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: 175534018
Revision 0

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

RE: Location Restrictions Compliance Demonstrations
Boiler Slag Pond
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 demonstrations for the Ohio Valley Electric Corporation (OVEC) Clifty Creek Station's Boiler Slag Pond. Included in these demonstrations for the West Boiler Slag Pond are assessments of a) Placement Above the Uppermost Aquifer, b) Wetlands, c) Fault Areas, d) Seismic Impact Zones, and e) Unstable Areas.

2.0 LOCATION RESTRICTION ASSESSMENTS

2.1 PLACEMENT ABOVE THE UPPERMOST AQUIFER

An existing CCR surface impoundment must be assessed to demonstrate that it meets the minimum location requirements for placement above the uppermost aquifer as per 40 CFR 257.60(a)-(d).

2.2 WETLANDS

An existing CCR surface impoundment must be assessed to demonstrate that it meets the location requirements for wetlands as per 40 CFR 257.61(a)-(d).

2.3 FAULT AREAS

An existing CCR surface impoundment must be assessed to demonstrate that it meets the minimum location requirements for fault areas as per 40 CFR 257.62(a)-(d).

2.4 SEISMIC IMPACT ZONES

An existing CCR surface impoundment must be assessed to demonstrate that it meets the minimum location requirements for seismic impact zones as per 40 CFR 257.63(a)-(d).

2.5 UNSTABLE AREAS

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

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

3.0 SUMMARY OF FINDINGS

The attached compliance demonstration reports outline the relevant project setting and technical elements considered for each of the location restriction demonstrations noted above in Section 2.0. Based on these assessments, the Kyger Creek Boiler Slag Pond 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

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

SIGNATURE Stan A. Harris DATE 10/16/18

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

TELEPHONE: (513) 842-8200

STATE OF OHIO
STAN A. HARRIS
53083
REGISTERED PROFESSIONAL ENGINEER
10/16/18

ATTACHMENTS:

A. Placement Above the Uppermost Aquifer Compliance Demonstration Report
B. Wetlands Compliance Demonstration Report
C. Fault Areas Compliance Demonstration Report
D. Seismic Impact Zones Compliance Demonstration Report
E. Unstable Areas Compliance Demonstration Report

ATTACHMENT A
PLACEMENT ABOVE THE UPPERMOST AQUIFER COMPLIANCE DEMONSTRATION REPORT

Placement Above the Uppermost Aquifer Demonstration

Boiler Slag Pond
Kyger Creek Generating Station
Cheshire, Ohio

Prepared for:
Ohio Valley Electric Corporation

Piketon, Ohio

Prepared by:
Stantec Consulting Services Inc.
Cincinnati, Ohio

September 24, 2018

Table of Contents

LIST OF FIGURES

1.0 INTRODUCTION

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 provide a compliance demonstration report and certification of the Placement Above the Uppermost Aquifer (UMA) Location Restriction for the Boiler Slag Pond (BSP) CCR unit at the Kyger Creek Generating Station (KCGS) as required by the EPA Final CCR Rule § 257.60.

1.1 OBJECTIVE

As required by §257.60 of the EPA Final CCR Rule, an owner or operator of new CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units is required by October 17, 2018 to demonstrate whether the unit is located no less than five feet above the upper limit of the UMA. The objective of this report is to demonstrate compliance with the location restriction for placement above the uppermost aquifer. Relevant sections of the EPA Final CCR Rule are cited below to provide context and additional detail regarding the objective (EPA, 2016).

The EPA Final CCR Rule § 257.53 provides definitions of CCR and CCR surface impoundments.

> *"Coal combustion residuals (CCR) means fly ash, bottom ash, boiler slag, and flue gas desulfurization materials generated from burning coal for the purpose of generating electricity by electric utilities and independent power producers." (257.53)*

> *"CCR surface impoundment means a natural topographic depression, manmade excavation, or diked area, which is designed to hold an accumulation of CCR and liquids, and the unit treats, stores, or disposes of CCR." (257.53)*

The EPA Final CCR Rule § 257.60 (a) requires that the CCR unit is constructed:

> *"…with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table)." (257.60 (a))*

OVEC must demonstrate that that the requirements of paragraph (a) of section 257.60 are met, and the demonstration must be certified to meet the requirements by a qualified professional engineer (P.E.) (§ 257.60 (b)). If the demonstration cannot be met, OVEC will be required to cease placing CCR and non-CCR waste streams into the BSP and close the unit within the time specified in § 257.101(b)(1). The demonstration and certification must be completed no later than October 17, 2018 (§ 257.60 (c)(1)).

1.2 UNIT DESCRIPTION

The KCGS is a coal-fired, electric-generating plant. The plant is located in Gallia County, Ohio, south of the town of Cheshire, Ohio. The Ohio River is located directly east of the plant, and Kyger Creek is located to the west and south.

The BSP is located at the south end of the KCGS and is approximately 32 acres in size (Figure 1). The BSP was built in 1955 to serve, and still currently serves, as a process and disposal area for the coal combustion waste products generated at the station. Overflow from the BSP is carried into a reinforced concrete intake structure at the south end of the Boiler Slag Complex. Water entering the intake structure is discharged into the Clearwater Pond. The Clearwater Pond was built in 1980, is approximately nine (9) acres in size and is located to the southwest end of the BSP. The Clearwater Pond is not a CCR Unit and monitoring is not required. (AGES, 2016).

The BSP at the KCGS meets the EPA definition of a CCR surface impoundment because it is a manmade area designed to hold CCR and liquids and is used to treat, store or dispose of CCR.

1.3 APPROACH AND METHODS

The following factors have been considered to determine whether the BSP located at the Kyger Creek Generating Station meets the requirements for placement above the UMA:

- Identification of the UMA at KCGS;
- Identification of the upper limit of the UMA at KCGS;
- Evaluation of the elevation of the top of the UMA within the extent of the BSP;
- Evaluation of the elevation of the bottom of CCR within the extent of the BSP; and
- Comparison of the elevations of the bottom of the CCR and the top of the UMA within the extent of the BSP.

The following methods were used to determine whether the BSP meets the requirements for placement above the UMA:

- Desktop review of historical documents; and
- Assessment of compliance with the EPA Final CCR Rule.

2.0 UPPERMOST AQUIFER (UMA)

2.1 DEFINITION

The EPA Final CCR Rule § 257.53 provides the following definitions of aquifer and uppermost aquifer (UMA):

> *"Aquifer means a geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of groundwater to wells or springs."*
>
> *"Uppermost aquifer means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary. Upper limit is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season."*

2.2 IDENTIFICATION

Stantec prepared a letter dated October 16, 2017 (Stantec, 2017) including a qualified professional engineer certification which stated that:

> *"…the groundwater monitoring system for the OVEC Kyger Creek Station's CCR Landfill, South Fly Ash Pond, and Boiler Slag Pond has been designed and constructed to meet the requirements specified in 40 CFR 257.9(a), (b), (c), and (e)." (Stantec, 2017).*

The groundwater monitoring system referenced in this letter included eight monitoring wells: KC-15-01 through KC-15-08. The letter indicates that the screened formation for these monitoring wells is the regional aquifer. A copy of this certification is available on the OVEC-IKEC CCR Rule Compliance Data and Information website (OVEC, 2018).

Gallia County is located on the western edge of the Appalachian Basin within the Appalachian Plateau Physiographic Province, Allegheny Section, locally known as the Marietta Plateau. The primary stratigraphic units underlying Gallia County include from youngest to oldest: recent (Holocene) colluvium and alluvium deposits, Pleistocene lacustrine and glacial sand and gravel deposits, and Pennsylvanian age bedrock composed predominantly of shale and sandstone, with occasional thin limestone and coal seams (AGES, 2016)

The geomorphology of the Appalachian Plateau in Gallia County consists of steeply sloping ridges and steep, narrow stream valleys. Upland areas are primarily underlain by sandstone bedrock while valleys are underlain by shale bedrock and colluvial and alluvial sediments. (AGES, 2016).

Regional aquifers in Gallia County include Pleistocene glacial sand and gravel deposits along the Ohio River (Hull, 2008). The BSP is directly underlain by 15 to 50 feet of low permeability clayey silty soil above a sand and gravel unconsolidated aquifer, which was identified as the regional aquifer at the BSP (AGES, 2016). The regional aquifer in the eight monitoring wells included in the certified groundwater monitoring system (KC-15-01 through KC-15-08) was generally described as dense sand and gravel. The sand within the regional aquifer in these borings ranged from fine to coarse grained.

2.3 UPPER LIMIT

According to the EPA Final CCR Rule, the upper limit of the UMA is measured at a point nearest to the natural ground surface to which the aquifer rises during the wet season. For a confined aquifer the top of the UMA is defined based on the structure of the top of the aquifer.

Recent groundwater elevation data collected from monitoring wells completed in the regional aquifer was reviewed to evaluate if groundwater within the regional aquifer is generally present under confined or unconfined conditions. Water levels were measured at eight monitoring wells (which are located around the perimeter of the BSP) completed in the regional aquifer at KCGS during three groundwater monitoring events between January 2016 and May 2016. The groundwater elevations measured during these gauging events ranged from 538.39 to 540.46 feet above mean sea level (ft amsl) (AGES, 2016). The measured groundwater elevations were above the elevation of the top of the regional aquifer at the gauging locations, indicating confined conditions (Stantec, 2017).

The review of groundwater elevation data indicates that groundwater within the regional aquifer is generally present under confined conditions; therefore, the top of the UMA beneath the BSP is defined based on the structure of the top of the regional aquifer.

For this demonstration, the top of the UMA was identified as a transition from finer grained material consistent with the alluvium that is present above the UMA to coarse grained material consistent with the UMA (as discussed in section 2.2).

2.4 DESKTOP REVIEW OF STRUCTURE

Stantec reviewed the boring logs of eight, certified groundwater monitoring well network locations that were completed at KCGS with indications of the elevation of the top of the regional aquifer. These borings and associated monitoring well locations (which are located around the perimeter of the BSP) are shown on Figure 3.

The elevation of the top of the regional aquifer at the BSP monitoring wells ranged from 521.8 to 522.8 ft amsl. The groundwater monitoring well locations and associated estimated elevations of the top of the regional aquifer are presented on Figure 3.

Stantec also reviewed sixteen historic soil boring logs presented in a History of Construction report (AEP, 2016). Based on historic figures presented within the report, the soil borings were advanced around 1953, and were located within, and adjacent to the current BSP unit. Historic soil borings adjacent to the BSP indicated that the elevation of the top of the regional aquifer ranged from approximately 513 to 536 ft amsl, which was generally consistent with elevations observed in the monitoring well network borings.

2.5 STRUCTURE OF THE TOP OF THE UMA

Interpolation of data between data points is an industry standard approach for utilizing geologic data from borings and wells. The stratigraphy data points identified in Figure 3 were interpolated to produce a raster representing the elevation of the top of the regional aquifer using a natural neighbor method (ESRI, 2016).

Figure 3 presents the interpolated surface representing the structure of the top of the regional aquifer. The figure also includes labels for the data points used to produce the surface. Beneath the BSP, the interpolated elevation of the top of the UMA ranges from 510.5 to 522.8 ft amsl, with an average elevation of 519.37 ft amsl.

3.0 AFFECTED BOUNDARY (BASE OF CCR UNIT)

To determine if the CCR unit meets the requirement for placement above the UMA, the affected boundary (base elevation of the CCR material) must be identified. Stantec developed a topographic surface representing the affected boundary (Figure 4). The surface was created by digitizing the USGS topographic map of the Point Pleasant Quadrangle (USGS, 1929).

4.0 AQUIFER SEPARATION

4.1 ISOPACH

The revised raster representing the top of the UMA (Section 2.6 and Figure 3) was subtracted from the raster representing the base of the CCR unit (Section 3.0 and Figure 4) to produce an isopach map with five-foot contour intervals (Figure 5) representing the separation of the base of the CCR unit from the top of the UMA. Within the extent of the BSP, the interpolated separation between the base of the CCR unit and the UMA was greater than 5 feet. The areas of the smallest interpolated separation distances are located within the eastern area of the BSP.

4.2 DISCUSSION

The following factors were considered to determine whether the BSP located at KCGS meets the requirements for placement above the UMA:

- Identification of the UMA at the BSP.
    - Regional aquifer (Stantec, 2017; AGES, 2016).

- Identification of the upper limit of the UMA at the BSP.
  - Gauging data indicates that groundwater within the regional aquifer is confined (AGES, 2016). The upper limit of the UMA is consistent with the stratigraphic top of the regional aquifer.
- Interpolated elevation of the top of the UMA within the extent of the BSP.
  - The elevation of the top of the UMA ranges from 510.5 to 522.8 ft amsl within the extent of the BSP based on interpolation of data from available boring logs (Sections 2.3 through 2.6).
- Interpolated elevation of the base of the CCR unit within the extent of the BSP.
  - Within the extent of the BSP, contours representing the base of the CCR were interpolated based on the interpretation of pre-construction contours and design drawings.
- Comparison of the elevations of the base of the CCR unit and the top of the UMA within the extent of the BSP.
  - The interpolated isopach map (Figure 5) representing the thickness of the deposits separating the CCR material from the top of the UMA indicates that the separation distance between the base of the CCR unit and the UMA is greater than five feet (Section 4.1).

5.0 CONCLUSIONS

Based on this assessment of the UMA and the CCR unit, the requirements of §257.60 of the EPA Final CCR Rule for placement above the UMA at the BSP at KCGS have been met.

6.0 LIMITATIONS

Boring logs, and reports completed by others have been furnished to Stantec by OVEC which Stantec has used, as furnished, in preparing this demonstration report. For identification of the UMA at KCGS, Stantec relied on the certification of the monitoring well network by a professional engineer which was included in the Stantec letter as discussed above (Stantec, 2017). Identification of separation distance relies of interpolation of data between data points.

7.0 REFERENCES

American Electric Power (AEP) (2016). History of Construction, Boiler Slag Pond, Kyger Creek Station, Cheshire, Ohio

Applied Geology and Environmental Science, Inc. (2016). Coal Combustion Residuals Regulation (CCR) Groundwater Monitoring Program Plan, Ohio Valley Electric Corporation, Kyger Creek Station, Cheshire, Gallia County, Ohio.

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Environmental Protection Agency (EPA) (2016). Federal Register, Vol. 80, No. 74, Part II. 40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule.

Environmental Systems Research Institute, Inc. (ESRI) (2016). How Natural Neighbor works – ArcMap 10.3. (http://desktop.arcgis.com/en/arcmap/10.3/tools/spatial-analyst-toolbox/how-natural-neighbor-works.htm)

Hull and Associates, Inc. 2017. Hydrogeologic and Subsurface Investigation Report

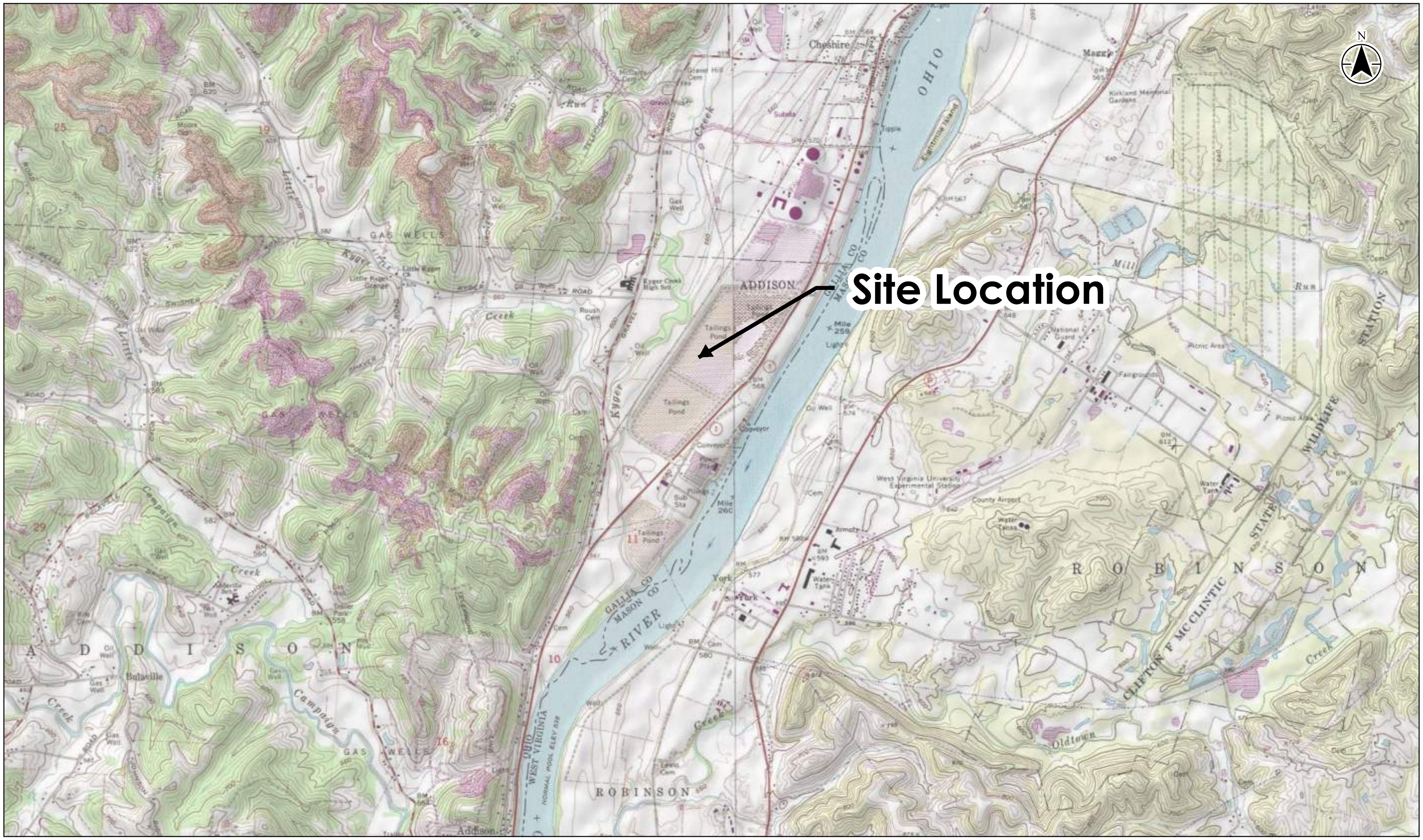
Ohio Division of Geological Survey, 2006, Bedrock geologic map of Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map BG-1, scale 1:2,000,00 (Revised 2017).

Ohio Valley Electric Corporation CCR Rule Compliance Data and Information, Kyger Creek Station (https://www.ovec.com/CCRKyger.php)

Stantec Consulting Services Inc. (2017). Groundwater Monitoring System, CCR Landfill, South Fly Ash Pond, and Boiler Slag Pond, EPA Final Coal Combustion Residuals (CCR) Rule, Kyger Creek Station, Cheshire, Gallia County, Ohio.

