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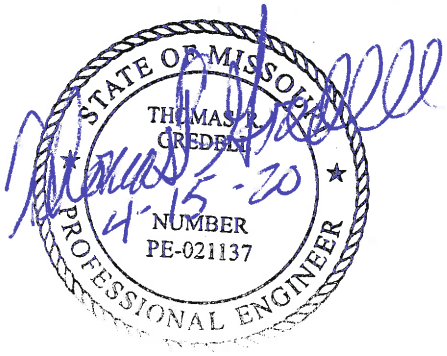
GREDELL Engineering Resources, Inc.

Sikeston Board of Municipal Utilities
Sikeston Power Station
Fly Ash Pond
Location Restrictions

Prepared for:

BMU Sikeston
Board of Municipal Utilities

Sikeston Power Station
1551 West Wakefield Avenue
Sikeston, MO 63801



April 2020

Sikeston Board of Municipal Utilities
Sikeston Power Station
Fly Ash Pond
Location Restrictions

April 2020

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Appendix A (Figures)

Professional Engineer's Certification

40 CFR 257.60(b) Placement Above The Uppermost Aquifer

I, Thomas R. Gredell, P.E., GREDELL Engineering Resources, Inc., a professional engineer licensed in the State of Missouri, hereby certify in accordance with 40 CFR 257.60(b) that the Sikeston Board of Municipal Utilities, Sikeston Power Station, Fly Ash Pond meets the location restrictions demonstration of 40 CFR 257.60(a) for placement above the uppermost aquifer as found in federal regulation 40 CFR 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. In addition, the demonstration has been prepared using good engineering, geologic, and environmental judgement, and standard accepted practices.

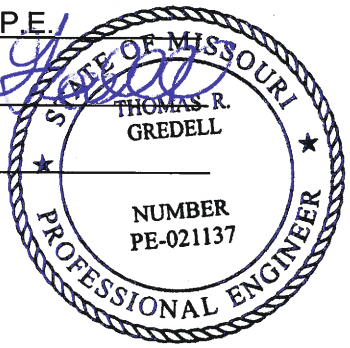
Name: Thomas R. Gredell, P.E.

Signature: _____

Date: 4-15-20

Registration Number: PE-021137

State of Registration: Missouri



Professional Engineer's Certification

40 CFR 257.61(b) Wetlands

I, Thomas R. Gredell, P.E., GREDELL Engineering Resources, Inc., a professional engineer licensed in the State of Missouri, hereby certify in accordance with 40 CFR 257.61(b) that the Sikeston Board of Municipal Utilities, Sikeston Power Station, Fly Ash Pond meets the location restrictions demonstration of 40 CFR 257.61(a) for wetlands as found in federal regulation 40 CFR 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. In addition, the demonstration has been prepared using good engineering and environmental judgement, and standard accepted practices.

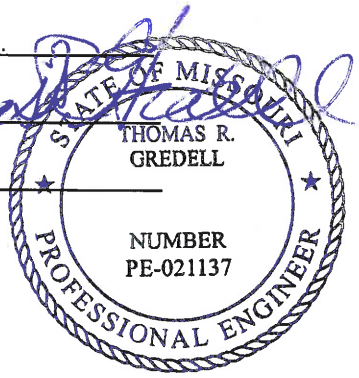
Name: Thomas R. Gredell, P.E.

Signature: _____

Date: 4-15-20

Registration Number: PE-021137

State of Registration: Missouri



Professional Engineer's Certification

40 CFR 257.62(b) Fault Areas

I, Thomas R. Gredell, P.E., GREDELL Engineering Resources, Inc., a professional engineer licensed in the State of Missouri, hereby certify in accordance with 40 CFR 257.62(b) that the Sikeston Board of Municipal Utilities, Sikeston Power Station, Fly Ash Pond meets the location restrictions demonstration of 40 CFR 257.62(a) for fault areas as found in federal regulation 40 CFR 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. In addition, the demonstration has been prepared using good engineering, geologic, and environmental judgement, and standard accepted practices.

Name: Thomas R. Gredell, P.E.

Signature: _____

Date: 4-15-20

Registration Number: PE-021137

State of Registration: Missouri

Professional Engineer's Certification

40 CFR 257.63(b) Seismic Impact Zones

I, Thomas R. Gredell, P.E., GREDELL Engineering Resources, Inc., a professional engineer licensed in the State of Missouri, hereby certify in accordance with 40 CFR 257.63(b) that the Sikeston Board of Municipal Utilities, Sikeston Power Station, Fly Ash Pond meets the location restrictions demonstration of 40 CFR 257.63(a) for seismic impact zones as found in federal regulation 40 CFR 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. In addition, the demonstration has been prepared using good engineering and environmental judgement, and standard accepted practices.

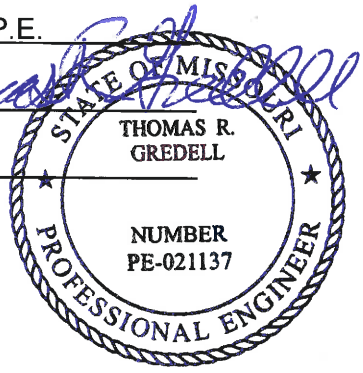
Name: Thomas R. Gredell, P.E.

Signature: _____

Date: 4-15-20

Registration Number: PE-021137

State of Registration: Missouri



Professional Engineer's Certification

40 CFR 257.64(b) Unstable Areas

I, Thomas R. Gredell, P.E., GREDELL Engineering Resources, Inc., a professional engineer licensed in the State of Missouri, hereby certify in accordance with 40 CFR 257.64(b) that the Sikeston Board of Municipal Utilities, Sikeston Power Station, Fly Ash Pond meets the location restrictions demonstration of 40 CFR 257.64(a) for unstable areas as found in federal regulation 40 CFR 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. In addition, the demonstration has been prepared using good engineering and environmental judgement, and standard accepted practices.

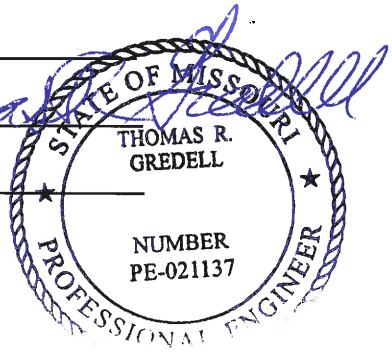
Name: Thomas R. Gredell, P.E.

Signature: _____

Date: 4-15-20

Registration Number: PE-021137

State of Registration: Missouri



1.0 INTRODUCTION

In accordance with the scope of services outlined in the Sikeston Board of Municipal Utilities (SBMU) Work Order No. 26 dated October 22, 2019, GREDELL Engineering Resources, Inc. (Gredell Engineering) conducted a location restrictions assessment for the SBMU Sikeston Power Station (SPS) Fly Ash Pond, an existing coal combustion residual (CCR) surface impoundment. This report describes Gredell Engineering's assessment for the Fly Ash Pond conducted in accordance with §257.60 through §257.64 and is accompanied by the required certifications by a qualified professional engineer.

On June 14, 2016, the D.C. Circuit Court of Appeals ordered the vacatur of the early closure provisions in §257.100. The impact of the vacatur was that SPS's inactive Fly Ash Pond must comply with all the requirements applicable to existing surface impoundments. In response, SPS elected not to continue with closure and resumed the disposal of fly ash in the Fly Ash Pond. As a result, the Fly Ash Pond is subject to extension compliance deadlines resulting from the initial inactive status and the Response to Partial Vacatur (the Direct Final Rule). The compliance deadline for Location Restrictions Assessment are specified in §257.100(e)(2).

