3. AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter of the Kemper County IGCC Project EIS presents information describing environmental and other resources that might potentially be affected by the proposed action or analyzed alternatives; it serves as a baseline from which the proposed project's impacts are evaluated. This chapter describes the existing or baseline conditions of resources relative to the three major components of the proposed project: (1) the power plant, which is the component of the project that would be supported by the proposed action (funding and loan guarantee), and several offsite connected actions, including (2) the lignite surface mine, and (3) various linear facilities (pipelines and electric power lines). Environmental characteristics of the affected sites and rights-of-way, as well as their immediate surroundings, are described to levels of detail commensurate with importance of the issues or potential impacts. In most sections baseline conditions are described in detail. However, in some other sections, given the nature of some aspects of this project and the limited potential to impact some environmental resources, relatively brief information is provided to describe the existing environmental characteristics or baseline conditions.

The information and data provided in this chapter were gathered during field surveys as well as drawn from literature reports, maps, databases, and other publicly available sources. Sources include specific, project-related environmental documents and permit applications that have previously been filed. The information is presented in the following sections, which describe the physical, biological, environmental, socioeconomic, cultural, and aesthetic and other features and conditions of the project areas and their surroundings:

- 3.2—Regional Setting and General Area Description.
- 3.3—Climate and Air Quality.
- 3.4—Geology.
- 3.5—Soils.
- 3.6—Surface Water Resources.
- 3.7—Ground Water Resources.
- 3.8—Terrestrial Ecology.
- 3.9—Aquatic Ecology.
- 3.10—Floodplains.
- 3.11—Wetlands.
- 3.12—Land Use.
- 3.13—Social and Economic Resources.
- 3.14—Transportation Infrastructure.
- 3.15—Waste Management Facilities.
- 3.16—Recreation Resources.
- 3.17—Aesthetic and Visual Resources.
- 3.18—Cultural and Historic Resources.
- 3.19—Noise.
- 3.20—Human Health and Safety.

3.2 REGIONAL SETTING AND GENERAL AREA DESCRIPTION

The setting for the proposed Kemper County IGCC Project, including its connected actions, is east-central Mississippi, centered on Meridian, just west of the Alabama state line (see Figure 2.1-1). The power plant and lignite surface mine could be considered the predominant features of the overall project. The former would be located entirely in Kemper County, as would the natural gas supply pipeline; the latter would be located principally in Kemper County and partially in Lauderdale County. The project would also include new and upgraded electrical transmission lines and substations as well as a pipeline delivering CO_2 produced by the power plant to an existing commercial CO_2 pipeline, which would deliver the CO_2 to enhanced oil recovery projects. Other pipelines would deliver reclaimed effluent from Meridian to the proposed power plant. The transmission lines would generally run from the power plant south around either side of Meridian and then to Stonewall, in northwestern Clarke County. The CO_2 pipeline would run from the power plant in a south-southwesterly direction through western Lauderdale County, cutting across the northwest corner of Clarke County, and then to its terminus in the vicinity of Heidelberg in southeastern Jasper County. The majority of the reclaimed effluent supply pipeline would be co-located with a segment of new transmission lines.

With exception of portions of the transmission lines and substations and reclaimed water and CO_2 pipelines that would be built in and around Meridian, the project areas could be described as rural and sparsely populated. Most rural areas are densely wooded (including pine plantations). Terrain of the project areas is gently to moderately rolling. Drainage of the project areas is provided by a number of creeks, streams, and small rivers.

3.3 CLIMATE AND AIR QUALITY

3.3.1 CLIMATOLOGY AND METEOROLOGY

As summarized by the National Oceanic and Atmospheric Administration (NOAA) (2008a) the climate of Mississippi is generally determined by the extensive landmass to the north, its subtropical latitude, and the Gulf of Mexico to the south. The prevailing southerly winds provide moist, semitropical climate, with conditions favorable for afternoon thunderstorms. When altered pressure distribution brings westerly or northerly winds, hotter drier weather interrupts the prevailing moist condition. The high humidity, combined with hot days and nights in the interior from May to September, produces discomfort at times. Thunderstorms provide the principal relief from the heat. In the colder season Mississippi is alternately subjected to warm tropical air and cold continental air, in periods of varying length. Cold spells seldom last more than 3 or 4 days, and the ground rarely freezes. Mississippi is south of the average track of winter cyclones, but occasionally they move over the state.

The normal annual temperature ranges from 60°F in the northern border counties to 67°F in the coastal counties. The minimum January normal is 27°F in the northern portion of the state and 43°F along the coast. The area experiencing the most number of days with temperatures higher than 90°F occurs approximately 50 miles inland from the moderating affects of the coast. Temperatures below freezing average less than 10 days along the coast and increase to as many as 82 days along the northern border.

Mean annual precipitation ranges from approximately 50 inches in the northwest to 65 inches in the southeast. Measurable snow or sleet falls on some part of the state in 95 percent of the years. Thunderstorms occur on an average of 50 to 60 days a year in the northern districts and 70 to 80 days a year near the coast. Thunderstorms occur more frequently in July and least frequently in December. The tropical cyclone (i.e., hurricane) season occurs from June to November, and these storms have on occasion entered the state as far north as Meridian or Greenville after passing through parts of Alabama or Louisiana.

Table 3.3-1. Mean Temperature Data for Meridian, Mississippi (1971 to 2000)

Month	Mean Temperature (°F)
January	46.1
February	50.2
March	57.3
April	63.8
May	71.7
June	78.5
July	81.7
August	81.4
September	76.1
October	64.8
November	55.7
December	48.9
Annual	**64.7**

Source: NOAA, 2008b.

Table 3.3-1 provides a summary of average monthly temperature data collected at Meridian Key Field for the period of 1971 through 2000. Generally, winter temperatures are quite temperate, ranging between approximately 46 and 50°F. Typical monthly summertime temperatures range between 79 and 82°F.

Average daily maximum and minimum temperatures in Meridian occurring during the summer months are 92.9 and 66.8°F, respectively. Average daily maximum and minimum temperatures occurring during the winter months are 62.6 and 34.7°F, respectively. The extreme maximum and minimum temperatures that occurred during the period of 1971 to 2000 are 107 and 0°F, respectively.

Summertime relative humidity is high and can exceed 90 percent during the night and early morning hours. Wintertime relative humidity is generally slightly lower than during the summer months.

The normal annual precipitation in the Meridian area is approximately 58.65 inches, with most of this precipitation occurring during the winter and spring months. The maximum rainfall during the period of 1971 to 2000 for March and April (the months with the highest average rainfall) was 16.47 and 15.95 inches, respectively. The fall months are much drier, with normal precipitation averaging approximately 3.3 to 5 inches per month (NOAA, 2008b).

Wind data from the Meridian Key Field Airport meteorological station (WBAN No. 13865) have been collected since 1933. The station is located approximately 21 miles south of the proposed Kemper IGCC Project site. A windrose generated from the airport data for the period of 1991 to 1995 is shown in Figure 3.3-1. The data were processed by MDEQ for use in AERMOD, the EPA guideline air quality model, and may be found at <http://www.deq.state.ms.us/MDEQ.nsf/page/epd_AERMET_Preprocessedmetdata?OpenDocument>. The years chosen were the latest available on the MDEQ Web site and were the same as those used for the air quality demonstration for the project's air permit application (Mississippi Power, 2007a). The values presented in Figure 3.3-1 represent the percent of the time the wind blows from a particular direction at a given speed. As shown, the predominant winds are from the south to south-southwest and north to north-northwest.

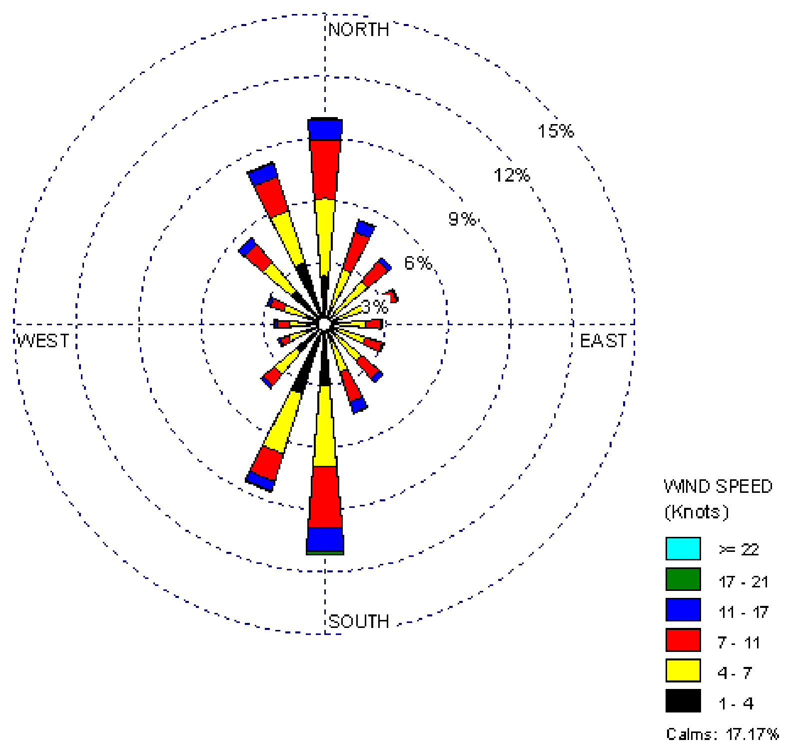


Figure 3.3-1. 5-year Wind Rose for Meridian Key Field Airport (1991 to 1995)

Sources: MDEQ, 2008. ECT, 2008.

3.3.2 AMBIENT AIR QUALITY

The discussion of ambient air quality focuses on southern Kemper County, the proposed location of the IGCC power plant and lignite surface mine. Construction and operation of these project components have the greatest potential to impact air quality. The construction of the pipelines and transmission lines would have insignificant and temporary impacts on air quality.