United States Geological Survey (USGS) (1929). Point Pleasant Quadrangle, W. VA.-O. Scale 1:62500

FIGURES



0 2,100 4,200 Feet

1:48,000 (At original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 2011 StatePlane Ohio South FIPS 3402 Ft US
2. Basemap Data Source: Copyright:© 2013 National Geographic Society, i-cubed

Stantec

Prepared by CNK on 2018-07-18
Technical Review by ABC on 2014-01-21
Independent Review by ABC on 2014-01-21

Client/Project
Ohio Valley Electric Corporation
Kyger Creek Generationg Station

Figure No.
1

DRAFT

Title
SITE LOCATION MAP
KYGER CREEK

Q:\active\175534017\03_data\gis_cad\2018_08\fig1_Site_Location_Map_Kyger_Creek_20180711.mxd Revised: 2018-08-29 By: ckwiatkowski

Legend

- Monitoring Well
- Site Boundary
- Road

0 260 520 Feet

1:6,000 (At original document size of 8.5x11)

Notes

1. Coordinate System: NAD 1983 2011 StatePlane Ohio South FIPS 3402 Ft US
2. Basemap Data Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Prepared by CNK on 2018-08-27
Technical Review by ABC on 2014-01-21
Independent Review by ABC on 2014-01-21

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Kyger Creek Generationg Station

Figure No.

2

DRAFT

Title

SITE MAP
BOILER SLAG POND

Q:\active\175534017\03_data\gis_cad\2018_08\Boiler Slag Pond Figures\fig2_Site_Map_Boiler_Slag_Pond_20180827.mxd Revised: 2018-08-30 By: ckwiatkowski

Legend

- Monitoring Well
- Interpolated top of Uppermost Aquifer (C.I. - 2 feet)
- Extraolated top of Uppermost Aquifer (C.I. - 2 feet)
- Site Boundary
- Road

Notes

1. Coordinate System: NAD 1983 2011 StatePlane Ohio South FIPS 3402 Ft US
2. Basemap Data Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
3. Top of uppermost aquifer interpolated from boiring logs
4. **KC-15-04**
   521.89 Uppermost Aquifer Level (FT AMSL)

0 270 540 Feet

1:6,000 (At original document size of 8.5x11)

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Prepared by CNK on 2018-08-27
Technical Review by ABC on 2014-01-21
Independent Review by ABC on 2014-01-21

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Ohio Valley Electric Corporation
Kyger Creek Generationg Station

Figure No.
3

DRAFT

Title

INTERPOLATED TOP OF THE UPPERMOST AQUIFER BOILER SLAG POND

Q:\active\175534017\03_data\gis_cad\2018_08\Boiler Slag Pond Figures\fig3_Top_Aquifer_Boiler_Slag_Pond_20180827.mxd Revised: 2018-08-30 By: ckwiatkowski

Legend

- Monitoring Well
- Pre-Construction Ground Surface (USGS, 1957) (C.I. - 10 feet)
- Site Boundary
- Road

Notes

1. Coordinate System: NAD 1983 2011 StatePlane Ohio South FIPS 3402 Ft US
2. Basemap Data Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
3. Pre-Construction Ground Surface Contours from: United States Geological Survey (USGS) (1957). Point Pleasant Quadrangle for Huntington, W. VA.-O. Scale 1:250000

0 270 540 Feet

1:6,000 (At original document size of 8.5x11)

Stantec

Prepared by CNK on 2018-08-28
Technical Review by ABC on 2014-01-21
Independent Review by ABC on 2014-01-21

Client/Project

Ohio Valley Electric Corporation
Kyger Creek Generationg Station

Figure No.
4

DRAFT

Title

ESTIMATED AFFECTED BOUNDARY (BASE OF CCR UNIT) BOILER SLAG POND

Q:\active\175534017\03_data\gis_cad\2018_08\Boiler Slag Pond Figures\fig4_Base_CCR_Boiler_Slag_Pond_20180828.mxd Revised: 2018-08-30 By: ckwiatkowski

Legend

- Monitoring Well
- Interpolated Isopach Thickness of Separation (Bottom of CCR - Top of UMA) (C.I. = 5 feet)
- Extrapolated Isopach Thickness of Separation (Bottom of CCR - Top of UMA) (C.I. = 5 feet)
- Site Boundary
- Road

0 270 540 Feet

1:6,000 (At original document size of 8.5x11)

Notes

1. Coordinate System: NAD 1983 2011 StatePlane Ohio South FIPS 3402 Ft US
2. Basemap Data Source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Stantec

Prepared by CNK on 2018-08-28
Technical Review by ABC on 2014-01-21
Independent Review by ABC on 2014-01-21

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Ohio Valley Electric Corporation
Kyger Creek Generationg Station

Figure No.
5

DRAFT

Title
ISOPACH MAP OF AQUIFER SEPARATION BOILER SLAG POND

Q:\active\175534017\03_data\gis_cad\2018_08\Boiler Slag Pond Figures\fig5_Aquifer_Seperation_Boiler_Slag_Pond_20180828.mxd Revised: 2018-08-30 By: ckwiatkowski

ATTACHMENT B
WETLANDS COMPLIANCE DEMONSTRATION REPORT

Compliance Demonstration Report – Wetlands
Boiler Slag Pond
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.
10509 Timberwood Circle
Louisville, Kentucky 40223

October 16, 2018

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COMPLIANCE DEMONSTRATION REPORT – WETLANDS
BOILER SLAG POND
KYGER CREEK STATION

October 16, 2018

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 to demonstrate proficiency regarding wetlands at the applicable CCR units of the Kyger Creek Station and evaluate compliance with §257.61 of the CCR Rule.

As required by §257.61 of the EPA Final CCR Rule, an owner or operator of a 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 a wetland, as defined in §232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section this the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.

Wetlands are defined under Section 404 of the Clean Water Act (CWA) as:

> "Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

Wetlands are further defined under §232.2 as a water having a "significant nexus" when any single function or combination of functions performed by the water, alone or together with similarly situated waters in the region, contributes significantly to the chemical, physical, or biological integrity of the nearest water of the U.S.

The U.S. Army Corps of Engineers, as described in the Corps of Engineers Wetland Delineation Manual (1987) provides further guidance in the identification of jurisdictional wetlands as:

> "Explicit in the definition is the consideration of three environmental parameters: hydrology, soil, and vegetation. Positive wetland indicators of all three parameters are normally present in wetlands. Although vegetation is often the most readily observed parameter, sole reliance on vegetation or either of the other parameters as the determinant of wetlands can sometimes be misleading. Many plant species can grow successfully in both wetlands and non-wetlands, and hydrophytic vegetation and hydric soils may persist for decades following alteration of hydrology that will render an area a non-wetland. The presence of hydric soils and

> wetland hydrology indicators in addition to vegetation indicators will provide a logical, easily defensible, and technical basis for the presence of wetlands. The combined use of indicators for all three parameters will enhance the technical accuracy, consistency, and credibility of wetland determinations."

Per §257.61(a), this provision prohibits the location of new CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units in wetlands unless the requirements of Sections 257.61(a)(1) through (5) are demonstrated to be met. If the unit is not in a wetland, no further analysis needs to be performed. The demonstration can be written based on evidence used to conclude that the unit is not in a wetland.

The following factors have been considered to determine whether the Boiler Slag Pond located at the Kyger Creek Station is in a wetland:

- Desktop review of available data,
- Field reconnaissance, and
- Experience in similar industrial settings.

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. A plan view of the station is included in Attachment A.

The Boiler Slag Pond is located south of the station adjacent to the Ohio River and is composed of the Boiler Slag Pond and the Clearwater Pond. Constructed in 1955, the complex was created by building a perimeter dike to enclose an area of approximately 40 acres. A splitter dike separates the Bottom Ash Complex into two ponds with the Boiler Slag Pond at 30.1 acres and the Clearwater Pond at 9.39 acres. Boiler slag is sluiced to the north end of the Boiler Slag Pond for settling. Overflow is conveyed through an outlet structure at the Boiler Slag Pond's south end into the Clearwater Pond for polishing. Water discharges into the Ohio River through a NPDES-permitted outlet structure in the southeastern end of the Clearwater Pond (AEPSC, 2016). The Boiler Slag Pond is bounded by State Route 7 to the west, a substation to the north, the Ohio River (Mile 255) to the east, and Kyger Creek and agricultural land to the south. The topography within the area varies from rolling hills to relatively flat, low-lying areas adjacent to major drainage features. Attachment A presents an overview of the Boiler Slag Pond.

3.0 DESKTOP REVIEW

A desktop review of available data was performed to determine the likelihood of the unit being sited in a wetland by evaluating the potential for wetlands within the CCR unit boundary, as defined by the outside toe of slope of the exterior dike. The desktop review of publicly available data for the facility included:

- U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) Mapping,
- U.S Geologic Survey Topographic Mapping,
- Natural Resources Conservation Service's (NRCS) Web Soil Survey, and
- FEMA Flood Maps.

Stantec reviewed available data for the presence or absence of wetlands within the Boiler Slag Pond boundary. The NWI mapping identified two wetlands within the unit boundary; however, the identified wetlands are within the treatment pond and not considered wetlands for the purposes of this demonstration.

The USGS topographic mapping indicates that no tributaries to the Ohio River, a traditional navigable water, originate in or near the Unit boundary. Little Kyger Creek, a tributary to the Ohio River, flows from the northwest to the southeast into the Ohio River just south of the impoundment dike for the Boiler Slag Pond.

The NRCS Soils Survey for Gallia County, Ohio identifies four soils within the study area. These are Mine dumps, Elkinsville silt loam, Newark silt loam, and Nolin silt loam. All four soils are listed as non-hydric with Elkinsville silt loam, Newark silt loam, and Nolin silt loam having minor hydric components.

A review of the FEMA flood maps indicates that the Boiler Slag Pond is designated Zone AE within the 100-year flood zone for the Ohio River. Approximately one-third of the unit along the southeast border is located within the designated floodway.

4.0 FIELD RECONNAISSANCE

Following the desktop data review, Stantec qualified biologists performed a field reconnaissance to assess the potential for jurisdictional features.

The reconnaissance investigation was conducted on May 9, 2018. Stantec biologists conducted a pedestrian survey to ascertain whether any areas of potential wetlands were present within the Boiler Slag Pond CCR Unit boundary. Upland plant communities typical of the region were the main species observed. Vegetation within the immediate vicinity of the Unit boundary was predominately maintained grass turf vegetation. One wetland area (Wetland A) was identified just outside of the study area boundary. Two additional locations (TP-01 and TP-02) were examined for potential wetland presence, but were found to be uplands. No wetland indicators were observed within the Boiler Slag Pond study area.

5.0 CONCLUSIONS

The desktop review provided no indication that the subject ash pond is located within wetlands.

It is Stantec's professional opinion that the current conditions of the subject ash pond meet the wetlands location requirements of the EPA Final CCR Rule §257.61.

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Attachment A: Site Reconnaissance Study Area Map

Attachment A

Title **CCR Wetlands Analysis**
Site Reconnaissance Study Area Map
Boiler Slag Pond

Client/Project
Kryger Creek Station
OKEC
CCR Analysis

Project Location 175534017
Cheshire, Gallia County, Ohio
Prepared by SPK on 2018-10-10
Technical Review by BW on 2018-10-10
Independent Review by RVD on 2018-10-10

0 250 500 750 Feet
1:3,600 (At original document size of 11x17)

Potential Wetlands
Stream
Study Area
Test Pit
Culvert

Notes

1. Coordinate System: NAD 1983 StatePlane Ohio South FIPS 3402 Feet
2. ImagerySource: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
3. No hydric soils are located within the project area

Stantec

ATTACHMENT C
FAULT AREAS COMPLIANCE DEMONSTRATION REPORT

Compliance Demonstration Report - Fault Areas
Boiler Slag Pond
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

1.0 INTRODUCTION AND RULE REQUIREMENTS

1.1 OBJECTIVE

The objective of this document is to present an assessment and engineering conclusions regarding the subject CCR unit's compliance with the Environmental Protection Agency (EPA) Final Coal Combustion Residual (CCR) Rule, 40 CFR 257.62(c) regarding fault areas.

1.2 RULE REQUIREMENTS

As required by §257.62 (a) of the EPA Final CCR Rule:

> *New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.*

2.0 ASSESSMENT

The Fault Areas demonstration was comprised of two phases: a literature survey/review and a Neotectonic analysis. A literature survey/review using available published data was performed, and the results are reported in "Literature Survey and Discussion of the Geology and Seismicity near Kyger Creek Fossil Plant, Southeastern Ohio". The result of this survey is included in Appendix A.

The Neotectonic analysis, a compilation of a lineament analysis and drainage analysis, was performed in the vicinity of and including the Boiler Slag Pond. The results of the neotectonics analysis are reported in "Neotectonics Analysis, CCR Unit Location Restrictions Demonstrations – Kyger Creek Plant, Cheshire, Ohio". This report is included in Appendix B.

3.0 CONCLUSIONS

Based on this assessment, the Boiler Slag Pond located at Kyger Creek Station meets the requirements of §257.62 of the EPA Final CCR Rule.

4.0 REFERENCES

Stantec Consulting Ltd. (2018). Neotectonic Analysis, CCR Unit Location Restrictions Demonstrations – Kyger Creek Plant, Cheshire, Ohio. May.

Dr. Robert D. Hatcher, Jr. (2018). Literature Survey and Discussion of the Geology and Seismicity near Kyger Creek Fossil Plant, Southeastern Ohio. May.

APPENDIX A
LITERATURE SURVEY

Literature Survey and Discussion of the Geology and Seismicity near Kyger Creek Fossil Plant, Southeastern Ohio

Robert D. Hatcher, Jr., Ph.D., P.G.
Department of Earth and Planetary Sciences
and Science Alliance Center of Excellence
University of Tennessee–Knoxville

Robert D. Hatcher, Jr.

May 6, 2018

Introduction

The purpose of this report is to provide a literature survey and discussion of known active or potentially active faults in the vicinity of the Ohio Valley Electric Corporation Kyger Creek Fossil Plant. This plant is located on the Ohio River floodplain near Cheshire, Ohio, some 40 (65 km) mi south of Athens, Ohio, and some 10 (16 km) mi north of Point Pleasant, West Virginia (Fig. 1; 38.935888° N, 82.116863° W). The Kyger Creek Plant is capable of producing 1,000 MW of electric power (Wikipedia). Concern is for seismic or other geologic hazards that could impact the integrity of the Coal Combustion Residuals Landfill, the Boiler Slag Pond, and the South Fly Ash Pond.

The references cited in this report are those considered critical for understanding the geology, paleoseismology, and seismicity of the region and near the Kyger Creek Fossil Plant in southeastern Ohio. Many of the papers, maps, and reports cited here contain a wealth of additional citations in their own references that provide much greater detail about the surface and subsurface geology and seismicity in the region. Several of these reports and publications include: Cardwell et al. (1968), McDowell et al. (1981), Slucher et al. (2006), Obermeier et al. (1991), Wheeler (1996), McBride and Nelson (2001), McBride et al. (2002), Petersen et al. (2014), and Marshak et al. (2016).

A useful definition of an active fault could be:

An active fault (or earthquake fault) is one that has been demonstrated to have moved during the Holocene (last 11,000 years). This would include the zone of deformation (damage zone) on either side of the fault, which would include geologic structures (folds, subsidiary faults, joints and shear fractures, etc.) that would have been produced as coseismic features during movement on the fault that produced seismicity (California Geological Survey, 2007).

Regional Geology and Seismicity

The Kyger Creek site is located immediately near Cheshire and north of Point Pleasant along the Ohio River in southeastern Ohio (Fig. 1). Surface geology consists of Pleistocene to Recent glaciogenic and river sediments on the Ohio River floodplain that overlie Pennsylvanian sedimentary rocks west and east of the river (Caldwell et al., 1968; McDowell et al., 1981; Reed et al., 2005; Slucher et al., 2006).

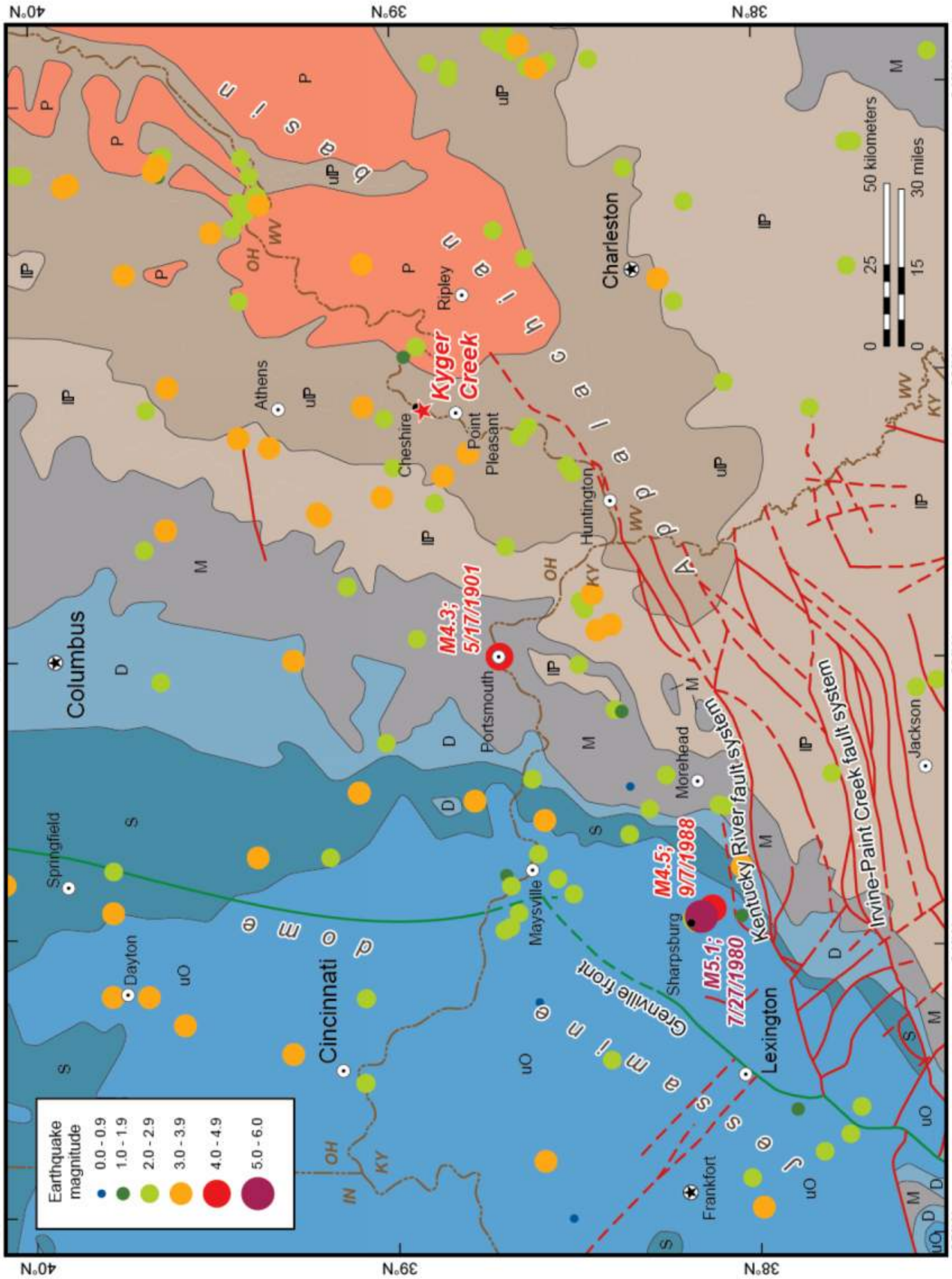

Figure 1. Location of the Kyger Creek Fossil Plant in southeastern Ohio showing the locations of earthquakes and regional geology. Red lines are mapped faults. Green line is teh subsurface Grenville front. uO–Upper Ordovician rocks. S–Silurian rocks. D–Devonian rocks. M–Mississippian rocks. IP–lower Pennsylvanian rocks. UP–upper Pennsylvanian rocks. P–Permian rocks. Sources: Political boundaries - National Atlas Data; Geology - Garrity, C. P., and Soller, D. R., 2009, Reed et al. (2005). Baranowski (2013). Earthquakes - USGS Earthquake Hazards Program, NEIC. Northern California Earthquake Data Center (NCEDC), 2014, ANSS (Advanced National Seismic System) Dataset: UC Berkeley Seismological Laboratory. doi:10.7932/NCEDC. Catalog of Ohio Earthquakes of 2.0 or Greater Magnitude, 2017, Ohio DNR Division of Geologic Survey. [http://geosurvey.ohiodnr.gov/earthquakes-ohioseis/quakes-felt-in-ohio/catalog-of-past-ohio-quakes/catalog-home].

