*Prepared for:*

**Louisiana Generating, LLC**

**10431 Cajun II Road, Highway 981**

**New Roads, Louisiana 70760**

# LOCATIONS RESTRICTIONS COMPLIANCE DEMONSTRATION REPORT

## Big Cajun II Power Station

## New Roads, Pointe Coupee Parish, Louisiana

*Prepared by:*

Geosyntec consultants

engineers | scientists | innovators

5420 Corporate Boulevard, Suite 202
Baton Rouge, Louisiana 70808

Project Number: TXR0944

October 2018

**Certification Statement – Demonstration of Compliance with Location Restrictions**

**Federal CCR Rule:** 40 CFR §257.60-64

**CCR Unit:** Fly Ash and Bottom Ash Basins at the Big Cajun II Power Station

**Certification:**

I, **James D. McNash**, a qualified professional engineer registered in the state of **Louisiana**, am the engineer-of-record for the Locations Restrictions Compliance Assessment of the above-referenced coal combustion residual (CCR) Unit – the design of which is documented in the Type 1 Solid Waste Facility Permit Renewal and Modification Application dated 30 November 2010 [Permit number P-0108]. Based on the evaluations presented in this Location Restrictions Compliance Demonstration Report, the above-referenced CCR Units are, in my professional opinion, demonstrated to be in compliance with the United States Environmental Protection Agency (USEPA) location restriction requirements for the siting criteria of 40 CFR §257.60-64 for existing CCR surface impoundments.

Seal and Signature: 


Printed Name: James D. McNash

PE License Number: 039007 State: Louisiana

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# 1. INTRODUCTION

Geosyntec Consultants (Geosyntec) prepared this *Location Restrictions Compliance Demonstration Report (Report)* on behalf of Louisiana Generating, LLC (LaGen). The subject of this compliance demonstration is the coal combustion residuals (CCR) surface impoundments at the Big Cajun II Power Station (Big Cajun II). These surface impoundments are also regulated under the Louisiana Department of Environmental Quality (LDEQ) solid waste regulations (LAC 33:VII Subpart 1).

On 17 April 2015, the United States Environmental Protection Agency (USEPA) promulgated the Federal Coal Combustion Residuals Rule (CCR Rule) that establishes national minimum criteria for existing and new CCR landfills and surface impoundments. The Bottom and Fly Ash Basins at Big Cajun II are subject to the CCR Rule as existing CCR surface impoundments as defined in 40 Code of Federal Regulations (CFR) §257.53. As such, a demonstration is required to document whether or not these CCR units are in compliance with the location restriction requirements under 40 CFR §257.60 through §257.64.

This Report serves as Big Cajun II's location restriction demonstration for the onsite Fly Ash Basin and Bottom Ash Basin CCR units.

## 1.1 Facility Background

Big Cajun II is a coal- and natural gas-fired, steam turbine electric power generation facility located on 1,939 acres northeast of New Roads, Louisiana (LA), as shown in Figure 1, and began operations over 30 years ago. A site map showing relevant facility areas associated with CCR management is presented on Figure 2. Figure 2 depicts the five industrial solid waste facilities: Fly Ash Basin, Bottom Ash Basin, Rainfall Surge Pond, Primary Treatment Pond, and Secondary Treatment Pond. The Fly Ash Basin and Bottom Ash Basin are subject to the Federal CCR Rule requirements described herein.

The Fly Ash Basin and Bottom Ash Basin occupy approximately 250 acres and are located to the northwest of the three generating units. The Fly Ash Basin and Bottom Ash Basin currently operate under a LDEQ Solid Waste Permit as industrial surface impoundments. Stormwater and process wastewater that accumulates within the two CCR Basins are routed to the treatment ponds prior to discharge to the Mississippi River under Big Cajun II's Louisiana Pollutant Discharge Elimination System (LPDES) permit.