SBMU-SPS is located west of the City of Sikeston, south of West Wakefield Avenue, and east of Route BB in Scott County, Missouri. The Fly Ash Pond resides to the northeast of SPS, east of SPS's coal pile, and north of the Bottom Ash Pond (Appendix A - Figure 1).

The Fly Ash Pond has a surface area of approximately 30 acres. According to the facility's construction record drawings, the berms were built with a crest elevation of 322 feet and capped with six inches of crushed rock. Internal and external sideslopes were graded to a 2:1 slope and top-of-berm width is 20 feet on all sides except the 25 foot wide southern berm that abuts the Bottom Ash Pond. The finished subgrade elevation of the Fly Ash Pond base was 300 feet. A two-foot-thick compacted clay liner was constructed on the floor and interior slopes. The bottom, interior, and exterior slopes of the pond berms were covered with four inches of topsoil, which was seeded, mulched and netted to protect against erosion. The construction record drawings demonstrate that the base elevation of the Fly Ash Pond is approximately 302 feet.

SPS and the Fly Ash Pond are located at a transition between agricultural and urban areas. City-owned property directly borders the Fly Ash Pond to the east, south, and west. The Fly Ash Pond is in proximity to residential, commercial, and agricultural areas. Residential areas are located approximately 450 feet northeast and 600 feet southeast of the Fly Ash Pond. Commercial areas are located approximately 1,700 feet east of the Fly Ash Pond. The remaining area near the Fly Ash Pond is agricultural land.

The Sikeston area is located in the Southeastern Lowland Province, a vast alluvial plain representing the northernmost point of the Mississippi River Embayment. Unlike other parts of the state, the geologic and hydrologic setting of the Southeastern Lowland Province is relatively straightforward. This is due to the relatively young geologic age of the region and to the

consistency in depositional processes that have resulted in a thick accumulation of fluvial and deltaic sediments that range from Upper Mesozoic (Cretaceous) to Recent (Holocene) in age.

Groundwater movement within the unconfined alluvial aquifer underlying the Fly Ash Pond is to the west-southwest toward Richland Drainage Ditch #4 (Appendix A - Figure 1), one of several north-south trending surface runoff control ditches in the area that flows to the south to a larger irrigation channel (Gredell Engineering, 2017). Movement is along a shallow hydraulic gradient estimated at between 1.72×10^{-4} to 1.36×10^{-3} ft/ft (Gredell Engineering, 2017). Depth to the top of the water table near the Fly Ash Pond varies from approximately 8.3 to 20.2 feet below ground surface, dependent on the topographic position of the monitoring well.

Unlike many coal-fired power plants, the Sikeston Power Station is not located adjacent to a major river (the Mississippi River is located approximately 16 miles northeast of the site). Therefore, short-term fluctuations or reversals in the water table surface due to river level changes do not occur. Rather, water levels in the alluvial aquifer fluctuate predominantly as a result of precipitation, which is the predominant source of recharge in the area (Miller and Vandike, 1997).

2.0 LOCATION RESTRICTIONS ASSESSMENT

The Federal CCR Rule requires a location restrictions assessment for existing CCR surface impoundments. The SBMU-SPS Fly Ash Pond is an existing CCR surface impoundment. This location restrictions assessment documents the placement above the uppermost aquifer, wetlands, fault areas, seismic impact zones, and unstable areas. These assessments are described in the following subsections.

2.1 §257.60 Placement Above the Uppermost Aquifer

The pertinent parts of the Federal CCR Rule for placement above the uppermost aquifer are reiterated below and require the following:

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be 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). The owner or operator must demonstrate by the dates specified in paragraph (c) of this section that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(c) The owner or operator of the CCR unit must complete the demonstration required by paragraph (a) of this section by the date specified in either paragraph (c)(1) or (2) of this section.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in §257.105(e), the notification requirements specified in §257.106(e), and the internet requirements specified in §257.107(e).

However, as a result of the extension compliance deadlines resulting from the initial inactive status of the Fly Ash Pond and the Response to Partial Vacatur (the Direct Final Rule), the compliance deadline for a Location Restrictions Assessment is specified in §257.100(e)(2)(i):

(e) Timeframes for certain inactive CCR surface impoundments.

(2) Location restrictions.

(i) No later than April 16, 2020, the owner or operator of the inactive CCR surface impoundment must:

(A) Complete the demonstration for placement above the uppermost aquifer as set forth by §257.60(a), (b), and (c)(3);

Evaluation: Gredell Engineering conducted an evaluation of the placement above the uppermost aquifer for the Fly Ash Pond. The Fly Ash Pond Groundwater Monitoring System consists of five wells, designated MW-1, MW-2, MW-3, MW-7, and MW-9 (Appendix A - Figure 2). MW-1 thru MW-3 were installed in April 2016. MW-7 was installed in April 2017 and MW-9 was installed in November 2017. Routine groundwater level measurements have been taken from these wells since installation. A summary of the static water levels for the uppermost aquifer from each well is depicted on the hydrographs presented in Appendix A – Figure 3. The hydrographs show the relationship between the recorded groundwater measurements in each well and the base of the CCR Unit. For much of the monitoring period, a five-foot vertical separation is maintained between the uppermost aquifer and the base of the CCR unit. However, during each of the Spring seasons depicted on the hydrograph, groundwater levels in at least one well rise to within five-foot of the unit base, with peak water levels rising to within approximately two-and-a-half feet of the base of the CCR unit. The typical duration of these seasonal cycles is approximately four months. The cycle duration was extended in 2019 as a result of non-typical (high) precipitation. The seasonal cycles shown by the recorded water levels represent a consistent pattern that is believed to be representative of future seasonal cycles.

The seasonal high water table portrayed on Appendix A - Figure 4 is a summary of the data collected on May 14, 2019, which represents the highest recorded groundwater levels for the uppermost aquifer. It illustrates the maximum extent to which groundwater in the uppermost aquifer has risen during the past four years routine monitoring has been conducted at the site.

Based on the data presented and in accordance with §257.60(a), Placement Above the Uppermost Aquifer, it is concluded that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations, including the seasonal high water table.

2.2 §257.61 Wetlands

The pertinent parts of the Federal CCR Rule for wetlands are reiterated below and require the following:

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in § 232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.

> *(1) Where applicable under section 404 of the Clean Water Act or applicable state wetlands laws, a clear and objective rebuttal of the presumption that an alternative to the CCR unit is reasonably available that does not involve wetlands.*
>
> *(2) The construction and operation of the CCR unit will not cause or contribute to any of the following:*
>
> > *(i) A violation of any applicable state or federal water quality standard;*

(ii) A violation of any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act;

(iii) Jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat, protected under the Endangered Species Act of 1973; and

(iv) A violation of any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary.

(3) The CCR unit will not cause or contribute to significant degradation of wetlands by addressing all of the following factors:

(i) Erosion, stability, and migration potential of native wetland soils, muds and deposits used to support the CCR unit;

(ii) Erosion, stability, and migration potential of dredged and fill materials used to support the CCR unit;

(iii) The volume and chemical nature of the CCR;

(iv) Impacts on fish, wildlife, and other aquatic resources and their habitat from release of CCR;

(v) The potential effects of catastrophic release of CCR to the wetland and the resulting impacts on the environment; and

(vi) Any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected.

