Department of Energy

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MAR 30 2016

Mr. Brian Begley
Federal Facility Agreement Manager
Division of Waste Management
Kentucky Department for Environmental Protection
200 Fair Oaks Lane, 2nd Floor
Frankfort, Kentucky 40601

PPPO-02-3467420-16

Ms. Julie Corkran
Federal Facility Agreement Manager
U.S. Environmental Protection Agency, Region 4
61 Forsyth Street
Atlanta, Georgia 30303

Dear Mr. Begley and Ms. Corkran:

TRANSMITTAL OF THE ADDENDUM TO THE FIVE-YEAR REVIEW FOR REMEDIAL ACTIONS AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY, (DOE/LX/07-1289&D2/R1/A2)

Reference: Letter from R. Chaffins to J. Woodard, Untitled [Subject: EPA Position on Protectiveness Determinations Associated with the Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky (DOE/LX/07-1289&D2/R1)], dated September 30, 2014

Enclosed for your approval is the Addendum to the *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/LX/07-1289&D2/R1/A2. This addendum contains the additional actions for the Water Policy protectiveness determination required by the U.S. Environmental Protection Agency on September 30, 2014. These actions include (1) the water policy educational mailer, (2) the water policy vapor intrusion screening study report, and (3) the demonstration that all residents located above the contaminated groundwater plume are not using groundwater from their wells. Based upon these completed actions, DOE confirms its original protectiveness determination for the Water Policy Removal Action as Short-term Protective as follows: "The remedy for the Water Policy currently protects human health and the environment by institutional controls in the short-term. Exposure pathways that could result in unacceptable risk are being controlled; however, additional actions, as part of the dissolved-phase plume, need to be evaluated for long-term protection."

If you have any questions or require additional information, please contact Cynthia Zvonar at (859) 219-4066.

Sincerely,

Tracey Duncan
Federal Facility Agreement Manager
Portsmouth/Paducah Project Office

Enclosure:
Addendum to the *Five-Year Review for Remedial Actions*

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DOE/LX/07-1289&D2/R1/A2
Secondary Document

Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

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DOE/LX/07-1289&D2/R1/A2
Secondary Document

Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—March 2016

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

Prepared by
LATA ENVIRONMENTAL SERVICES OF KENTUCKY, LLC
managing the
Environmental Remediation Activities at the
Paducah Gaseous Diffusion Plant
under contract DE-AC30-10CC40020

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APPENDIX C

WATER POLICY ADDITIONAL ACTIONS

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WATER POLICY ADDITIONAL ACTIONS

This addendum was prepared to document the additional information that has been collected to support the protectiveness determination of the Water Policy Removal Action (Section 8 of the main text), as requested by the U.S. Environmental Protection Agency (EPA) in letter dated September 30, 2014. EPA's letter stated the following:

> …The potential for current and new landowners using their groundwater is identified as an issue in the FYR. The recommendation to address the issue is for DOE to educate all landowners through an annual educational fact sheet, and contact and inform new landowners about the contaminated groundwater. These actions may reduce risk but will not eliminate the risk to residents using contaminated groundwater.
>
> In addition, based on groundwater data from off-site wells, a potential risk for vapor intrusion exists for off-site residents located above the TCE groundwater plume. EPA expects the vapor intrusion risk is small given TCE groundwater concentrations. However, DOE must demonstrate whether vapor intrusion is a risk to residents through a vapor intrusion study. Until DOE demonstrates that all residents located above the contaminated groundwater plume are not using groundwater and vapor intrusion is not occurring into residential properties, the protectiveness statement should be "deferred".
>
> Based on the information provided in the subject document and additional data provided by DOE, EPA has made the following determination for the Water Policy Removal Action:
>
> The protectiveness determination of the removal action for the Water Policy cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: DOE demonstrates that all residents located above the contaminated groundwater plume are not using groundwater from their wells, and a vapor intrusion study is conducted if current groundwater data indicate a study is warranted. It is expected that these actions will be completed 1.5 years from the signature date of this letter, at which time a protectiveness determination will be made.

The U.S. Department of Energy has completed the following actions:

- The Water Policy Educational Fact Sheet, Attachment C1, mailed to area residents within the Water Policy Box with the recipient listed as "Current Resident" on January 27, 2016.

- The Water Policy Vapor Intrusion Screening Study Report, Attachment C2, was submitted to EPA/Kentucky Department for Environmental Protection on October 21, 2015. Comments were received and a revised report was submitted on February 22, 2016. This addendum contains the revised report.

- The demonstration that residents located over the contaminated groundwater plume are not using groundwater is included as Attachment C3 of this Addendum.

Based upon these completed actions, the protectiveness determination for the Water Policy Removal Action is determined to be Short-term Protective as follows:

The remedy for the Water Policy currently protects human health and the environment by institutional controls in the short-term. Exposure pathways that could result in unacceptable risk are being controlled; however, additional actions, as part of the dissolved-phase plume, need to be evaluated for long-term protection.

ATTACHMENT C.1

WATER POLICY EDUCATIONAL MAILER

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INFORMATIONAL BROCHURE - DOE WATER POLICY RESIDENT

Water Policy Area

Upon discovering residential well contamination in 1988, DOE committed to eliminate residents' exposure to trichloroethene (TCE) and technetium-99 (Tc-99) contamination by providing alternate drinking water to potentially affected residents. This action became known as the DOE Water Policy. To achieve the goal of eliminating residents' exposure to contamination, DOE paid for extending the West McCracken public water supply to the potentially affected area. The potentially affected area is bounded by the Ohio River to the north, DOE property boundary on the south, Metropolis Lake Road to the east, and Bethel Church Road to the west.

DOE also asked property owners in the area to sign a license agreement, in which DOE agreed to pay residents' water bills, allowed DOE representatives access to residential properties to collect samples, and prohibited the property owner from drilling new water supply wells or using existing water supply wells.

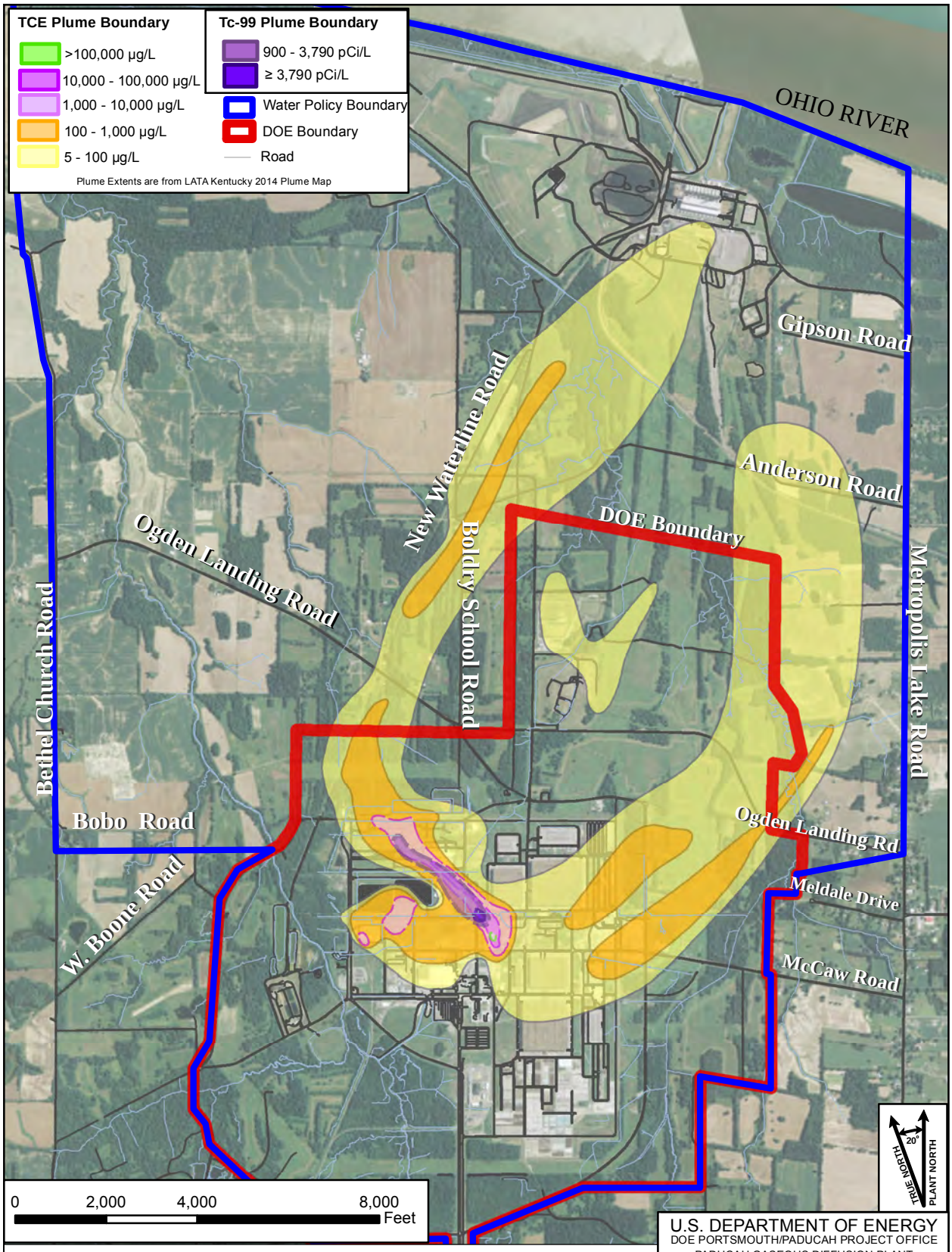
DOE continues to implement the Water Policy by renewing license agreements with property owners within the potentially affected area. The protectiveness of the Water Policy is required by law to be reviewed every five years. As a result of the most recent review, DOE with agreement from the U.S. Environmental Protection Agency (EPA) and the Kentucky Department for Environmental Protection (KDEP) decided to send this fact sheet to all Water Policy residents to ensure they are educated about the potential contamination in underlying groundwater.

Since discovering the residential well contamination in 1988, DOE has taken actions that have reduced the groundwater concentrations of TCE and Tc-99 in the potentially affected area, including implementing groundwater remedial actions in the northeast and northwest contaminant plumes, which underlie the potentially affected area, and reducing contaminants at the source of those plumes. DOE continues these actions under the oversight of EPA and KDEP.

Resident Need to Know

All residents are asked to not drill a new water supply well or use any existing water wells.

For more information about the Water Policy, please contact: Buz Smith at 270-441-6000



Location of Water Policy Boundary

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

FLUOR

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12/22/2015

ATTACHMENT C.2

WATER POLICY VAPOR INTRUSTION SCREENING STUDY

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DOE/LX/07-1289&D2/R1/A1/R1
Secondary Document

Water Policy Area Vapor Intrusion Screening Study Report for the Five-Year Review of Remedial Actions Paducah, Kentucky

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DOE/LX/07-1289&D2/R1/A1/R1
Secondary Document

Water Policy Area Vapor Intrusion Screening Study Report for the Five-Year Review of Remedial Actions Paducah, Kentucky

Date Issued—February 2016

U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

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

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PREFACE

This *Water Policy Area Vapor Intrusion Screening Study Report for the Five-Year Review of Remedial Actions, Paducah, Kentucky*, DOE/LX/07-1289&D2/R1/A1/R1, has been prepared as a Secondary Document under the *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant* (EPA 1998). This report has been developed to supplement the *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1289&D2/R1 (DOE 2014a).

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FIGURES

TABLES

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ACRONYMS

bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
DPT	Direct Push Technology (boring)
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
KDFWR	Kentucky Department of Fish and Wildlife Resources
PGDP	Paducah Gaseous Diffusion Plant
Pot	potentiometric surface
RGA	Regional Gravel Aquifer
SAP	sampling and analysis plan
TIC	top of inner casing
TOC	top of casing
UCRS	Upper Continental Recharge System
VISL	Vapor Intrusion Screening Level
VOC	volatile organic compound
WKWMA	West Kentucky Wildlife Management Area
WWR	Well Wizard riser

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EXECUTIVE SUMMARY

This report presents the results of a vapor intrusion screening study performed as an additional action based on determinations made in the *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1289&D2/R1 (Five-Year Review) (DOE 2014a). The vapor intrusion screening study was conducted at four locations within the Water Policy Area to determine whether volatile organic compound (VOC) [primarily trichloroethene (TCE)] concentrations in groundwater warrant a detailed vapor intrusion study.

This study meets the sampling requirements in *Sampling and Analysis Plan to Support the Additional Action for the CERCLA Five-Year Review at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2200&D1, as modified by field conditions. During the study, first available water samples were collected, as available, from locations within the Water Policy Area near the residences located near/above the TCE plumes. The Federal Facility Agreement parties agreed that the sampling results provide quality data sufficient to address the study's decision rules.

Direct push technology borings were advanced into the Upper Continental Recharge System (UCRS) matrix in the vicinity of four residences located near/above the Regional Gravel Aquifer (RGA) TCE plumes. Although groundwater was encountered at all four boring locations, only two sets of the borings had sufficient water to allow collection of a water sample. The dearth of water for sample collection at the residences is consistent with the conceptual site model (CSM) for the UCRS and earlier UCRS sampling efforts. The CSM for the UCRS shows the upper UCRS matrix consists of silt and clay that limits water migration and the upward migration of vapor phase VOCs.

The groundwater samples collected were analyzed, and no detectable VOCs were found above the project's detection limit of 1 μg/L. Based upon the failure to detect VOCs in UCRS groundwater, the very low permeability of the UCRS matrix, the low VOC concentrations in the underlying RGA, and the review of the vapor intrusion guidance, this vapor intrusion screening study determined that an additional vapor intrusion study (i.e., a detailed investigation) is not warranted in the Water Policy Area.

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1. INTRODUCTION

This report presents the results of the vapor intrusion screening study performed in accordance with the approved *Sampling and Analysis Plan to Support the Additional Action for the CERCLA Five-Year Review at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2200&D2 [Sampling and Analysis Plan (SAP)] (DOE 2015a), which was conducted as an additional action subsequent to the *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1289&D2/R1 (Five-Year Review) (DOE 2014a). The vapor intrusion screening study was performed to determine whether volatile organic compound (VOC) [primarily trichloroethene (TCE)] concentrations in Upper Continental Recharge System (UCRS) groundwater warrant a detailed vapor intrusion study within the Water Policy Area. TCE plumes in the Regional Gravel Aquifer (RGA) underlie the Water Policy Area, and TCE vapor released from these plumes has the potential to migrate upward. To evaluate this potential for upward migration, a vapor intrusion screening study was designed and a SAP was prepared that described how to collect first-available water samples from locations within the Water Policy Area near the residences located near/above the TCE plumes. The Federal Facility Agreement (FFA) parties agreed that this sampling approach would provide a sufficient basis on which to determine whether a detailed vapor intrusion study is warranted, and the SAP was approved by the U.S. Environmental Protection Agency (EPA) on May 21, 2015, (EPA 2015a) and by the Kentucky Division of Waste Management on May 22, 2015 (KDWM 2015).