## 1.2 Previous Investigations and Reports

LaGen conducted a number of onsite field and subsurface investigations to collect geologic, hydrogeologic, and geotechnical data and these investigations include information within and adjacent to the Fly Ash and Bottom Ash Basin footprint that are relevant to, and used by, this location restriction demonstration. As such, this Report was prepared and supported by the

detailed information contained in available design and permit application reports, which are listed as follows:

- *Preliminary Subsoil Investigation and Foundation Design Data, Big Cajun No. 2 Site C-2*, New Roads, Louisiana, prepared by Louis J. Capozzoli & Associates, Inc. (Capozzoli), June 1974
- *Subsurface Soil Investigation and Laboratory Testing Ash Storage Area, CEPCO No. 2 Plant Site*, prepared by Louis J. Capozzoli & Associates, Inc., July 1977
- *Preliminary Subsoil Investigation and Foundation Design Dat*a, Big Cajun No. 2 Site C-2, New Roads, Louisiana, June 1974, prepared by Louis J. Capozzoli & Associates, Inc., 1974
- *Geotechnical Investigation Bottom Ash Storage Pond Expansion*, *Big Cajun No. II,* Pointe Coupee Parish, Louisiana, prepared by Louis J. Capozzoli & Associates, Inc., 2005
- *Appendix H Sampling and Analysis Plan, Big Cajun II,* Prepared by Shaw Environment and Infrastructure, Inc. (Shaw) as part of the Solid Waste Permit Renewal in November 2010.
- *Final Copies of Permit Renewal and Modification Application, Louisiana Generating LLC, Big Cajun II Power Plant.* Prepared by Shaw in November 2010.
- *Preliminary Geotechnical Engineering Services: Ash Basins/Wastewater Treatment Ponds, Big Cajun II Generation Site.* Prepared by GeoEngineers, Inc. in May 2011.
- *Completion Report – Monitoring Well Installation Solid Waste Impoundment Monitoring System. Louisiana Generating, LLC, Big Cajun II Power Plant*. Prepared by Shaw in August 2011.
- *Groundwater Assessment Monitoring Plan, Fly Ash Basin, Bottom Ash Basin, Rainfall Surge Pond, Primary Treatment Pond, Secondary Treatment Pond, Louisiana Generating, LLC.* Prepared by M.S. Environmental Consultants, Inc. in January 2013.
- *Big Cajun II, Coal Combustion Residual (CCR), Annual Inspection Report* prepared by CB&I Environmental & Infrastructure, Inc. (CB&I), January 2016
- *Big Cajun II, CCR Compliance: Fly Ash Basin and Bottom Ash Basin Structural Integrity Assessment Report*, prepared by CB&I, October 2016

## 2. LOCATION RESTRICTIONS EVALUATION

The location restrictions under §257.60 through §257.64 include: (1) Placement above the uppermost aquifer; (2) wetlands; (3) fault areas; (4) seismic impact zones; and (5) unstable areas.

The following sections describe the assessments conducted within this Report to demonstrate compliance of the Fly and Bottom Ash Basins with these location restrictions.

## 2.1 Placement Above the Uppermost Aquifer

40 CFR §257.60(a) states that existing surface impoundments "*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 "uppermost aquifer" is defined by §257.53 as 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 a facility's property boundary. Upper limit is measured at a point nearest to the ground surface to which the aquifer rises during the wet season.

Big Cajun II is located within the Mississippi River alluvial plain in a predominantly rural area. Land use within a 3-mile radius of Big Cajun II is dominated by cropland, pasture land, and deciduous forest land (M.S. Environmental Consultants, 2013). The subsurface alluvial sediments beneath Big Cajun II comprise a complex series of southerly dipping Holocene age clay, silt, sand, and gravel deposits that coarsen with depth. Braided outwash deposits of Pleistocene age are found below the Holocene age alluvium (Shaw, 2011).

The Groundwater Sampling and Analysis Plan (Shaw, 2010) described the Alluvial Aquifer as nearly 200-feet (ft) thick in the vicinity of Big Cajun II and overlain by as much as 35 feet of surficial silts, clays, and fine sands.

The alluvial aquifer is hydraulically connected to the Mississippi River and groundwater flows from the site toward the river. The Alluvial Aquifer is separated from the next underlying aquifer by approximately 100 feet of silts and clays with low permeability that provide an effective barrier for groundwater migration between the aquifers (Louis, J. Capazzoli & Associates, 1974).

Both the Fly Ash and Bottom Ash Basins were constructed above natural grade with a base of between approximately 28 feet mean sea level (MSL) and 32 feet MSL. The Fly Ash Basin and the Bottom Ash Basin were designed and constructed with a perimeter berm. The nearest aquifer to the base of the Fly Ash and Bottom Ash Basins (the uppermost aquifer) is the Alluvial Aquifer, which consists of dense and very dense gray sand and gravel with interbedded silts and clays and the upper limit of the aquifer is approximately 35 ft below ground surface (ft bgs) or -10 feet MSL (Shaw, 2010; see Appendix A). Appendix A presents depths (in ft bgs) where the upper limit of the uppermost permeable zone was identified in historical borings and is not corrected for elevation.