Ambient air quality is affected by meteorology, atmospheric chemistry, and pollutant emissions. The types, toxicities, amounts, and locations of emissions can affect ambient air quality. Meteorology controls the distribution, dilution, and removal (e.g., deposition) of pollutants. Atmospheric chemistry governs the reactions that transform given pollutants into other chemical compounds, which may also be considered as pollutants. It is during periods of low windspeeds that the maximum ground level concentrations of pollutants normally occur. During the summer months, the intensity of sunlight is at its highest peak. The combination of high pollutant concentrations and an abundance of ultraviolet light cause the production of photochemical smog, which contains pollutants such as ozone. Relative humidity is important to atmospheric dispersion and chemical transformation because of the interaction between pollutants and water molecules.

Air pollutants are broken down into two different categories, primary and secondary. Primary pollutants (i.e., NO_x, sulfur oxides [SO_x], CO, PM, and lead) are emitted by specific sources. Secondary pollutants are formed when primary pollutants react with typical atmospheric compounds (water, nitrogen, oxygen) under various atmospheric conditions (temperature, humidity, light intensity). An example of a secondary pollutant is ozone, which is formed when NO_x and organic compounds chemically react in the presence of light.

EPA has established national ambient air quality standards (NAAQS) for six different pollutants: SO_2, nitrogen dioxide (NO_2), CO, PM, lead, and ozone. These six pollutants are referred to as *criteria* pollutants.

As a criteria pollutant, PM is separated into two different size categories. The NAAQS for particulate matter less than or equal to 10 micrometers (PM_{10}) was promulgated with the Clean Air Act (CAA) Amendments of 1990, while the NAAQS for particulate matter less than or equal to 2.5 micrometers ($PM_{2.5}$) was promulgated in September 1997.

The 8-hour ozone NAAQS was also promulgated in July 1997. EPA issued a new ozone implementation rule in April 2004.

There are two sets of federal limits developed for each criteria pollutant: primary and secondary NAAQS (not to be confused with primary and secondary *pollutants*). Primary NAAQS are health-based, with the principle objective being to protect human health. Secondary NAAQS were developed to protect the environment and physical property. Table 3.3-2 shows primary and secondary NAAQS developed for different averaging

Table 3.3-2. NAAQS (micrograms per cubic meter [μg/m³] unless otherwise stated)

Pollutant	Averaging Periods	National Standards	
		Primary	Secondary
SO_2	3-hour[1]		1,300 (0.5 ppm)
	24-hour[1]	365 (0.14 ppm)	
	Annual[2]	80 (0.03 ppm)	
PM_{10}	24-hour[3]	150	150
	Annual	50	50
$PM_{2.5}$	24-hour[4]	35	35
	Annual[5]	15	15
CO	1-hour[1]	40,000 (35 ppm)	
	8-hour[1]	10,000 (9 ppm)	
Ozone (ppmv)	8-hour[6]	0.08	0.08
NO_2[7]	Annual[2]	100 (0.053 ppm)	100
Lead	Calendar quarter arithmetic mean	1.5	1.5
	Rolling 3-month average[8]	0.15	0.15

[1]Not to be exceeded more than once per calendar year.
[2]Arithmetic mean.
[3]The standards are attained when the expected number of days per calendar year with a 24-hour average concentration above 150 μg/m³, as determined in accordance with 40 CFR 50 Appendix K, is equal to or less than one.
[4]98th percentile concentration, as determined in accordance with 40 CFR 50, Appendix N.
[5]Arithmetic mean concentration, as determined in accordance with 40 CFR 50, Appendix N.
[6]Standard attained when the average of the annual 4th highest daily maximum 8-hour average concentration is less than or equal to the standard, as determined by 40 CFR 50, Appendix I.
[7]NO_2 is the regulated ambient air pollutant. When referring to emissions, the term NO_x is used. NO_x consists of NO_2 and nitric oxide, which rapidly oxidizes to NO_2 in the atmosphere.
[8]Final rule signed October 15, 2008.

Source: 40 CFR 50.

times dependent on pollutant characteristics. Mississippi has adopted by reference the federal limits for all tants. The Mississippi rules include a prohibition of “odorous substances in the ambient air in concentrations sufficient to” cause adverse impacts (MCEQ Reg. APC-S-4) (<www.deq.state.ms.us/newweb /MDEQRegulations.nsf>).

All areas of Mississippi, including Kemper County, are designated as better than national standards (i.e., attainment for the NAAQS for SO_2, CO, NO_2, ozone, and $PM_{2.5}$) (as codified at 40 CFR 81.325).

MDEQ operates ambient air quality monitoring sites around the state to collect data used to determine the attainment status of counties and parts of counties. The monitoring stations closest to the project site are in Meridian (Lauderdale County) and Columbus (Lowndes County). Both sites collect $PM_{2.5}$ data; the Meridian site also collects ozone data. Both sites are listed by EPA as being in “Urban and Center City” locations and having a monitoring objective of “Population Exposure.” The Alabama Department of Environmental Management (ADEM) has also been operating a monitor for $PM_{2.5}$ and ozone in Sumter County, located immediately east of Kemper and Lauderdale Counties. This monitor was established to provide rural regional background air quality data. ADEM has previously operated a PM_{10} monitoring site in Demopolis (a suburban setting), approximately 50 miles east of the power plant site. Figure 3.3-2 shows these ambient monitor locations in relation to the project site.

The 8-hour ozone standard is met when the 3-year average of the annual 4th highest daily maximum 8-hour average concentration (also known as the design value) is less than 0.08 ppm (or 84 parts per billion [ppb]) standard. The 2006 to 2008 design value at the Lauderdale site was reported as 72 ppb, and the design value for the same period at the Sumter site was 65 ppb. Table 3.3-3 shows the most recent years of ozone 8-hour average design values for these monitors.

The annual average $PM_{2.5}$ standard is met when the 3-year average of the annual averages does not exceed 15.0 micrograms per cubic meter (μg/m^3). The averages for the 2006 to 2008 period at the Lauderdale and Lowndes monitoring sites were 12.5 and 12.6 μg/m^3, respectively. The average for the 2004 to 2006 period at the rural Sumter site was 11.7 μg/m^3. Table 3.3-4 shows the most recent years of $PM_{2.5}$ annual average values for these monitors. Monitoring at the Sumter site was discontinued in 2006.

Table 3.3-3. 8-hour Ozone Design Values—2002 through 2008

	3-year Average (ppb)				
	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008
Lauderdale	71	73	75	76	72
Sumter (AL)	68	63	64	66	65

Sources: MDEQ, 2007.
ADEM, 2008.

Table 3.3-4. $PM_{2.5}$ Annual Averages— 2002 through 2008

	3-year Average of Annual Means (μg/m^3)				
	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008
Lauderdale	12.8	13.3	13.1	13.1	12.5
Lowndes	12.7	12.7	12.5	13.1	12.6
Sumter (AL)	11.7	11.9	11.7	—	—

Sources: MDEQ, 2007.
ADEM, 2008.
EPA, 2008.

The 24-hour average $PM_{2.5}$ standard is met when the 3-year average of the annual 98th percentiles of the 24-hour averages does not exceed 35 μg/m^3. The most recent averages for Lauderdale, Lowndes, and Sumter sites were 28, 27, and 28 μg/m^3, respectively. Table 3.3-5 shows the most recent years of $PM_{2.5}$ 24-hour average values for these monitors.

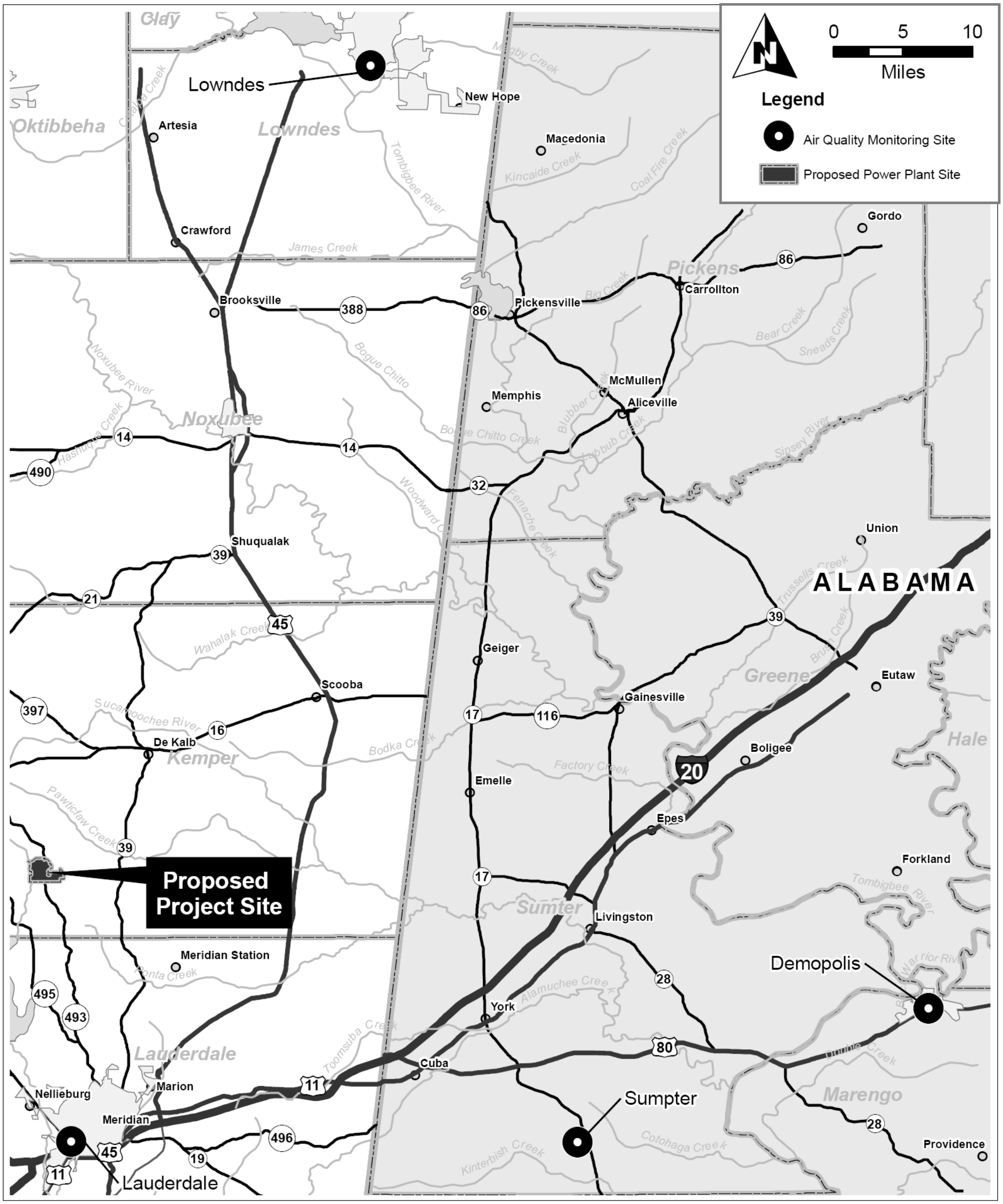


Figure 3.3-2. Location of Ambient Air Quality Monitors

Sources: U.S. Census, 2000. MARIS, 2008. ECT, 2008.