Seismicity in this region varies both geographically and temporally, with most seismic activity concentrated far to the west in the Wabash Valley fault zone along the Indiana-Illinois border. Obermeier et al. (1991) discussed the seismic hazard of the Wabash Valley fault zone, indicating that there have been significant earthquakes in this area in the prehistoric past, but with a recurrence interval of thousands of years. Most of the largest earthquakes (>M 5.0) that have occurred in this region in the past several decades have occurred in the Wabash Valley seismic zone (Fig. 1). A M 5.1 earthquake occurred near Sharpsburg, KY, some 115 mi southwest of the

Kyger Creek site in 1980, and a M 4.5 earthquake occurred in the same area (but not exactly at the same location) in 1988. A M 4.3 earthquake occurred in 1901 at Portsmouth, Ohio, some 30 mi west-southwest of the Kyger Creek site (see Fig. 1 and sources of information). No active faults have been identified within the Kyger Creek Fossil Plant, within 200 ft of the facilities of concern, or within 50 mi of the site.

Although the Marshak et al. (2016) report deals with the geology and seismic hazard of the area from Indiana to eastern Missouri, and southward into Kentucky and part of Arkansas, it provides a useful summary of the regional perspective for the most tectonically active region in the eastern U.S. McBride and Nelson (2001) and McBride et al. (2002) recognized numerous faults in southwestern Illinois that cut young sediments there, and may pose a seismic hazard.

Kyger Creek Site Geology and Potentially Active Faults within Two Miles of the Site

The Kyger Creek site is located on the southeast flank of the Jessamine dome in the eastward transition into the Appalachian basin. The youngest rocks in the Appalachian basin, the Early Permian Dunkard Group, occur only a few miles northeast of the Kyger Creek site (Fig. 1). Ordovician rocks are predominantly limestone, with some shaly limestone and shale in the upper part of the section; Lower Silurian rocks consist of limestone, while Middle Silurian rocks consist of limestone and shale; and Lower and Middle Devonian rocks (all in Ohio) consist of limestone; and Upper Devonian rocks farther west are predominantly shale (New Albany black shale). Mississippian rocks are dominantly marine limestones and shales with minor sandstone; Pennsylvanian rocks consist of sandstones and shales, with some coal beds, and younger Permian rocks similarly consist of sandstone and shale (Cardwell et al., 1968; McDowell et al., 1981; Slucher et al., 2006). Sediments on the Ohio River floodplain consist of Pleistocene glacial outwash (and reworked glacial sediments) and drift, while Quaternary alluvium consists of sands, clays, and gravels Miller and King (2016).

Faults belonging to the Paleozoic Kentucky River and Irvine-Paint Creek fault systems (Fig. 1) largely terminate around the Kentucky-West Virginia state line, with one segment of the Kentucky River fault system passing through the edge of Huntington and northeastward to within ~15 mi of the Kyger Creek site (Cardwell et al., 1968; McDowell et al., 1981). None of the low level of seismic activity in this region has been associated with any of these faults (Hansen, 2012) (Fig. 1). Other major subsurface regional structures, such as the early Paleozoic Rome trough or the even older late Mesoproterozoic Grenville front (Drahovzal and Noger, 1995; Baranowski, 2013) produced faults that have not had any activity since the early Paleozoic or during earlier geologic periods.

None of the available geologic maps of this region (Cardwell et al., 1968; McDowell et al., 1981; Slucher et al., 2006) indicate any surface faults exist within >50 mi of the site, or summaries of seismic activity in Ohio and Kentucky (e. g., Wang et al., 2008; Hansen, 2012) indicate any active faults within several miles of the Kyger Creek site. The geotechnical/hydrologic investigation in the area around the ash ponds by Miller and King (2016) did not identify any faults or active faults within 200 feet or several miles of the Kyger Creek site.

Conclusions

1. The Kyger Creek site is located along the eastern flank of the Jessamine dome in southeastern Ohio, resting on Pleistocene and Holocene Ohio River and tributary stream alluvium, and glacial outwash (and reworked sediments). The underlying bedrock consists of Upper Pennsylvanian sandstone and shale, with Permian rocks along the axis of the Appalachian (locally the Dunkard) basin located a very short distance to the east in West Virginia.

2. The Kyger Creek power plant is located in a region of low seismicity. The only significant historic seismic events in the region are several M 4.5 to 5.2 earthquakes that occurred from 1901 to 2008 near Portsmouth, Ohio (1901), and Sharpsburg, KY (1980 and 1988), and in or near the Wabash Valley seismic zone along the border between Indiana and Illinois.

3. None of the literature reviewed, including published papers and reports from other organizations, have indicated the existence of any active faults within two miles of the Ohio Valley Electric Corporation Kyger Creek Fossil Plant.

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APPENDIX B
NEOTECTONIC ANALYSIS

CCR Unit Location Restrictions Demonstrations—Kyger Creek Plant, Cheshire, Ohio

Neotectonics Analysis

October 12, 2018

Prepared for:

Ohio Valley Electric Corporation

Prepared by:

Stantec Consulting Ltd.
500 – 4730 Kingsway
Burnaby, British Columbia
V5H 0C6

Revision	Description	Author		Quality Check		Independent Review	
A	Draft	M. Hackett	2018-03-26	S. Tsang	2018-04-05	R. Guthrie	2018-05-02
0	Final	M. Hackett	2018-10-11	S. Tsang	2018-10-12	R. Guthrie	2018-10-12

Sign-off Sheet

This document entitled CCR Unit Location Restrictions Demonstrations—Kyger Creek Plant, Cheshire, Ohio was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Ohio Valley Electric Corporation (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by Melanie Hackett

(signature)

Melanie Hackett, G.I.T.

Reviewed by Sid Tsang

(signature)

Sid Tsang, P.Geo. (AB, BC, MB)

Approved by ______________________________

(signature)

Richard Guthrie, M.Sc., Ph.D., P.Geo. (AB, BC)

Table of Contents

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by the Ohio Valley Electric Corporation (OVEC) to conduct a Phase 1 Assessment for a fault area demonstration of the Kyger Creek Plant near Cheshire, Ohio. The demonstration is required by the U.S. Environmental Protection Agency (EPA) Disposal of Coal Combustion Residuals (CCR) from Electric Utilities rule. In accordance with the Stantec proposal dated August 25, 2017, this investigation was to include:

- A literature review of publicly available data of known active or potentially active (last 11,000 years) faults in the vicinity of the CCR Landfill, the South Fly Ash Pond (SFAP) and the Boiler Slag Pond (BSP).
- A neotectonics analysis within a two-mile radius of the CCR landfill, SFAP and BSP sites, hereafter referred to as the study area (Figure 1-1).

The neotectonics analysis was conducted to support the fault area demonstration only and the conclusions are not valid for other applications. The neotectonics analysis is based on a literature review of cited references, desktop lineament and drainage mapping based on interpretation of LiDAR hillshade and satellite imagery. No fieldwork was conducted to verify actual conditions within the study limits.

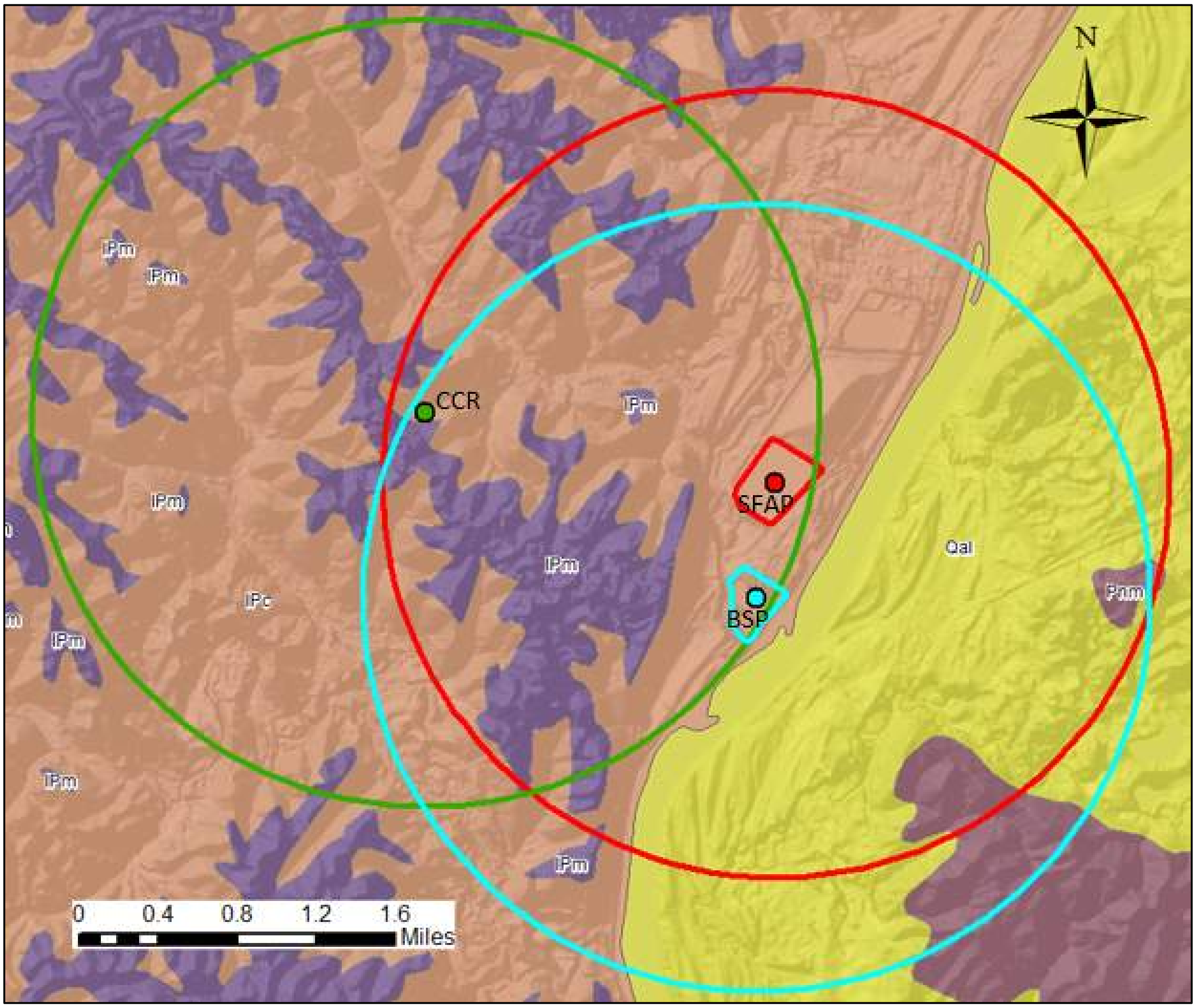
1.1 SCOPE OF WORK

For the purpose of this investigation, we define neotectonics as the study of geologically recent (last 11,000 years) movement and deformation of the earth's crust and measurement of its local effects on the creation of geomorphological features observed at the surface. The scope of work for this neotectonics analysis comprises three tasks:

Task 1 builds on the literature review findings by utilizing the online USGS seismic hazard map, the USGS online interactive faults map, the U.S. Department of Agriculture soil survey website, the Ohio Geological Survey map website, and the West Virginia Geological Survey geologic map information service website. Publicly available maps, reports and scientific literature relevant to the terrain conditions near Kyger Creek Plant were also reviewed.

Task 2 involves a lineament analysis where lineaments are mapped from air photographs and hillshade imagery built from Light Detection and Ranging (LiDAR) and Digital Elevation Model (DEM), within at least a two-mile radius of the CCR Landfill, SFAP and BSP sites. The mapping was carried out in ESRI ArcGIS® software to facilitate plotting of maps and viewing spatial data.

Task 3 involves a drainage analysis of well-defined patterns (dendritic, parallel, trellis, rectangular, radial, annular and contorted), which are not redirected by anthropogenic activity. Deviations from an expected pattern such as a flow direction that is oblique to the regional topographic gradient could indicate structural or lithological discontinuities.



NOTE: CCR = Coal Combustion Residuals landfill; BSP = Boiler Slag Pond; SFAP = South Fly Ash Pond

Map Symbol	Age	Description
Qal	Quaternary	Alluvial - Clay, silt, sand and gravel
IPm	Pennsylvanian	Siltstone and shale
IPc	Pennsylvanian	Siltstone and shale
Pnm	Pennsylvanian	Sandstone and siltstone

Figure 1-1 Geologic Map of the Study Area[1]

[1] Modified from Bedrock geologic map of Ohio (1:2,000,000) Map BG-1 (Ohio Division of Geological Survey 2006) and Geologic Map of West Virginia (1:2,000,000) Map 25A (WVGES 2011); Ohio Geological Survey and West Virginia Geological Survey map websites.

2.0 BACKGROUND INFORMATION

2.1 DATA SOURCES

Readily available background information relevant to the neotectonics analysis and geological conditions was gathered and reviewed. This information included (but was not limited to):

- The Physiographic Regions of Ohio (Ohio Division of Geological Survey 1998)
- Glacial Map of Ohio (Ohio Division of Geological Survey 2005)
- USGS National Seismic Map (Petersen et al. 2014)
- West Virginia Geological and Economic Survey maps
- Ohio Division of Geological Survey geologic map information service website
- United States Department of Agriculture - web soil survey
- Drainage network from the National Hydrographic Dataset
- U.S. Quaternary Faults and Folds Database (USQFFD)
- 2016 DigitalGlobe aerial photographs from the USGS National Map office
- 2007 LiDAR (30 foot-grid) from the USGS National Map office
- DEM (30 foot-grid) from the USGS National Map office
- Publicly available literature relevant to the terrain conditions in the area (Dart and Hansen 2008; Goldthwait 1959; Stout et al. 1943)
- Existing hydrogeologic reports of the study area from the American Electric Power Service Corporation (1995) and Applied Geology and Environmental Science, Inc. (2016)

2.2 PROJECT SETTING

2.2.1 Physiography

The study area is located within the Marietta Plateau physiographic sub-region of Ohio and West Virginia, part of the Appalachian Plateau. The Marietta Plateau is dissected with high relief (generally 350 ft, to 600 ft near the Ohio River). It is composed of fine-grained rocks. Red shales and red soils are common. Lacustrine deposits from the ancient Teays River drainage system are also common (Ohio Division of Geological Survey 1998).

The study area is dissected by the southerly flowing Ohio River. The study area east of the river is comprised of flood plain and lowland topography, while west of the river is high relief topography dissected by a dendritic drainage pattern. The CCR, SFAP and BSP sites are approximately 660, 580 and 560 ft above sea level, respectively.

2.2.2 Bedrock Geology

Regional bedrock geologic mapping shows the study area is underlain by Pennsylvanian sedimentary rocks. West of the Ohio River, the geology is mostly shale and siltstone, and east of the river it is sandstone and siltstone. The Pennsylvanian red mudstones (“red beds”) common throughout the Marietta Plateau are the most landslide-prone rocks in Ohio, producing rotational slumps and earthflows common (Hansen 1995).

No recent faults and folds were previously recorded within the vicinity of the study area. The two closest faults and folds were recorded 65 miles to the west, and 70 miles to the south (OGS, WVGS, and USQFFD online websites).

Between 1776 and 2007, there were two recorded earthquakes with magnitudes between 3.0–3.9 within 12 miles of the Kyger Creek sites (Figure 2-1). One epicenter is located approximately 12 miles west of Addison, and the other is located 12 miles north of the study area. A magnitude 4.0–4.9 earthquake was recorded in 1901 approximately 50 miles west-southwest of the study area (Dart and Hansen 2008).

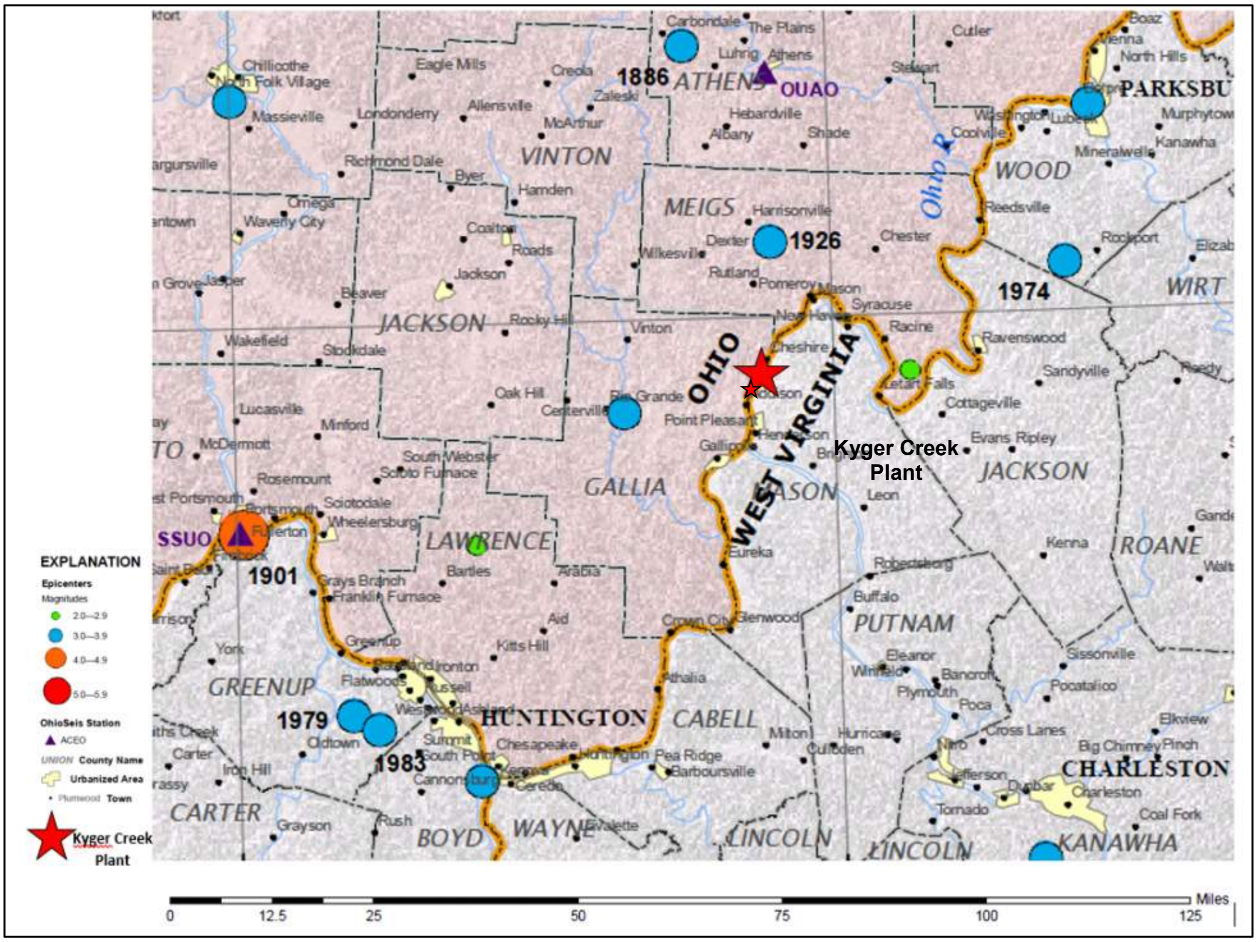


Figure 2-1 Earthquakes in Ohio and Vicinity 1776–2007[2]

The 2014 USGS National Seismic Hazard Model displays a probabilistic seismic hazard map with a 2% probability of exceedance in 50 years (Figure 2-2). The map was derived from information on potential earthquake hazards based on probabilistic risk assessment, and incorporates new findings on earthquakes ground shaking, faults, seismicity, and geodesy (Petersen et al. 2014). The seismic hazard level is shown as low for the Kyger Creek Plant.