The base of the CCR basins is situated approximately between 28 and 32 ft MSL. Therefore, sufficient separation is provided for both the Bottom Ash and Fly Ash Basins. For the foregoing

reasons, the Fly Ash and Bottom Ash Basins are considered to be in compliance with the requirements of 40 CFR §257.60 for placement above the uppermost aquifer.

## 2.2 Wetlands

40 CFR §257.61(a) states that new CCR landfills "*must not be located in wetlands, as defined in §232.2 of this chapter, unless the owner or operator demonstrates…that the CCR unit meets the requirements of paragraph (a)(1) through (5) of this section.*" Wetlands, as defined in 40 CFR §232.2, means "*those areas that are inundated or saturated by surface or groundwater 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.*"

The National Wetlands Inventory classifies the Fly Ash and Bottom Ash Basins as man-made lake features (classification codes L2UBHx, L2USAx, L2EM2Fx, and L2USCx) and not as a wetland. (Figure 3). As such, the Fly Ash and Bottom Ash Basins are considered to be in compliance with the requirements of 40 CFR §257.61 for wetlands. A demonstration to show that the Fly Ash and Bottom Ash Basins meets the requirements of paragraphs (a)(1) through (a)(5) of 40 CFR §257.61 is not necessary since the CCR unit is not located within a wetland.

## 2.3 Fault Areas

40 CFR §257.62(a) states that existing surface impoundments *"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."*

The United States Geologic Survey (USGS) interactive fault map does not identify any faults within 200 meters of the Fly Ash or Bottom Ash Basins during the Quaternary Period with known displacement (USGS, 2006) as shown within Figure 4. Big Cajun II and the Fly Ash and Bottom Ash Basins are located within a recent alluvial deposit created by meandering of the Mississippi River. Surface manifestation of fault movements within the adjacent point bar deposit was not observed and does not suggest faults within the vicinity of the Fly Ash or Bottom Ash Basins. As such, no structural features indicative of recent (Holocene-age/Early Quaternary Period) fault movements were or have been identified within 200 feet of the Fly Ash or Bottom Ash Basins. For the foregoing reasons, the Fly Ash and Bottom Ash Basins are considered to be in compliance with the requirements of 40 CFR §257.62 for fault areas.

## 2.4 Seismic Impact Zones

40 CFR §257.63(a) states that existing CCR surface impoundments must not be located in seismic impact zones unless the Owner or Operator demonstrates that the unit was designed to resist the maximum horizontal acceleration in lithified material. A seismic impact zone is defined as "*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 0.10 g in 50 years.*"

The peak ground acceleration (PGA) for the site is 0.0505g as provided by the USGS Unified Hazard Tool (USGS, 2018) and the deaggregation is provided as Figure 5. The predicted PGA indicates that Big Cajun II does not reside within a seismic impact zone. As such, the Fly Ash and Bottom Ash Basins are in compliance with the requirements of 40 CFR §257.63 with respect to seismic impact zones.

## 2.5 Unstable Areas

40 CFR §257.64(a) indicates that existing surface impoundments "*must not be located in an unstable area unless the owner or operator demonstrates…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.*" An unstable area is defined as "*a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity, including structural components of some or all of the CCR unit that are responsible for preventing releases from such unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and karst terrains.*" To assess whether the Fly and Bottom Ash Basins are situated within an unstable area, the following conditions were evaluated:

- On-site or local soil conditions that may result in differential settlements;
- On-site or local soil conditions that may constitute poor foundation conditions;
- On-site or local geologic or geomorphologic features (i.e., potential karst terrain); and
- On-site or local human-made features or events (both surface and subsurface).

Historical subsurface investigations and reports indicate the following relevant information with respect to unstable areas in the vicinity of the Fly and Bottom Ash Basins.

- The Fly Ash and Bottom Ash Basins are not situated in an area with geologic features or the potential for geomorphically-induced phenomena that could be indicators of susceptibility to mass movements (i.e., landslides, avalanches, debris slides and flows, soil flocculation, block sliding, rock falls, or excessive surface erosion).

- The Fly Ash and Bottom Ash Basins are not situated in an area that is subject to coastal or river erosion, as the Mississippi River is over a half mile from and separated by engineered levees from the Fly Ash and Bottom Ash Basins.

