



Department of Energy

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September 9, 2025

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PPPO-02-10034286-25

Ms. April Webb
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Dear Mr. Begley and Ms. Webb:

TRANSMITTAL OF THE GEOTECHNICAL SAMPLING AND ANALYSIS PLAN AT THE PADUCAH GASEOUS DIFFUSION PLANT, PADUCAH, KENTUCKY (DOE/LX/07-2507&D1/R1)

Please find enclosed the revised *Geotechnical Sampling and Analysis Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2507&D1/R1 (SAP). The revisions included in this document reflect the adjusted scope of geotechnical testing relative to the in-progress design efforts for a potential on-site waste disposal facility (OSWDF), the data needed to support the design, and the updated footprint of the potential OSWDF and addition of the centralized wastewater treatment (CWWT) facility study area. The title of the SAP has been revised to be more general as discussions are ongoing regarding the CWWT project. The revision also includes removal of the groundwater analytical program and associated quality assurance project plan (formerly included as Appendix B) in recognition of current funding profiles and the ability to collect this information post-Record of Decision.

Work performed to date is consistent with the previously accepted SAP (DOE/LX/07-2507&D1 Errata). Phase 2 of the investigation program may be initiated prior to approval of this revised SAP as the previously accepted SAP provides for addition of soil borings or cone penetration testing locations as warranted by the analysis and evaluation of field-collected data with documentation of these additions in the project remedial investigation/feasibility study. The methodology for performance of the borings and the geotechnical testing has been retained. Table 1, which previously included a potential list of procedures, guides, and standards for many parameters with multiple options, has been revised to indicate the items used during Phase 1 of the investigation and those currently planned to be used for Phase 2 of the investigation. In

accordance with Section XX.G and Appendix F of the Federal Facility Agreement (FFA), as the D1 Errata was accepted, the U.S. Environmental Protection Agency and Kentucky Department for Environmental Protection have a 30-day review and comment period, which ends on October 9, 2025. If the FFA parties have no substantive comments, the U.S. Department of Energy requests a letter of concurrence.

If you have any questions or require additional information, please contact me at (270) 217-2029.

Sincerely,

**APRIL
LADD**

 Digitally signed by APRIL
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April Ladd
Federal Facility Agreement Manager
Portsmouth/Paducah Project Office

Enclosures:

1. *Geotechnical Sampling and Analysis Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/LX/07-2507&D1/R1—Clean*
2. *Geotechnical Sampling and Analysis Plan at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/LX/07-2507&D1/R1—Redline*

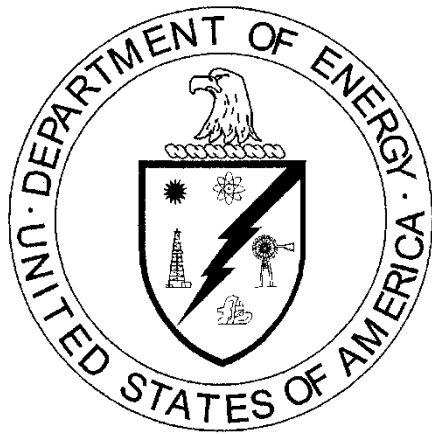
Administrative Record File—ARF WDA—CERCLA Waste Disposal Alternatives Evaluation at PGDP

cc w/enclosures:

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**Geotechnical Sampling and Analysis Plan
at the Paducah Gaseous Diffusion Plant,
Paducah, Kentucky**



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**Geotechnical Sampling and Analysis Plan
at the Paducah Gaseous Diffusion Plant,
Paducah, Kentucky**

Date Issued—September 2025

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

ARAR	applicable or relevant and appropriate requirement
CEC	cation exchange capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
<i>CFR</i>	<i>Code of Federal Regulations</i>
CPT	cone penetration testing
CWWT	centralized wastewater treatment
DOE	U.S. Department of Energy
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FFA	Federal Facility Agreement
Foc	fraction of organic carbon
FS	feasibility study
HSS&Q	health, safety, support, and quality
HU	hydrogeologic unit
IDW	investigation-derived waste
IH	industrial hygiene
IS	industrial safety
JHA	job hazard analysis
KDEP	Kentucky Department for Environmental Protection
KDWM	Kentucky Division of Waste Management
KPDES	Kentucky Pollutant Discharge Elimination System
KRCEE	Kentucky Research Consortium for Energy and Environment
NRCS	Natural Resources Conservation Service
OREIS	Oak Ridge Environmental Information System
OSWDF	on-site waste disposal facility
PEGASIS	PPPO Environmental Geographic Analytical Spatial Information System
PEMS	Project Environmental Measurements System
PM	project manager
PGDP	Paducah Gaseous Diffusion Plant
PPE	personal protective equipment
PPPO	Portsmouth/Paducah Project Office
RCRA	Resource Conservation and Recovery Act of 1976
RDI	regulatory decision integration
RGA	Regional Gravel Aquifer
RI	remedial investigation
SAP	sampling and analysis plan
SMO	sample management office
SPT	standard penetration test
TCLP	toxicity characteristic leachate procedure
TOC	total organic carbon
UCRS	Upper Continental Recharge System
USDA	U.S. Department of Agriculture
USEC	United States Enrichment Corporation
WAC	waste acceptance criteria
WDA	waste disposal alternatives
WMP	waste management plan

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EXECUTIVE SUMMARY

The Paducah Site is an inactive uranium enrichment facility that is owned by the U.S. Department of Energy (DOE). DOE is conducting environmental remediation activities at the Paducah Site in accordance with the requirements of the Kentucky Department for Environmental Protection (KDEP) and the U.S. Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation, and Liability Act. The Paducah Site was placed on the National Priorities List in 1994. DOE, EPA, and KDEP entered into the *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant* in 1998 (EPA 1998).

This sampling and analysis plan (SAP) for the Waste Disposal Alternatives (WDA) Project and the proposed centralized wastewater treatment (CWWT) facility at the Paducah Gaseous Diffusion Plant (PGDP) describes the field and laboratory activities that will be carried out to support siting, planning, and design of a potential CWWT facility and a potential on-site waste disposal facility (OSWDF) as well as the development of the analytical waste acceptance criteria (WAC) for an OSWDF. The Paducah Site refers to the property, programs, and facilities at or near PGDP for which DOE has ultimate responsibility. As an OSWDF site has not yet been selected at the Paducah Site, two proposed study areas (a representative study area, study area 5B; and a potential alternate study area, study area 11), potential support areas, and the planned CWWT facility study area are included in this SAP.

This SAP provides guidance on collecting the following types of data:

- Geotechnical data to support the WDA remedial investigation/feasibility study addendum, as well as the siting, planning, and design of a potential OSWDF and the siting, planning, and design of a potential CWWT facility.
- Geochemical data to support modeling for the analytical WAC and to develop a geochemical baseline.

The main activities included in this SAP are as follows.

- Review existing PGDP geotechnical data, especially data that pertains to the study areas.
- Propose locations for drilling for standard penetration test borings, for collecting soil samples for geotechnical and geochemical analysis, and for carrying out cone penetrometer test soundings.
- Provide project procedures related to sample handling, data management, investigation-derived waste (IDW) management, and field assessment procedures.

This SAP is divided into 10 sections.

- Section 1 provides background on PGDP and the WDA and CWWT facility projects.
- Section 2 summarizes existing data for PGDP relevant to the study and support areas.
- Section 3 provides an overview of roles and responsibilities of key project team members.
- Section 4 discusses the data quality objective process.
- Section 5 details planned field activities, which includes the drilling of soil borings.

- Section 6 summarizes documentation requirements for field operations.
- Section 7 summarizes sample packaging and shipping requirements.
- Section 8 addresses the management of IDWs during the course of field activities.
- Section 9 summarizes field assessment procedures.
- Section 10 provides guidance on addressing nonconformance or deviations from the requirements of the SAP.

1. INTRODUCTION AND PROJECT BACKGROUND

The Paducah Gaseous Diffusion Plant (PGDP) is located approximately 10 miles west of Paducah, Kentucky, population approximately 26,000, and 3.5 miles south of the Ohio River in the western part of McCracken County. PGDP is on a 3,556-acre U.S. Department of Energy (DOE) site with approximately 1,450 acres utilized for site operations (within as well as outside a fenced security area) (Figure 1). Paducah Site generally refers to the property, programs, and facilities at or near PGDP for which DOE has ultimate responsibility.

The Paducah Site is an inactive uranium enrichment facility that is owned by DOE. DOE is conducting environmental remediation activities at the Paducah Site in accordance with the requirements of the Kentucky Department for Environmental Protection (KDEP) and the U.S. Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Paducah Site was placed on the National Priorities List in 1994. DOE, EPA, and KDEP entered into the *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant*, in 1998 (EPA 1998).

Construction of PGDP began in 1951, and operations initiated in 1952. PGDP was owned and managed first 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 (USEC) assumed management and operation of PGDP enrichment facilities under a lease agreement with DOE. Until 2013, USEC enriched uranium at PGDP to supply nuclear fuel to electric utilities worldwide. In 2014, USEC returned the leased facilities to DOE control and enrichment operations ceased.

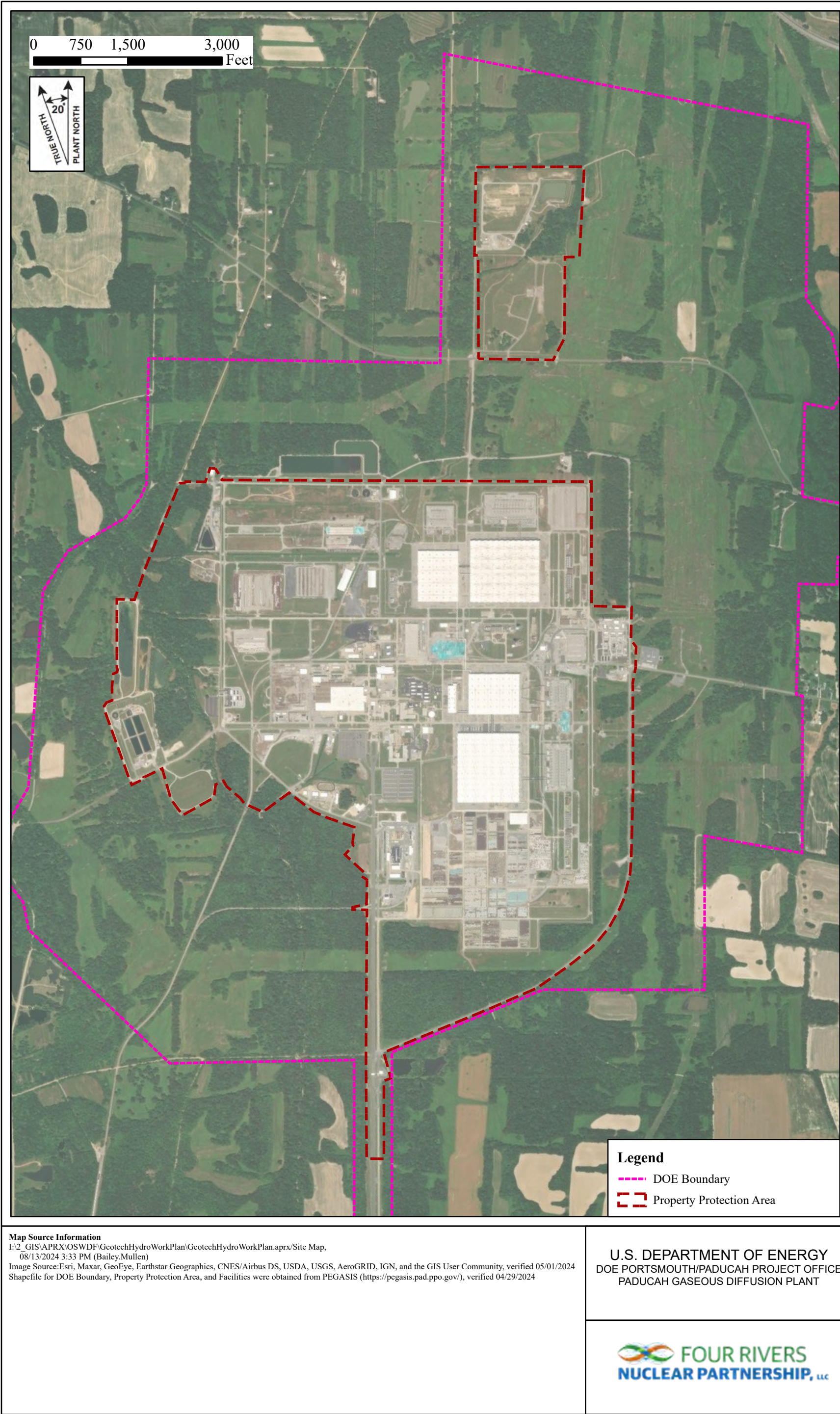
From 1953 until 1977, most of the uranium hexafluoride (UF₆) used by PGDP was produced from feedstock in the feed plant, which was designed to process both natural uranium and uranium from reactor tails. The reactor tails included uranium that had been returned for reenrichment from the plutonium production reactors at the DOE Hanford and Savannah River plants. As a result of nuclear reactions in the plutonium production reactors, the reactor tails contained traces of technetium-99 (Tc-99) and are believed to be the sole source of Tc-99 released to the environment at PGDP. After 1977, PGDP was supplied with UF₆ feedstock from commercial converters, such as Honeywell International, Inc., in Metropolis, Illinois, and from foreign sources.

Since the plant's construction, trichloroethene (TCE) was used as a cleaning solvent. The use of TCE as a degreaser ceased on July 1, 1993. Polychlorinated biphenyls (PCBs) were used extensively as an insulating, nonflammable, thermally-conductive fluid in electrical capacitors and transformers at PGDP. PCB oils were used as flame retardants on the gaskets of diffusion cascades and in other sections of the plant and as hydraulic fluid.

This sampling and analysis plan (SAP) has been prepared to provide the sampling approach and protocols for the field activities to be conducted in support of the Waste Disposal Alternatives (WDA) Project and the evaluation of a representative and a potential alternative on-site waste disposal facility (OSWDF) site and associated potential support areas. This SAP addresses data needs related to siting a potential OSWDF, OSWDF design, and developing the analytical waste acceptance criteria (WAC) for an OSWDF. A geotechnical investigation for a centralized wastewater treatment (CWWT) facility study area is also included in this SAP.

The *Health and Safety Plan for the Remedial Investigation/Feasibility Study Work Plan for the C-400 Complex Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, CP2-ES-0106, addresses hazards that are associated with the types of field-related activities described in this SAP. In the course of planning the work, the project team will identify hazards, which includes personnel safety and environmental risks associated with the performance of the work. Hazards may be

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identified and assessed by performing a site visit, reviewing lessons learned, and reviewing project plans or historical data. The hazard assessment process is described in procedure CP3-HS-2004, *Job Hazard Analysis*. Once the hazards have been identified and assessed, measures will be identified to minimize risks to workers, the public, and the environment. These measures are described in the project-specific job hazard analyses (JHAs) or work instructions and provide a control mechanism for all work activities. JHAs are detailed, activity-specific evaluations that address the hazards associated with the tasks and/or activities that will be performed. The JHA development process is a detailed evaluation of each task in order to identify specific activities or operations that are required to successfully complete the scope of work and define the potential chemical, physical, radiological, and/or biological hazards that may be encountered; the media and manner in which they may occur; and how they are to be recognized, mitigated, and controlled. Appropriate hazard controls may include engineering controls, administrative controls, and the use of personal protective equipment (PPE). The project team is responsible for the preparation, revision, and implementation of JHAs and hazard controls. Applicable JHAs and hazard controls will be reviewed with the assigned personnel who will perform the work. Participants in this review will sign and date the JHA or applicable work control to signify that they understand all hazards, controls, and requirements in the work control documents and/or JHAs. Copies of the work control documents and/or JHAs with appropriate signatures shall be maintained and readily accessible.

1.1 PROJECT OBJECTIVE

The objective of this SAP is to gather the information necessary to support the WDA remedial investigation (RI)/feasibility study (FS) addendum and to evaluate siting, planning, design, and analytical WAC development for an OSWDF and associated potential support areas. This SAP is also intended to gather information to support the siting, planning, and design of a proposed CWWT facility as part of the WDA RI/FS or separate CERCLA document.

This SAP is written to guide field investigations and sampling so that they are performed in a technically acceptable manner and meet project data quality objectives (DQOs). The specific types of data to be collected include the following:

- Geotechnical data from sites for a potential OSWDF for use in the siting, planning, and design of a potential OSWDF and support facilities, and also the siting, planning, and design of a proposed CWWT facility; and
- Geochemical data to support modeling for the analytical WAC.

Data obtained from implementing the SAP also will be used to support addressing any applicable or relevant and appropriate requirements (ARARs) in the planning and design of an OSWDF or CWWT facility and may support any needed ARAR waivers related to siting and remedial design.

This SAP is specifically focused on the potential OSWDF study areas and the associated potential support areas (e.g., areas for stockpiling) and the study area for the potential CWWT facility. The specific details of an investigation of potential borrow sources will be appended to the SAP or a new SAP will be developed, as needed.

1.2 DEFINITION OF THE PROBLEM

Data confirming the implementability, effectiveness, and cost of disposal alternatives are needed to evaluate the on-site disposal alternatives for waste that might be disposed of in an OSWDF and for water treatment at a CWWT facility. This SAP is designed to address gaps identified in the existing geotechnical data to support siting, planning, design, and cost assessment for an OSWDF and associated potential support areas, as well as the development of the analytical WAC. This SAP is also intended to gather information to support the siting, planning, and design of a proposed CWWT facility as part of the WDA RI/FS or separate CERCLA document. Additional SAPs may be prepared if further data gaps are identified.

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2. SUMMARY OF EXISTING DATA

Over the history of the Paducah Site, multiple investigations have been performed, and documents prepared, that include relevant geotechnical and geochemical data of the areas proposed for the OSWDF and CWWT facility. This existing data set is reviewed and summarized in this section of the SAP.

Two potential OSWDF sites, OSWDF study areas 5B and 11 (referred to herein as study areas 5B and 11), and the surrounding support areas are being evaluated with this SAP, as shown in Figure 2. Based on the current site information, the geotechnical field investigation will focus on study area 5B (a representative study area) and the associated potential support areas as well as the potential CWWT facility study area. Upon review of the study area 5B analytical results, the geotechnical investigation in study area 11 (a potential alternate study area) may be performed.¹ The following are a sample of the existing documents related to study area 5B, study area 11, the associated potential support areas, the potential CWWT facility study area, or to the Paducah Site in general, which were reviewed as part of this process:

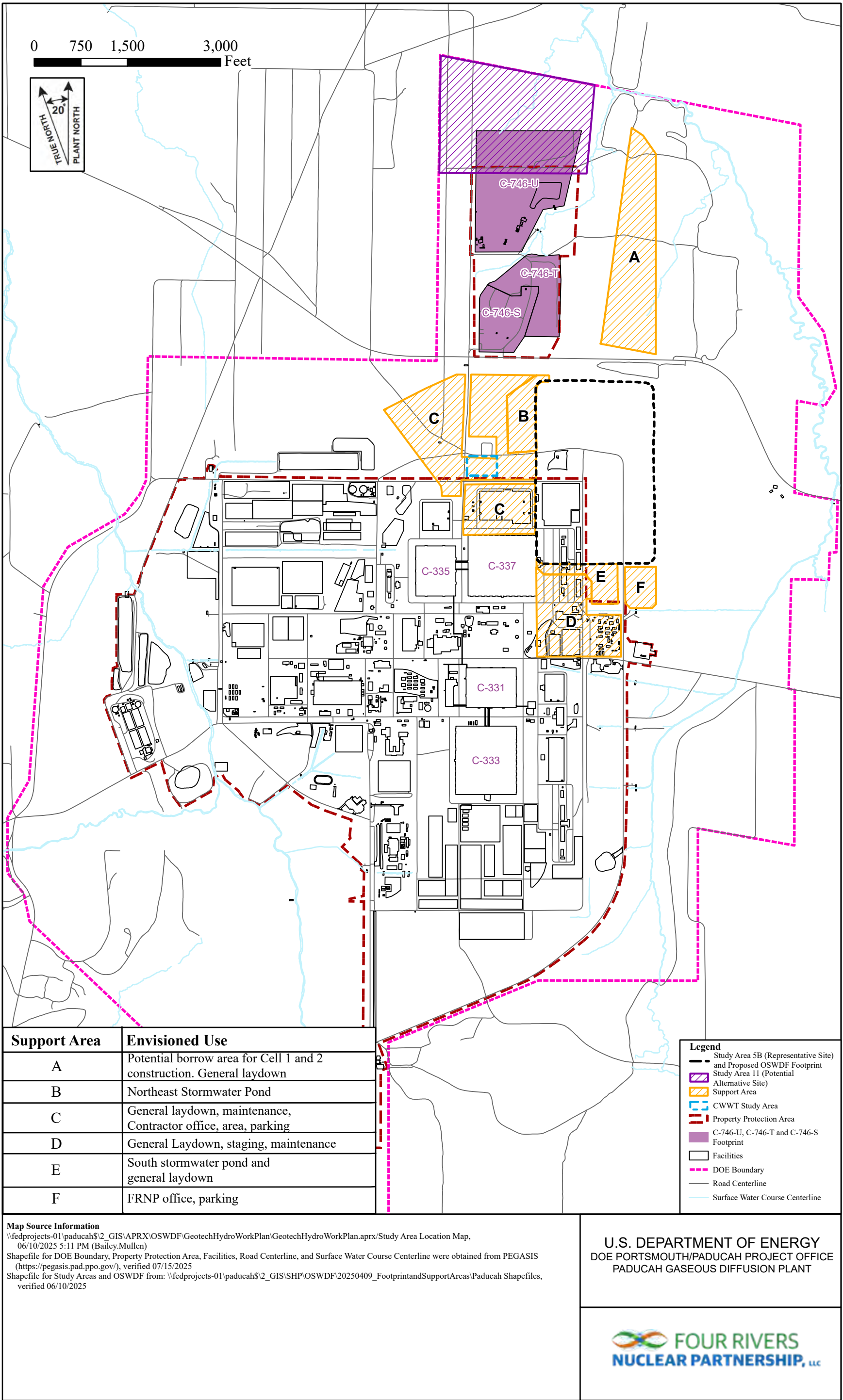
- *Geologic Characterization of the Paducah Gaseous Diffusion Plant and Surrounding Area Determined from Geophysical Logs* (Dreier et al. 1989)
- *Solid Waste Landfill Subsurface Investigation Report* (SAIC 1994)
- *Geologic Features Relevant to Ground-water Flow in the Vicinity of the Paducah Gaseous Diffusion Plant* (Drahovzal and Hendricks 1997)
- *Investigation of Holocene Faulting, Proposed C-746-U Landfill Expansion, Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (KRCEE 2006)
- Boring logs and well construction records retrieved through the PPPO Environmental Geographic Analytical Spatial Information System (PEGASIS)
- *Remedial Investigation/Feasibility Study Report for CERCLA Waste Disposal Alternatives at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2018)
- *Detailed Correlations between Lithologic Units in the McNairy Formation across the Paducah Gaseous Diffusion Plant* (FRNP 2022)
- August 2024 Regional Gravel Aquifer (RGA) Potentiometric Surface Map (see Section 5.2)

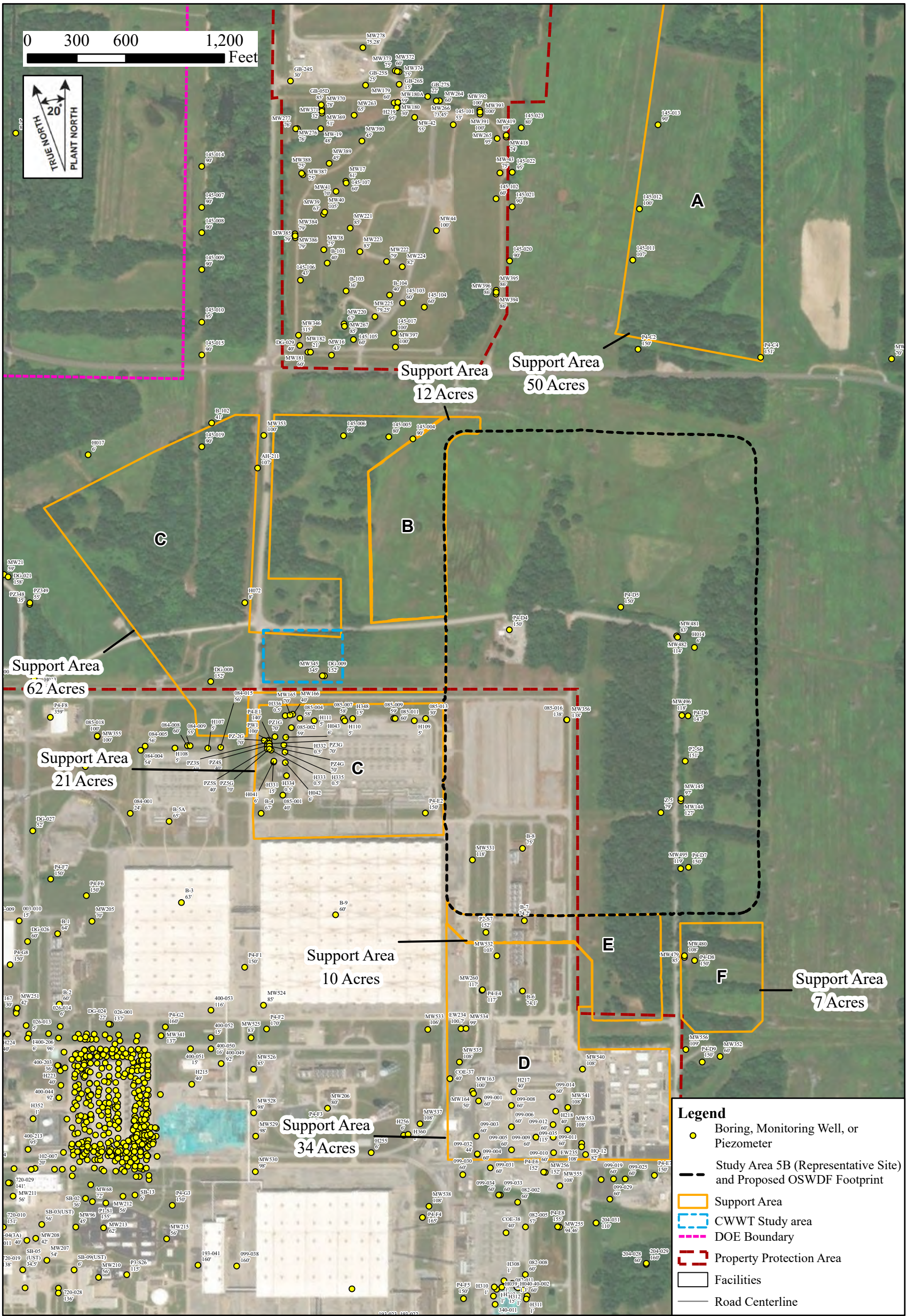
A summary of the existing borings and monitoring wells compiled from the above documents is included in Appendix A. Figure 3 and Figure 4 show the locations of these existing borings and monitoring wells, as well as the locations of nearby existing borings and monitoring wells completed at the Paducah Site.