Data from ADEM's PM_{10} monitoring site in Demopolis were available from 1998 through 2001 from EPA's AirData Web site (<http://www.epa.gov/air/data/repsst.html?st~AL~Alabama>). As can be seen in Table 3.3-6, the standard was met in all years, with the second high value being well below the 150-µg/m^3 24-hour NAAQS.

Table 3.3-5. $PM_{2.5}$ 24-hour Averages— 2002 through 2008

	3-year Average 98th Percentiles (µg/m^3)				
	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008
Lauderdale	29	30	30	30	28
Lowndes	31	33	32	32	27
Sumter (AL)	29	29	28	—	—

Sources: MDEQ, 2007.
EPA, 2008.

Table 3.3-6. PM_{10} 24-hour Averages for Demopolis, Alabama—1998 through 2001

	24-hour Concentrations (µg/m^3)			
Year	1st High	2nd High	3rd High	4th High
2001	53	52	52	43
2000	53	46	37	35
1999	56	55	54	53
1998	51	46	46	46

Source: EPA, 2008.

Local and regional ambient air monitoring data are used to generally characterize the existing air quality conditions in the vicinity of the site. Using the available data, EPA has developed a descriptor of air quality, called the air quality index (AQI), which can be used to characterize the air quality in a given county. Air quality is described over a range from *good* to *hazardous* based on a calculated numerical value, as follows (<www.airnow.gov/index.cfm?action=static.aqi>):

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range:	*...air quality conditions are:*	*...as symbolized by this color:*
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Each category corresponds to a different level of health concern. The six levels of health concern and what they mean are:

- Good—The AQI value for your community is between 0 and 50. Air quality is considered satisfactory, and air pollution poses little or no risk.
- Moderate—The AQI for your community is between 51 and 100. Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a small number of people. For example, people who are unusually sensitive to ozone may experience respiratory symptoms.
- Unhealthy for Sensitive Groups—When AQI values are between 101 and 150, members of sensitive groups may experience health effects. This means they are likely to be affected at lower levels than the general public. For example, people with lung disease are at greater risk from exposure to

ozone, while people with either lung disease or heart disease are at greater risk from exposure to particle pollution. The general public is not likely to be affected when the AQI is in this range.

- Unhealthy—Anyone may begin to experience health effects when AQI values are between 151 and 200. Members of sensitive groups may experience more serious health effects.
- Very Unhealthy—AQI values between 201 and 300 trigger a health alert, meaning everyone may experience more serious health effects.
- Hazardous—AQI values higher than 300 trigger health warnings of emergency conditions. The entire population is more likely to be affected.

The higher the AQI value, the greater the level of air pollution and the greater the health concern. For example, an AQI value of 50 represents good air quality with little potential to affect public health, while an AQI value higher than 300 represents hazardous air quality.

An AQI value of 100 generally corresponds to the NAAQS for the pollutant, which is the level EPA has set to protect public health. AQI values below 100 are generally thought of as satisfactory. As AQI values go above 100, air quality is considered to be unhealthy—at first for certain sensitive groups of people, then for everyone as AQI values get higher.

Figure 3.3-3 provides AQI charts for Lauderdale County for 2006 through 2008 (no AQI data are available for Kemper County). In 2006, out of 326 days of measurements, Lauderdale County experienced 229 *good* air quality days, 91 *moderate* days, and 6 days that were *unhealthy for sensitive groups*. The main pollutant for 2006 was ozone. In 2007, there were 247 *good* days, 117 *moderate* days, and 1 day that was *unhealthy for sensitive groups*. The main pollutant for 2007 was $PM_{2.5}$. During the portion (331 days) of 2008 reported, there were 248 *good* days and 83 *moderate*, and the main pollutant was $PM_{2.5}$. Overall, based on these charts, air quality in Lauderdale County is generally *good* to *moderate*.

3.3.3 EXISTING EMISSION SOURCES

Air quality is, of course, influenced by the emissions of pollutants into the air. Emissions come from a variety of sources, including the combustion of fuel by stationary sources (e.g., power plants, factories, home heating fired by natural gas, fuel oil, or wood), automobiles, and manufacturing processes. Figure 3.3-4 summarizes data on emissions of six criteria pollutants in Kemper and Lauderdale Counties for the year 2001. Recall that there are no ambient air quality standards for VOCs; rather, VOC emissions contribute to the formation of ozone, for which ambient standards have been set. Most emissions of PM were attributed to fugitive dust (included in Area Source "Miscellaneous, Other"). Vehicles and other types of area fuel combustion sources emitted the greatest percentages of NO_x, CO, and VOC, which are all products of incomplete combustion. Overall, approximately 84 percent of the total emissions shown in Figure 3.3-4 were attributed to sources in Lauderdale County. Greater population and the presence of major highways (e.g., I-20) and more vehicle-miles driven in Lauderdale County would, in large part, account for this fact.

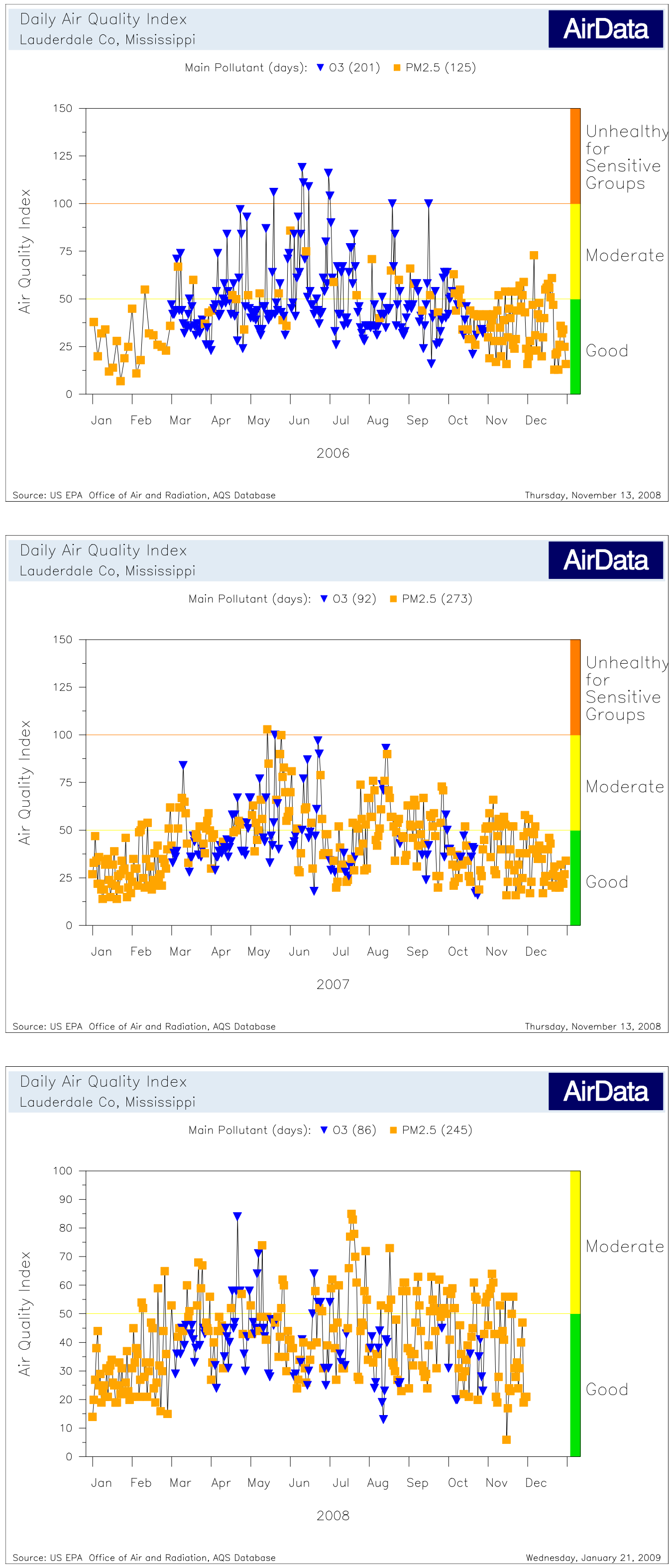


Figure 3.3-3. AQI Charts for Lauderdale County—2006 through 2008

Source: www.epa.gov/air/data, 2008.

