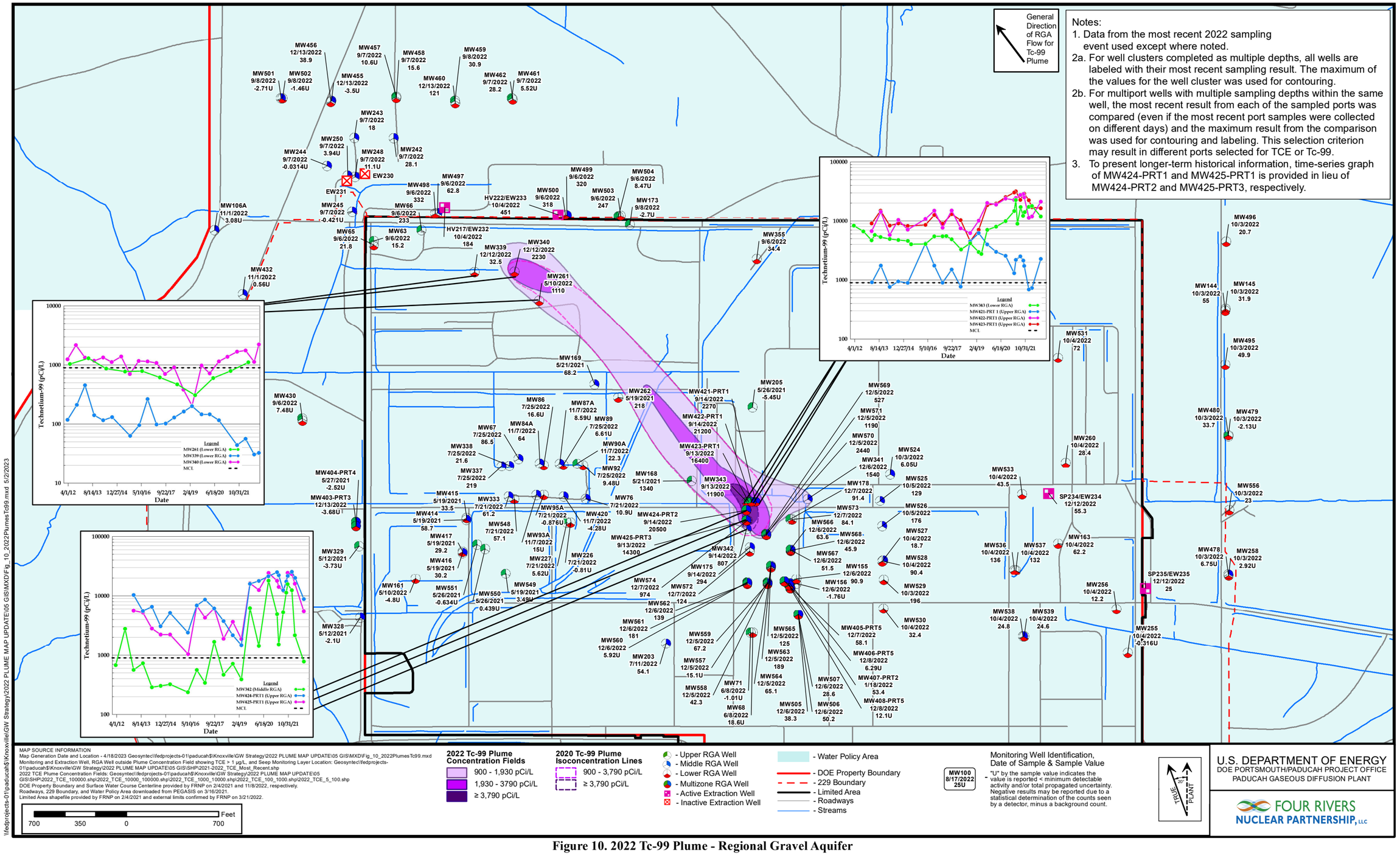


Figure 10. 2022 Tc-99 Plume - Regional Gravel Aquifer

collected in 2021) contained Tc-99 at activities greater than 900 pCi/L and 1,930 pCi/L. Figure 10 also presents 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). From the 2020 interpreted contour, the 900 pCi/L contour was expanded to the east to include MW341, which increased from 555 pCi/L in December 2020 (i.e., the last sampling event of the 2020 plume map update) to 1,540 pCi/L in December 2022 (Figure 10). A 1,930–3,790 pCi/L contour was added at the northwestern extent of the plume to include MW340 because the Tc-99 concentrations in MW340 increased from 1,150 pCi/L in September 2020 (i.e., the last sampling event of the 2020 plume map update) to 2,230 pCi/L in December 2022. The 900 pCi/L contour in this area was expanded to accommodate this change, as well as MW261 because the Tc-99 activity increased from 601 pCi/L in May 2020 (i.e., the last sampling event of the 2020 plume map update) to 1,110 pCi/L in May 2022. Tc-99 activities in nearby MW339 remained below 900 pCi/L.

The highest concentration level of Tc-99 occurred in the area of MW422 through MW425 (which are located downgradient of the Tc-99 source area at the C-400 Cleaning Building) during the 2021 and 2022 monitoring period. This is consistent with historical releases at the C-400 Cleaning Building. The southern extent of the 3,790 pCi/L isoconcentration contour was moved slightly to the north to exclude MW342, where the Tc-99 activity decreased from 18,200 pCi/L in September 2020 (i.e., the maximum concentration for this MW and the last sampling event of the 2020 plume map update) to 807 pCi/L in September 2022. MW425-PRT1 and MW424-PRT1 showed overall increases in Tc-99 activity since 2019, but the Tc-99 activity in these wells declined during the last sampling event in September 2022 (Figure 10).

The 1,930 pCi/L isocontour, not defined prior to the 2020 Plume Map, is a dose-based groundwater screening level that equates to an effective dose of 4 millirem (mrem)/year (DOE 2022). The northwestern extent of the area exceeding 1,930 pCi/L and 900 pCi/L is delineated by downgradient wells MW497/MW498/EW232 and MW499/MW500/EW233, where the activity was below 900 pCi/L in all samples collected in 2022.

The southern extent of the Tc-99 plume is delineated by MW175 and MW566/MW567/MW568, with reported Tc-99 activity for all samples collected in 2022 of less than 900 pCi/L.

Northeast Plume transect wells, MW524 to MW530, installed as part of the Northeast Plume Optimization project, all contain less than 900 pCi/L of Tc-99 (ranging from nondetect to 196 pCi/L during the most recent monitoring event in October 2022). A figure including Tc-99 concentration time-series graphs in monitoring wells MW524 to MW530, as presented during the Routine Paducah Groundwater Update meeting on March 16, 2023, and attended by representatives from EPA and KDEP, is included in Appendix D. Based on evaluation of the time-series graphs, the Tc-99 activity that is migrating into the NEPCS extraction field is below 900 pCi/L, and thus, below a concentration which would require Tc-99 treatment as part of the NEPCS.

5. POTENTIOMETRIC MAPS

Synoptic water level measurements were collected in August 2021 and August 2022 to evaluate groundwater flow direction. In 2021, water level measurements in wells screened in the RGA were made in 297 EWs, MWs, residential wells, and piezometers during a 3-day period between August 23, 2021, and August 25, 2021. Similarly, in 2022, groundwater level measurements were conducted in 312 EWs, MWs and piezometers during a 4-day period between August 22, 2022, and August 25, 2022. These water level

measurements (Table 2) are the basis for the August 2021 and August 2022 potentiometric surface maps of the RGA, presented as Figures 11 and 12, respectively. The contours of the potentiometric surface map define lines of equal hydraulic potential. The local direction of hydraulic gradient is perpendicular to the hydraulic potential lines. These potentiometric surface contours help explain the plume geometries. In addition to groundwater flow direction, 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; near-field recharge effects; recharge sources not associated with the PGDP; and advection, dispersion, and natural attenuation of the contaminants.

Table 2. RGA Water Levels Measurement Events during CY 2021 and 2022

Event Dates	Number of Wells/Piezometers	Ohio River Stage (ft amsl)	Barometric Pressure (in/Hg)	Rainfall during the event (inches)
August 23–25, 2021	297	301.8	30.05	0.0
August 22–25, 2022	312	301.6	30.01	0.0

Notes: Ohio River elevation was estimated as the average of elevations measured by the U.S. Geological Survey at Paducah Station USGS 0361100 and Olmsted, IL Station USGS 03612600. Rainfall data was obtained from the Paducah, Barkley Regional Airport office of the National Weather Service (i.e., https://w1.weather.gov/data/obhistory/KPAH.html).

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 2021, the Ohio River stage near the Paducah Site was approximately 301.8 ft above mean sea level (amsl); in August 2022, the stage of the Ohio River was approximately 301.6 ft amsl. In addition, the Northeast Plume and Northwest Plume Pump-and-Treat Systems form local cones of depression in the RGA potentiometric surface.

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 and will impact the river stage during the operational life of the dam. As such, the August 2021 and August 2022 maps documented RGA hydraulic potential contours during a higher river stage (301.8 ft amsl and 301.6 ft amsl, respectively) compared with the August 2017 and August 2018 maps (290 ft amsl and 298 ft amsl, respectively).

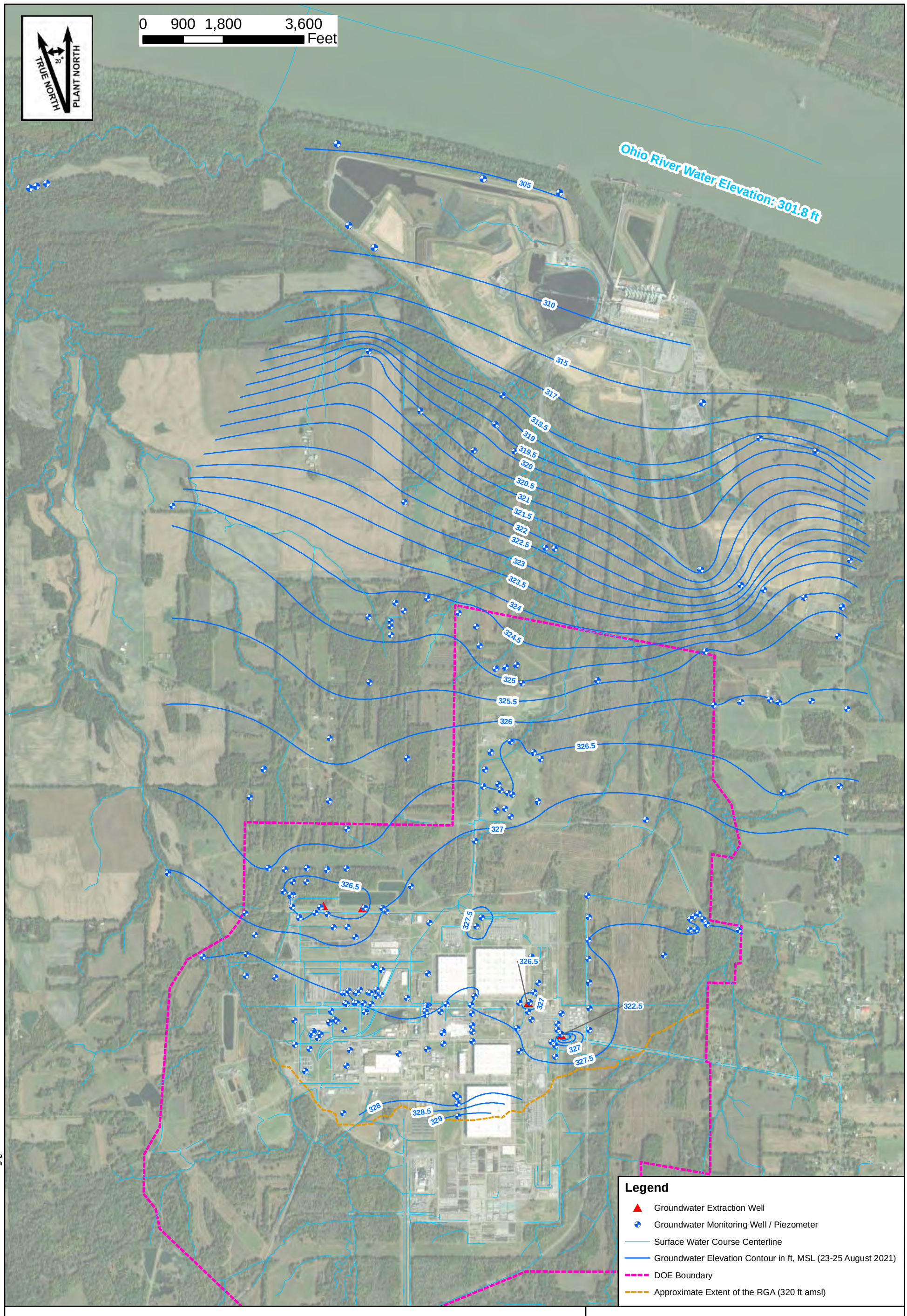
RGA water level measurements were converted to elevation and corrected to a standard barometric pressure that was common during the period of the water level measurements: 30.05 inches of mercury for the August 2021 measurements and 30.01 inches of mercury for the August 2022 measurements. Rainfall was minimal during both periods of water level measurements: 0.0 inches of precipitation during both August 2021 and August 2022 water level measurements.