The Paducah Site is underlain by a sequence of clay, silt, sand, and gravel layers deposited on limestone bedrock. The sediments above the Mississippian limestone (bedrock) are grouped into three major stratigraphic units (loess, continental deposits, and McNairy Formation) and three groundwater systems [the Upper Continental Recharge System (UCRS), the RGA, and McNairy Formation Flow System] as shown in Figure 5. Additional information on Paducah Site geology can be found in numerous documents, including in the *Remedial Investigation/Feasibility Study Work Plan for the C-400 Complex Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE 2020).

¹ Analytical results referred to in this SAP refer to geotechnical and geochemical results unless otherwise specified.

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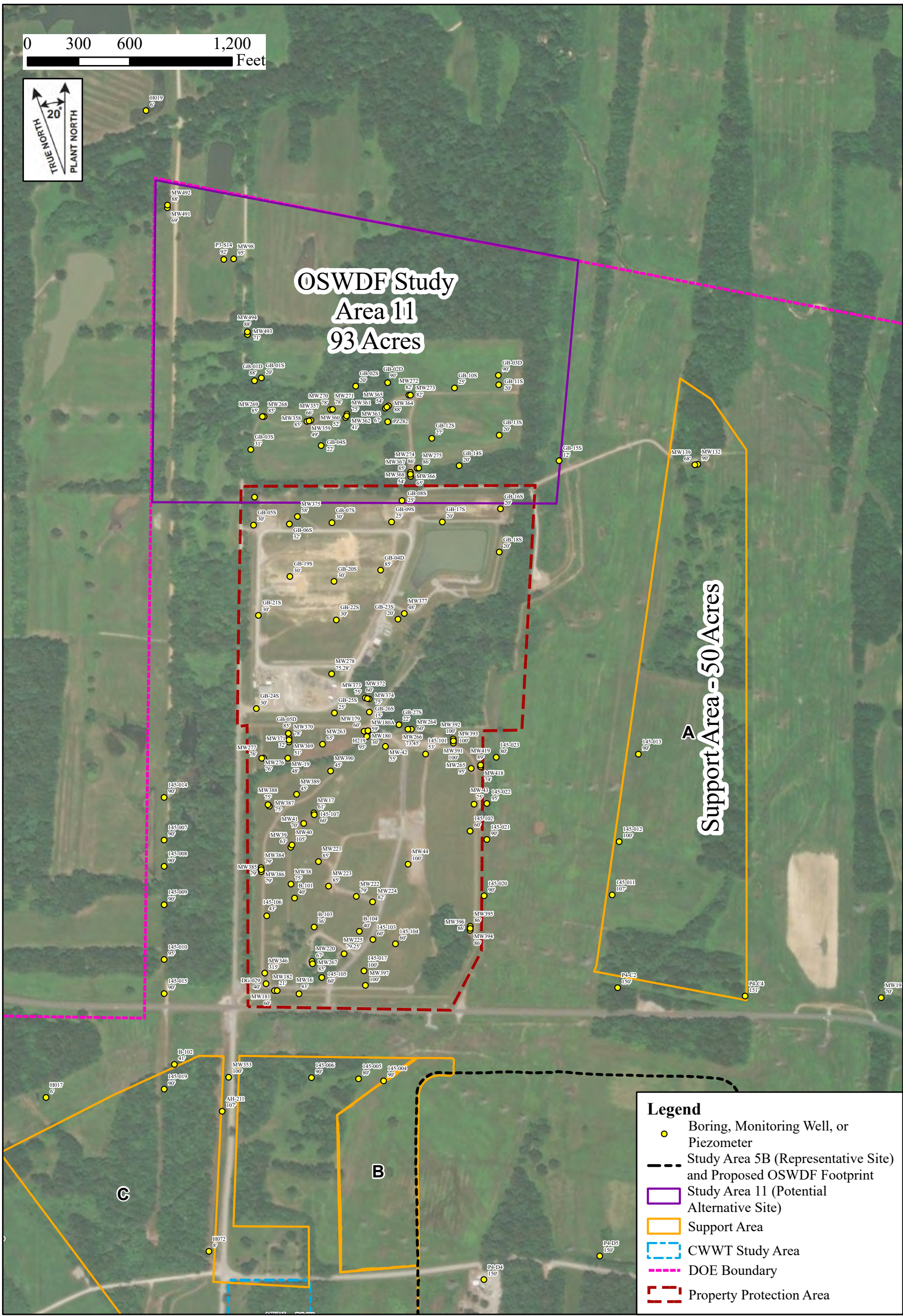


Map Source Information
\\fedprojects-01\paducah\S2_GIS\APRX\OSWDF\GeotechHydroWorkPlan\GeotechHydroWorkPlan.aprx\Area 5B Historic Borings and MWs, 04/11/2025 1:57 PM (Bailey.Mullen)
Image Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, verified 04/10/2025
Shapefile for DOE Boundary and Property Protection Area were obtained from PEGASIS (<https://pegasis.pad.ppo.gov/>), verified 07/15/2025
Boring Locations were obtained from the twelfth revision (R12) of the PGDP lithostratigraphic database and PEGASIS, verified 05/09/2024
Shapefile for Monitoring Well and Boring Locations from: \\fedprojects-01\paducah\S2_GIS\APRX\OSWDF\GeotechHydroWorkPlan\Default.gdb, verified 04/09/2025
Active Monitoring Well Locations were obtained from FRNP, verified 05/09/2024
Shapefile for Study Areas and OSWDF from: \\fedprojects-01\paducah\S2_GIS\SHP\OSWDF\20250409_FootprintandSupportAreas\Paducah Shapefiles, verified 04/09/2025

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PADUCAH GASEOUS DIFFUSION PLANT



Figure 3. Historic Borings and Active Monitoring Wells in Study Area 5B and Surrounding Support Areas



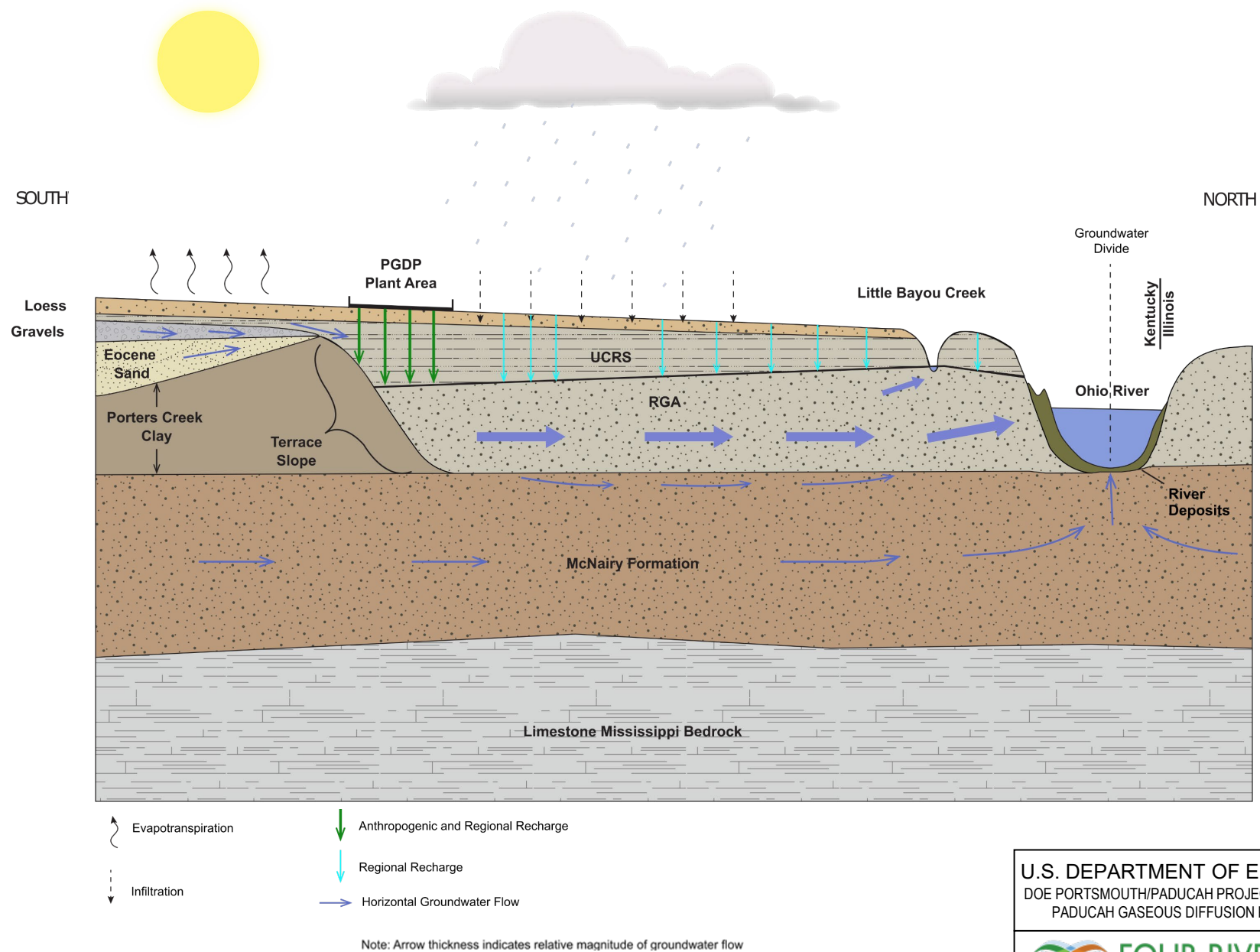
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Image Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, verified 04/10/2025
Shapefile for DOE Boundary, Property Protection Area, Facility, and Road Centerline were obtained from PEGASIS (<https://pegasis.pad.ppo.gov/>), verified 07/15/2025
Boring Locations were obtained from the twelfth revision (R12) of the PGDP Lithostratigraphic Database and PEGASIS, verified 05/23/2024
Active Monitoring Well Locations were obtained from FRNP, verified 05/09/2024
Shapefile for Monitoring Well and Boring Locations from: \\fedprojects-01\paducah\S2_GIS\APRX\OSWDF\GeotechHydroWorkPlan\Default.gdb, verified 05/22/2024
Shapefile for Study Areas and OSWDF from: \\fedprojects-01\paducah\S2_GIS\SHP\OSWDF\20250409_FootprintandSupportAreas\Paducah Shapefiles, verified 04/09/2025

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Figure 4. Historic Boring and Active Monitoring Wells in Study Area 11 and Surrounding Support Areas

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Source: Adapted from 2016 Update of the Paducah Gaseous Diffusion Plant Sitewide Groundwater Flow Model (DOE/LX/07-2415&D2) – July 2017

Figure 5. Hydrogeologic Conceptual Site Model

The primary water-bearing units, in order of increasing depth, are the UCRS, the RGA, and the McNairy Formation (Figure 5). The RGA has been identified as the uppermost aquifer at the Paducah Site (MMES 1992). The RGA is the dominant groundwater flow system at the Paducah Site and contains the on-site and off-site contaminant plumes. The UCRS is generally composed of layers of clayey silt (loess deposits and upper continental deposits) underlain by the RGA (sand and gravel units of the basal upper continental deposits and the lower continental deposits). Below the RGA is a thick layer of fine textured sediments referred to as the McNairy Formation, which includes interbedded layers of sand, silt, and clay until bedrock is reached at approximately 300 to 400 ft below ground surface (bgs). It is noted that the layers beneath the RGA (i.e., the McNairy Formation and bedrock) are sparsely characterized and, therefore, will be studied in further detail as part of this SAP.

Five hydrogeologic units (HUs) are commonly used to discuss the shallow groundwater flow system beneath the Paducah Site and the contiguous lands to the north (Figure 6). In descending order, the HUs are as follows:

- HU 1 (UCRS): Loess that covers most of the site.
- HU 2 (UCRS): Discontinuous sand and gravel lenses in a clayey silt matrix.
- HU 3 (UCRS): Relatively impermeable unit that acts as the upper semiconfining-to-confining layer for the RGA. The lithologic composition of HU 3 is predominantly silt and fine sand.
- HU 4 (RGA): Sand unit with a silt matrix that forms the top of the RGA, where present.
- HU 5 (RGA): Sand and gravel, primary member of the RGA.

For the purposes of this SAP, testing and sample collection are targeted as follows.

- UCRS (HU 1–HU 3)
- RGA (HU 4–HU 5)
- McNairy Formation
- Bedrock

Groundwater flow in the UCRS has been demonstrated to be derived from precipitation infiltration and is predominately vertically downward in the UCRS, providing recharge to the RGA. In general, the depth to the UCRS water table is < 20 ft in the western half of the Paducah Site industrial area (as shallow as 5 ft in some areas and as much as 40 ft in the northeastern corner). Hydraulic conductivities for the UCRS range from 1.6×10^{-7} to 9.9×10^{-5} cm/s, and with yields of < 1 gal per minute (gpm), and as such the UCRS is not a locally-used groundwater source. The limited hydraulic conductivity, thickness, and the limited lateral extent of the more permeable units of the UCRS preclude use as a consumable source for groundwater.

The RGA is the uppermost aquifer containing sufficient saturated permeable material to conduct groundwater and to yield significant quantities of water to wells and springs. Groundwater flow in the RGA has been demonstrated to be predominately lateral flow, with hydraulic conductivities ranging from 4.6×10^{-3} cm/s to 2.6×10^{-1} cm/s, and with well yields from 100 to 1,000 gpm.

There have been several geotechnical investigations and monitoring well installations at the Paducah Site, as shown in Figure 3 and Figure 4. There is geotechnical data for certain portions of study area 11; however, study area 5B and the support areas have limited geotechnical data beyond soil classifications. This SAP includes a detailed and phased geotechnical investigation plan to evaluate the geotechnical properties of soils in study area 5B, study area 11 (if needed), and the support areas. During Phase 1, borings will be

performed at select locations. Based on the findings of Phase 1, proposed borings for Phase 2 of study area 5B and the support areas (also planned for Phase 2) and potential CWWT facility study area may be adjusted. Study area 11 is a potential alternate study area; therefore, borings for study area 11 may be performed if study area 5B is removed from further consideration.

PGDP is situated between the Fluorspar Area Fault Complex of southern Illinois and the New Madrid seismic zone of Arkansas, Missouri, and Tennessee. Numerous studies have delineated fault and seismicity trends that can be extrapolated into the PGDP area. In 2006, the Kentucky Research Consortium for Energy and Environment (KRCEE) used 30 ft deep soil borings and S_H -wave reflection profiles to investigate the occurrence of faulting at a site located north of the PGDP industrial area (Blackhawk Geosciences 2003). While three shallow loess units are generally flat lying and have a mantle of pre-existing topography, study of the cross sections based on the lithologic logs identified undulations of deeper lithologic contacts that may be fault-related. The 2006 investigation interpreted two northeast-southwest trending faults relative to the plant coordinate system with oblique normal and reverse displacement. A detailed study of the uppermost McNairy Formation located in the area of the C-400 Complex concluded that faulting is not present locally (FRNP 2022).

DOE has contracted with KRCEE to perform a seismic investigation specific to study areas 5B and 11 to support siting and design of an OSWDF. The findings of the seismic investigation are intended to be coordinated with this geotechnical SAP and information from this plan also may be used as input data for the seismic project.

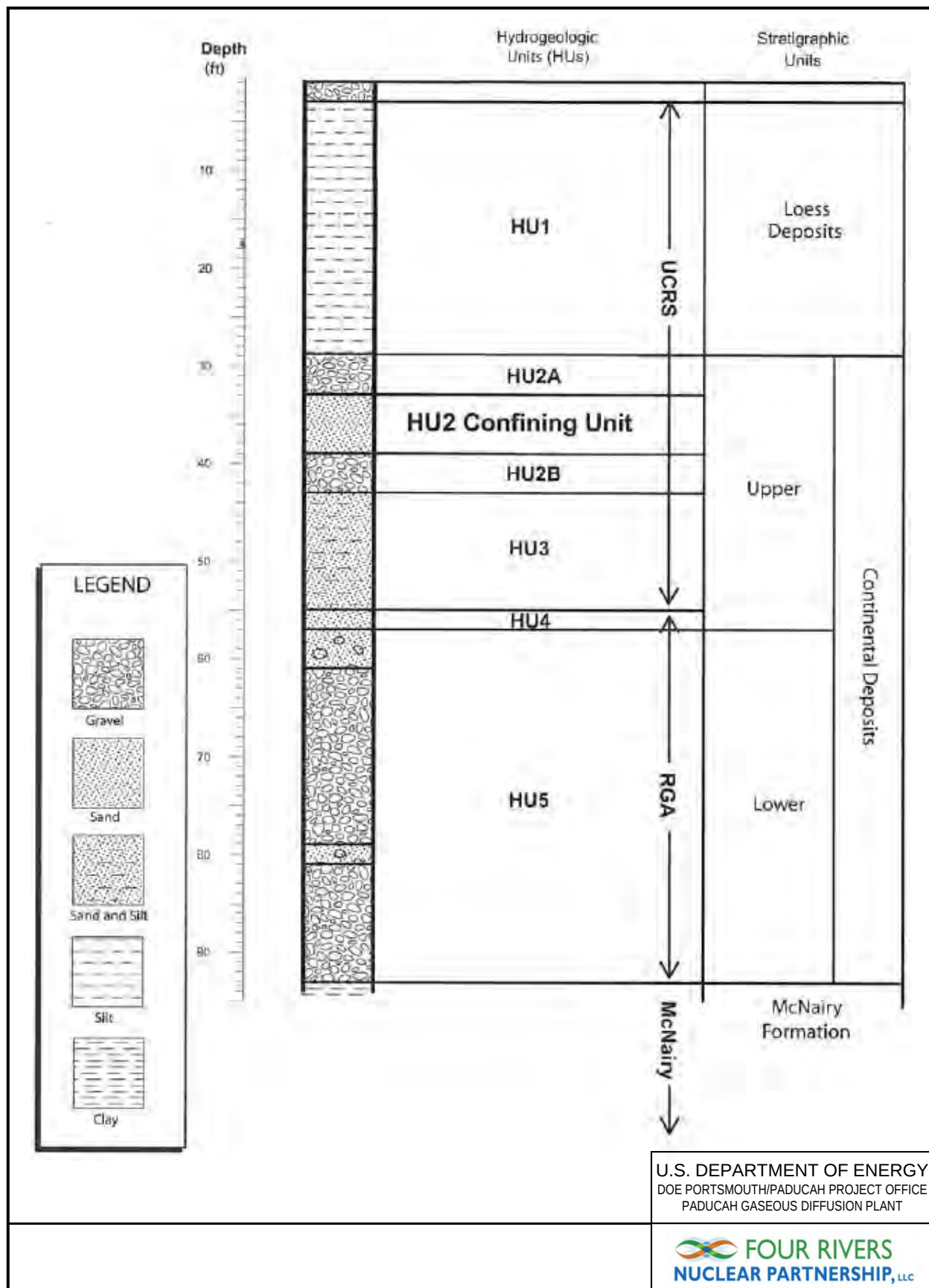


Figure 6. Major Hydrogeologic Units Beneath the Paducah Site

3. PROJECT ORGANIZATION AND RESPONSIBILITIES

This section describes the organization and management structure to be used in implementing this SAP for the project. The project organization chart (Figure 7) shows the management structure that will be used to implement this SAP. The responsibilities of the project positions are described in this section of this SAP.

3.1 PROJECT ORGANIZATION, RESPONSIBILITIES, AND STAFFING

The organization chart shown in Figure 7 outlines the management structure that will be used for implementing the SAP. The responsibilities of key personnel are described in the following paragraphs.

3.1.1 DOE Project Manager

The DOE Project Manager (PM) will provide overall management and technical oversight for the WDA RI/FS and SAP. The DOE PM will be the primary interface among the EPA, KDEP, KRCEE, and DOE Prime Contractor PMs. The DOE PM will ensure that appropriate resources are available to provide adequate technical oversight and maintain project schedules.

3.1.2 DOE Federal Facility Agreement Manager

The DOE Federal Facility Agreement (FFA) Manager oversees implementation and compliance with the terms of the FFA and has overall FFA responsibility for DOE. This individual will serve as the primary interface among EPA, KDEP, and the DOE Prime Contractor FFA managers. This individual also will interface with the DOE PM, DOE Prime Contractor personnel, and the regulators for FFA activities related to the study areas, as appropriate.