[2] Modified from Dart and Hansen 2008.

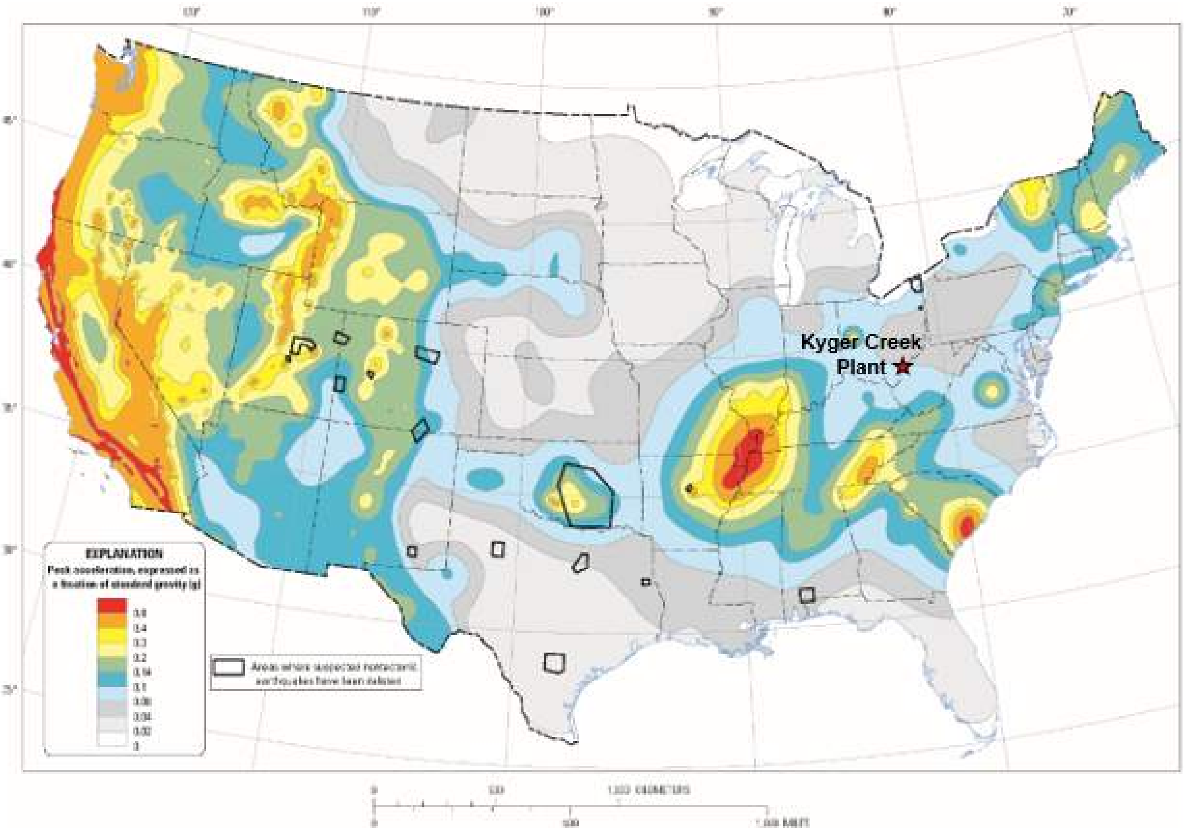


Figure 2-2 2014 USGS National Seismic Hazard Map, 2% Probability of Exceedance in 50 Years Map of Peak Ground Acceleration

2.2.3 Quaternary and Surficial Geology

During the Pleistocene (2.6 M to 12,000 years before present), the northwestern three-quarters of Ohio was glaciated by ice sheets flowing south from central Canada. These glaciers carved the landscape and deposited till (morainal material) throughout the region and created a lower relief topography. The study area, on the southeastern border of Ohio, was not glaciated. The unglaciated quarter of the state has high relief, with steep valley walls that were incised by glacial meltwater. The last of the ice was gone from Ohio by about 14,000 years ago (Hansen 2008).

Prior to the last Ice Age, the southern portions of Ohio were drained by the major Teays River system, which had its headwaters in the Appalachian Highlands. During glaciation, the Teays River was dammed by the Kansan or pre-Kansan glacier (Stout et al. 1943), forming a 7,000-square-mile lake (Proglacial Lake Tight) that encompasses the study area. Lacustrine clays and silts known as the Minford Silts were deposited as a result (Hansen 2008). Although the study area was unglaciated, the landscape was incised by abundant meltwater at the end of glaciation, and outwash deposits are present. The abundant outwash deposits occasionally dammed valley outlets, forming lakes and making lacustrine deposits common in this area (Ohio Division of Geological Survey 2005).

Much of the surficial material in the study area is colluvium and soils formed from the weathering of the Pennsylvanian sedimentary bedrock that comprises the area. East of the Ohio River, in the lowlands of the study area, alluvium is deposited by the present-day Ohio River.

Based on data from Applied Geology and Environmental Science, Inc (2016), the BSP is underlain by deposits of silts and clays ranging from 15 to 50 ft thick. The silts and clays transition to a layer of dense sand and gravel where groundwater is present. The SFAP is directly underlain by 10 to 20 ft of silty clay over a sand and gravel aquifer. The sedimentary bedrock is found 70 to 95 ft below ground surface (Miller and King 2016).

3.0 LINEAMENT ANALYSIS

The desktop lineament analysis utilizes 2016 aerial photographs and hillshade imagery built from 2007 DEM and LiDAR data. The aerial photographs and hillshade imagery, along with GIS layers (faults and earthquakes epicenter inventory, geology, surficial material, drainage flowlines), were viewed and interpreted in ESRI ArcGIS software.

The lineament analysis is based on visible interpretation of linear, rectilinear or curvilinear surface features that are suspected to reflect subsurface phenomena. Changes in elevation, slope gradients and surface patterns are also used to identify lineaments. Without local geophysical data, mapping of these surface features is subjective at best.

Although too small-scale to map as lineaments, many of the ridges in the study area trend SW-NE, reflecting the regional trend of the recorded faults and folds in the Appalachian Plateau. Each lineament is numbered, and several lineaments follow this regional trend (Figure 3-1). Lineaments are summarized in Table 3-1. L7 and L9, which are connected by the yellow L8 (an inferred lineament), trend in a SW-NE direction. There is no clear evidence of active faulting. However, much of the flood plain is altered by human activity and obscured by the river. There is a possibility that a lineament exists through the SFAP connecting L7 and L9, but further investigation would be required to confirm whether this is the case and whether active faulting is a possibility.

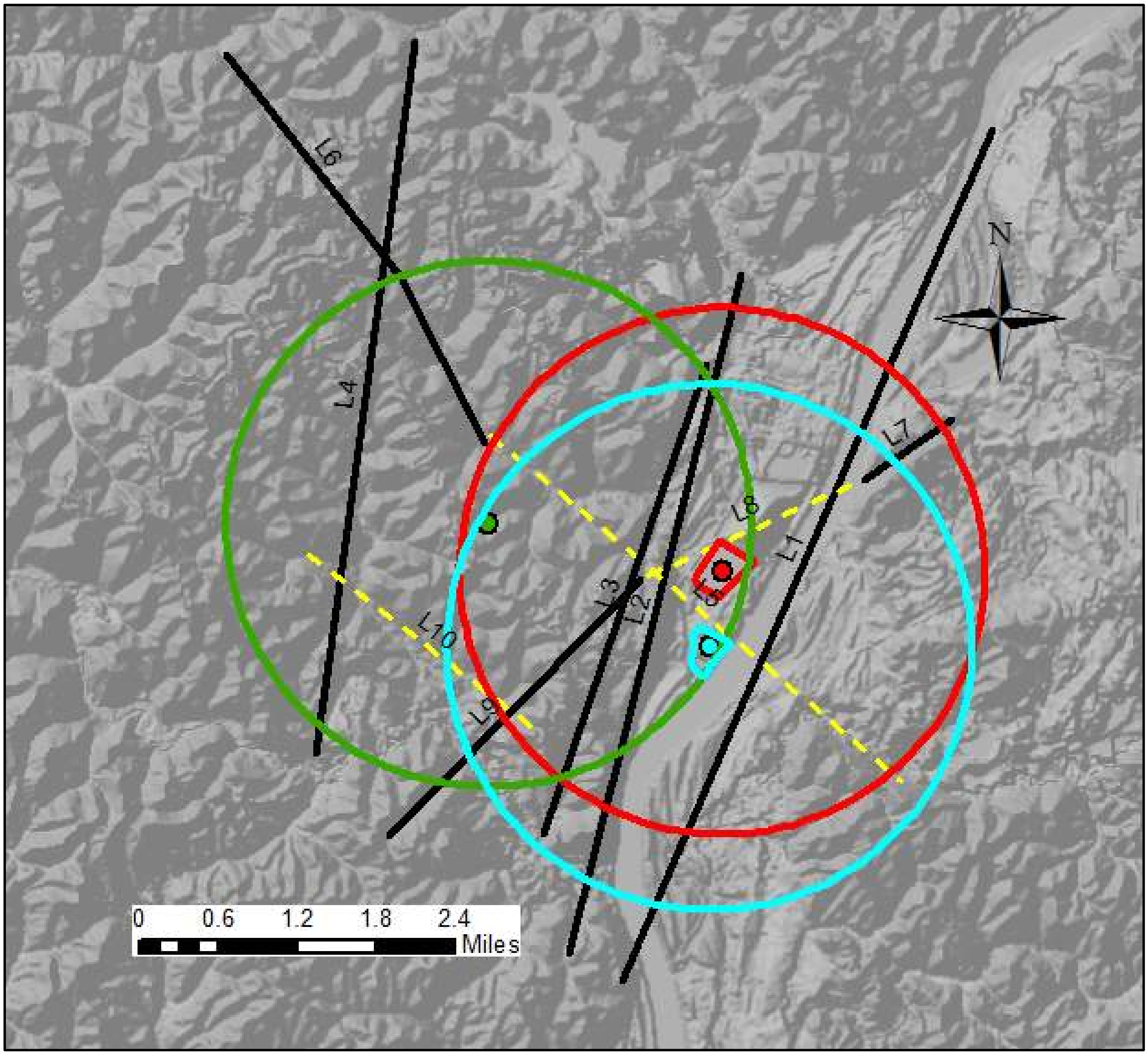
L1 represents the Ohio River Valley, which is inferred to be the geologic contact between the sandstone beds east of the river and the shales west of the river. L2 and L3 indicate the contact between the Quaternary alluvium and the Pennsylvanian bedrock.

Another set of parallel lineaments trends NW-SE. L6 and L10 mark prominent river valleys. These valleys are likely controlled by the underlying sedimentary strata to form the parallel trends and are following the slope towards the Ohio River. L5 is an inferred lineament that extends between the SFAP and the BSP. However, no clear offset or other evidence of active faulting was identified.

L4 trends N-S and is likely the result of stream erosion of the underlying sedimentary bedrock.

Table 3-1 Summary of Lineaments

Lineament	Trend	Comments
L1	SW-NE	Ohio River Valley
L2	NNE-SSW	Contact between Quaternary alluvium and Pennsylvanian bedrock
L3	NNE-SSW	Contact between Quaternary alluvium and Pennsylvanian bedrock
L4	N-S	No evidence of active faulting
L5	NW-SE	Inferred lineament near the SFAP and BSP obscured by Quaternary alluvium
L6	NW-SE	Prominent river valley
L7	SW-NE	Follows regional trend of faults and folds in the Appalachian Plateau
L8	SW-NE	Inferred, covered by Quaternary alluvium
L9	SW-NE	Follows regional trend of faults and folds in the Appalachian Plateau
L10	NW-SE	Prominent river valley



NOTE: CCR = Coal Combustion Residuals landfill; BSP = Boiler Slag Pond; SFAP = South Fly Ash Pond

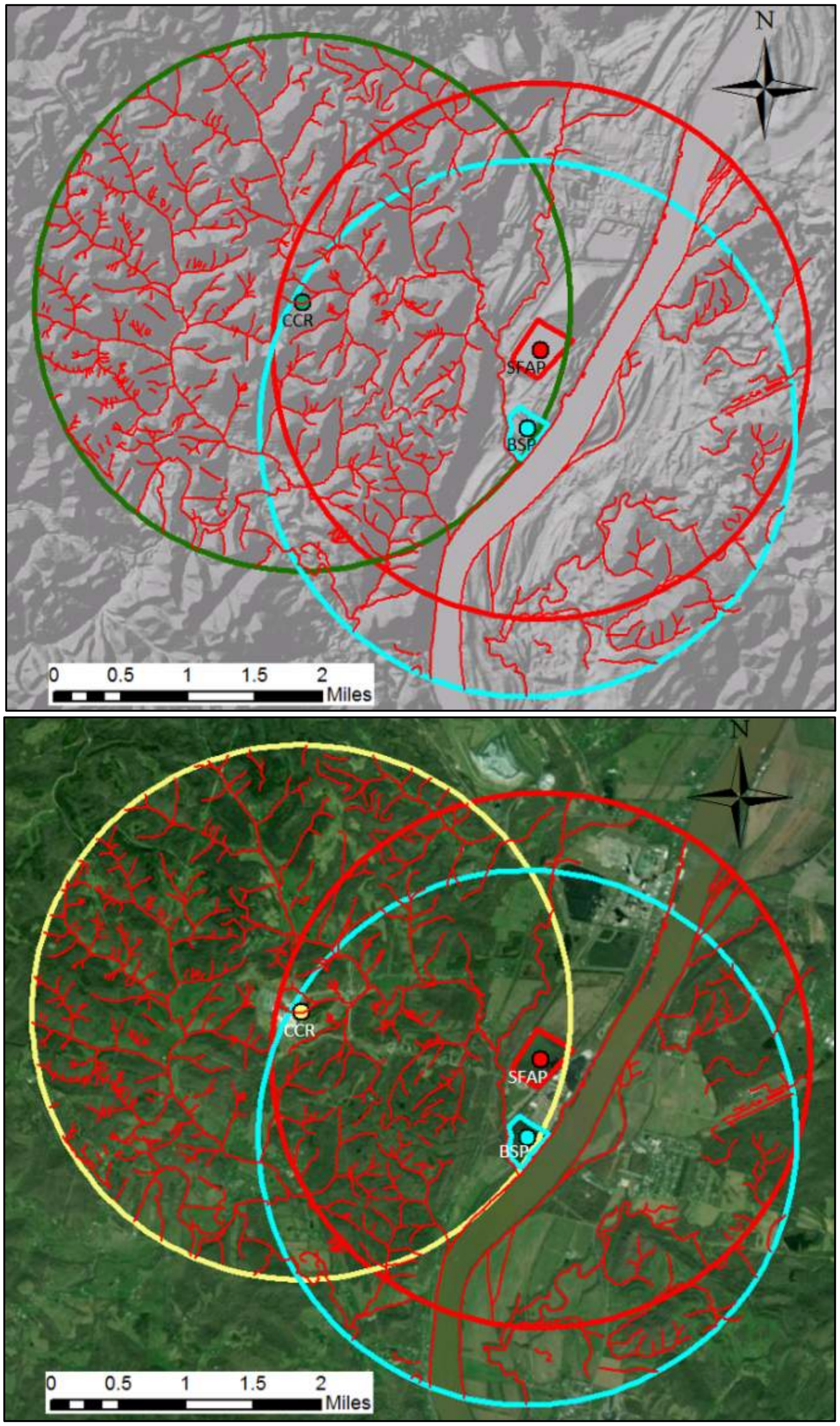
Figure 3-1 Mapped Lineaments (Black) and Inferred Lineaments (Yellow dashed) Overlain on LiDAR Image

4.0 DRAINAGE ANALYSIS

Drainage analysis is useful in structural geology interpretation—it includes consideration for drainage patterns, drainage texture, individual stream patterns and drainage anomalies. Deviations from an expected pattern such as flow in a direction that is oblique from the regional topographical gradient, could be related to structural or lithologic discontinuities.

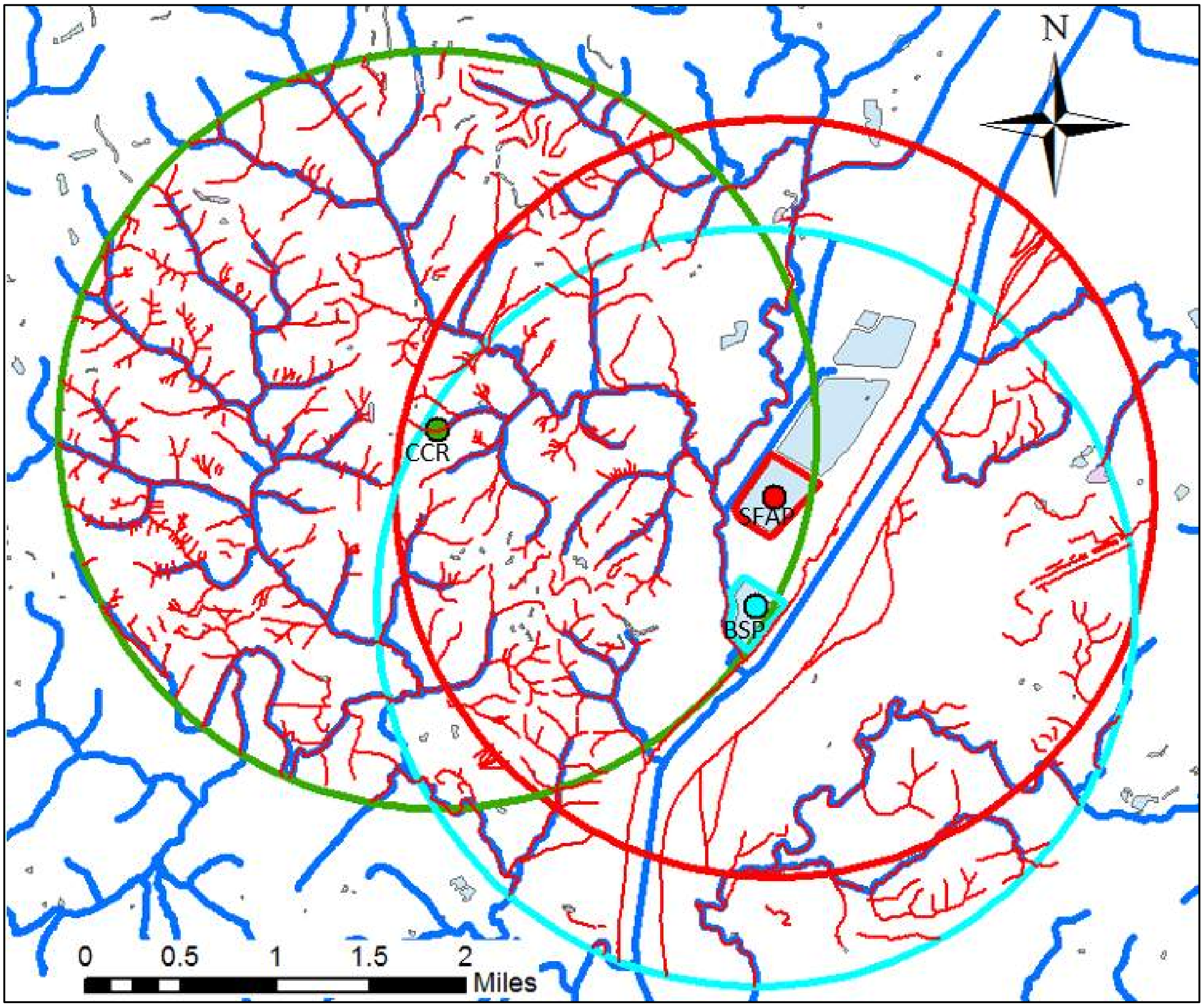
The drainage analysis was conducted using ESRI ArcGIS software and carried out through the interpretation of aerial photographs, hillshade imagery, and the OGS map services hydrologic features dataset. The hillshade was used to delineate the drainage networks of streams at scales ranging from 1:1,000 to 1:5,000 (Figure 4-1). A comparison of the OGS map services hydrological features dataset and mapping from the drainage analysis is presented in Figure 4-2.