1.1 PROJECT SCOPE

The Five-Year Review (DOE 2014a) presented the results of a 2013 review of the Water Policy Removal Action. In a letter dated September 30, 2014, (EPA 2014a) EPA noted the following project-related uncertainty:

> The protectiveness determination of the removal action for the Water Policy cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: DOE demonstrates that all residents located above the contaminated groundwater plume are not using groundwater from their wells, and a vapor intrusion study is conducted if current groundwater data indicate a study is warranted.

Three meetings were held to scope the vapor intrusion concern raised by EPA and develop an approach to collecting groundwater data. The meetings were held on August 8, 2014; February 24, 2015; and April 22, 2015. As a result of these meetings, the FFA parties agreed to undertake a vapor intrusion screening study to determine whether a detailed vapor intrusion study is warranted. This study was performed under the provisions of Section XXX, Five-Year Review, of the FFA, as documented in the Record of Conversation letter dated August 1, 2014 (DOE 2014b).

1.2 PROJECT OBJECTIVES

The objective of the field work was to collect first-available water samples from locations within the Water Policy Area near residences located near/above the TCE plumes. Figure 1 presents a map of the RGA TCE plumes and the four boring locations (NW1, NW2, NE1, and NE2). The water samples would be analyzed for selected VOCs per the SAP. Analytical results were compared to the respective default Vapor Intrusion Screening Level (VISL) for groundwater from the VISL Calculator (VISL values)

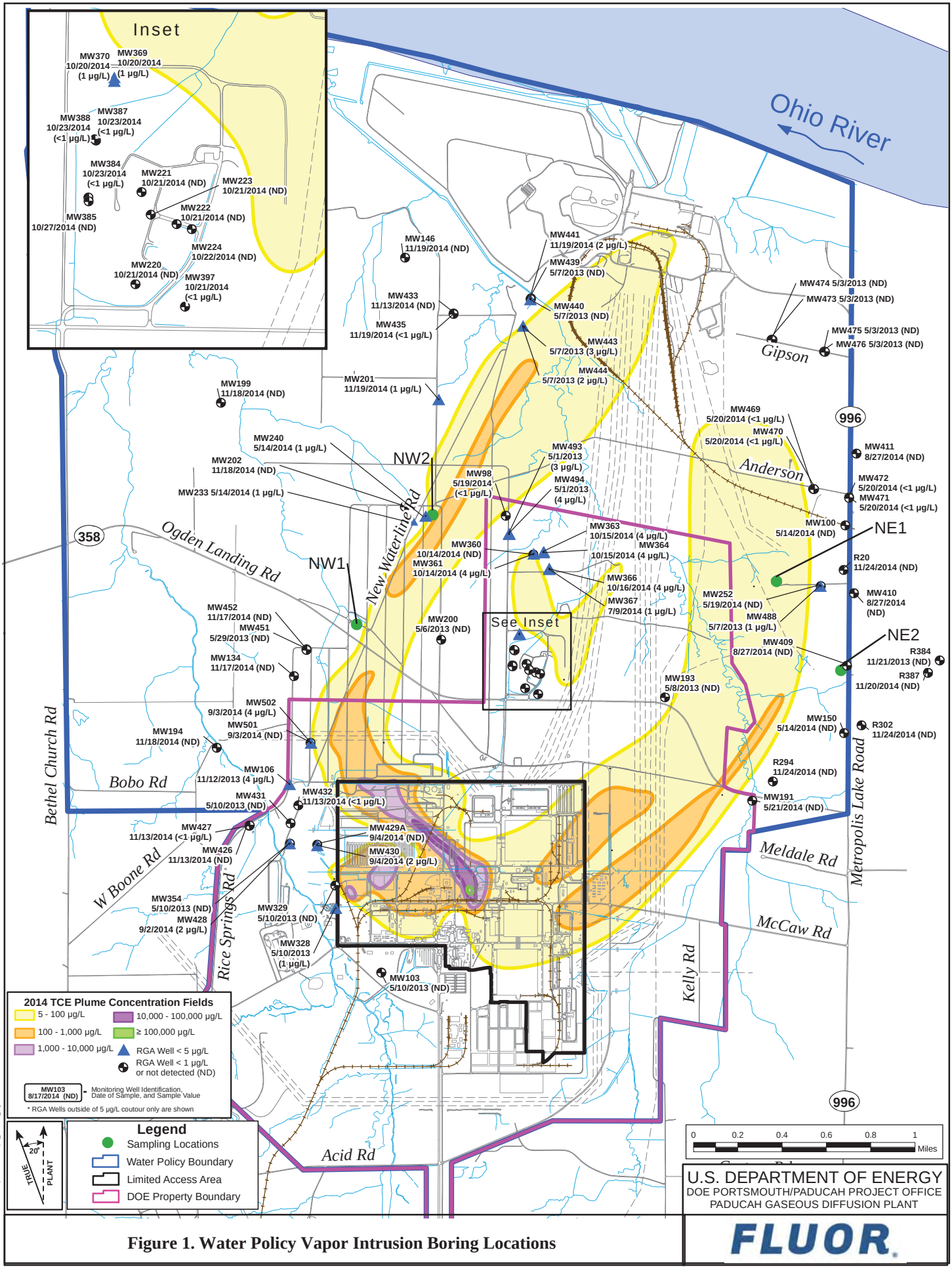

Figure 1. Water Policy Vapor Intrusion Boring Locations

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(EPA 2014b). If groundwater data for selected VOCs are less than the VISL or nondetect, then no additional groundwater sampling is needed and the vapor intrusion pathway does not pose a concern for the residence.

1.3 PROJECT APPROACH

The approach agreed to by the FFA parties to meet the project objective of this vapor intrusion screening study was as follows.

- Advance Direct Push Technology (DPT) rods into the UCRS to allow collection of water from the first-available UCRS depth.
- Sample groundwater from the first available UCRS depth and analyze for VOCs.
- Compare groundwater analytical results to the respective default VISL for groundwater calculated using the VISL Calculator (EPA 2014b).
- Groundwater samples were to be collected from first-available water from four locations within the Water Policy Area near the residences located near/above the TCE Plume. Samples were to be taken within 100 ft laterally, where possible, and not further than 300 ft from the residence for the study.

The 2014 TCE Plume contours were used in conjunction with groundwater monitoring well results that were < 5μg/L and < 1 μg/L or nondetect (Figure 1) to select the residences to be sampled. The *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2014 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PAD-ENR-0146, states that all data for the 2014 TCE Plume map were extracted from the Paducah Oak Ridge Environmental Information System database. The map for calendar year 2014 is based on analytical results from the most recent sampling event (primarily January–December 2014). Where collocated monitoring wells (i.e., clustered wells or multiport wells) provide analytical results for the calendar year from screened intervals at multiple elevations within the RGA (e.g., upper, middle, and/or lower RGA), the maps use the value from the interval that has the highest concentration. Data from sampling in 2013 have been used, as necessary, to supplement the 2014 information and aid in plume delineation.

1.4 AREA DESCRIPTION

Paducah Gaseous Diffusion Plant (PGDP), located within the Jackson Purchase region of western Kentucky, is an inactive uranium enrichment facility owned by the U.S. Department of Energy (DOE). PGDP first was owned and managed by the Atomic Energy Commission and the Energy Research and Development Administration, DOE's predecessors; DOE then managed PGDP until 1993. On July 1, 1993, the United States Enrichment Corporation assumed management and operation of the PGDP enrichment facility under a lease agreement with DOE that continued until October 2014 when the facility was returned to DOE. DOE retains ownership of the enrichment complex.

Of the 3,556 acres owned by DOE, approximately 650 acres of this parcel are inside the PGDP fenced area. Most of the facilities used to support enrichment operations are located inside the PGDP fenced area. Outside the fenced area, several support facilities for DOE projects can be found. The support facilities include landfills (both active and closed), modular office complexes, a water treatment facility, groundwater remediation systems, decontamination facilities, storage areas, a storm water retention basin, and liquid effluent treatment facilities. Of the remaining DOE land, approximately 1,986 acres is licensed

to the Commonwealth of Kentucky Department of Fish and Wildlife Resources (KDFWR) and serves as a portion of the West Kentucky Wildlife Management Area (WKWMA). The licensed portion of the WKWMA is used by the public for hunting and horse and dog field trials. KDFWR staff work in the licensed area performing wildlife management activities.

The topography of DOE property is level to slightly rolling. It is rural and predominantly open grasslands with scattered wooded areas of mature hardwoods and brush. Approximately 60% of the total area outside PGDP but on DOE-owned property is grasslands; much of this nonwooded area is right-of-way for electrical power lines.

1.5 GEOLOGY AND SOILS

The Jackson Purchase region of western Kentucky, where PGDP is located, represents the northern tip of the Mississippi Embayment portion of the Coastal Plain. The Jackson Purchase region is an area of land that includes all of Kentucky west of the Tennessee River. The stratigraphic sequence in the region consists of Cretaceous, Tertiary, and Quaternary sediments unconformably overlying Paleozoic bedrock. Relative to the shallow groundwater flow system in the vicinity of PGDP, the continental deposits and the overlying loess and alluvium are of key importance. The continental deposits locally consist of an upper silt member, with lesser sand and gravel interbeds, and a thick, basal sand and gravel member, which fills a buried river valley. A subcrop of the Porters Creek Clay, located beneath and immediately south of PGDP marks the southern extent of the buried river valley. Fine sand and clay of the McNairy Formation directly underlie the continental deposits in the buried river valley. These continental deposits are continuous from beneath PGDP northward beyond the present course of the Ohio River.

The general soil map for Ballard and McCracken Counties indicates that three soil associations are found within the vicinity of PGDP (USDA 1976): the Rosebloom-Wheeling-Dubbs association, the Grenada-Calloway association, and the Calloway-Henry association. The predominant soil association in the vicinity of PGDP is the Calloway-Henry association, which consists of nearly level, somewhat poorly drained, medium-textured soils on upland positions. Many of the characteristics of the original soil have been lost due to industrial activity that has occurred over the past 50-plus years. Activities that have disrupted the original soil classifications include filling, mixing, and grading. The soil type present in these disturbed areas is characterized as urban.

1.6 HYDROGEOLOGY

PGDP is located in the western portion of the Ohio River drainage basin, approximately 15 miles downstream of the confluence of the Ohio River with the Tennessee River and approximately 35 miles upstream of the confluence of the Ohio River with the Mississippi River. Locally, PGDP is within the drainage areas of the Ohio River, Bayou Creek, and Little Bayou Creek.

PGDP is situated on the divide between the two creeks. Bayou Creek is a perennial stream on the western boundary of the plant that flows generally northward, from approximately 2.5 miles south of the plant site to the Ohio River. Little Bayou Creek becomes a perennial stream at the east outfalls of PGDP. The Little Bayou Creek drainage originates within WKWMA and extends northward and joins Bayou Creek near the Ohio River. The drainage basins for both creeks are located in rural areas; however, they receive surface drainage from numerous swales that drain residential and commercial properties, including WKWMA, PGDP, and Tennessee Valley Authority Shawnee Fossil Plant. The confluence of the two creeks is approximately 3 miles north of the plant site, just upstream of the location at which the combined flow of the creeks discharges into the Ohio River (DOE 2008).

During uranium enrichment operations (1952–2013) and continuing into 2014, most of the flow within Bayou and Little Bayou Creeks was from process effluents or surface water runoff from PGDP. Contributions from PGDP comprised approximately 85% of flow within Bayou Creek and near 100% of flow within Little Bayou Creek. (Process effluents have been significantly reduced during 2015.) A network of ditches discharges effluent and surface water runoff from PGDP to the creeks. Plant discharges are monitored at the Kentucky Pollutant Discharge Elimination System outfalls prior to discharge into the creeks.

The local groundwater flow system at PGDP occurs within the sands of the Cretaceous McNairy Formation, Pliocene Terrace Gravel, Plio-Pleistocene lower continental gravel deposits and upper continental deposits, and Holocene alluvium. The primary local aquifer is the RGA. The RGA consists of the Quaternary sand and gravel facies of the lower continental deposits and Holocene alluvium found adjacent to the Ohio River and is of sufficient thickness and saturation to constitute an aquifer. These deposits have an average thickness of 30 ft. Groundwater flow is predominantly north toward the Ohio River (DOE 2008).

The primary source of groundwater recharge to the RGA derives as downward percolation of infiltrating rainwater and seepage from streams and ponds, through the shallow silt and fine sand units (and lesser clayey units) overlying the RGA. This flow system is termed the UCRS. The top of the saturated zone within the UCRS is the water table, which is poorly known within the Water Policy Area overlying the TCE plumes. These sediments have low hydraulic conductivity (10^{-7} to 10^{-6} cm/sec); hydraulic gradients often approach -1 ft/ft within the saturated UCRS in response to the downward groundwater flow.

1.7 PROJECT CONCEPTUAL SITE MODEL

There are TCE plumes in RGA groundwater that have migrated off of the DOE property and into the vicinity of four residences (see Figure 1); therefore, a theoretical potential exists for the TCE to migrate upward from the RGA, through the UCRS groundwater and the UCRS vadose zone (as a vapor) and to the surface. Figure 2, reproduced from the scoping presentations and the SAP, presents an EPA figure (EPA 2013; EPA 2015b) adapted to PGDP conditions to present the conceptual model for how VOCs have the potential to migrate.

The SAP presented the results of historical investigations that indicate that the UCRS soils in the vicinity of PGDP have very low permeability and do not show evidence of vapor migration. Figures 3 and 4, reproduced from the scoping presentations, document trends of soil texture with depth along transects of the two off-site TCE plumes. Figure 5 shows the projected location of the cross sections. Low permeability soils (silts and clays) are continuous to depths of approximately 30 to 50 ft throughout the transects, with the exception of the incised stream valley of Little Bayou Creek. This vapor intrusion screening study was designed to sample UCRS groundwater and confirm that shallow groundwater concentrations do not exceed default VISL values.