3.1.3 DOE Prime Contractor Regulatory Decision Integration Director

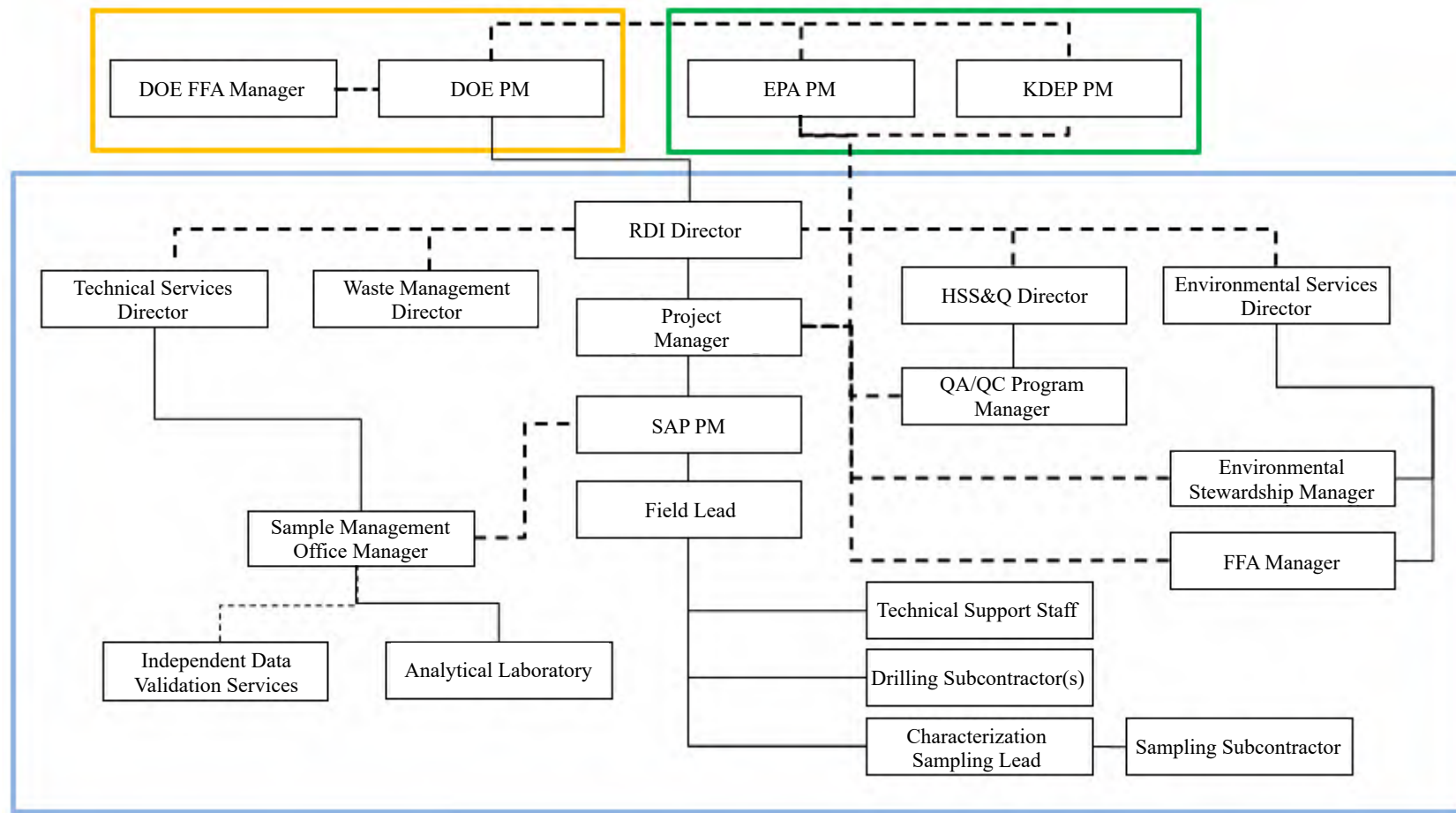
The DOE Prime Contractor Regulatory Decision Integration (RDI) Director will have overall responsibility for technical, financial, and scheduling matters related to the project and will ensure appropriate resources are available to facilitate execution of the SAP in a timely and efficient manner. The RDI director will monitor field team performance throughout the project. This individual is also responsible for the communication of any field change orders to the DOE PM.

3.1.4 DOE Prime Contractor Health, Safety, Support, and Quality Director

The DOE Prime Contractor Health, Safety, Support, and Quality (HSS&Q) Director will have overall HSS&Q program responsibility for the contractor. The HSS&Q director will provide support/resources to the RDI director and/or the field team, as necessary. This individual will interface with DOE and the regulators, as appropriate.

3.1.5 DOE Prime Contractor Technical Services Director

The DOE Prime Contractor Technical Services Director will have overall programmatic responsibility for characterization, the sample management office (SMO), etc., for the contractor related to this SAP. This individual will interface with DOE and the regulators, as appropriate. The technical services director will provide support/resources to the RDI director and/or the field team, as necessary.



Notes:

DOE personnel are in the orange box, Regulatory personnel are in the green box, and DOE Prime Contractor personnel are in the blue box.

Solid lines indicate lines of authority and dashed lines indicate lines of communication.

DOE = U.S. Department of Energy

FFA = Federal Facility Agreement

KDEP = Kentucky Department for Environmental Protection

QA/QC = quality assurance/quality control

SAP = Sampling Analysis Plan

EPA = U.S. Environmental Protection Agency

HSS&Q = Health, Safety, Support, and Quality

PM = project manager

RDI = Regulatory Decision Integration

WDA = Waste Disposal Alternatives

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



Figure 7. Project Organization Chart

3.1.6 DOE Prime Contractor Waste Management Director

The DOE Prime Contractor Waste Management Director will have overall programmatic responsibility for the contractor for waste management related to this SAP. This individual will interface with DOE and the regulators, as appropriate. The waste management director will provide support/resources to the RDI director and/or the field team, as necessary.

3.1.7 DOE Prime Contractor Federal Facility Agreement Manager

The DOE Prime Contractor FFA Manager will have overall FFA responsibility for the contractor. This individual reports to the Prime Contractor Environmental Services Director. This individual will coordinate with the DOE FFA Manager and also will interface with the SAP PM (see Section 3.1.10), DOE, and the regulators, as appropriate.

3.1.8 DOE Prime Contractor Environmental Stewardship Manager

The DOE Prime Contractor Environmental Stewardship Manager will have overall environmental stewardship responsibility (e.g., environmental compliance) for the contractor. This individual reports to the Prime Contractor Environmental Services Director. This individual will interface with the SAP PM, DOE, and the regulators, as appropriate.

3.1.9 DOE Prime Contractor Project Manager

The DOE Prime Contractor Project Manager will have overall responsibility for the SAP for the contractor. This individual reports to the Prime Contractor RDI Director. This individual will interface with the DOE Prime Contractor SAP PM, DOE, and the regulators, as appropriate.

3.1.10 DOE Prime Contractor Sampling and Analysis Plan Project Manager

The DOE Prime Contractor SAP PM will have overall responsibility for implementing the investigation and conducting field activities. The SAP PM will track the project budget and schedules and will delegate specific responsibilities to project team members. This individual reports to the DOE Prime Contractor PM. This individual will interface with DOE, and the regulators, as appropriate.

3.1.11 DOE Prime Contractor Field Lead

The DOE Prime Contractor Field Lead/Frontline Supervisor provides technical oversight and coordination for all field team activities during the investigation. The field lead/frontline supervisor also acts as the primary contact for coordination of subcontractor field efforts and coordinates scheduling of support services from other groups such as industrial safety (IS)/industrial hygiene (IH) personnel, waste management personnel, radiological control personnel, protective services, fire services, and infrastructure management contractor. This individual reports to the SAP PM. This individual will interface with the DOE Prime Contractor PM, DOE, and the regulators, as appropriate.

3.1.12 DOE Prime Contractor Technical Support

Throughout implementation of this SAP, several technical areas may support the project. Technical support areas that may provide support include, but are not limited to, the following.

- IS/IH support
- Waste management
- Quality assurance specialist
- Radiological control
- Geologic support
- Engineering
- Laborers and operators
- Risk assessor
- SMO
- Characterization

3.2 PROJECT COORDINATION

Coordination and liaison between the DOE Prime Contractor and subcontractor personnel will occur at various levels and among personnel appropriate to each level. DOE, regulatory agencies, and the DOE Prime Contractor will communicate via telephone, email, and face-to-face meetings, as appropriate. Additional discussion on project communications related to deviations from the SAP or nonconformances is included in Section 10.

4. DATA QUALITY OBJECTIVES

The DQO process provides a structured approach to planning projects where environmental data are used to support decision making. Use of the DQO process leads to efficient and effective expenditures of resources; consensus on the type, quality, and quantity of data needed to meet the project goals; and full documentation of actions taken during development of the project. For this project, DOE will apply the concepts defined in *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA 2006) and other relevant documents to the qualitative assessment of data needs; however, because this project is not the typical investigation of contaminant releases to the environment, DQO guidance will be applied with a graded approach. The DQO process is flexible enough to meet the needs of any study, regardless of project size. The process uses a common-sense approach to show that the level of documentation and rigor of effort in planning is commensurate with the intended use of the information and available resources.

In accordance with EPA DQO guidance, there are seven steps in the DQO process. The first five can be applied to any decision that utilizes qualitative or quantitative data to support decision making, while steps 6 and 7 are specific to supporting quantitative (statistical) analysis of data:

- Step 1—State the problem (define the problem that necessitates the study).
- Step 2—Identify the goal of the study (state how geotechnical and geochemical data will be used in meeting objectives and solving the problem, identify study questions, and define alternative outcomes).
- Step 3—Identify information inputs (identify data and information needed to answer study questions).
- Step 4—Define the boundaries of the study (specify target population and characteristics of interest, define spatial and temporal limits, specify scale of inference).
- Step 5—Develop the analytic approach (define the parameter of interest, specify the type of inference, and develop the logic for drawing conclusions from findings).
- Step 6—Specify performance (acceptance) criteria (develop performance criteria for new data being collected or acceptable criteria for existing data being considered for use).
- Step 7—Develop the plan for obtaining data (select the resource-effective SAP that meets the performance criteria).

The project, consistent with EPA DQO guidance, has used the DQO process to aid in planning, information gathering and analysis, data qualification, and decision making. The DQO process is a decision support system that addresses decisions in an efficient and effective manner. In this project, DQOs have been developed for the data needed to support evaluation of the potential sites and support areas for a potential OSWDF and associated support areas, design of the OSWDF, and determination of the analytical WAC, as well as design of the potential CWWT facility.

Step 1—State the problem

The Paducah Site is evaluating alternatives for CERCLA waste disposal, including an alternative for on-site waste disposal. Additional data are needed to support the CERCLA alternatives analyses.

Step 2—Identify the goal of the study

The goal of this study is to identify and evaluate sites for a potential OSWDF; provide data needed for OSWDF and CWWT facility design; and to provide data necessary to develop the analytical WAC for an OSWDF. A variety of subsurface information will be collected and analyzed to support site evaluation and design. After site identification and evaluation, acceptable analytical WAC will be calculated using appropriate models to determine the allowable concentrations of constituents that may be disposed of in the potential OSWDF.

Step 3—Identify information inputs

To assist in the evaluation of a potential site and design of the OSWDF and CWWT facility, geochemical and geotechnical data need to be delineated and analyzed. Geotechnical data are needed for site evaluation and design. Geochemical data are input in subsurface flow and transport models that will be used for analytical WAC development.

Step 4—Define the boundaries of the study

Two study areas with support areas have been identified as potential locations for a potential OSWDF: a representative study area 5B and a potential alternate study area 11. The two OSWDF study areas and associated support areas are identified in Figure 2. The McNairy Formation, underlying the RGA, defines the lower boundary for the majority of the geotechnical borings; six borings in study area 5B are planned to extend to competent bedrock, with two of these planned to continue into competent bedrock. The CWWT facility is anticipated to be located in the CWWT facility study area in the vicinity of study area 5B.

Step 5—Develop the analytic approach

Several intrusive field methods will be used to obtain the data to support this study, including, but not limited to, drilling soil borings in the unconsolidated formations, performing standard penetration tests (SPTs), and advancing cone penetration testing (CPT) borings. SPT samples will be collected at discrete depths and logged to document lithology, soil characteristics, and lithologic contacts, and estimate the depth to the water table. Shelby tube samples will be collected in cohesive soils for laboratory testing. During the drilling program, selected discrete-depth soil samples will be collected for geochemical analyses [e.g., pH, cation exchange capacity (CEC), fraction of organic carbon (Foc), total organic carbon (TOC)] and geotechnical analyses (e.g., Atterberg limits, water content, consolidation, unconfined compression). Soil samples from the UCRS (HU 1–HU 3), the RGA (HU 4–HU 5), and the McNairy Formation will be collected for batch testing for site-specific distribution coefficients (K_d) for uranium and Tc-99.

To support the planned seismic investigation by KRCEE, suspension logging to measure *in situ* shear-wave (s-wave) and compressional-wave (p-wave) velocities is planned to be completed in boring SB-A5B-01, which is planned to be advanced into bedrock as part of this SAP.

Step 6—Specify performance (acceptance) criteria

Section 5 includes the acceptance criteria for soil geotechnical and geochemical sampling activities.

Step 7—Develop the plan for obtaining data

This step is presented in Section 5 of this SAP.

5. FIELD ACTIVITIES

The primary focus of the field sampling is to collect geotechnical and geochemical data identified during the DQO process. This section identifies the media to be sampled during the field investigation and specifies the methods for collecting and analyzing the samples. Investigation activities will use standard industry practices that are consistent with DOE Prime Contractor procedures. Procedures, reference guides, and standards that will guide this field project are listed in Table 1. If field conditions differ from those anticipated, then the sampling approach, if appropriate, will be evaluated and revisions to the sampling program will be made as needed. Additional soil borings or CPT locations may be utilized as warranted by the analysis and evaluation of field-collected data. Any additional locations will require the approval of a field change request in accordance with DOE Prime Contractor procedures.

Table 1. DOE Prime Contractor Procedures, Reference Guides, and Standards

Procedures	Reference Documents
CPT	ASTM International (ASTM) D5778, <i>Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils</i>
Drilling	ASTM D6151, <i>Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil Sampling</i> ASTM D6914, <i>Standard Practice for Sonic Drilling for Site Characterization and the Installation of Subsurface Monitoring Devices</i> ASTM D5876, <i>Standard Guide for Use of Direct Rotary Wireline Casing Advancement Drilling Methods for Geoenvironmental Exploration and Installation of Subsurface Water-Quality Monitoring Devices</i>
Soil geotechnical sampling	ASTM D1586, <i>Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils</i> ASTM D1587, <i>Standard Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes</i>
Lithologic logging	CP4-ES-2303, <i>Borehole Logging</i>
Decontamination	CP4-ES-2702, <i>Decontamination of Sampling Equipment and Devices</i>
Sample shipping	CP3-ES-2709, <i>Chain-of-Custody Forms, Sample Labels, and Custody Seals</i> CP3-ES-5004, <i>Sample Tracking, Lab Coordination, and Sample Handling</i>
Geotechnical Analyses/Analytical Procedures	
Particle size analysis	ASTM D6913, <i>Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis</i>
Consolidated undrained triaxial compression (3-point)	ASTM D4767, <i>Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils</i>
Unconsolidated undrained triaxial compression (1-point)	ASTM D2850, <i>Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils</i>
Laboratory compaction characteristics	ASTM D698, <i>Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³))</i>
Specific gravity	ASTM D854, <i>Standard Test Methods for Specific Gravity of Soil Solids by the Water Displacement Method</i>
Moisture content	ASTM D2216, <i>Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass</i>
One-dimensional consolidation	ASTM D2435, <i>Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading</i>
Engineering classification	ASTM D2487, <i>Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)</i>

Table 1. DOE Prime Contractor Procedures, Reference Guides, and Standards (Continued)

Procedures	Reference Documents
Organic content (Foc and TOC)	ASTM D2974, <i>Standard Test Methods for Determining the Water (Moisture) Content, Ash Content, and Organic Material of Peat and Other Organic Soils</i> EPA SW-846, Method 9060, <i>Total Organic Carbon (TOC) in Soil (modified for soil samples)</i>
Atterberg limits	ASTM D4318, <i>Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils</i>
Dry unit weight	ASTM D7263, <i>Standard Test Methods for Laboratory Determination of Density and Unit Weight of Soil Specimens</i>
Hydraulic conductivity	ASTM D5084, <i>Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter</i>
Collapse potential	ASTM D4546 Method B, <i>Standard Test Methods for One-Dimensional Swell or Collapse of Soils</i>
Suspension logging	ASTM D5753, <i>Standard Guide for Planning and Conducting Geotechnical Borehole Geophysical Logging</i>
K _d	ASTM C1733, <i>Standard Test Method for Distribution Coefficients of Inorganic Species by Batch Method</i>
CEC	ASTM D7503, <i>Standard Test Method for Measuring the Exchange Complex and Cation Exchange Capacity of Inorganic Fine-Grained Soils</i>

5.1 GEOPHYSICS

One deep boring (SB-A5B-48) is planned to be advanced to a targeted 30 ft into competent bedrock for the purposes of supporting the OSWDF design. Another deep boring (SB-A5B-01) is planned to be advanced to a targeted 100 ft into competent bedrock for the purposes of long-term seismic monitoring. Suspension logging will be used to measure *in situ* s-wave and p-wave velocities in soil and bedrock at SB-A5B-01 and SB-A5B-48. To date, there are no directly measured s-wave velocity measurements in bedrock anywhere across the Paducah Site. Suspension logging in SB-A5B-01 and SB-A5B-48 will be used to address this data gap. S-wave and p-wave velocity data from soil and bedrock from a deep boring on the property to south of the Paducah Site also is available. Suspension logging will be completed in general accordance with the latest version of ASTM D5753, *Standard Guide for Planning and Conducting Geotechnical Borehole Geophysical Logging*. ASTM D5753 provides generic guidance on borehole geophysical methods and there is not a more specific ASTM standard that exists for suspension logging.

Although surface geophysical methods can be used to investigate depth to bedrock, identify geologic structures (e.g., faults), and locate buried wastes, geophysical methods are not planned for those purposes as part of this SAP. Geophysical surveys and/or other methods may be used prior to drilling to locate buried utilities as part of the penetration/excavation permit process.

DOE is coordinating a seismic investigation with KRCEE that will provide some relevant geophysical data.

5.2 GROUNDWATER

Based on historical site investigations at the site, the hydrogeology, including groundwater flow, is reasonably understood at the Paducah Site.

Sitewide potentiometric maps have been developed for the RGA across the Paducah Site. An example RGA potentiometric surface map from August 2024 is provided in Figure 8, which shows existing RGA monitoring wells across the site and in the vicinity of the study areas. The depth to water (perched) in the UCRS varies across the Paducah Site, from as shallow as 5 to 10 ft in some localities to as much as 40 ft in the northeast plant area, where a storm sewer system is present to collect storm runoff. The collection of groundwater samples or measurements of depth to groundwater are not part of this SAP. Additional depth to groundwater measurements may be collected in accordance with the procedures and scope detailed in the fiscal year 2025 environmental monitoring plan to support the OSWDF or CWWT facility siting, planning, and design.

5.3 SOIL

This section describes the sampling approach to be used for collecting soil samples and geotechnical data.

5.3.1 Rationale/Design

Additional geotechnical and geochemical data are needed for use in siting, planning, and design of a potential OSWDF and support facilities, to support modeling for the analytical WAC, and for siting, planning, and design of a potential CWWT facility. Soil samples from soil borings will be collected using CP4-ES-2300, *Collection of Soil Samples*, as a guide. SPT samples will be completed in accordance with the latest version of ASTM D1586, *Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*.

CPT will be used to collect geotechnical and geological data and evaluate the presence of weak zones. CPT is an *in situ* testing method used for estimating geotechnical engineering properties of soils and delineating soil stratigraphy. The CPT will be implemented using a specially-designed CPT truck or a CPT tool designed to be used on a standard direct-push rig. CPT will follow ASTM D5778, *Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils*. CPT will be advanced in unconsolidated soils to a depth of 60 ft or until refusal, whichever is shallower, and will provide continuous readout of tip and sleeve resistivity and pore pressure to bottom depth. One dissipation test will be performed at each CPT location. Dissipation test depths will be varied from one location to the next to capture hydraulic conductivity measurements at a range of depths within the UCRS. The depth of each test will be determined by field staff based on the lithology identified from SPT borings and the depth of the dissipation test performed at other nearby CPTs (e.g., if a dissipation test is completed in shallow UCRS soils in one CPT location, then the dissipation test in the next nearest CPT will be completed in deeper UCRS soils).

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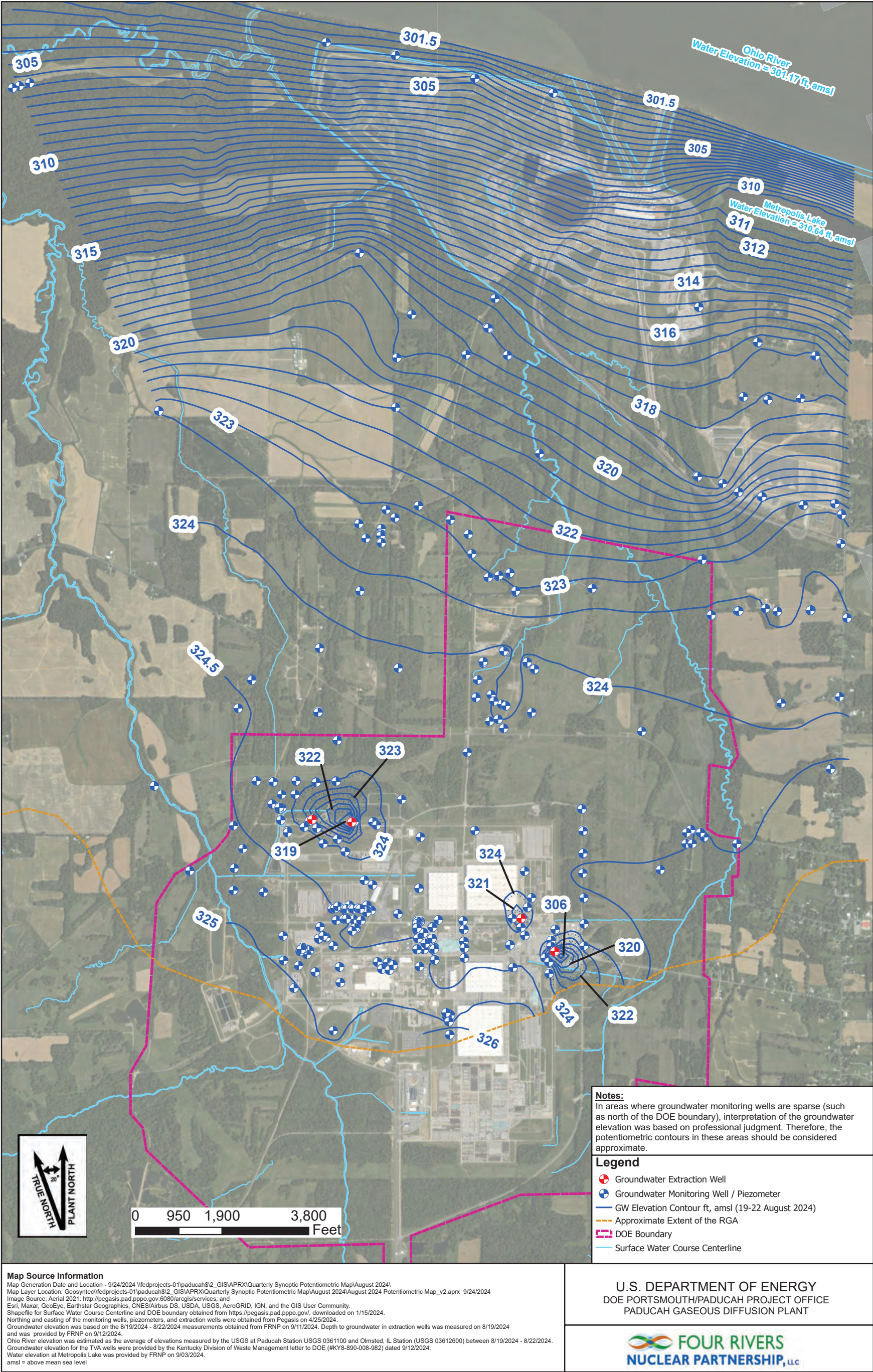


Figure 8. August 2024 RGA Potentiometric Surface Map

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5.3.1.1 Soil boring and CPT locations

The two study areas together with the associated potential support areas and the CWWT facility study area have been divided into soil examination blocks approximately 1,000 ft × 1,000 ft, as shown in Figures 9a and 9b for study area 5B and Figure 10 for study area 11. Each soil examination block contains a minimum of nine soil borings, of which at least one boring will be completed to depth sufficient to sample within the McNairy Formation, which is the first confining layer below the uppermost aquifer. Generally, borings were placed so that boring locations were distributed across each soil examination block; existing infrastructure (e.g., buildings, substations) was avoided. At least one boring location was placed in each U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil group in each soil examination block. USDA NRCS soil groups were identified using the USDA web soil survey and soil type descriptions are included in Appendix B (USDA 2024). A majority of the soil borings will be terminated at the bottom of the lower continental deposits (directly overlying the McNairy Formation), estimated to be 100 ft bgs in study area 5B and 80 ft bgs in study area 11.