The drainage pattern in the study area is predominantly dendritic, which is consistent with the underlying horizontal sedimentary strata. The only abnormal drainage deviations observed are the result of redirection by anthropogenic activity. No fault scarps or other tectonic features associated with active (Holocene-aged) faults were observed within the study area.



NOTE: CCR = Coal Combustion Residuals landfill; BSP = Boiler Slag Pond; SFAP = South Fly Ash Pond

Figure 4-1 Drainage Network Mapping on LiDAR Image (Top) and Overlay on Aerial Photograph (Bottom)



NOTE: CCR = Coal Combustion Residuals landfill; BSP = Boiler Slag Pond; SFAP = South Fly Ash Pond

Figure 4-2 Ohio State Geological Survey Map Services Hydrological Features Dataset (Blue) Compared with the Detailed Drainage Analysis Mapping (Red)

5.0 SUMMARY OF KEY FINDINGS

A neotectonics analysis of the Kyger Creek Plant near Cheshire, Ohio, was completed within a two-mile radius centered on the Coal Combustion Residuals Landfill, South Fly Ash Pong and Boiler Slag Pond sites. The neotectonics analysis involved an extended review of publicly available information (geology, faults, hydrology, seismic hazard, geophysical surveys, Quaternary history, and surficial deposits), lineament analysis, and drainage analysis. The findings from a separate literature review show that the study area is located in a region of low seismicity, with the only significant historic seismic events being several M 4.5 to 5.2 earthquakes that occurred from 1901 to 2008 near Portsmouth, Ohio (1901), and Sharpsburg, KY (1980 and 1988), and in or near the Wabash Valley seismic zone along the border between Indiana and Illinois (Hatcher 2018). None of the literature reviewed indicated the existence of any active faults within two miles of the Ohio Valley Electric Corporation Kyger Creek Fossil Plant.

The lineament analysis identified several linear features. There is a trend in orientation that follows the regional trend of faults recorded in the Appalachian Plateau. There is a possibility that one such lineament extends underneath the SFAP, but this is uncertain. There is no clear evidence of active faulting here, but further detailed investigation (geophysical or trenching) would be required to confirm whether this is a fault and whether it is active. The other lineaments are inferred to be remnants of pre-Holocene stream erosion and features along existing joint sets in the bedrock; no active faulting was observed.

The drainage analysis shows a predominantly dendritic drainage pattern which is consistent with the underlying horizontal sedimentary strata. The only abnormal drainage deviations observed are the result of redirection by anthropogenic activity (e.g., ditches, river training).

No clear offsets, fault scarps or other tectonic features associated with active (Holocene-aged) faults were observed within a 2-mile radius of the CCR Landfill, SFAP or the BSP sites.

Limitations. The desktop neotectonics analysis presented in this report is based on a review of available aerial photographs and hillshade imagery derived from the LiDAR data and DEM. The LiDAR data date from a 2007 survey and may not represent actual terrain conditions. A 30 ft-grid DEM was used; lineament and drainage analysis may be limited due to lack of a higher resolution DEM. Also, stereoscopic air photo interpretation was not conducted as part of the assessment.

6.0 CLOSURE

This report supports the fault area demonstration only for the Kyger Creek Plant and the conclusions are not valid for other applications. This report is based on a literature review of cited references, a desktop lineament and drainage mapping exercise based on interpretation of LiDAR and satellite imagery, and no fieldwork was conducted to verify actual conditions within the study limits.

We trust that the information contained in this report is adequate for your present purposes. If you have any questions about the contents of the report, or if we can be of any other assistance, please do not hesitate to contact us at your convenience.

This desktop terrain analysis was conducted by Melanie Hackett, G.I.T., technically reviewed by Sid Tsang, P.Geo.; and approved by Richard Guthrie M.Sc., Ph.D., P.Geo..

Yours very truly,

STANTEC CONSULTING LTD.

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ATTACHMENT D
SEISMIC IMPACT ZONES COMPLIANCE DEMONSTRATION REPORT

Compliance Demonstration Report – Seismic Impact Zones Boiler Slag Pond 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

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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 seismic impact zones at the Kyger Creek Station and evaluate compliance with §257.63 of the CCR Rule.

As required by §257.63 of the EPA Final CCR Rule, an owner or operator of a new CCR landfill, existing or new CCR surface impoundment, or a lateral expansion of a CCR unit is required by October 17, 2018 to demonstrate that the unit is not located in a seismic impact zone unless the owner or operator demonstrates that all structural components of the CCR unit are designed to resist the maximum horizontal acceleration (MHA) in the lithified material on site.

In support of §257.63 of the EPA Final CCR Rule, §257.53 provides the following definitions:

> *Lithified Earth Material:* all rock, including all naturally occurring and naturally formed aggregates or masses of minerals or small particles of older rock that formed by crystallization of magma or by induration of loose sediments. This term does not include man-made materials, such as fill, concrete, and asphalt, or unconsolidated earth materials, soil, or regolith lying at or near the earth surface.
>
> *Maximum horizontal acceleration in lithified earth material:* the maximum expected horizontal acceleration at the ground surface as depicted on a seismic hazard map, with a 98% or greater probability that the acceleration will not be exceeded in 50 years, or the maximum expected horizontal acceleration based on a site-specific risk assessment.
>
> *Seismic impact zone:* An area having a 2% or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 50 years.
>
> *Structural components:* liners, leachate collection and removal systems, final covers, run-on and run-off systems, inflow design flood control systems, and any other component used in the construction and operation of the CCR unit that is necessary to ensure the integrity of the unit and that the contents of the unit are not released into the environment.

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.

The Boiler Slag Pond is located south of the station adjacent to the Ohio River. It part of the Bottom Ash Complex, composed of the Boiler Slag Pond and the Clearwater Pond. Constructed in 1955, the complex was created by building a perimeter dike to enclose an area of approximately 40 acres. A splitter dike separates the Bottom Ash Complex into two ponds with the Boiler Slag Pond at 30.1 acres and the Clearwater Pond at 9.39 acres. Boiler slag is sluiced to the north end of the Boiler Slag Pond for settling. Overflow is conveyed through an outlet structure at the Boiler Slag Pond's south end into the Clearwater Pond for polishing. Water discharges into the Ohio River through a NPDES-permitted outlet structure in the southeastern end of the Clearwater Pond (AEPSC, 2016). The Boiler Slag Pond is bounded by State Route 7 to the west, a substation to the north, the Ohio River to the east, and Kyger Creek and agricultural land to the south.

Figure 1 below presents an overview of the Kyger Creek Station and related appurtenances including the main plant and the Boiler Slag Pond.

Figure 1. Aerial View of Kyger Creek Station

3.0 SEISMIC IMPACT ZONE DETERMINATION (§257.63(A))

Per §257.63(a) and §257.53, it must first be determined if the Boiler Slag Pond is located within a seismic impact zone.

Assessment of the existing surface impoundment was completed considering the following criteria related to the CCR rule:

- Review of the site's peak ground acceleration having a 2% or greater probability of being exceeded in 50 years as defined by the United States Geological Survey (USGS), Earthquake Hazard Program.
- Review documentation (including but not limited to geotechnical data reports, construction drawings, and published geologic mapping) containing information that indicate the foundation materials within the top 100 feet of the subsurface.

3.1 BACKGROUND

The Boiler Slag is located at approximately 38˚ 54' 38.0196" (latitude) and -82˚ 7' 57.2088" (longitude). This converts to 38.910561, -82.132558 decimal degrees.

Boring logs and geotechnical laboratory testing are available for the original ash pond design (AEPSC, 2016) and for the ash pond embankment during the initial safety factor assessment for the EPA Final CCR Rule (DLZ Ohio, Inc., 2011 and 2015).

The Boiler Slag Ponds classified as an existing, unlined CCR surface impoundment (OVEC, 2016). The pond's perimeter dike was built between 1954 and 1955 during construction of the Kyger Creek Station. The dike encompasses the entire Bottom Ash Complex. The splitter dike between the two ponds was built in 1980. The rolled earth dike is approximately 5,800 feet long with a maximum height of 41 feet. The crest wide is estimated as 20 feet with an elevation of 582 feet (CHA, 2009). The interior embankment has a slope of 2.25H:1V, while the exterior slope is 2.5H:1V to 3H:1V. The bottom of the ponds is at elevation 541 feet (Terracon, 2014).

The configuration of the primary spillway system for the Bottom Ash Complex is documented by CHA (2009) and by construction drawings (AEPSC, 2016). The Boiler Slag Pond discharges into the Clearwater Pond through a reinforced concrete intake structure composed of a 36-inch pipe with a 42-inch by 39-inch riser at elevation 557.0 feet. Water entering the intake structure is discharged into the Clearwater Pond through a 30-inch diameter reinforced concrete pipe near the western end of the splitter dike. The outlet invert for this discharge pipe is elevation 551.0 feet (Terracon, 2014; CHA, 2009). A similar reinforced concrete intake structure and discharge pipe are located in the southeastern portion of the Clearwater Pond to discharge into the Ohio River (CHA, 2009).

The inflow design flood control demonstration indicates that the surface impoundment does not overtop and maintains adequate freeboard assuming that two drainage pumps are functioning (DLZ Ohio, Inc., 2015).

The initial safety factor assessment analyzed the critical cross section of the Boiler Slag Pond for seismic conditions. The pseudo-static analysis used a horizontal seismic coefficient of 0.06g and estimated a factor of safety of 1.30 (DLZ Ohio, Inc., 2015). Conventional guidelines for pseudo-static analyses assume a horizontal seismic coefficient (k_h) equal to one-half of the PGA on rock (Hynes-Griffin and Franklin, 1984). The referenced initial safety factor assessment used a ground acceleration correlation between rock site and soil sites to adjust the peak ground acceleration (PGA) for rock to PGA_{soil}.

3.2 ASSESSMENT

The United States Geological Survey (USGS), Earthquake Hazard Program publishes seismic hazard maps to allow preliminary site assessments based on current understanding of:

- Known faults and historic earthquakes,
- The behavior of seismic waves as they propagate between a source and a site, and
- The near-surface conditions at specific locations of interest.

The National Hazard Maps referenced in the EPA Final CCR Rule show the distribution of earthquake shaking levels that have a certain probability of occurring in the United States (USGS, 2018). They are created to provide preliminary information to assist in the design of infrastructure (e.g. buildings, roads, utilities) to withstand shaking from earthquakes. The USGS provides probabilistic ground motion maps depicting earthquake hazard using contours to illustrate the earthquake ground motions of a particular frequency that have a given probability of being exceeded in a given time period (USGS, 2018).

For this demonstration, the ground motion used for seismic impact zone determination corresponds to predicted motion with a 2% or greater probability of exceedance in 50 years. Appendix A contains the 2014 National Hazard Map with the site located and a site-specific unified hazard report for the Boiler Slag Pond based on an input of latitude and longitude into the interactive Unified Hazard Tool. As established by the USGS reference, the peak ground acceleration (PGA) ground motion is estimated as 0.0658g. It should be noted that the USGS mapping referenced assumes a return period of 2,475 years (equivalent to 2% probability of exceedance in 50 years).

3.3 CONCLUSION

The preamble of the EPA Final CCR Rule (p. 21366, Vol. 80, No. 74 of the Federal Register) discusses the data determining seismic impact zone as being mapped and readily available through the USGS. This implies that the intended methodology was to determine seismic impact zone based on PGA $_{B/C}$ (USGS, 2018). The referenced USGS mapping indicates the Boiler Slag Pond has a PGA $_{B/C}$ of 0.0658g, which is below the 0.10g specified as a seismic impact zone.

Based on the interpretation of the EPA Final CCR Rule requirements outlined herein, it is Stantec's professional opinion that the subject CCR unit is not located within a seismic impact zone.

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October 16, 2018

Appendix A PEAK GROUND ACCELERATION

Stantec

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (v4.1.

Spectral Period

Peak ground acceleration

Latitude

Decimal degrees

38.910561

Time Horizon

Return period in years

2475

Longitude

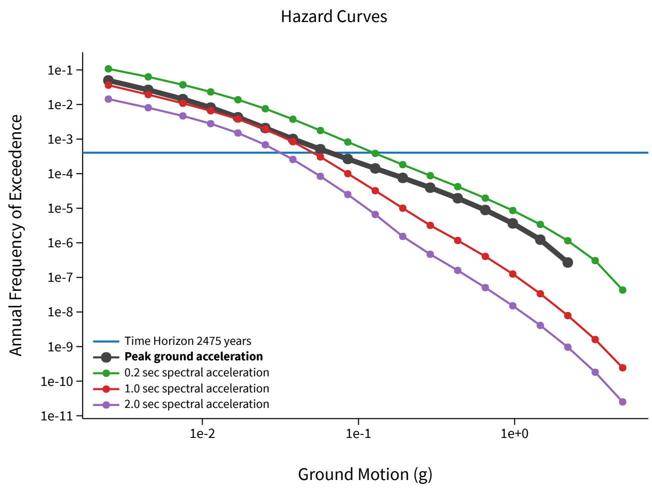
Decimal degrees, negative values for western longitudes

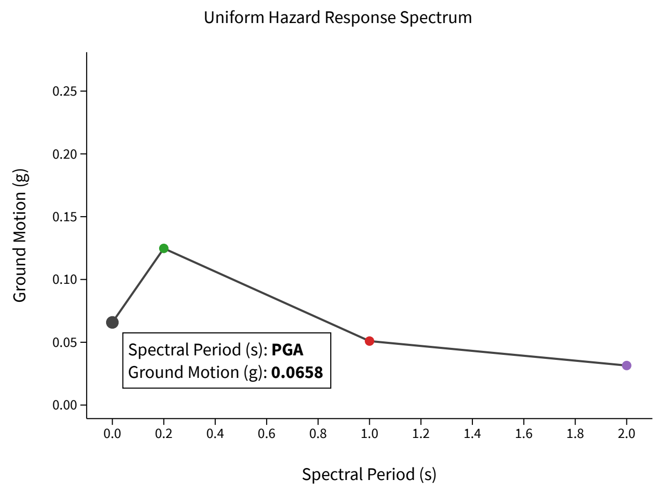
-82.132558

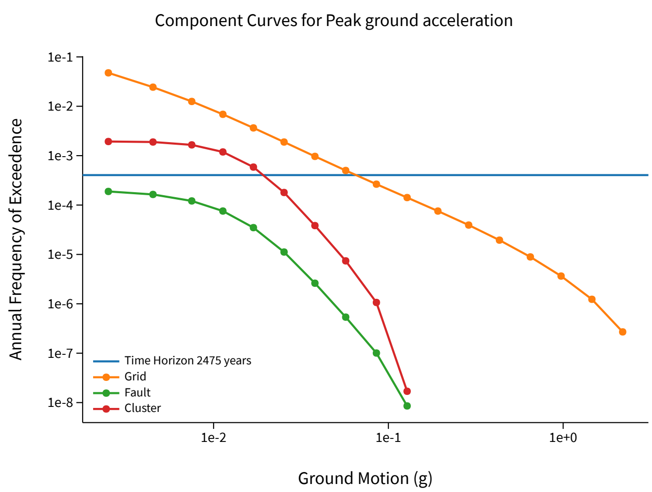
Site Class

760 m/s (B/C boundary)

Hazard Curve





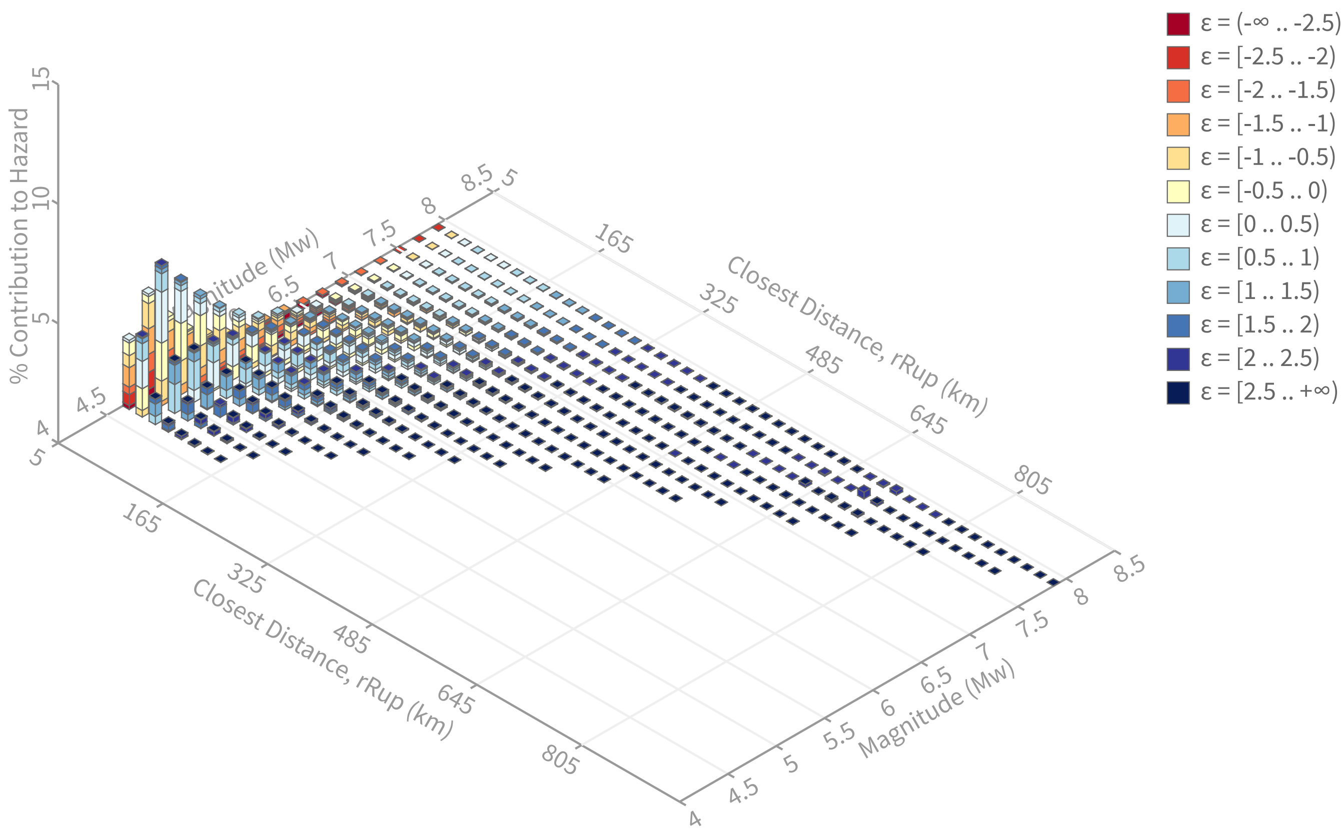


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.065814405 g

Recovered targets

Return period: 2484.3621 yrs
Exceedance rate: 0.00040251781 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 2.08 %