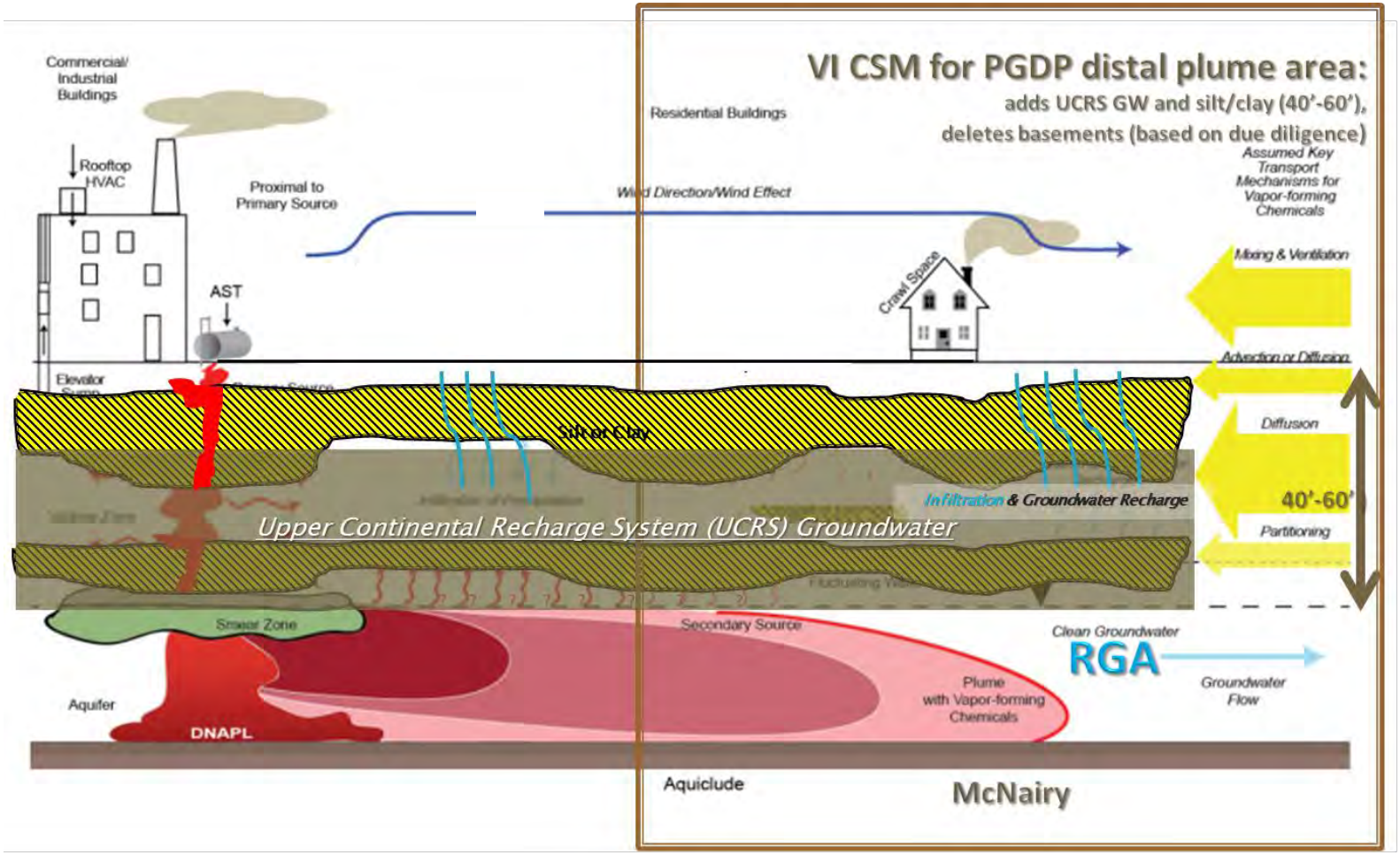

Figure 2. Conceptual Site Model: EPA Figure Adapted to PGDP Conditions

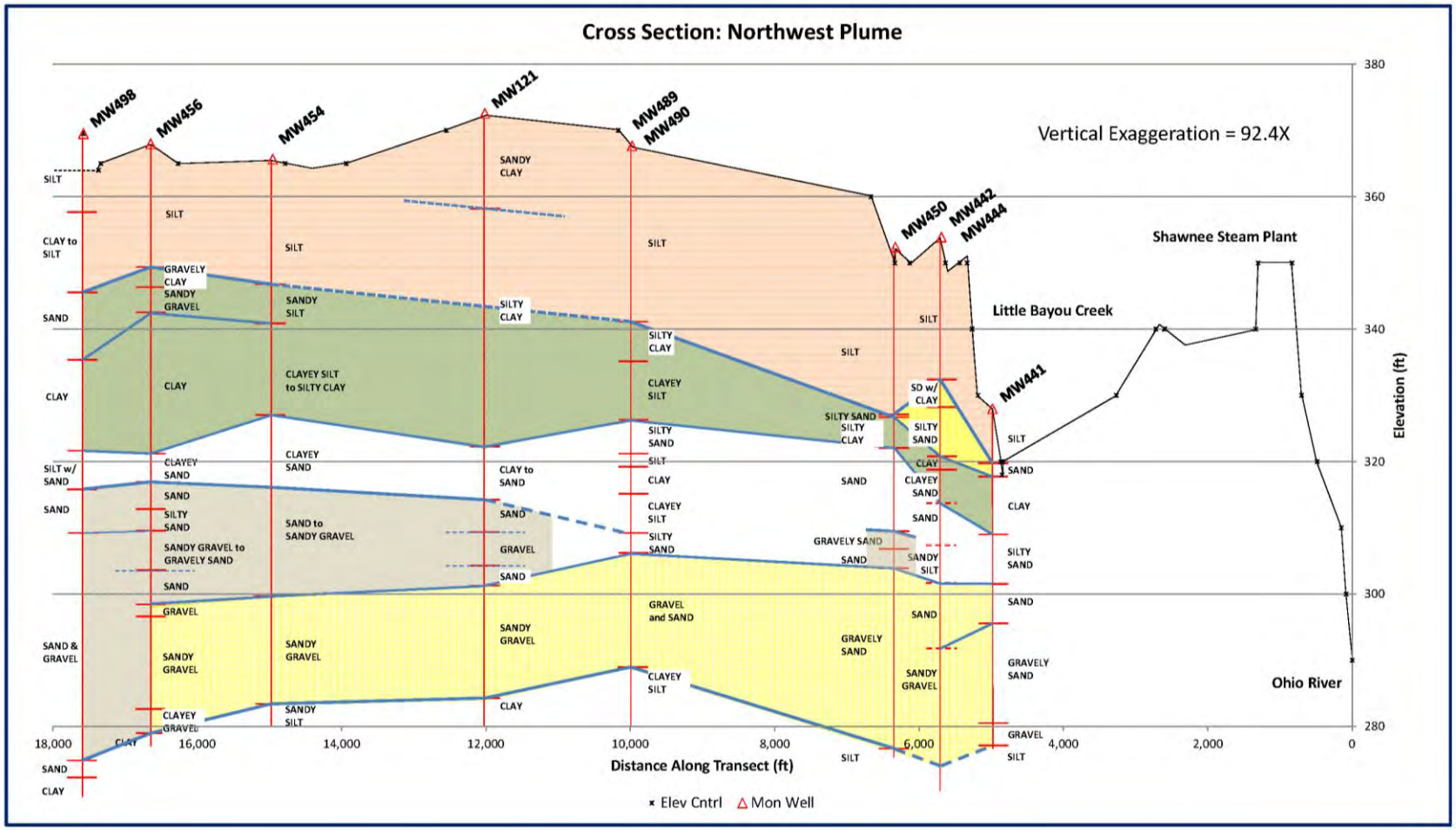

Figure 3. Northwest Plume Cross Section

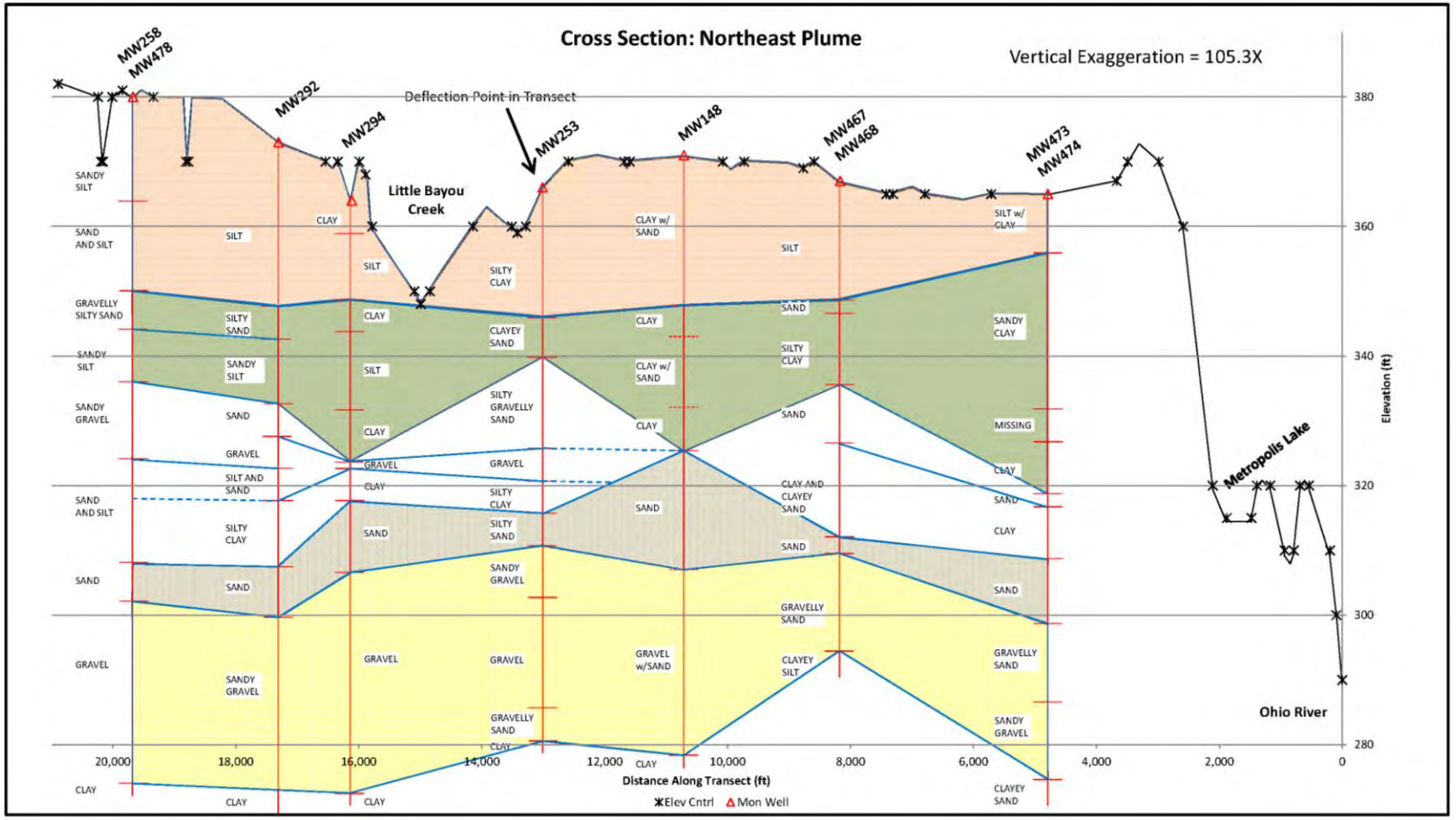

Figure 4. Northeast Plume Cross Section

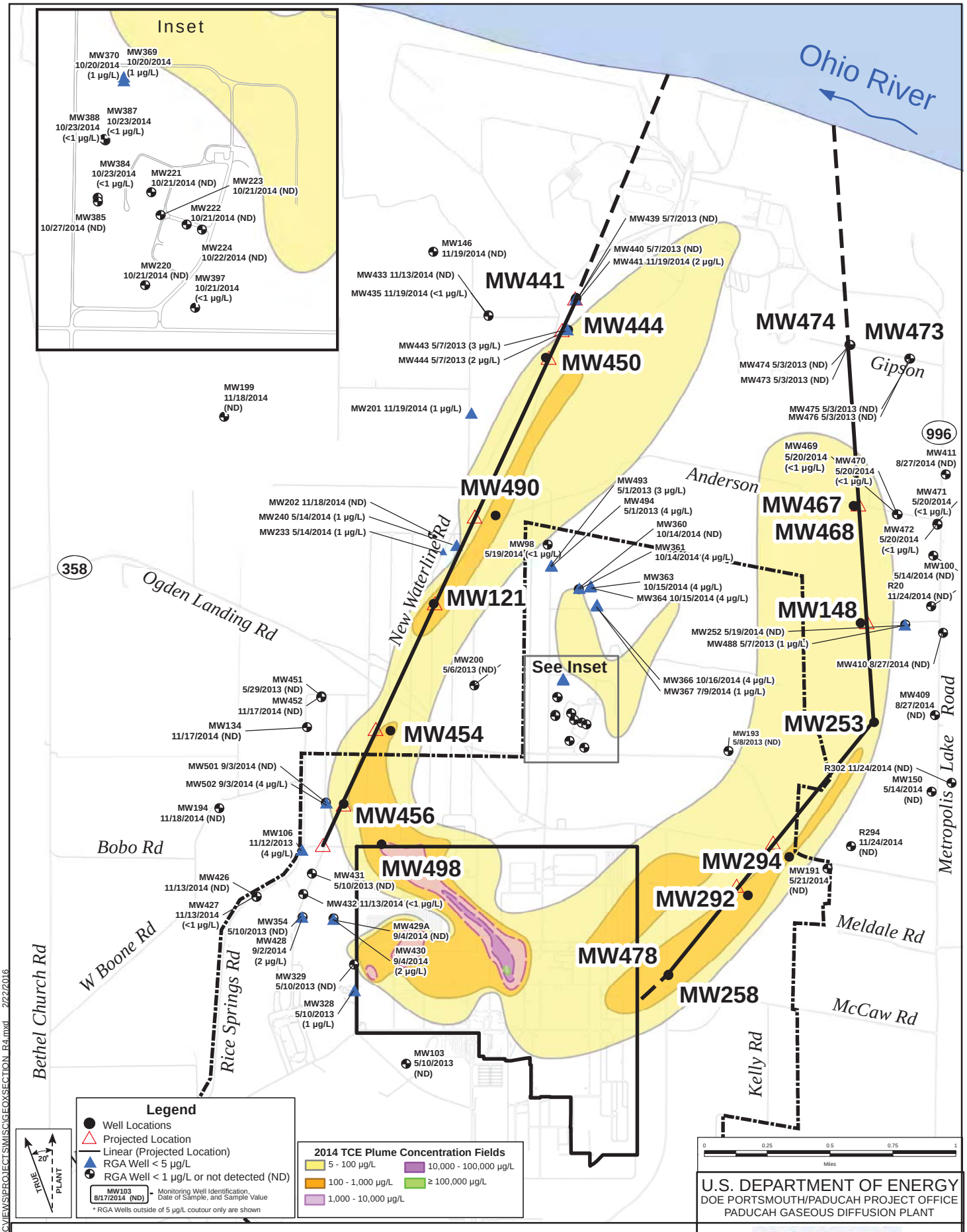

Figure 5. Northeast and Northwest Plumes Geologic Cross Sections Locations

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2. VAPOR INTRUSION SCREENING STUDY APPROACH

At each of four locations, DPT rods were advanced to three depths [nominally 12 ft below ground surface (bgs), 22 ft bgs, and 32 ft bgs]. The borings were advanced in accordance with the SAP at locations summarized in Table 1 and shown on Figures 6, 7, 8, and 9. When target depth had been reached at each boring, the DPT rod was retracted 0.5 ft to allow for groundwater to enter. The rods remained in that position overnight. The groundwater from the shallowest DPT was sampled the following morning.