Borings intended for sampling within the McNairy Formation are planned to estimated depths of 130 ft bgs in study area 5B and 110 ft bgs in study area 11 (i.e., 30 ft into the McNairy Formation). Four borings in study area 5B (SB-A5B-07, SB-A5B-23, SB-A5B-31, and SB-A5B-41) are planned to be completed to the top of competent bedrock (estimated depth of 300 ft to 350 ft bgs).²

One deep boring (SB-A5B-48) is planned to be completed through the weathered zone of the McNairy Formation and extended to a target depth of 30 ft into competent bedrock for the purposes of supporting the OSWDF design. Another deep boring (SB-A5B-01) will be completed with a target depth of 100 ft into competent bedrock for the purposes of long-term seismic monitoring.³ The depth to the top of competent bedrock is estimated to be between 300 ft to 350 ft bgs in study area 5B; therefore, the deep boring target termination depth is estimated to be between 400 ft to 450 ft bgs for boring SB-A5B-01 and 330 ft to 380 ft bgs for SB-A5B-48. If field conditions are not conducive for the advancement of the borehole to the desired depth (e.g., rock collapse, loss of circulation, cavities, slow rate of penetration in the bedrock) the borings will be terminated.

Borings in support areas are planned to estimated depths of 60 ft bgs; however, if the last interval of the boring is not in competent soil (defined as having an SPT N-value > 10), then the boring shall be continued until competent soil is encountered.

CPT will be used to supplement the soil borings and provide a continuous soil profile. CPT will be advanced in unconsolidated soils to a depth of 60 ft or until refusal, whichever is shallower. The proposed soil boring and CPT locations for study areas 5B and 11 are shown on Figures 9a, 9b, and 10, respectively. The proposed soil boring and CPT locations for the support areas are shown on Figures 11a-c. The depths and locations of soil borings and CPT may be modified in the field based on geologic data collected while drilling. Soil boring and CPT locations are summarized in Appendix C.

The CWWT facility study area is approximately 400 ft × 400 ft, as shown in Figure 11b. Eleven soil borings are planned, of which two borings will be completed to depths sufficient to sample within the RGA (HU 4–HU 5) (target depth of 75 ft bgs). The remaining soil borings will be terminated in the UCRS (HU 1–HU 3), with target depths of 50 ft bgs.

² Competent bedrock will be determined by field staff based on observation of drilling and recovered cores.

³ The target depth into competent bedrock to attempt s-wave and p-wave velocity measurements at SB-A5B-01 is ideally 100 ft, with a minimum target of 25 ft.

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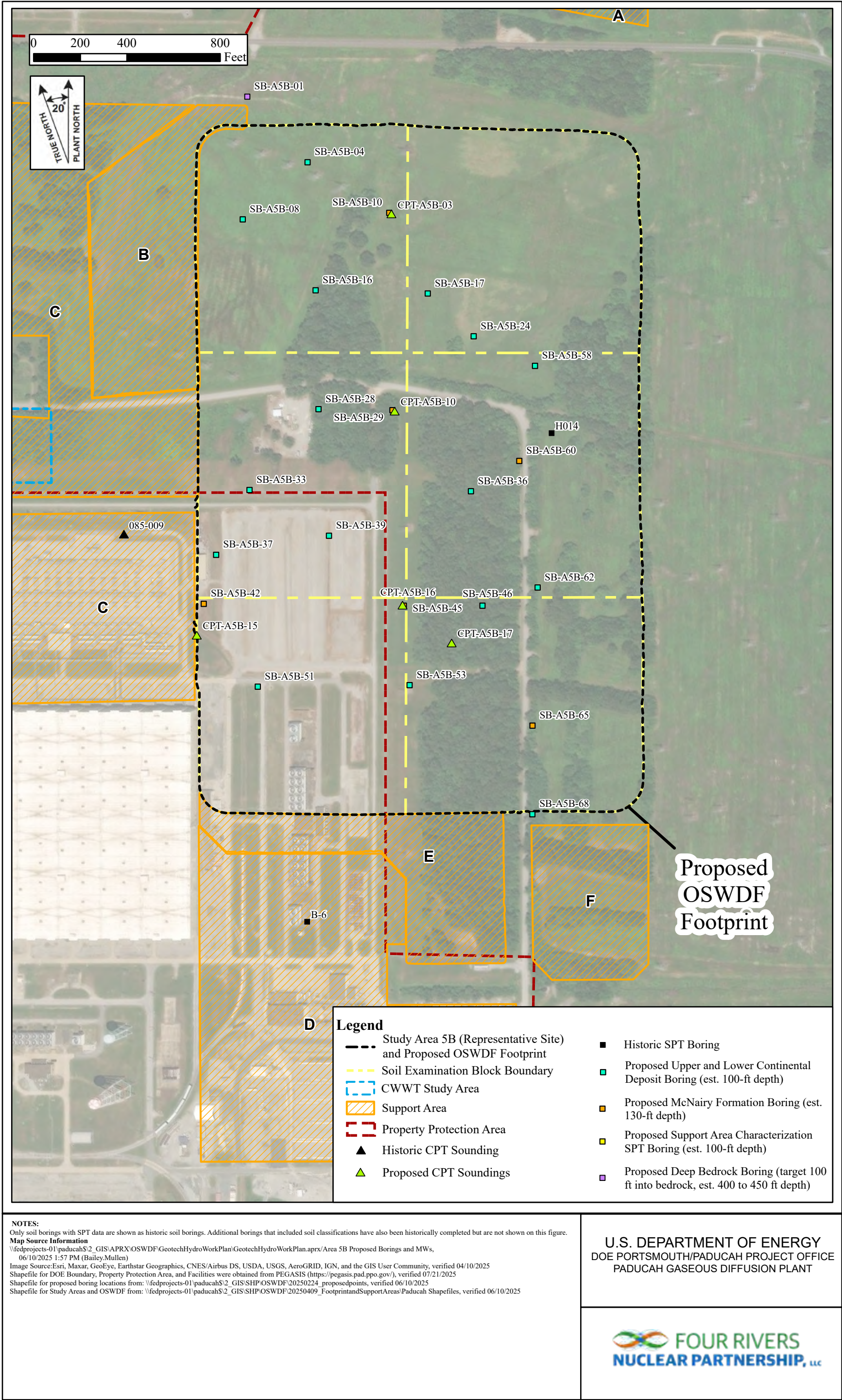


Figure 9a. Proposed and Historic Soil Borings and CPT Soundings in Study Area 5B (Phase 1)

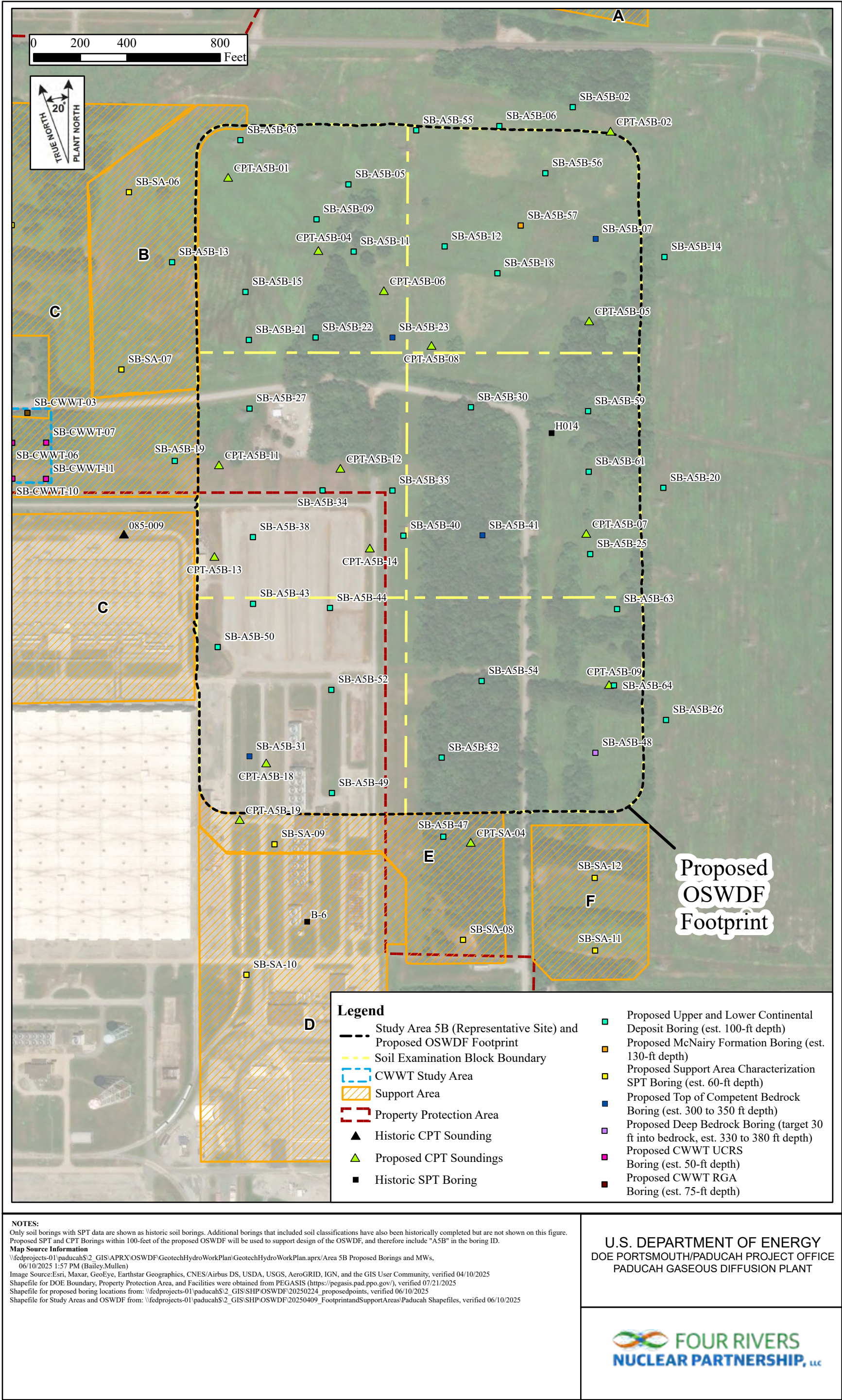


Figure 9b. Proposed and Historic Soil Borings and CPT Soundings in Study Area 5B (Phase 2)

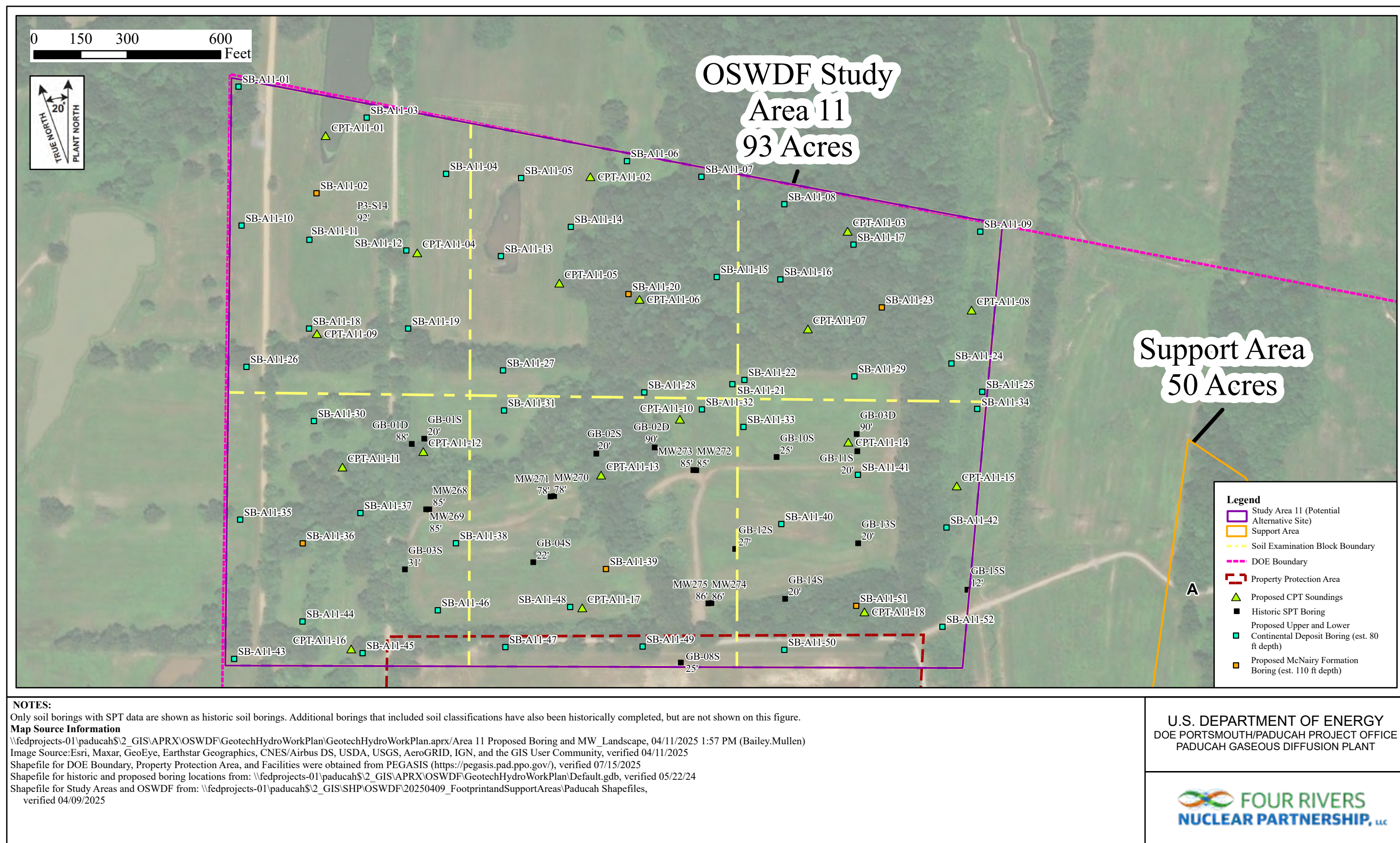


Figure 10. Proposed and Historic Soil Borings and CPT Soundings in Study Area 11 (Potential)

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5.3.1.2 Drilling methods and equipment

Soil borings with planned termination depths in the lower continental deposits, in the McNairy Formation, or at the top of competent bedrock will be completed using either sonic or hollow-stem auger drilling methods (Table 1). Upon completion of drilling each borehole, the borehole will be abandoned by placing high solids (30%) bentonite grout in the McNairy Formation interval of the borehole using a tremie pipe; allowing the lower continental deposits to collapse into the open borehole and backfilling any remaining open boreholes in the lower continental deposits with clean #2 filter sand; and placing high solids (30%) bentonite grout in the upper continental deposits interval of the borehole to near ground surface using a tremie pipe. The attending geologist will document the addition of #2 filter sand within the lower continental deposits, if necessary.

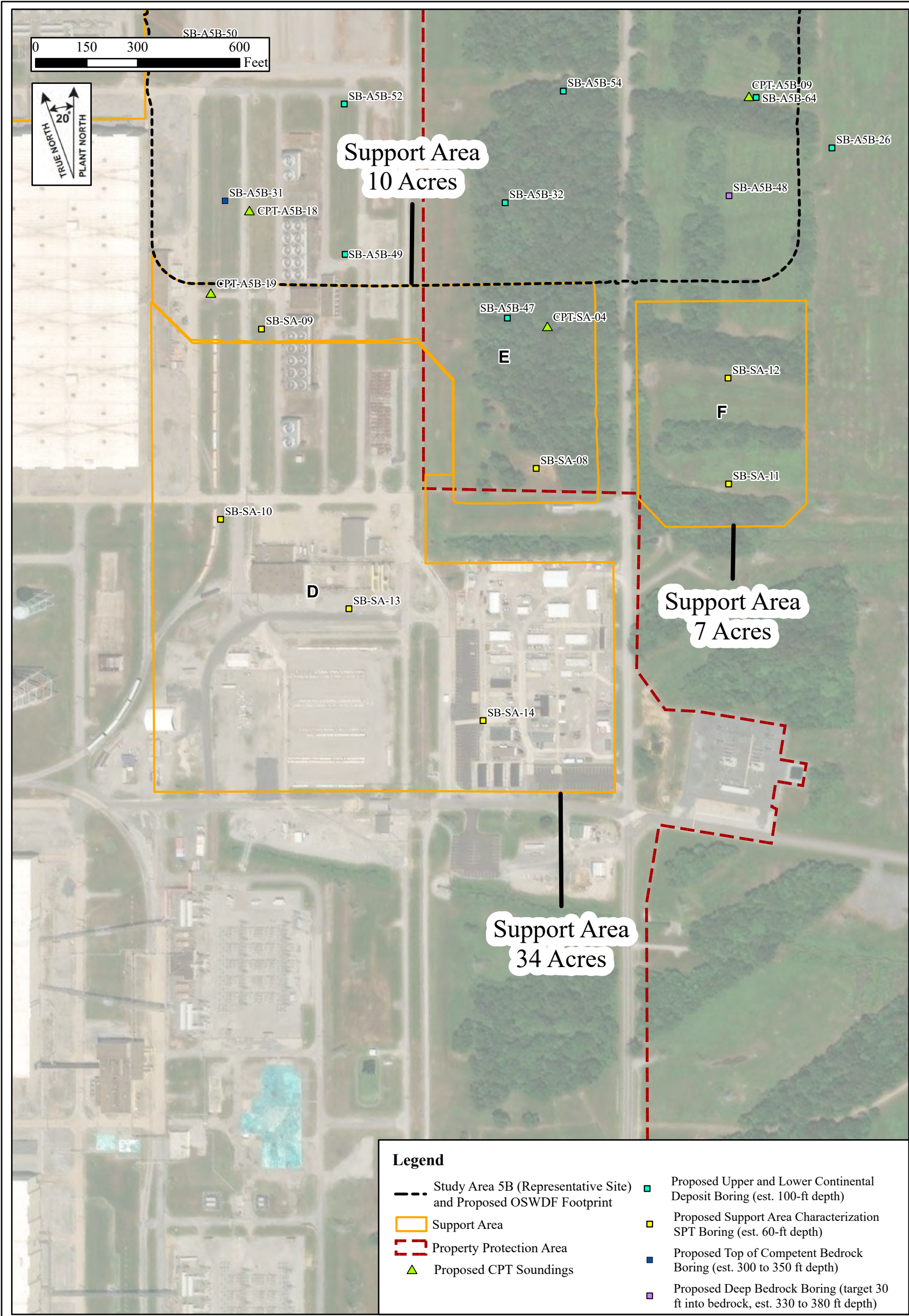
The deep borings (SB-A5B-01 and SB-A5B-48) are planned to be advanced into bedrock using the sonic-drilling method (Table 1) with a minimum 7-inch diameter borehole advanced a few feet into the top of bedrock, stabilized with a drill casing. When the top of bedrock is encountered, a minimum 5-inch diameter polyvinyl chloride (PVC) casing will be placed in the borehole a few feet into the top of bedrock and grouted in place, and the drill casing will be removed. Once the PVC casing is installed and grout is allowed to set, drilling into bedrock will proceed with a 4-inch diameter borehole using rotary rock coring (Table 1). It is assumed that a sonic drilling rig with full rotary capabilities will be used to advance SB-A5B-01 and SB-A5B-48 into competent bedrock. Upon completion of the deep borings and suspension logging (Section 5.1), the borings will either be decommissioned (SB-A5B-48) or a permanent casing will be installed to facilitate the instrumentation for continued data collection related to the KRCEE seismic investigation (SB-A5B-01).

Unless otherwise approved in advance by the attending geologist, decommissioning of a deep boring will consist of abandonment by removal of the PVC casing, sealing the entirety of the borehole within bedrock with cement-bentonite grout via tremie pipe from the bottom up, grouting within the continental deposits as described above, and restoring the surface to the surrounding grade.

5.3.1.3 Discrete/composite soil sampling requirement

Soil samples will be collected from borings using CP4-ES-2300, *Collection of Soil Samples*, as a guide. Split-spoon samples will be collected at regular intervals throughout the depth of the soil material. Shelby tube samples will be collected in fine-grained (i.e., clay and silt) layers primarily found in the loess deposits and upper continental deposits (HU 1–HU 4) and within the McNairy Formation. The samples selected for testing will be packaged and shipped to the laboratory for analysis in accordance with CP3-ES-5004, *Sample Tracking, Lab Coordination, and Sample Handling*. The geotechnical engineer will select the samples for laboratory testing. Sample selection will depend on materials encountered during drilling, sample recovery, and sample conditions to obtain engineering properties of the soil strata encountered in the study areas. In addition to geotechnical samples, soil samples for K_d , Foc, TOC, and CEC analyses will be collected from various depths in specified soil borings to target the UCRS (HU 1–HU 3), the RGA (HU 4–HU 5), and the McNairy Formation.

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NOTES:
Only soil borings with SPT data are shown as historic soil borings. Additional borings that included soil classifications have also been historically completed but are not shown on this figure. Proposed SPT and CPT Borings within 100-feet of the proposed OSWDF will be used to support design of the OSWDF, and therefore include "A5B" in the boring ID.