Mean (for all sources)

r: 82.37 km
m: 5.69
ε_0: 0.03 σ

Mode (largest r-m bin)

r: 29.39 km
m: 4.9
ε_0: 0.04 σ
Contribution: 5.86 %

Mode (largest ε_0 bin)

r: 32.24 km
m: 4.89
ε_0: 0.23 σ
Contribution: 2.13 %

Discretization

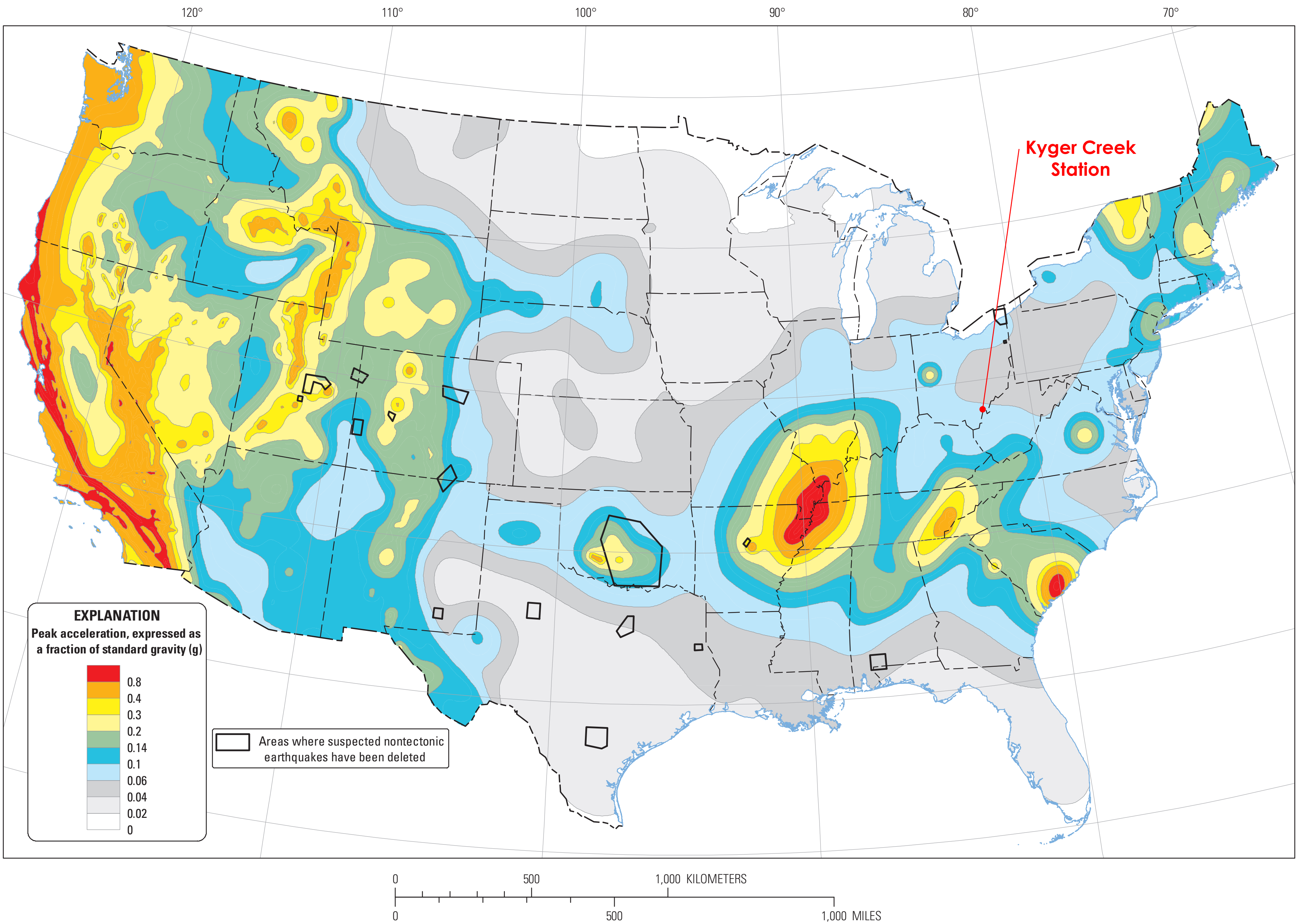
r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

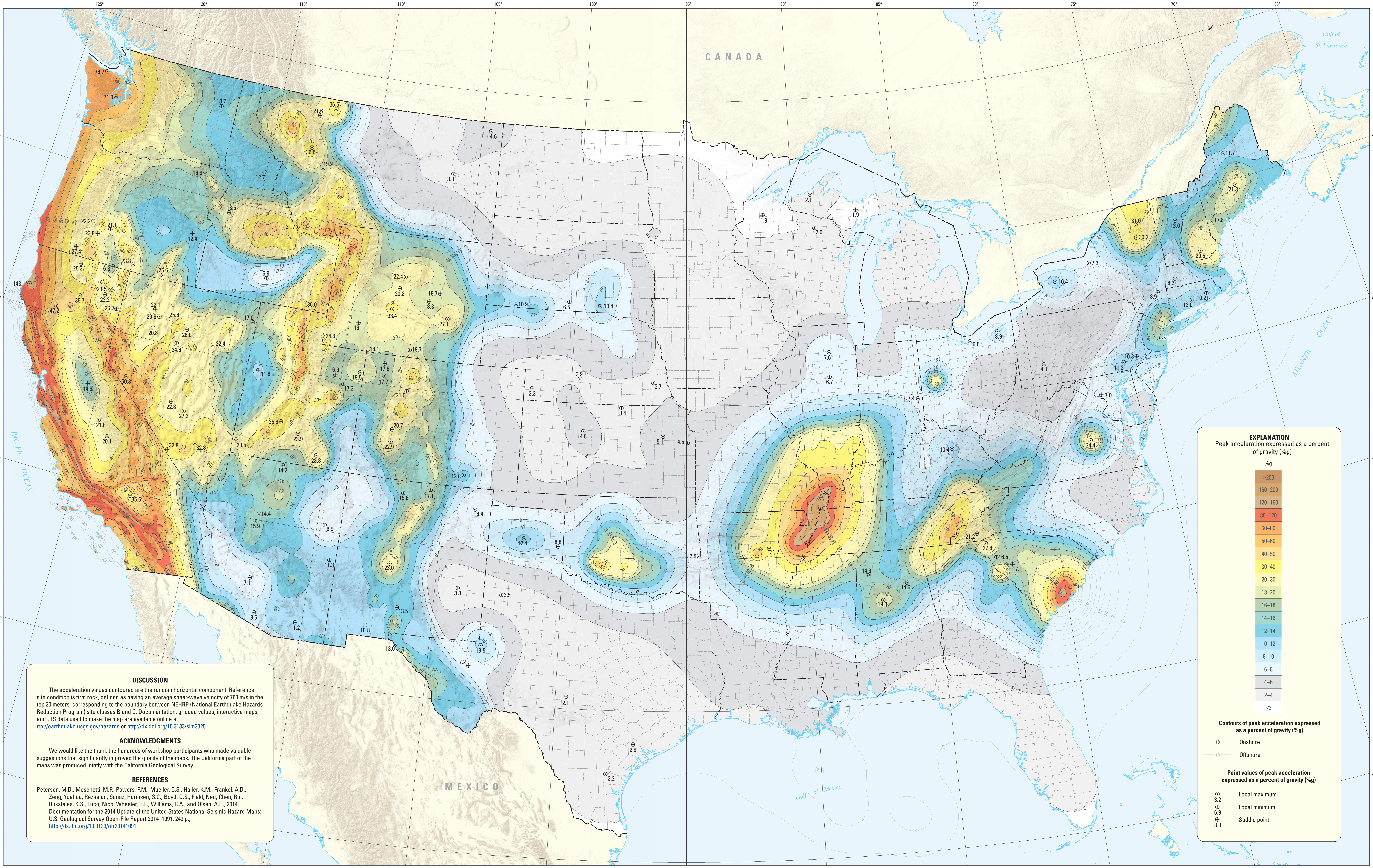
Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
SSCn Fixed Smoothing Zone 1 (opt)	Grid							18.16
PointSourceFinite: -82.133, 39.023		13.31	5.14	-1.74	82.133°W	39.023°N	0.00	2.47
PointSourceFinite: -82.133, 39.113		22.78	5.21	-0.81	82.133°W	39.113°N	0.00	2.20
PointSourceFinite: -82.133, 39.203		32.46	5.30	-0.28	82.133°W	39.203°N	0.00	1.52
PointSourceFinite: -82.133, 39.068		17.99	5.17	-1.20	82.133°W	39.068°N	0.00	1.42
PointSourceFinite: -82.133, 39.158		27.61	5.25	-0.51	82.133°W	39.158°N	0.00	1.13
PointSourceFinite: -82.133, 39.248		37.31	5.35	-0.09	82.133°W	39.248°N	0.00	1.02
USGS Fixed Smoothing Zone 1 (opt)	Grid							16.59
PointSourceFinite: -82.133, 39.023		13.31	5.14	-1.74	82.133°W	39.023°N	0.00	2.47
PointSourceFinite: -82.133, 39.113		22.78	5.21	-0.81	82.133°W	39.113°N	0.00	1.62
PointSourceFinite: -82.133, 39.203		32.46	5.30	-0.28	82.133°W	39.203°N	0.00	1.36
PointSourceFinite: -82.133, 39.158		27.61	5.25	-0.51	82.133°W	39.158°N	0.00	1.13
PointSourceFinite: -82.133, 39.068		17.99	5.17	-1.20	82.133°W	39.068°N	0.00	1.06
USGS Fixed Smoothing Zone 2 (opt)	Grid							13.31
SSCn Adaptive Smoothing Zone 1 (opt)	Grid							12.07
PointSourceFinite: -82.133, 39.023		13.31	5.14	-1.74	82.133°W	39.023°N	0.00	1.48
PointSourceFinite: -82.133, 39.113		22.78	5.21	-0.81	82.133°W	39.113°N	0.00	1.38
SSCn Fixed Smoothing Zone 7 (opt)	Grid							11.42
USGS Adaptive Smoothing Zone 1 (opt)	Grid							11.04
PointSourceFinite: -82.133, 39.023		13.31	5.14	-1.74	82.133°W	39.023°N	0.00	1.48
PointSourceFinite: -82.133, 39.113		22.78	5.21	-0.81	82.133°W	39.113°N	0.00	1.01
USGS Adaptive Smoothing Zone 2 (opt)	Grid							8.59
SSCn Adaptive Smoothing Zone 7 (opt)	Grid							7.36



Two-percent probability of exceedance in 50 years map of peak ground acceleration

Source: The 2014 U.S. Geological Survey (USGS) National Seismic Hazard Map
https://earthquake.usgs.gov/static/lfs/nshm/conterminous/2014/2014pga2pct.pdf



DISCUSSION

The acceleration values contoured are the random horizontal component. Reference site condition is firm rock, defined as having an average shear-wave velocity of 760 m/s in the top 30 meters, corresponding to the boundary between NEHRP (National Earthquake Hazards Reduction Program) site classes B and C. Documentation, gridded values, interactive maps, and GIS data used to make the map are available online at ttp://earthquake.usgs.gov/hazards or http://dx.doi.org/10.3133/sim3325.

ACKNOWLEDGMENTS

We would like the thank the hundreds of workshop participants who made valuable suggestions that significantly improved the quality of the maps. The California part of the maps was produced jointly with the California Geological Survey.

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Petersen, M.D., Moschetti, M.P., Powers, P.M., Mueller, C.S., Haller, K.M., Frankel, A.D., Zeng, Yuehua, Rezaeian, Sanaz, Harmsen, S.C., Boyd, O.S., Field, Ned, Chen, Rui, Rukstales, K.S., Luco, Nico, Wheeler, R.L., Williams, R.A., and Olsen, A.H., 2014, Documentation for the 2014 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2014–1091, 243 p., http://dx.doi.org/10.3133/ofr20141091.

Shaded relief base from Esri Inc., 2008, Data and Maps
All other base map data from Esri Inc., 1993, Digital Chart of the World
United States County base map from the U.S. Geological Survey National Atlas, available at http://nationalatlas.gov/

Projection: Albers equal-area conic
Standard parallels 29.5°N. and 45.5°N., central meridian 95°W

SCALE 1:7 000 000
100 0 100 200 300 400 500 600 700 800 900 1000 MILES
100 0 100 200 300 400 500 600 700 800 900 1000 KILOMETERS

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Or visit the Geologic Hazards Science Center Web site at:
http://geohazards.cr.usgs.gov/.

Seismic-Hazard Maps for the Conterminous United States, 2014

Peak Horizontal Acceleration with 2 Percent Probability of Exceedance in 50 Years

By

Mark D. Petersen,[1] Morgan P. Moschetti,[1] Peter M. Powers,[1] Charles S. Mueller,[1] Kathleen M. Haller,[1] Arthur D. Frankel,[1] Yuehua Zeng,[1] Sanaz Rezaeian,[1] Stephen C. Harmsen,[1] Oliver S. Boyd,[1] Edward H. Field,[1] Rui Chen,[2] Nicolas Luco,[1] Russell L. Wheeler,[1] Robert A. Williams,[1] Anna H. Olsen,[1] and Kenneth S. Rukstales[1]

2015

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ATTACHMENT E
UNSTABLE AREAS COMPLIANCE DEMONSTRATION REPORT

Compliance Demonstration Report – Unstable Areas Boiler Slag Pond 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

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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 Boiler Slag Pond 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.

The Boiler Slag Pond is located south of the station adjacent to the Ohio River. It is part of the Bottom Ash Complex, composed of the Boiler Slag Pond and the Clearwater Pond. Constructed in 1955, the complex was created by building a perimeter dike to enclose an area of approximately 40 acres. A splitter dike was constructed in 1980 (CHA, 2010), separating the Bottom Ash Complex into two ponds with the Boiler Slag Pond at 30.1 acres and the Clearwater Pond at 9.39 acres. Boiler slag is sluiced to the north end of the Boiler Slag Pond for settling. Overflow is conveyed through a southern outlet structure into the Clearwater Pond for polishing. Water discharges into the Ohio River through a NPDES-permitted outlet structure in the southeastern end of the Clearwater Pond (AEPSC, 2016). The Boiler Slag Pond is bounded by State

Route 7 to the west, a substation to the north, the Ohio River to the east, and Kyger Creek and agricultural land to the south.

Figure 1 below presents an overview of the Kyger Creek Station and related appurtenances including the main plant and the Boiler Slag Pond.

Figure 1. Aerial View of Kyger Creek Station

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

Site inspections of the Boiler Slag Pond have been conducted and documented regularly since 1985 to present (Stantec, 2016). 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 along the Boiler Slag Pond perimeter dikes are predominately Elkinsville silt loam (EkB). These soils are derived from alluvium and consist of silt loam, loam, and sandy loam. The Elkinsville silt loam is relatively flat (1 to 6 percent) with depths greater than 80 inches. The depth to water is expected to be more than 80 inches.

A subsurface exploration was performed in 2010 by DLZ to provide subsurface information for stability analysis of the ash pond embankments at the Kyger Creek Station (DLZ, 2011). Six borings were drilled at the Boiler Slag Pond. Foundation materials consisted primarily of lean clay above Elevation 530 feet, with lean clay occasionally interbedded with silt, sand, and gravel underlain by granular soils below Elevation 530 feet.

Two exploratory soil borings were completed at the Boiler Slag Pond in 2015 to obtain geologic information specific to designing CCR monitoring networks (AGES, 2016). A total of 8 monitoring wells were installed in at the Boiler Slag Pond to meet the monitoring network requirements of the CCR Rule. The boring logs from the exploratory soil borings and monitoring wells indicate that the subsurface conditions consist of lean clay underlain by sand.

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

3.2 ASSESSMENT

Inspections of the Boiler Slag Pond have shown no visual signs of differential settlement or deformations of the structural components (AEPSC, 2017).

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 Boiler Slag Pond. For the purposes of this report, soft and compressible soils are fat clays, elastic silts, organic silts and clays, or highly organic soils (peat).

Limited information is available for the foundation investigation prior to the construction of the Kyger Creek Station. However, logs of borings (AEPSC, 2016) typically describe the soil encountered as soft to hard sandy lean clay underlain by sand. The subsurface investigations performed in 2010 (DLZ, 2011) and 2015 (AGES, 2016) did not indicate the presence of the soil types noted above underlying the Boiler Slag Pond.

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

Site inspections of the Boiler Slag Pond have been conducted and documented regularly since 1985 to present (Stantec, 2016). These inspections include observations related to identifying characteristic features of karstic formations.

Physiographic mapping (ODNR, 1998) indicates that the Kyger Creek Station is 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 Boiler Slag Pond is underlain by Holocene alluvium and alluvial terraces, deposited in present and former floodplains. The alluvium ranges from silty clay to coarse sand, gravel, or cobbles in areas of shallow bedrock. Late Wisconsinan Intermediate-level outwash terraces (sand and gravel) and Cenozoic colluvium derived from local bedrock in unglaciated areas (weathered material, landslides, and bedrock outcrop) are located in the vicinity of the Kyger Creek Station.

Ohio bedrock geologic mapping (ODNR, 1996; ODNR, 2011) indicates that the bedrock underlying the Boiler Slag Pond is in the Monogahela Group of the Pennsylvanian system. Bedrock in this group consists of shale, siltstone, limestone, sandstone, and coal.

Appendix B contains mapping showing the physiographic regions of Ohio (ODNR, 1998), karst features in Ohio and West Virginia (ODNR, 2006; WVGES, 2016), and landslides and rockfalls documented by the Ohio Department of Transportation (ODOT, 2018).

4.2 ASSESSMENT

Based on the information presented in the available inspection reports for the South Fly Ash Pond, there have been no documented characteristic features of sinkholes or karstic formation (AEPSC, 2017). As shown on the karst maps for Ohio and West Virginia (ODNR, 2006; WVGES, 2016) included in Appendix B, Kyger Creek Station is not located in a known karst area.

Several landslides are documented south of the Kyger Creek Station along State Route 7 near the Ohio River. The nearest landslide is approximately 1.5 miles south of the Kyger Creek Station (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 Boiler Slag Pond.

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 related to the CCR rule:

- 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 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

Site inspections of the Boiler Slag Pond have been conducted and documented regularly since 1985 to present (Stantec, 2016). 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.

In 2010, four piezometers were installed to monitor the water levels along the embankment of the Boiler Slag Pond (DLZ, 2011). In 2015, eight monitoring wells were installed at the Boiler Slag Pond to meet the monitoring network requirements of the CCR Rule (AGES, 2016). In the 2017 Annual Dam and Dike Inspection Report (AEPSC, 2017), maximum readings since the last inspection for the four piezometers installed in 2010 were included.

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

5.2 ASSESSMENT

Inspections of the Boiler Slag Pond have shown no visual signs of differential settlement or deformations of the structural components (AEPSC, 2017).