(4) To the extent required under section 404 of the Clean Water Act or applicable state wetlands laws, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent reasonable as required by paragraphs (a)(1) through (3) of this section, then minimizing unavoidable impacts to the maximum extent reasonable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and reasonable compensatory mitigation actions (e.g., restoration of existing degraded wetlands or creation of man-made wetlands); and

(5) Sufficient information is available to make a reasoned determination with respect to the demonstrations in paragraphs (a)(1) through (4) of this section.

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(c) The owner or operator of the CCR unit must complete the demonstrations required by paragraph (a) of this section by the date specified in either paragraph (c)(1) or (2) of this section.

(d) The owner or operator must comply with the recordkeeping requirements specified in §257.105(e), the notification requirements specified in §257.106(e), and the Internet requirements specified in §257.107(e).

However, as a result of the extension compliance deadlines resulting from the initial inactive status of the Fly Ash Pond and the Response to Partial Vacatur (the Direct Final Rule), the compliance deadline for a Location Restrictions Assessment is specified in §257.100(e)(2)(i):

(e) Timeframes for certain inactive CCR surface impoundments.

(2) Location restrictions.

(i) No later than April 16, 2020, the owner or operator of the inactive CCR surface impoundment must:

(B) Complete the demonstration for wetlands as set forth by §257.61(a), (b), and (c)(3);

Evaluation: Gredell Engineering conducted an evaluation of the location restriction based on wetlands for the Fly Ash Pond. To evaluate the location restriction, Gredell Engineering utilized the Missouri Department of Natural Resources (MDNR) National Pollutant Discharge Elimination Permit (Permit Number MO-0095575), which was reissued on March 28, 2018; the United States Fish and Wildlife Service (U.S. Fish and Wildlife), National Wetlands Inventory; and U.S. Fish and Wildlife Endangered Species Inventory for Scott County.

Appendix A - Figure 1 is a map of the area surrounding the SBMU facility. Using the U.S. Fish and Wildlife Wetlands Inventory, the locations of wetlands were identified and are depicted on Appendix A - Figure 5. In addition to depicting locations, the Wetland Inventory also provides information on each of these symbols when the user clicks the symbol. The Fly Ash Pond is identified as: “L1UBK”, which is defined as Lacustrine, Subsystem Limnetic, indicating it has an unclassified bottom and is artificially flooded.

A Lacustrine System includes wetlands and deep water habitats with the following characteristics: 1) situated in a topographic depression; 2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens; and 3) has a total area of at least 20 acres. A Limnetic Subsystem includes all deep water habitats. An unclassified bottom includes deep water habitats with at least 25 percent cover of particles smaller than stones (less than 6 to 7 centimeters), and a vegetative cover of less than 30 percent. Artificially Flooded indicates that the amount and duration of flooding are controlled by means of pumps or siphons in combination with dikes, berms or dams. The vegetation growing on these areas cannot be considered a reliable indicator of Water Regime. The Artificially Flooded Water Regime Modifier should not be used in the Riverine System or for impoundments or excavated wetland unless the inputs and outputs are controlled to achieve a specific depth and duration of flooding. The Fly Ash Pond does not control the inputs and outputs to maintain a specific depth; therefore, it cannot be classified as a ‘wetland’.

Operation of the Fly Ash Pond consists of transporting fly ash by truck and depositing it in the pond. Water level is inconsistent and dependent on precipitation events, wind and

evapotranspiration, which is incompatible with sustaining wetland growth. There is little to no cover, less than 30 percent, no hydric soils, and the Fly Ash Pond is greater than 20 acres in size. Therefore, by classification, wetlands are not present in the area of the Fly Ash Pond and the operation of the Fly Ash Pond does not impact wetlands. Further, Gredell Engineering has not observed wetland plants during routine annual inspections.

In accordance with §257.61, Wetlands, (a)(1)(3)(4) and (5) the Fly Ash Pond does not cause or contribute to significant degradation of wetlands. There will not be a net loss of wetlands or impacts to existing wetlands since wetlands are not present.

Using the U.S. Fish and Wildlife Information and Planning Consultation website, the area of the Fly Ash Pond in Scott County, Missouri was evaluated for species listed under the Endangered Species Act which are identified as threatened and endangered. The following is a listing of the analysis presented:

- Mammals: Gray Bat, Indiana Bat, and Northern long-eared Bat; “There are no critical habitats at this location.”
- Migratory Birds: Certain birds are protected under the Migratory Bird Treaty Act; “There are no migratory birds of conservation concern expected to occur at this location.”
- Facilities: National Wildlife Refuge Lands; “There are no Refuge Lands at this location.”
- Fish Hatcheries: “There are no Fish Hatcheries at this location.”

In accordance with §257.61, Wetlands, (a)(2), based on this information, the Fly Ash Pond does not jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat.

SBMU-SPS operates under NPDES permit MO-0095575. The NDPES permit process incorporates the requirements of the Clean Water Act and its subsection, which are transferred by the United States Environmental Protection Agency (USEPA) to the State of Missouri who reviews those requirements in conjunction with Missouri State Water Quality Standards and issues a State Operating Permit under the Missouri Clean Water Law. Discharges from SBMU-SPS are controlled through Outfall #003 (Appendix A - Figure 1). The SBMU-SPS site is in compliance with the State of Missouri Operating Permit.

Appendix A - Figure 5 identifies the receiving stream; Richland Drainage Ditch #4, Ditch #4 (P) WBID #3046; located in United States Geological Service Basin Ash Slough Ditch 08020204-0604. The discharge from SBMU-SPS is in compliance with The Missouri State Operating Permit and does not impact fish, wildlife, and aquatic resources and their habitat as coal combustion residuals are not discharged above the permit limits.

The Marine Protection, Research, and Sanctuaries Act is not applicable to this site as the Act is directly applied to coastal facilities.

In accordance with §257.61, Wetlands, (a)(2) and (5), the Fly Ash Pond does not cause or contribute to a violation of applicable state or federal water quality standards; a violation of applicable toxic effluent standards of the Clean Water Act; or violate the requirements of the

Marine Protection, Research, and Sanctuaries Act. Therefore, the SBMU-SPS site meets the location restriction of §257.61 Wetlands.

2.3 §257.62 Fault Areas

The pertinent parts of the Federal CCR Rule for fault areas are reiterated below and require the following:

(a) 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.

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(c) The owner or operator of the CCR unit must complete the demonstration required by paragraph (a) of this section by the date specified in either paragraph (c)(1) or (2) of this section.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in §257.105(e), the notification requirements specified in §257.106(e), and the Internet requirements specified in §257.107(e).

However, as a result of the extension compliance deadlines resulting from the initial inactive status of the Fly Ash Pond and the Response to Partial Vacatur (the Direct Final Rule), the compliance deadline for a Location Restrictions Assessment is specified in §257.100(e)(2)(i):

(e) Timeframes for certain inactive CCR surface impoundments.

(2) Location restrictions.

(i) No later than April 16, 2020, the owner or operator of the inactive CCR surface impoundment must:

(C) Complete the demonstration for fault areas as set forth by §257.62(a), (b), and (c)(3);

Evaluation: Gredell Engineering conducted an evaluation of the location restriction based on fault areas for the Fly Ash Pond. To evaluate the location restriction, Gredell Engineering utilized the MDNR Geosciences Technical Resource Assessment Tool (GeoSTRAT). The Missouri Geological Survey (MGS) has collected geologic data in Missouri for over 165 years. The MGS developed this web-based, interactive tool in order to provide on-line information and make that data accessible at all times to citizens, city planners, industry representatives, academia and others. GeoSTRAT can be used for data assessments in various disciplines such as hazards assessment, environmental consulting and engineering, local and regional planning, insurance assessment and others.