A data quality review of the RGA water level measurements identified a few measurements that were rejected for mapping the RGA potentiometric surface (Table 3).[10] In the August 2021 data set, 22 out of 297 measurements were rejected. In the August 2022 data set, 23 out of 312 measurements were rejected.

Table 3. RGA Water Levels Measurements (Total and Useable) from Events during CY 2021 and 2022

Event	Total Number of Measurements	Number of acceptable measurements
August 23–25, 2021	297	275
August 22–25, 2022	312	289

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



MAP SOURCE INFORMATION

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Map Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\GIS\MXDs\2020-2021 Potentiometric Surface Maps\August 2021 Potentiometric Surface Map.mxd
Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Shapefile for Surface Water Course Centerline was obtained from Pegasis (https://pegasis.pad.pppo.gov/), downloaded on 12/1/2021.
DOE Property Boundary provided by FRNP 2/4/2021.
Northing and easting of wells obtained from Pegasis, downloaded on 10/5/2021. Northing and easting of SHF and TVAGW series wells obtained from OREIS on 10/15/2021.
Ohio River elevation was estimated as the average of elevations measured by the USGS at Paducah Station USGS 0361100 and Olmsted, IL Station (USGS 03612600) between August 23-25, 2021.

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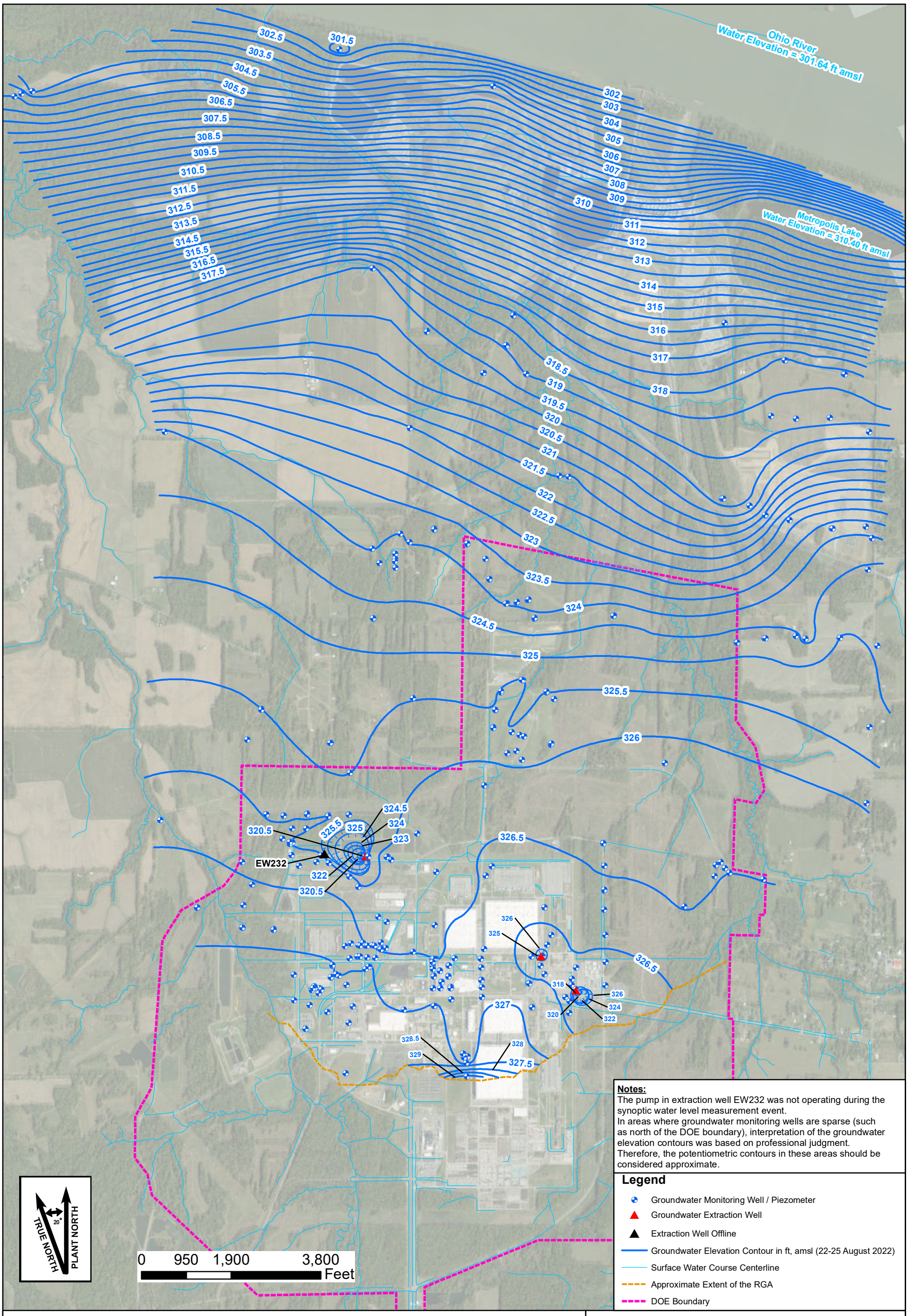
Figure 11. August 2021 RGA Potentiometric Surface Map



MAP SOURCE INFORMATION

Map Generation Date and Location - 10/11/2022 Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\GIS\MXDs\2021-2022 Potentiometric Surface Maps
Map Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\GIS\MXDs\2021-2022 Potentiometric Surface Maps\August 2022 Potentiometric Surface Map 9_28_22.mxd
Image Source: Aerial 2021: http://pegasis.pad.pppo.gov:6080/arcgis/services; and
Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
Shapefile for Surface Water Course Centerline was obtained from Pegasis (https://pegasis.pad.pppo.gov/), downloaded on 6/27/2022.
DOE Property Boundary provided by FRNP 2/4/2021.
Northing and easting of wells obtained from Pegasis, downloaded on 6/14/2022.
Groundwater elevation was based on the 8/22/2022 - 8/25/2022 measurements. Ohio River elevation was estimated as the average of elevations measured by the USGS at Paducah Station USGS 0361100 and Olmsted, IL Station (USGS 03612600) between 8/22/2022 - 8/25/2022.
Groundwater elevation for the TVA wells were provided by the Kentucky Division of Waste Management on 9/1/2022. Water elevation at Metropolis Lake was provided by FRNP on 8/30/2022.
amsl = above mean sea level

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Figure 12. August 2022 RGA Potentiometric Surface Map

The RGA hydraulic potential contours first were generated by computer using a Surfer® software (i.e., version 12.8.1009 from 2015) and ArcGIS (i.e., version 10.8). The Surfer® software created contours using kriging, based on the well coordinates and water level elevations of the August 2021 and August 2022 synoptic water measurements events. The resulting contours then were exported into ArcGIS for the presentation of the contours together, with relevant site features and smoothed manually in ArcGIS where site knowledge provided bias to understanding the hydraulic potential field.

The available wells and piezometers for both the August 2021 and 2022 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 parallel to the Ohio River, which includes the Tennessee Valley Authority 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 2022 plumes were developed by consensus by FRNP subject matter experts and were reviewed by hydrogeologists familiar with the site. DOE subsequently reviewed, provided comments and, after resolution of comments, concurred on the maps.

7. REFERENCES

CH2M HILL 1992. *Results of the Site Investigation, Phase II at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, KY/SUB/13B-97777C P-03/1991/1, U.S. Department of Energy, Paducah, KY, April.

DOE (U.S. Department of Energy) 1999. *Remedial Investigation Report for Waste Area Grouping 6 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/07-1727&D2, Volumes 1-6, U.S. Department of Energy, Paducah, KY, May.

DOE 2011. *Technical Performance Evaluation for Phase I of the C-400 Interim Remedial Action at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1260&D1, U.S. Department of Energy, Paducah, KY, August.

DOE 2013. *Remedial Action Work Plan for Phase IIa of the Interim Remedial Action for the Volatile Organic Compound Contamination at the C-400 Cleaning Building at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1271&D2/R3, U.S. Department of Energy, Paducah, KY, October.

DOE 2016. *Treatability Study Report for the C-400 Interim Remedial Action Phase IIb Steam Injection Treatability Study at Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2202&D2, U.S. Department of Energy, Paducah, KY, May.

DOE 2022. *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant Paducah, Kentucky Volume 1. Human Health*, DOE/LX/07-0107&D2/R13/V1, U.S. Department of Energy, Paducah, KY, June.

FRNP (Four Rivers Nuclear Partnership, LLC) 2020. *Environmental Monitoring Plan Fiscal Year 2021 Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-0006/FR6, Four Rivers Nuclear Partnership, LLC, Paducah, KY, October.

FRNP 2021a. *Environmental Monitoring Plan Fiscal Year 2022 Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-0006/FR7, Four Rivers Nuclear Partnership, LLC, Paducah, KY, October.

FRNP 2021b. *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2020 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FRNP-RPT-0175, Four Rivers Nuclear Partnership, LLC, Paducah, KY, July.

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)

Figure A.1. 2022 TCE Plume–Regional Gravel Aquifer Alternate Interpretation Using Maximum Values

Notes:
1. Data from the maximum result sampled 2021-2022.
2a. For well clusters completed as multiple depths, all wells are labeled with the maximum sampling result. The maximum of the values for the well cluster was used for contouring.
2b. For multiport wells with multiple sampling depths within the same well, the maximum result was used for contouring and labeling.