Map Source Information
\\fedprojects-01\paducah\$2_GIS\APRX\OSWDF\GeotechHydroWorkPlan\GeotechHydroWorkPlan.aprx\South Support Area Proposed Borings and MWs, 04/11/2025 1:57 PM (Bailey.Mullen)

Image Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, verified 04/10/2025

Shapefile for DOE Boundary, Property Protection Area, and Facilities were obtained from PEGASIS (<https://pegasis.pad.ppo.gov/>), verified 07/15/2025

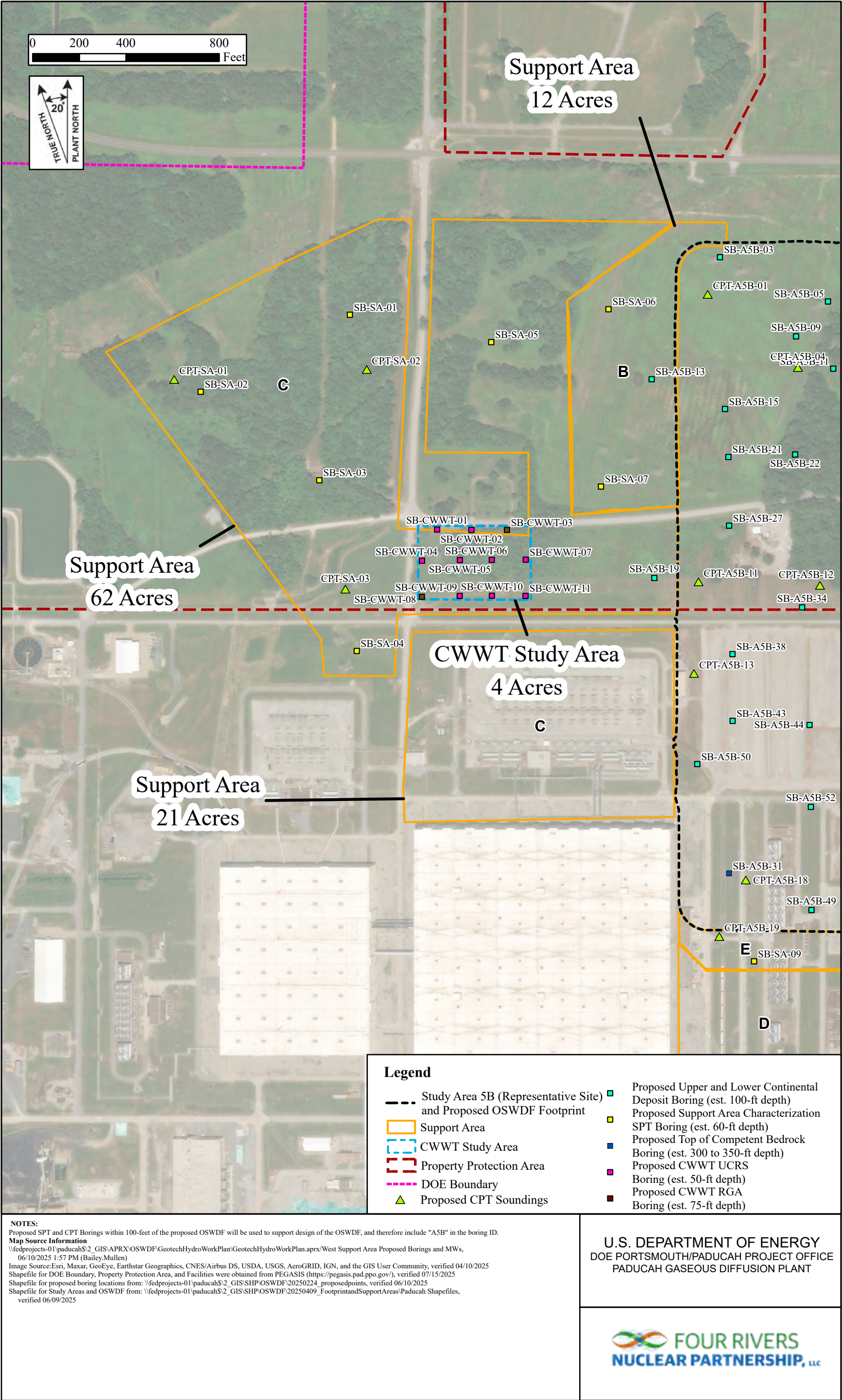
Shapefile for proposed boring locations from: \\fedprojects-01\paducah\$2_GIS\SHP\OSWDF\20250224_proposedpoints, verified 04/10/2025

Shapefile for Study Areas and OSWDF from: \\fedprojects-01\paducah\$2_GIS\SHP\OSWDF\20250409_FootprintandSupportAreas\Paducah Shapefiles, verified 04/09/2025

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PADUCAH GASEOUS DIFFUSION PLANT



Figure 11a. Proposed Soil Borings and CPT Soundings in Southern Support Areas (Phase 2)



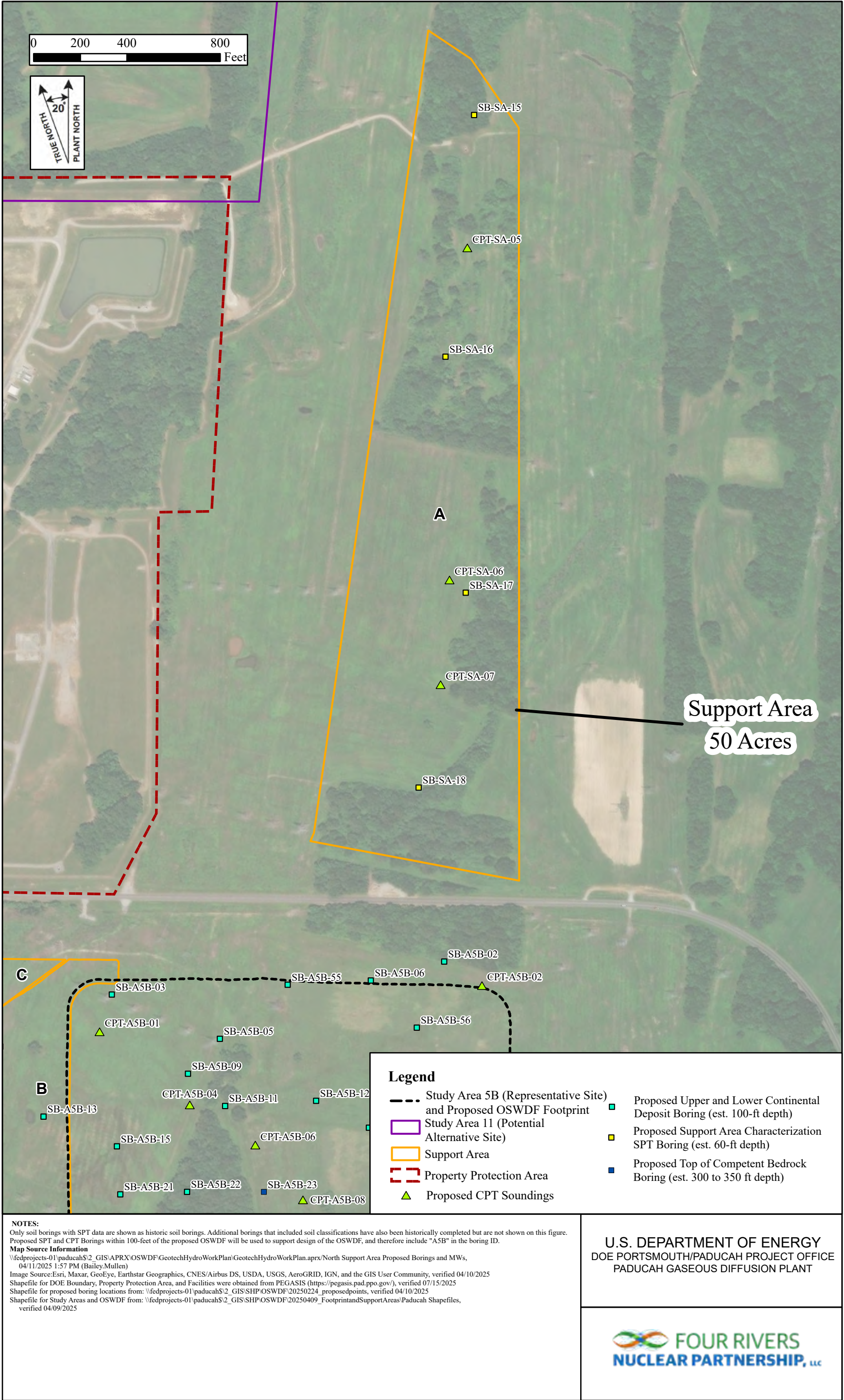


Figure 11c. Proposed Soil Borings and CPT Soundings in Northern Support Area (Phase 2)

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A summary of proposed SPT soil borings, CPT locations, deep borings, and geochemical sample locations are presented in Table 2. The actual number of samples may vary based on SPT and soil boring depths. It is expected that many of the geotechnical samples collected will not be subjected to laboratory testing. The target number of geotechnical tests expected to be performed for each study area is shown in Table 3. Geotechnical samples will be collected in general accordance with the appropriate procedures, reference guides, and standards listed in Table 1.

Table 2. Project Investigation and Sampling Location Summary

Study Area	SPT Soil Boring Locations	CPT Locations
	(ASTM D1586)	[ASTM D5778 (electrical)]
OSWDF Study Area 5B (Phase 1)	23	5
OSWDF Study Area 5B (Phase 2)	43	14
OSWDF Study Area 11 (if needed)	52	18
Support Areas (Phase 2)	18	7
CWWT Facility Study Area	11	0
TOTAL	147	44

Table 3. Target Number of Laboratory Tests Per Area

Test Method	Test Description	OSWDF Study Area 5B (Phase 1)	OSWDF Study Area 5B (Phase 2)	OSWDF Study Area 11 (if needed)	Support Areas	CWWT Facility Study Area	Totals
Index Properties							
ASTM D2487	Engineering classification	69	69	138	18	50	350
ASTM D2216	Moisture content	69	69	138	18	50	350
ASTM D6913	Particle size analysis	69	69	138	18	50	350
ASTM D7263	Dry unit weight	11	10	21	12	4	58
ASTM D854	Specific gravity	11	10	21	12	3	58
ASTM D4318*	Atterberg limits	69	69	138	18	50	350
ASTM D698	Laboratory compaction characteristics	2	6	8	4	4	24
Performance Properties							
ASTM D4767	Consolidated undrained triaxial (3-point)	2 remolded 2 <i>in situ</i>	2 remolded 2 <i>in situ</i>	4 remolded 4 <i>in situ</i>	4	3	15
ASTM D2850	Unconsolidated undrained triaxial Testing (1-point)	0	0	0	0	7	7
ASTM D4546 Method B	Collapse potential (undisturbed*)	2	2	4	8	4	20
ASTM D2435	One-dimensional consolidation	8	10	18	8	10	54
ASTM D5084	Hydraulic conductivity (undisturbed)	16	8	24	16	0	64
Geochemical Analysis							
ASTM C1733	K _d	35	25	60	0	0	120
EPA SW-846, Method 9060	Foc and TOC	35	25	60	0	0	120
ASTM D7503	CEC	35	25	60	0	0	120

*Undisturbed soil samples are collected using Shelby tubes to minimize disturbance of the sample structure, water content, and density.

5.3.2 Field Procedures

The following subsections describe the methods for drilling and sampling. Procedures, reference guides, and standards to be used in implementing this SAP are listed in Table 1.

5.3.2.1 Drilling methods and equipment

Drilling will be performed using one of the drilling techniques listed in Table 1. Field-screening instruments or equipment (e.g., photoionization detectors, radiological pancake-type probes) will be used by radiological control personnel or IS/IH personnel, as appropriate, to measure the volatile organic compound and radiological contamination of drill cuttings and samples to monitor conditions for the workers as the boring is advanced.

Soil boreholes will be abandoned as described in Section 5.3.1.2.

5.3.2.2 Boring logs

A geologist or geotechnical engineer will observe drilling and sampling and will prepare a boring log for each soil boring using CP4-ES-2303, *Borehole Logging*, as a guide.

5.3.2.3 Sampling for physical/geotechnical analysis

Sampling for geochemical analyses (to inform contaminant transport properties) and geotechnical analyses (to obtain engineering properties) will be performed with split-spoon samplers and/or Shelby tubes while drilling. Sampling will be performed using CP4-ES-2300, *Collection of Soil Samples*, as a guide. Specific procedures for handling samples for geochemical analysis are discussed further in the following section.

One of the drilling techniques listed in Table 1 will be used to advance the borings to the target sample depth. Samples will be obtained by the driller at each soil boring location at intervals selected in the field. Soil will be sampled with different sample types being obtained at the following approximate intervals:

- CWWT Facility Study Area—Split-spoon or other geotechnical samples will be driven continuously from 0 to 16 ft depth. Below 16 ft depth, sampling will continue at 5 ft intervals until termination depth is reached.
- Other Areas—Split-spoon or other geotechnical samples will be driven 2 ft in depth at nominal 2.5 ft intervals from 0 to 30 ft depth. Below 30 ft depth, sampling will continue at 5 ft intervals until termination depth is reached.
- Shelby tube samples will be pushed 2 to 2.5 ft deep in accordance with ASTM D1587 when cohesive soils are present.
- When Shelby tube samples conflict with split-spoon sample locations, the split-spoon sample at the given test depth will be eliminated.

After each sample is obtained from the driller, samples are collected for geotechnical and geochemical analyses (as applicable) and the material recovered is logged. The SMO provides coordination for sample shipment to the laboratory. Samples not selected for laboratory testing will be stored on-site until data review is complete.

5.3.2.4 Sampling for geochemical analysis

Samples for geochemical analyses (K_d , Foc, TOC, and CEC) will be collected from selected borings at depths corresponding to the UCRS (HU 1–HU 3), the RGA (HU 4–HU 5), and the McNairy Formation. Soil samples representing the various geologic strata will be collected from various soil borings.

To obtain site-specific K_d estimates, standard adsorption and desorption tests following ASTM C1733 will be performed on soil samples using synthetic groundwater prepared by the laboratory. A targeted total of 10 samples will be designated from each HU in the UCRS (HU 1–HU 3) and the RGA (HU 4–HU 5), as well as in the McNairy Formation for geochemical testing. The actual number of samples from each HU may vary based on the successful recovery of soils.

5.3.2.5 Sample containers and preservation techniques

Samples will be placed in sample containers compatible with the intended analysis.

5.3.2.6 Decontamination procedures

The objectives of decontamination are to remove contaminants from surfaces, mitigate the spread of contaminants to uncontaminated surfaces, prevent cross-contamination of sample matrices, and minimize personnel exposure and waste volume. The contractor will use the equipment decontamination procedure CP4-ES-2702, *Decontamination of Sampling Equipment and Devices*, as needed.

6. FIELD OPERATIONS DOCUMENTATION

Project records, including field operating records, field investigation data, sample collection information, and analytical data records will be managed in accordance with PGDP procedures, as appropriate. The field lead is responsible for reviewing and approving the project records and for ensuring the project records are transferred to the PGDP project files for long-term storage. While the project is active, conforming copies of records will be maintained at the project field office in secure locations either as hard or electronic copies.

Field operating records include, but are not limited to, boring logs, field testing results, and chain-of-custody forms. As these records are completed by the project team, they will be reviewed, processed, evaluated on-site, and submitted to the field task lead for review. Sample chain-of-custody forms contain sample-specific information that was recorded during the collection of the sample. Any deviations from the sampling plan are noted on the sample chain-of-custody form or field logbook. The sampling team reviews each sample chain-of-custody form for accuracy and completeness as soon as practical following sample collection. A copy of the sample chain-of-custody forms are submitted to the SMO prior to sample shipment.

Training and qualification records for each employee are maintained in the project files. Training and certification records are reviewed prior to assignment of work to verify the individual has the appropriate training, certifications, and/or qualifications.

6.1 SAMPLE DOCUMENTATION

Field documentation will conform to procedure CP4-ES-2303, *Borehole Logging*. Chain-of-custody forms will contain sample-specific information for each field sample collected. Generally, chain-of-custody forms and field logbooks will include the following information.

- Name of sampler
- Project name and number
- Sample identification number
- Sampling location, station code, and description
- Sample medium or media
- Sample collection date
- Sample collection device
- Sample visual description
- Collection procedure
- Sample type
- Analytes
- Preservative

6.2 PHOTOGRAPHIC RECORDS

Photographic records will be obtained as necessary to document sample locations or off-normal conditions. Photographic records will be documented in the RI/FS report or other appropriate CERCLA document.

6.3 SAMPLE DOCUMENTATION

Sampling will be documented in the field logbooks and the laboratory chain-of-custody forms (see Section 6.1). Field logbooks and chain-of-custody forms will be scanned, and the hard and electronic copies will be retained as part of the project files.

6.3.1 Sample Numbering System

Sample identification numbers are identified in the Project Environmental Measurements System (PEMS) and are assigned by the SMO. An example of the sample numbering scheme used for this project is provided below:

WDASBbbbbbbMA000

where:

WDA	=	indicates the WDA project and is the highest tier sample identifier
SBbbbbbb	=	designates the sample boring location with “bbbbbb” being the boring number (SBA5B01 would be location SB-A5B-01)
M	=	identifies the media type (“S” will identify the sample as soil; “W” will identify the sample as groundwater)
A	=	identifies the sequential sample (usually “A” for the primary sample and “B” for a secondary sample)
000	=	identifies the planned depth of the sample (top of sample depth) in ft bgs.

A similar sample numbering scheme would be used for CWWT facility study area samples where “SBbbbbbb” is replaced by “SBCWTbb” to designate the CWWT facility study area and the boring number.

6.3.2 Sample Labels and/or Tags

All physical samples obtained for laboratory analysis or for future evaluation will be handled, packaged, and labelled in accordance with CP3-ES-2709, *Chain-of-Custody Forms, Sample Labels, and Custody Seals*.

6.3.3 Chain-of-Custody Records

Procedures CP3-ES-2709, *Chain-of-Custody Forms, Sample Labels, and Custody Seals*, and CP3-ES-5004, *Sample Tracking, Lab Coordination, and Sample Handling*, should be followed for all samples obtained for laboratory analysis. The chain-of-custody documents sample possession from time of collection, through transfers of custody, to receipt at the laboratory, and into the subsequent analysis. A sample will be considered under custody if it is in the possession of the sampling team, in view of the sampling team, or transferred to a secured (i.e., locked) location. Chain-of-custody records will follow the requirements as specified in CP3-ES-2709. The laboratory chain-of-custody form will be generated by the PEMS database. This form will be used to collect and track samples from collection until transfer to the laboratory.

The field lead is responsible for the review and confirmation of the accuracy and completeness of the chain-of-custody form and for the custody of samples in the field until proper transfer to the sample coordinator. The sample manager or his/her designee is responsible for sample custody until the samples are properly packaged, documented, and released to a courier or directly to the off-site analytical laboratory.

6.3.4 Sample Location Survey

Surveying of sampling locations will be conducted prior to drilling. Where possible, temporary markers consisting of painting, flagging, or wooden or metal stakes will be used to mark boring locations. A member of the SAP field team will accompany the survey crew to provide information regarding the location of sampling points. Each location will be surveyed for its horizontal and vertical location using the PGDP coordinate system for horizontal control. Work will be performed by or under responsible charge of a professional land surveyor registered in the Commonwealth of Kentucky. Coordinates will be entered and transferred with the station's ready-to-load file to the Paducah Oak Ridge Environmental Information System (OREIS).

Boring or CPT locations may be field relocated to reflect obstructions, such as utilities, trees, inaccessibility, etc. The revised locations will be surveyed.

6.4 DOCUMENTATION PROCEDURES/DATA MANAGEMENT AND RETENTION

Field logbooks, and other documentation generated by the sampling technician, geologist, or geotechnical engineer will be handled as field operating records and will be reviewed to confirm accuracy and completeness, approved, and signed to show all field protocols were met.

The SMO maintains the signed chain-of-custody forms as part of the data assessment package, which is submitted to records management. Conformed copies of the forms will be retained by the laboratory and field personnel.

Nondirect measurements, sometimes used to gather data, include literature searches and database queries and retrieval. In these measurements, it is important to use reliable, documented sources. Once the source of the data is identified and verified as reliable, a reference of this source document will be cited in applicable data summaries and reports. Whenever possible, verification from multiple, independent sources that yield comparable data will be obtained and documented. This should be noted in associated data summaries and reports.

The project will implement data management processes to meet the requirements of PEGASIS and the data management plan (DOE 2024). The SMO manager will be responsible for recording field and laboratory data into a computerized format as required by this system, as appropriate.

Laboratories may provide electronic data deliverable files that are uploaded to PEMS, then to OREIS. Upon completion of data review and clearance for release to the public, applicable project data will be transferred from the OREIS database to PEGASIS. For geotechnical test results that cannot be readily uploaded to the database, the project will maintain the results.

The SAP PM will assess the accuracy and completeness of all data submitted. All applicable data entered into the PEMS database and submitted to the PEGASIS shall correspond with the data contained in the original laboratory reports, logbooks, sample chain-of-custody forms, and other documents associated with the sampling and laboratory analysis tasks. All data submitted will be reviewed for conformance with format and content requirements.

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7. SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

Soil samples collected in Shelby tubes require additional care in packing and shipping. Both ends of the tube should be completely sealed, either over each end or with expanding packers. Tubes sealed over the ends should be provided with spacers and/or appropriate packing materials to provide proper confinement of the soil sample. Packing materials must be nonabsorbent and must maintain their properties through shipment to provide continuous sample support. The top end of the tube should be labeled “top” using a marking or label that is adequate to survive transportation. The tube should be transported with the top end up at all times. During shipment to the laboratory, the tube shall be confined in an elongated box (e.g., a triangular or square tube box) or drum with packing materials surrounding the tube to cushion the tube during shipping. The shipping box or drum shall have markings and labels indicating the top, similar to the tube, as well as annotation that the box or drum should be transported with the top facing up.

Upon laboratory receipt of the samples, the laboratory sample custodian will note the condition of the shipping container received as well as any questions or observations concerning sample integrity. The laboratory sample custodian will record the condition and verify the presence of each sample named on the chain-of-custody form. Nonconformances noted in the sample identifications, types of analyses, or sample condition upon receipt will be documented and the SMO manager will be notified. The laboratory will maintain an internal sample tracking record that will document the date of sample removal from storage; extraction, preparation, and analysis information; and laboratory-assigned sample number, which is affixed to each sample container upon sample receipt.

Samples will be tracked in the PEMS database as they are collected, packaged, and shipped or delivered to the laboratory for analysis. Sample information can be accessed by the SMO through the PEMS database.

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8. INVESTIGATION-DERIVED WASTES OR CONTAMINANTS

8.1 OVERVIEW

This SAP documents the management and disposition of IDW, decontamination water, and wastewater that will be generated during the implementation of this SAP.

This SAP addresses the specific management of wastes generated during the performance of the SAP from generation through final disposition. All waste generated will also be managed according to the most recent revision of the *Four Rivers Nuclear Partnership, LLC, Paducah Deactivation and Remediation Project Waste Management Plan* (WMP), CP2-WM-0001.

A copy of this SAP and the WMP (electronic or hardcopy) will be available on-site during execution of the SAP. The waste management coordinator will be responsible for daily oversight of waste management activities and for ensuring compliance with this SAP and the WMP.

This SAP emphasizes the following objectives:

- Manage the waste(s) in a manner that is protective of human health and the environment.
- Minimize waste generation, as feasible, thereby reducing unnecessary costs (e.g., analytical, storage, disposal).
- Select appropriate storage and/or disposal methods for generated waste(s).
- Comply with waste handling and shipping timeline requirements.

All waste management activities must comply with this SAP, the WMP, applicable procedures, and *Waste Acceptance Criteria for the Treatment, Storage, and Disposal Facilities at the Paducah U.S. Department of Energy Site*, CP2-WM-0011, for on-site treatment, storage, and disposal facilities that may be designated to receive SAP waste. Off-site disposal of CERCLA-generated waste must comply with the CERCLA off-site rule.

During the course of the SAP, additional contractor and DOE waste management requirements may be identified. If necessary, revisions will be made to the WMP to ensure project compliance.

8.2 TYPES AND MANAGEMENT OF INVESTIGATION-DERIVED WASTE, SAMPLE RESIDUALS, AND MISCELLANEOUS WASTE

A variety of IDW is expected to be generated during the SAP. All waste generated has the potential to contain contaminants related to known or suspected past operational or disposal practices. IDW generated during sampling activities may include materials such as soil (including drill cuttings), grout, PPE, plastic, sampling residuals and returns, sampling equipment, field laboratory waste, wastewater, sediment and mud from wastewater treatment, filter media, and filter bags/cloths. Waste will be stored at the designated CERCLA waste storage areas during the waste characterization period prior to disposal.

The waste generated from field-related activities of this SAP has the potential to contain contaminants related to past operations. Waste that is likely to have either hazardous or radiological contamination typically will be stored on-site in containers within the area of contamination and/or other CERCLA waste storage areas in accordance with CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*, during the characterization period and prior to treatment/disposal.

Brief descriptions of each expected waste stream are outlined in the following sections.

8.2.1 Soil

Contaminated soil may be generated during drilling/sampling. Study area 5B, including associated study areas and CWWT facility study area, and study area 11 waste material must be segregated exclusive from other study area waste to facilitate waste characterization at the conclusion of field activities. Soil will be containerized in appropriate containers.

8.2.2 Sampling Equipment, Sample Residuals

Sample residuals will be generated from sampling activities. Geotechnical laboratories typically return sample residuals. Sample returns, sample containers, and disposable sampling equipment will be containerized or be added to the original waste that was sampled and characterized by process knowledge. Each waste stream will be segregated, labeled, and stored in an approved container.

