OHIO VALLEY ELECTRIC CORPORATION
INDIANA- KENTUCKY ELECTRIC CORPORATION
3932 U. S. Route 23
P.O. Box 468
Piketon, Ohio 45661
740-289-7200
WRITER'S DIRECT DIAL NO:
(740) 897-7768

October 17, 2018

Mr. Craig Butler
Director
Ohio Environmental Protection Agency
50 West Town Street, Suite 700
P.O. Box 1049
Columbus, OH 43216-1049

Re: Ohio Valley Electric Corporation
Kyger Creek Station
Notification of CCR Location Restrictions Posting

Dear Mr. Butler:

In accordance with 40 CFR 257.107(e), the Ohio Valley Electric Corporation (OVEC) is providing notification to the Director of the Ohio Environmental Protection Agency that Coal Combustion Residual (CCR) units located at Kyger Creek Station in Cheshire, Ohio have undergone assessment by a qualified professional engineer and have been certified to be in compliance with the location restrictions outlined in 40 CFR 257.60 through 40 CFR 257.64. Reports documenting the process employed and final results of each assessment have been certified and posted to the facility's publically accessible internet site, as well as placed in the facility's operating record on October 17, 2018.

This information can be viewed at OVEC's publically accessible internet site at:

https://www.ovec.com/CCRCompliance.php

If you have any questions, or require any additional information, please call me at (740) 897-7768.

Sincerely,

Tim Fulk

Tim Fulk
Engineer II

TLF:klr

Stantec Consulting Services Inc.
11687 Lebanon Road, Cincinnati OH 45241-2012

October 16, 2018
File: 175534017
Revision 0

Ohio Valley Electric Corporation
3932 U.S. Route 23
P.O. Box 468
Piketon, Ohio 45661

RE: Location Restrictions Compliance Demonstrations
CCR Landfill
EPA Final Coal Combustion Residuals (CCR) Rule
Kyger Creek Station
Cheshire, Gallia County, Ohio

1.0 PURPOSE

This letter documents Stantec's certification of the location restrictions compliance demonstration for the Ohio Valley Electric Corporation (OVEC) Kyger Creek Station's CCR Landfill. Included is a demonstration assessing the CCR Landfill for Unstable Areas. An existing CCR landfill not required to perform a compliance demonstration for Placement Above the Uppermost Aquifer, Wetlands, Fault Areas, or Seismic Impact Zones.

2.0 LOCATION RESTRICTION ASSESSMENT - UNSTABLE AREAS

An existing CCR landfill must be assessed to demonstrate that it meets the minimum location requirements for unstable areas as per 40 CFR 257.64(a)-(e).

3.0 SUMMARY OF FINDINGS

The attached compliance demonstration report outlines the relevant project setting and technical elements considered for the Unstable Areas location restriction demonstration. Based on this assessment, the Kyger Creek CCR Landfill is in compliance with the location restriction requirements in the Final CCR Rule.

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Stan A. Harris, being a Professional Engineer in good standing in the State of Ohio, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;

2. that the information contained herein is accurate as of the date of my signature below; and

RE: **Location Restrictions Compliance Demonstrations**
CCR Landfill
EPA Final Coal Combustion Residuals (CCR) Rule
Kyger Creek Station
Cheshire, Gallia County, Ohio

3. that the OVEC Kyger Creek Station's CCR Landfill meets all requirements specified for locations restrictions outlined within the EPA CCR Final Rule.

SIGNATURE ______________________ DATE 10/16/18

ADDRESS: Stantec Consulting Services Inc.
11687 Lebanon Road
Cincinnati, Ohio 45241

TELEPHONE: (513) 842-8200

ATTACHMENTS: Kyger Creek CCR Landfill Unstable Areas Compliance Demonstration Report

ATTACHMENT A
UNSTABLE AREAS COMPLIANCE DEMONSTRATION REPORT

Compliance Demonstration Report – Unstable Areas CCR Landfill Kyger Creek Station

Ohio Valley Electric Corporation
Cheshire, Gallia County, Ohio

Prepared for:
Ohio Valley Electric Corporation
Piketon, Ohio

Prepared by:
Stantec Consulting Services Inc.
11687 Lebanon Road
Cincinnati, Ohio 45241

October 16, 2018

Table of Contents

LIST OF FIGURES

LIST OF APPENDICES

1.0 PROJECT BACKGROUND

On April 17, 2015, the "Disposal of Coal Combustion Residuals (CCR) from Electric Utilities" (EPA Final CCR Rule) was published in the Federal Register. Stantec Consulting Services Inc. (Stantec) was contracted by the Ohio Valley Electric Corporation (OVEC) to demonstrate proficiency regarding unstable areas at the Kyger Creek Station and evaluate compliance with §257.64 of the CCR Rule.

As required by §257.64 of the EPA Final CCR Rule, an owner or operator of an existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit is required by October 17, 2018 to demonstrate that the unit is not located in an unstable area unless the owner or operator demonstrates that generally accepted good engineering practices have been incorporated into the design of the CCR unit to promote the geotechnical integrity of the unit in such a manner that structural components of the CCR unit will not be disrupted.

The following factors have been considered to determine whether the CCR Landfill located at the Kyger Creek Station is in an unstable area:

- On-site or local soil conditions that may result in significant differential settling,
- On-site or local geologic or geomorphic features, and
- On-site or local human-made features or events (both surface and subsurface).

2.0 UNIT DESCRIPTION

The Kyger Creek Station is located on the north shore of the Ohio River downstream of Cheshire, Ohio. The station consists of five coal-fired electric generating units, each nominally rated at 217 megawatts. The Kyger Creek Station is directly accessible from State Route 7.

CCRs produced by the Kyger Creek Station are placed in the Kyger Creek restricted waste landfill (CCR Landfill). OVEC received its restricted waste permit and approval from the Ohio Environmental Protection Agency (OEPA) to begin construction on the landfill in April 2009. The landfill is divided into five phases with Phase 1 currently receiving CCRs. The landfill is a 98-acre Class III residual solid waste landfill with a capacity of 20.4 million cubic yards (AGES, 2015b).

Figure 1 presents an overview of the Kyger Creek Station and related appurtenances, and Figure 2 presents a more detailed overview of the CCR Landfill.

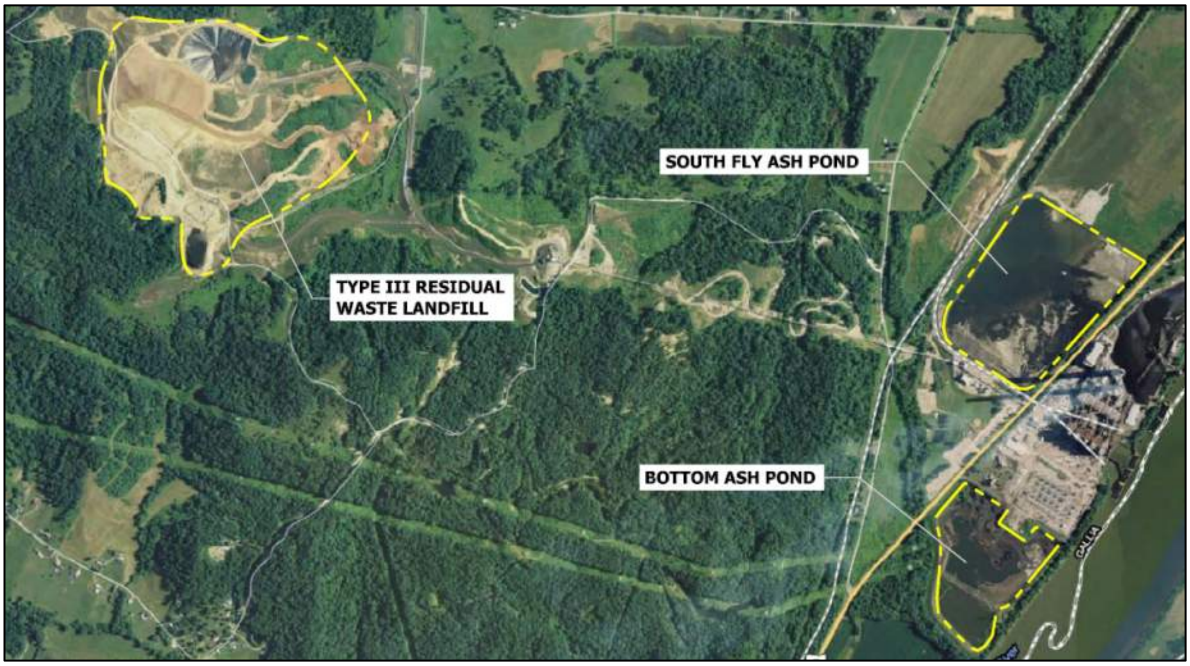


Figure 1. Aerial View of Kyger Creek Station (from AGES, 2015a)

Figure 2. Aerial View of Kyger Creek Station CCR Landfill (from Stantec, 2018)

3.0 SOIL CONDITIONS (§257.64(B)(1))

Per §257.64(b)(1), the unstable areas demonstration must consider on-site or local soil conditions that may result in significant differential settling when determining whether the area is unstable.