- The Fly Ash and Bottom Ash Basins are not situated in an area of known subsurface mines, or in an area experiencing significant water or mineral withdrawal, nor do there appear to be evidence of other human-made features or human-induced events that could result in the downslope transport of soil material and subsequently induce mass movement for the CCR unit or otherwise impair the integrity of the unit.

- The Fly Ash and Bottom Ash Basins are not situated (as previously discussed) in an area where active faults have been observed.

- The Fly Ash and Bottom Ash Basins are underlain by clays and silts that are compressible and/or weaker soil strata and were thus further evaluated in the following subsections.

### 2.5.1 Differential Settlements

The Fly Ash and Bottom Ash Basins were evaluated to assess the potential of differential settlements on the CCR unit structural integrity as the structure is underlain by soft to stiff silts and clays, with variable compressibility. Since the CCR unit was constructed nearly 40 years ago, primary settlements are complete or nearly complete within the compressible foundation soils. In addition, the thickness and compressibility of the foundation soils is relatively uniform underneath the perimeter dike structure. Based on a review of the reports referenced in Section 1.2 and routine inspection reports, significant ground surface manifestations of differential settlements were not observed during routine inspections or operations and maintenance activities at and adjacent to the basins. As such, future differential settlements along the Fly Ash and Bottom Ash Basin perimeter dikes are not anticipated and will not affect the integrity of the structural components.

### 2.5.2 Poor Foundation Conditions

The presence of low shear strength, liquefiable, and potentially sensitive soils was evaluated at and in the vicinity of the Fly and Bottom Ash Basins. Extensive, continuous, or thick zones of sensitive soils, soils subject to rapid shear strength loss, or liquefiable soils based on the PGA for the 2 percent in 50 years seismic event were not identified. GeoEngineers (2011) compiled undrained shear strength ($S_u$) data with elevation data from available soil boring and laboratory records (Capozzoli, 1974; 1977; 2005) within the vicinity of the Fly Ash and Bottom Ash Basins. The data indicate lower undrained shear strength clay ($S_u < 400$ psf) was encountered in generally isolated pockets or a relatively thin layer beneath the Fly Ash and Bottom Ash Basin perimeter dike structures prior to basin construction. CB&I (2016b) evaluated the structural stability of the Fly Ash and Bottom Ash Basins with engineering parameters presented by GeoEngineers (2011).

GeoEngineers selected engineering parameters which were developed from data partially collected prior to surface impoundment construction; however, they considered undrained shear strength increases associated with post-dike construction consolidation within foundation soils. Based on the selected parameters, CB&I (2016b) demonstrated that the computed safety factors meet the requirements of the CCR Rule, for both the Fly Ash and Bottom Ash Basin perimeter dikes and the underlying foundation soils. Thus, the Fly Ash and Bottom Ash Basins are not located within an unstable area for which a mass movement is anticipated and would impair the CCR units' integrity.

## 3. CONCLUSION

Geosyntec evaluated the relevant and available data associated with the Fly Ash and Bottom Ash Basins at Big Cajun II to evaluate compliance with location restrictions per 40 CFR §257.60 through §257.64. Based on this evaluation, the Fly Ash and Bottom Ash Bains were found to be in compliance with the requirements of 40 CFR §257.60 through §257.64.

## 4. REFERENCES

CB&I Environmental & Infrastructure, Inc., 2016a. *Big Cajun II, Coal Combustion Residual (CCR), Annual Inspection Report,* Louisiana Generating, LLC, NRG Energy, Inc., New Roads, Louisiana.