Ohio River

MW146 (12.2U)
MW441 (10.5U)
MW433 (5.45U)
MW435 (10.8U)
MW442 (4.77U)
MW444 (3.32U)
MW443 (5.9U)
MW450 (13.6U)
MW445 (-0.05U)
MW448 (10.3U)
MW447 (2.83U)
R245 (3.75U)
MW199 (4.27U)
MW201 (9.93U)
MW135 (80.8)
R14 (9.46U)
MW490 (19U)
MW489 (10.3U)
MW492 (56)
MW202 (11U)
MW236 (7.65U)
MW240 (0.05U)
MW491 (58.7)
MW98 (59)
MW493 (21U)
MW494 (32.6)
MW360 (28.3)
MW361 (55.5)
MW364 (61.7)
MW357 (53.6)
MW363 (14.9U)
MW358 (55.8)
MW367 (63.9)
MW366 (72.5)
MW139 (10.6U)
MW488 (6.61U)
R13 (4.59U)
MW125 (38.1)
MW67 (111)
MW86 (31.5)
MW338 (52)
MW87A (11.6U)
MW337 (230)
MW84A (722)
MW89 (6.61U)
MW90A (34.4)
MW92 (17.8)
MW333 (82.3)
MW420 (12.4U)
MW415 (33.5)
MW93A (26.9)
MW95A (15.7U)
MW548 (57.1)
MW76 (10.9U)
MW414 (58.7)
MW227 (5.62U)
MW417 (29.2)
MW226 (1.16U)
MW551 (-0.63U)
MW550 (0.44U)
MW416 (30.2)
Inset A
MW200 (19.4)
MW372 (79.4)
MW373 (17.5U)
MW370 (58.8)
MW391 (11.4U)
MW369 (67.7)
MW419 (1.82U)
MW387 (476)
MW392 (10.2U)
MW418 (5.75U)
MW388 (112)
MW221 (12.1U)
MW384 (49.9)
MW222 (10.8U)
MW224 (13.6U)
MW385 (48.5)
MW223 (12.5U)
MW395 (17.4U)
MW394 (11.4U)
MW220 (21.3U)
MW397 (23)
MW451 (2.99U)
R2 (9.9U)
MW452 (4.52U)
MW134 (5.66U)
MW454 (29.9)
MW453 (13.8U)
MW197 (114)
MW457 (27.1)
MW456 (38.9)
MW458 (31.1)
MW455 (7.91U)
MW459 (87.2)
MW460 (150)
MW502 (5.41U)
MW461 (9.51U)
MW501 (1.83U)
MW243 (18)
MW242 (28.1)
MW462 (46.5)
MW244 (6.7U)
MW500 (363)
MW499 (356)
MW250 (7.82U)
HV222/EW233 (451)
MW248 (11.1U)
HV217/EW232 (195)
MW504 (8.47U)
MW106A (11U)
MW245 (4.22U)
MW497 (164)
MW503 (252)
MW355 (46.9)
MW165A (21.2)
MW63 (40.3)
MW498 (332)
MW65 (21.8)
MW66 (438)
MW339 (56.3)
MW173 (1.62U)
MW340 (2230)
MW261 (1110)
MW262 (218)
MW432 (7.18U)
MW426 (5.5U)
MW427 (6.69UJ)
MW205 (-5.45U)
MW169 (68.2)
MW428 (3.96U)
MW429A (5.66U)
MW354 (19U)
MW430 (7.48U)
MW524 (48.1)
MW260 (44.7)
MW525 (146)
MW533 (67.6)
SP234/EW234 (82.4)
MW526 (221)
MW163 (66.6)
MW403-PRT3 (9.22U)
MW329 (-3.73U)
MW404-PRT4 (-2.52U)
MW527 (59.6)
MW536 (136)
SP235/EW235 (42.9)
MW528 (90.4)
MW537 (157)
MW256 (23.8)
MW529 (213)
MW538 (25.8)
MW255 (4.53U)
MW530 (50.6)
MW539 (25.2)
MW549 (3.49U)
MW161 (-1.38U)
MW328 (-2.1U)
MW203 (102)
MW71 (10.3)
MW68 (40.8)
MW103 (-5.08U)
See Inset A
See Inset B
MW481 (-2.36U)
MW482 (11.8U)
MW496 (25.1)
MW145 (35)
MW144 (61.2)
MW495 (56.7)
MW531 (92.3)
MW480 (48.1)
MW479 (2.2U)
MW556 (28.6)
MW478 (12.9U)
MW258 (7.11U)
MW291 (8.42U)
MW283 (12.5U)
MW293A (5.46U)
MW288 (28.6)
MW124 (6.41U)
MW126 (12.3U)
MW292 (15.5)
MW150 (3.35U)
MW194 (3.54U)
R53 (5.29U)
MW168 (1340)
MW422-PRT1/PRT2/PRT3 (28500)
MW423-PRT1/PRT2/PRT3 (31700)
MW421-PRT1/PRT2/PRT3 (2510)
MW343 (22600)
MW341 (1710)
MW424-PRT1/PRT2/PRT3 (25400)
MW178 (101)
MW425-PRT1/PRT2/PRT3 (26900)
MW573 (96)
MW574 (974)
MW569 (607)
MW342 (15700)
MW570 (16500)
MW571 (8390)
MW566 (68.3)
MW567 (63.7)
MW568 (63.8)
MW175 (306)
MW572 (148)
MW563 (189)
MW564 (111)
MW405-PRT2/PRT3/PRT4/PRT5/PRT6 (59.7)
MW560 (26.3)
MW565 (131)
MW155 (119)
MW561 (201)
MW156 (7.73U)
MW562 (185)
MW557 (63.4)
MW406-PRT2/PRT3/PRT4/PRT5 (6.29U)
MW558 (56.9)
MW407-PRT2/PRT3/PRT4/PRT5 (53.4)
MW559 (120)
MW408-PRT2/PRT3/PRT4/PRT5 (6.46)
MW505/MW506/MW507 (81)
Inset B

TRUE
20°
PLANT

Feet
600 300 0 600 1,200 1,800

2022 Tc-99 Plume Concentration Fields Interpretation Using Maximum Concentrations
- 900 - 1,930 pCi/L
- 1,930 - 3790 pCi/L
- ≥ 3790 pCi/L

2022 Tc-99 Plume Concentration Fields (Figure C.2)
- 900 - 1,930 pCi/L
- 1,930 - 3790 pCi/L
- ≥ 3790 pCi/L

- Upper RGA Well
- Middle RGA Well
- Lower RGA Well
- Multizone RGA Well
- Extraction Well
- Surface Water Course Centerline
- DOE Property Boundary
- Roadways
- 229 Boundary
- Limited Area
- Water Policy Area

MW242 (28.1) - Monitoring Well Identification
Sample Value (TCE Concentration in µg/L)
U = Compound analyzed for but not detected at or below the lowest concentration reported
UJ = Not detected and result estimated

MAP SOURCE INFORMATION
Map Generation Date and Location - 3/9/2023 Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_A2_2022PlumesTc99_MAXR1.mxd
Monitoring and Extraction Well Layer Location: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_Tc-99_MAX.shp
2022 Maximum Tc-99 Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_Tc99_MAX_Above_3790.shp\2022_Tc99_MAX_1930_3790.shp\2022_Tc99_MAX_900_1930.shp
2022 Tc-99 Plume Concentration Fields : Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_Tc99_Above_3790.shp\2022_Tc99_1930_3790.shp\2022_Tc99_900_1930.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.

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

FOUR RIVERS NUCLEAR PARTNERSHIP, LLC

Figure A.2. 2022 Tc-99 Plume–Regional Gravel Aquifer Alternate Interpretation Using Maximum Values

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APPENDIX B

TABLE OF DATA USED TO PREPARE THE 2022 PLUME MAPS

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Table B.1. 2021 and 2022 TCE and Tc-99 Data Used to Create Plume Maps

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Most Recent Date TCE Sample Collected[b]	TCE (µg/L)[c]	Most Recent Date Tc-99 Sample Collected[b]	Tc-99 (pCi/L)[d]	Notes
MW100	Lower	283–293	5/9/2022	1U	Not Sampled		
MW103	Middle	293–303	12/27/2021	1.7	5/12/2021	-5.08U	
MW106A	Middle	295–305	11/1/2022	3.42	11/1/2022	3.08U	
MW124	Lower	270–280	10/5/2022	67.3	10/5/2022	3.78U	
MW125	Lower	285–295	5/2/2022	24.4	5/2/2022	25.5	
MW126	Middle	298–308	10/5/2022	30	10/5/2022	2.22U	
MW134	Lower	272–282	11/1/2022	1U	11/1/2022	2.22U	
MW135	Lower	283–293	9/21/2022	0.4J	9/21/2022	58.4	
MW139	Middle	294–304	5/9/2022	1.44	5/9/2022	3.15U	
MW144	Lower	263–273	10/3/2022	95.4	10/3/2022	55	
MW145	Lower	283–293	10/3/2022	29.3	10/3/2022	31.9	
MW146	Lower	283–293	11/1/2022	1U	11/1/2022	-2.41U	
MW148[e]	Middle	281–311	5/21/2021	7.51	Not Sampled		
MW150[e]	Lower	278–308	5/3/2022	1U	5/3/2022	-10.1U	
MW155	Lower	287–292	12/6/2022	3320	12/6/2022	90.9	
MW156	Upper	310–317	12/6/2022	3640	12/6/2022	-1.76U	
MW161	Lower	289–294	12/12/2022	77.9	5/10/2022	-4.8U	
MW163	Lower	285–290	10/4/2022	58.9	10/4/2022	62.2	
MW165A	Upper	310–315	9/7/2022	0.56J	9/7/2022	5.3U	
MW168	Upper	307–312	5/21/2021	54.6	5/21/2021	1340	
MW169	Middle	301–306	5/21/2021	224J	5/21/2021	68.2	
MW173	Upper	314–319	9/8/2022	1U	9/8/2022	-2.7U	
MW175	Middle	299–304	9/14/2022	3180	9/14/2022	294	
MW178	Upper	309–314	12/7/2022	67.5	12/7/2022	91.4	
MW191	Middle	297–302	5/9/2022	1U	Not Sampled		
MW193	Upper	298–303	5/27/2021	1U	Not Sampled		
MW194	Middle	302–307	11/1/2022	1U	11/1/2022	-9.9U	
MW197	Upper	303–308	9/20/2022	32.5	9/20/2022	39	
MW199[e]	Lower	292–297	11/1/2022	1U	11/1/2022	-3.46U	
MW200	Middle	298–303	5/24/2021	1.04	5/24/2021	19.4	
MW201	Middle	297–302	11/1/2022	0.84J	11/1/2022	-1.15U	
MW202	Lower	289–294	11/1/2022	1U	11/1/2022	0.216U	
MW203	Middle	299–304	7/11/2022	51.6	7/11/2022	54.1	
MW205	Upper	307–312	5/26/2021	1.69J	5/26/2021	-5.45U	
MW220	Upper	310–320	10/18/2022	1U	10/18/2022	21.3U	
MW221	Upper	304–314	10/12/2022	1U	10/12/2022	12.1U	
MW222	Upper	314–324	10/12/2022	1U	10/12/2022	10.8U	
MW223	Upper	309–319	10/12/2022	1U	10/12/2022	11.2U	
MW224	Upper	310–320	10/18/2022	1U	10/18/2022	0.623U	
MW226	Lower	287–297	7/21/2022	166	7/21/2022	-0.81U	
MW227	Upper	301–311	7/21/2022	196	7/21/2022	5.62U	
MW236	Lower	290–300	5/2/2022	4.53	5/2/2022	4.67U	
MW240	Middle	290–300	5/2/2022	1.69	5/2/2022	-5.62U	
MW242	Middle	295–305	9/7/2022	3.44	9/7/2022	28.1	
MW243	Middle	293–303	9/7/2022	15.4	9/7/2022	18	
MW244	Middle	291–301	9/7/2022	2.14	9/7/2022	-0.0314U	
MW245	Middle	294–304	9/7/2022	2.91	9/7/2022	-0.421U	
MW248	Middle	289–299	9/7/2022	1.94	9/7/2022	11.1U	
MW250	Middle	293–303	9/7/2022	2.52	9/7/2022	3.94U	
MW252[e]	Lower	283–288	5/2/2022	1U	Not Sampled		
MW253A[e,f]	Lower	268–273	5/3/2022	1.03	Not Sampled		
MW255	Lower	286–291	10/4/2022	134	10/4/2022	-0.316U	
MW256	Lower	279–284	10/4/2022	108	10/4/2022	12.2	
MW258	Lower	287–292	10/3/2022	169	10/3/2022	2.92U	
MW260	Lower	284–289	10/4/2022	38.9	10/4/2022	28.4	
MW261	Lower	276–281	5/10/2022	2070	5/10/2022	1110	
MW262	Lower	278–283	12/28/2021	540	5/19/2021	218	
MW283	Lower	288–298	10/5/2022	6.97	10/5/2022	3.34U	
MW288	Lower	280–290	10/5/2022	151	10/5/2022	25.2	
MW291	Lower	288–298	10/5/2022	3.19	10/5/2022	3.8U	
MW292	Lower	276–286	10/5/2022	163	10/5/2022	9.77	
MW293A	Middle	289–299	10/5/2022	18.4	10/5/2022	5.46U	
MW328	Middle	301–306	5/12/2021	0.77J	5/12/2021	-2.1U	
MW329	Upper	303–308	5/12/2021	1.15	5/12/2021	-3.73U	
MW333	Middle	296–305	7/21/2022	2210	7/21/2022	61.2	
MW337	Middle	297–307	7/25/2022	1780	7/25/2022	219	
MW338	Middle	298–308	7/25/2022	647	7/25/2022	21.6	
MW339	Lower	277–286	12/12/2022	667	12/12/2022	32.5	
MW340	Lower	277–286	12/12/2022	3650	12/12/2022	2230	
MW341	Middle	293–303	12/6/2022	3720	12/6/2022	1540	
MW342	Middle	292–302	9/14/2022	2450	9/14/2022	807	
MW343	Lower	290–300	9/13/2022	8480	9/13/2022	11900	