Assessment of the soil conditions was completed considering the following criteria related to the CCR rule:

- Review inspection reports of the CCR unit that document deformations in the soils or movement of structural components indicating differential settlement of foundation soils.
- Review published soil surveys that indicate on-site or local presence of soft or compressible soil formation(s).
- Review documentation (including but not limited to geotechnical data reports, construction drawings, and field notes) containing information that may indicate the foundation materials are soft or compressible.
- Review results of existing analyses to confirm that any settlement of the unit would be marginal (within acceptable limits) and would not cause any unpermitted release of CCR into the environment.

3.1 BACKGROUND

Inspections of the landfill facility have commenced in accordance with the EPA Final CCR Rule as of October 17, 2015 and are being conducted at least once every seven days (Stantec, 2018). These inspections include observations of vegetative cover, crest and slope conditions, and hydraulic structures for any signs of deformations in the soil or movement of the structural components that would indicate differential settlement of the foundation soils.

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) maintains an online web soil survey tool that provides information of local soils for a user-specified area of interest. The surficial soils at the Landfill predominately consist of the Upshur-Gilpin Complex (Ug) or Pinegrove Sand (Pn). The Upshur-Gilpin Complex is derived from residuum and consists of silty clay loam and silty clay loam with a moderately high to high capacity to transmit water. The Pinegrove sand is derived from coal extraction mine spoil and consists of sand and channery loamy coarse sand with a high to very high capacity to transmit water. Most of the soils have 25 to 70 percent slopes. The depth to water is expected to be more than 80 inches in both soil groups.

A subsurface investigation was completed in conjunction with the Permit to Install (PTI) prior to construction of the Landfill (Hull, 2008a). The investigation included 27 continuously sampled soil boring/rock cores to characterize the geotechnical and geologic conditions beneath the CCR Landfill. According to the report, the borings indicate an average of 6.1 feet of silty clayey soil overlying an average of 12.2 feet of weathered shale material.

Appendix A includes the Web Soil Survey completed for the CCR Landfill (USDA, 2018). Additional geologic information is included in Section 4.0.

3.2 ASSESSMENT

The most recent annual inspection of the CCR Landfill (Stantec, 2018) did not note stability issues affecting facility integrity. Issues noted were operational and maintenance items to address within the landfill's active phase. No visual signs of tension cracks, depressions, or deformation of the structural components were observed.

Historic soil reports and geotechnical exploration reports were reviewed for evidence of soft and compressible soils that may have been on site prior to the development of the CCR Landfill. For the purposes of this report, soft and compressible soils are fat clays, elastic silts, organic silts and clays, or highly organic soils (peat).

The CCR Landfill's Permit to Install Report discusses 14 soil classifications (excluding weathered shale bedrock and mine spoils). Nine were lean clay, while five were classified as fat clay. Weathered shale bedrock classified as lean clay. Mine spoil materials classified as a silty sand, clayey sand, or lean clay.

The construction certification report for Area 1 Parts 2 and 3 (S&ME, 2013) indicates that unsuitable surface materials were excavated, extending to bedrock or firm existing soils. Excavations were proofrolled with heavily loaded off-road dump trucks to assess suitable for construction.

Some minor differential settlement over relatively long lengths is expected due to varying loading conditions and consolidation properties/thicknesses of foundation materials. Selection of construction materials (as defined in design requirements) are intended to accommodate calculated liner strain.

3.3 CONCLUSION

Based on the assessment of the soil conditions, the CCR Rule-related criteria listed above have been met.

4.0 GEOLOGIC OR GEOMORPHOLOGIC FEATURES (§257.64(B)(2))

Per §257.64(b)(2), the unstable areas demonstration must consider on-site or local geologic or geomorphologic features when determining whether the area is unstable.

Assessment of the geologic or geomorphologic features was completed considering the following criteria related to the CCR rule:

- Review of published geologic maps that indicate on-site or local geomorphologic features such as:
    - Karst potential,
    - Known sinkhole outlines,
    - Known spring locations, and
    - Known landslide locations.
- Review of inspection reports of the CCR unit that document characteristic features of karstic formation (e.g. sinkholes, vertical shafts, sinking streams, caves, seeps, large springs, or blind valleys).
- Review documentation (including but not limited to geotechnical data reports, construction drawings, and field notes) containing information regarding the on-site or local geology and geomorphology.
- Review of topographic information to identify areas susceptible to mass movement (including but not limited to project drawings and 7.5-minute topographic mapping provided by the United States Geological Survey (USGS, 2016)).

4.1 BACKGROUND

Inspections of the landfill facility have commenced in accordance with the CCR Rule as of October 17, 2015 and are being conducted at least once every seven days (Stantec, 2018). These inspections include observations related to identifying characteristic features of karstic formations.

Physiographic mapping (ODNR, 1998) indicates that the Kyger Creek Station is located in the Marietta Plateau Region of the Allegheny Plateaus. The Marietta Plateau is described as a dissected plateau with high relief (600 feet near the Ohio River). Common features of the region include fine-rocks, red shales and soils, landslides, and remnants of ancient lacustrine clay-filled Teays drainage system.

According to quaternary geology mapping (ODNR, 1999), the Kyger Creek Landfill is underlain by Pre-Illinoian lacustrine deposits or Cenozoic colluvium. The Pre-Illinoian lacustrine deposits consist mostly of Minford Clay formed in ice-dammed lakes or eroded remnants of lacustrine clays and silts. The Cenozoic colluvium is derived from local bedrock in unglaciated areas and includes areas of residuum, weathered materials, and bedrock outcrop.

Ohio bedrock geologic mapping (ODNR, 1996; ODNR, 2011) indicates that the bedrock underlying the Landfill is in the Monogahela Group or Conemaugh of the Pennsylvanian system. The Monogahela Group consists of shale, siltstone, limestone, sandstone, and coal, and the Conemaugh Group consists of shale, siltstone, sandstone, mudstone, and lesser amounts of limestone and coal.

Appendix B contains mapping showing the physiographic regions of Ohio (ODNR, 1998), karst features in Ohio (ODNR, 2006), and landslides and rockfalls documented by the Ohio Department of Transportation (ODOT, 2018).

4.2 ASSESSMENT

The most recent annual inspection of the CCR Landfill (Stantec, 2018) did not note stability issues affecting facility integrity. Issues noted were operational and maintenance items to address within the landfill active phase. No visual signs of tension cracks, depressions, or deformation of the structural components were observed. The seep discussed is associated with a perched groundwater table addressed in the landfill design using a groundwater interceptor drain and overexcavation within the landfill footprint (Hull, 2008b).

As shown on the karst map for Ohio (ODNR, 2006) included in Appendix B, the CCR Landfill is not located in an area known to contain karst features.

Several landslides are documented south of the Kyger Creek Station along State Route 7 near the Ohio River. The nearest landslide is approximately 2 miles southeast of the Kyger Creek Landfill (ODOT, 2018).

Mapping does not indicate any faults or other geologic deficiencies to be present in the immediate area of the impoundment (Baranoski, 2013).

Topographic mapping (USGS, 2016) shows no indication of areas susceptible to mass movement within the vicinity of the CCR Landfill.

4.3 CONCLUSION

Based on the assessment of the geologic and geomorphologic features, the CCR Rule-related criteria listed above have been met.

5.0 HUMAN-MADE FEATURES OR EVENTS (§257.64(B)(3))

Per §257.64(b)(3), the unstable areas demonstration must consider on-site or local human-made features or events when determining whether the area is unstable.