Appendix A - Figure 6 is an area map of the surrounding area to the SBMU facility developed using GeoSTRAT to depict the locations of faults and structural folds in relation to the site. In addition to depicting locations, GeoSTRAT also provides information on each of these symbols when the user left clicks the symbol. The northeast trending feature located to the south of the SBMU facility is the approximate northwest boundary of the Reelfoot Rift. The northeast trending feature located north of the SBMU facility-is the Commerce Fault.

Both of these faults are associated with the New Madrid Seismic Zone (NMSZ) which covers parts of Arkansas, Illinois, Kentucky, Missouri, and Tennessee. The NMSZ is approximately 125 miles long and contains multiple faults that extend from Marked Tree, Arkansas, to Cairo, Illinois. More than 200 microseismic (magnitude less than 1.0 to about 2.0) earthquakes occur in the region each year, but most are of insufficient magnitude to be felt by humans.

The Commerce Fault is located approximately eight miles northwest of the SBMU facility and the Reelfoot Rift boundary is located approximately thirteen miles southeast of the site.

In accordance with §257.62(a), Fault Areas, these distances indicate the SBMU facility meets the location restriction criteria, and is located outside the required distance of 60 meters (200 feet) from the outermost damage zone of these faults.

2.4 §257.63 Seismic Impact Zones

The pertinent parts of the Federal CCR Rule for seismic impact zones are reiterated below and require the following:

(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

(b) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(c) The owner or operator of the CCR unit must complete the demonstration required by paragraph (a) of this section by the date specified in either paragraph (c)(1) or (2) of this section.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in §257.105(e), the notification requirements specified in §257.106(e), and the Internet requirements specified in §257.107(e).

However, as a result of the extension compliance deadlines resulting from the initial inactive status of the Fly Ash Pond and the Response to Partial Vacatur (the Direct Final Rule), the compliance deadline for a Location Restrictions Assessment is specified in §257.100(e)(2)(i):

(e) Timeframes for certain inactive CCR surface impoundments.

(2) Location restrictions.

(i) No later than April 16, 2020, the owner or operator of the inactive CCR surface impoundment must:

(D) Complete the demonstration for seismic impact zones as set forth by §257.63(a), (b), and (c)(3);

Evaluation: Gredell Engineering conducted an evaluation of the location restriction based on seismic impact zones for the Fly Ash Pond. To evaluate the location, Gredell Engineering accessed the United States Geological Survey (USGS) National Seismic Hazard Maps website. Data and maps are available for download of the most recent long-term model update (Petersen et al., 2019).

§257.53 Definitions: Seismic Impact Zone – means an area having a 2 percent or greater probability that the maximum expected horizontal acceleration, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years.

Appendix A - Figure 7 is a map of the area surrounding the SBMU facility, which incorporates data obtained from the USGS website indicating the facility is located in an area of chronic seismic activity known as the New Madrid Seismic Zone (NMSZ). This seismic activity is embedded in deeply buried Paleozoic and Precambrian basement rocks and reflects the vestiges of a failed rift system believed related to the early Pennsylvanian (Morrowan-Atokan) Oklahoma Aulocogen (e.g. Houseknecht, 1983). Spasmodic earthquakes generally of low magnitude (<2.0 Richter Scale) are therefore common and it is because of the seismic activity that the region is considered part of a seismic impact zone.

§257.63 states in part; "(a) New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site."

There have been multiple geologic and geotechnical investigations completed at SBMU-SPS that relate to seismic considerations. They are listed as follows:

- Burns & McDonnell (1977). *Report of Preliminary Subsurface Investigation for Board of Municipal Utilities, Sikeston, Missouri,* 76-076-1. (This is the original investigation for construction of the power station.)
- O'Brien & Gere Engineers (2010). *Dam Safety Assessment of CCW Impoundments, Sikeston Power Station,* a report to the U.S. EPA.
- Geotechnology (2011). *Global Stability Evaluation, Fly Ash and Bottom Ash Ponds, Sikeston Power Station, Sikeston, Missouri*, a report for Sikeston BMU.
- Haley & Aldrich (2016). *Detailed Initial Safety Factor Assessment, Sikeston Power Station, Bottom Ash Pond, Sikeston, Missouri*, a report for Sikeston BMU.

- Reitz & Jens (2018). *Safety Factor Assessment for Sikeston Power Station Fly Ash Pond*, *Sikeston, Missouri*, a report for Gredell Engineering and Sikeston BMU.

The Haley & Aldrich (2016) reference included a seismic evaluation as part of their safety factor assessment specifically for the Bottom Ash Pond. Data obtained during both the Burns & McDonnell (1977) subsurface investigation and the Geotechnology (2011) stability evaluation were used in conjunction with new data from field work conducted as part of their assessment. Haley and Aldrich contracted with the University of Memphis Center for Earthquake Research and Information to conduct a seismic survey to characterize shear wave velocity of subsurface soils at the site and develop a shear wave velocity profile for use in seismic response analysis and liquefaction evaluation. The findings from the measurement of the shear wave velocity profile by the University of Memphis were used in the Reitz & Jens (2018) safety factor assessment with permission from Sikeston BMU.

In addition to information provided in these referenced reports, Reitz & Jens collected Cone Penetrometer Test (CPT) soundings in two locations northeast and east of, and approximately 25 to 30 feet beyond, the Fly Ash Pond. This new data augmented information from previous reports collected on the west of the Fly Ash Pond and limited to within the dike itself. The soil strata beneath the pond and dike have been consolidated or densified by the weight of the CCR and dike, and therefore would have greater shear strength properties. The shear strength properties of the unconsolidated soil strata beyond the dike was critical to the stability assessment. The program CPT Pro was utilized to analyze the field data and determine soil characteristics used as input for the seismic assessment.

Reitz & Jens used the program SHAKE2000 to complete a site-specific seismic analysis for the Fly Ash Pond. They selected pseudo bedrock acceleration time-histories for Memphis for their analysis because it is more geologically similar to Sikeston than other choices in the program. They ran multiple analyses of short, medium and long duration time-histories analyses. The results of peak horizontal ground accelerations provided a range of 0.39 g to 0.6 g for top of bedrock, and 0.35 g to 0.39 g at the ground surface. Analyses for liquefaction indicated potential in three of nine different sand strata identified at the site.

Reitz & Jens analyzed the stability of the critical embankment cross-section using the program SLIDE 7.0. The analyses were conducted under the static load condition, seismic load condition, and static load condition with liquefaction.

Results of the analyses under the static load condition indicated slides with factors of safety of 1.64, 3.631, and 3.672. The minimum FS (1.64) is for a surficial slide on the downstream slope, which would have little impact on the stability of the dike. The minimum required FS for this load condition is 1.50. Therefore, the Fly Ash Pond is satisfactory for the long-term, maximum storage load condition.

Results of analyses under the seismic load condition indicated slides with factors of safety of 1.089, 1.611, and 2.662. The minimum FS (1.09) is for a surficial slide on the downstream slope,

which would have little risk of allowing discharge of the CCR and water from the pond. The minimum required FS for this load condition is 1.00. Therefore, the Fly Ash Pond is satisfactory for the seismic load condition.

Results of analyses under the static load condition with liquefaction indicated slides with factors of safety of 1.682, 3.097, and 4.069. The minimum FS (1.68) is for a surficial slide on the downstream slope, which would have little risk of allowing discharge of the CCR and water from the pond. The minimum required FS for this load condition is 1.20. Therefore, the Fly Ash Pond is satisfactory for the static load condition with liquefaction of the foundation soil strata.