Table B.1. 2021 and 2022 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Most Recent Date TCE Sample Collected[b]	TCE (µg/L)[c]	Most Recent Date Tc-99 Sample Collected[b]	Tc-99 (pCi/L)[d]	Notes
MW354	Middle	301–306	12/13/2022	3.6	12/13/2022	19U	
MW355	Lower	285–290	9/6/2022	7.01	9/6/2022	34.4	
MW356	McNairy[g]	257–262	Not Sampled		Not Sampled		
MW357	Upper	304–314	10/6/2022	2.84	10/6/2022	35.2	
MW358	Lower	285–295	10/6/2022	0.63J	10/6/2022	17.5	
MW360	Upper	310–320	10/6/2022	0.61J	10/6/2022	3.53U	
MW361	Middle	294–304	11/17/2022	1U	10/6/2022	45.1	
MW363	Upper	301–311	10/10/2022	1U	10/10/2022	-7.61U	
MW364	Lower	283–293	10/10/2022	3.01	10/10/2022	35	
MW366	Upper	304–314	10/10/2022	2.03	10/10/2022	54.9	
MW367	Lower	284–294	10/10/2022	1U	10/10/2022	-14.3 UJ	
MW369	Upper	311–321	10/11/2022	1.02	10/11/2022	56.4	
MW370	Middle	292–302	10/11/2022	1.68	10/11/2022	20.9	
MW372	Upper	301–311	10/11/2022	2.78	10/11/2022	69.7	
MW373	Lower	288–298	10/11/2022	4.13	10/11/2022	-1.78U	
MW384	Upper	287–297	10/13/2022	0.53J	10/13/2022	49.9	
MW385	Lower	303–313	10/13/2022	1U	10/13/2022	47.5	
MW387	Upper	304–314	10/13/2022	0.63J	10/13/2022	14.5U	
MW388	Middle	291–301	10/13/2022	1U	10/13/2022	90.5	
MW391	Middle	297–307	10/17/2022	3.44	10/17/2022	11.4U	
MW392	Lower	273–283	10/17/2022	12.2	10/17/2022	4.19U	
MW394	Upper	302–312	10/17/2022	7	10/17/2022	11.1U	
MW395	Middle	295–305	10/17/2022	5.62	10/17/2022	8.43U	
MW397	Lower	290–300	10/18/2022	1U	10/18/2022	23	
MW403-PRT3	Multiport[h]	272–274	12/13/2022	1.93	12/13/2022	-3.68U	
MW404-PRT4	Multiport[i]	284–286	5/27/2021	5.42	5/27/2021	-2.52U	
MW405	Multiport[j]	271-319	1/19/2022	638 (PRT4)	12/7/2022	58.1 (PRT5)	
MW406	Multiport[k]	296-342	1/19/2022	17800 (PRT1)	12/8/2022	6.29U (PRT5)	
MW407	Multiport[l]	296-342	4/27/2021	645000 (PRT1)	1/18/2022	53.4 (PRT2)	
MW408	Multiport[m]	298-320	1/19/2022	2560 (PRT3)	12/8/2022	12.1U (PRT5)	
MW409[e]	Lower	280–290	9/19/2022	1.3	Not Sampled		
MW410[e]	Lower	278–288	9/19/2022	0.62J	Not Sampled		
MW411[e]	Middle	294–304	9/26/2022	0.41J	Not Sampled		
MW414	Middle	297–307	5/19/2021	695	5/19/2021	58.7	
MW415	Lower	273–283	5/19/2021	1910	5/19/2021	33.5	
MW416	Middle	300–310	12/27/2021	320	5/19/2021	30.2	
MW417	Lower	272–282	5/19/2021	883	5/19/2021	29.2	
MW418	Middle	296–306	5/9/2022	6.53	5/9/2022	-11.8U	
MW419	Lower	281–291	5/9/2022	27.5	5/9/2022	-2.51U	
MW420	Middle	299–309	8/15/2022	1620	11/7/2022	-4.28U	
MW421	Multiport[n]	291–305	9/14/2022	38500 (PRT3)	9/14/2022	2270 (PRT1)	
MW422	Multiport[n]	290–304	9/14/2022	18900 (PRT3)	9/14/2022	21200 (PRT1)	
MW423	Multiport[n]	290–305	9/13/2022	14900 (PRT3)	9/13/2022	16400 (PRT1)	
MW424	Multiport[n]	292–306	9/14/2022	5530 (PRT3)	9/14/2022	20500 (PRT2)	
MW425	Multiport[n]	292–306	9/13/2022	2050 (PRT2)	9/13/2022	14300 (PRT3)	
MW426	Upper	304–314	11/1/2022	1U	11/1/2022	5.5U	
MW427	Lower	273–283	11/1/2022	0.48J	11/1/2022	-0.519U	
MW428	Lower	277–287	9/8/2022	2.58	9/8/2022	-0.651U	
MW429A	Upper	302–312	9/6/2022	3.41	9/6/2022	5.66U	
MW430	Lower	281–291	9/6/2022	2.76	9/6/2022	7.48U	
MW431	Lower	285–295	12/13/2022	2.38	Not Sampled		
MW432	Middle	292–302	11/1/2022	1.45	11/1/2022	0.56U	
MW433	Middle	302–305	11/1/2022	1U	11/1/2022	1.46U	
MW435	Lower	274–284	11/1/2022	0.96J	11/1/2022	3.67U	
MW439	Middle	295–297	5/20/2021	0.88J	Not Sampled		
MW441	Lower	277–279	11/1/2022	1.39	11/1/2022	4.23U	
MW442	Lower	288–291	5/21/2021	2.52	5/21/2021	4.77U	
MW443	Lower	274–277	5/21/2021	0.91J	5/21/2021	5.9U	
MW444	Lower	259–264	5/21/2021	1.03	5/21/2021	3.32U	
MW445	Middle	297–300	5/20/2021	0.65J	5/20/2021	-0.0544U	
MW447	Lower	261–266	5/20/2021	0.67J	5/20/2021	2.83U	
MW448	Middle	303–305	5/21/2021	1.33	5/21/2021	10.3U	
MW450	Lower	276–286	5/21/2021	7.73	5/21/2021	13.6U	
MW451	Upper	304–314	5/24/2021	0.37J	5/24/2021	2.99U	
MW452	Lower	280–290	11/1/2022	1U	11/1/2022	-0.67U	
MW453	Upper	306–316	5/2/2022	28.9	5/2/2022	13.8U	
MW454	Lower	284–294	5/2/2022	42.5	5/2/2022	8.09U	
MW455	Middle	300–310	12/13/2022	1.61	12/13/2022	-3.5U	
MW456	Lower	278–288	12/13/2022	8.56	12/13/2022	38.9	
MW457	Upper	305–315	9/7/2022	1.37	9/7/2022	10.6U	