The nearest mining location (past, current, or proposed) is approximately 0.5 miles west of the Boiler Slag Pond (ODNR, 2018a; WVGES, 2018). There are no oil and gas wells located in the footprint of the Boiler Slag Pond. However, there are 21 active wells within a one-mile radius of the Boiler Slag Pond (ODNR, 2018b; WVDEP, 2018). It is not expected that human events related to these industries or their operations pose any negative impact to the structural components of the Boiler Slag Pond.

According to Ohio Department of Natural Resources (ODNR) mapping (ODNR, 2018c), there are several wells within a one-mile radius of the Boiler Slag Pond. There are no wells shown in the footprint of the Boiler Slag Pond. As discussed in Section 5.1, eight monitoring wells have been installed to meet the monitoring network requirements for the CCR Rule. Monitoring wells would not typically cause excessive drawdown of groundwater levels, thus posing no significant hazard.

5.3 CONCLUSION

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

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COMPLIANCE DEMONSTRATION REPORT –
UNSTABLE AREAS
BOILER SLAG POND
KYGER CREEK STATION

October 16, 2018

Appendix A SOIL CONDITIONS

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 Boiler Slag Pond

February 21, 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.

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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: 1:4,390 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 200, 400, 800, 1200

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
Dm	Dumps, mine	12.7	34.1%
EkB	Elkinsville silt loam, 1 to 6 percent slopes	8.8	23.7%
New1AF	Newark silt loam, 0 to 3 percent slopes, frequently flooded	1.6	4.2%
W	Water	14.1	38.0%
Totals for Area of Interest		**37.2**	**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. 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

Dm—Dumps, mine

Map Unit Composition

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

EkB—Elkinsville silt loam, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: l0l6
Elevation: 340 to 800 feet
Mean annual precipitation: 37 to 46 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 150 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Elkinsville

Setting

Landform: Terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 40 inches: silt loam
H3 - 40 to 54 inches: loam
H4 - 54 to 74 inches: sandy loam

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e

Hydrologic Soil Group: B
Other vegetative classification: Unnamed (G126XYA-6OH)
Hydric soil rating: No

Minor Components

Peoga
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Taggart
Percent of map unit: 5 percent
Landform: Terraces

New1AF—Newark silt loam, 0 to 3 percent slopes, frequently flooded

Map Unit Setting
National map unit symbol: 2n7wc
Elevation: 660 to 1,150 feet
Mean annual precipitation: 34 to 45 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

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

Description of Newark

Setting
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Silty alluvium

Typical profile
Ap - 0 to 8 inches: silt loam
Bw - 8 to 35 inches: silt loam
C - 35 to 79 inches: silty clay loam

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly 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 6 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 11.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Other vegetative classification: Unnamed (G124XYC-3OH)
Hydric soil rating: No

Minor Components

Lindside

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Moist Loams (ML3), Unnamed (G124XYA-5OH)
Hydric soil rating: No

Melvin

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Unnamed (G124XYC-3OH)
Hydric soil rating: Yes

W—Water

Map Unit Composition

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

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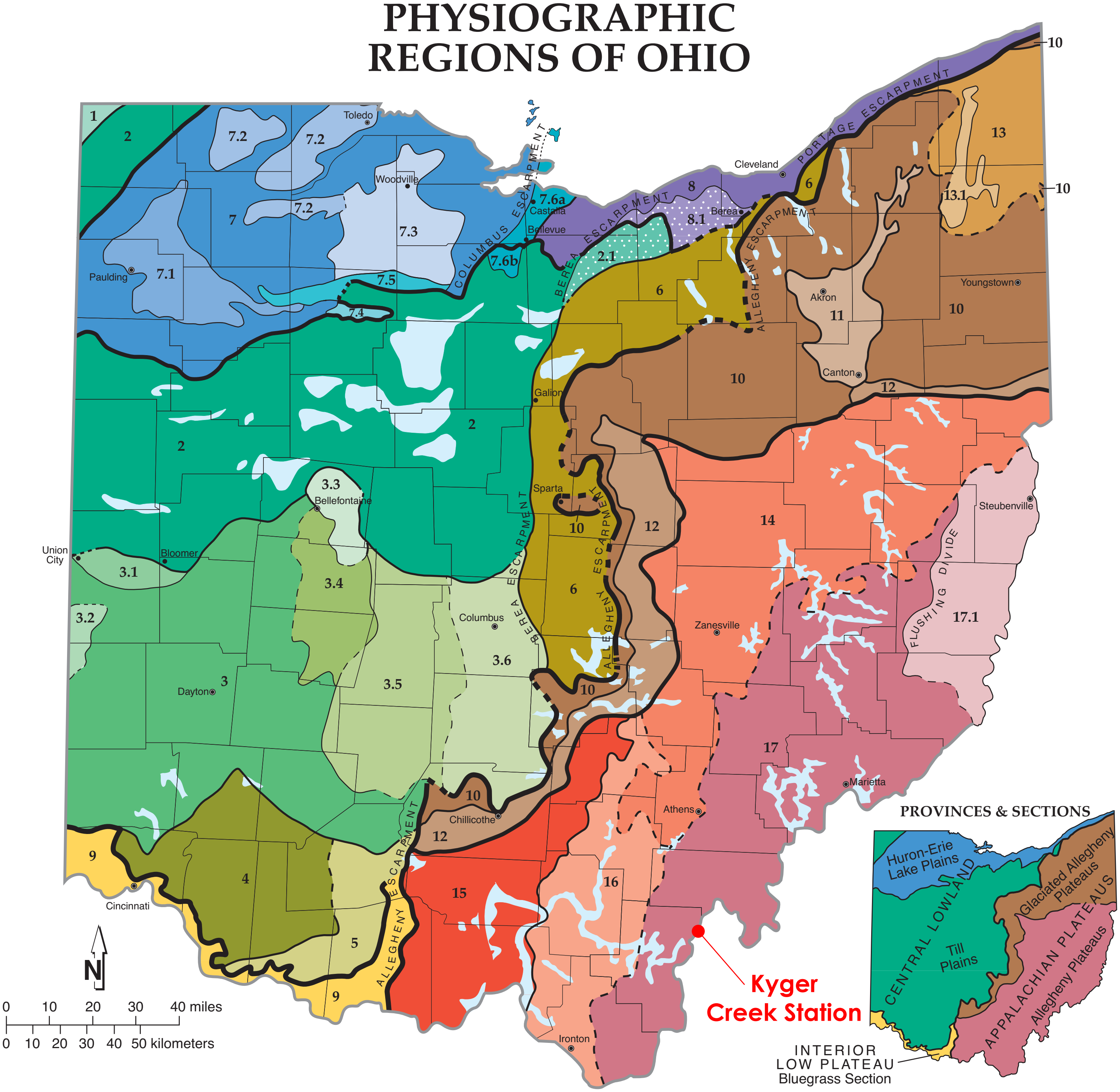
COMPLIANCE DEMONSTRATION REPORT – UNSTABLE AREAS BOILER SLAG POND KYGER CREEK STATION

October 16, 2018

Appendix B GEOLOGIC OR GEOMORPHOLOGIC CONDITIONS

Stantec

PHYSIOGRAPHIC REGIONS OF OHIO



Transitional boundary

Lake basin/deposits outside Huron-Erie Lake Plains

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

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

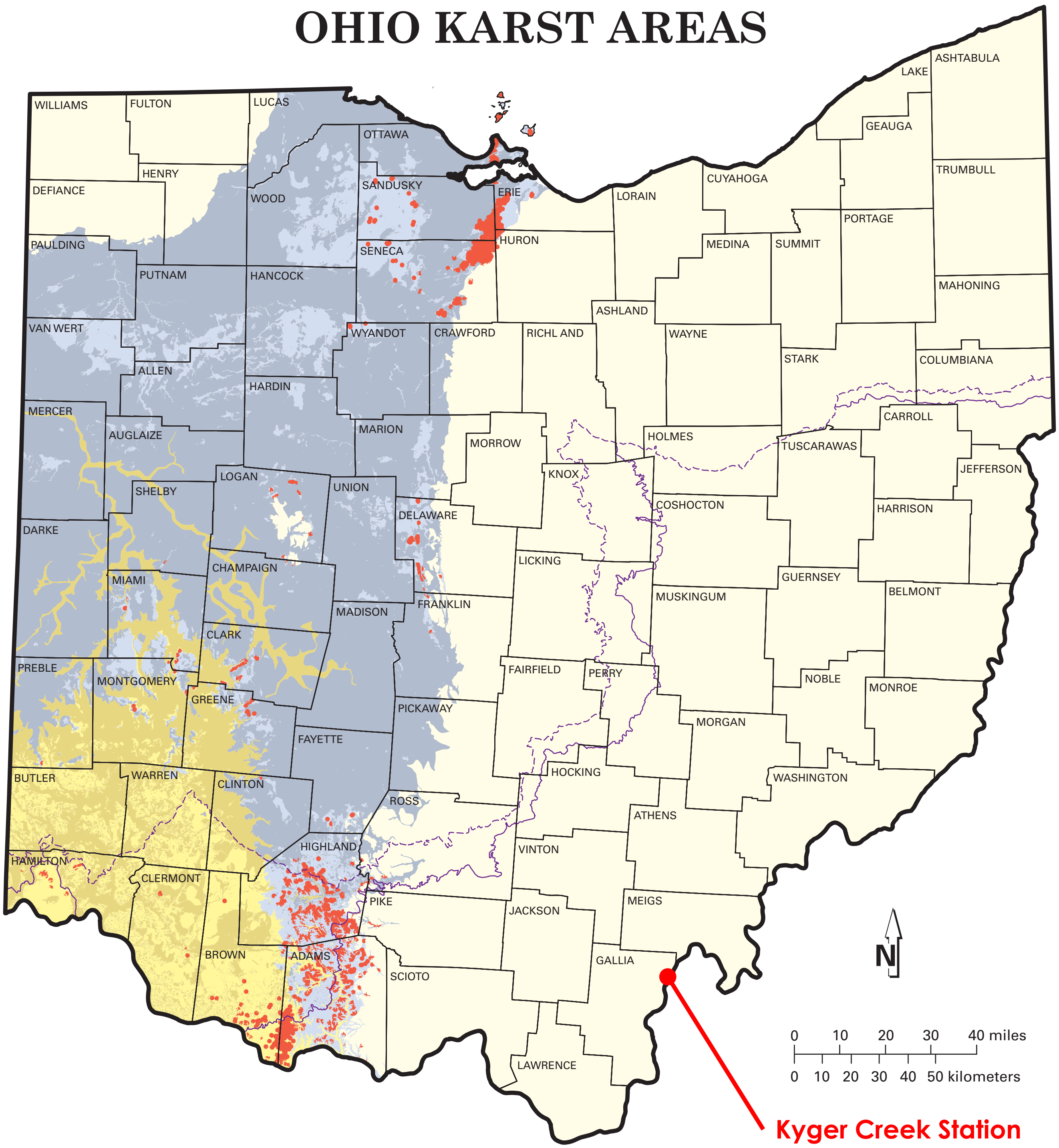
Allegheny Plateaus

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

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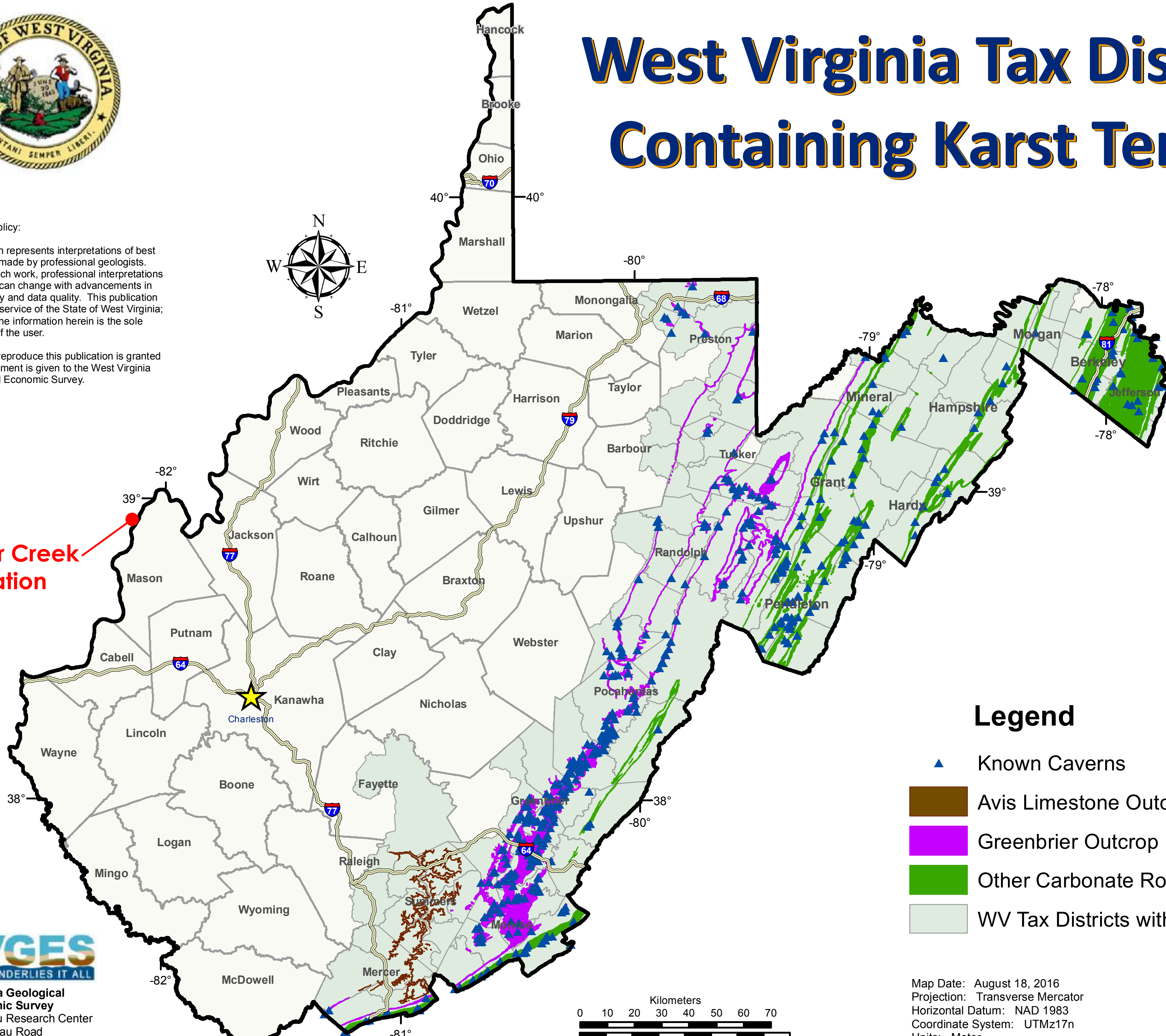
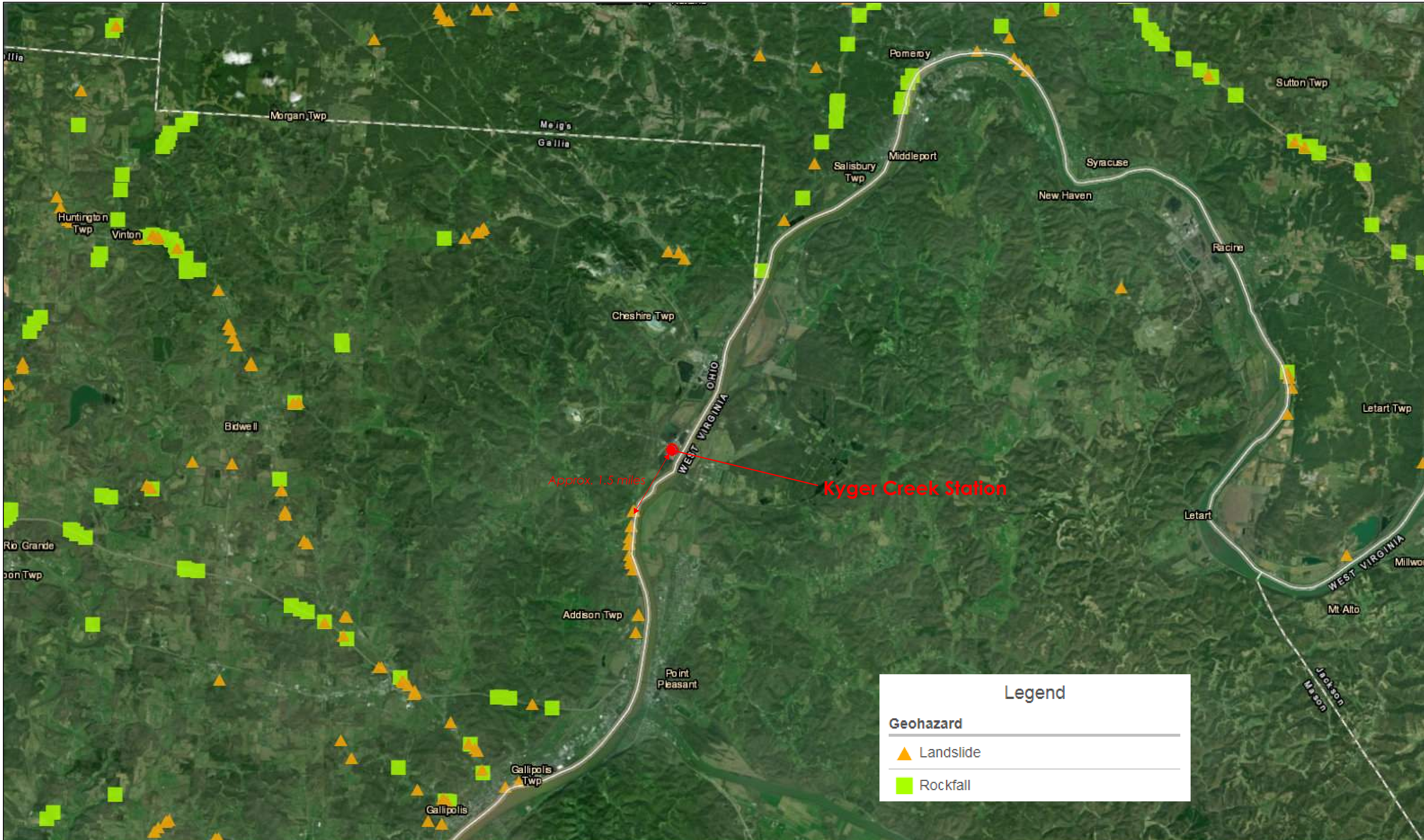


West Virginia Geological and Economic Survey
Mont Chateau Research Center
1 Mont Chateau Road
Morgantown, WV 26508-8079
Phone: (304) 594-2331
Web: **www.wvgs.wvnet.edu**