The methods used to install the DPTs matched the SAP, except for increasing the sampling depth at one location; however, the groundwater sampling approach was modified from what had been planned in the SAP, after consultation with the FFA parties, due to field conditions. On June 11, 2015, the FFA parties met and discussed the results of NE1 and NE2 borings being found dry. For the NE locations, the FFA parties agreed to the following, which was documented in a record of conversation (DOE 2015b):

- Should no water be available or should the amount of water be insufficient to collect a groundwater sample, water levels will be verified up to three subsequent days, as necessary, in an effort to obtain a groundwater sample.

- Abandon NE1 12 ft and NE2 12 ft and 22 ft borings.

- NE1 22 ft DPT boring will be increased in depth to 5 ft minimum distance of the measured water level in the paired RGA monitoring well, MW148.

If a groundwater sample cannot be obtained from the DPT borings at NE2, then the sample collected at NE1 will be used to extrapolate the conditions at NE2. On June 29, 2015, the FFA parties met and discussed the results of NW1 and NW2 borings having insufficient water to sample. For the NW locations, the FFA parties agreed to the following, which is documented in a record of conversation (DOE 2015c):

- Fieldwork should be considered finished and the borings abandoned.
- The one sample collected from NW2 can be used to extrapolate the condition for NW1.
- The soils have been demonstrated to be sufficiently tight such that water movement is inhibited.

Table 1. Five-Year Review Vapor Intrusion Screening Study DPT Sample Borings Locations

Sample Boring Group	Approximate Location of Boring from Residence	DPT Depths (bgs) Paired RGA well	Approx. Plant Coordinates	
			East	North
NW1	~ 264 ft east (Figure 2)[a]	12 ft, 22 ft, 32 ft MW451	-6837	4808
NW2	~ 117 ft west (Figure 3)	12 ft, 22 ft, 32 ft MW236	-5025	7417
NE1 (three residences—one boring location)	Left Residence ~ 102 ft northeast Middle Residence ~ 54 ft north Right Residence ~ 255 ft west (Figure 4)	12 ft, 22 ft and 42 ft[b], 32 ft MW148	3173	5832
NE2	~ 65 ft south (Figure 5)	12 ft, 22 ft, 32 ft MW253	4707	3708

[a] Location changed from SAP based on resident's request.
[b] NE1 22 ft boring extended to 42 ft in attempt to secure UCRS groundwater sample.

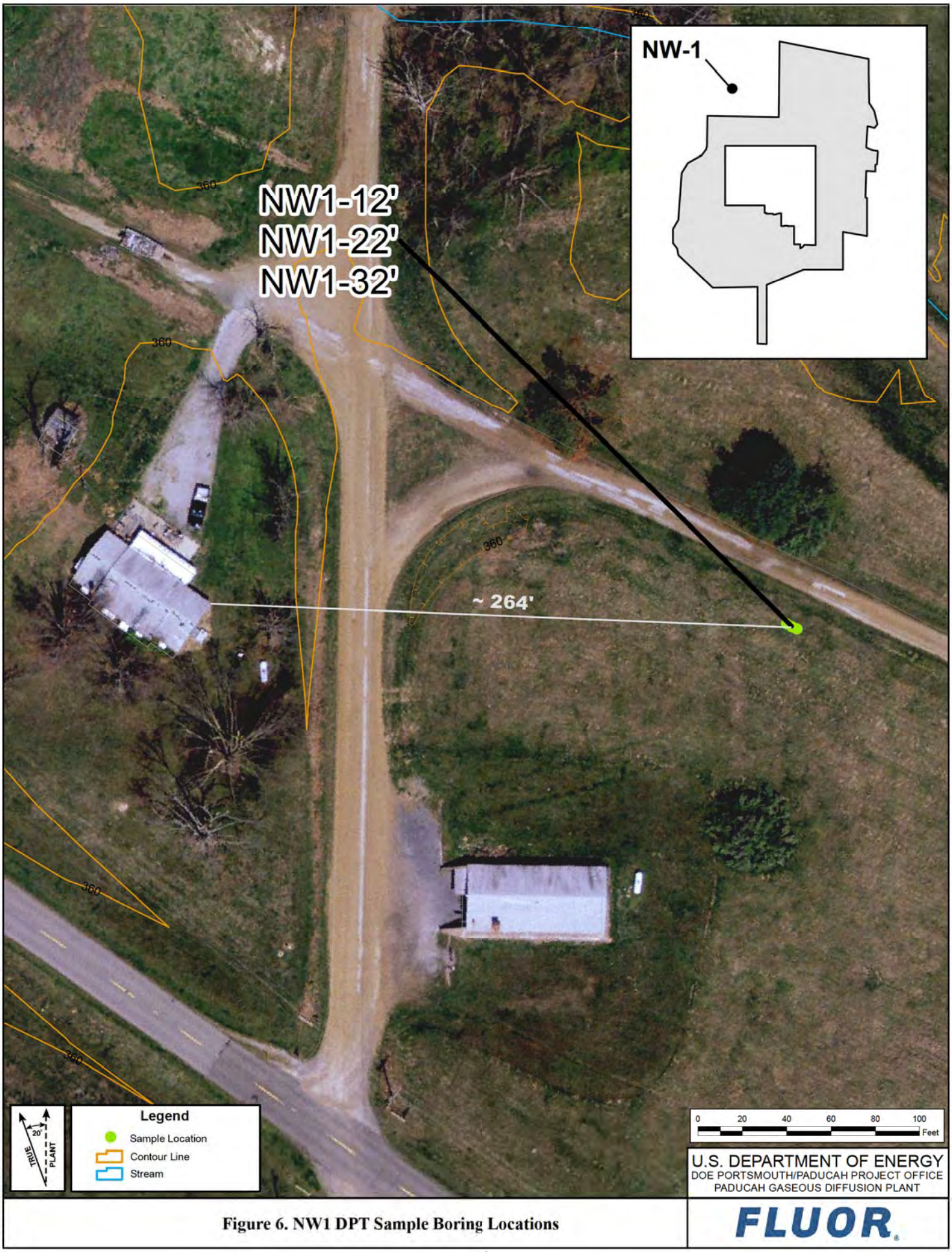

Figure 6. NW1 DPT Sample Boring Locations

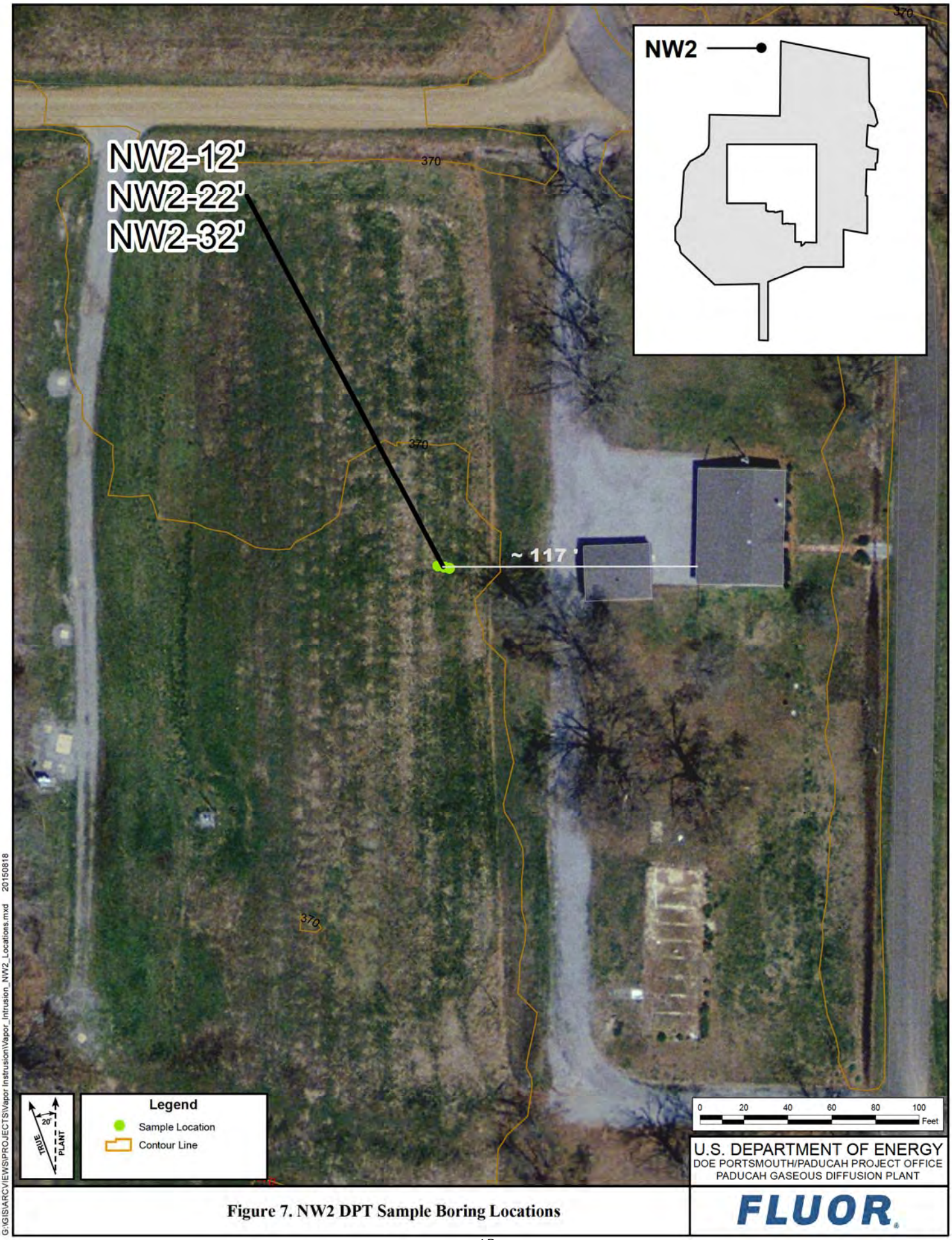

Figure 7. NW2 DPT Sample Boring Locations

Figure 8. NE1 DPT Sample Boring Locations

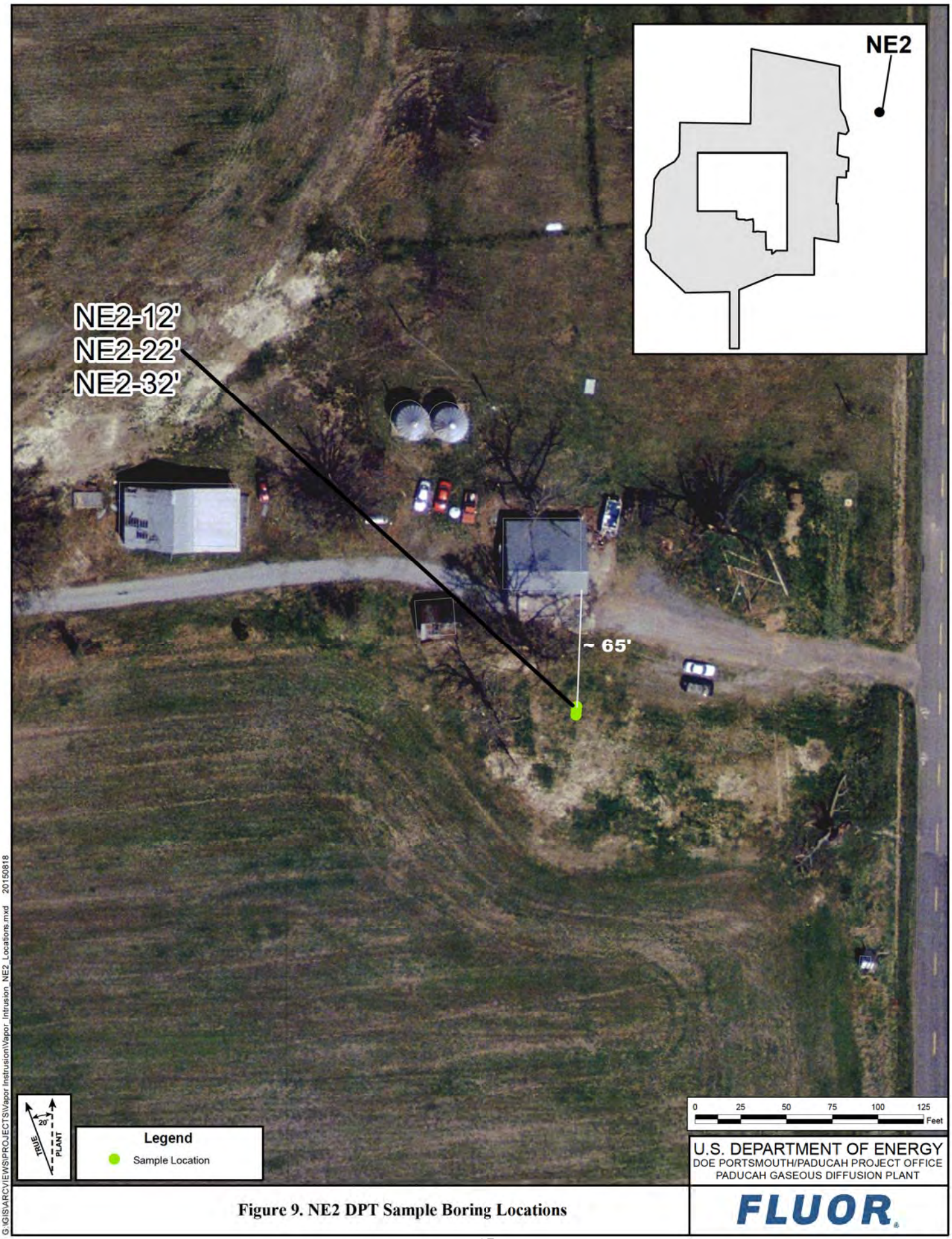

Figure 9. NE2 DPT Sample Boring Locations

2.1 DRILLING METHOD

This vapor intrusion screening study used a DPT rig and dual tube sampling system. The drill crew advanced the sample system with a center rod and drive point assembly to 5 ft short of the target depth (see Section 6) and withdrew the drive point for the bottom 5 ft, allowing the sampler to fill with soil over the bottom 5 ft. This approach was used to minimize the compaction of soils over the bottom 5 ft. Compaction by the DPT rods in the overlying soils provided an effective temporary seal for the DPT rods.