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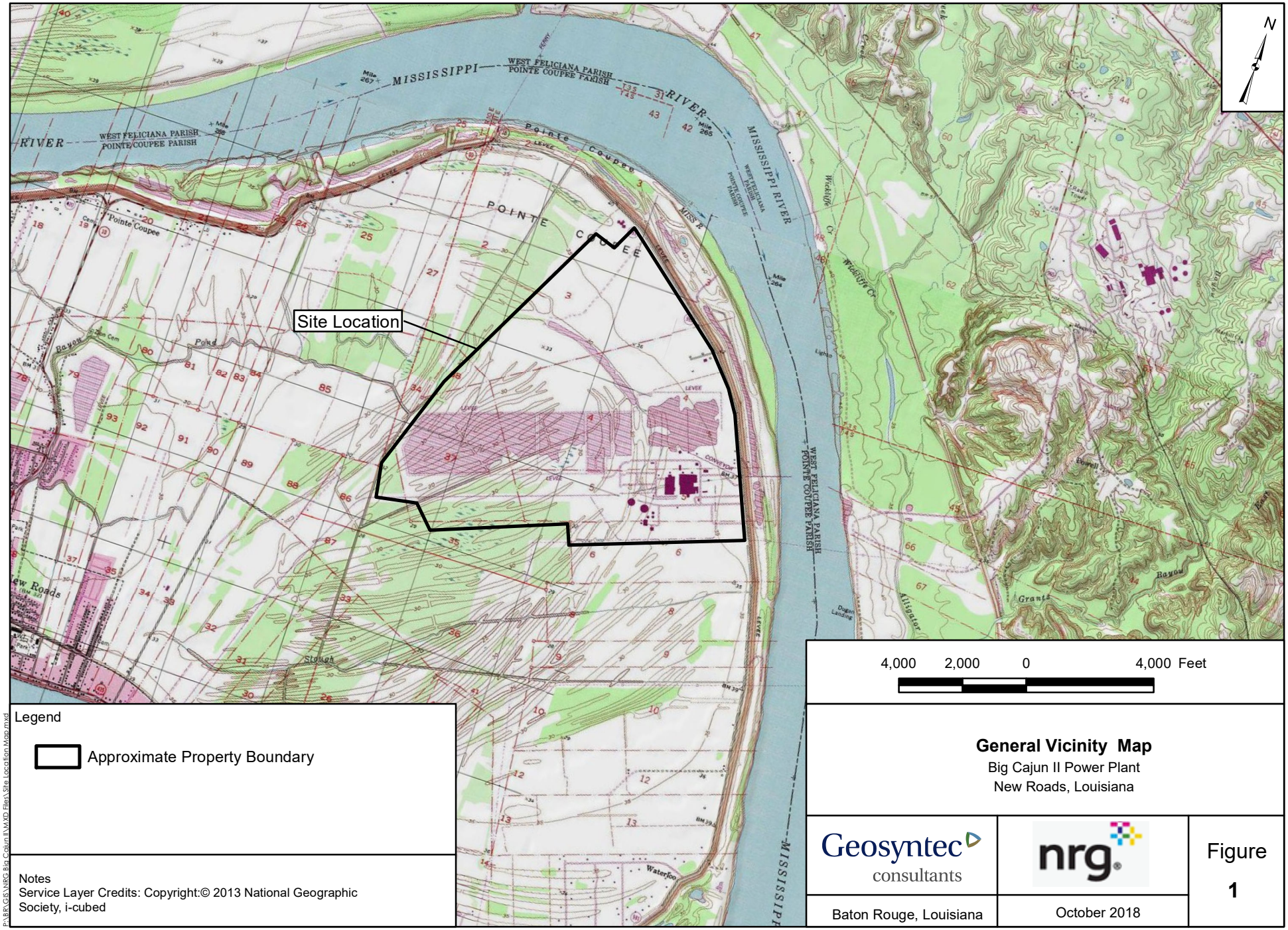
# Figures