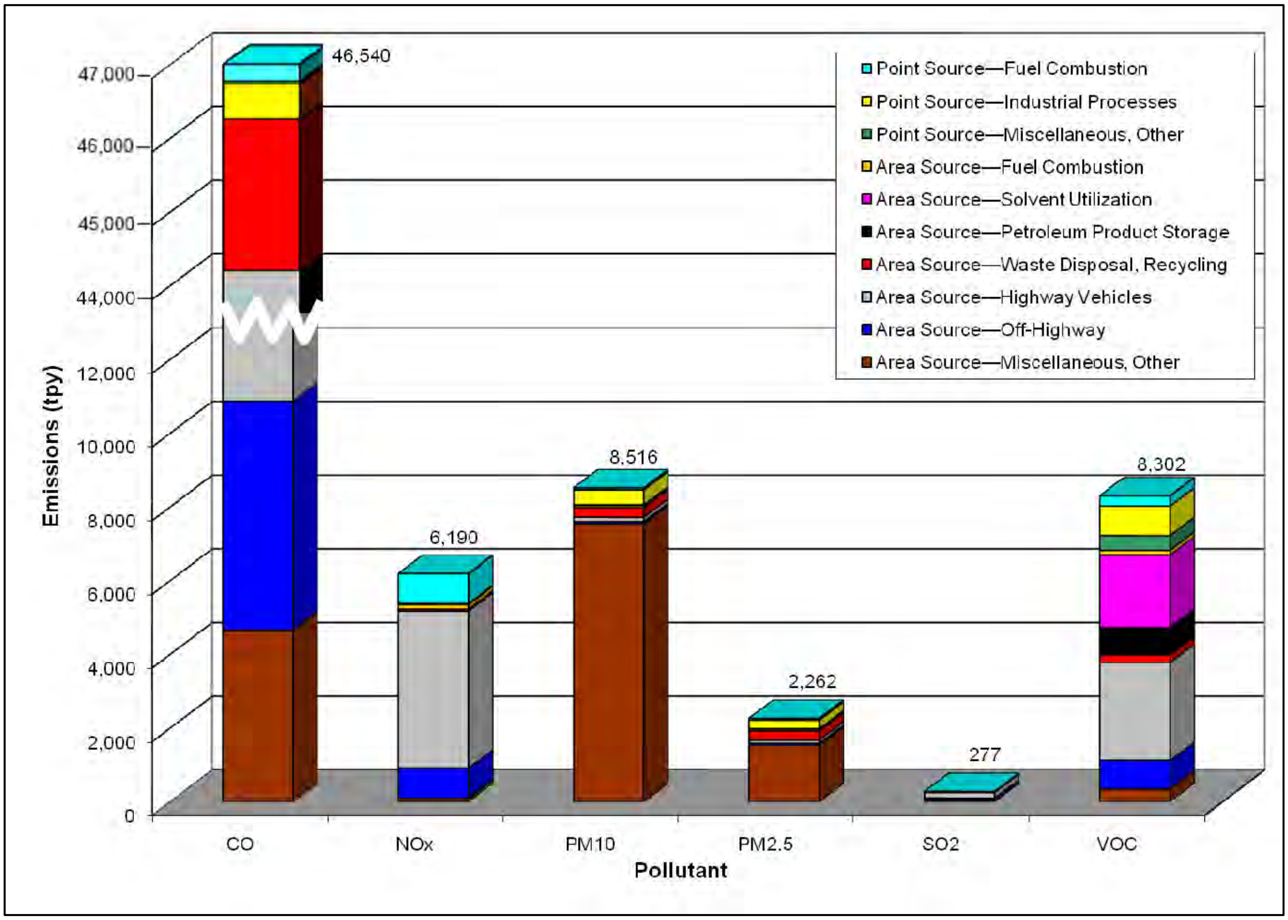


Figure 3.3-4. Existing Emissions in Kemper and Lauderdale Counties (2001)
Sources: <www.epa.gov/air/data>, 2008. ECT, 2008.

The vast majority of emissions in the two counties were accounted for by area sources, as opposed to large individual industrial plants. The three largest stationary industrial sources of air pollutant emissions in the two-county area are the TGP gas compressor station (located in southern Kemper County approximately 6 miles east of the proposed IGCC power plant site), Mississippi Power's Plant Sweatt located south of Meridian approximately 25 miles south of the proposed plant site, and Ludlow Corporation's packaging manufacturing plant in east Meridian, approximately 18 miles south-southeast of the proposed plant site.

In addition to the six criteria pollutants, EPA categorizes 188 other compounds as *noncriteria* air pollutants, or hazardous air pollutants (HAPs). HAPs are those pollutants known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. Examples of HAPs include benzene, which is found in gasoline; perchloroethlyene, which is emitted from some dry cleaning facilities; and methylene chloride, which is used as a solvent and paint stripper by a number of industries. Examples of other listed air toxics include dioxin, asbestos, toluene, and metals such as cadmium, mercury, chromium, and lead compounds.

3.4 GEOLOGY

Figure 3.4-1 is a geologic map of Mississippi that illustrates the spatial distribution of geologic units that outcrop at land surface (MARIS, 2008a). Table 3.4-1 identifies the subsurface geologic units that occur in Mississippi (MDEQ, 1996a and 1996b) and shows their stratigraphic relations. Figure 3.4-1 shows that the proposed power plant site and proposed mine study area are situated in the outcrop area of the Wilcox Group. Table 3.4-1 shows that the Wilcox Group is comprised of several different geologic formations and that some of the formations are further subdivided into members. The specific geologic formation that outcrops at land surface in the vast majority of the mine study area is the Tuscahoma formation. However, the Tuscahoma formation thins toward the northeast and is absent in the extreme northeastern areas of the mine and power plant sites; in those limited areas, the Grampian Hills member of the Nanafalia formation outcrops at land surface.

The following subsections describe the geology in terms of regional physiography, structure, stratigraphy, mine study area overburden chemistry, mineral resources, and seismology. Hydrogeology and related ground water resources topics are described in Section 3.7.

3.4.1 REGIONAL PHYSIOGRAPHY

The physiographic provinces (subdivisions) of Mississippi are shown in Figure 3.4-2 (MARIS, 2008a). On a larger scale, all of those physiographic province subdivisions are included within the Gulf Coastal Plain physiographic province. These physiographic features reflect differing topographies that have resulted from uplift and erosion of the underlying geologic formations. The arcuate shaped spatial distribution of these physiographic province subdivisions closely mimics the outcrops of geologic units (Mallory, 1993). The project areas lie within the Red Hills province, with the Flatwoods province situated nearby to the northeast of the project areas (Hughes, 1958). These two physiographic province subdivisions are briefly described in the following paragraphs; some authors lump them together and refer to both as the North Central Hills.

The Red Hills is also locally known as the North Central Hills (Mallory, 1993) and by several other names by other authors. The Red Hills is a highland area characterized by eroded gullies and stream-cut valleys. It is underlain by the sand and sandy clay sediments of the Wilcox and Claiborne Groups, which are typically unconsolidated and thus readily subject to erosion. The Red Hills is a maturely dissected plateau, with relatively rugged terrain particularly in western Kemper County. The terrain is less rugged in the flats areas of major streams and in the rolling hills that occur between streams (Hughes, 1958). Surface water features are described in Section 3.6.

The Flatwoods (also included within the North Central Hills by some authors) is a narrow belt of relatively flat lowlands underlain by the stiff clay sediment of the Porters Creek clay of the Midway Group. The land surface elevations in the Flatwoods increase from approximately 200 ft in the east to approximately 300 feet National Geodetic Vertical Datum (ft-NGVD) in its western sections. In these western sections, the terrain becomes more rugged, and the Flatwoods grades into the highlands of the Red Hills (Hughes, 1958).

The Red Hills belt rises 200 to 400 ft in elevation above the Flatwoods (Mallory, 1993). The land surface elevations at the proposed power plant site and mine study area generally range from 400 to 510 ft-NGVD, yet are as low as 350 ft-NGVD in the extreme south and southwest portions of the mine study area.

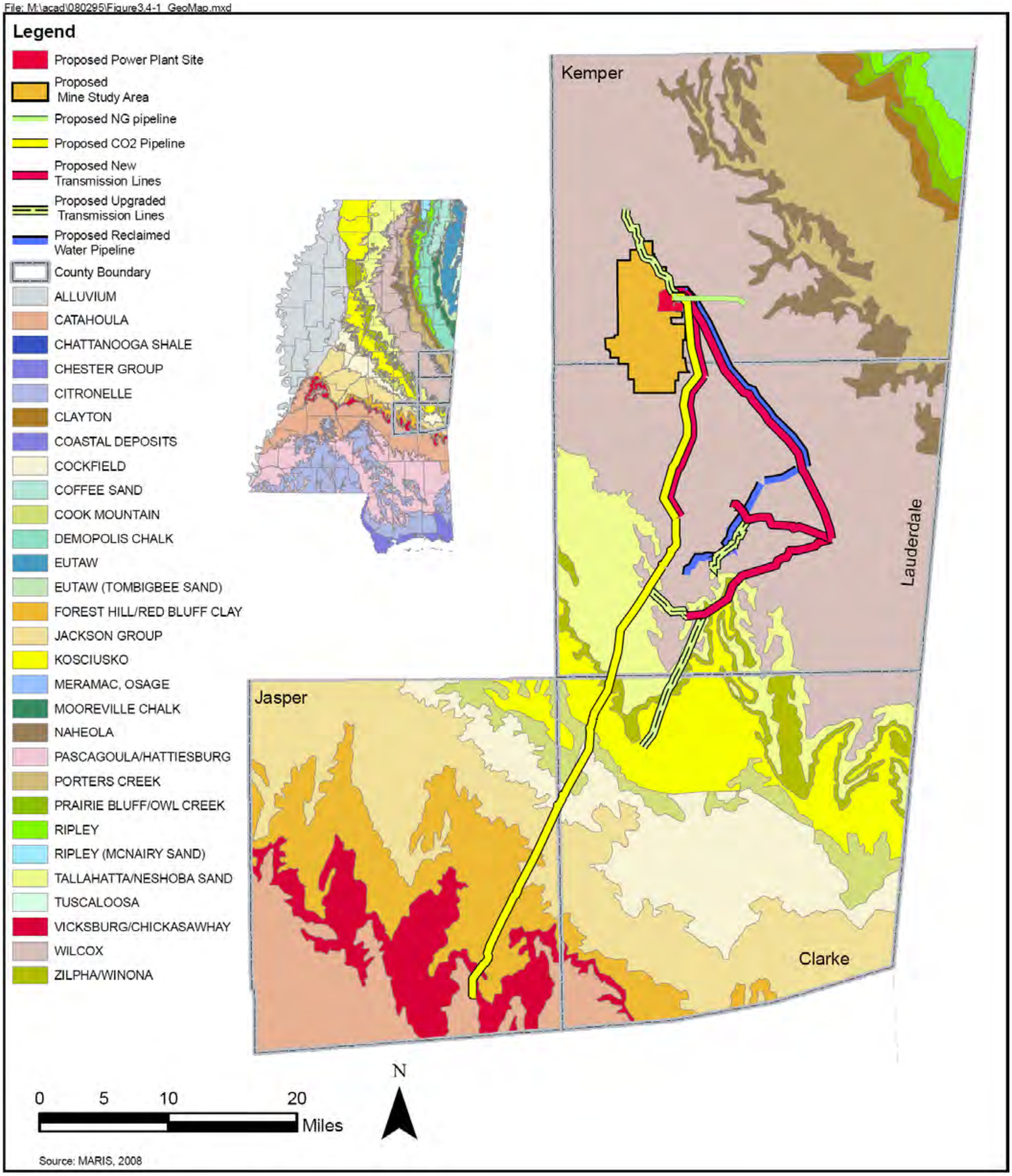


Figure 3.4-1. Surface Geology Map of Mississippi

Sources: MARIS.state.ms.us, Surface Data, 2008. ECT, 2008.