Assessment of the human-made features or events was completed considering the following criteria:

- Review inspection reports of the CCR unit that document indications of tension cracking, settlement, depressions, or deformation of the unit's structural components (embankments, spillways, outlets, liners, leachate collection systems, or final covers).
- Review of routine operations and inspections at the landfill to maintain precaution from human-induced events or forces that might impair the integrity of some or all the structural components responsible for preventing unpermitted release of CCR into the environment.
- Review instrumentation installed to monitor the CCR unit to ensure readings are maintained within documented tolerances.
- Review of maps and other resources to confirm that the CCR unit is not located:
  - On previously mined or quarried areas,
  - On areas that have undergone excessive drawdown of groundwater, or
  - On an old landfill.

5.1 BACKGROUND

Inspections of the landfill facility have commenced in accordance with the CCR Rule as of October 17, 2015 and are being conducted at least once every seven days (Stantec, 2018). These inspections include observations that document indications of human-induced events or forces that could have impaired the integrity of any structural components, which are responsible for preventing the unpermitted release of CCR to the environment.

Two piezometers and 38 monitoring wells were installed as part of the hydrogeologic and subsurface investigation for the Permit to Install prior to the construction of the CCR Landfill in 2009 (Hull, 2008a). Two additional monitoring wells were installed in 2015 along the Phase 1 limit of the CCR Landfill to meet the monitoring network requirements of the CCR Rule (AGES, 2016).

Appendix C contains maps presenting the locations of mining activity, water wells, and oil and gas wells from available data and mapping in Ohio (ODNR, 2018).

5.2 ASSESSMENT

The most recent annual inspection of the CCR Landfill (Stantec, 2018) did not note stability issues affecting facility integrity. Issues noted were operational and maintenance items to address within the landfill active phase. No visual signs of tension cracks, depressions, or deformation of the structural components were observed. The seep discussed is associated with a perched groundwater table addressed in the landfill design using a groundwater interceptor drain and overexcavation within the landfill footprint (Hull, 2008b).

According to Ohio Department of Natural Resources (ODNR) mapping (ODNR, 2018b), there is one inactive oil and/or gas well located in the footprint of the CCR Landfill. This well is noted in the Permit to Install report, indicating that the stratigraphic log, well log and closure report would be provided to the Ohio Environmental Protection Agency prior to construction of the CCR Landfill (Hull, 2008a). Four additional wells were field verified within 1,000 feet of the CCR Landfill. Within 2,000 feet of the unit, 12 oil and gas wells were present during the permitting process. Current ODNR mapping (ODNR 2018b) indicates that there are 20 active oil and gas wells within a one-mile radius of the CCR Landfill.

Several historic surface mines location were documented within the footprint of the CCR Landfill (ODNR, 2018a). As part of the subsurface investigation prior to construction for the Permit to Install (Hull, 2008a), a mine was located and visually inspected. The mine is reported as being very small, approximately 20 feet deep. Seven test pits were completed to determine if horizontal auger mining was performed at the facility. Based on these test pits, no horizontal auger mines were present. Additionally, mine spoils were encountered in the borings advanced during the subsurface exploration. According to the construction certification report for Area 1 Parts 2 and 3 (S&ME, 2013), excavation was performed to remove the mine spoils and were terminated after penetrating into bedrock or firm, suitable existing soils.

According to ODNR mapping (ODNR, 2018c), there are several wells within the general vicinity of the CCR Landfill. There are 11 wells registered by American Electric Power (AEP) shown within the footprint of the CCR Landfill. Three additional wells are located within a one-radius of the CCR Landfill. As discussed in Section 5.1, 40 monitoring wells have been installed at the CCR Landfill.

Monitoring wells would not typically cause excessive drawdown of groundwater levels, thus posing no significant hazard.

It is not expected that human events related to these past industries or their operations pose any negative impact to the structural components of the CCR Landfill.

5.3 CONCLUSION

Based on the assessment of the human-made features or events, the CCR Rule-related criteria listed above have been met.

6.0 REFERENCES

Applied Geology and Environmental Science, Inc. (AGES) (2016). *Coal Combustion Residuals Regulation, Monitoring Well Installation Report, Ohio Valley Electric Corporation, Kyger Creek Station, Cheshire, Gallia County, Ohio.* August.

Applied Geology and Environmental Science, Inc. (2015a). *Recommended Upgrades to Groundwater Monitoring System, For CCR Compliance, Ohio Valley Electric Corporation (OVEC), Kyger Creek Station-Cheshire, Ohio.* May 7.

Applied Geology and Environmental Science, Inc. (2015b). *Semi-Annual Groundwater Monitoring Report (April 2015 Sampling). Ohio Valley Electric Corporation. Kyger Creek Plant Landfill. Gallia County, Cheshire, Ohio.* June.

Baranoski, Mark T. (2013). *Structure Contour Map on the Precambrian Unconformity Surface in Ohio and Related Basement Features.* Digital Map Series PG-23, Version 2.0. State of Ohio Department of Natural Resources. Division of Geological Survey.

Hull & Associates, Inc. (Hull) (2008a). *Section B – Hydrogeologic and Subsurface Investigation Report.* Permit to Install (PTI). Ohio Valley Electric Corporation. Kyger Creek Plant Landfill. Revised December.

Hull & Associates, Inc. (Hull) (2008b). *Kyger Creek Plant Landfill. Phase 1 Construction Plans. Class III Residual Waste Facility*. Cheshire, Ohio. Ohio Valley Electric Corporation.

Ohio Department of Natural Resources (ODNR) (2018a). *Mines of Ohio.* https://gis.ohiodnr.gov/MapViewer/?config=OhioMines. Accessed February.

Ohio Department of Natural Resources (ODNR) (2018b). *Ohio Oil & Gas Wells.* https://gis.ohiodnr.gov/MapViewer/?config=oilgaswells. Accessed February.

Ohio Department of Natural Resources(ODNR) (2018c). *Ohio Water Wells.* https://gis.ohiodnr.gov/MapViewer/?config=WaterWells. Accessed February.

Ohio Department of Transportation (ODOT) (2018). *Traffic Information Mapping System.* https://gis.dot.state.oh.us/tims/Map/Geotech. Accessed February.

Ohio Department of Natural Resources (ODNR) (2011). *Descriptions of Geologic Maps.* Ohio Division of Geological Survey. April 25.

Ohio Department of Natural Resources (ODNR) (2006). *Known and Probable Karst in Ohio*. Ohio Division of Geological Survey.

Ohio Department of Natural Resources (ODNR) (1999). *Quaternary Geology of Ohio.* Ohio Division of Geological Survey.

Ohio Department of Natural Resources (ODNR) (1998). *Physiographic Regions of Ohio*. Ohio Division of Geological Survey.

Ohio Department of Natural Resources (ODNR) (1996). *Reconnaissance bedrock geology of the Addison, Ohio-W. Va, quadrangle.* Ohio Division of Geological Survey. C. L. Rice.

S&ME Inc. (S&ME) (2013). *Construction Certification Report. Area 1, Parts 2 and 3, Kyger Creek Plant, Residual Waste Landfill*. January.

Stantec Consulting Services, Inc. (Stantec) (2018). *2017 CCR Rule Inspection, Kyger Creek Landfill.* Kyger Creek Generating Station. Cheshire, Gallia County, Ohio. January 11.

United States Department of Agriculture (USDA) (2018). *Custom Soil Resource Report for Gallia County, Ohio. Kyger Creek Boiler Landfill.* Natural Resources Conservation Service. February 28.

United States Geological Survey (USGS) (2016). *USGS US Topo 7.5-minute map for Addison, OH-WV 2016.* USGS - National Geospatial Technical Operations Center (NGTOC).

COMPLIANCE DEMONSTRATION REPORT –
UNSTABLE AREAS
CCR LANDFILL
KYGER CREEK STATION

October 16, 2018

Appendix A SOIL CONDITIONS

Stantec

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

Gallia County, Ohio

Kyger Creek Landfill

February 28, 2018

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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

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.