The drill crew extracted the soil core from the bottom of the hole and pulled the outer rods up 0.5 ft to expose the soils and allow groundwater to flow into the interior of the DPT rods. Upon completion of sampling, the DPT boreholes were abandoned by pulling the DPT rods from the ground and filling the boreholes to within 2 ft of ground surface with 3/8-inch particle size bentonite, hydrating the bentonite in 3-ft lifts. The top 2 ft of the borehole was filled with materials consistent with the surrounding ground surface.

2.2 SAMPLING

Three DPT borings were installed at each location, to assure that samples were collected above the potentiometric surface of the underlying RGA (i.e., ~ 32 ft bgs sample above ~ 37 ft bgs RGA potentiometric surface).[1]

Table 2 summarizes the information on each sample boring group including the identification of an RGA monitoring well closest to the boring location. The depth to water in each of these wells was measured to ensure that the greatest boring depth was still nominally 5 ft above the RGA potentiometric surface.

Table 2. RGA Paired Well Information

Sample Boring Group	Paired RGA MW	Approx. Plant Coordinates for Paired RGA Well		Reference Point	Reference Elevation (ft)	Ground Elev. (ft)	Depth to RGA (ft)	~ RGA Pot. Elev.
		X	Y					
NW1	MW451	-8,031.59	4,211.78	TOC	367.22	364.68	42.69	324.53
NW2	MW236	-5,090.64	7,919.36	WWR	369.05	369.28	38.92	330.13
NE1	MW148	3,289.83	5,755.06	TOC	374.00	371.08	47.20	326.80
NE2	MW253	3,572.22	3,669.88	TIC	370.86	368.90	38.52	332.34

TOC = top of casing reference elevation
WWR = Well Wizard riser top reference elevation
TIC = Top Inner Casing
Pot = Potentiometric Surface

When the target depth was reached at each boring, the DPT rod was retracted 0.5 ft to allow groundwater to enter. The rods remained in that position overnight. The next day water levels were measured in each of the DPTs to identify the shallowest DPT with water.

[1] The potentiometric surface of the RGA occurs within the UCRS, above the top of the RGA. The RGA potentiometric surface provides a measurable and reliable reference to assure that the deepest sample depth represents the UCRS and is approximately 10 ft above the top of the RGA.

Table 3 presents a summary timeline of boring installation, sample attempts, and field adjustments to the vapor intrusion screening study.

Table 3. Vapor Intrusion Screening Study Implementation Timeline

Date	Event	Notes
5/28/2015	Initial contact with residents to discuss vapor intrusion screening study borings.	Relocated NW1 borings based upon resident's request and in accordance with the SAP.
6/08/2015	Mobilized to northeast locations. Measured depth to water at MW253 and MW148. Installed NE1 and NE2 borings at 12 ft, 22 ft, and 32 ft bgs.	Groundwater in MW148 measured at 47.20 ft bgs. Groundwater in MW253 measured at 38.52 ft bgs.
6/09/2015	NE1 and NE2 borings found dry.	--
6/11/2015	FFA parties met via teleconference and agreed to path forward: • Abandon NE1 12 ft and NE2 12 ft and 22 ft borings. • NE1 22 ft DPT boring will be increased in depth to 5 ft minimum distance of the measured water level in the paired RGA monitoring well, MW148. • If a groundwater sample cannot be obtained from the DPT borings at NE2, then the sample collected at NE1 will be used to extrapolate the conditions at NE2. • Should no water be available or should the amount of water be insufficient to collect a groundwater sample, water levels will be verified up to three subsequent days, as necessary, in an effort to obtain a groundwater sample.	--
6/15/2015	Collected sample from NE1 32 ft boring. NE2 borings had insufficient water for a sample to be collected. NE1 12 ft boring abandoned per the SAP. NE1 22 ft boring advanced to 42 ft bgs. NE2 12 ft and 22 ft borings abandoned per SAP.	Sample collected at NE1 32 ft boring had heavy sediment; uncertain if enough water for lab to run analysis. Laboratory was able to analyze the sample.
6/16/2015	Collected sample from NE1 32 ft boring. Insufficient water in both NE1 42 ft and NE2 32 ft borings to allow sample to be collected.	Sample collected at NE1 32 ft had heavy sediment. Laboratory was able to analyze the sample.
6/17/2015	Water present in both NE1 32 ft and NE2 32 ft borings but too much sediment to allow sample to be collected. Insufficient water in the NE1 42 ft boring to collect a sample.	--
6/22/2015	DOE issued Record of Conversation for 6/11/2015 teleconference.	--

Table 3. Vapor Intrusion Screening Study Implementation Timeline (Continued)

Date	Event	Notes
6/23/2015	NE1 22 ft and 42 ft and NE2 32 ft borings abandoned per the SAP. Mobilized to northwest locations. Measured depth to water at MW 236 and MW451. Installed NW1 and NW2 borings at 12 ft, 22 ft, and 32 ft bgs.	Groundwater in MW236 measured at 42.69 ft bgs. Groundwater in MW451 measured at 38.92 ft bgs.
6/24/2015	Insufficient water to sample NW1 or NW2.	--
6/25/2015	Insufficient water to sample NW1 or NW2.	--
6/29/2015	Water sample collected from NW2 22 ft boring. Remaining borings were either dry or had insufficient water to collect a sample. FFA parties met via teleconference and agreed to the following: • Fieldwork should be considered finished and the borings abandoned. • The one sample collected from NW2 can be used to extrapolate the condition for NW1. • The soils have been demonstrated to be sufficiently tight that water movement is inhibited.	--
6/30/2015	NW1 and NW2 borings abandoned in accordance with approved work plan.	--
7/16/2015	DOE issued Record of Conversation for 6/29/2015 teleconference.	--

3. DATA EVALUATION

3.1 RESULTS

Three samples were submitted for laboratory analysis for VOCs, one sample from NW2 and two samples from NE1. The results of the analysis for TCE, *cis*-1,2-dichloroethene, *trans*-1,2-dichloroethene, and vinyl chloride were nondetect for each sample with a reporting limit of 1 µg/L. Table 4 presents a summary of the results including the recorded field temperature of the water sample.

Table 4. DPT Boring Water Sample Results

Boring Sampled	Date Sampled	*cis*-1,2-Dichloroethene[1]	*trans*-1,2-Dichloroethene[1]	Trichloroethene[1]	Vinyl Chloride[1]	Field Temperature (F)
NE1-32 ft	15-Jun-15	ND	ND	ND	ND	75.5
NE1-32 ft	16-Jun-15	ND	ND	ND	ND	81.2
NW2-22 ft	29-Jun-15	ND	ND	ND	ND	72.7

[1] Results were all nondetect at a reporting limit of 1µg/L.
ND = nondetect

Table 5 contains the default VISL values from EPA VISL Calculator, v3.4.2, September 3, 2015.

Table 5. Default VISL Values for Selected VOCs

Selected VOC	Default VISL Value[a]
cis-1,2-Dichloroethene	No Inhalation Toxicity Information
trans-1,2-Dichloroethene	No Inhalation Toxicity Information
Trichloroethene	1.2 µg/L
Vinyl Chloride	0.15 µg/L[b]

[a] http://www.epa.gov/oswer/vaporintrusion/documents/VISL-Calculator.xlsm.
[b] During scoping, the FFA parties agreed 1 µg/L detection limit was sufficient.

3.2 CONCLUSION

The intent of this vapor intrusion screening study was to compare TCE (and other selected chlorinated VOCs) concentrations in the first available water against VISLs developed using default parameter assumptions. VOCs of concern for this vapor intrusion screening study are TCE, *cis*-1,2-dichloroethene, *trans*-1,2-dichloroethene, and vinyl chloride. The Decision Rules presented in the SAP (DOE 2015a) are as follows:

- **IF** groundwater data for selected VOCs are less than the associated VISL or nondetect, **THEN** no additional groundwater sampling is needed and the vapor intrusion pathway does not pose a concern for the residence.

- **IF** groundwater data for selected VOCs are greater than or equal to the associated VISL, **THEN** reevaluate and scope the next step to address the potential for a vapor intrusion concern.

The groundwater data for all the selected VOCs was nondetect at a reporting limit of 1µg/L; therefore, according to the Decision Rules presented in the SAP (DOE 2015a), no additional groundwater sampling is needed, and the vapor intrusion pathway does not pose a concern for the residences. This study is consistent with historical investigations and the conceptual site model, which demonstrated limited

potential for vapor intrusion. Based on the results of this vapor intrusion screening study, historical information provided/referenced in the SAP, and the vapor intrusion guidance (EPA 2015b), an additional vapor intrusion study (i.e., a detailed investigation) is not warranted in the Water Policy Area.

DOE will continue to evaluate groundwater conditions in the Water Policy Area in a manner consistent with five-year reviews for remedial actions required under Section 121(c) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and final remedial actions required under Section XXX of the FFA. Results of these periodic evaluations will be used to determine if a detailed vapor intrusion study is warranted.

4. REFERENCES

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APPENDIX

RESIDENT CONTACT SUMMARY

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RESIDENT CONTACT SUMMARY

Called NE1 resident on May 28, 2015, and scheduled a visit for May 29, 2015. Met with resident and provided information about the needed sampling on May 29, 2015. Resident reviewed a map of the proposed sampling and agreed to the proposed location. The resident called and left a voice mail on June 1, 2015, regarding a buried fiber optic line in the area. Spoke to the resident on June 11, 2015, and discussed that a groundwater sample had not been obtained and would like to leave the rods in longer. Resident agreed.

Called NE2 resident on May 28, 2015, but no one answered and no answering machine picked up. On May 29, 2015, met with resident on their property and discussed the sampling project. The resident reviewed a map of proposed sampling location and agreed to the location. On June 4, 2015, utilities were scheduled to be marked, but the resident refused to let that be done. Resident stated that he would not allow this to happen and wanted a change to his license agreement. On June 5, 2015, met with resident and he agreed to the sampling event. The change he wants is to add a word to the license agreement. He was told that the requested change would be presented to DOE for their approval. He also wants two separate agreements: one for this water and the other for the monitoring wells. Spoke to the resident on June 11, 2015, and discussed that a groundwater sample had not been obtained and would like to leave the rods in longer. Resident agreed.

Called NW1 and NW2 resident/property owner and left a voice mail on May 28, 2015. Called again on June 1, 2015, and spoke to resident and scheduled a meeting to discuss the project on June 2, 2015. The resident reviewed a map of the proposed sampling location and agreed to the NW2 location on June 2, 2015. The resident requested a different location for the NW1 location. The resident did not want sampling that close to the home and wanted it to be at least 150 yards away. Resident stated that a previous sampling event had rattled objects on the walls of the club house and did not want that to happen to the home. With further discussion and a new map, the resident agreed to a location that was approximately 260 ft away from the house.

Called NW1 and NW2 resident/property owner on June 11, 2015, and left message on office phone. Called again on June 12, 2015, both cell and office phones, no answer. Called on June 15, 2015, and left voice mail on cell phone. Called office on June 16, 2015, and left message for resident to call. Sent e-mail on June 16, 2015, and received response e-mail on June 17, 2015, stating that sampling event could not happen on June 17, 2015. Spoke on phone with resident about the sampling event on June 17, 2015. Resident was having a meeting on the June 17, 2015, date and needed to reschedule because the resident wanted to be present for the sampling event. Sent e-mail, per the resident's request, with new proposed date of June 23, 2015, for sampling event and received e-mail from resident stating that the sampling event could begin on that date.

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ATTACHMENT C.3

DEMOSTRATE NO GROUNDWATER USAGE

(The following is a historical document reprinted in its original format. Pagination and formatting from original document retained.)

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Demonstration that Residents Located over the Contaminated Groundwater Plume Are Not Using Groundwater at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

This document is approved for public release per review by:

FPDP Classification Support — Date

FPDP-RPT-0008

Demonstration that Residents Located over the Contaminated Groundwater Plume Are Not Using Groundwater at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—March 2016

U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

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

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CONTENTS

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FIGURES

TABLE

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ACRONYMS

AKGWA	Assembled Kentucky Ground Water Database
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ND	nondetectable
PGDP	Paducah Gaseous Diffusion Plant

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1. INTRODUCTION

This document describes actions taken by the U.S. Department of Energy (DOE) in response to comments on the *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1289&D2/R1 (DOE 2014). In a letter dated September 30, 2014, (EPA 2014) the U.S. Environmental Protection Agency (EPA) stated the following:

> Until DOE demonstrates that all residents located above the contaminated groundwater plume are not using groundwater and vapor intrusion is not occurring into residential properties, the protectiveness statement should be "deferred"…Further information will be obtained by taking the following actions: DOE demonstrates that all residents located above the contaminated groundwater plume are not using groundwater from their wells…

This document has been developed to address EPA's requirement that DOE demonstrate that all residents located above the contaminated groundwater plume are not using groundwater from their wells. To further protect the health of residents living north of the PGDP in the area commonly referred to as the "Water Policy Area" (Figure 1), DOE conducted a vapor intrusion screening study (DOE 2016) and determined that vapor intrusion is not occurring into residential properties.

DOE also developed and mailed an educational flyer to all residents within the Water Policy Area. This flyer was designed to educate landowners about the presence and risks posed by groundwater contamination in the area.