In accordance with §257.63(a), Seismic Impact Zones, based on the evidence provided above, Gredell Engineering concludes that the demonstration has been made by recent past analysis by others that all structural components are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

2.5 §257.64 Unstable Areas

The pertinent parts of the Federal CCR Rule for unstable areas are reiterated below and require the following:

(a) An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.

(b) The owner or operator must consider all of the following factors, at a minimum, when determining whether an area is unstable:

(1) On-site or local soil conditions that may result in significant differential settling;

(2) On-site or local geologic or geomorphologic features; and

(3) On-site or local human-made features or events (both surface and subsurface).

(c) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of paragraph (a) of this section.

(d) The owner or operator of the CCR unit must complete the demonstration required by paragraph (a) of this section by the date specified in either paragraph (d)(1) or (2) of this section.

(e) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in §257.105(e), the notification requirements specified in §257.106(e), and the Internet requirements specified in §257.107(e).

However, as a result of the extension compliance deadlines resulting from the initial inactive status of the Fly Ash Pond and the Response to Partial Vacatur (the Direct Final Rule), the compliance deadline for a Location Restrictions Assessment is specified in §257.100(e)(2)(i):

(e) Timeframes for certain inactive CCR surface impoundments.

(2) Location restrictions.

(i) No later than April 16, 2020, the owner or operator of the inactive CCR surface impoundment must:

(E) Complete the demonstration for unstable areas as set forth by §257.64(a), (b), and (c)(3);

Evaluation: Gredell Engineering conducted an evaluation of the location restriction based on unstable areas for the Fly Ash Pond. To evaluate the location restriction, Gredell Engineering utilized GeoSTRAT. The MGS has collected geologic data in Missouri for over 165 years. The MGS developed this web-based, interactive tool in order to provide on-line information and make that data accessible at all times to citizens, city planners, industry representatives, academia and others. GeoSTRAT can be used for data assessments in various disciplines such as hazard assessments, environmental consulting and engineering, local and regional planning, insurance assessment and others.

Appendix A - Figure 8 is a map of the surrounding area to the SBMU facility developed using GeoSTRAT to depict the locations of features that may indicate unstable areas. Losing and gaining streams are often associated with a karst topography. The presence of springs may also be an indicator of a karst area. Sinkholes are often surface expressions of collapse features created from dissolution of the bedrock below the surface.

All of these features are co-located in an area of the map northwest of the SBMU facility associated with the increased density of caves. The southern boundary of cave density occurrence on this figure is a northeast trending line located approximately 20 miles from SBMU-SPS.

Not all indicators of unstable areas are naturally occurring. Mining activities below a site may also be responsible for sinkholes and losing streams. The depiction of mining activity on the map indicates a few locations approximately 10 to 20 miles west of the SBMU facility. In addition to depicting locations, GeoSTRAT also provides information on each of these symbols when the user left clicks the symbol. Each of these symbols located west of the site indicate they are either clay, or sand and gravel open pit mines which do not affect the subsurface or create an unstable area below the site.

In accordance with §257.64(a), Unstable Areas, the information presented above indicates the Fly Ash Pond is not located in an unstable area based on data obtained from GeoSTRAT and site specific information recorded on logs of borings and excavations located around the perimeter of the Fly Ash Pond.

3.0 MISCELLANEOUS REQUIREMENTS

§257.60(d), §257.61(d), §257.62(d), §257.63(d) and §257.64(d) state that SBMU-SPS must comply with:

- The recordkeeping requirements specified in §257.105(e);
- The notification requirements specified in §257.106(e), and;
- The Internet requirements specified in §257.107(e).

4.0 REFERENCES

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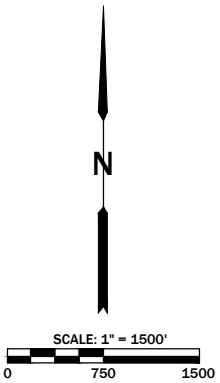

LOCATION RESTRICTIONS
FLY ASH POND
SIKESTON POWER STATION

FIGURE 1 - AERIAL VIEW

GREDELL Engineering Resources, Inc.

ENVIRONMENTAL ENGINEERING LAND - AIR - WATER

1505 East High Street
Jefferson City, Missouri

Telephone: (573) 659-9078
Facsimile: (573) 659-9079

MO CORP. ENGINEERING LICENSE NO. E-2001001669-D

DATE	SCALE	PROJECT NAME	REVISION
4/2020	AS NOTED	SIKESTON	
DRAWN	**APPROVED**	**FILE NAME**	**SHEET #**
CP	KE	AERIAL	1 OF 1

N

SCALE: 1" = 500'

0 250 500

LEGEND

PROPERTY LINE (APPROXIMATE)	PL
MONITORING WELL	MW
UP GRADIENT MONITORING LOCATION	UG
DOWN GRADIENT MONITORING LOCATION	DG

NOTES:
1. IMAGE PROVIDED BY BING MAPS.
2. MONITORING WELL LOCATIONS/ELEVATIONS SURVEYED BY BOWEN ENGINEERING & SURVEYING.

SIKESTON POWER STATION
LOCATION RESTRICTIONS - PLACEMENT ABOVE THE UPPERMOST AQUIFER

FIGURE 2 - FLY ASH POND MONITORING WELL NETWORK

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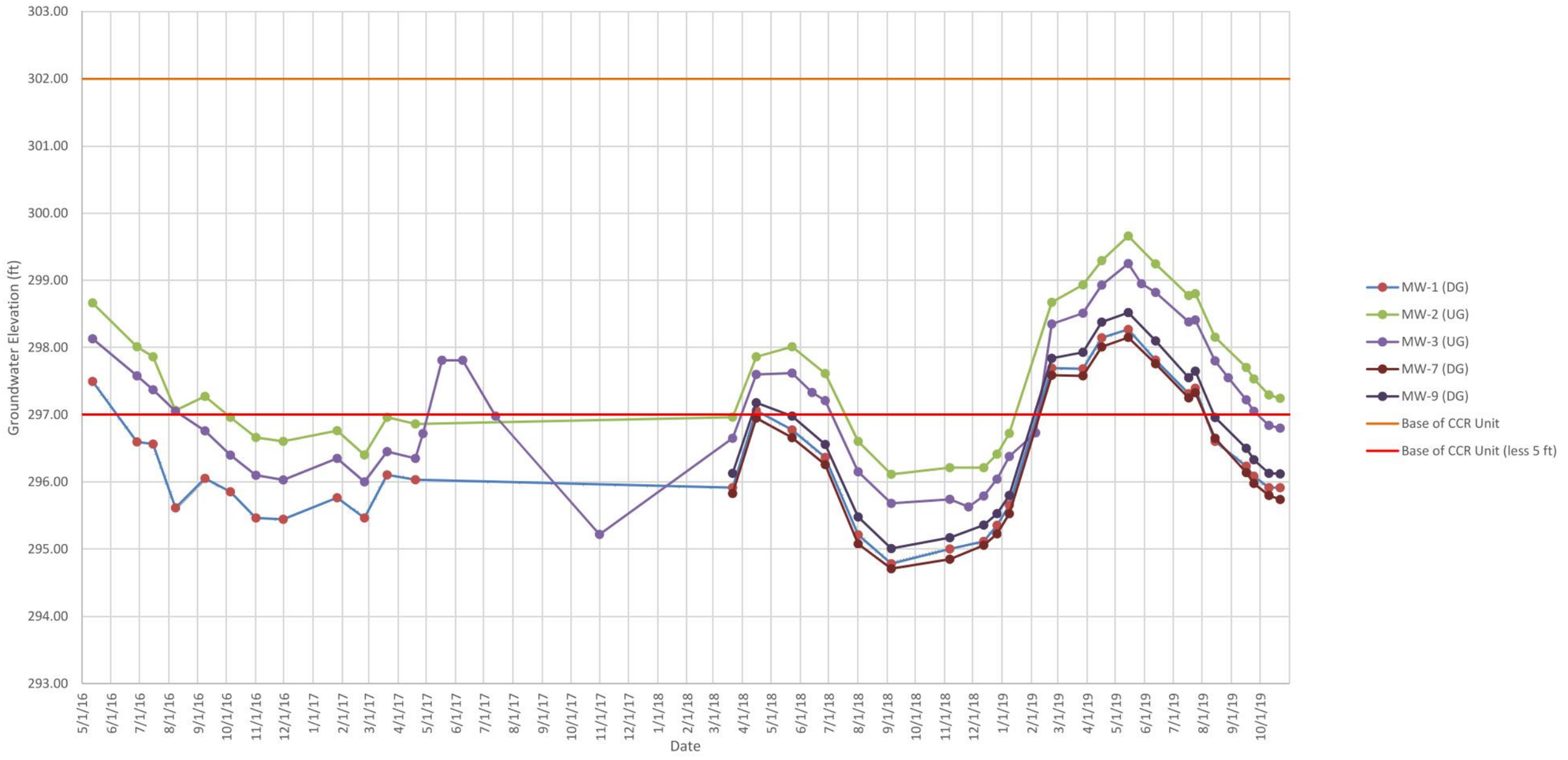
DATE	SCALE	PROJECT NAME	REVISION
4/2020	AS NOTED	SIKESTON	
DRAWN	APPROVED	FILE NAME	SHEET #
CP	KE	LOCATION RESTRICTION	1 OF 1