Table B.1. 2021 and 2022 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Most Recent Date TCE Sample Collected[b]	TCE (µg/L)[c]	Most Recent Date Tc-99 Sample Collected[b]	Tc-99 (pCi/L)[d]	Notes
MW458	Lower	282–292	9/7/2022	2.62	9/7/2022	15.6	
MW459	Upper	306–316	9/8/2022	3.75	9/8/2022	30.9	
MW460	Lower	279–289	12/13/2022	1.94	12/13/2022	121	
MW461	Upper	307–317	9/7/2022	14.9	9/7/2022	5.52U	
MW462	Lower	287–297	9/7/2022	31.8	9/7/2022	28.2	
MW463	Middle	298–308	5/17/2022	0.85J	Not Sampled		
MW464	Lower	267–277	5/17/2022	0.71J	Not Sampled		
MW465	Middle	302–307	5/27/2021	0.92J	Not Sampled		
MW466	Middle	295–300	5/25/2021	0.69J	Not Sampled		
MW467	Upper	300–310	5/25/2021	3.13	Not Sampled		
MW468	Middle	294–299	5/25/2021	6.53	Not Sampled		
MW469	Middle	297–307	5/17/2022	1U	Not Sampled		
MW470	Lower	292–297	5/17/2022	1U	Not Sampled		
MW471	Middle	292–302	5/17/2022	1U	Not Sampled		
MW472	Lower	286–291	5/17/2022	1U	Not Sampled		
MW473[e]	Lower	289–299	5/24/2021	1U	Not Sampled		
MW474[e]	Lower	275–285	5/24/2021	1U	Not Sampled		
MW475[e]	Middle	293–303	5/24/2021	1U	Not Sampled		
MW476[e]	Lower	267–277	5/24/2021	1U	Not Sampled		
MW477	Lower	282–292	5/25/2021	0.59J	Not Sampled		
MW478	Middle	295–305	10/3/2022	241	10/3/2022	6.75U	
MW479	Upper	301–311	10/3/2022	1.16	10/3/2022	-2.13U	
MW480	Lower	283–293	10/3/2022	166	10/3/2022	33.7	
MW481	Middle	298–308	5/12/2021	1U	5/12/2021	-2.36U	
MW482	Lower	269–279	5/12/2021	66.5	5/12/2021	11.8U	
MW483[e]	Middle	294–304	5/2/2022	31.5	Not Sampled		
MW484[e]	Lower	278–288	5/2/2022	2.93	Not Sampled		
MW485[e]	Middle	295–305	5/25/2021	78.7	Not Sampled		
MW486A[c]	RGA	311-314	5/21/2021	40.9	Not Sampled		
MW487[e]	Lower	282–292	5/21/2021	5.08	Not Sampled		
MW488[e]	Middle	299–309	5/2/2022	0.34J	5/2/2022	-10.5U	
MW489	Middle	300–310	9/15/2021	41.8	5/24/2021	10.3U	
MW490	Lower	290–300	9/15/2021	33.3	5/24/2021	19U	
MW491	Upper	301–311	5/20/2021	6.38	5/20/2021	58.7	
MW492	Lower	286–296	5/20/2021	13	5/20/2021	56	
MW493	Upper	302–312	5/27/2021	1.05J	5/27/2021	21U	
MW494	Middle	290–300	5/27/2021	1.22J	5/27/2021	32.6	
MW495	Lower	268–278	10/3/2022	46.1	10/3/2022	49.9	
MW496	Lower	267–277	10/3/2022	121	10/3/2022	20.7	
MW497	Middle	300–310	9/6/2022	88.7	9/6/2022	62.8	
MW498	Lower	276–286	9/6/2022	658	9/6/2022	332	
MW499	Middle	297–307	9/6/2022	638	9/6/2022	320	
MW500	Lower	278–288	9/6/2022	477	9/6/2022	318	
MW501	Middle	299–309	9/8/2022	1U	9/8/2022	-2.71U	
MW502	Lower	282–292	9/8/2022	1.94	9/8/2022	-1.46U	
MW503	Lower	282–287	9/6/2022	11	9/6/2022	247	
MW504	Upper	315–320	9/6/2022	2.02	9/6/2022	8.47U	
MW505	Upper	312–317	12/6/2022	16.6	12/6/2022	38.3	
MW506	Middle	300–305	12/6/2022	2910	12/6/2022	50.2	
MW507	Lower	287–292	12/6/2022	170	12/6/2022	28.6	
MW524	Middle	299–309	10/3/2022	8.12	10/3/2022	6.05U	
MW525	Middle	301–311	10/5/2022	377	10/5/2022	129	
MW526	Middle	302–312	10/5/2022	1720	10/5/2022	176	
MW527	Middle	302–311	10/4/2022	7.96	10/4/2022	18.7	
MW528	Lower	291–301	10/4/2022	14	10/4/2022	90.4	
MW529	Lower	289–299	10/3/2022	791	10/3/2022	196	
MW530	Lower	285–295	10/4/2022	42.9	10/4/2022	32.4	
MW531	Lower	267–277	10/4/2022	89.6	10/4/2022	72	
MW533	Lower	282–292	10/4/2022	848	10/4/2022	43.5	
MW536	Lower	288–298	10/4/2022	22.1	10/4/2022	136	
MW537	Lower	277–287	10/4/2022	42.3	10/4/2022	132	
MW538	Middle	294–304	10/4/2022	64.2	10/4/2022	24.8	
MW539	Lower	281–291	10/4/2022	21.9	10/4/2022	24.6	
MW542	Upper	305–310	12/12/2022	1.84	Not Sampled		
MW543	Upper	304–309	12/12/2022	1.68	Not Sampled		
MW544	Upper	308–313	12/12/2022	15.8	Not Sampled		
MW545	Upper	309–314	12/12/2022	1.49	Not Sampled		
MW546	Upper	305–310	12/12/2022	82.8	Not Sampled		
MW547	Upper	305–310	12/12/2022	914	Not Sampled		
MW548	Lower	287–297	7/21/2022	4990	7/21/2022	57.1	
MW549	Upper	303–313	5/19/2021	4130J	5/19/2021	3.49U	

Table B.1. 2021 and 2022 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Most Recent Date TCE Sample Collected[b]	TCE (µg/L)[c]	Most Recent Date Tc-99 Sample Collected[b]	Tc-99 (pCi/L)[d]	Notes
MW550	Upper	297–307	5/26/2021	7260J	5/26/2021	0.439U	
MW551	Upper	298–308	5/26/2021	1320	5/26/2021	-0.634U	
MW556	Lower	279–289	10/3/2022	59.2	10/3/2022	23	
MW557	Upper	314-310	12/5/2022	10400	12/5/2022	15.1U	
MW558	Middle	303-298	12/5/2022	2310	12/5/2022	42.3	
MW559	Lower	292-287	12/5/2022	1100	12/5/2022	67.2	
MW560	Upper	312-307	12/6/2022	43.4	12/6/2022	5.92U	
MW561	Middle	301-297	12/6/2022	3050	12/6/2022	181	
MW562	Lower	290-285	12/6/2022	1460	12/6/2022	139	
MW563	Upper	314-310	12/5/2022	23600	12/5/2022	189	
MW564	Middle	305-301	12/5/2022	4840	12/5/2022	65.1	
MW565	Lower	296-292	12/5/2022	1370	12/5/2022	125	
MW566	Upper	319-314	12/6/2022	173	12/6/2022	63.6	
MW567	Middle	309-304	12/6/2022	1460	12/6/2022	51.5	
MW568	Lower	299-294	12/6/2022	8110	12/6/2022	45.9	
MW569	Upper	314-309	12/5/2022	329	12/5/2022	527	
MW570	Middle	306-302	12/5/2022	4250	12/5/2022	2440	
MW571	Lower	295-290	12/5/2022	3380	12/5/2022	1190	
MW572	Lower	296-291	12/7/2022	943	12/7/2022	124	
MW573	Lower	297-292	12/7/2022	7000	12/7/2022	84.1	
MW574	Upper	314-309	12/7/2022	1590	12/7/2022	974	
MW575	Upper	309-304	7/6/2022	1100	Not Sampled		
MW576	Middle	304-299	7/6/2022	3760	Not Sampled		
MW577	Upper	309-304	7/6/2022	138	Not Sampled		
MW578	Middle	304-299	7/6/2022	80.8	Not Sampled		
MW579	Upper	309-304	7/6/2022	22.3	Not Sampled		
MW580	Middle	304-299	7/6/2022	14.7	Not Sampled		
MW581	Upper	310-305	7/6/2022	14.9	Not Sampled		
MW582	Upper	310-305	7/6/2022	76	Not Sampled		
MW586	Middle	305-300	7/6/2022	900	Not Sampled		
MW63	Upper	307–312	9/6/2022	13.6	9/6/2022	15.2	
MW65	Lower	279–284	9/6/2022	7.35	9/6/2022	21.8	
MW66	Upper	308–313	9/19/2022	314	9/6/2022	233	
MW67	Middle	302–307	7/25/2022	1030	7/25/2022	86.5	
MW68	Lower	275–280	6/8/2022	64.5J	6/8/2022	18.6U	
MW71	Upper	306-310	6/8/2022	2.12J	6/8/2022	-1.01U	
MW76	Middle	295–305	7/21/2022	254	7/21/2022	10.9U	
MW84A	Middle	297–307	7/11/2022	6570	11/7/2022	64	
MW84	Middle	296–307	Not Sampled		Not Sampled		abandoned 2019
MW86	Lower	287–298	7/25/2022	7440	7/25/2022	16.6U	
MW87A	RGA	298–308	8/15/2022	1400	11/7/2022	8.59U	
MW87	Middle	298–309	Not Sampled		Not Sampled		abandoned 2019
MW89	Lower	285–295	7/25/2022	244	7/25/2022	6.61U	
MW90A	Upper	301–311	8/15/2022	222	11/7/2022	22.3	
MW92	Lower	282–293	7/25/2022	28.2J	7/25/2022	9.48U	
MW93A	RGA	296–306	8/15/2022	1630	11/7/2022	15U	
MW93	Middle	295–305	Not Sampled		Not Sampled		abandoned 2019
MW95A	Lower	288–298	7/21/2022	2180	7/21/2022	-0.876U	
MW98	Middle	293–303	9/20/2022	1.27	9/20/2022	36.7	
MW99	Middle	295–305	5/17/2022	0.36J	Not Sampled		
R114[e]	Unknown[o]	—	11/2/2022	1U	Not Sampled		East of map extent
R13[e]	Unknown[o]	—	11/3/2022	1U	11/3/2022	4.59U	
R10	Unknown[o]	—	11/3/2022	1U	—	—	West of map extent
R14[e]	Unknown[o]	—	11/3/2022	1U	11/3/2022	7.99U	
R20[e]	RGA[o]	—	11/2/2022	1U	Not Sampled		
R21[e]	Unknown[p]	—	11/2/2022	1U	Not Sampled		
R245[e]	Unknown[p]	—	11/2/2022	1U	11/2/2022	-2.75U	
R26[e]	Unknown[p]	—	11/3/2022	1U	11/3/2022	1.41U	West of map extent
R2[e]	Unknown[p]	—	11/2/2022	3.98	11/2/2022	5.43U	
R40	Unknown[p]	—	12/19/2022	1U	—	—	West of map extent
R424[e]	RGA-Multiport[p]	304–306	12/19/2022	2.24 (PRT1)	12/19/2022	9.82U (PRT1)	
R53[e]	Unknown[o]	—	11/2/2022	1U	11/2/2022	0.543U	
R83[e]	Unknown[o]	—	11/2/2022	1U	Not Sampled		
R90[e]	Unknown[o]	—	11/2/2022	1U	Not Sampled		East of map extent
R9[e]	Unknown[o]	—	11/2/2022	1U	Not Sampled		
R302[e]	RGA[o]	—	11/2/2022	1U	Not Sampled		
SP234/EW234	Extraction Well[q]	286-301	12/12/2022	313	12/12/2022	55.3	
SP235/EW235	Extraction Well[q]	283-298	12/12/2022	106	12/12/2022	25	
HV217/EW232	Extraction Well[q]	283-303	10/4/2022	388	10/4/2022	184	

Table B.1. 2021 and 2022 TCE and Tc-99 Data Used to Create Plume Maps (Continued)

Station	RGA Monitored Zone	Screened Interval (ft amsl)[a]	Most Recent Date TCE Sample Collected[b]	TCE (µg/L)[c]	Most Recent Date Tc-99 Sample Collected[b]	Tc-99 (pCi/L)[d]	Notes
HV222/EW233	Extraction Well[q]	276-296	10/4/2022	1290	10/4/2022	451	
LBCSP5[r]	Surface Water Seep	—	4/28/2022	0.4J	Not Sampled		

Notes

[a] Screened intervals are approximate.

[b] For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days) and the maximum result from the comparison is presented in this table. This selection criterion may result in different ports select for TCE or Tc-99.

[c] TCE results of "1U" indicate the compound analyzed for, but not detected at or below, the lowest concentration reported; J indicates the concentration is estimated.

[d] Tc-99 results with "U" indicate "U" the value is reported < 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.

[e] Location designated as 'Private-Residential' or Residential Well in annual Environmental Monitoring Plans.

[f] MW253A RGA monitored zone and screened interval zone are assumed to be the same as the original well, MW253.