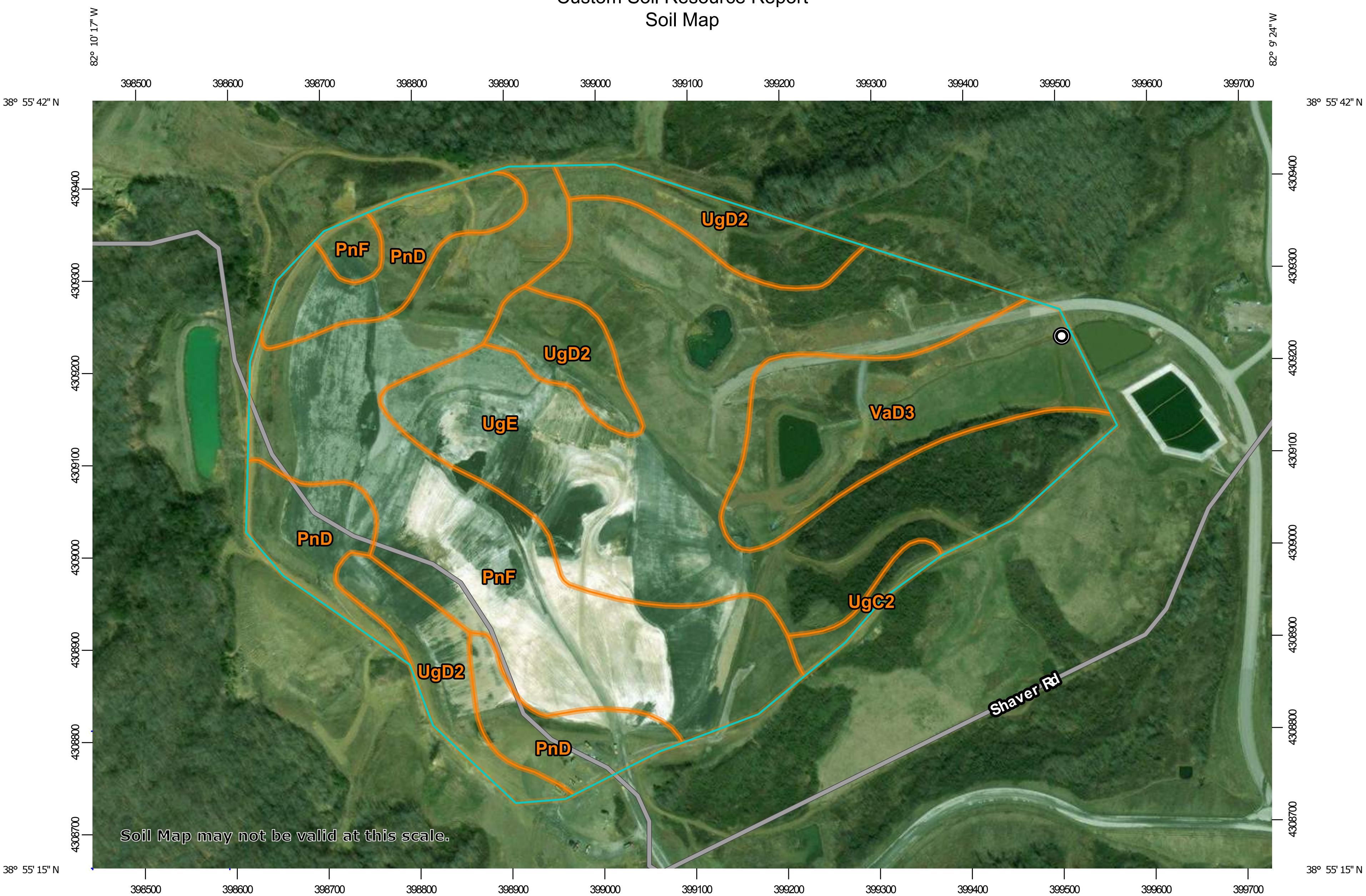
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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 identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

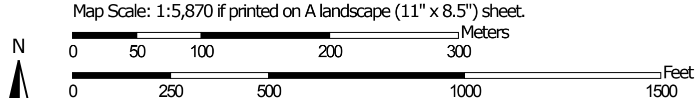
Soil Map

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.

Soil Map



Map Scale: 1:5,870 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

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 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Gallia County, Ohio
Survey Area Data: Version 15, Sep 25, 2017

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

Date(s) aerial images were photographed: Sep 17, 2015—Mar 26, 2017

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
PnD	Pinegrove sand, 8 to 25 percent slopes	13.0	12.1%
PnF	Pinegrove sand, 25 to 70 percent slopes	28.6	26.8%
UgC2	Upshur-Gilpin complex, 8 to 15 percent slopes, eroded	1.2	1.1%
UgD2	Upshur-Gilpin complex, 15 to 25 percent slopes, eroded	11.4	10.7%
UgE	Upshur-Gilpin complex, 25 to 50 percent slopes	39.9	37.4%
VaD3	Vandalia silty clay loam, 15 to 25 percent slopes, severely eroded	12.7	11.9%
Totals for Area of Interest		**106.8**	**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. 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.

Gallia County, Ohio

PnD—Pinegrove sand, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: l0m5
Mean annual precipitation: 37 to 45 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 160 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Pinegrove

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coal extraction mine spoil

Typical profile

H1 - 0 to 8 inches: sand
H2 - 8 to 60 inches: channery loamy coarse sand

Properties and qualities

Slope: 8 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Steinsburg

Percent of map unit: 5 percent
Landform: Hills

Lily

Percent of map unit: 5 percent

Landform: Hills

PnF—Pinegrove sand, 25 to 70 percent slopes

Map Unit Setting

National map unit symbol: l0m6
Mean annual precipitation: 37 to 45 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 160 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Pinegrove

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coal extraction mine spoil

Typical profile

H1 - 0 to 8 inches: sand
H2 - 8 to 60 inches: channery loamy coarse sand

Properties and qualities

Slope: 25 to 70 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Bethesda

Percent of map unit: 15 percent
Landform: Hills

UgC2—Upshur-Gilpin complex, 8 to 15 percent slopes, eroded

Map Unit Setting

National map unit symbol: l0ml
Mean annual precipitation: 37 to 45 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 160 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Upshur and similar soils: 40 percent
Gilpin and similar soils: 40 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Upshur

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 3 inches: silty clay loam
H2 - 3 to 38 inches: silty clay
H3 - 38 to 44 inches: silty clay loam
H4 - 44 to 46 inches: weathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 40 to 71 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Gilpin

Setting

Landform: Hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 34 inches: silty clay loam
H3 - 34 to 37 inches: very channery silty clay loam
H4 - 37 to 39 inches: weathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Wellston

Percent of map unit: 10 percent
Landform: Hills

Rarden

Percent of map unit: 10 percent
Landform: Hills

UgD2—Upshur-Gilpin complex, 15 to 25 percent slopes, eroded

Map Unit Setting

National map unit symbol: l0mm
Mean annual precipitation: 37 to 45 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 160 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Upshur and similar soils: 40 percent
Gilpin and similar soils: 40 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Upshur

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 3 inches: silty clay loam
H2 - 3 to 38 inches: silty clay
H3 - 38 to 44 inches: silty clay loam
H4 - 44 to 46 inches: weathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 40 to 71 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Gilpin

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 34 inches: silty clay loam
H3 - 34 to 37 inches: very channery silty clay loam
H4 - 37 to 39 inches: weathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Berks

Percent of map unit: 10 percent
Landform: Hills

Guernsey

Percent of map unit: 10 percent
Landform: Hills

UgE—Upshur-Gilpin complex, 25 to 50 percent slopes

Map Unit Setting

National map unit symbol: l0mn
Mean annual precipitation: 37 to 45 inches
Mean annual air temperature: 50 to 55 degrees F

Frost-free period: 160 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Upshur and similar soils: 40 percent
Gilpin and similar soils: 40 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Upshur

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 6 inches: silty clay loam
H2 - 6 to 50 inches: silty clay
H3 - 50 to 71 inches: silty clay loam
H4 - 71 to 73 inches: weathered bedrock

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: 40 to 71 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Gilpin

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 24 inches: channery silt loam
H3 - 24 to 30 inches: very channery silt loam

H4 - 30 to 32 inches: weathered bedrock

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Berks

Percent of map unit: 10 percent
Landform: Hills

Guernsey

Percent of map unit: 10 percent
Landform: Hills

VaD3—Vandalia silty clay loam, 15 to 25 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 2t31c
Elevation: 520 to 1,300 feet
Mean annual precipitation: 40 to 49 inches
Mean annual air temperature: 51 to 55 degrees F
Frost-free period: 175 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Vandalia

Setting

Landform: Hillslopes
Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope
Down-slope shape: Concave, convex
Across-slope shape: Linear, convex
Parent material: Colluvium derived from sandstone and siltstone

Typical profile
Ap - 0 to 4 inches: silty clay loam
Bt1 - 4 to 11 inches: silty clay
Bt2 - 11 to 20 inches: silty clay
Bt3 - 20 to 41 inches: channery silty clay
C - 41 to 72 inches: very channery silty clay loam