8.2.3 Decontamination Water, Solvents, and Contaminated Environmental Media

Decontamination water, solvents, contaminated environmental media, or other similar materials may be generated during drilling/sampling equipment decontamination. The decontamination water will be containerized and stored at on-site storage facilities. The water will be managed as described in Section 8.2.4. Each waste stream will be segregated and will be labeled and stored in an approved container.

8.2.4 Wastewater

Wastewater may be generated by excess sample residues, drilling activities, or decontamination of equipment. The wastewater will be containerized and stored at on-site storage facilities. The water will be sampled and, if necessary, treated (e.g., C-612 Northwest Plume Groundwater System) before it is discharged through an existing KPDES Outfall or a CERCLA outfall or managed at an off-site wastewater treatment facility, if needed.

8.2.5 Contained-In/Contaminated-With Determinations

Based on process knowledge of past operations at the Paducah Site and review of existing historic sampling data, waste streams (e.g., contaminated environmental media and debris) generated during drilling may be contaminated with listed-hazardous waste [i.e., TCE, 1,1,1-trichloroethane (1,1,1-TCA)]. If either TCE and/or 1,1,1-TCA is determined to be present based on detectable concentrations of TCE and/or 1,1,1-TCA, the waste stream in question shall be managed as a Resource Conservation and Recovery Act of 1976 (RCRA) hazardous waste per the contained-in policy until such time the waste stream is determined no longer to contain the listed-hazardous waste. Contaminated debris and environmental media are no longer considered to contain hazardous waste when (1) they no longer exhibit a characteristic of hazardous waste, and (2) concentrations of the listed-hazardous constituents are below health-based levels. Sampling, process knowledge, or a combination of both may be used to make such determinations, Kentucky Division of Waste Management (KDWM) and EPA Region 4 previously have approved site-specific, health-based levels for making no longer contained-in/contaminated-with determinations for environmental media and

debris at the Paducah Site, with respect to TCE and 1,1,1-TCA. The health-based levels originally were approved by KDWM in the 2003 Agreed Order. The health-based levels originally were approved by EPA in correspondence dated March 5, 2009, and May 19, 2009, and the *Remedial Action Work Plan for 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/07-0004&D2/R2/A1 (DOE 2010). The approved health-based levels for TCE and 1,1,1-TCA are shown in Table 4.

Table 4. Approved Health-Based Contaminant Levels for Solids and Aqueous Liquids

Listed Constituent	Solids	Aqueous Liquids
TCE	39.2 parts per million (ppm)	0.081 ppm
1,1,1-TCA	2,080 ppm	Not Applicable*

*Aqueous solutions that meet the health-based level for TCE also shall be deemed no longer to contain 1,1,1-TCA.

DOE shall be responsible for comparing characterization data and/or using process knowledge for the environmental media/debris streams suspected as being contaminated with TCE and/or 1,1,1-TCA to the approved health-based levels. If, based on DOE's comparison, the total detectable concentrations of TCE and/or 1,1,1-TCA are below the approved health-based levels, the waste stream will be deemed as not to contain or be contaminated-with a listed-hazardous waste.

8.3 WASTE MANAGEMENT TRACKING RESPONSIBILITIES

Waste generated during sampling activities will require implementation of a comprehensive waste tracking system to maintain waste inventory. The tracking system will document waste container numbers and locations; waste description; generation date; sampling, treatment and disposal date; and disposal location. The waste management organization includes the waste generator services group, waste transportation group, and waste facilities operations group. The waste generator services group will maintain the tracking system and will maintain a waste inventory system such that all waste generated during the siting, planning, and design investigation is tracked properly and identified. To prevent inappropriate disposal of waste, generation data and any other information necessary to determine the amount of contamination present will be documented so that proper disposal methods can be implemented. Determination of the ultimate disposal method is the responsibility of the waste management organization. The following are additional responsibilities of the waste management organization.

- Ensure that waste storage areas are properly established, maintained, and closed in accordance with state and federal regulations.
- Track and update waste inventory database and reports.
- Support project waste personnel in the selection of containers and in the segregation of wastes.
- Provide Authorization Basis approval for movement and storage of waste containers to appropriate on-site storage facilities as needed.
- Maintain waste container inventories.
- Coordinate with off-site disposal facilities on waste acceptance and disposal pricing and disposition.

The following information is included in the waste inventory database.

- Generation date
- Request for disposal number
- Origin location
- Waste type
- Description
- Quantity
- Storage location

8.4 SCREENING OF SAMPLES

In situ screenings of samples are performed by radiological control personnel for radiation and radioactive contamination. Additional screenings are performed prior to samples being shipped off-site. Prior to shipping samples, samples are surveyed in accordance with CP3-WM-3028, *Off-Site Shipping*. Survey procedures CP3-RP-1109, *Radioactive Contamination Control and Monitoring*; CP3-RP-1108, *Posting and Labeling*; and CP4-RP-1110, *Radiation Surveys*, are used to perform the various radiation and contamination surveys required.

8.5 INVESTIGATION-DERIVED WASTE CHARACTERIZATION, SAMPLING, AND ANALYSIS

Sampling and analysis of all SAP waste shall comply with this SAP and the WAC. Because all waste will be segregated according to study area, the waste will be characterized according to nearby historical analytical results or process knowledge. PPE will be characterized based on analytical results of historical samples from the study area in which it was used. The most stringent waste classification will be applied to all PPE from a study area.

For solid waste, the “20 times” rule may be used to determine if the waste is characteristically hazardous. If the total concentration of RCRA constituents is > 20 times the toxicity characteristic leachate procedure (TCLP) limits in 40 *CFR* § 261.24, *Toxicity Characteristic*, then the waste will be considered characteristically hazardous and placed into RCRA storage until further TCLP analysis can be performed for complete analysis.

Characterization requirements and guidance are provided in the site procedure for waste management, CP3-WM-0437, *Waste Characterization and Profiling*, and CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*. The waste transportation group will coordinate with the characterization group and the SMO for required data, analyses, and guidance on collection and transfer of characterization samples to a fixed-base laboratory that participates in the DOE Consolidated Audit Program.

9. FIELD ASSESSMENT PROCEDURES

Field assessment procedures are implemented to provide the quality of data suitable for their intended use and to show the project DQOs are met.

9.1 CONTRACTOR QUALITY CONTROL

The contractor quality control will be performed in general accordance with the procedures, reference guides, and standards listed in Table 1.

9.2 SAMPLING APPARATUS AND FIELD INSTRUMENTATION CHECKLIST

Field testing and monitoring instruments and/or equipment will be inspected and calibrated before use and when specified in the appropriate procedures, reference guides, and standards or as recommended by the manufacturer. Detailed requirements for calibrations are described in the procedures, reference guides, and standards listed in Table 1. Testing and monitoring equipment includes hand-held equipment used for health and safety air monitoring, soil vapor screening, and radiation emissions monitoring. Calibration standards for these instruments will be representative of the measured parameter's concentrations on-site, be in good condition, and be replaced when expired. Each day an instrument is used, its calibration will be checked against at least one certified standard. Operational checks are performed on radiological instruments daily or prior to use in accordance with CP4-RP-1336, *Radiological Instrumentation Field Operability Tests*. A radioactive source is used to conduct this check.

The date, time, and results of all calibration and source checks will be noted in an instrument calibration log. If an instrument is out of calibration, it will not be used until it is recalibrated and the recalibration will be recorded on the appropriate form. Calibrated instruments or equipment will be uniquely identified using the manufacturer's serial number or other unique identification markings.

Certain weather conditions, such as high humidity, can interfere with calibration and operation of the field screening equipment. If these calibration issues are encountered, they will be noted and operation of the equipment will be discontinued.

Equipment that fails calibration or becomes inoperable during use will be tagged, removed from service, and separated from serviceable equipment to prevent inadvertent use. Such equipment will be repaired and recalibrated or replaced as appropriate. No equipment that has failed calibration will be used until the equipment has been repaired or replaced.

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10. NONCONFORMANCE/DEVIATIONS

The implementation of alternative sampling procedures could be necessary if any unanticipated problems develop during the field investigation. Alternative sampling procedures, or deviations, consist of either sampling plan variances or sampling plan nonconformances.

If it becomes necessary to deviate from the listed procedure, reference guide, or standard for sampling in Table 1, such a variance will be handled in the following manner.

1. The field sampling technician, geotechnical engineer, or geologist will identify the need to deviate from the procedure, reference guide, or standard listed in Table 1.
2. The sampling technician, geologist, or geotechnical engineer will bring the deviation to the attention of the SAP PM and the PM and make recommendations on how best to proceed with sample collection with minimal impact to the existing sampling procedures, reference guides, or standards and project DQOs.
3. Possible solutions and the impacts of the solutions on the project DQOs will be determined.
4. The SAP PM and PM will evaluate and approve the variance request. If the field change request affects the environmental, safety, and/or health aspects of the project, then the environment, safety, and health project representative will also approve the variance prior to implementation.
5. The approved field change request will be documented in the project file and be reported in the RI/FS report.

Sampling plan nonconformances are defined as field or laboratory activities that have been completed but are subsequently found not to have been performed according to the SAP. A nonconformance may have a significant impact on the usability of field- or laboratory-derived investigation results. The resolution of a project nonconformance will be the responsibility of the SAP PM or PM.

Deviations from the SAP or nonconformances will be communicated using communication tools commensurate with the issue. Modifications to planned activities and deviations from procedures shall be recorded and documented in the RI/FS report.

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11. REFERENCES

- Blackhawk Geoservices 2003. *Final Shear Wave Seismic Survey Report, C-746-U Landfill Seismic Assessment*, Paducah Gaseous Diffusion Plant, Paducah, KY, October.
- Drahovzal, J. A, and T. D. Hendricks 1997. *Geologic Features Relevant to Ground-water Flow in the Vicinity of the Paducah Gaseous Diffusion Plant*, Kentucky Geological Survey Open File Report OF-97-02, Kentucky Geological Survey, University of Kentucky, Lexington, KY, April.
- Dreier R B., R. O. Kennard, and R. J. Selfridge 1989. *Geologic Characterization of the Paducah Gaseous Diffusion Plant and Surrounding Area Determined From Geophysical Logs*, Martin Marietta Energy Systems, Inc., Paducah, KY, September.
- DOE (U.S. Department of Energy) 2010. *Remedial Action Work Plan for 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/07-0004&D2/R2/A1, U.S. Department of Energy, Paducah, KY, November.
- DOE 2018. *Remedial Investigation/Feasibility Study Report for CERCLA Waste Disposal Alternatives Evaluation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-0244&D2/R2, U.S. Department of Energy, Paducah, KY, July.
- DOE 2020. *Remedial Investigation/Feasibility Study Work Plan for the C-400 Complex Operable Unit at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, DOE/LX/07-2433&D2/R1, U.S. Department of Energy, Paducah, KY, March.
- DOE 2024. *Paducah Gaseous Diffusion Plant Data Management Plan*, DOE/LX/07-2498&D1, U.S. Department of Energy, Paducah, KY, February.
- EPA (U.S. Environmental Protection Agency) 1998. *Federal Facility Agreement for the Paducah Gaseous Diffusion Plant*, DOE/OR/07-1707, U.S. Environmental Protection Agency, Atlanta, GA, February 13.
- EPA 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA-QA/G-4, EPA/240/B-06/001, Office of Environmental Information, U.S. Environmental Protection Agency, Washington, DC, February.
- FRNP (Four Rivers Nuclear Partnership, LLC) 2022. *Detailed Correlations between Lithologic Units in the McNairy Formation across the Paducah Gaseous Diffusion Plant*, FRNP-RPT-0249, Four Rivers Nuclear Partnership, LLC, Paducah, KY, August.
- KRCEE (Kentucky Research Consortium for Energy and Environment) 2006. *Investigation of Holocene Faulting, Proposed C-746-Landfill Expansion, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, 17.6 2006, Kentucky Research Consortium for Energy and Environment, University of Kentucky, Lexington, KY, July.
- MMES (Martin-Marietta Energy Systems, Inc.) 1992. *Resource Conservation and Recovery Act Part B Permit Modification for Inclusion of C-404 Low-Level Radioactive/Hazardous Waste Landfill*, KY/E-129, Martin Marietta Energy Systems, Inc., Paducah, KY, November.

SAIC (Science Applications International Corporation) 1994. *Solid Waste Landfill Subsurface Investigation Report*, KY/ERWM-12, Martin-Marietta Energy Systems, February.

USDA (U.S. Department of Agriculture) 2024. “USDA Web Soil Survey,” accessed May 21, 2024, <https://websoilsurvey.nrcs.usda.gov/app/>.

APPENDIX A
HISTORICAL DATA

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Table A.1. Summary of Historic and Active Monitoring Wells

Area	Status	ID	Data Type Available			Well Construction Details			Screen Information					
			SPT	Soil Classification	Well Construction	Ground EL (ft NGVD)	Boring Depth (ft)	Install Date	Type	Length (ft)	Depth (ft)		EL (ft NGVD)	
Study Area 5B	Active	MW144	X		X	378.01	127	3/25/1990	2" SS	10	105	115	273.01	263.01
		MW145			X	378.06	95	10/4/1990	2" SS	10	85	95	293.06	283.06
		MW356			X	379.86	138	8/7/1999	2" SS	5	118	123	261.86	256.86
		MW481			X	376.59	83	9/19/2009	4" PVC	10	68.8	78.8	307.79	297.79
		MW482		X	X	376.00	113	9/18/2009	4" PVC	10	97.9	107.9	278.10	268.10
		MW495		X	X	380.00	115.5	11/4/2009	4" PVC	10	111.4	101.4	268.60	258.60
		MW496			X	378.03	118	10/29/2009	4" PVC	10	101.4	111.4	276.63	266.63
		MW531		X		381.26	118	3/29/2017	2" PVC	10	103.3	113.3	277.96	267.96
Study Area 11	Active	MW98			X	367.5	95	10/25/1991	2" SS	10	64.5	74.5	303.00	293.00
		MW357			X	366.86	65.5	3/10/2002	4" PVC	10	52.7	62.7	314.16	304.16
		MW358		X	X	366.62	85	3/8/2002	4" PVC	10	71.5	81.5	295.12	285.12
		MW359		X	X	366.65	49	2/23/2002	4" PVC	10	29	39	337.65	327.65
		MW360			X	360.03	52.4	3/7/2002	4" PVC	10	40	50	320.03	310.03
		MW361		X	X	359.46	75	3/6/2002	4" PVC	10	55	65	304.46	294.46
		MW362		X	X	359.63	41	2/21/2002	4" PVC	10	20.5	30.5	339.13	329.13
		MW363			X	366.25	67.4	3/7/2002	4" PVC	10	55	65	311.25	301.25
		MW364		X	X	365.95	88	3/5/2002	4" PVC	10	73	83	292.95	282.95
		MW365		X	X	366.00	54	2/14/2002	4" PVC	10	32	42	334.00	324.00
		MW366			X	366.87	65.4	3/11/2002	4" PVC	10	53	63	313.87	303.87
		MW367		X	X	367.37	85.4	3/9/2002	4" PVC	10	73	83	294.37	284.37
		MW368			X	367.07	54	2/25/2002	4" PVC	10	33	43	334.07	324.07
		MW491			X	365.71	69	9/24/2009	4" PVC	10	55	65	310.71	300.71
		MW492			X	365.72	88	9/23/2009	4" PVC	10	69.8	79.8	295.92	285.92
		MW493			X	367.67	70.5	9/24/2009	4" PVC	10	55.9	65.9	311.77	301.77
		MW494			X	367.95	82	9/23/2009	4" PVC	10	67.9	77.9	300.05	290.05
	Historic	MW268	X	X	X	368.47	85	1/3/1995	2" SS	9.7	57.2	66.9	311.27	301.57
		MW269	X	X	X	368.32	85	1/4/1995	2" SS	9.7	69.2	78.9	299.12	289.42
		MW270	X	X		366.35	78	11/4/1995	2" SS	9.7	55.2	64.9	311.15	301.45
		MW271	X	X	X	368.78	78	12/20/1994	2" SS	9.7	63.2	72.9	305.58	295.88
		MW272	X	X	X	363.48	82	11/18/1994	2" SS	9.7	53.8	63.5	309.68	299.98
		MW273	X	X	X	363.31	82	1/2/1995	2" SS	9.7	66.3	76	297.01	287.31
		MW274	X	X	X	365.90	86	12/20/1994	2" SS	9.7	55.2	64.9	310.70	301.00
		MW275	X	X	X	365.74	86	11/8/1994	2" SS	9.7	71.2	80.9	294.54	284.84
		PZ281		X		370.21	36	11/17/1994	2" SS	9.7	25.7	35.4	344.51	334.81
		PZ282				367.22	38.9	12/12/1994	2" SS	9.7	24.3	34.0	342.92	333.22
Support Area A	Active	MW132	X	X	X	360.61	90	3/12/1990	2" SS	10	76	86	284.61	274.61
		MW139			X	360.97	68	3/26/1990	2" SS	10	57	67	303.97	293.97
Support Area C	Active	MW166			X	378.16	40	12/20/1990	2" SS	5	33	38	345.16	340.16
		MW345			X	378.11	NR	6/25/1999	2" SS	10	40.61	50.61	337.5	327.5
		PZ5S			X	378.80	40	4/2/1991	2" SS	5	33	38	345.80	340.80
		PZ5G		X	X	NR	70	4/24/1991	2" SS	5	62.8	67.8	NR	NR
	Historic	MW165		X	X	379.74	70	1/3/1991	2" SS	5	63	68	316.74	311.74
		MW21			X	371.8	59	5/25/1994	4" PVC	10	49	59	322.80	312.80
		PW1			X	NR	100	1991	NR	40	60	100	NR	NR
		PZ1G			X	NR	70	5/2/1991	2" SS	5	64	69	NR	NR
		PZ-2G			X	NR	70	5/15/1991	2" SS	5	62.5	67.5	NR	NR
		PZ3G		X	X	NR	70	4/11/1991	2" SS	5	64.5	69.5	NR	NR
		PZ3S		X	X	NR	40	4/11/1991	2" SS	5	33	38	NR	NR
		PZ4G			X	NR	70	4/17/1991	2" SS	5	64.5	69.5	NR	NR
		PZ4S			X	NR	40	4/17/1991	2" SS	5	33	38	NR	NR

Table A.1. Summary of Historic and Active Monitoring Wells (Continued)

Area	Status	ID	Data Type Available			Well Construction Details			Screen Information					
			SPT	Soil Classification	Well Construction	Ground EL. (ft NGVD)	Boring Depth (ft)	Install Date	Type	Length (ft)	Depth (ft)		EL. (ft NVGD)	
Support Area D	Active	MW163	X		X	383.14	100	12/17/1990	2" SS	5	94.0	99.0	289.14	284.14
		MW164			X	383.29	48	12/19/1990	2" SS	5	42.0	47.0	341.29	336.29
		MW260			X	381	117	2/9/1995	2" SS	4.7	93.2	97.9	287.80	283.10
		MW532				381.87	103	4/6/2017	2" PVC	10	86.2	96.2	295.67	285.67
		MW534				381.14	99.6	9/22/2016	2" PVC	9.7	87.5	97.2	293.64	283.94
		MW535												
		MW540												
		MW541												
		MW553												
	Historic	EW235												
		EW234				381.61	100.7	4/11/2017	8" SS	15.2	80.5	95.7	301.11	285.91
Support Area F	Active	MW479			X	380.78	85	9/19/2009	4" PVC	10	69.8	79.8	310.98	300.98
		MW480			X	380.83	108	9/18/2009	4" PVC	10	87.9	97.9	292.93	282.93

NR = Not recorded on original log.

Table A.2. Summary of Historic Soil Borings and CPT Soundings

Area	ID	Data Type Available			Construction Details		
		SPT	CPT	Soil Classification	Ground EL (ft NGVD)	Boring Depth (ft)	Drill Date
Study Area 5B	085-016			X	379.86	138	8/4/1999
	B-8			X	371	75	NR
	H014	X		X	NR	6	11/20/1989
	P4-D4			X	380.14	150	7/12/1994
	P4-D5			X	376.57	150	8/2/1994
	P4-D6			X	377.43	147	6/27/1994
	P4-D7			X	378.89	150	6/25/1994
	P2-S6			X	378.02	151	10/28/1988
	Z-5			X	379.9	140	3/6/1990
Study Area 11	GB-01D	X		X	360.20	88	11/3/1993
	GB-01S	X		X	361.70	20	11/2/1993
	GB-02D	X		X	362.30	90	11/5/1993
	GB-02S	X		X	357.40	20	11/9/1993
	GB-03D	X		X	361.90	90	11/8/1993
	GB-03S	X		X	367.90	30.7	11/3/1993
	GB-04S	X		X	359.60	22	11/3/1993
	GB-08S	X		X	366.70	25	11/6/1993
	GB-10S	X		X	363.40	25	11/9/1993
	GB-11S	X		X	361.90	20	11/8/1993
	GB-12S	X		X	364.50	27	11/9/1993
	GB-13S	X		X	361.60	20	11/10/1993
	GB-14S	X		X	361.10	20	11/10/1993
	GB-15S	X		X	344.70	12	11/12/1993
	P3-S14			X	383.00	92	10/25/1991
Support Area A	145-011			X	NR	107	7/22/2004
	145-012			X	NR	100	7/21/2004
	145-013				368	90	7/26/2004
	P4-C4			X	370.83	150	NR
Support Area C	085-001			X	378.54	40	5/26/1999
	085-002		X		376.98	59	3/25/1999
	085-004			X	376.80	58	5/26/1999
	085-007			X	377.55	58	5/25/1999
	085-009		X		378.41	59	3/25/1999
	085-011			X	378.38	60	5/24/1999
	085-013			X	378.49	30	5/24/1999
	145-004			X	373.60	90	7/9/2004
	145-005						
	145-006						
	145-019			X	NR	90	7/27/2004
	AH-211			X	370.00	107	2/26/1964
	DG-008			X	374.32	152	5/19/1999
	DG-009			X	377.45	152	5/10/1999
	H043				NR	6	10/18/1991
	H072			X	NR	8	1/26/1990
	H109			X	NR	5	6/21/1990
	H110				NR	5	6/21/1990
	H111				375.29	5	10/9/1991
	H331				NR	15	4/2/1991
	H332			X	NR	0.5	4/3/1991
	H333			X	NR	0.5	4/3/1991
	H334			X	NR	0.5	4/3/1991
	H335			X	NR	0.5	4/3/1991
	H336			X	NR	0.5	4/3/1991
	H348			X	NR	15	4/8/1991
	P4-E1			X	377.76	140	NR
	P4-E2			X	379.08	150	8/6/1994

Table A.2. Summary of Historic Soil Borings and CPT Soundings (Continued)

Area	ID	Data Type Available			Construction Details		
		SPT	CPT	Soil Classification	Ground EL (ft NGVD)	Boring Depth (ft)	Drill Date
Support Area D	099-001						
	099-003						
	099-004						
	099-005						
	099-006						
	099-008						
	099-009						
	099-010						
	099-011						
	099-012						
	099-014						
	099-032						
	099-035						
	B-6	X		X	372.5	74	6/9/1982
	P4-E4			X	381.08	117	8/2/1994
Support Area E	COE-37			X	382.00	40	NR
	H217			X	383.54	40	3/4/1991
Support Area F	H218			X	383.24	40	3/4/1991
	HQ-12						
Support Area E	B-7			X	371	74	NR
	P2-S7			X	382.29	152	9/6/1988
Support Area F	P4-D8			X	380.12	150	6/30/1994

NR = Not recorded on original log.