[g] MW initial lithologic log indicated well was completed in the RGA; however, the lithology has been reinterpreted to show a higher top of McNairy.

[h] MW403 was sampled from Port 3 during 2021–2022. Port 3 screen interval is shown.

[i] MW404 was sampled from Port 4 during 2021–2022. Port 4 screen interval is shown.

[j] MW405 was sampled from Ports 2 through 6 during 2021–2022. The screen interval shown encompasses Ports 2 through 6.

[k] MW406 was sampled from Ports 1 through 5 during 2021–2022. The screen interval shown encompasses all five ports.

[l] MW407 was sampled from Ports 1 through 5 during 2021–2022. The screen interval shown encompasses all five ports.

[m] MW408 was sampled from Ports 2 through 5 during 2021–2022. The screen interval shown encompasses Ports 2 through 5.

[n] MW421–MW425 were sampled from all three ports during 2021–2022. The screen interval shown encompasses all three ports.

[o] Residential wells are assumed to be completed in the Upper RGA unless known to be otherwise.

[p] R424 was sampled from Ports 1 and 3 during 2021–2022. The screen interval shown encompasses Ports 1 through 3.

[q] Extraction wells are screened across the RGA.

[r] LBCSP5 = Little Bayou Creek Surface Water Seep

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APPENDIX C

2022 PLUME MAPS

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FIGURES

C.1. 2022 TCE Plume—Regional Gravel Aquifer C-5
C.2. 2022 Tc-99 Plume—Regional Gravel Aquifer C-6

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Notes:
1. Data from the most recent 2022 sampling event used except where noted.
2a. For well clusters completed as multiple depths, all wells are labeled with their most recent sampling result. The maximum of the values for the well cluster was used for contouring.
2b. For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days) and the maximum result from the comparison was used for contouring and labeling. This selection criterion may result in different ports selected for TCE or Tc-99.

Ohio River

MW146 11/1/2022 (1U)
MW439 5/20/2021 (0.88J)
MW433 11/1/2022 (1U)
MW441 11/1/2022 (1.39)
MW435 11/1/2022 (0.96J)
LBCSP5 4/28/2022 (0.4J)
MW443 5/21/2021 (0.91J)
MW442 5/21/2021 (2.52)
MW444 5/21/2021 (1.03)
MW450 5/21/2021 (7.73)
MW445 5/20/2021 (0.65J)
MW448 5/21/2021 (1.33)
MW447 5/20/2021 (0.67J)
R83 11/2/2022 (1U)
R21 11/2/2022 (1U)
MW474 5/24/2021 (1U)
MW473 5/24/2021 (1U)
MW475 5/24/2021 (1U)
MW476 5/24/2021 (1U)
R245 11/2/2022 (1U)
MW199 11/1/2022 (1U)
MW201 11/1/2022 (0.84J)
MW135 9/21/2022 (0.4J)
MW463 5/17/2022 (0.85J)
MW464 5/17/2022 (0.71J)
MW465 5/27/2021 (0.92J)
MW467 5/25/2021 (3.13)
MW466 5/25/2021 (0.69J)
MW468 5/25/2021 (6.53)
MW469 5/17/2022 (1U)
MW470 5/17/2022 (1U)
MW471 5/17/2022 (1U)
MW472 5/17/2022 (1U)
MW411 9/26/2022 (0.41J)
R14 11/3/2022 (1U)
MW236 5/2/2022 (4.53)
MW489 9/15/2021 (41.8)
MW490 9/15/2021 (33.3)
MW492 5/20/2021 (13)
MW491 5/20/2021 (6.38)
MW202 11/1/2022 (1U)
MW240 5/2/2022 (1.69)
MW98 9/20/2022 (1.27)
MW493 5/27/2021 (1.05J)
R13 11/3/2022 (1U)
MW494 5/27/2021 (1.22J)
MW361 11/17/2022 (1U)
MW360 10/6/2022 (0.61J)
MW364 10/10/2022 (3.01)
MW357 10/6/2022 (2.84)
MW363 10/10/2022 (1U)
MW358 10/6/2022 (0.63J)
MW139 5/9/2022 (1.44)
MW477 5/25/2021 (0.59J)
MW99 5/17/2022 (0.36J)
MW100 5/9/2022 (1U)
MW125 5/2/2022 (24.4)
MW367 10/10/2022 (1U)
MW366 10/10/2022 (2.03)
MW486A 5/21/2021 (40.9)
MW485 5/25/2021 (78.7)
MW148 5/21/2021 (7.51)
R20 11/2/2022 (1U)
MW483 5/2/2022 (31.5)
MW484 5/2/2022 (2.93)
MW487 5/21/2021 (5.08)
MW488 5/2/2022 (0.34J)
MW252 5/2/2022 (1U)
MW410 9/19/2022 (0.62J)
MW373 10/11/2022 (4.13)
MW370 10/11/2022 (1.68)
MW372 10/11/2022 (2.78)
MW392 10/17/2022 (12.2)
MW369 10/11/2022 (1.02)
MW200 5/24/2021 (1.04)
MW388 10/13/2022 (1U)
MW391 10/17/2022 (3.44)
MW419 5/9/2022 (27.5)
MW418 5/9/2022 (6.53)
MW387 10/13/2022 (0.63J)
MW452 11/1/2022 (1U)
R2 11/2/2022 (3.98)
MW451 5/24/2021 (0.37J)
MW384 10/13/2022 (0.53J)
MW221 10/12/2022 (1U)
MW385 10/13/2022 (1U)
MW253A 5/3/2022 (1.03)
MW409 9/19/2022 (1.3)
MW134 11/1/2022 (1U)
MW454 5/2/2022 (42.5)
MW453 5/2/2022 (28.9)
MW223 10/12/2022 (1U)
MW395 10/17/2022 (5.62)
MW222 10/12/2022 (1U)
MW394 10/17/2022 (7)
MW224 10/18/2022 (1U)
MW220 10/18/2022 (1U)
MW193 5/27/2021 (1U)
MW197 9/20/2022 (32.5)
MW397 10/18/2022 (1U)
MW150 5/3/2022 (1U)
MW456 12/13/2022 (8.56)
MW455 12/13/2022 (1.61)
MW458 9/7/2022 (2.62)
MW459 9/8/2022 (3.75)
MW501 9/8/2022 (1U)
MW457 9/7/2022 (1.37)
MW460 12/13/2022 (1.94)
MW502 9/8/2022 (1.94)
MW461 9/7/2022 (14.9)
MW194 11/1/2022 (1U)
MW243 9/7/2022 (15.4)
MW462 9/7/2022 (31.8)
MW242 9/7/2022 (3.44)
MW244 9/7/2022 (2.14)
MW498 9/6/2022 (658)
MW500 9/6/2022 (477)
MW248 9/7/2022 (1.94)
MW499 9/6/2022 (638)
MW481 5/12/2021 (1U)
MW250 9/7/2022 (2.52)
MW504 9/6/2022 (2.02)
MW482 5/12/2021 (66.5)
MW291 10/5/2022 (3.19)
MW106A 11/1/2022 (3.42)
HV217/EW232 10/4/2022 (388)
MW165A 9/7/2022 (0.56J)
MW293A 10/5/2022 (18.4)
MW283 10/5/2022 (6.97)
MW245 9/7/2022 (2.91)
MW497 9/6/2022 (88.7)
MW503 9/6/2022 (11)
MW496 10/3/2022 (121)
MW126 10/5/2022 (30)
R53 11/2/2022 (1U)
MW63 9/6/2022 (13.6)
HV222/EW233 10/4/2022 (1290)
MW173 9/8/2022 (1U)
MW355 9/6/2022 (7.01)
MW124 10/5/2022 (67.3)
MW432 11/1/2022 (1.45)
MW65 9/6/2022 (7.35)
MW145 10/3/2022 (29.3)
MW191 5/9/2022 (1U)
MW66 9/19/2022 (314)
MW144 10/3/2022 (95.4)
MW288 10/5/2022 (151)
MW339 12/12/2022 (667)
MW531 10/4/2022 (89.6)
MW495 10/3/2022 (46.1)
MW292 10/5/2022 (163)
MW426 11/1/2022 (1U)
MW340 12/12/2022 (3650)
MW169 5/21/2021 (224J)
MW427 11/1/2022 (0.48J)
MW431 12/13/2022 (2.38)
MW262 12/28/2021 (540)
MW205 5/26/2021 (1.69J)
MW261 5/10/2022 (2070)
MW429A 9/6/2022 (3.41)
MW480 10/3/2022 (166)
MW428 9/8/2022 (2.58)
MW430 9/6/2022 (2.76)
MW524 10/3/2022 (8.12)
MW260 10/4/2022 (38.9)
MW533 10/4/2022 (848)
MW479 10/3/2022 (1.16)
MW354 12/13/2022 (3.6)
SP234/EW234 12/12/2022 (313)
MW525 10/5/2022 (377)
MW556 10/3/2022 (59.2)
MW403-PRT3 12/13/2022 (1.93)
MW526 10/5/2022 (1720)
MW404-PRT4 5/27/2021 (5.42)
MW163 10/4/2022 (58.9)
MW329 5/12/2021 (1.15)
MW542 12/12/2022 (1.84)
MW527 10/4/2022 (7.96)
SP235/EW235 12/12/2022 (106)
MW478 10/3/2022 (241)
MW161 12/12/2022 (77.9)
MW528 10/4/2022 (14)
MW536 10/4/2022 (22.1)
MW258 10/3/2022 (169)
MW545 12/12/2022 (1.49)
MW537 10/4/2022 (42.3)
MW547 12/12/2022 (914)
MW529 10/3/2022 (791)
MW256 10/4/2022 (108)
MW543 12/12/2022 (1.68)
MW539 10/4/2022 (21.9)
MW544 12/12/2022 (15.8)
MW530 10/4/2022 (42.9)
MW328 5/12/2021 (0.77J)
MW538 10/4/2022 (64.2)
MW255 10/4/2022 (134)
MW546 12/12/2022 (82.8)
MW582 7/6/2022 (76)
MW68 6/8/2022 (64.5J)
MW576 7/6/2022 (3760)
MW586 7/6/2022 (900)
MW71 6/8/2022 (2.12J)
MW575 7/6/2022 (1100)
MW203 7/11/2022 (51.6)
MW579 7/6/2022 (22.3)
MW581 7/6/2022 (14.9)
MW580 7/6/2022 (14.7)
MW578 7/6/2022 (80.8)
MW577 7/6/2022 (138)
MW103 12/27/2021 (1.7)
R9 11/2/2022 (1U)

See Inset A
See Inset B

Inset A
MW67 7/25/2022 (1030)
MW84A 7/11/2022 (6570)
MW86 7/25/2022 (7440)
MW338 7/25/2022 (647)
MW87A 8/15/2022 (1400)
MW337 7/25/2022 (1780)
MW89 7/25/2022 (244)
MW90A 8/15/2022 (222)
MW92 7/25/2022 (28.2J)
MW333 7/21/2022 (2210)
MW420 8/15/2022 (1620)
MW548 7/21/2022 (4990)
MW93A 8/15/2022 (1630)
MW76 7/21/2022 (254)
MW95A 7/21/2022 (2180)
MW415 5/19/2021 (1910)
MW414 5/19/2021 (695)
MW227 7/21/2022 (196)
MW551 5/26/2021 (1320)
MW226 7/21/2022 (166)
MW550 5/26/2021 (7260J)
MW417 5/19/2021 (883)
MW416 12/27/2021 (320)