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



TIMS TRANSPORTATION INFORMATION MAPPING SYSTEM

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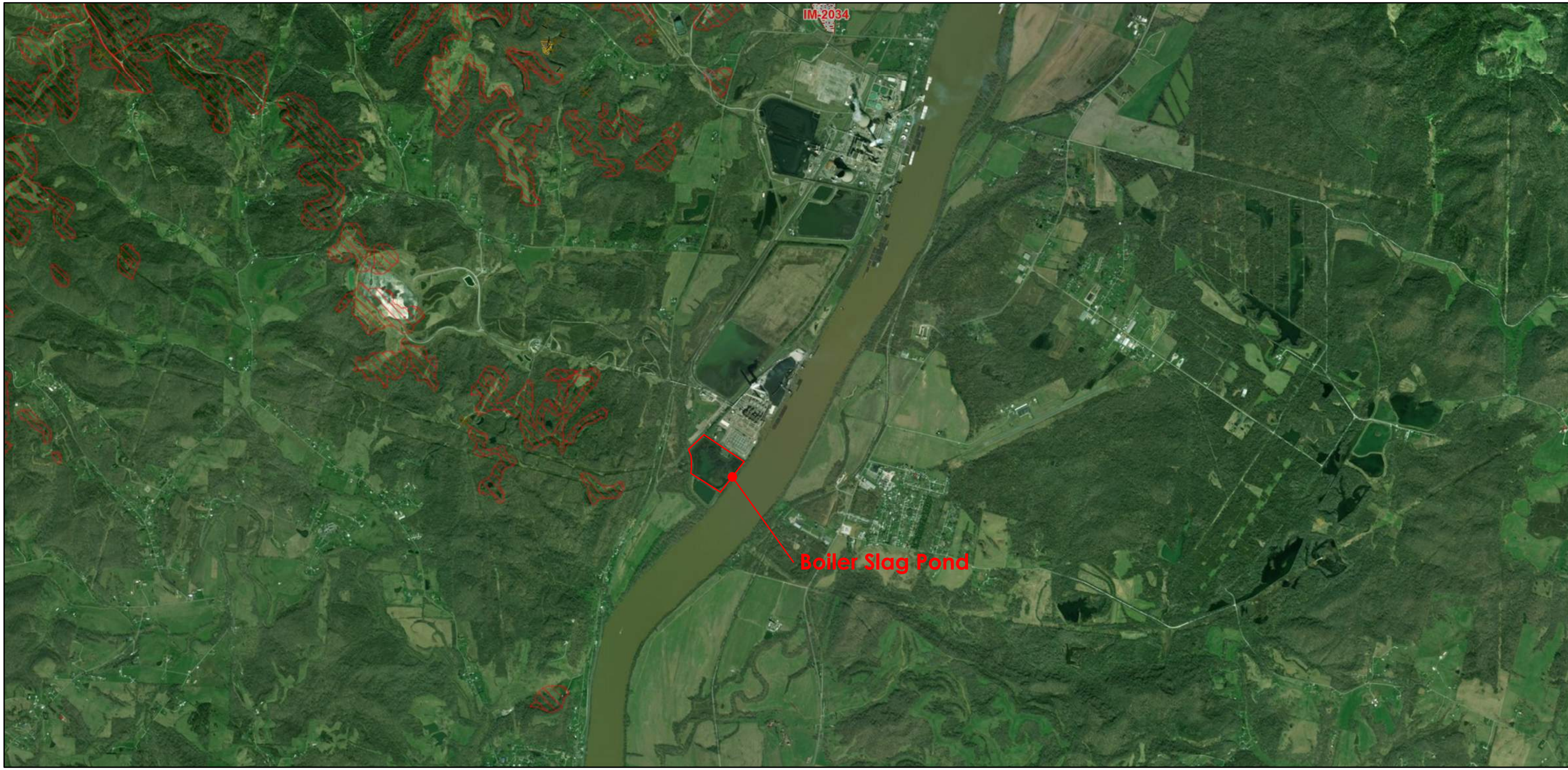
Date: 2/23/2018

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

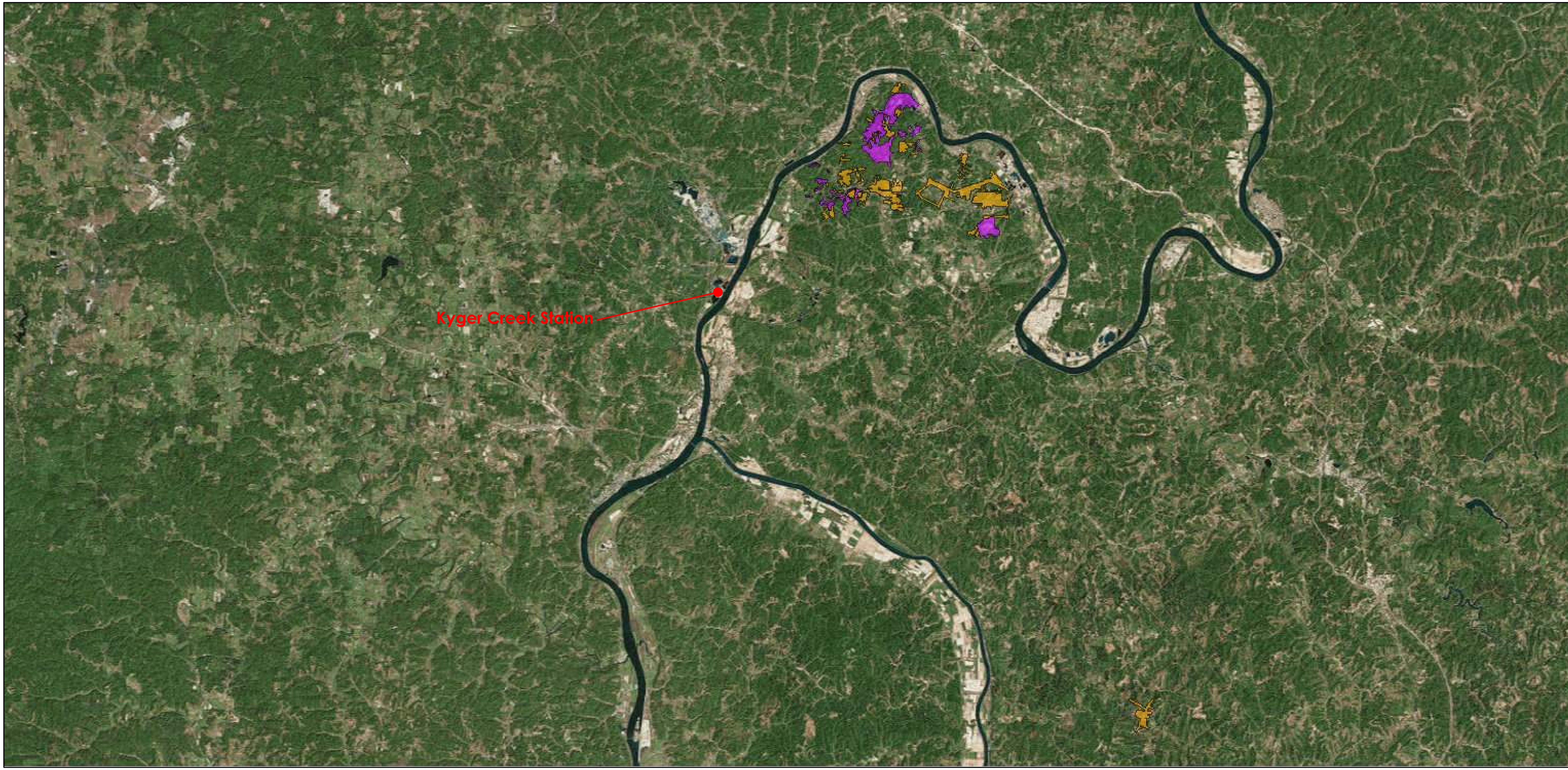
N

0 0.5 1 2 mi

0 0.75 1.5 3 km

Ohio Dept. of Natural Resources

WV Coal Mining



February 21, 2018

Underground Mining

Surface Mining

Surface Mined

Auger Mined

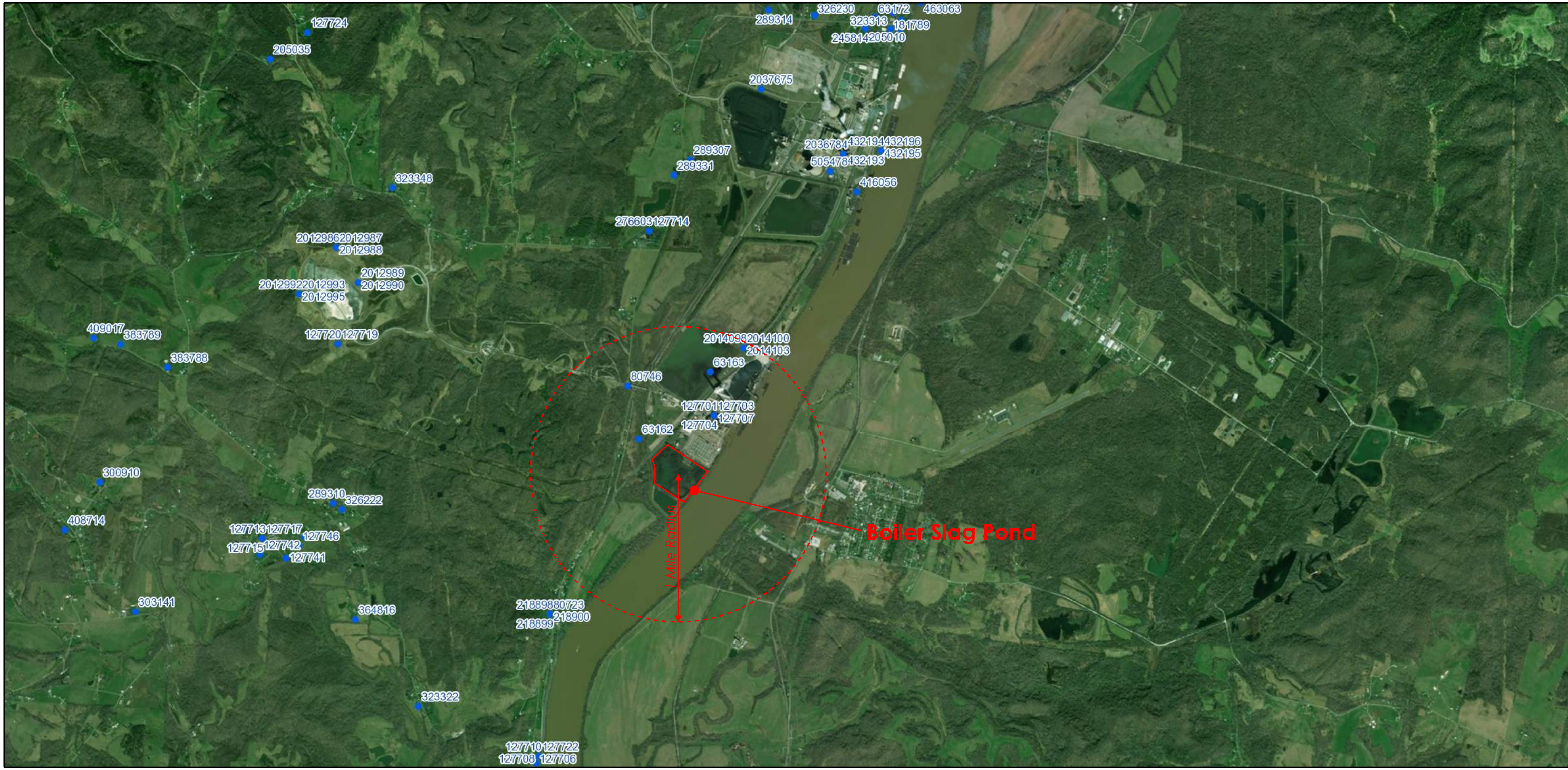
Highwall Mined

0 3.5 7 14 mi

0 5 10 20 km

West Virginia Geological and Economic Survey, Coal Bed Mapping Program
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Ohio Water Wells



February 21, 2018

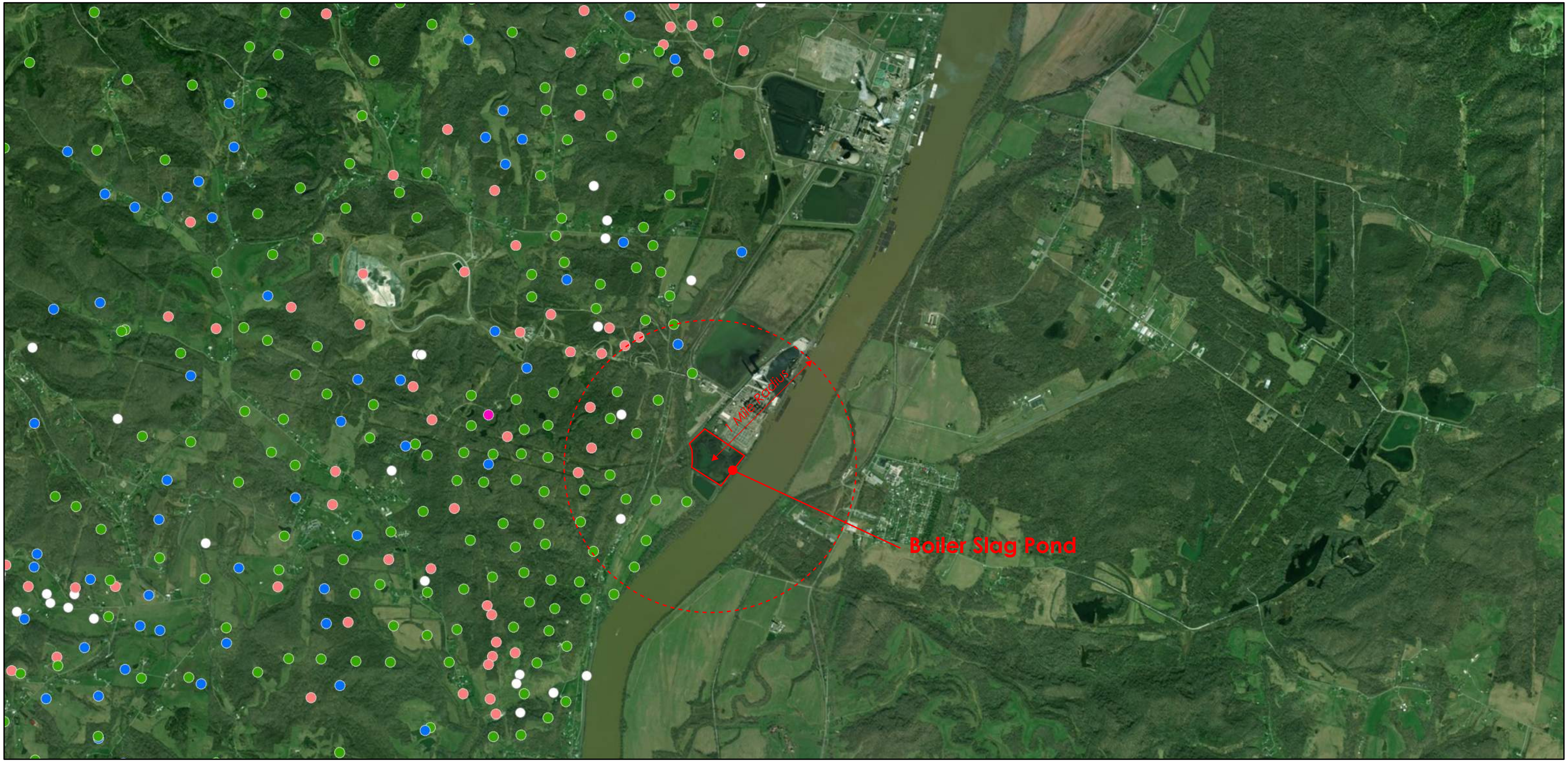
● Water Wells

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

West Virgina Oil and Gas Wells

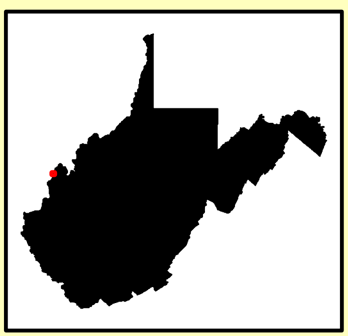
Map Key

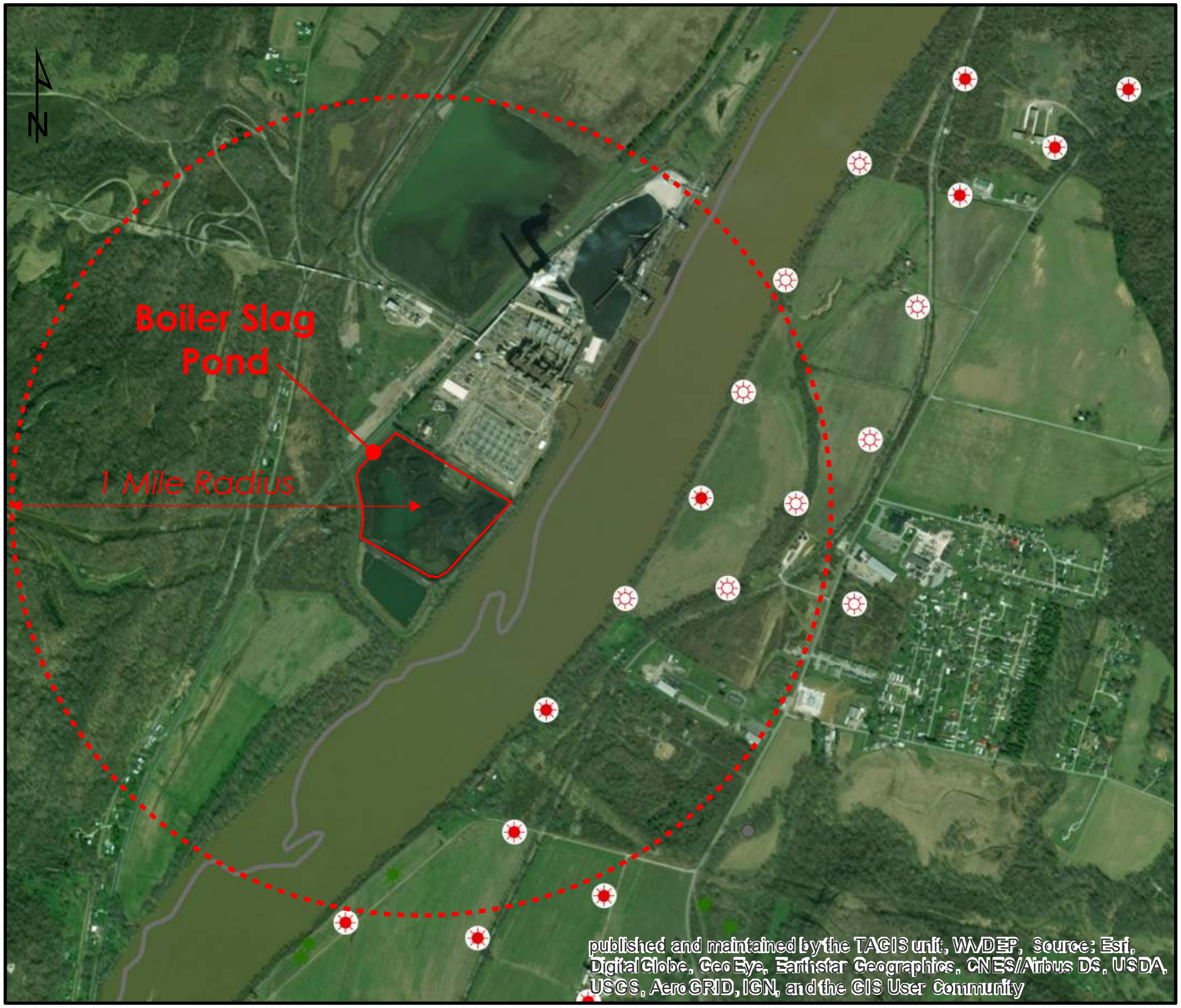
WVDEP Wells, Horizontal Only

- <all other values>
- Permit Application
- Never Issued
- Permit Issued
- Never Drilled
- Active Well
- Plugged

WVDEP Wells, Active Status Only

- <all other values>
- Brine Disposal
- Fluid Injection
- Gas Production
- House Gas
- Observation
- Oil Production
- Production
- Solution Mining
- Storage
- Vent





0 0.1 0.2 0.4 0.6 0.8 Miles

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