APPENDIX B

**U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
SOIL REPORT**

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United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for **Ballard and McCracken Counties, Kentucky**



May 23, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Ballard and McCracken Counties, Kentucky
Survey Area Data: Version 17, Sep 10, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 13, 2011—Oct 21, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BnD3	Brandon silt loam, 12 to 20 percent slopes, severely eroded	0.3	0.0%
CaA	Calloway silt loam, 0 to 2 percent slopes	212.0	11.6%
CaB2	Calloway silt loam, 2 to 4 percent slopes, eroded	137.1	7.5%
Dp	Dumps and Udorthents, loamy	90.7	5.0%
Du	Dumps, Coal, and Waste disposal areas	18.3	1.0%
Fa	Falaya-Collins complex, 0 to 2 percent slopes, occasionally flooded	124.7	6.8%
GrB2	Grenada silt loam, 2 to 6 percent slopes, eroded	56.1	3.1%
GrB3	Grenada silt loam, 4 to 6 percent slopes, severely eroded	93.7	5.1%
GrC3	Grenada silt loam, 6 to 12 percent slopes, severely eroded	71.6	3.9%
LoC3	Loring silt loam, 6 to 12 percent slopes, severely eroded	40.6	2.2%
LpD3	Loring-Purchase complex, 12 to 20 percent slopes, severely eroded	48.9	2.7%
M-W	Miscellaneous water	10.8	0.6%
RtA	Routon silt loam, 0 to 2 percent slopes	614.2	33.7%
UrA	Urban land-Udorthents complex, 0 to 4 percent slopes	284.1	15.6%
W	Water	8.1	0.4%
Wa	Waverly silt loam, 0 to 2 percent slopes, occasionally flooded, brief	13.9	0.8%
Totals for Area of Interest		1,825.2	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps.

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The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Ballard and McCracken Counties, Kentucky

BnD3—Brandon silt loam, 12 to 20 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 1qm5y

Elevation: 310 to 500 feet

Mean annual precipitation: 40 to 56 inches

Mean annual air temperature: 46 to 69 degrees F

Frost-free period: 177 to 222 days

Farmland classification: Not prime farmland

Map Unit Composition

Brandon, severely eroded, and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brandon, Severely Eroded

Setting

Landform: Hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Thin fine-silty noncalcareous loess over fluviomarine deposits

Typical profile

H1 - 0 to 4 inches: silt loam

H2 - 4 to 27 inches: silty clay loam

H3 - 27 to 80 inches: extremely gravelly sandy loam

Properties and qualities

Slope: 12 to 20 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: B

Ecological site: F134XY006AL - Northern Loess Sideslope - PROVISIONAL

Hydric soil rating: No

Minor Components

Feliciania, severely eroded

Percent of map unit: 10 percent

Landform: Hills

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Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F134XY006AL - Northern Loess Sideslope - PROVISIONAL
Hydric soil rating: No

Saffell, severely eroded

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Smithdale, severely eroded

Percent of map unit: 2 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

CaA—Calloway silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 1qm5h
Elevation: 320 to 510 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Calloway and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Calloway

Setting

Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile

H1 - 0 to 7 inches: silt loam
H2 - 7 to 22 inches: silt loam
H3 - 22 to 34 inches: silty clay loam
H4 - 34 to 69 inches: silt loam
H5 - 69 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 17 to 36 inches to fragipan
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 7 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F134XY004AL - Northern Moderately Wet Loess Interfluvium - PROVISIONAL, F134XY008AL - Northern Moderately Wet Loess Terrace - PROVISIONAL
Hydric soil rating: No

Minor Components

Grenada

Percent of map unit: 5 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluvium
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F134XY012AL - Northern Loess Fragipan Upland - PROVISIONAL, F134XY013AL - Northern Loess Fragipan Terrace - PROVISIONAL
Hydric soil rating: No

Routon

Percent of map unit: 3 percent
Landform: Flats
Landform position (three-dimensional): Interfluvium
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F134XY005AL - Northern Wet Loess Interfluvium - PROVISIONAL, F134XY010AL - Northern Wet Loess Terrace - PROVISIONAL
Hydric soil rating: Yes

Collins

Percent of map unit: 1 percent
Landform: Drainageways, flood plains
Down-slope shape: Linear

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Across-slope shape: Linear

Ecological site: F134XY018AL - Northern Alluvial Flat - PROVISIONAL

Hydric soil rating: No

Falaya

Percent of map unit: 1 percent

Landform: Drainageways, flood plains

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F134XY019AL - Northern Moderately Wet Alluvial Flat - PROVISIONAL

Hydric soil rating: No

CaB2—Calloway silt loam, 2 to 4 percent slopes, eroded

Map Unit Setting

National map unit symbol: 1qm5j

Elevation: 310 to 500 feet

Mean annual precipitation: 40 to 56 inches

Mean annual air temperature: 46 to 69 degrees F

Frost-free period: 177 to 222 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Calloway and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Calloway

Setting

Landform: Ridges

Landform position (two-dimensional): Shoulder

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Thick fine-silty noncalcareous loess

Typical profile

H1 - 0 to 5 inches: silt loam

H2 - 5 to 18 inches: silt loam

H3 - 18 to 25 inches: silty clay loam

H4 - 25 to 50 inches: silt loam

H5 - 50 to 80 inches: silt loam

Properties and qualities

Slope: 2 to 4 percent

Depth to restrictive feature: 24 to 38 inches to fragipan

Drainage class: Somewhat poorly drained

Runoff class: Low

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Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 12 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: C/D

Ecological site: F134XY004AL - Northern Moderately Wet Loess Interfluvium - PROVISIONAL

Hydric soil rating: No

Minor Components

Grenada

Percent of map unit: 5 percent

Landform: Ridges

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Interfluvium

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F134XY012AL - Northern Loess Fragipan Upland - PROVISIONAL

Hydric soil rating: No

Purchase

Percent of map unit: 3 percent

Landform: Ridges

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Linear

Ecological site: F134XY012AL - Northern Loess Fragipan Upland - PROVISIONAL

Hydric soil rating: No

Collins

Percent of map unit: 2 percent

Landform: Drainageways

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F134XY018AL - Northern Alluvial Flat - PROVISIONAL

Hydric soil rating: No

Dp—Dumps and Udorthents, loamy

Map Unit Setting

National map unit symbol: 1qm64

Elevation: 310 to 500 feet

Mean annual precipitation: 40 to 56 inches

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Mean annual air temperature: 46 to 69 degrees F

Frost-free period: 177 to 222 days

Farmland classification: Not prime farmland

Map Unit Composition

Dumps: 70 percent

Udorthents and similar soils: 20 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dumps

Properties and qualities

Depth to water table: About 18 to 24 inches

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8

Hydric soil rating: No

Description of Udorthents

Setting

Landform: Ridges

Landform position (two-dimensional): Shoulder

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Linear

Properties and qualities

Depth to restrictive feature: More than 80 inches

Depth to water table: About 18 to 24 inches

Frequency of flooding: None

Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8e

Hydric soil rating: No

Minor Components

Feliciania

Percent of map unit: 3 percent

Landform: Hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Grenada

Percent of map unit: 2 percent

Landform: Ridges

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Linear

Custom Soil Resource Report

Hydric soil rating: No

Loring

Percent of map unit: 2 percent

Landform: Hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Brandon

Percent of map unit: 1 percent

Landform: Hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Saffell

Percent of map unit: 1 percent

Landform: Hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Water

Percent of map unit: 1 percent

Hydric soil rating: No

Du—Dumps, Coal, and Waste disposal areas

Map Unit Setting

National map unit symbol: 1qm65

Mean annual precipitation: 40 to 56 inches

Mean annual air temperature: 46 to 69 degrees F

Frost-free period: 177 to 222 days

Farmland classification: Not prime farmland

Map Unit Composition

Dumps, coal and waste disposal areas: 95 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dumps, Coal And Waste Disposal Areas

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8

Hydric soil rating: No

Minor Components

Water

Percent of map unit: 5 percent

Hydric soil rating: No

Fa—Falaya-Collins complex, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 1qm4q

Elevation: 310 to 480 feet

Mean annual precipitation: 40 to 56 inches

Mean annual air temperature: 46 to 69 degrees F

Frost-free period: 177 to 222 days

Farmland classification: Prime farmland if drained

Map Unit Composition

Falaya, occasionally flooded, and similar soils: 55 percent

Collins, occasionally flooded, and similar soils: 35 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Falaya, Occasionally Flooded

Setting

Landform: Drainageways, flood plains

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Coarse-silty alluvium

Typical profile

H1 - 0 to 10 inches: silt loam

H2 - 10 to 52 inches: silt loam

H3 - 52 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high
(0.06 to 2.00 in/hr)

Depth to water table: About 12 to 24 inches

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Frequency of flooding: Occasional

Frequency of ponding: None

Available water supply, 0 to 60 inches: Very high (about 12.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: B/D

Ecological site: F134XY019AL - Northern Moderately Wet Alluvial Flat - PROVISIONAL

Hydric soil rating: No

Description of Collins, Occasionally Flooded

Setting

Landform: Drainageways, flood plains

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Coarse-silty alluvium

Typical profile

H1 - 0 to 12 inches: silt loam

H2 - 12 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: About 22 to 40 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Available water supply, 0 to 60 inches: Very high (about 12.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: C

Ecological site: F134XY018AL - Northern Alluvial Flat - PROVISIONAL

Hydric soil rating: No

Minor Components

Waverly, occasionally flooded

Percent of map unit: 3 percent

Landform: Drainageways, flood plains

Down-slope shape: Concave

Across-slope shape: Linear

Ecological site: F134XY020AL - Northern Wet Alluvial Flat - PROVISIONAL

Hydric soil rating: Yes

Vicksburg

Percent of map unit: 3 percent

Landform: Drainageways, flood plains

Down-slope shape: Linear

Across-slope shape: Linear

Custom Soil Resource Report

Ecological site: F134XY018AL - Northern Alluvial Flat - PROVISIONAL

Hydric soil rating: No

Iuka

Percent of map unit: 2 percent

Landform: Flood plains

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Center

Percent of map unit: 1 percent

Landform: Stream terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F134XY008AL - Northern Moderately Wet Loess Terrace - PROVISIONAL

Hydric soil rating: No

Kurk

Percent of map unit: 1 percent

Landform: Stream terraces

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F134XY008AL - Northern Moderately Wet Loess Terrace - PROVISIONAL

Hydric soil rating: No

GrB2—Grenada silt loam, 2 to 6 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2wn5t

Elevation: 310 to 640 feet

Mean annual precipitation: 52 to 62 inches

Mean annual air temperature: 48 to 69 degrees F

Frost-free period: 175 to 244 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Grenada, eroded, and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grenada, Eroded

Setting

Landform: Ridges

Landform position (two-dimensional): Shoulder

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Landform position (three-dimensional): Nose slope

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Fine-silty noncalcareous loess

Typical profile

Ap - 0 to 5 inches: silt loam

Bw - 5 to 21 inches: silt loam

E - 21 to 28 inches: silt loam

Btx/E - 28 to 38 inches: silt loam

Btx - 38 to 80 inches: silt loam

Properties and qualities

Slope: 2 to 6 percent

Depth to restrictive feature: 17 to 36 inches to fragipan

Drainage class: Moderately well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 18 to 32 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Moderate (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: C

Ecological site: F134XY012AL - Northern Loess Fragipan Upland - PROVISIONAL

Hydric soil rating: No

Minor Components

Calloway

Percent of map unit: 6 percent

Landform: Flats

Landform position (three-dimensional): Tread

Down-slope shape: Concave

Across-slope shape: Linear

Ecological site: F134XY004AL - Northern Moderately Wet Loess Interfluve - PROVISIONAL

Hydric soil rating: No

Collins

Percent of map unit: 4 percent

Landform: Flood-plain steps

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F134XY018AL - Northern Alluvial Flat - PROVISIONAL

Hydric soil rating: No

GrB3—Grenada silt loam, 4 to 6 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 1qgc0
Elevation: 310 to 500 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Grenada, severely eroded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grenada, Severely Eroded

Setting

Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile

H1 - 0 to 4 inches: silt loam
H2 - 4 to 18 inches: silt loam
H3 - 18 to 22 inches: silt loam
H4 - 22 to 32 inches: silt loam
H5 - 32 to 80 inches: silt loam

Properties and qualities

Slope: 4 to 6 percent
Depth to restrictive feature: 18 to 23 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: F134XY012AL - Northern Loess Fragipan Upland -
PROVISIONAL

Hydric soil rating: No

Minor Components

Purchase, severely eroded

Percent of map unit: 7 percent

Landform: Ridges

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Linear

Ecological site: F134XY012AL - Northern Loess Fragipan Upland - PROVISIONAL

Hydric soil rating: No

Calloway

Percent of map unit: 4 percent

Landform: Ridges

Landform position (two-dimensional): Shoulder

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Linear

Ecological site: F134XY004AL - Northern Moderately Wet Loess Interfluvium - PROVISIONAL

Hydric soil rating: No

Collins

Percent of map unit: 2 percent

Landform: Drainageways

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F134XY018AL - Northern Alluvial Flat - PROVISIONAL

Hydric soil rating: No

Falaya

Percent of map unit: 2 percent

Landform: Drainageways

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F134XY019AL - Northern Moderately Wet Alluvial Flat - PROVISIONAL

Hydric soil rating: No

GrC3—Grenada silt loam, 6 to 12 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 1qls1

Elevation: 310 to 500 feet

Mean annual precipitation: 40 to 56 inches

Mean annual air temperature: 46 to 69 degrees F

Frost-free period: 177 to 222 days

Farmland classification: Not prime farmland

Map Unit Composition

Grenada, severely eroded, and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grenada, Severely Eroded

Setting

Landform: Ridges

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Thick fine-silty noncalcareous loess

Typical profile

H1 - 0 to 4 inches: silt loam

H2 - 4 to 18 inches: silt loam

H3 - 18 to 22 inches: silt loam

H4 - 22 to 32 inches: silt loam

H5 - 32 to 80 inches: silt loam

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: 18 to 23 inches to fragipan

Drainage class: Moderately well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: About 18 to 24 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: D

Ecological site: F134XY012AL - Northern Loess Fragipan Upland - PROVISIONAL

Hydric soil rating: No

Minor Components

Purchase, severely eroded

Percent of map unit: 7 percent

Landform: Ridges

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Linear

Ecological site: F134XY012AL - Northern Loess Fragipan Upland - PROVISIONAL

Hydric soil rating: No

Calloway

Percent of map unit: 4 percent

Custom Soil Resource Report

Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F134XY004AL - Northern Moderately Wet Loess Interfluvium -
PROVISIONAL
Hydric soil rating: No

Collins

Percent of map unit: 2 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F134XY018AL - Northern Alluvial Flat - PROVISIONAL
Hydric soil rating: No

Falaya

Percent of map unit: 2 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F134XY019AL - Northern Moderately Wet Alluvial Flat -
PROVISIONAL
Hydric soil rating: No

LoC3—Loring silt loam, 6 to 12 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 2wn6l
Elevation: 340 to 590 feet
Mean annual precipitation: 52 to 62 inches
Mean annual air temperature: 45 to 69 degrees F
Frost-free period: 182 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Loring, severely eroded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Loring, Severely Eroded

Setting

Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile

Ap - 0 to 4 inches: silt loam
Bt - 4 to 21 inches: silt loam
Btx - 21 to 46 inches: silt loam
C - 46 to 80 inches: silt loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 18 to 41 inches to fragipan
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 15 to 38 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C/D
Ecological site: F134XY012AL - Northern Loess Fragipan Upland - PROVISIONAL
Hydric soil rating: No

Minor Components

Purchase, severely eroded

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F134XY012AL - Northern Loess Fragipan Upland - PROVISIONAL
Hydric soil rating: No

Adler

Percent of map unit: 3 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F134XY014AL - Northern Non-Acid Floodplain - PROVISIONAL
Hydric soil rating: No

Convent

Percent of map unit: 2 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear

Custom Soil Resource Report

Ecological site: F134XY015AL - Northern Non-Acid Moderately Wet Floodplain -
PROVISIONAL
Hydric soil rating: No

LpD3—Loring-Purchase complex, 12 to 20 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 1qm5p
Elevation: 310 to 500 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition

Loring, severely eroded, and similar soils: 45 percent
Purchase, severely eroded, and similar soils: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Loring, Severely Eroded

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 20 inches: silt loam
H3 - 20 to 46 inches: silt loam
H4 - 46 to 80 inches: silt loam

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: 18 to 24 inches to fragipan
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Custom Soil Resource Report

Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: F134XY012AL - Northern Loess Fragipan Upland -
PROVISIONAL
Hydric soil rating: No

Description of Purchase, Severely Eroded

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Thick fine-silty noncalcareous loess

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 10 inches: silt loam
H3 - 10 to 51 inches: silt loam
H4 - 51 to 80 inches: silt loam

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: 5 to 18 inches to fragipan
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: F134XY012AL - Northern Loess Fragipan Upland -
PROVISIONAL
Hydric soil rating: No

Minor Components

Feliciania, severely eroded

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F134XY006AL - Northern Loess Sideslope - PROVISIONAL
Hydric soil rating: No

Brandon, severely eroded

Percent of map unit: 3 percent
Landform: Hills

Custom Soil Resource Report

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F134XY006AL - Northern Loess Sideslope - PROVISIONAL
Hydric soil rating: No

Collins

Percent of map unit: 2 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F134XY018AL - Northern Alluvial Flat - PROVISIONAL
Hydric soil rating: No

M-W—Miscellaneous water

Map Unit Setting

National map unit symbol: 1qm7p
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition

Water, miscellaneous: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

RtA—Routon silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 1qgbt
Elevation: 310 to 490 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Routon and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Routon

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-silty alluvium

Typical profile

H1 - 0 to 17 inches: silt loam
H2 - 17 to 52 inches: silt loam
H3 - 52 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very high (about 12.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F134XY005AL - Northern Wet Loess Interfluvium - PROVISIONAL,
F134XY010AL - Northern Wet Loess Terrace - PROVISIONAL
Hydric soil rating: Yes

Minor Components

Kurk

Percent of map unit: 12 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F134XY004AL - Northern Moderately Wet Loess Interfluvium - PROVISIONAL, F134XY008AL - Northern Moderately Wet Loess Terrace - PROVISIONAL
Hydric soil rating: No

Natalbany

Percent of map unit: 7 percent
Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Center

Percent of map unit: 1 percent

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F134XY008AL - Northern Moderately Wet Loess Terrace -
PROVISIONAL
Hydric soil rating: No

UrA—Urban land-Udorthents complex, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: 1qmkz
Elevation: 300 to 500 feet
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Udorthents and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Properties and qualities

Slope: 0 to 4 percent
Runoff class: Very high
Depth to water table: About 18 to 24 inches

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Udorthents

Setting

Landform: Ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Medium
Depth to water table: About 18 to 24 inches
Frequency of flooding: None

Custom Soil Resource Report

Frequency of ponding: None

Minor Components

Routon

Percent of map unit: 4 percent
Landform: Drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Grenada

Percent of map unit: 4 percent
Landform: Flats
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Loring

Percent of map unit: 3 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Feliciania

Percent of map unit: 2 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Collins

Percent of map unit: 1 percent
Landform: Drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Falaya

Percent of map unit: 1 percent
Landform: Drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

W—Water

Map Unit Setting

National map unit symbol: 1qm7q
Mean annual precipitation: 40 to 56 inches
Mean annual air temperature: 46 to 69 degrees F
Frost-free period: 177 to 222 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Wa—Waverly silt loam, 0 to 2 percent slopes, occasionally flooded, brief

Map Unit Setting

National map unit symbol: 2t242
Elevation: 250 to 490 feet
Mean annual precipitation: 41 to 76 inches
Mean annual air temperature: 46 to 72 degrees F
Frost-free period: 175 to 230 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Waverly, occasionally flooded, and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Waverly, Occasionally Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Coarse silty alluvium

Typical profile

Ap - 0 to 7 inches: silt loam
Bg - 7 to 40 inches: silt loam
Cg - 40 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent

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Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)

Depth to water table: About 4 to 10 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Available water supply, 0 to 60 inches: Very high (about 13.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: B/D

Ecological site: F134XY020AL - Northern Wet Alluvial Flat - PROVISIONAL

Hydric soil rating: Yes

Minor Components

Falaya, occasionally flooded

Percent of map unit: 5 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Rise

Down-slope shape: Linear

Across-slope shape: Convex

Ecological site: F134XY019AL - Northern Moderately Wet Alluvial Flat -
PROVISIONAL

Hydric soil rating: No

Rosebloom, occasionally flooded

Percent of map unit: 3 percent

Landform: Flood plains

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F134XY020AL - Northern Wet Alluvial Flat - PROVISIONAL

Hydric soil rating: Yes

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

AOI Inventory

This folder contains a collection of tabular reports that present a variety of soil information. Included are various map unit description reports, special soil interpretation reports, and data summary reports.

Component Text Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the selected area. The component descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit. A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the associated soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas (components) for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

The "Map Unit Component Nontechnical Descriptions" report gives a brief, general description of the soil components that occur in a map unit. Descriptions of nonsoil (miscellaneous areas) and minor map unit components may or may not be included. This description is written by the local soil scientists responsible for the respective

soil survey area data. A more detailed description can be generated by the "Map Unit Description" report.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Report—Component Text Descriptions

Ballard and McCracken Counties, Kentucky

Map Unit: BnD3—Brandon silt loam, 12 to 20 percent slopes, severely eroded

Description Category: GENSOIL

Brandon, severely eroded: 85 percent

The Brandon, severely eroded component makes up 85 percent of the map unit. Slopes are 12 to 20 percent. This component is on hills on uplands. The parent material consists of thin fine-silty noncalcareous loess over fluviomarine deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the F134XY006AL Northern Loess Sideslope - PROVISIONAL ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Description Category: GENSOIL

Feliciano, severely eroded: 10 percent

Generated brief soil descriptions are created for major soil components. The Feliciano, severely eroded soil is a minor component.

Description Category: GENSOIL

Saffell, severely eroded: 3 percent

Generated brief soil descriptions are created for major soil components. The Saffell, severely eroded soil is a minor component.

Description Category: GENSOIL

Smithdale, severely eroded: 2 percent

Generated brief soil descriptions are created for major soil components. The Smithdale, severely eroded soil is a minor component.

Map Unit: CaA—Calloway silt loam, 0 to 2 percent slopes

Description Category: GENSOIL

Calloway: 90 percent

The Calloway component makes up 90 percent of the map unit. Slopes are 0 to 2 percent. This component is on broad flats on uplands. The parent material consists of thick fine-silty noncalcareous loess. Depth to a root restrictive layer, fragipan, is 17 to 36 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during January, February, March, April. Organic matter content in the surface horizon is about 3 percent. This component is in the F134XY008AL Northern Moderately Wet Loess Interfluvium - PROVISIONAL, Northern Moderately Wet Loess Terrace - PROVISIONAL ecological site. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Description Category: GENSOIL

Grenada: 5 percent

Generated brief soil descriptions are created for major soil components. The Grenada soil is a minor component.

Description Category: GENSOIL

Routon: 3 percent

Generated brief soil descriptions are created for major soil components. The Routon soil is a minor component.

Description Category: GENSOIL

Falaya: 1 percent

Generated brief soil descriptions are created for major soil components. The Falaya soil is a minor component.

Description Category: GENSOIL

Collins: 1 percent

Generated brief soil descriptions are created for major soil components. The Collins soil is a minor component.

Map Unit: CaB2—Calloway silt loam, 2 to 4 percent slopes, eroded

Description Category: GENSOIL

Calloway: 90 percent

Custom Soil Resource Report

The Calloway component makes up 90 percent of the map unit. Slopes are 2 to 4 percent. This component is on broad ridges on uplands. The parent material consists of thick fine-silty noncalcareous loess. Depth to a root restrictive layer, fragipan, is 24 to 38 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 15 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 3 percent. This component is in the F134XY004AL Northern Moderately Wet Loess Interfluvium - PROVISIONAL ecological site. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Description Category: GENSOIL

Grenada: 5 percent

Generated brief soil descriptions are created for major soil components. The Grenada soil is a minor component.

Description Category: GENSOIL

Purchase: 3 percent

Generated brief soil descriptions are created for major soil components. The Purchase soil is a minor component.

Description Category: GENSOIL

Collins: 2 percent

Generated brief soil descriptions are created for major soil components. The Collins soil is a minor component.