Inset B
MW168 5/21/2021 (54.6)
MW422-PRT3 9/14/2022 (18900)
MW341 12/6/2022 (3720)
MW423-PRT3 9/13/2022 (14900)
MW343 9/13/2022 (8480)
MW421-PRT3 9/14/2022 (38500)
MW178 12/7/2022 (67.5)
MW424-PRT3 9/14/2022 (5530)
MW573 12/7/2022 (7000)
MW425-PRT2 9/13/2022 (2050)
MW569 12/5/2022 (329)
MW570 12/5/2022 (4250)
MW574 12/7/2022 (1590)
MW342 9/14/2022 (2450)
MW571 12/5/2022 (3380)
MW567 12/6/2022 (1460)
MW175 9/14/2022 (3180)
MW566 12/6/2022 (173)
MW568 12/6/2022 (8110)
MW572 12/7/2022 (943)
MW563 12/5/2022 (23600)
MW406-PRT2 1/19/2022 (7820)
MW564 12/5/2022 (4840)
MW155 12/6/2022 (3320)
MW565 12/5/2022 (1370)
MW156 12/6/2022 (3640)
MW560 12/6/2022 (43.4)
MW561 12/6/2022 (3050)
MW407-PRT2 1/18/2022 (272000)
MW562 12/6/2022 (1460)
MW408-PRT5 1/19/2022 (2560)
MW557 12/5/2022 (10400)
MW405-PRT4 1/19/2022 (638)
MW558 12/5/2022 (2310)
MW505 12/6/2022 (16.6)
MW559 12/5/2022 (1100)
MW506 12/6/2022 (2910)
MW507 12/6/2022 (170)

N
TRUE
20°
PLANT
Feet
600 300 0 600 1,200 1,800

2022 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

- Upper RGA Well
- Middle RGA Well
- Lower RGA Well
- Multizone RGA Well
- Extraction Well
- Seep Monitoring Location

- RGA Well outside Plume Concentration Field showing TCE > 1 µg/L
- Surface Water Course Centerline
- DOE Property Boundary
- Roadways
- 229 Boundary

- Limited
- Water Policy

MW100 5/9/2022 (1U) - Monitoring Well Identification
Date of Sample and Sample Value (TCE Concentration in µg/L)
U = Compound analyzed for, but not detected at or below, the lowest concentration reported
J = Concentration is estimated

Note: Contours defining >10,000 µg/L used historical records in addition to recent groundwater monitoring results.

MAP SOURCE INFORMATION
Map Generation Date and Location - 4/18/2023 Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_C01_2022PlumesTCER1.mxd
Monitoring and Extraction Well, RGA Well outside Plume Concentration Field showing TCE > 1 µg/L, and Seep Monitoring Layer Location: Geosyntec\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_TCE_Most_Recent.shp
2022 TCE Plume Concentration Fields: Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_TCE_100000.shp\2022_TCE_10000_100000.shp\2022_TCE_1000_10000.shp\2022_TCE_100_1000.shp\2022_TCE_5_100.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.

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Figure C.1. 2022 TCE Plume–Regional Gravel Aquifer

Notes:
1. Data from the most recent 2022 sampling event used except where noted.
2a. For well clusters completed as multiple depths, all wells are labeled with their most recent sampling result. The maximum of the values for the well cluster was used for contouring.
2b. For multiport wells with multiple sampling depths within the same well, the most recent result from each of the sampled ports was compared (even if the most recent port samples were collected on different days) and the maximum result from the comparison was used for contouring and labeling. This selection criterion may result in different ports selected for TCE or Tc-99.

Ohio River

MW146 11/1/2022 (-2.41U)
MW441 11/1/2022 (4.23U)
MW433 11/1/2022 (1.46U)
MW435 11/1/2022 (3.67U)
MW444 5/21/2021 (3.32U)
MW443 5/21/2021 (5.9U)
MW442 5/21/2021 (4.77U)
MW450 5/21/2021 (13.6U)
MW445 5/20/2021 (-0.0544U)
MW448 5/21/2021 (10.3U)
MW447 5/20/2021 (2.83U)
R245 11/2/2022 (-2.75U)
MW199 11/1/2022 (-3.46U)
MW201 11/1/2022 (-1.15U)
MW135 9/21/2022 (58.4)
R14 11/3/2022 (7.99U)
MW489 5/24/2021 (10.3U)
MW202 11/1/2022 (0.216U)
MW236 5/2/2022 (4.67U)
MW490 5/24/2021 (19U)
MW492 5/20/2021 (56)
MW240 5/2/2022 (-5.62U)
MW491 5/20/2021 (58.7)
MW98 9/20/2022 (36.7)
MW493 5/27/2021 (21U)
MW360 10/6/2022 (3.53U)
MW494 5/27/2021 (32.6)
MW361 10/6/2022 (45.1)
MW364 10/10/2022 (35)
MW357 10/6/2022 (35.2)
MW363 10/10/2022 (-7.61U)
R13 11/3/2022 (4.59U)
MW358 10/6/2022 (17.5)
MW367 10/10/2022 (-14.3U)
MW139 5/9/2022 (3.15U)
MW366 10/10/2022 (54.9)
MW125 5/2/2022 (25.5)
MW488 5/2/2022 (-10.5U)
MW67 7/25/2022 (86.5)
MW84A 11/7/2022 (64)
MW86 7/25/2022 (16.6U)
MW87A 11/7/2022 (8.59U)
MW338 7/25/2022 (21.6)
MW337 7/25/2022 (219)
MW89 7/25/2022 (6.61U)
MW90A 11/7/2022 (22.3)
MW92 7/25/2022 (9.48U)
MW333 7/21/2022 (61.2)
MW420 11/7/2022 (-4.28U)
MW95A 7/21/2022 (-0.876U)
MW415 5/19/2021 (33.5)
MW548 7/21/2022 (57.1)
MW76 7/21/2022 (10.9U)
MW93A 11/7/2022 (15U)
MW414 5/19/2021 (58.7)
MW227 7/21/2022 (5.62U)
MW226 7/21/2022 (-0.81U)
MW417 5/19/2021 (29.2)
MW551 5/26/2021 (-0.634U)
MW550 5/26/2021 (0.439U)
MW416 5/19/2021 (30.2)
Inset A
MW373 10/11/2022 (-1.78U)
MW370 10/11/2022 (20.9)
MW372 10/11/2022 (69.7)
MW369 10/11/2022 (56.4)
MW391 10/17/2022 (11.4U)
MW200 5/24/2021 (19.4)
MW387 10/13/2022 (14.5U)
MW392 10/17/2022 (4.19U)
MW419 5/9/2022 (-2.51U)
MW388 10/13/2022 (90.5)
MW221 10/12/2022 (12.1U)
MW418 5/9/2022 (-11.8U)
MW451 5/24/2021 (2.99U)
R2 11/2/2022 (5.43U)
MW452 11/1/2022 (-0.67U)
MW384 10/13/2022 (49.9)
MW222 10/12/2022 (10.8U)
MW224 10/18/2022 (0.623U)
MW134 11/1/2022 (2.22U)
MW454 5/2/2022 (8.09U)
MW453 5/2/2022 (13.8U)
MW385 10/13/2022 (47.5)
MW223 10/12/2022 (11.2U)
MW395 10/17/2022 (8.43U)
MW394 10/17/2022 (11.1U)
MW220 10/18/2022 (21.3U)
MW397 10/18/2022 (23)
MW197 9/20/2022 (39)
MW456 12/13/2022 (38.9)
MW457 9/7/2022 (10.6U)
MW455 12/13/2022 (-3.5U)
MW458 9/7/2022 (15.6)
MW459 9/8/2022 (30.9)
MW460 12/13/2022 (121)
MW150 5/3/2022 (-10.1U)
MW194 11/1/2022 (-9.9U)
MW502 9/8/2022 (-1.46U)
MW461 9/7/2022 (5.52U)
MW501 9/8/2022 (-2.71U)
MW462 9/7/2022 (28.2)
MW242 9/7/2022 (28.1)
MW243 9/7/2022 (18)
MW500 9/6/2022 (318)
MW244 9/7/2022 (-0.0314U)
MW248 9/7/2022 (11.1U)
MW499 9/6/2022 (320)
MW250 9/7/2022 (3.94U)
HV217/EW232 10/4/2022 (184)
MW481 5/12/2021 (-2.36U)
MW245 9/7/2022 (-0.421U)
MW504 9/6/2022 (8.47U)
MW291 10/5/2022 (3.8U)
MW293A 10/5/2022 (5.46U)
MW106A 11/1/2022 (3.08U)
MW497 9/6/2022 (62.8)
MW503 9/6/2022 (247)
MW165A 9/7/2022 (5.3U)
MW355 9/6/2022 (34.4)
MW496 10/3/2022 (20.7)
MW482 5/12/2021 (11.8U)
MW283 10/5/2022 (3.34U)
MW63 9/6/2022 (15.2)
MW498 9/6/2022 (332)
HV222/EW233 10/4/2022 (451)
MW173 9/8/2022 (-2.7U)
R53 11/2/2022 (0.543U)
MW65 9/6/2022 (21.8)
MW145 10/3/2022 (31.9)
MW288 10/5/2022 (25.2)
MW126 10/5/2022 (2.22U)
MW124 10/5/2022 (3.78U)
MW432 11/1/2022 (0.56U)
MW66 9/6/2022 (233)
MW339 12/12/2022 (32.5)
MW144 10/3/2022 (55)
MW426 11/1/2022 (5.5U)
MW427 11/1/2022 (-0.519U)
MW340 12/12/2022 (2230)
MW495 10/3/2022 (49.9)
MW292 10/5/2022 (9.77)
MW261 5/10/2022 (1110)
MW531 10/4/2022 (72)
MW205 5/26/2021 (-5.45U)
MW428 9/8/2022 (-0.651U)
MW169 5/21/2021 (68.2)
MW429A 9/6/2022 (5.66U)
MW480 10/3/2022 (33.7)
MW262 5/19/2021 (218)
MW354 12/13/2022 (19U)
MW430 9/6/2022 (7.48U)
MW524 10/3/2022 (6.05U)
MW260 10/4/2022 (28.4)
MW479 10/3/2022 (-2.13U)
MW533 10/4/2022 (43.5)
SP234/EW234 12/12/2022 (55.3)
MW525 10/5/2022 (129)
MW556 10/3/2022 (23)
MW403-PRT3 12/13/2022 (-3.68U)
MW526 10/5/2022 (176)
MW404-PRT4 5/27/2021 (-2.52U)
MW329 5/12/2021 (-3.73U)
MW163 10/4/2022 (62.2)
See Inset A
MW527 10/4/2022 (18.7)
MW536 10/4/2022 (136)
MW478 10/3/2022 (6.75U)
SP235/EW235 12/12/2022 (25)
MW528 10/4/2022 (90.4)
MW256 10/4/2022 (12.2)
MW258 10/3/2022 (2.92U)
MW161 5/10/2022 (-4.8U)
MW549 5/19/2021 (3.49U)
MW537 10/4/2022 (132)
MW529 10/3/2022 (196)
See Inset B
MW538 10/4/2022 (24.8)
MW255 10/4/2022 (-0.316U)
MW530 10/4/2022 (32.4)
MW539 10/4/2022 (24.6)
MW328 5/12/2021 (-2.1U)
MW203 7/11/2022 (54.1)
MW71 6/8/2022 (-1.01U)
MW68 6/8/2022 (18.6U)
MW103 5/12/2021 (-5.08U)
MW168 5/21/2021 (1340)
MW422-PRT1 9/14/2022 (21200)
MW423-PRT1 9/13/2022 (16400)
MW421-PRT1 9/14/2022 (2270)
MW341 12/6/2022 (1540)
MW343 9/13/2022 (11900)
MW178 12/7/2022 (91.4)
MW424-PRT2 9/14/2022 (20500)
MW573 12/7/2022 (84.1)
MW425-PRT3 9/13/2022 (14300)
MW569 12/5/2022 (527)
MW574 12/7/2022 (974)
MW566 12/6/2022 (63.6)
MW570 12/5/2022 (2440)
MW342 9/14/2022 (807)
MW571 12/5/2022 (1190)
MW567 12/6/2022 (51.5)
MW572 12/7/2022 (124)
MW568 12/6/2022 (45.9)
MW175 9/14/2022 (294)
MW563 12/5/2022 (189)
MW405-PRT5 12/7/2022 (58.1)
MW564 12/5/2022 (65.1)
MW155 12/6/2022 (90.9)
MW560 12/6/2022 (5.92U)
MW565 12/5/2022 (125)
MW561 12/6/2022 (181)
MW156 12/6/2022 (-1.76U)
MW562 12/6/2022 (139)
MW406-PRT5 12/8/2022 (6.29U)
MW557 12/5/2022 (15.1U)
MW407-PRT2 1/18/2022 (53.4)
MW558 12/5/2022 (42.3)
MW408-PRT5 12/8/2022 (12.1U)
MW505 12/6/2022 (38.3)
MW559 12/5/2022 (67.2)
MW506 12/6/2022 (50.2)
MW507 12/6/2022 (28.6)
Inset B