To demonstrate that all residents located above the contaminated groundwater plume are not using groundwater from their wells, DOE has evaluated which parcels currently are located over the plume. DOE has identified 16 parcels situated above or immediately downgradient of the trichloroethene (TCE)-contaminant plume (Figure 2). Each affected parcel was researched to identify the landowner(s), the presence of a residence, the presence of a license agreement, the presence of groundwater wells, and current integrity of DOE caps and locks. DOE then assessed the current uses of each parcel by reviewing applicable state groundwater well databases, examining aerial photographs for evidence of disturbances potentially related to wells, and physically assessing the conditions of the property, either by driving past the property where no access agreement was in place or through a sight check from the former well location where access agreements were in place. Through these surveillance actions, DOE has demonstrated that all residents located above the contaminated groundwater plume are not using groundwater from their wells.

2. BACKGROUND

Upon detecting TCE and technetium-99 in private wells located north of Paducah Gaseous Diffusion Plant (PGDP) in August 1988, the U.S. Department of Energy (DOE) placed affected residences/businesses on alternate water supplies and began a monitoring and investigation program to define the extent and temporal variations of the groundwater contaminant plumes. DOE developed the current PGDP Water Policy in accordance with the *Engineering Evaluation/Cost Analysis for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, (DOE 1993) and the *Action Memorandum for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* (DOE 1994) for the Water Policy removal action.

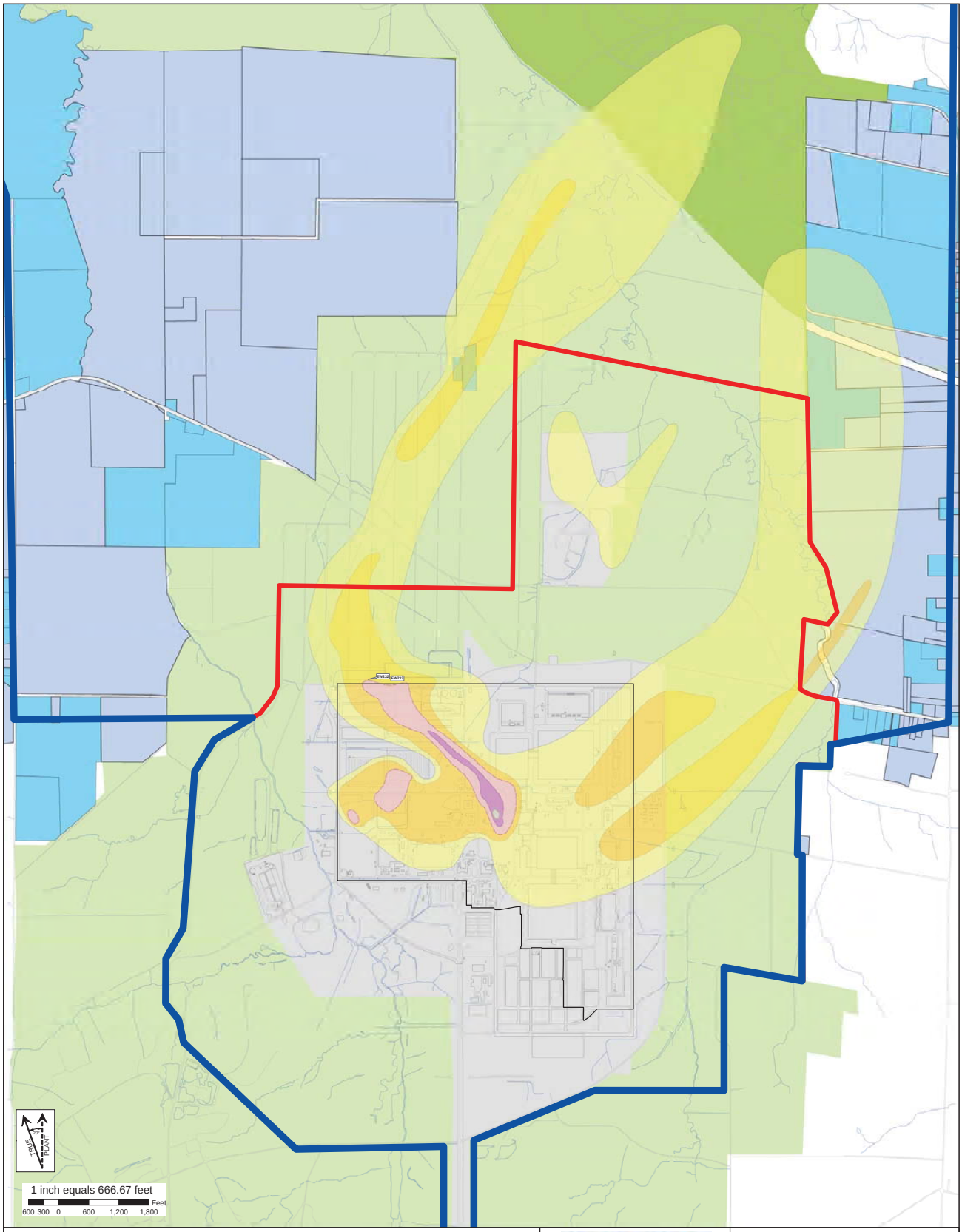
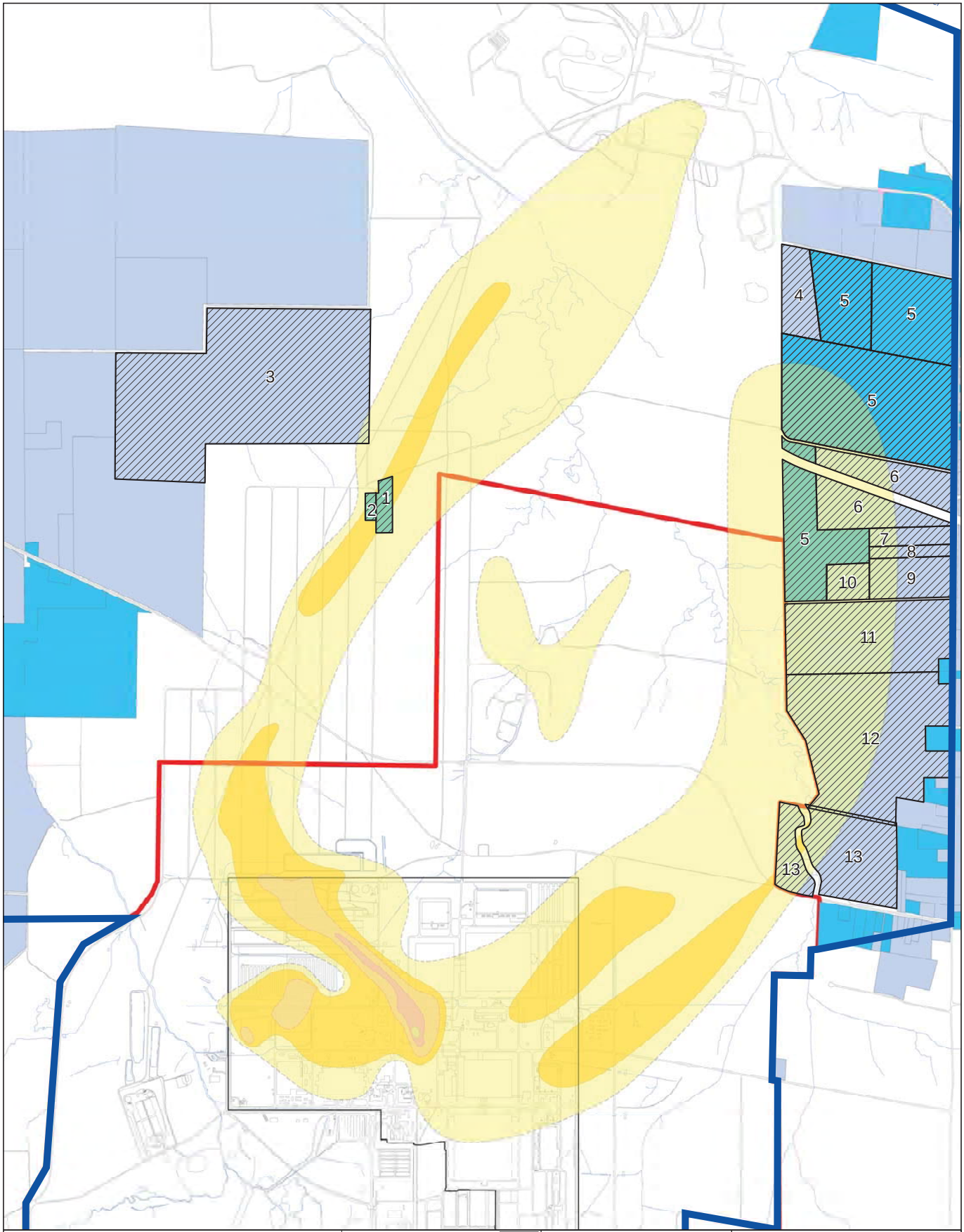


Figure 1. 2014 Plume Map with Parcels



LEGEND

2014 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

- Water Policy Area
- Parcels w/o Current Agreement
- Parcels Overlying Plume 16 parcels with 13 landowners
- Parcels w/Current Agreements
- DOE Property Boundary
- Roadways
- Streams
- PGDP Boundary

TRUE NORTH / PLANT

1 inch = 565.62 feet

0 287.5 575 1,150 1,725 2,300 Feet

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PORTSMOUTH / PADUCAH PROJECT OFFICE
PADUCAH GASEOUS DIFFUSION PLANT

Figure 2. Parcels Identified as Affected Properties

FILE NAME:	PROJECT #:	SCALE:	DATE:
Figure 2 WP_2014Plumes_TCER_Parcels	EM	AS NOTED	3/23/2016

The PGDP Water Policy states, "It is the intent of the PGDP Environmental Restoration Program to offer municipal water service in accordance with this Policy to all existing private residences and businesses within the projected migration area of the contaminated groundwater originating at Paducah Gaseous Diffusion Plant (affected area)."

In June 1994, DOE signed the Action Memorandum for the Water Policy (DOE 1994). The Action Memorandum contains the following regarding the purpose of the water policy:

> The purpose of long-term remedial action is to eliminate, reduce, or control risks to human health and the environment. Implementation of this removal action is consistent with that purpose. Potential threats to public health require attention prior to initiation of long term remediation. This action prohibits exposure to contaminated water from residential wells until a permanent remedy has been successfully completed, or other actions have formally been deemed appropriate.

Management activities of the Water Policy include the following:

- Water bills are reviewed monthly looking for abnormal bills; residents whose bills are outside the range of historical usage are notified by mail and/or a site visit.
- A due diligence is conducted yearly at the McCracken County Property Valuation Office for new owners of land parcels within the Water Policy Box.
- As License Agreements are set to expire, property owners are contacted prior to the expiration date to request a renewal.
- Caps and locks installed on residential wells are inspected to verify the wells are nonoperational.

3. DEMONSTRATION OF NO WATER USAGE OVER THE GROUNDWATER PLUMES

3.1 EVALUATION PROCESS

The following approach was developed and implemented to evaluate groundwater usage above the contaminated groundwater plumes.

1. Determined locations of land parcels situated over the plumes by overlaying property boundaries on the 2014 TCE Plume.
2. Reaffirmed land ownership of affected properties by reviewing relevant records in the McCracken County Property Valuation office.
3. Reviewed records for properties situated over the plumes to determine whether those parcels had residential wells, DOE caps and locks, and/or license agreements.
4. Reviewed the Kentucky water well database to ensure no additional groundwater wells have been installed over the contaminant plume.

5. Conducted visual assessment of affected properties. For affected properties with a current Water Policy license agreement, contacted the landowner, accessed the site, confirmed no residential well is being used, and checked well cap and lock, if applicable. For affected properties without a current Water Policy license agreement, conducted a drive-by assessment and documented any evidence of water well usage.

6. Examined aerial images of affected properties for signs of groundwater well usage.

The results of each evaluation step are found in Sections 3.1.1–3.1.6.

3.1.1 Determination of Property Overlying the Plume

The lateral extent of the plume, shown on Figures 1 and 2, is defined by the 5 ppb TCE contour, which is the Safe Drinking Water Act maximum contaminant level for TCE. Figure 1 shows a total of 16 parcels situated over the plume or immediately downgradient.

3.1.2 Review of Land Ownership of Affected Properties

Land ownership was verified for these 16 parcels with the McCracken County Property Valuation Office. There are 13 landowners associated with these 16 parcels. Figure 2 groups the potentially affected parcels by landowner and provides a unique identifier for each property owner and each individual parcel (1–13). The following sections will refer to the 16 parcels by landowner numbers 1–13.

3.1.3 Review of Municipal Water Usage

Water bills were reviewed to identify any decrease in usage that could suggest a resident's change from use of municipal water to groundwater. A review of water bill data shows continuing use of municipal water and no decrease that would suggest a resident's use of groundwater for all affected properties.

3.1.4 Review of Known Existing Wells (Residential or Monitoring) and Historical Capping and Locking Information

DOE contractors periodically inspect residential wells where access is available to ensure that they remain nonoperational. Table 1 provides additional information on the affected properties.

Table 1. Affected Property Information

Property No.	Has License Agreement		Has a Well		Has a Residence		Cap and Lock Date	Comments
	Yes	No	Yes	No	Yes	No		
1		X		X		X	N/A	The structure is used as a hunting club.
2		X	X		X		Pre-1994	DOE capping and locking notes from 1994 state that the resident abandoned the well [Assembled Kentucky Ground Water Database (AKGWA) # 0003-0205] and capped it below grade. The Kentucky database for water wells (see Section 3.1.5) reports the status of the well as "Inactive" and lists the well as "unused" on a 1992 inspection record.
3	X			X		X	N/A	Farmland with no known residential well on parcel. The adjoining property to the north, which is owned by the same landowner, has two capped and locked residential wells, R16 and R245, and a monitoring well, MW199.
4	X			X	X		N/A	Farmland with no known residential well. Residence was built in 1998.
5		X		X		X	N/A	Farmland with no known residential well.
6	X			X	X		N/A	Farmland with no known residential well. Monitoring wells 465-472 are located on this property. Residence was built approximately 2006.
7	X		X		X		N/A	R530, AKGWA 0004-2844, is located under the house with no access to the well without removing flooring. There is no cap and lock on well.
8	X			X	X		N/A	No known well for this property.
9	X		X		X		June 22, 1995	R20, AKGWA 0003-5077
10	X		X		X		June 22, 1995	R31, AKGWA 0003-5008; Two monitoring wells are located on the property: MW148 and MW149.
11	X			X		X	N/A	Farmland with no known residential well.
12	X		X		X		N/A	R528, DOE capping and locking notes state owner reported that the well was buried. Therefore, there is no cap and lock on well.
13	X		X		X		June 21, 1995	R294, AKGWA 0003-5035.