Map Unit: Dp—Dumps and Udorthents, loamy

Description Category: GENSOIL

Dumps: 70 percent

Generated brief soil descriptions are created for major soil components. The Dumps is a miscellaneous area.

Description Category: GENSOIL

Udorthents: 20 percent

The Udorthents component makes up 20 percent of the map unit. Slopes are This component is on ridges on uplands. Depth to a root restrictive layer is greater than 60 inches. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 20 inches during January, February, March, April.

Custom Soil Resource Report

Nonirrigated land capability classification is 8e. This soil does not meet hydric criteria.

Description Category: GENSOIL

Feliciana: 3 percent

Generated brief soil descriptions are created for major soil components. The Feliciana soil is a minor component.

Description Category: GENSOIL

Loring: 2 percent

Generated brief soil descriptions are created for major soil components. The Loring soil is a minor component.

Description Category: GENSOIL

Grenada: 2 percent

Generated brief soil descriptions are created for major soil components. The Grenada soil is a minor component.

Description Category: GENSOIL

Water: 1 percent

Generated brief soil descriptions are created for major soil components. The Water soil is a minor component.

Description Category: GENSOIL

Saffell: 1 percent

Generated brief soil descriptions are created for major soil components. The Saffell soil is a minor component.

Description Category: GENSOIL

Brandon: 1 percent

Generated brief soil descriptions are created for major soil components. The Brandon soil is a minor component.

Map Unit: Du—Dumps, Coal, and Waste disposal areas

Description Category: GENSOIL

Dumps, coal and waste disposal areas: 95 percent

Generated brief soil descriptions are created for major soil components. The Dumps is a miscellaneous area.

Description Category: GENSOIL

Water: 5 percent

Generated brief soil descriptions are created for major soil components. The Water soil is a minor component.

Map Unit: Fa—Falaya-Collins complex, 0 to 2 percent slopes, occasionally flooded

Description Category: GENSOIL

Falaya, occasionally flooded: 55 percent

The Falaya, occasionally flooded component makes up 55 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on valleys. The parent material consists of coarse-silty alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very high. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 18 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 3 percent. This component is in the F134XY019AL Northern Moderately Wet Alluvial Flat - PROVISIONAL ecological site. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Description Category: GENSOIL

Collins, occasionally flooded: 35 percent

The Collins, occasionally flooded component makes up 35 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on valleys. The parent material consists of coarse-silty alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is very high. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 34 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 3 percent. This component is in the F134XY018AL Northern Alluvial Flat - PROVISIONAL ecological site. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Description Category: GENSOIL

Vicksburg: 3 percent

Generated brief soil descriptions are created for major soil components. The Vicksburg soil is a minor component.

Description Category: GENSOIL

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Waverly, occasionally flooded: 3 percent

Generated brief soil descriptions are created for major soil components. The Waverly, occasionally flooded soil is a minor component.

Description Category: GENSOIL

luka: 2 percent

Generated brief soil descriptions are created for major soil components. The luka soil is a minor component.

Description Category: GENSOIL

Kurk: 1 percent

Generated brief soil descriptions are created for major soil components. The Kurk soil is a minor component.

Description Category: GENSOIL

Center: 1 percent

Generated brief soil descriptions are created for major soil components. The Center soil is a minor component.

Map Unit: GrB2—Grenada silt loam, 2 to 6 percent slopes, eroded

Description Category: GENSOIL

Grenada, eroded: 90 percent

The Grenada, eroded component makes up 90 percent of the map unit. Slopes are 2 to 6 percent. This component is on broad ridges on uplands. The parent material consists of fine-silty noncalcareous loess. Depth to a root restrictive layer, fragipan, is 17 to 36 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 25 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F134XY012AL Northern Loess Fragipan Upland - PROVISIONAL ecological site. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Description Category: GENSOIL

Calloway: 6 percent

Generated brief soil descriptions are created for major soil components. The Calloway soil is a minor component.

Description Category: GENSOIL

Custom Soil Resource Report

Collins: 4 percent

Generated brief soil descriptions are created for major soil components. The Collins soil is a minor component.

Map Unit: GrB3—Grenada silt loam, 4 to 6 percent slopes, severely eroded

Description Category: GENSOIL

Grenada, severely eroded: 85 percent

The Grenada, severely eroded component makes up 85 percent of the map unit. Slopes are 4 to 6 percent. This component is on broad ridges on uplands. The parent material consists of thick fine-silty noncalcareous loess. Depth to a root restrictive layer, fragipan, is 18 to 23 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 20 inches during January, February, March, April. Organic matter content in the surface horizon is about 2 percent. This component is in the F134XY012AL Northern Loess Fragipan Upland - PROVISIONAL ecological site. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Description Category: GENSOIL

Purchase, severely eroded: 7 percent

Generated brief soil descriptions are created for major soil components. The Purchase, severely eroded soil is a minor component.

Description Category: GENSOIL

Calloway: 4 percent

Generated brief soil descriptions are created for major soil components. The Calloway soil is a minor component.

Description Category: GENSOIL

Falaya: 2 percent

Generated brief soil descriptions are created for major soil components. The Falaya soil is a minor component.

Description Category: GENSOIL

Collins: 2 percent

Generated brief soil descriptions are created for major soil components. The Collins soil is a minor component.

Map Unit: GrC3—Grenada silt loam, 6 to 12 percent slopes, severely eroded

Description Category: GENSOIL

Grenada, severely eroded: 85 percent

The Grenada, severely eroded component makes up 85 percent of the map unit. Slopes are 6 to 12 percent. This component is on broad ridges on uplands. The parent material consists of thick fine-silty noncalcareous loess. Depth to a root restrictive layer, fragipan, is 18 to 23 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 20 inches during January, February, March, April. Organic matter content in the surface horizon is about 2 percent. This component is in the F134XY012AL Northern Loess Fragipan Upland - PROVISIONAL ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Description Category: GENSOIL

Purchase, severely eroded: 7 percent

Generated brief soil descriptions are created for major soil components. The Purchase, severely eroded soil is a minor component.

Description Category: GENSOIL

Calloway: 4 percent

Generated brief soil descriptions are created for major soil components. The Calloway soil is a minor component.

Description Category: GENSOIL

Collins: 2 percent

Generated brief soil descriptions are created for major soil components. The Collins soil is a minor component.

Description Category: GENSOIL

Falaya: 2 percent

Generated brief soil descriptions are created for major soil components. The Falaya soil is a minor component.

Map Unit: LoC3—Loring silt loam, 6 to 12 percent slopes, severely eroded

Description Category: GENSOIL

Loring, severely eroded: 90 percent

The Loring, severely eroded component makes up 90 percent of the map unit. Slopes are 6 to 12 percent. This component is on ridges on uplands. The parent

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material consists of thick fine-silty noncalcareous loess. Depth to a root restrictive layer, fragipan, is 18 to 41 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 18 inches during January, February, March, December. Organic matter content in the surface horizon is about 1 percent. This component is in the F134XY012AL Northern Loess Fragipan Upland - PROVISIONAL ecological site. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Description Category: GENSOIL

Purchase, severely eroded: 5 percent

Generated brief soil descriptions are created for major soil components. The Purchase, severely eroded soil is a minor component.

Description Category: GENSOIL

Adler: 3 percent

Generated brief soil descriptions are created for major soil components. The Adler soil is a minor component.

Description Category: GENSOIL

Convent: 2 percent

Generated brief soil descriptions are created for major soil components. The Convent soil is a minor component.

Map Unit: LpD3—Loring-Purchase complex, 12 to 20 percent slopes, severely eroded

Description Category: GENSOIL

Loring, severely eroded: 45 percent

The Loring, severely eroded component makes up 45 percent of the map unit. Slopes are 12 to 20 percent. This component is on hills on uplands. The parent material consists of thick fine-silty noncalcareous loess. Depth to a root restrictive layer, fragipan, is 18 to 24 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 20 inches during January, February, March, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F134XY012AL Northern Loess Fragipan Upland - PROVISIONAL ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Description Category: GENSOIL

Purchase, severely eroded: 40 percent

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The Purchase, severely eroded component makes up 40 percent of the map unit. Slopes are 12 to 20 percent. This component is on hills on uplands. The parent material consists of thick fine-silty noncalcareous loess. Depth to a root restrictive layer, fragipan, is 5 to 18 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the F134XY012AL Northern Loess Fragipan Upland - PROVISIONAL ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Description Category: GENSOIL

Feliciano, severely eroded: 10 percent

Generated brief soil descriptions are created for major soil components. The Feliciano, severely eroded soil is a minor component.

Description Category: GENSOIL

Brandon, severely eroded: 3 percent

Generated brief soil descriptions are created for major soil components. The Brandon, severely eroded soil is a minor component.

Description Category: GENSOIL

Collins: 2 percent

Generated brief soil descriptions are created for major soil components. The Collins soil is a minor component.

Map Unit: M-W—Miscellaneous water

Description Category: GENSOIL

Water, miscellaneous: 100 percent

Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

Map Unit: RtA—Routon silt loam, 0 to 2 percent slopes

Description Category: GENSOIL

Routon: 80 percent

The Routon component makes up 80 percent of the map unit. Slopes are 0 to 2 percent. This component is on stream terraces on valleys. The parent material consists of fine-silty alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most

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restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F134XY010AL Northern Wet Loess Interfluvium - PROVISIONAL, Northern Wet Loess Terrace - PROVISIONAL ecological site. Nonirrigated land capability classification is 3w. This soil meets hydric criteria.

Description Category: GENSOIL

Kurk: 12 percent

Generated brief soil descriptions are created for major soil components. The Kurk soil is a minor component.

Description Category: GENSOIL

Natalbany: 7 percent

Generated brief soil descriptions are created for major soil components. The Natalbany soil is a minor component.

Description Category: GENSOIL

Center: 1 percent

Generated brief soil descriptions are created for major soil components. The Center soil is a minor component.

Map Unit: UrA—Urban land-Udorthents complex, 0 to 4 percent slopes

Description Category: GENSOIL

Urban land: 65 percent

Generated brief soil descriptions are created for major soil components. The Urban land is a miscellaneous area.

Description Category: GENSOIL

Udorthents: 20 percent

The Udorthents component makes up 20 percent of the map unit. Slopes are 0 to 4 percent. This component is on ridges on uplands. Depth to a root restrictive layer is greater than 60 inches. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 20 inches during January, February, March, April. This soil does not meet hydric criteria.

Description Category: GENSOIL

Grenada: 4 percent

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Generated brief soil descriptions are created for major soil components. The Grenada soil is a minor component.

Description Category: GENSOIL

Routon: 4 percent

Generated brief soil descriptions are created for major soil components. The Routon soil is a minor component.

Description Category: GENSOIL

Loring: 3 percent

Generated brief soil descriptions are created for major soil components. The Loring soil is a minor component.

Description Category: GENSOIL

Feliciano: 2 percent

Generated brief soil descriptions are created for major soil components. The Feliciano soil is a minor component.

Description Category: GENSOIL

Falaya: 1 percent

Generated brief soil descriptions are created for major soil components. The Falaya soil is a minor component.

Description Category: GENSOIL

Collins: 1 percent

Generated brief soil descriptions are created for major soil components. The Collins soil is a minor component.

Map Unit: W—Water

Description Category: GENSOIL

Water: 100 percent

Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

Map Unit: Wa—Waverly silt loam, 0 to 2 percent slopes, occasionally flooded, brief

Description Category: GENSOIL

Waverly, occasionally flooded: 92 percent

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The Waverly, occasionally flooded component makes up 92 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on valleys. The parent material consists of coarse silty alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is very high. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 7 inches during January, February, March, April, May, December. Organic matter content in the surface horizon is about 2 percent. This component is in the F134XY020AL Northern Wet Alluvial Flat - PROVISIONAL ecological site. Nonirrigated land capability classification is 3w. This soil meets hydric criteria.

Description Category: GENSOIL

Falaya, occasionally flooded: 5 percent

Generated brief soil descriptions are created for major soil components. The Falaya, occasionally flooded soil is a minor component.

Description Category: GENSOIL

Rosebloom, occasionally flooded: 3 percent

Generated brief soil descriptions are created for major soil components. The Rosebloom, occasionally flooded soil is a minor component.

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084>

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United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

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APPENDIX C

PROPOSED SOIL BORING LOCATIONS

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**Table C.1. Summary of Proposed Soil Borings
and CPT Soundings—Phase 1**

Type	ID	Easting (ft, PGDP coordinates)	Northing (ft, PGDP coordinates)
Soil Boring with Standard Penetration Testing (SPT)	SB-A5B-01	-1,991.7	2,748.0
	SB-A5B-04	-1,733.3	2,466.6
	SB-A5B-08	-2,011.3	2,221.8
	SB-A5B-10	-1,383.0	2,249.7
	SB-A5B-16	-1,698.8	1,917.5
	SB-A5B-17	-1,218.0	1,903.8
	SB-A5B-24	-1,021.1	1,720.4
	SB-A5B-28	-1,686.4	1,407.8
	SB-A5B-29	-1,369.4	1,403.4
	SB-A5B-33	-1,982.3	1,061.1
	SB-A5B-36	-1,032.8	1,055.8
	SB-A5B-37	-2,125.4	783.0
	SB-A5B-39	-1,641.6	864.9
	SB-A5B-42	-2,178.5	572.9
	SB-A5B-45	-1,320.6	565.0
	SB-A5B-46	-983.4	565.0
	SB-A5B-51	-1,946.7	217.7
	SB-A5B-53	-1,295.9	224.2
	SB-A5B-58	-758.1	1,593.5
	SB-A5B-60	-825.5	1,185.7
	SB-A5B-62	-746.8	643.0
	SB-A5B-65	-768.9	50.6
	SB-A5B-68	-769.4	-329.5
Cone Penetration Test (CPT) Sounding	CPT-A5B-03	-1,373.7	2,245.2
	CPT-A5B-10	-1,359.9	1,399.2
	CPT-A5B-15	-2,208.4	438.3
	CPT-A5B-16	-1,326.1	567.2
	CPT-A5B-17	-1,115.5	405.0

**Table C.2. Summary of Proposed Soil Borings
and CPT Soundings—Phase 2**

Type	ID	Easting (ft, PGDP coordinates)	Northing (ft, PGDP coordinates)
Soil Boring with Standard Penetration Testing (SPT)	SB-A5B-02	-596.3	2,703.0
	SB-A5B-03	-2,021.4	2,561.6
	SB-A5B-05	-1,558.2	2,371.7
	SB-A5B-06	-911.0	2,621.8
	SB-A5B-07	-497.9	2,138.0
	SB-A5B-09	-1,694.9	2,221.9
	SB-A5B-11	-1,535.6	2,083.6
	SB-A5B-12	-1,145.5	2,105.8
	SB-A5B-13	-2,314.2	2,038.1
	SB-A5B-14	-203.1	2,060.3
	SB-A5B-15	-1,999.5	1,910.6
	SB-A5B-18	-919.3	1,990.6
	SB-A5B-19	-2,302.7	1,185.8
	SB-A5B-20	-207.9	1,070.4
	SB-A5B-21	-1,985.1	1,704.6
	SB-A5B-22	-1,698.8	1,715.3
	SB-A5B-23	-1,369.3	1,715.2
	SB-A5B-25	-521.4	786.2
	SB-A5B-26	-196.4	74.7
	SB-A5B-27	-1,982.3	1,410.2
	SB-A5B-30	-1,032.8	1,415.9
	SB-A5B-31	-1,982.4	-81.0
	SB-A5B-32	-1,158.2	-86.5
	SB-A5B-34	-1,669.0	1,059.5
	SB-A5B-35	-1,369.4	1,058.7
	SB-A5B-38	-1,967.7	859.1
	SB-A5B-40	-1,322.4	865.1
	SB-A5B-41	-983.4	866.9
	SB-A5B-43	-1,967.2	572.9
	SB-A5B-44	-1,637.2	555.4
	SB-A5B-47	-1,151.5	-425.9
	SB-A5B-48	-499.2	-66.0
	SB-A5B-49	-1,628.9	-238.4
	SB-A5B-50	-2,118.6	387.6
	SB-A5B-52	-1,631.4	203.9
	SB-A5B-54	-986.9	241.9
	SB-A5B-55	-1,267.4	2,603.6
	SB-A5B-56	-713.8	2,419.6
	SB-A5B-57	-819.5	2,195.3
	SB-A5B-59	-530.6	1,399.2
	SB-A5B-61	-527.9	1,139.4
	SB-A5B-63	-406.2	550.5
	SB-A5B-64	-419.5	223.0
	SB-SA-01	-3,608.3	2,314.5
	SB-SA-02	-4,247.8	1,984.4
	SB-SA-03	-3,739.4	1,604.9
	SB-SA-04	-3,578.7	872.7

**Table C.2. Summary of Proposed Soil Borings
and CPT Soundings—Phase 2 (Continued)**

Type	ID	Easting (ft, PGDP coordinates)	Northing (ft, PGDP coordinates)
	SB-SA-05	-3,002.2	2,197.1
	SB-SA-06	-2,499.3	2,338.3
	SB-SA-07	-2,531.5	1,577.9
	SB-SA-08	-1,066.7	-868.1
	SB-SA-09	-1,875.1	-458.3
	SB-SA-10	-1,995.5	-1,018.1
	SB-SA-11	-500.4	-914.0
	SB-SA-12	-502.1	-602.5
	SB-SA-13	-1,617.8	-1,281.1
	SB-SA-14	-1,223.0	-1,610.1
	SB-SA-15	-468.0	6,333.6
	SB-SA-16	-590.8	5,297.1
	SB-SA-17	-503.9	4,285.1
	SB-SA-18	-706.0	3,449.1
Cone Penetration Test (CPT) Sounding	CPT-A5B-01	-2,073.9	2,401.8
	CPT-A5B-02	-434.3	2,599.9
	CPT-A5B-04	-1,687.1	2,088.2
	CPT-A5B-05	-526.1	1,786.3
	CPT-A5B-06	-1,406.2	1,915.9
	CPT-A5B-07	-538.3	874.8
	CPT-A5B-08	-1,202.0	1,680.9
	CPT-A5B-09	-440.5	226.3
	CPT-A5B-11	-2,113.2	1,169.0
	CPT-A5B-12	-1,592.5	1,153.9
	CPT-A5B-13	-2,132.6	776.1
	CPT-A5B-14	-1,466.2	811.7
	CPT-A5B-18	-1,910.6	-109.6
	CPT-A5B-19	-2,024.1	-352.4
	CPT-SA-01	-4,361.7	2,037.1
	CPT-SA-02	-3,535.8	2,079.9
	CPT-SA-03	-3,627.6	1,137.8
	CPT-SA-04	-1,033.6	-450.2
	CPT-SA-05	-497.0	5,763.7
	CPT-SA-06	-573.5	4,339.5
	CPT-SA-07	-611.7	3,890.3

**Table C.3. Summary of Proposed Soil Borings
and CPT Soundings—Site 11 (Potential)**

Type	ID	Easting (ft, PGDP coordinates)	Northing (ft, PGDP coordinates)
Soil Boring with Standard Penetration Testing (SPT)	SB-A11-01	-3,718.2	7,830.5
	SB-A11-02	-3,467.4	7,487.9
	SB-A11-03	-3,306.0	7,730.9
	SB-A11-04	-3,050.8	7,550.2
	SB-A11-05	-2,809.6	7,536.8
	SB-A11-06	-2,469.2	7,591.1
	SB-A11-07	-2,229.8	7,540.9
	SB-A11-08	-1,963.1	7,452.7
	SB-A11-09	-1,333.2	7,364.4
	SB-A11-10	-3,708.4	7,384.1
	SB-A11-11	-3,490.4	7,338.3
	SB-A11-12	-3,178.5	7,303.9
	SB-A11-13	-2,874.5	7,285.8
	SB-A11-14	-2,649.6	7,379.8
	SB-A11-15	-2,180.4	7,218.7
	SB-A11-16	-1,976.0	7,211.0
	SB-A11-17	-1,740.7	7,322.8
	SB-A11-18	-3,491.5	7,053.0
	SB-A11-19	-3,172.8	7,053.0
	SB-A11-20	-2,464.4	7,163.8
	SB-A11-21	-2,130.2	6,874.3
	SB-A11-22	-2,091.5	6,888.0
	SB-A11-23	-1,649.7	7,120.8
	SB-A11-24	-1,426.0	6,940.7
	SB-A11-25	-1,326.7	6,849.8
	SB-A11-26	-3,692.6	6,929.9
	SB-A11-27	-2,867.8	6,918.6
	SB-A11-28	-2,413.5	6,847.8
	SB-A11-29	-1,737.8	6,899.4
	SB-A11-30	-3,475.7	6,755.9
	SB-A11-31	-2,864.4	6,789.8
	SB-A11-32	-2,228.2	6,793.1
	SB-A11-33	-2,094.6	6,737.0
	SB-A11-34	-1,343.0	6,794.8
	SB-A11-35	-3,712.9	6,438.8
	SB-A11-36	-3,511.8	6,362.6
	SB-A11-37	-3,326.2	6,460.0
	SB-A11-38	-3,019.0	6,362.9
	SB-A11-39	-2,536.7	6,280.2
	SB-A11-40	-1,972.9	6,424.8
	SB-A11-41	-1,726.5	6,583.0
	SB-A11-42	-1,441.8	6,413.5
	SB-A11-43	-3,732.2	5,991.3
	SB-A11-44	-3,512.4	6,111.4
	SB-A11-45	-3,319.2	6,009.8
	SB-A11-46	-3,077.3	6,147.5
	SB-A11-47	-2,860.1	6,029.2

**Table C.3. Summary of Proposed Soil Borings
and CPT Soundings—Site 11 (Potential) (Continued)**

Type	ID	Easting (ft, PGDP coordinates)	Northing (ft, PGDP coordinates)
	SB-A11-48	-2,651.8	6,158.1
	SB-A11-49	-2,418.8	6,031.0
	SB-A11-50	-1,963.3	6,020.4
	SB-A11-51	-1,732.0	6,161.7
	SB-A11-52	-1,454.8	6,094.6
Cone Penetration Test (CPT) Sounding	CPT-A11-01	-3,438.1	7,673.0
	CPT-A11-02	-2,586.9	7,540.9
	CPT-A11-03	-1,759.6	7,365.5
	CPT-A11-04	-3,143.5	7,296.3
	CPT-A11-05	-2,686.5	7,198.8
	CPT-A11-06	-2,428.8	7,146.9
	CPT-A11-07	-1,887.4	7,051.6
	CPT-A11-08	-1,361.1	7,112.2
	CPT-A11-09	-3,466.2	7,036.4
	CPT-A11-10	-2,298.9	6,761.5
	CPT-A11-11	-3,383.9	6,607.8
	CPT-A11-12	-3,124.0	6,657.6
	CPT-A11-13	-2,552.3	6,581.8
	CPT-A11-14	-1,757.4	6,687.9
	CPT-A11-15	-1,408.8	6,547.1
	CPT-A11-16	-3,355.8	6,023.2
	CPT-A11-17	-2,612.9	6,155.2
	CPT-A11-18	-1,705.5	6,142.3

**Table C.4. Summary of Proposed Soil Borings
and CPT Soundings—CWWT Facility Support Area**

Type	ID	Easting (ft, PGDP coordinates)	Northing (ft, PGDP coordinates)
Soil Boring with Standard Penetration Testing (SPT)	SB-CWWT-01	-3,234.2	1,393.4
	SB-CWWT-02	-3,087.0	1,391.9
	SB-CWWT-03	-2,934.6	1,391.9
	SB-CWWT-04	-3,298.7	1,259.7
	SB-CWWT-05	-3,136.6	1,262.7
	SB-CWWT-06	-2,999.9	1,263.5
	SB-CWWT-07	-2,854.3	1,264.2
	SB-CWWT-08	-3,299.5	1,105.1
	SB-CWWT-09	-3,137.3	1,108.8
	SB-CWWT-10	-2,999.2	1,109.6
	SB-CWWT-11	-2,855.0	1,108.8