N
600 300 0 600 1,200 1,800 Feet

2022 Tc-99 Plume Concentration Fields
- 900 - 1,930 pCi/L
- 1,930 - 3790 pCi/L
- ≥ 3790 pCi/L

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

- Surface Water Course Centerline
- DOE Property Boundary
- Roadways
- 229 Boundary

- Limited Area
- Water Policy Area

MW242 9/7/2022 (28.1) - Monitoring Well Identification; Date of Sample and Sample Value (Tc-99 Concentration in pCi/L)
U = Compound analyzed for but not detected at or below the lowest concentration reported
UJ = Not detected and result estimated

MAP SOURCE INFORMATION
Map Generation Date and Location - 3/2/2023 Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\MXD\Fig_C02_2022PlumesTc99R1.mxd
Monitoring and Extraction Well Layer Location: Geosyntecfedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2021-2022_Tc-99_Most_Recent.shp
2022 Tc-99 Plume Concentration Fields : Geosyntec\\fedprojects-01\paducah$\Knoxville\GW Strategy\2022 PLUME MAP UPDATE\05 GIS\SHP\2022_Tc99_Above_3790.shp\2022_Tc99_1930_3790.shp\2022_Tc99_900_1930.shp
DOE Property Boundary and Surface Water Course Centerline provided by FRNP on 2/4/2021 and 11/8/2022, respectively.
Roadways, 229 Boundary, and Water Policy Area downloaded from PEGASIS on 3/16/2021.
Limited Area shapefile provided by FRNP on 2/4/2021 and external limits confirmed by FRNP on 3/21/2022.

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Figure C.2. 2022 Tc-99 Plume–Regional Gravel Aquifer

APPENDIX D

NORTHEAST PLUME TRANSECT WELL QUARTERLY SAMPLING RESULTS FOR TRICHLOROETHENE

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Box 2

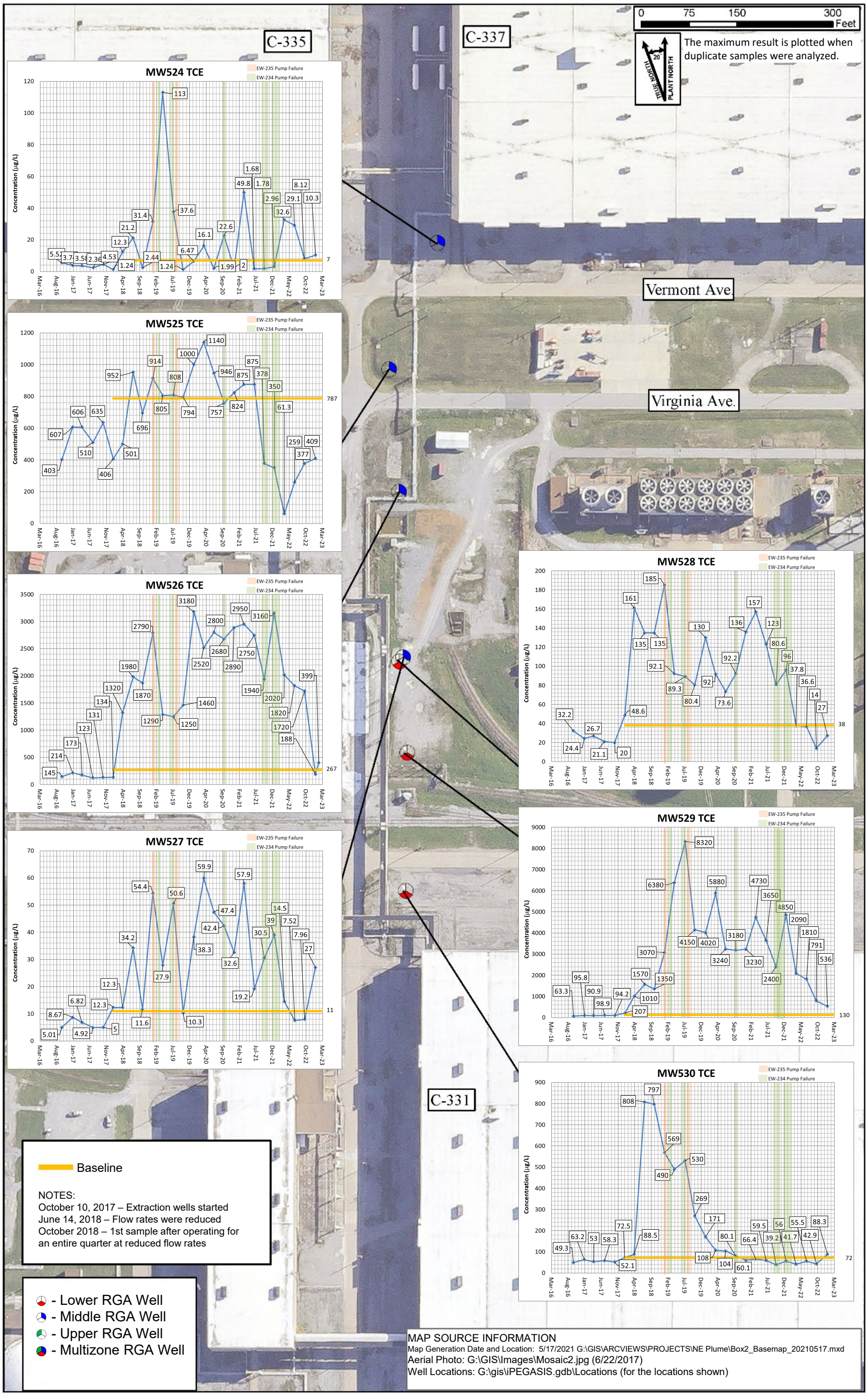

Figure D.1. Northeast Plume Transect Well Quarterly Sampling Results Trichloroethene

Box 2

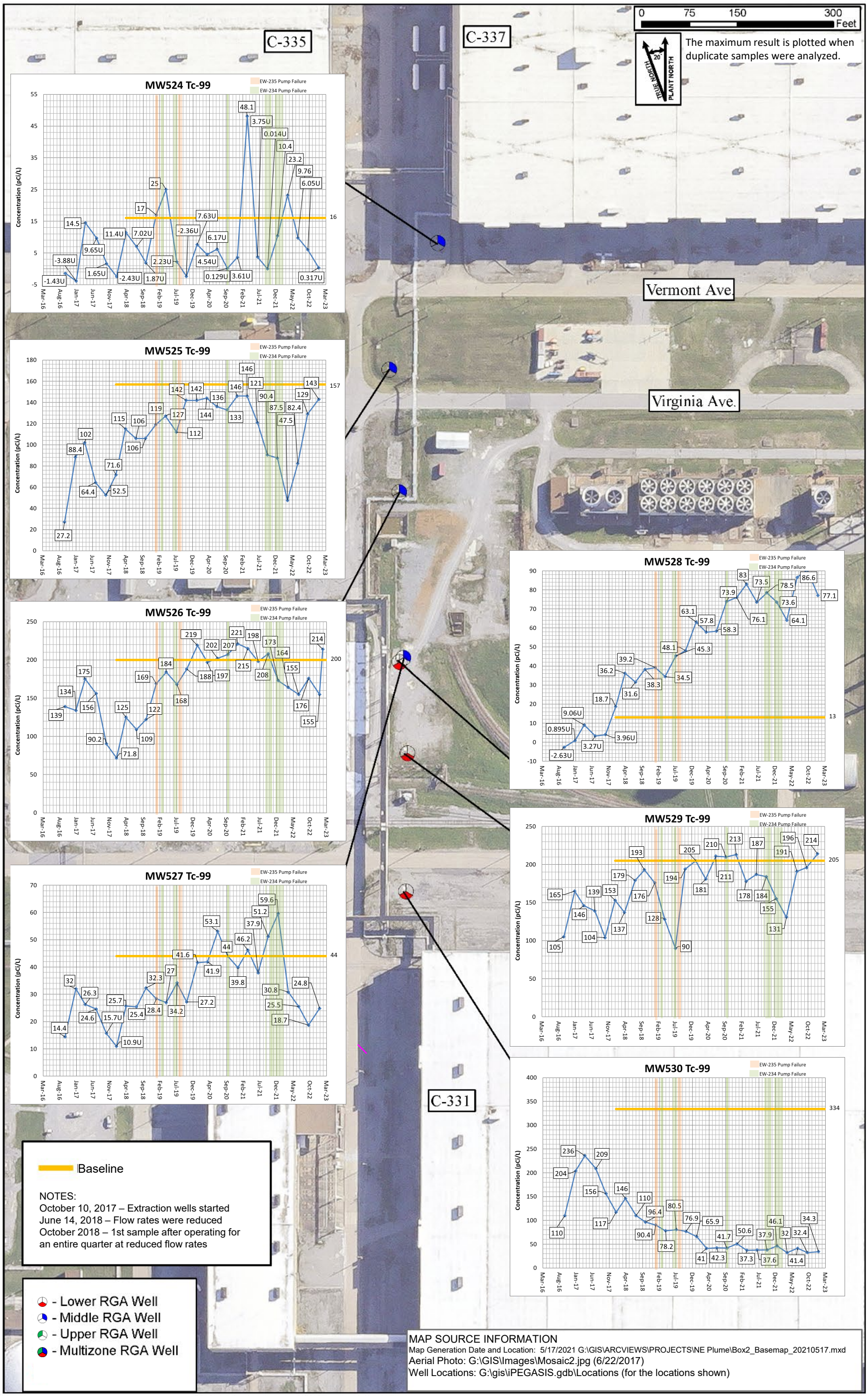

Figure D.2. Northeast Plume Transect Well Quarterly Sampling Results Technetium-99