Table 3.4-1. Geologic Units in Mississippi

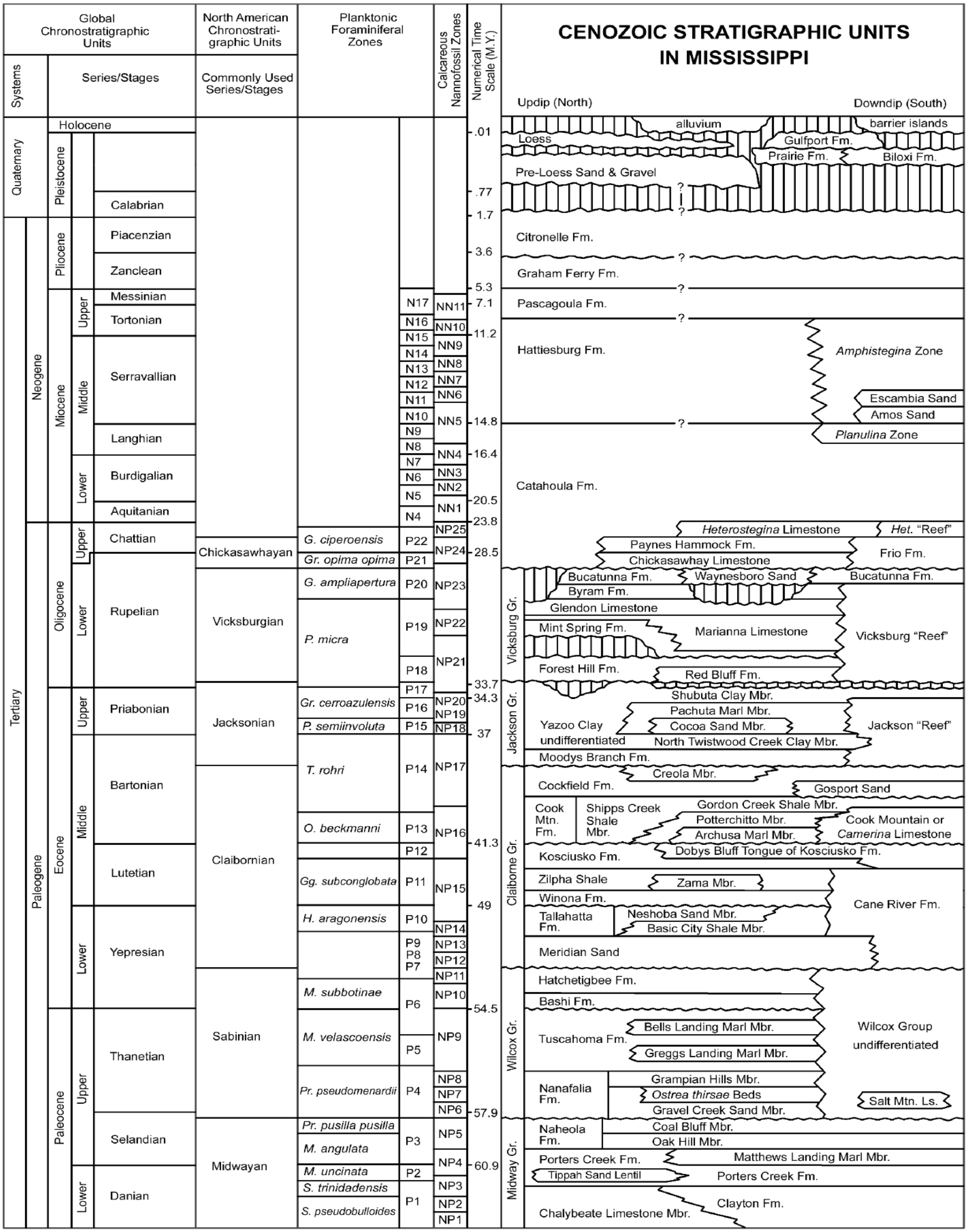
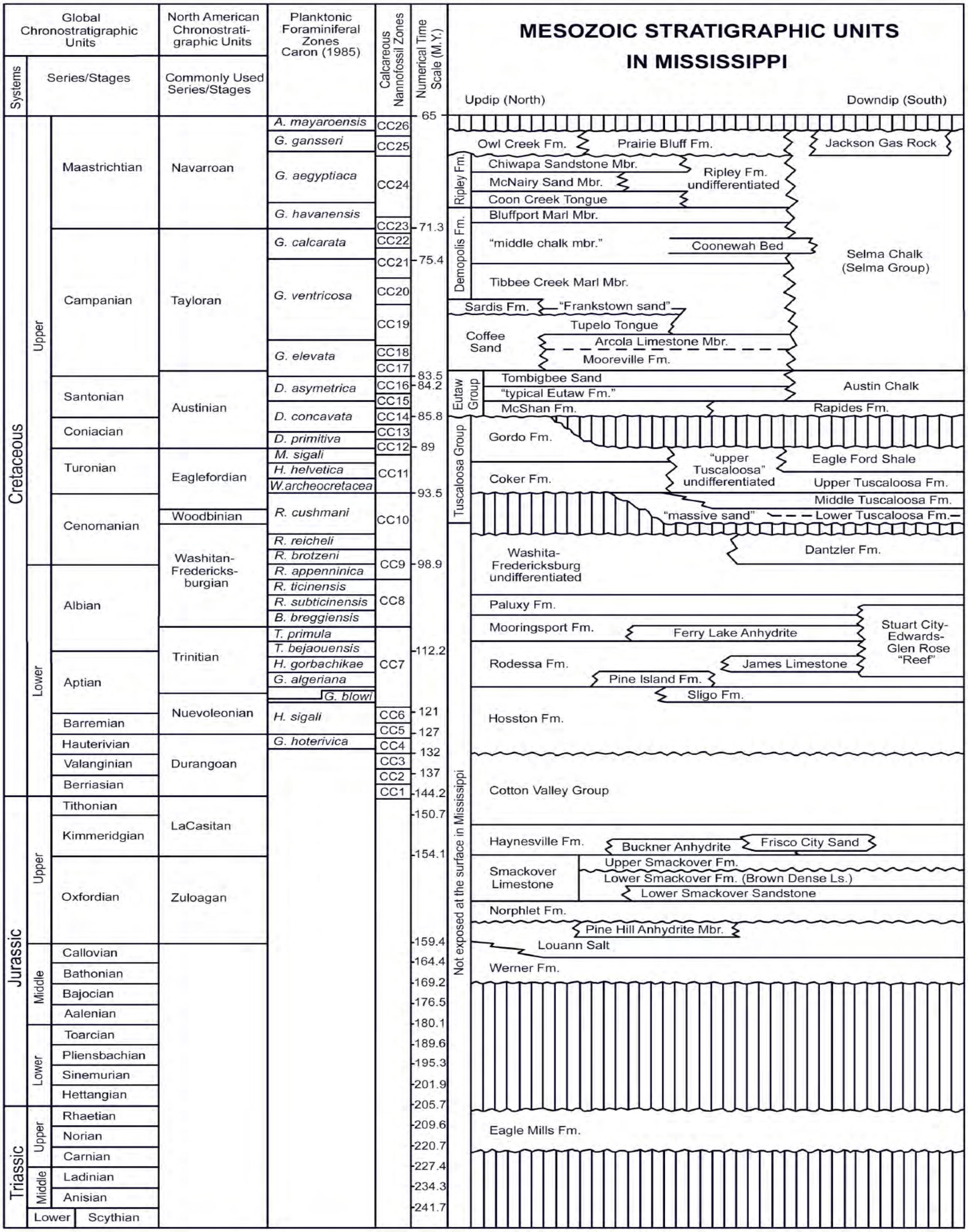


Table 3.4-1. Geologic Units in Mississippi (Page 2 of 2)



Sources: MDEQ, 1996a, 1996b, and 2008.