Properties and qualities
Slope: 15 to 25 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.9 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Other vegetative classification: Fertile Loams (FL3)
Hydric soil rating: No

Minor Components

Upshur
Percent of map unit: 8 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Sensabaugh
Percent of map unit: 7 percent
Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Gilpin
Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex

Hydric soil rating: No

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

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

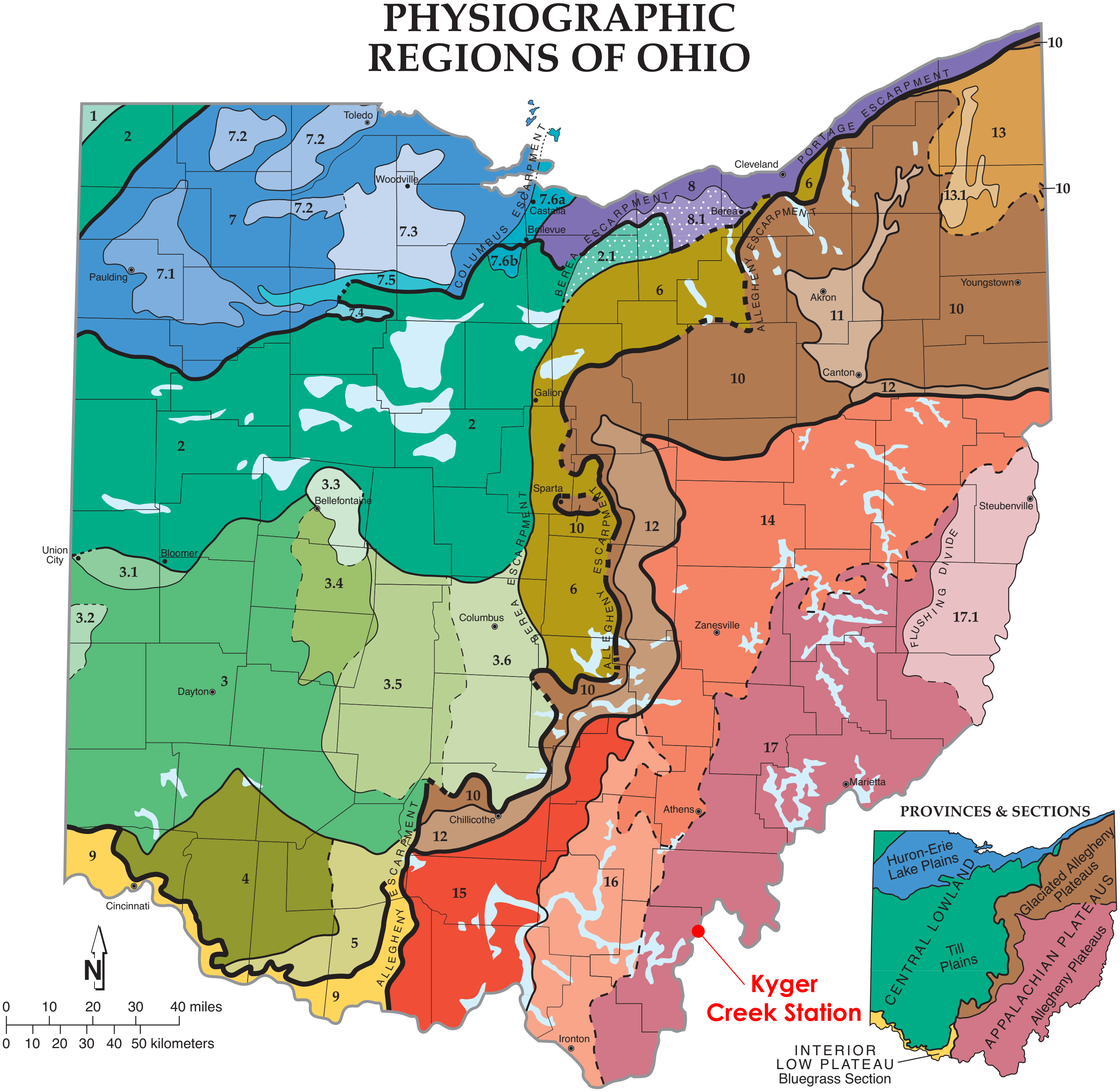
COMPLIANCE DEMONSTRATION REPORT –
UNSTABLE AREAS
CCR LANDFILL
KYGER CREEK STATION

October 16, 2018

Appendix B GEOLOGIC OR GEOMORPHOLOGIC CONDITIONS

Stantec

PHYSIOGRAPHIC REGIONS OF OHIO



Till Plains

1. Steuben Till Plain
2. Central Ohio Clayey Till Plain
   - 2.1. Berea Headlands of the Till Plain
3. Southern Ohio Loamy Till Plain
   - 3.1. Union City-Bloomer Transitional Terrain
   - 3.2. Whitewater Interlobate Plain
   - 3.3. Bellefontaine Upland
   - 3.4. Mad River Interlobate Plain
   - 3.5. Darby Plain
   - 3.6. Columbus Lowland
4. Illinoian Till Plain
5. Dissected Illinoian Till Plain
6. Galion Glaciated Low Plateau

Transitional boundary

Lake basin/deposits outside Huron-Erie Lake Plains

Huron-Erie Lake Plains

7. Maumee Lake Plains
   - 7.1. Paulding Clay Basin
   - 7.2. Maumee Sand Plains
   - 7.3. Woodville Lake-Plain Reefs
   - 7.4. Findlay Embayment
   - 7.5. Fostoria Lake-Plain Shoals
   - 7.6a and 7.6b. Bellevue-Castalia Karst Plain
8. Erie Lake Plain
   - 8.1. Berea Headlands of the Erie Lake Plain

Bluegrass Section

9. Outer Bluegrass Region

Glaciated Allegheny Plateaus

10. Killbuck-Glaciated Pittsburgh Plateau
11. Akron-Canton Interlobate Plateau
12. Illinoian Glaciated Allegheny Plateau
13. Grand River Low Plateau
   - 13.1 Grand River Finger-Lake Plain