3.1.5 Review of the Kentucky Database for Water Wells

The Kentucky database for water wells was reviewed (current on the Web as of June 2014), and the installation of any new wells has not been reported in the Water Policy Area. The database may be accessed using the following link: http://kgs.uky.edu/kgsweb/DataSearching/Water/WaterWellSearch.asp.

3.1.6 Assessment of Affected Properties with License Agreement

DOE has attempted to execute license agreements with property owners within the Water Policy area. In the license agreements, DOE agrees to provide and pay for the owner's reasonable municipal water usage in exchange for the property owner's commitment to forego the use of groundwater from the property. In addition, the license agreements grant DOE access to the property to collect samples and to check the status of caps and locks placed on residential wells. DOE has executed license agreements with owners of ten of the thirteen owners of properties situated above the contaminant plume and immediately down gradient.

Of the three properties for which there are no license agreements:

- Property 1 has no residence, but has a hunt club; municipal water is paid by DOE;
- Property 2 has a residence, but municipal water is paid by DOE; and
- Property 5 is farmland, has no residence, no water bill, and no known well.

A checklist was developed for the property assessment that includes the following:

- Background (e.g., current license agreement);
- Results of any on-site assessment (e.g., confirming that owner does not use groundwater);
- Results of any off-site assessment where access is not granted; and
- Results of examination of aerial images.

Appendix A contains forms from the assessment of each property that overlies the plume. None of the assessments revealed any sign of groundwater use at any of the properties.

4. CONCLUSION

DOE has examined all reasonably available lines of evidence and has concluded that no owners or occupants of any of the parcels located above the contaminated groundwater plume are using groundwater. As such, this study meets the requirements set forth in EPA's September 30, 2014, letter requesting that DOE demonstrate that all residents located above the contaminated groundwater plume are not using groundwater from their wells.

5. REFERENCES

DOE (U.S. Department of Energy) 1993. *Engineering Evaluation/Cost Analysis for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1142&D2, U.S. Department of Energy, Paducah, KY, May.

DOE 1994. *Action Memorandum for the Water Policy at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/OR/06-1201&D2, U.S. Department of Energy, Paducah, KY, June.

DOE 2014. The *Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-1289&D2/R1, U.S. Department of Energy, Paducah, KY, May.

DOE 2016. *Water Policy Area Vapor Intrusion Screening Study Report for the Five-Year Review of Remedial Actions, Paducah, Kentucky,* DOE/LX/07-1289&D2/R1/A1/R1, U.S. Department of Energy, Paducah, KY, February.

EPA (U.S. Environmental Protection Agency) 2014. R. Chaffins, U.S. Environmental Protection Agency, Region 4, Atlanta, GA, letter to J. Woodard, U.S. Department of Energy, Paducah, KY, September 30.

APPENDIX

ASSESSMENT FORMS

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Assessment of Selected Property within the Water Policy Box

Property ID: 1

1. Background
   a. Current License Agreement expiration date: N/A
   b. Known existing wells: NONE

2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):

      N/A

   b. Are cap and lock in good condition: N/A
   c. Is well in good condition: N/A
   d. Confirm with occupant that they are not using existing water wells? N/A
   e. Confirm with occupant that they have not drilled a new water well? N/A
   f. From location of existing well, are there signs of additional wells? NO
   g. Other observations related to possible groundwater usage?

      There is no sign of groundwater usage. The property appears to be abandoned.

3. Aerial Observations

   No signs of groundwater well was seen on property.

Completed by: Justin Riley 2-4-16 Teresa Overby 2-4-16

Print/Sign/Date Print/Sign/Date

Property 1 Aerial View

Assessment of Selected Property within the Water Policy Box

Property ID: 2

1. Background
   a. Current License Agreement expiration date: N/A

   b. Known existing wells: 1 well capped below grade.
   AKGWA # 0003-0205

2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):

   N/A

   b. Are cap and lock in good condition: N/A

   c. Is well in good condition: N/A

   d. Confirm with occupant that they are not using existing water wells? N/A

   e. Confirm with occupant that they have not drilled a new water well? N/A

   f. From location of existing well, are there signs of additional wells? NO

   g. Other observations related to possible groundwater usage?

   Drive by observation indicates no groundwater usage and no visible residential wells.

3. Aerial Observations

No signs of groundwater well being present on property.

Completed by: Justin Riley Print/Sign/Date 2-4-16

Teresa Overby Print/Sign/Date 2/4/2016

Property 2 Aerial View

Assessment of Selected Property within the Water Policy Box

Property ID: 3

1. Background
   a. Current License Agreement expiration date: 12-31-18
   b. Known existing wells: R116 - Located under existing house
      R245
2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):
      Telephone
   b. Are cap and lock in good condition: R-245 No (cap is broken, Lock is missing)
   c. Is well in good condition: Yes
   d. Confirm with occupant that they are not using existing water wells? Yes
   e. Confirm with occupant that they have not drilled a new water well? Yes
   f. From location of existing well, are there signs of additional wells? NO
   g. Other observations related to possible groundwater usage?
      No observations of possible groundwater usage.
3. Aerial Observations
   No visable sign of water wells being installed on property other than existing well.

Completed by: Justin Riley Print/Sign/Date 2-4-16

Teresa Cooley/Travis County Print/Sign/Date 2-4-2016

* Replacement parts order as of 2/8/2016. TO 2/12/2016

** cap and lock were fixed on 2/25/2016. TO 3/3/2016

Property 3 Aerial View

Assessment of Selected Property within the Water Policy Box

Property ID: 4

1. Background
   a. Current License Agreement expiration date: 12-31-18
   b. Known existing wells: None
2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):

      Telephone

   b. Are cap and lock in good condition: N/A
   c. Is well in good condition: N/A
   d. Confirm with occupant that they are not using existing water wells? N/A
   e. Confirm with occupant that they have not drilled a new water well? Yes
   f. From location of existing well, are there signs of additional wells? No
   g. Other observations related to possible groundwater usage?

      No indication of possible groundwater usage. Owner indicated there was a residential well on the property in the 1950's but it was filled many years ago.

3. Aerial Observations

   No signs of new groundwater well installed on property.

Completed by: Justin Riley
Print/Sign/Date 2-4-16

Teresa Derby
Print/Sign/Date 2/4/2016

Property 4 Aerial View

Assessment of Selected Property within the Water Policy Box

Property ID: 5

1. Background
   a. Current License Agreement expiration date: N/A
   b. Known existing wells: NONE

2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):

      N/A

   b. Are cap and lock in good condition: N/A
   c. Is well in good condition: N/A
   d. Confirm with occupant that they are not using existing water wells? N/A
   e. Confirm with occupant that they have not drilled a new water well? N/A
   f. From location of existing well, are there signs of additional wells? NO
   g. Other observations related to possible groundwater usage?

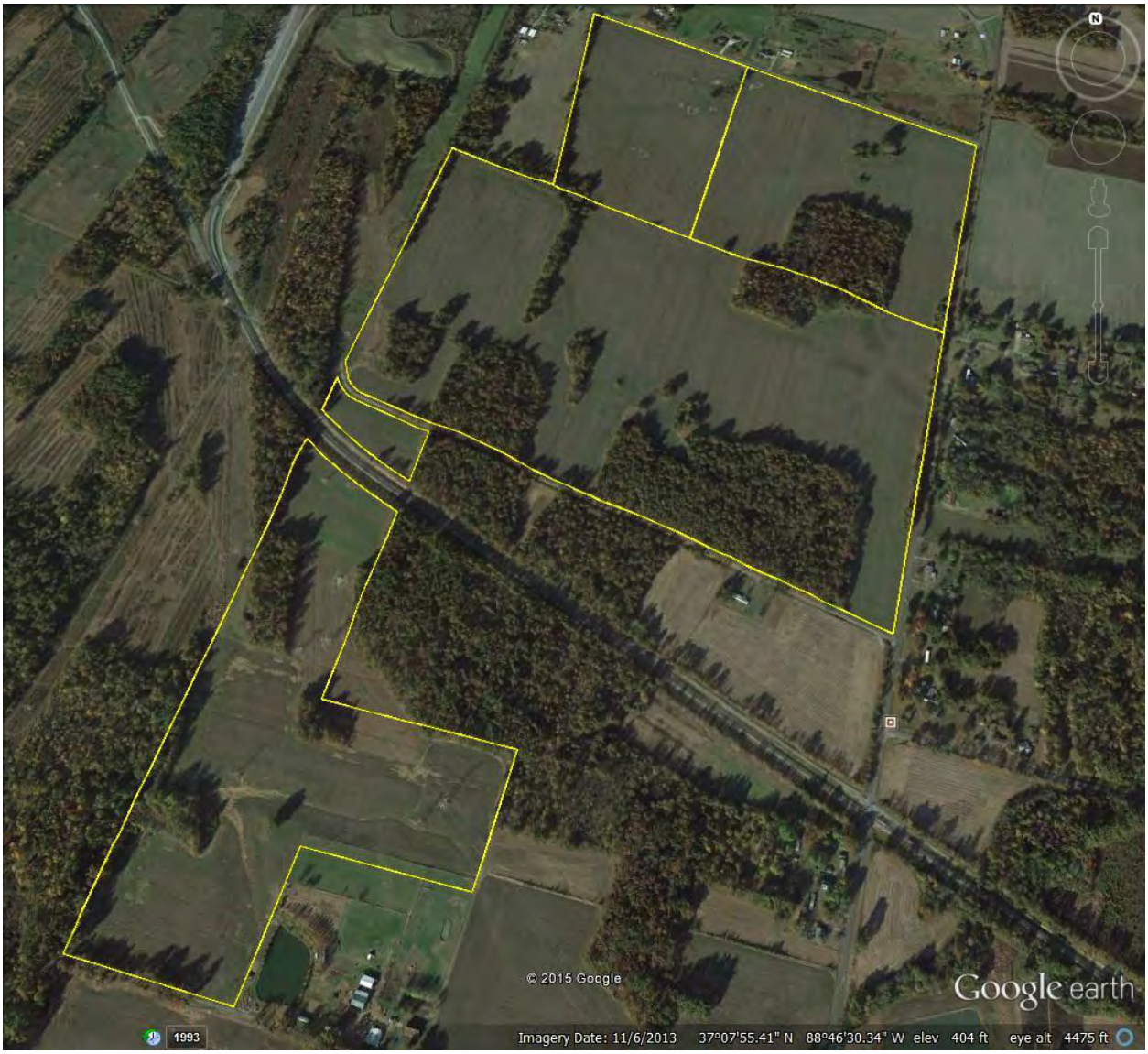
      Drive by observation of property revealed no evidence of new or existing groundwater wells.

3. Aerial Observations

   No signs of groundwater well on property.

Completed by: Justin Riley
Print/Sign/Date 2-4-16

Teresa Overby/Teresa Overby
Print/Sign/Date 2-4-16



Property 5 Aerial View

Assessment of Selected Property within the Water Policy Box

Property ID: 6

1. Background
   a. Current License Agreement expiration date: 9-30-19
   b. Known existing wells: NONE

2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):

      Telephone

   b. Are cap and lock in good condition: N/A
   c. Is well in good condition: N/A
   d. Confirm with occupant that they are not using existing water wells? Yes
   e. Confirm with occupant that they have not drilled a new water well? Yes
   f. From location of existing well, are there signs of additional wells? NO
   g. Other observations related to possible groundwater usage?

      Observations do not indicate any groundwater usage.

3. Aerial Observations

   No signs of groundwater well on property.

Completed by: Justin Riley Print/Sign/Date 2-4-16

Teresa Overby Print/Sign/Date 2-4-16

Property 6 Aerial View

Assessment of Selected Property within the Water Policy Box

Property ID: 7

1. Background
   a. Current License Agreement expiration date: 12-31-18
   b. Known existing wells: R530, AKGWA 0004-2844

2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):

      Person

   b. Are cap and lock in good condition: N/A*
   c. Is well in good condition: N/A*
   d. Confirm with occupant that they are not using existing water wells? Yes
   e. Confirm with occupant that they have not drilled a new water well? Yes
   f. From location of existing well, are there signs of additional wells? No
   g. Other observations related to possible groundwater usage?

      *The existing residential well is located under an addition to the house. It is not accessible.

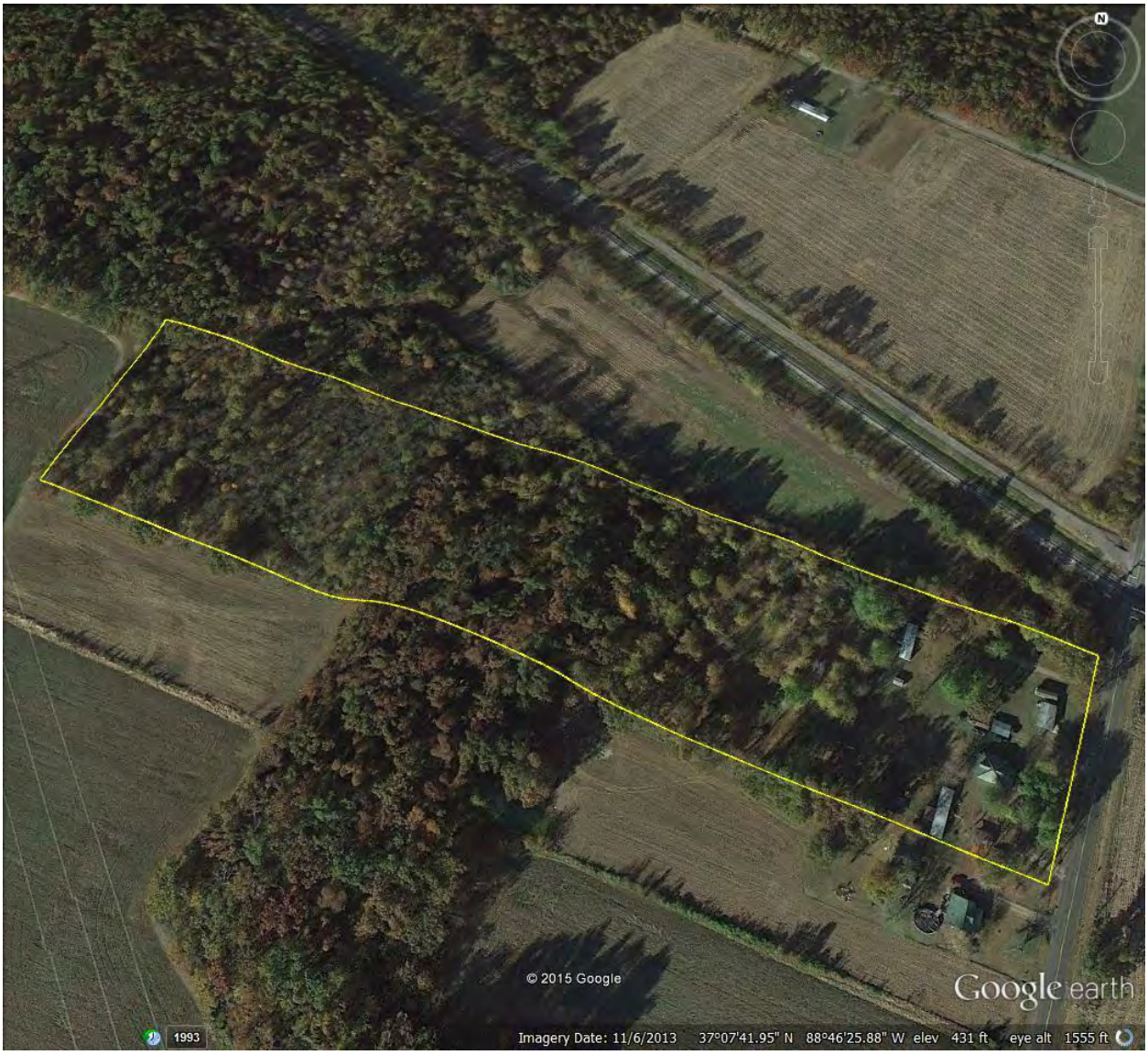
      There is no evidence of groundwater usage.