O:\CADDFiles\SIKESTON\LOCATION RESTRICTIONS\FAP\FLY ASH POND MAP.dwg, FIGURE 2, 3/3/2020 9:46:07 AM

Groundwater Monitoring System - Fly Ash Pond
Sikeston Power Station
Sikeston, Missouri
Monitoring Well Hydrographs



#	DATE	REVISION DESCRIPTION	BY

FIGURE 3 - GROUNDWATER MONITORING SYSTEM HYDROGRAPHS

SIKESTON POWER STATION
LOCATION RESTRICTIONS
PLACEMENT ABOVE THE UPPERMOST AQUIFER

SURVEYED	DESIGNED	DRAWN	CHECKED	APPROVED	DATE	SCALE
NA	NA	CP	KE	MCC	4/2020	AS NOTED

PROJECT NAME: SIEMSTON
FILE NAME: LOCATION RESTRICTION
SHEET # 1 OF 1

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O:\CAD\Siemston\LOCATION RESTRICTIONS\PLACEMENT ABOVE THE UPPERMOST AQUIFER.dwg, FIGURE 3, 3/17/2020 12:30:36 PM

N

SCALE: 1" = 500'

0 250 500

LEGEND

PROPERTY LINE (APPROXIMATE)	PL
VERTICAL SEPARATION ISOPACH (BASED ON 5-14-19 MEASUREMENTS)	3.0
MONITORING WELL	MW
UP GRADIENT MONITORING LOCATION	UG
DOWN GRADIENT MONITORING LOCATION	DG

NOTES:

1. IMAGE PROVIDED BY BING MAPS.
2. MONITORING WELL LOCATIONS/ELEVATIONS SURVEYED BY BOWEN ENGINEERING & SURVEYING.
3. GROUNDWATER ELEVATION MEASUREMENTS BY SIKESTON POWER STATION ON 5-14-19.
4. MAP DEVELOPMENT BASED ON CONTOURS GENERATED BY SURFER® SOFTWARE.

SIKESTON POWER STATION
LOCATION RESTRICTIONS - PLACEMENT ABOVE THE UPPERMOST AQUIFER

FIGURE 4 - VERTICAL SEPARATION ISOPACH MAP

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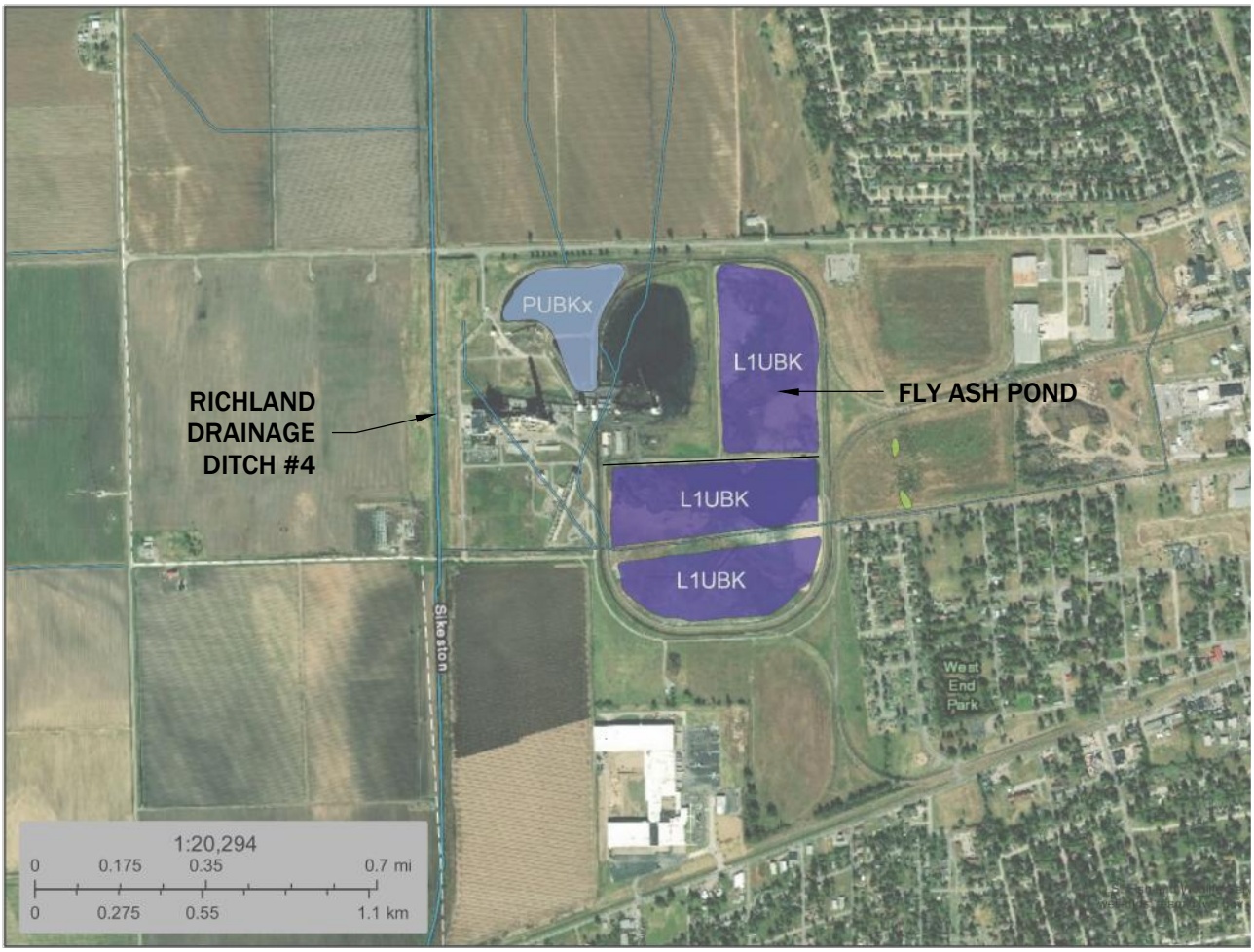
DATE	SCALE	PROJECT NAME	REVISION
4/2020	AS NOTED	SIKESTON	
DRAWN	**APPROVED**	**FILE NAME**	**SHEET #**
CP	KE	LOCATION RESTRICTION	1 OF 1

O:\CADDFiles\SIKESTON\LOCATION RESTRICTIONS\FAP\FLY ASH POND MAP.dwg, FIGURE 4, 3/3/2020 9:45:44 AM



February 26, 2020

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

N

N.T.S.