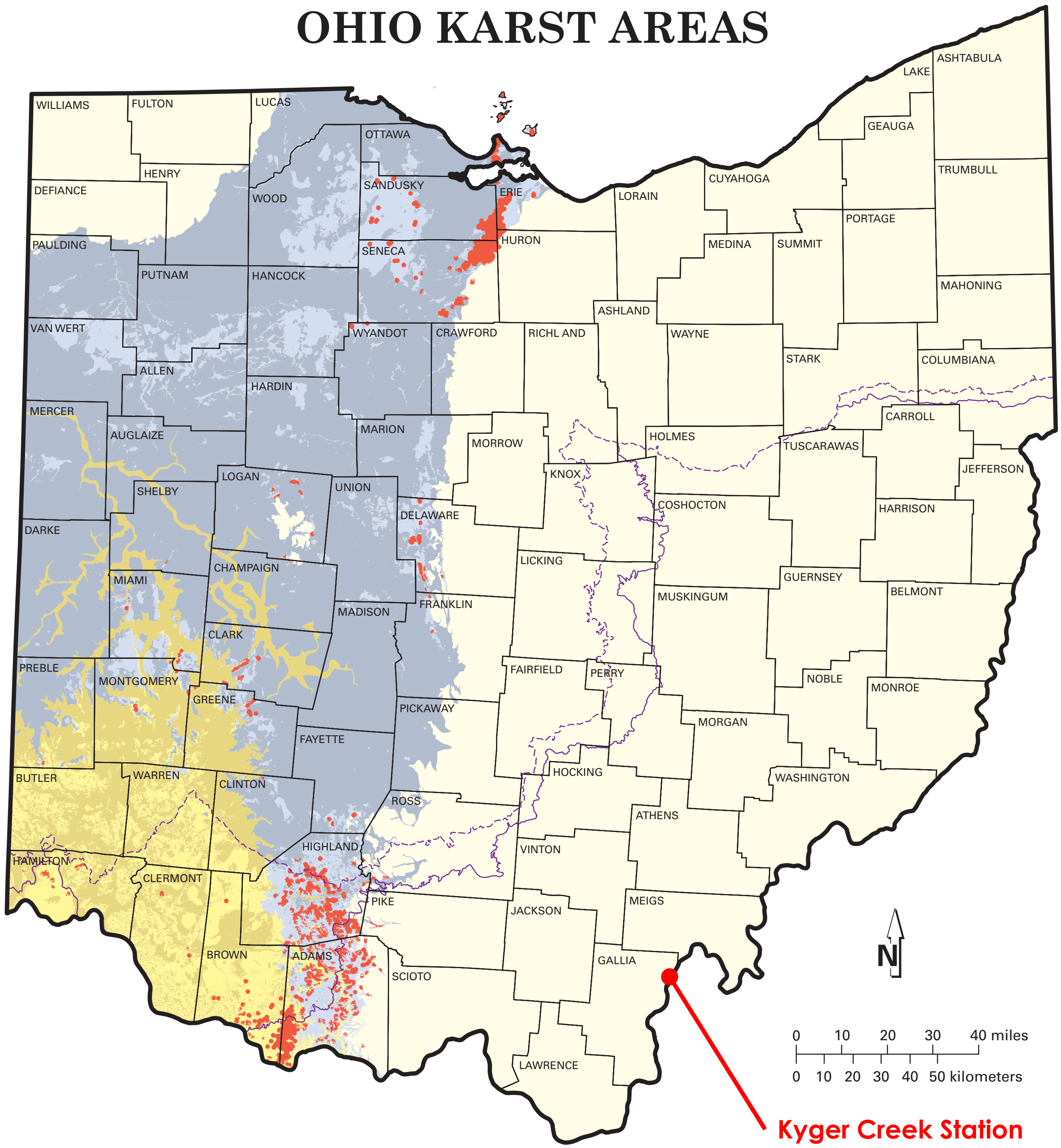
Allegheny Plateaus

14. Muskingum-Pittsburgh Plateau
15. Shawnee-Mississippian Plateau
16. Ironton Plateau
17. Marietta Plateau
   - 17.1. Little Switzerland Plateau

4/98

Recommended citation: Ohio Division of Geological Survey, 1998, Physiographic regions of Ohio: Ohio Department of Natural Resources, Division of Geological Survey, page-size map with text, 2 p., scale 1:2,100,00.

OHIO KARST AREAS



EXPLANATION

- Silurian- and Devonian-age carbonate bedrock overlain by less than 20 feet of glacial drift and/or alluvium
- Silurian- and Devonian-age carbonate bedrock overlain by more than 20 feet of glacial drift and/or alluvium
- Interbedded Ordovician-age limestone and shale overlain by less than 20 feet of glacial drift and/or alluvium
- Interbedded Ordovician-age limestone and shale overlain by more than 20 feet of glacial drift and/or alluvium
- Probable karst areas
- Area not known to contain karst features
- Wisconsinan Glacial Margin
- Illinoian Glacial Margin

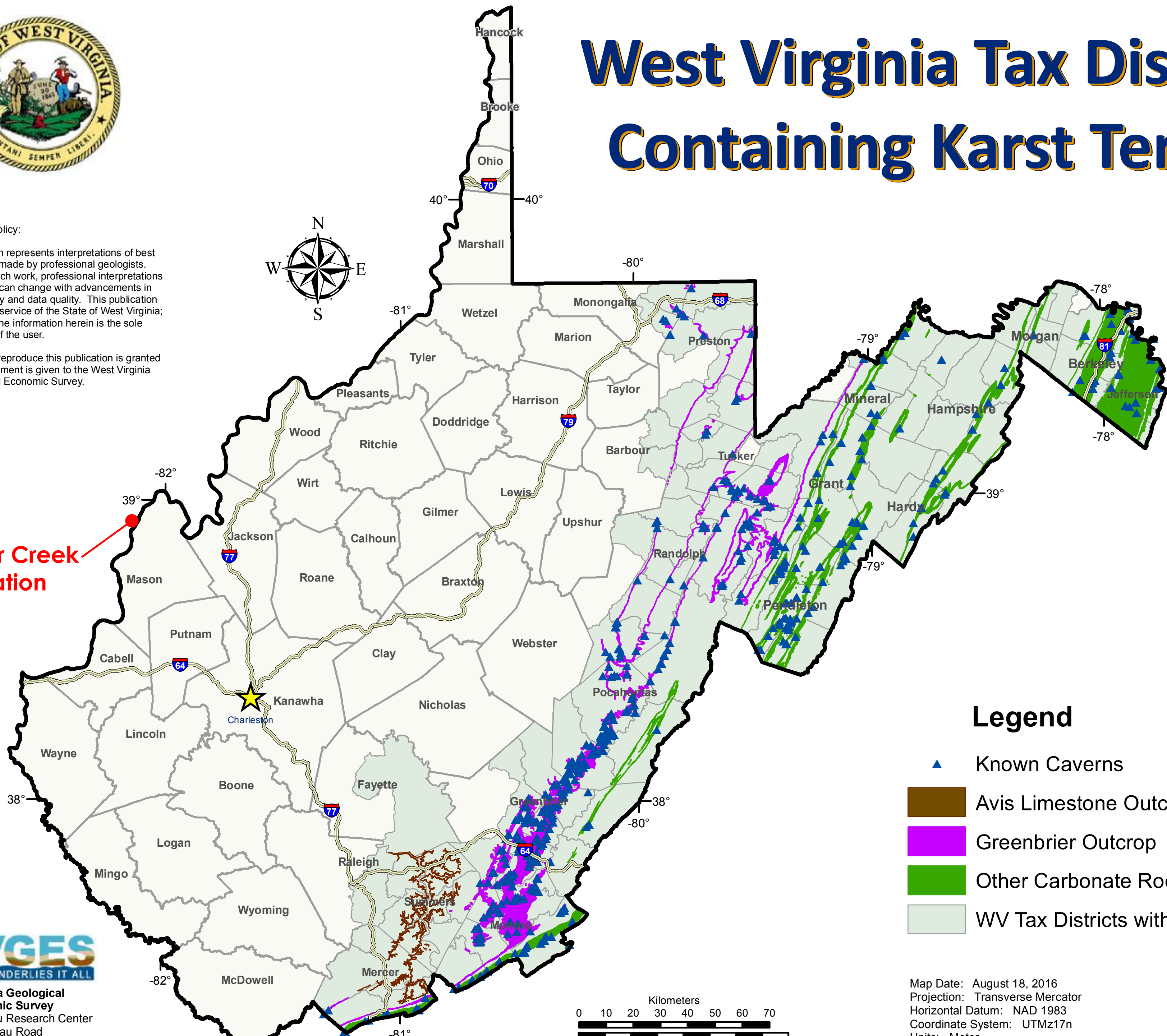
Recommended citation: Ohio Division of Geological Survey, 1999 (rev. 2002, 2006), Known and probable karst in Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map EG-1, generalized page-size version with text, 2 p., scale 1:2,000,000.

West Virginia Tax Districts Containing Karst Terrain

Publications Policy:

This publication represents interpretations of best available data made by professional geologists. As in all research work, professional interpretations may vary, and can change with advancements in both technology and data quality. This publication is offered as a service of the State of West Virginia; proper use of the information herein is the sole responsibility of the user.

Permission to reproduce this publication is granted if acknowledgement is given to the West Virginia Geological and Economic Survey.