**General Vicinity Map**

Big Cajun II Power Plant
New Roads, Louisiana

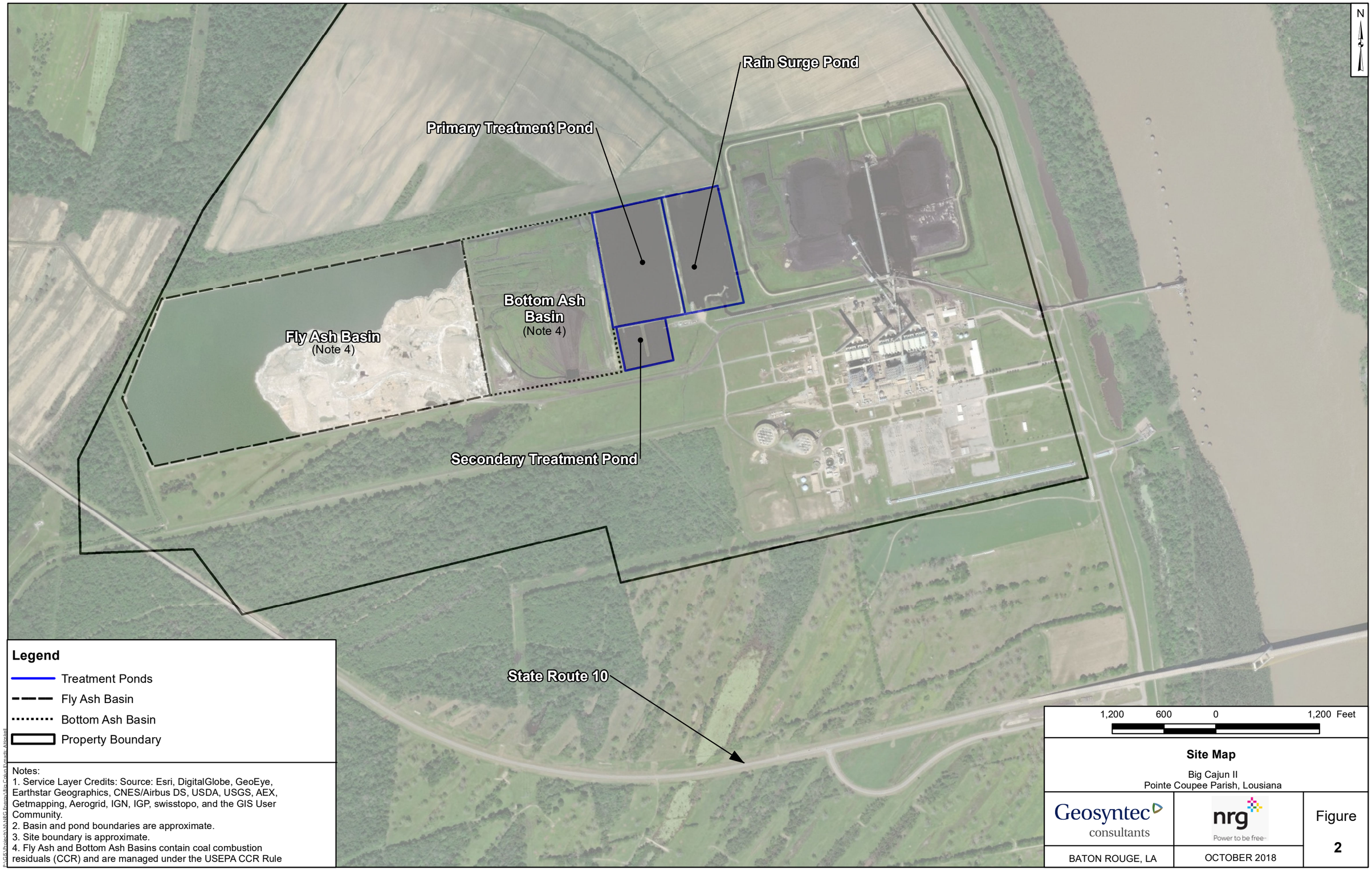
Geosyntec consultants

Baton Rouge, Louisiana

nrg

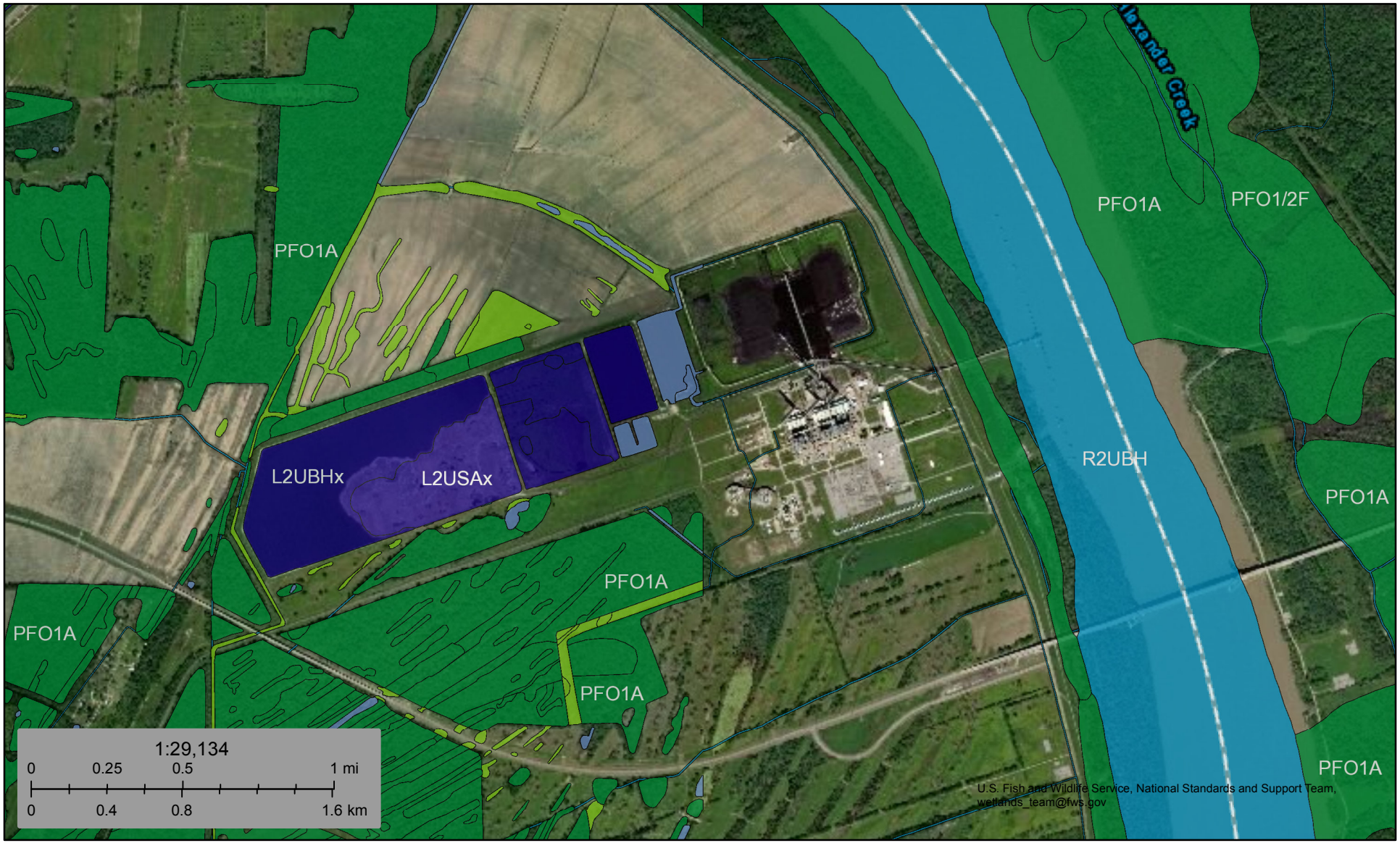
October 2018

Figure 1


N
Rain Surge Pond
Primary Treatment Pond
Bottom Ash Basin
(Note 4)
Fly Ash Basin
(Note 4)
Secondary Treatment Pond
State Route 10
Legend
Treatment Ponds
Fly Ash Basin
Bottom Ash Basin
Property Boundary
Notes:
1. Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.
2. Basin and pond boundaries are approximate.
3. Site boundary is approximate.
4. Fly Ash and Bottom Ash Basins contain coal combustion residuals (CCR) and are managed under the USEPA CCR Rule
1,200 600 0 1,200 Feet
Site Map
Big Cajun II
Pointe Coupee Parish, Lousiana
Geosyntec consultants
nrg Power to be free
Figure 2
BATON ROUGE, LA
OCTOBER 2018
P:\GIS\Projects\NA\NRG Energy\Big Cajun II\mxds\ Aerial.mxd