3. Aerial Observations

   No sign of groundwater well on property.

Completed by: Justin Riley Print/Sign/Date 2-5-16

Teresa Everby Print/Sign/Date 2-5-16



Property 7 Aerial View

Assessment of Selected Property within the Water Policy Box

Property ID: 8

1. Background
   a. Current License Agreement expiration date: 12-14-17
   b. Known existing wells: None

2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):

      Occupants could not be reached after several attempts in person.

   b. Are cap and lock in good condition: N/A
   c. Is well in good condition: N/A
   d. Confirm with occupant that they are not using existing water wells? N/A
   e. Confirm with occupant that they have not drilled a new water well? NO
   f. From location of existing well, are there signs of additional wells? NO
   g. Other observations related to possible groundwater usage?

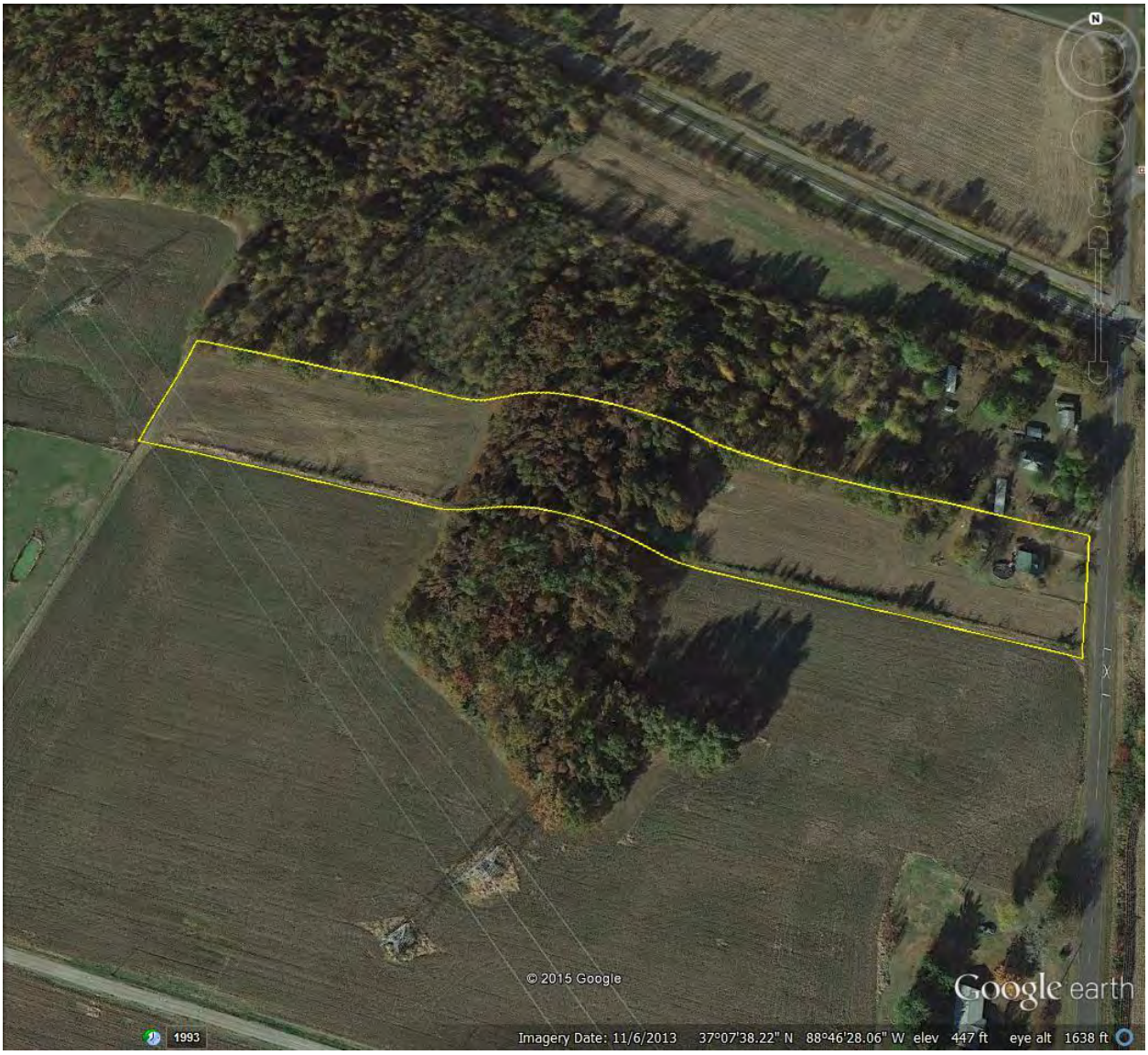
      Property surrounding the house was inspected and there is no evidence of possible groundwater usage.

3. Aerial Observations

   No signs of groundwater well on property.

Completed by: Justin Riley Justin Riley
Print/Sign/Date 2-5-16

Teresa Derby/Teresa Derby
Print/Sign/Date 2-5-16



Property 8 Aerial View

Assessment of Selected Property within the Water Policy Box

Property ID: 9

1. Background
   a. Current License Agreement expiration date: 6-30-17
   b. Known existing wells: R20 - AKGWA 0003-5077

2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):

      Telephone

   b. Are cap and lock in good condition: Yes
   c. Is well in good condition: Yes
   d. Confirm with occupant that they are not using existing water wells? Yes
   e. Confirm with occupant that they have not drilled a new water well? Yes
   f. From location of existing well, are there signs of additional wells? No
   g. Other observations related to possible groundwater usage?

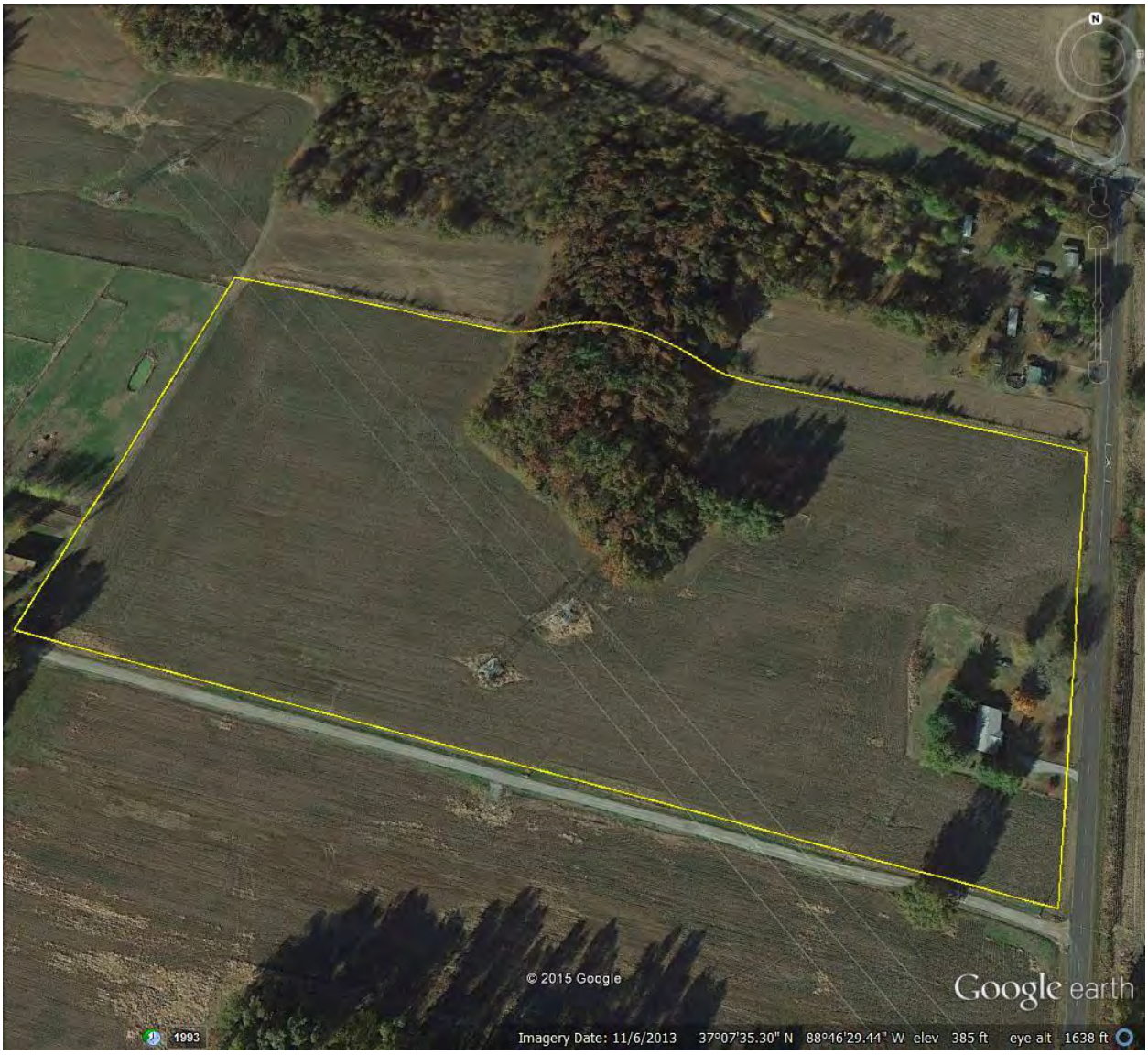
      No observations of possible groundwater usage.

3. Aerial Observations

   No signs of additional groundwater well on property.

Completed by: Justin Riley Print/Sign/Date 2-4-16

Teresa Overby Print/Sign/Date 2-4-16



Property 9 Aerial View

Assessment of Selected Property within the Water Policy Box

Property ID: 10

1. Background
   a. Current License Agreement expiration date: 7-21-20
   b. Known existing wells: R31 AKGWA 0003-5008

2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):

      Telephone

   b. Are cap and lock in good condition: Cap is present, lock is missing.
   c. Is well in good condition: Yes
   d. Confirm with occupant that they are not using existing water wells? Yes
   e. Confirm with occupant that they have not drilled a new water well? Yes
   f. From location of existing well, are there signs of additional wells? No
   g. Other observations related to possible groundwater usage?

      There are no indications of possible groundwater usage. Owner was notified the lock will be replaced on the well cap.

3. Aerial Observations

   No signs of additional groundwater well on property.

Completed by: Justin Riley [signature] Print/Sign/Date 2-4-16

Teresa Overby/Teresa Overby Print/Sign/Date 2-4-16

* Lock replacement has been obtained and scheduled for 2/18/2016. TO 2/16/2016

** Lock was replaced on 2/19/2016 TO 3/3/2016

Property 10 Aerial View

Assessment of Selected Property within the Water Policy Box

Property ID: 11

1. Background
   a. Current License Agreement expiration date: 9-30-19
   b. Known existing wells: None
2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):

      Telephone

   b. Are cap and lock in good condition: N/A
   c. Is well in good condition: N/A
   d. Confirm with occupant that they are not using existing water wells? Yes
   e. Confirm with occupant that they have not drilled a new water well? Yes
   f. From location of existing well, are there signs of additional wells? NO
   g. Other observations related to possible groundwater usage?

      There is no evidence of possible groundwater usage.

3. Aerial Observations

   No signs of groundwater well on property.

Completed by: Justin Riley
Print/Sign/Date 2-4-16

Teresa Derby
Print/Sign/Date 2-4-16

Property 11 Aerial View

Assessment of Selected Property within the Water Policy Box

Property ID: 12

1. Background
   a. Current License Agreement expiration date: 12-31-17
   b. Known existing wells: R528 (buried)

2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):

      Telephone

   b. Are cap and lock in good condition: N/A
   c. Is well in good condition: N/A
   d. Confirm with occupant that they are not using existing water wells? yes
   e. Confirm with occupant that they have not drilled a new water well? yes
   f. From location of existing well, are there signs of additional wells? NO
   g. Other observations related to possible groundwater usage?

      Owner confirmed previous well R528 was buried years ago. There is no evidence to suggest possible groundwater usage.

3. Aerial Observations

   No sign of groundwater well on property.

Completed by: Justin Riley Print/Sign/Date 2-4-16

Teresa Overby Print/Sign/Date 2-4-16

Property 12 Aerial View

Assessment of Selected Property within the Water Policy Box

Property ID: 13

1. Background
   a. Current License Agreement expiration date: 12-31-2018
   b. Known existing wells: R294, AKGWA 0003-5035

2. Onsite Assessment
   a. Means by which consent to enter property is provided (e.g., in person/telephone):

      Telephone

   b. Are cap and lock in good condition: Yes
   c. Is well in good condition: yes
   d. Confirm with occupant that they are not using existing water wells? yes*
   e. Confirm with occupant that they have not drilled a new water well? yes*
   f. From location of existing well, are there signs of additional wells? No
   g. Other observations related to possible groundwater usage?

      *Currenty not occupied. Confirmation made with owner's sister.
      No evidence of possible groundwater usage.

3. Aerial Observations

   No signs of new groundwater well was seen on property.

Completed by: Justin Riley Print/Sign/Date 2-4-16

Teresa Eberly Print/Sign/Date 2-4-16

Property 13 Aerial View