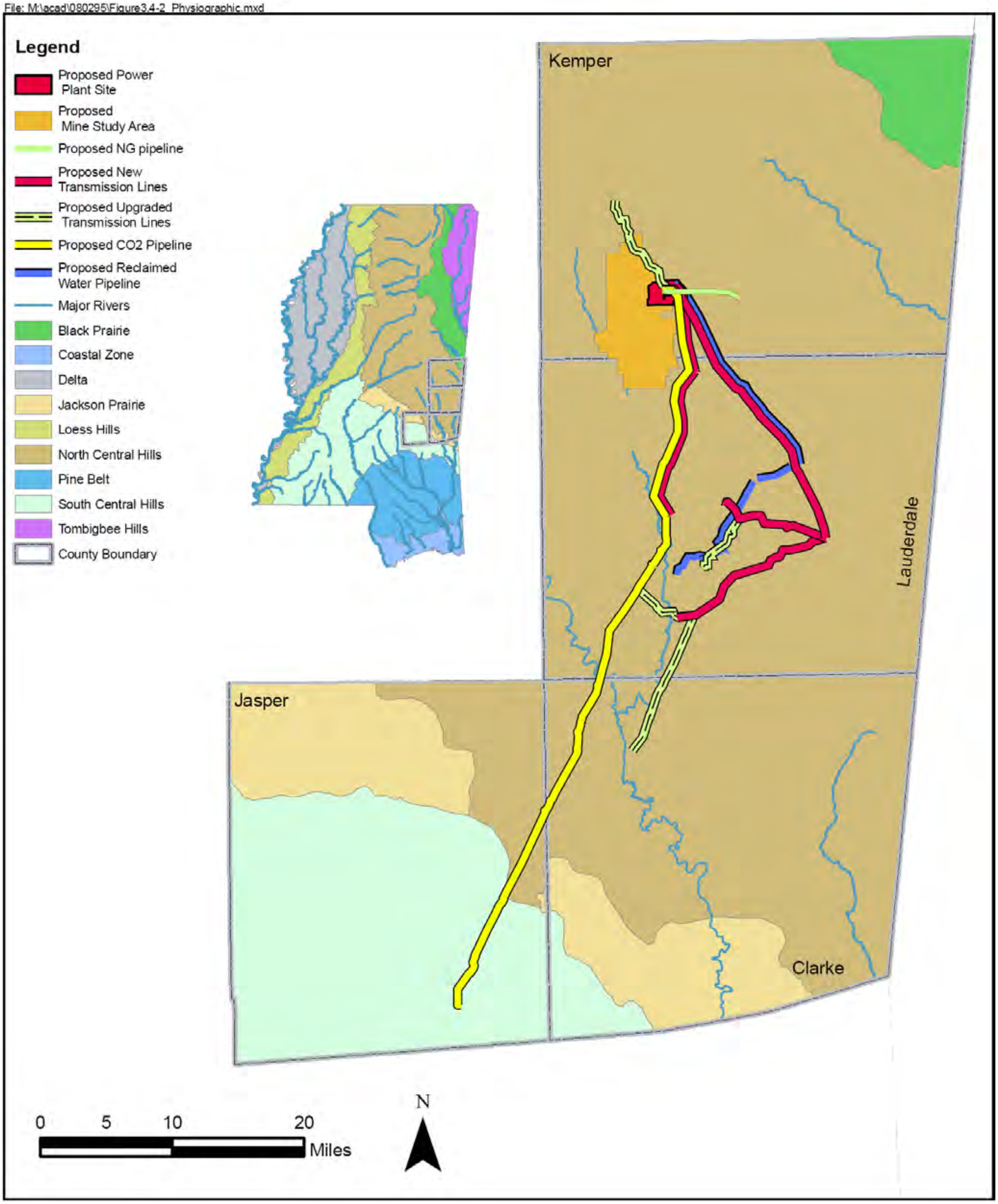


Figure 3.4-2. Physiographic Provinces of Mississippi
Sources: MARIS, 2008. ECT, 2008.

3.4.2 STRATIGRAPHY AND STRUCTURE

The project areas are situated near the northeastern edge of the Gulf Coast Basin, which is a large regional geosyncline structure. On a more local scale, Figure 3.4-3 shows that the project areas are located near the southern end of the Black Warrior Basin (Tennessee Valley Authority [TVA], July 1998, Red Hills Power Project [RHPP] Final Environmental Impact Statement [FEIS]). The Black Warrior Basin has a triangular shaped surface area. It is bordered on the southwest by the Ouachita tectonic belt and on the southeast by the Appalachian tectonic belt. The proposed power plant site is located within 25 miles of each of these two tectonic belts.

The geologic formations dip toward the southwest within the geosyncline in this region. Figure 3.4-4 is a geologic cross-section (A-A') that illustrates the regional stratigraphic relations and the southwest trending dip (Dalsin, 1979). Figure 3.4-5 illustrates the location of that geologic cross-section. Evaluation of published structural contour maps indicates that the geologic formations dip to the southwest at a slope of approximately 40 ft per mile in the immediate area of the projects (Boswell, 1978; Gandl, 1982).

The hydrogeologic relations among these geologic strata are described in Section 3.7.

3.4.2.1 Power Plant Site

A geotechnical study providing detailed information regarding the upper 125 ft of geologic sediments was conducted at the site. In addition, onsite deep-well drilling and testing have been conducted at the proposed power plant site, providing site-specific information regarding the geologic units present. These two onsite subsurface studies are summarized in the following paragraphs.

A preliminary geotechnical study included drilling and testing at 12 borehole locations with depths typically to 125 ft bls and a few boreholes to 100 ft bls. A preliminary subsurface investigation report was prepared by Earth Science & Environmental Engineering (ES&EE), Southern Company Generation, in September 2007 (ES&EE, 2007). The report also includes a detailed lithologic log of the subsurface geology encountered in each of the 12 boreholes and a map showing the borehole locations. Table 3.4-2 provides a general summary of the observed subsurface conditions. As shown, the upper 125 ft of sediments are unconsolidated and include two general layers. The surface layer is 5 to 20 ft thick and comprised of fine-grained silts and clays that have variable amounts of included sand. That layer is underlain (to the full depth of investigation of 125 ft bls) by sands that have variable amounts of included silt and clay. These sediments are all included within the Grampian Hills member of the Nanafalia formation of the Wilcox Group, which outcrops in this area of the site.

Deep well drilling and testing went to a maximum depth of 3,960 ft bls at the power plant site. Geophysical borehole logging was performed at the deep test well location. The geophysical logging included gamma ray, spontaneous potential, and electrical resistivity logs. Interpretation of the geophysical logs resulted in the estimates of depths to the indicated geologic groups or formations shown in this table:

Geologic Group/ Formation	Depth to Top of Geologic Unit (ft bls)	Thickness of Geologic Unit (ft)
Wilcox Group	0	490
Nanafalia		
Grampian Hills	0	140
Gravel Creek	140	350
Midway Group		
Naheola	490	100
Porter Creek Clay	590	550
Clayton	1,140	20
Selma Group	1,160	850
Eutaw Group	2,010	360
Tuscaloosa Group		
Gordo	2,370	470
Coker	2,840	520
Massive Sand	3,360	290
Lower Cretaceous	3,650	~1,500

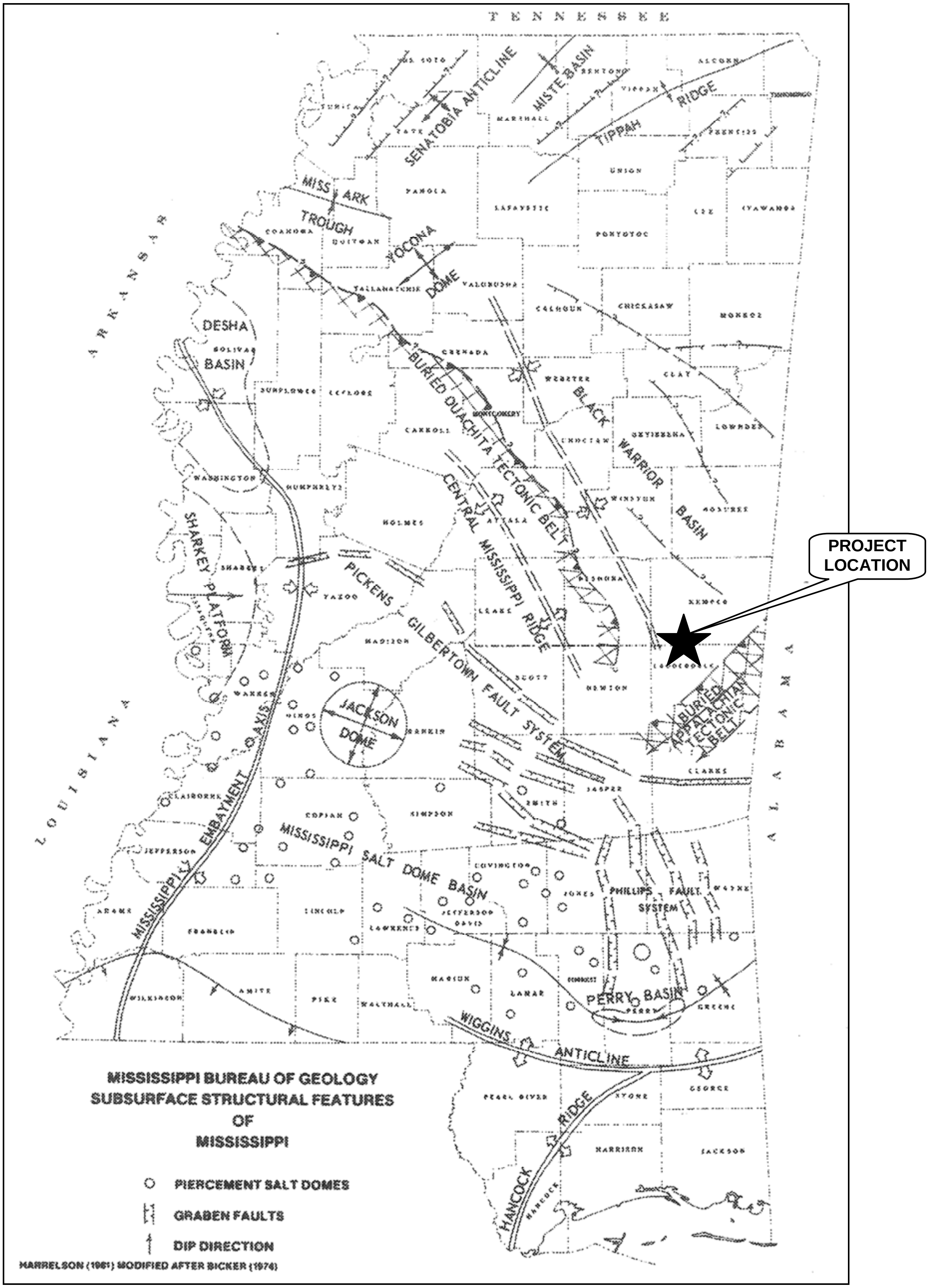


Figure 3.4-3. Subsurface Structural Features of Mississippi
Sources: TVA, 1998. ECT, 2008.