NOTES:

1. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
2. ALL BOUNDARIES ARE APPROXIMATE.

SIKESTON POWER STATION LOCATION RESTRICTIONS WETLANDS

FIGURE 5 - WETLANDS INVENTORY MAP

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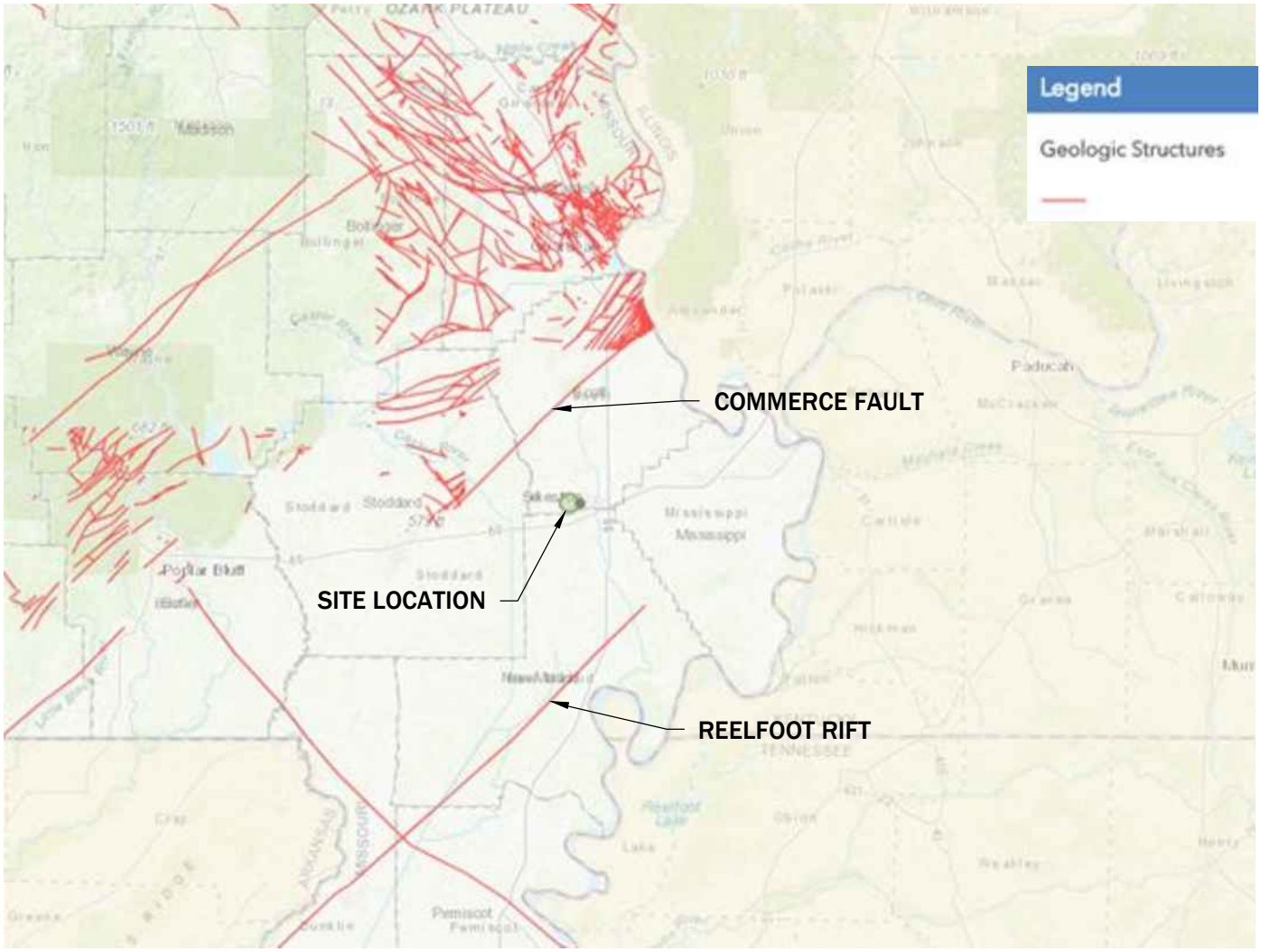
DATE	SCALE	PROJECT NAME	REVISION
4/2020	AS NOTED	SIKESTON	
DRAWN	APPROVED	FILE NAME	SHEET #
CP	MCC	LOCATION RESTRICTION	1 OF 1



SOURCE: GEOSTRAT (2020)

N

SCALE: 1" = 20 MILES

0 10 20

SIKESTON POWER STATION
LOCATION RESTRICTIONS
FAULT AREAS

FIGURE 6 - FAULT LOCATION MAP

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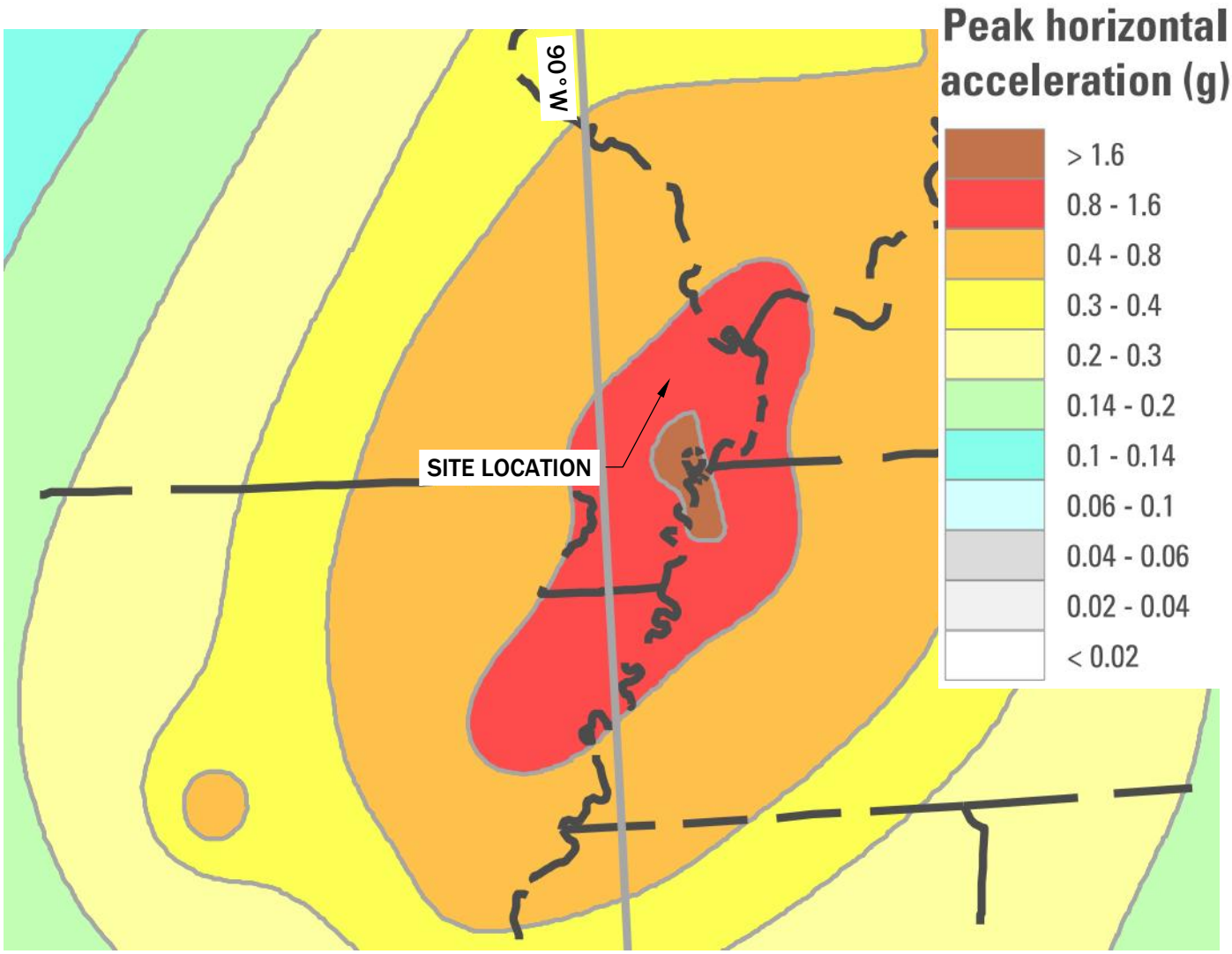
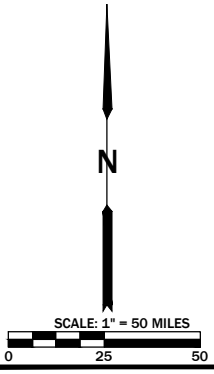
DATE	SCALE	PROJECT NAME	REVISION
4/2020	AS NOTED	SIKESTON	
DRAWN	APPROVED	FILE NAME	SHEET #
CP	MCC	LOCATION RESTRICTION	1 OF 1