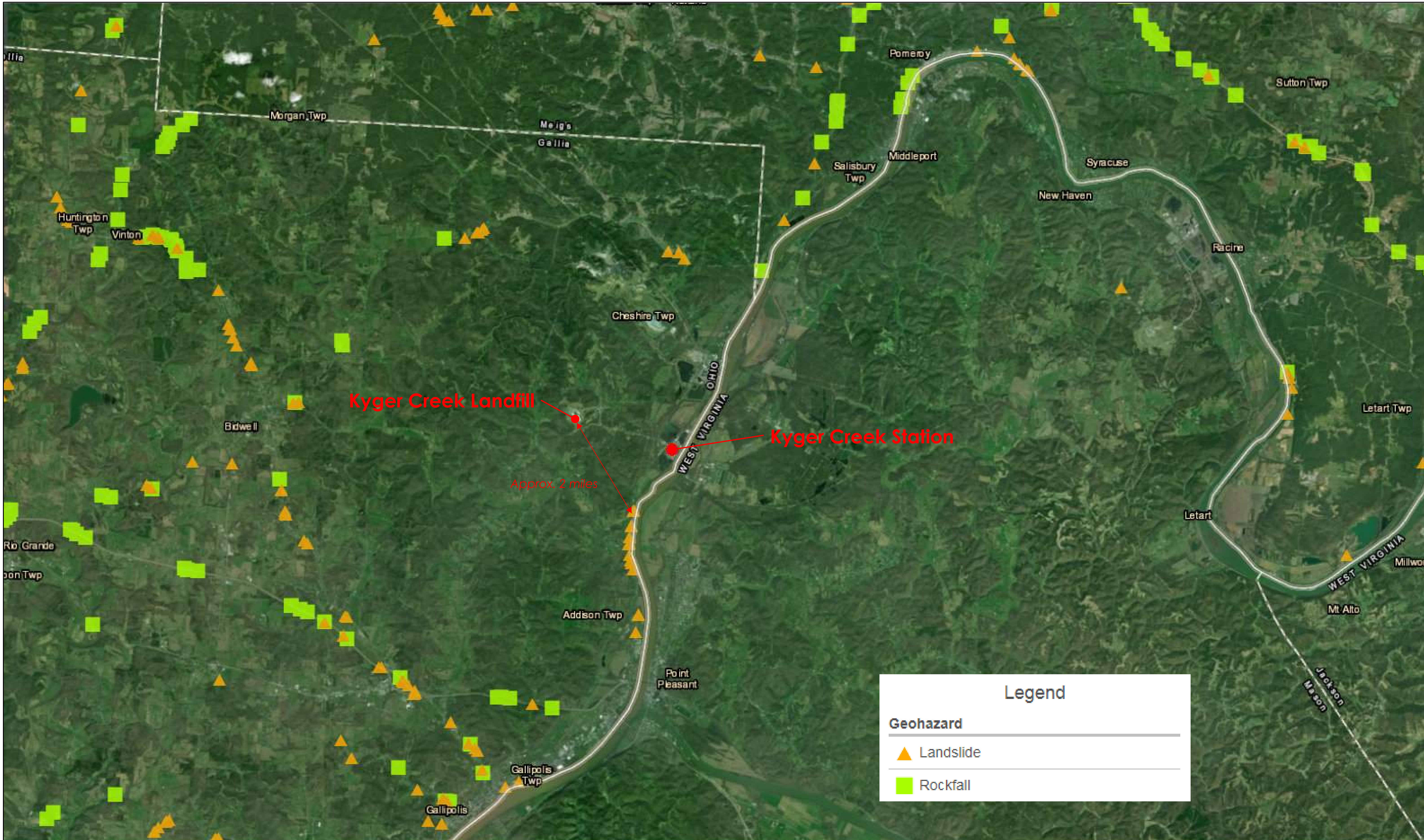
Legend

- Known Caverns
- Avis Limestone Outcrop
- Greenbrier Outcrop
- Other Carbonate Rocks Outcrop
- WV Tax Districts with Karst Terrain

Map Date: August 18, 2016
Projection: Transverse Mercator
Horizontal Datum: NAD 1983
Coordinate System: UTMz17n
Units: Meter
Map Scale (for full 8.5" x 11" display): 1:2,000,000

WVGES
GEOLOGY UNDERLIES IT ALL

West Virginia Geological and Economic Survey
Mont Chateau Research Center
1 Mont Chateau Road
Morgantown, WV 26508-8079
Phone: (304) 594-2331
Web: **www.wvgs.wvnet.edu**



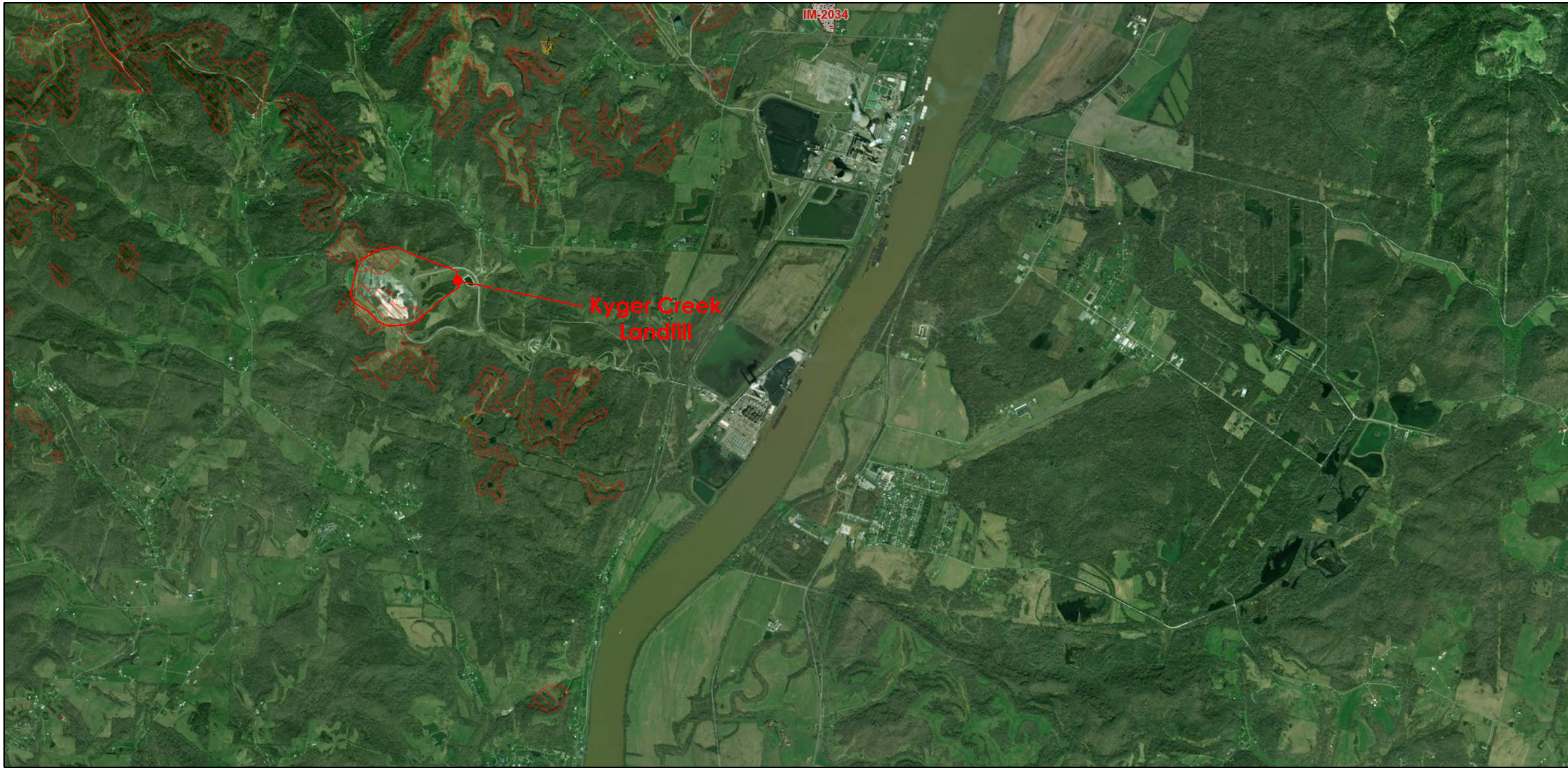
TIMS TRANSPORTATION INFORMATION MAPPING SYSTEM

This file was generated by the Transportation Information Mapping System from the Ohio Department of Transportation (ODOT). ODOT does not make any warranty and does not assume any legal liability or responsibility for the accuracy, completeness, or usefulness of the data provided herein. Any use of this information is at the recipients own risk.