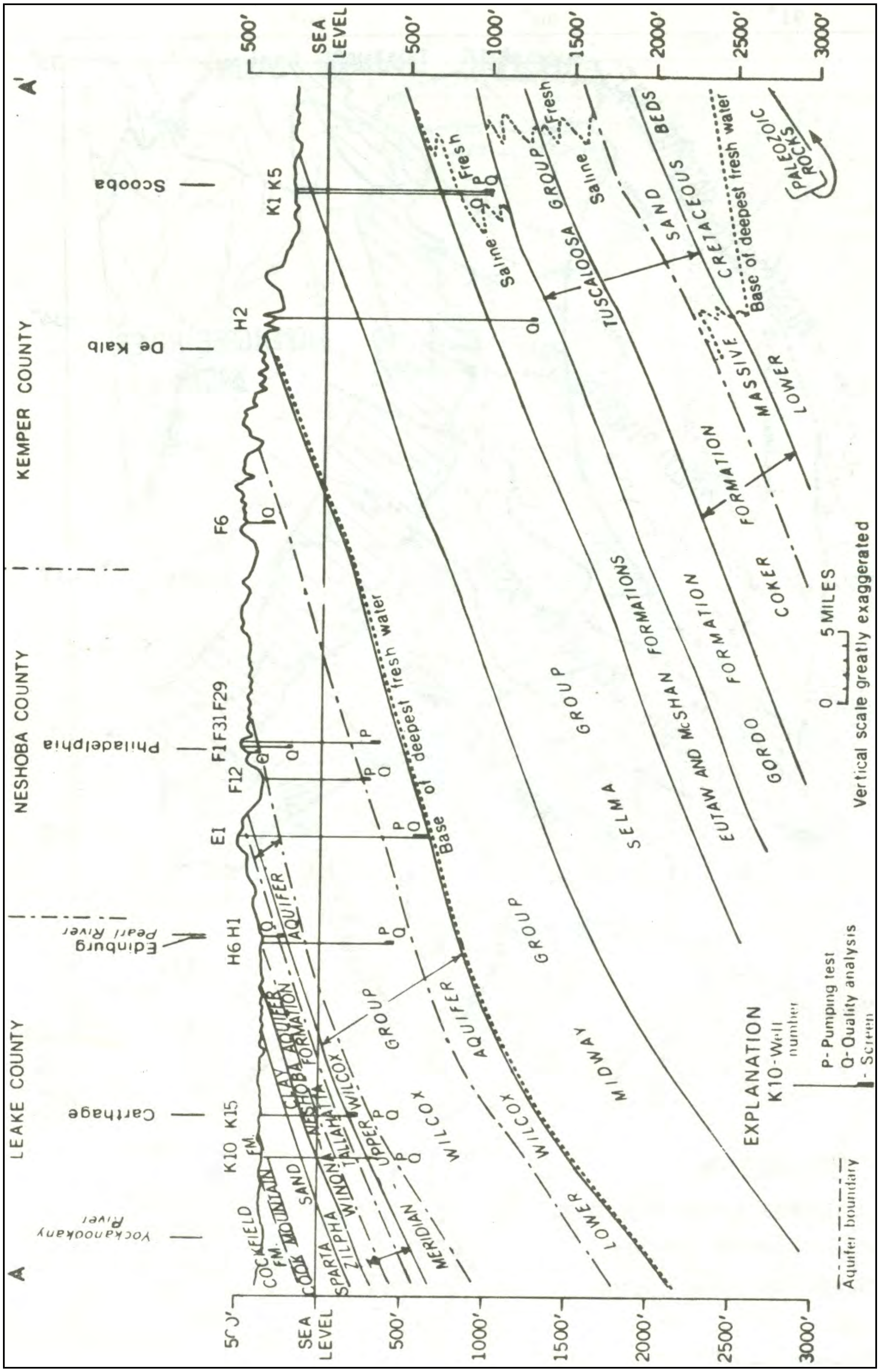


Figure 3.4-4. Regional Geologic Cross-Section

Source: Dalsin, 1979.

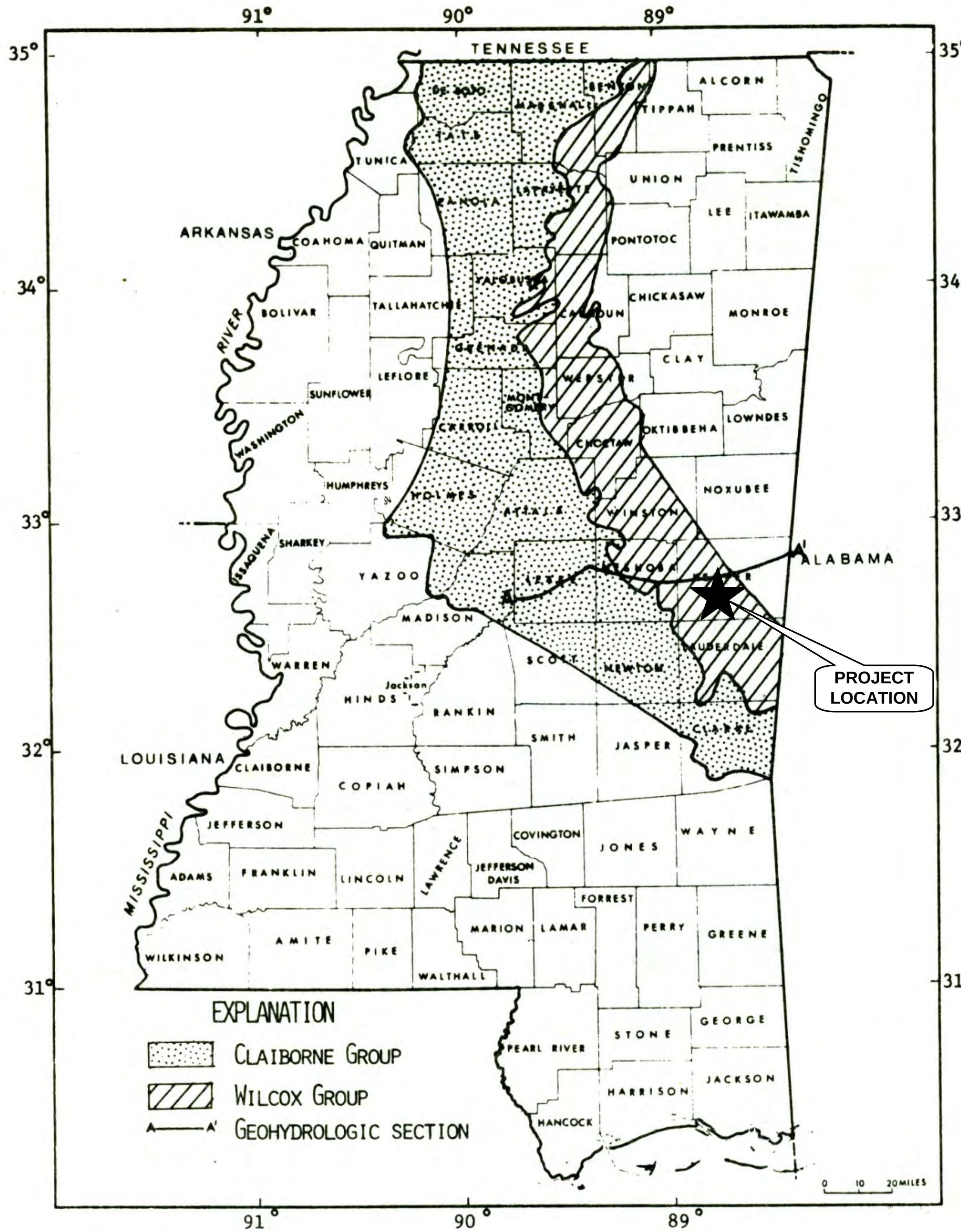


Figure 3.4-5. Location of Geologic Cross-Section A-A'

Sources: Dalsin, 1979.

Table 3.4-2. Summary of Subsurface Conditions Observed to a Depth of 125 ft at the Power Plant Site

Location/ Layer	Typical Depth From/To (ft)	Primary Soil Type in Layer	Typical Overall Soil Consistency	Range of SPT N Values of Layer (bpf)
Cooling towers				
1	0 to 5	Sandy and silty clay	Stiff to very stiff	10 to 21
2	5 to 125+	Sand, silty sand, and clayey sand	Firm to very dense	11 to 100+
Gasifier building				
1	0 to 20	Sandy silt and sandy clay	Very stiff to very hard	16 to 100+
2	20 to 125+	Silty sand and clayey sand	Very firm to very dense	20 to 100+
Combined-cycle unit				
1	0 to 10	Clay, sandy clay, and silt	Stiff to very hard	10 to 66
2	10 to 125+	Silty sand with some sandy silt and clay	Very firm to very dense	27 to 100+

Note: SPT = standard penetration test.
bpf = blows per foot.

As can be seen from this table, the cooling tower area consisted primarily of stiff to very stiff clayey soils underlain by sandy soil of a firm to very dense consistency. The clayey soil contained some silt and sand content and was generally reddish in color, while the sandy soils tended to be light red with grey and brown. The sand layer was micaceous with some clay and silt observed. SPT N values generally increased with depth.

The gasifier building area soils generally consisted of very stiff to very hard sandy silts and clays underlain by silty and clayey sand of a very firm to very dense consistency. The silts and clays were red, brown, and grey in color, and SPT N values varied with depth. Sand was generally present in the silt/clay matrix. The sandy soils were silty, micaceous, and primarily grey to brown with some red banding. SPT N values in the sand generally increased with depth. Consistent N values of 50 bpf or higher were observed below 40 ft bls in this area, with 50+ bpf material encountered as shallow as 10 ft bls.

The combined-cycle area soils primarily consisted of stiff to very hard clays and silts underlain by very firm to very dense silty sand. Exceptions to this were observed in Borings PCC-4 and PCC-6, where silty soils were observed discontinuously to the bottom of the borings. The clays were generally reddish in color, while the silts were generally brown to grey. Clay and silt samples usually contained some sand content in the soil matrix. Sands were generally silty.

Sources: ES&EE, 2007.
ECT, 2008.