U.S. Fish and Wildlife Service
National Wetlands Inventory

# Big Cajun II Wetlands Inventory



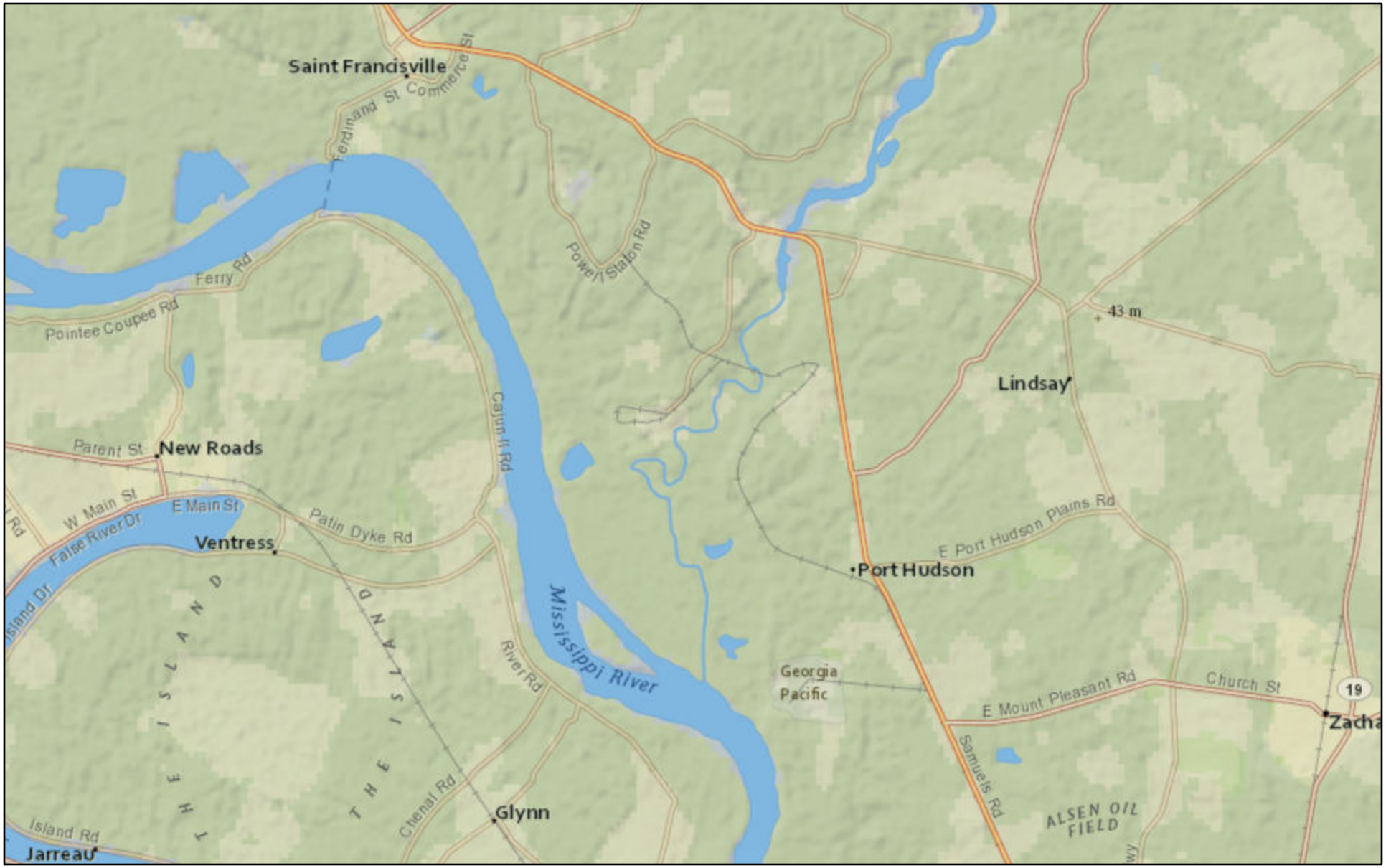

September 13, 2018

**Wetlands**

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

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

# U.S. Quaternary Faults Database - New Roads, LA




9/13/2018, 8:19:46 AM

1:144,448

0 1 2 4 mi

0 1.75 3.5 7 km

Quaternary faults

- unspecified age, well constrained location
- unspecified age, moderately constrained location
- unspecified age, inferred location
- undifferentiated Quaternary (< 130,000 years), well constrained location
- undifferentiated Quaternary (< 130,000 years), moderately constrained location

# Appendices

| IMAGE | X-REF | OFFICE | DRAWN BY | CHECKED BY | APPROVED BY | DRAWING NUMBER |
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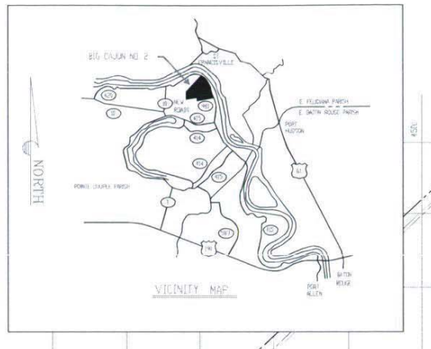






NOTES:
1. FOR PROPERTY DIMENSIONS AND BEARINGS SEE MAP PREPARED BY OFFICE OF BROUILLETTE, GIEPKE & ASSOC., INC. DATED 3-22-83

**LEGEND**

- PROPERTY LINE
- TOP OF SAND CONTOUR
- SOIL BORINGS ADVANCED IN 2005
- SOIL BORINGS ADVANCED PRIOR TO 1977
- MONITORING WELL LOCATION
- SOIL BORINGS ADVANCED IN 1974

SCALE
0 1000 2000 FEET

Shaw®

LOUISIANA GENERATING, L.L.C.
BIG CAJUN II POWER PLANT
NEW ROADS, LOUISIANA

**FIGURE 32**

**STRUCTURE CONTOUR MAP UPPERMOST PERMEABLE ZONE**

BIG CAJUN II POWER PLANT
SOLID WASTE PERMIT APPLICATION