Date: 2/23/2018

Appendix C HUMAN-MADE FEATURES OR EVENTS

Mines of Ohio



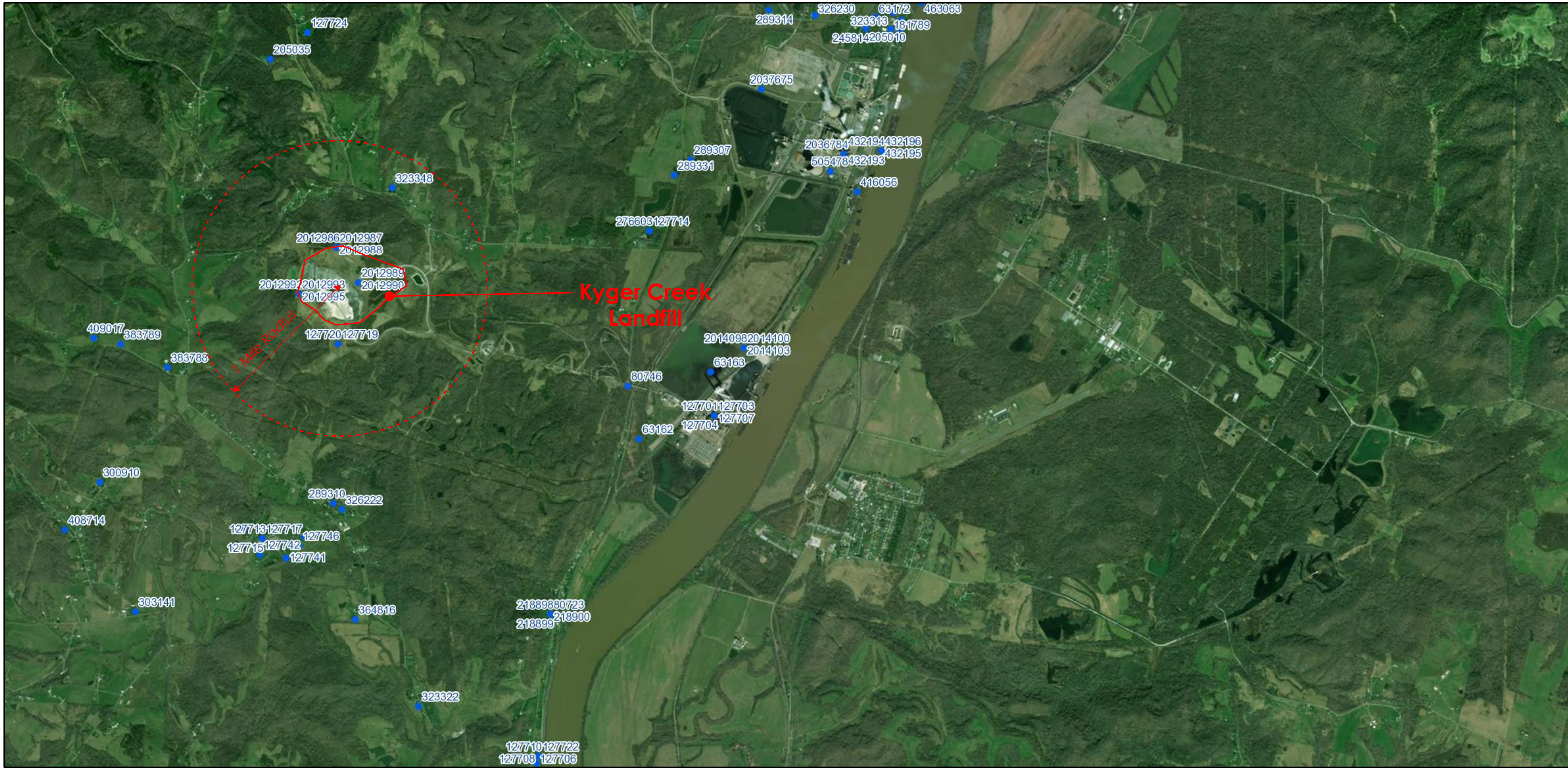
February 21, 2018

Current
Air Shaft
Drift Entry
Vertical Mine Shaft
Slope Entry
Past
Air Shaft
Drift Entry
Vertical Mine Shaft
Slope Entry
Locations
Locations - From Geologic Maps
Abandoned pit
Abandoned quarry
Quarry area
Sand, gravel, or barrow pit
Locations
Surface Affected Area
Proposed
Original Application
Adjacent Area Application
Current
Past
A Law (1965 - 1972)
B Law (1972 - 1975)
C Law (1976 - 1981)
D Law (1982 - Present)
Historic - From Topo Maps
Historic - From Geology Maps
Proposed
Original Application
Adjacent Area Application
Permitted
Current
Past
Partially Known
Known
AUM level 3
AUM level 2
AUM level 1
AUM level 0
Proposed
Original Application
Adjacent Area Application
Current
Past
Historic - From Geology Maps

N
0 0.5 1 2 mi
0 0.75 1.5 3 km

Ohio Dept. of Natural Resources

Ohio Water Wells



February 21, 2018

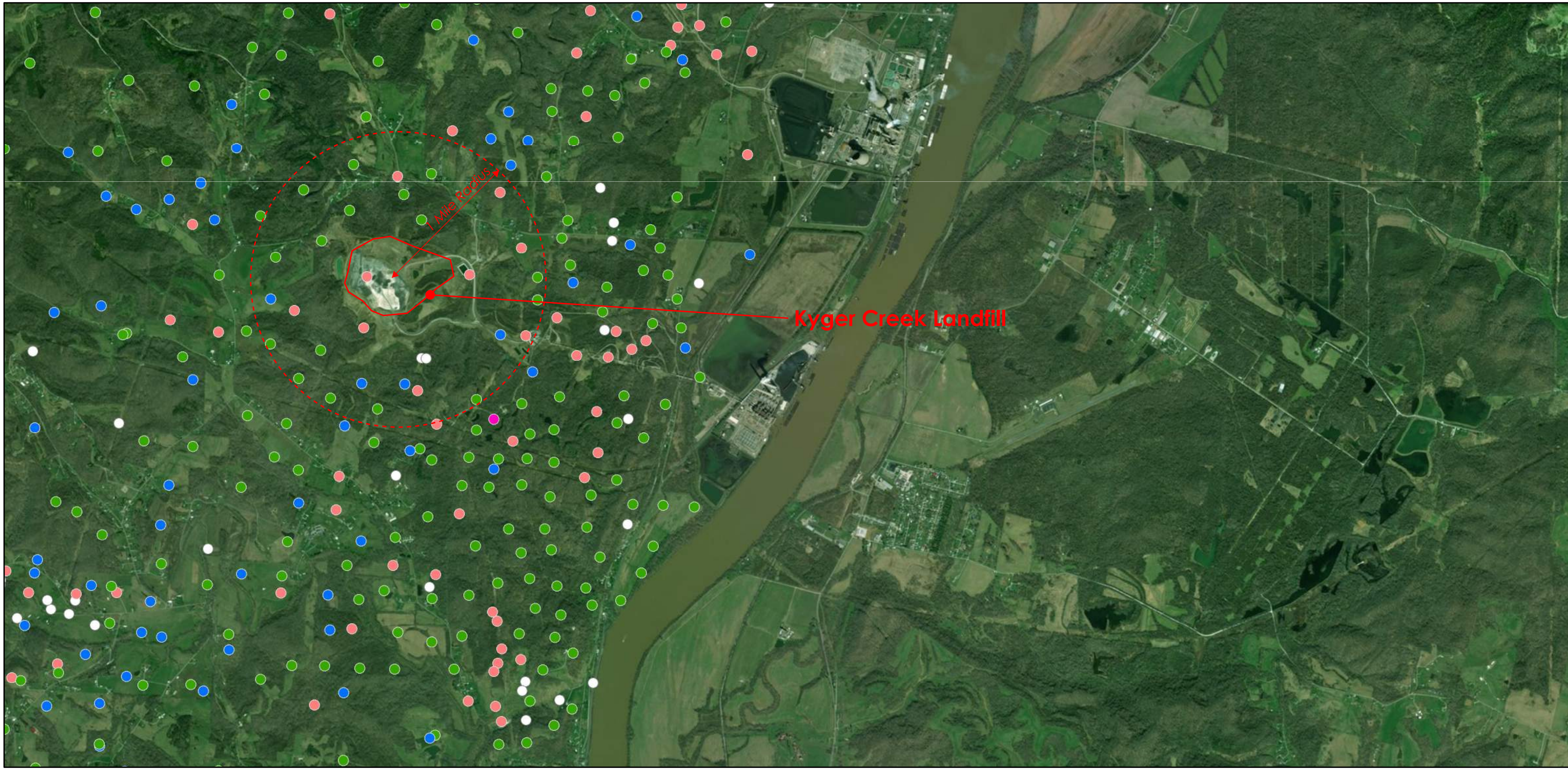
- Water Wells

N

0 0.5 1 2 mi

0 0.75 1.5 3 km

Ohio Oil & Gas Wells



February 21, 2018

Active Wells
- Permitted
- Producing
- Drilling
- UIC
- Storage

Inactive Wells
- Plugged
- Inactive
- Dry and Abandoned
- Unknown; Other

N

0 0.5 1 2 mi
0 0.75 1.5 3 km

ODNR - Division of Oil and Gas Resources Management