O:\CADDFiles\SIKESTON\LOCATION RESTRICTIONS\FAP\GEOLOGIC STRUCTURE.dwg, FIGURE 6, 3/3/2020 9:45:12 AM



SOURCE : PETERSEN ET AL. (2019)



NOTES:
1. MAP DEPICTS PEAK HORIZONTAL ACCELERATION WITH 2% PROBABILITY OF EXCEEDANCE IN 50 YEARS.

SIKESTON POWER STATION
LOCATION RESTRICTIONS
SEISMIC IMPACT ZONES

FIGURE 7 - SEISMIC IMPACT ZONE LOCATION MAP

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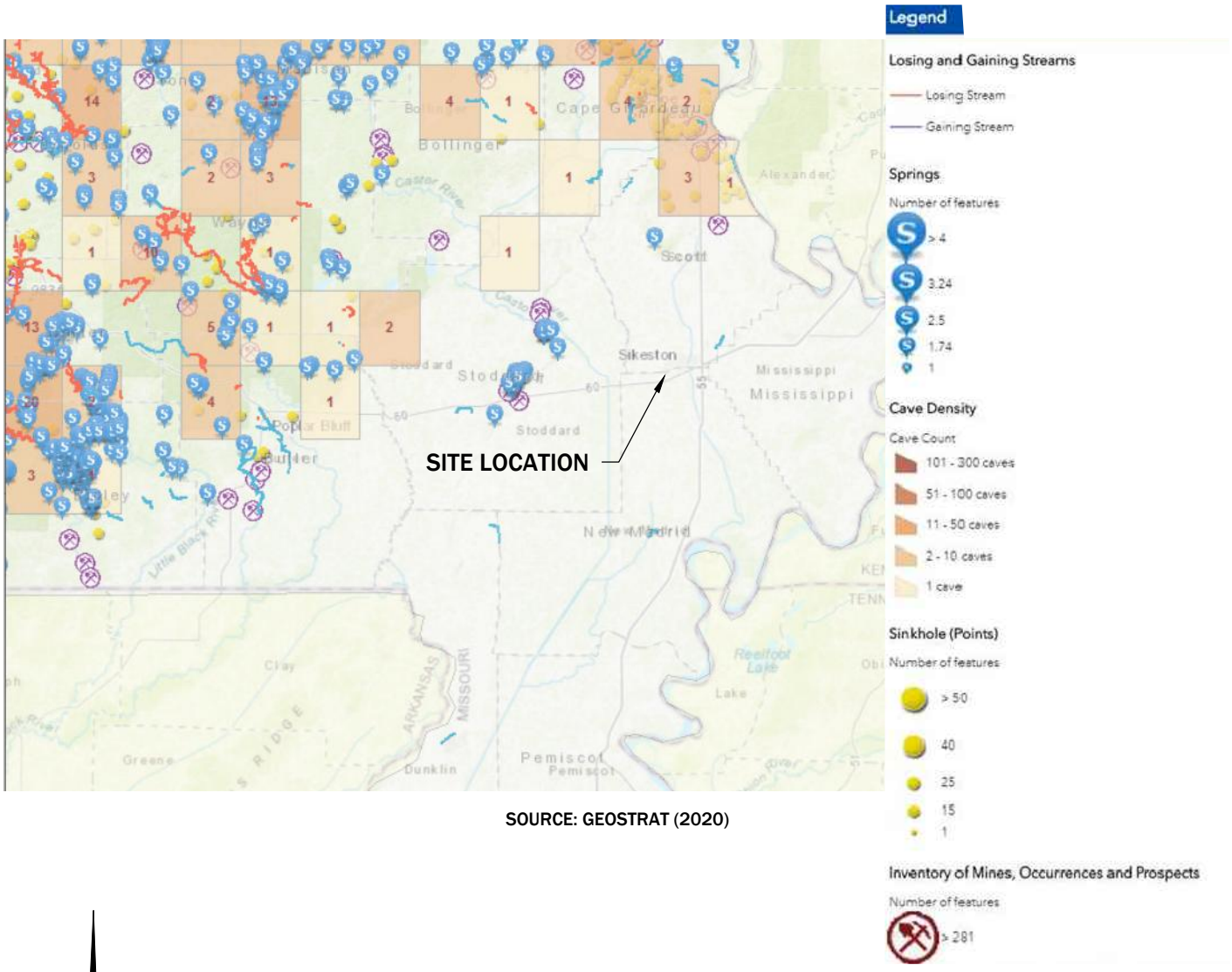
DATE	SCALE	PROJECT NAME	REVISION
4/2020	AS NOTED	SIKESTON	
DRAWN	APPROVED	FILE NAME	SHEET #
CP	MCC	LOCATION RESTRICTION	1 OF 1

O:\CADDFiles\SIKESTON\LOCATION RESTRICTIONS\FAP\UNSTABLE AREAS.dwg, FIGURE 7, 3/4/2020 9:32:49 AM



SOURCE: GEOSTRAT (2020)

N

SCALE: 1" = 20 MILES

0 10 20

SIKESTON POWER STATION
LOCATION RESTRICTIONS
UNSTABLE AREAS

FIGURE 8 - UNSTABLE FEATURES MAP

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DATE	SCALE	PROJECT NAME	REVISION
4/2020	AS NOTED	SIKESTON	
DRAWN	APPROVED	FILE NAME	SHEET #
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O:\CADDFiles\SIKESTON\LOCATION RESTRICTIONS\FAP\KARST & MINES.dwg, FIGURE 8, 3/4/2020 11:45:59 AM