The well driller report and well log (Layne-Central, 2008) for the deep well at the power plant site indicated the following description of the formations encountered within the indicated depth intervals:

- Sand and clay lignite—0 to 140 ft bls.
- Clay with sand streaks—140 to 590 ft bls.
- Hard clay—590 to 1,140 ft bls.
- Clay with limestone streaks—1,140 to 2,010 ft bls.
- Hard clay and limestone—2,010 to 2,920 ft bls.
- Hard shale, chert, sand—2,920 to 3,360 ft bls.
- Hard sand—3,360 to 3,440 ft bls.

3.4.2.2 Mine Study Area

Local stratigraphic conditions in the mine study area have been established from the extensive shallow exploratory drilling of the lignite reserves (more than 400 exploratory holes). Figure 3.4-6 presents geophysical and stratigraphic data from a mine study area borehole at test well 3095LW4. Figure 3.6-2 shows the location of that test well. The mine study area lies entirely within the outcrop of the Wilcox Group. The Wilcox Group is typically 500 to 600 ft thick in the project area and consists of heterogeneous, lenticular sequences of clay, silt, sand, and lignite deposits.

Figure 3.4-6 shows that the lignite seams affected by proposed mining lie within the Nanafalia Formation of the Wilcox Group. The lowest lignite seam to be mined is the G seam, which occurs at the contact between the Grampian Hills member and the Gravel Creek sand member of the Nanafalia formation.

Shallow Holocene alluvial deposits derived from erosion of the Wilcox sediments are present beneath the floodplains of the larger streams in the project area.

3.4.3 MINE STUDY AREA OVERBURDEN CHEMISTRY

Eighteen continuous cores were drilled within the proposed mine study area to determine the geochemical characteristics of the material above the lowest seam to be mined (the G Seam). The total depth of these continuous cores ranged from 135 to 239 ft, and a total of 545 samples were collected. These samples were analyzed for selected geochemical parameters, and Table 3.4-3 presents a summary of these analyses. The analyses' summaries are divided into oxidized and unoxidized overburden.

As indicated by the data summary, the oxidized overburden within the study area is very strongly acidic with an average pH of 4.9 and a range of 4.3 to 5.8. The unoxidized overburden is slightly acidic to neutral with an average pH of 6.5, a minimum of 5.7, and maximum of 7.1. The oxidized overburden does not contain any acid-forming material in the form of pyritic sulfur. More than 95 percent of the unoxidized overburden samples had detectable levels of pyritic sulfur. Twenty percent of the unoxidized overburden samples had pyritic sulfur concentrations greater than 0.5 percent by weight. Twenty-six percent of the acid-base accounting results for the unoxidized overburden samples were less than -5 tons per 1,000 tons of material (t/1000t), calcium carbonate equivalent. The acid-base accounting is a means of evaluating the overburden's maximum potential acidity against total potential neutralizers. The value of -5 t/1000t relates to *potentially toxic material*, defined as earth material having a net potential deficiency of 5.0 tons of calcium carbonate equivalent or more per 1,000 tons of material.

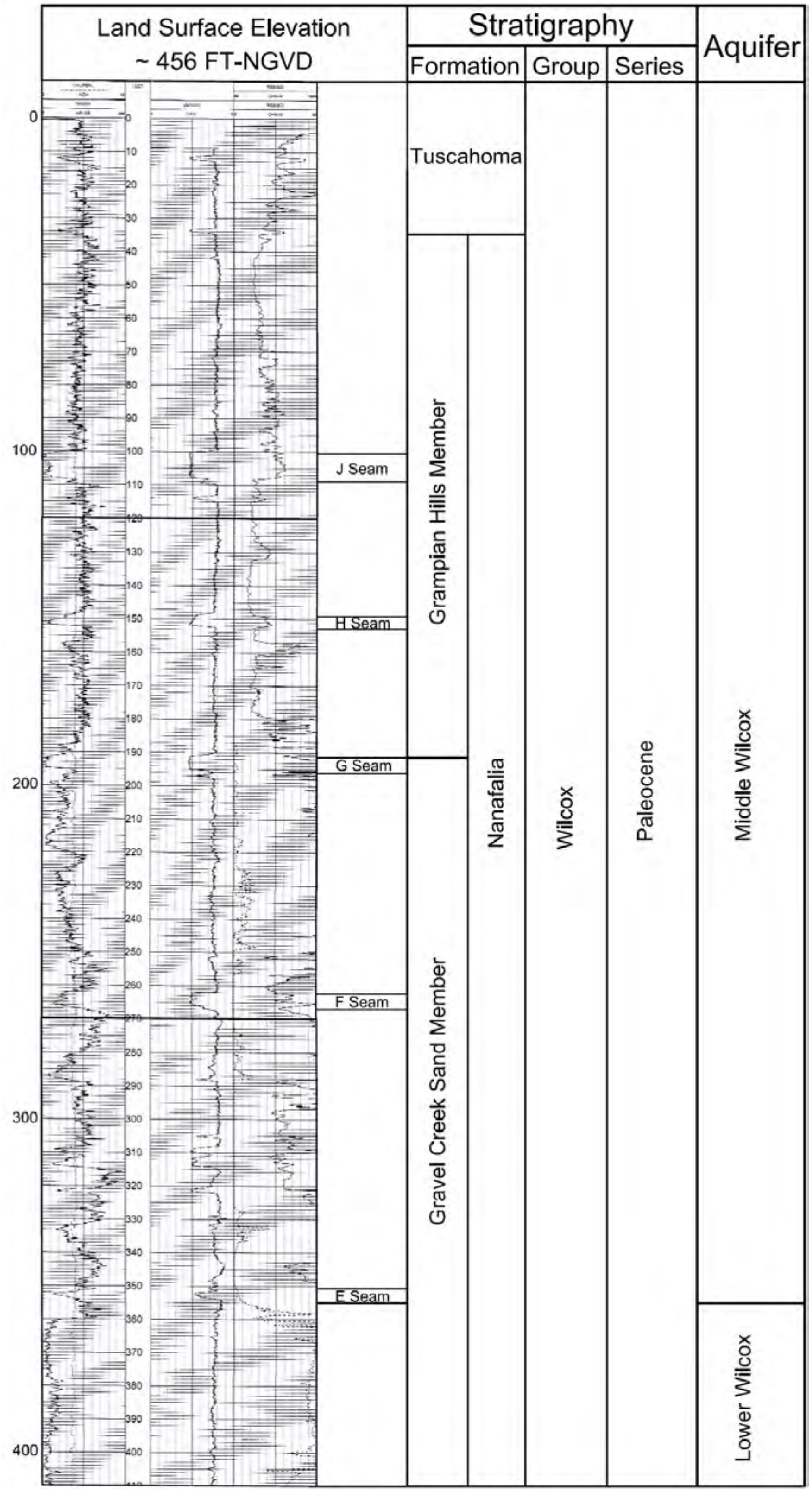


Figure 3.4-6. Shallow Stratigraphy in the Mine Study Area
Source: NACC, 2009.

Table 3.4-3. Summary of Overburden Geochemical Results

Parameter	Units	Oxidized			Unoxidized		
		Mean	Minimum	Maximum	Mean	Minimum	Maximum
pH	s.u.	4.9	4.3	5.8	6.5	5.7	7.1
Pyritic sulfur	% by weight	0.0	0.0	0.0	0.3	0.1	0.5
Potential acidity	t/1000t	0.0	0.0	0.5	8.5	2.3	14.7
Neutralization potential	t/1000t	1.0	0.0	11.1	9.6	5.6	18.0
Acid-base accounting	t/1000t	-0.8	-4.7	10.4	1.0	-9.1	9.3
Sand	% by weight	42.7	11.3	76.9	39.8	27.3	59.0
Clay	% by weight	24.8	8.2	40.5	19.0	10.9	24.7
Cation exchange capacity	meq/100g	13.0	3.4	27.2	21.4	17.4	24.3
Electrical conductivity	mmhos/cm	0.1	0.0	0.5	1.5	0.8	2.1
Sodium adsorption ratio		2.9	0.6	10.3	0.5	0.4	0.7
Arsenic (total)	ppm	4.8	1.4	8.5	4.4	3.4	6.0
Cadmium (total)	ppm	0.1	0.0	0.2	0.2	0.0	0.4
Chromium (total)	ppm	35.1	18.9	51.0	41.4	36.0	50.3
Copper (total)	ppm	9.6	4.5	16.6	11.2	6.6	15.2
Lead (total)	ppm	9.2	4.1	12.4	7.7	7.0	8.4
Manganese (total)	ppm	180.8	45.4	707.0	254.6	177.4	393.8
Nickel (total)	ppm	9.9	4.5	14.5	17.4	14.6	21.2
Selenium (total)	ppm	0.4	0.0	0.7	0.6	0.4	0.9
Zinc (total)	ppm	29.9	13.9	52.5	52.0	43.1	62.1

Note: meq/100g = milli-equivalents per 100 grams.
mmhos/cm = millimhos per centimeter.

Sources: NACC, 2009.
ECT, 2009.

The oxidized overburden is nonsaline with an average electrical conductivity of 0.1 millimhos per centimeter (mmhos/cm) and a range of 0.0 to 0.5 mmhos/cm (U.S. Department of Agriculture [USDA] Natural Resources Conservation Service [NRCS] [formerly Soil Conservation Service], 2007). The unoxidized overburden is also nonsaline to very slightly saline with an average electrical conductivity of 1.5 mmhos/cm and a range of 0.8 to 2.1 mmhos/cm (USDA, 2007).

Heavy metal concentrations in the oxidized and unoxidized overburden samples are all below the upper limits recommended by the EPA for the land application of sewage sludge (40 CFR 503). The geochemistry of the oxidized overburden is discussed further in Section 3.5, Soils.

3.4.4 MINERAL RESOURCES

Lignite occurs in the Paleocene and Eocene Series of the Gulf Coast in Mississippi (Breyer, 1991; Gandl, 1982). Although lignite has been known to exist in the project area for some time (Bicker, 1970; Booth and Schmitz, 1983; Luppens and Bograd, 1994), no previous mining attempts have been made in the area. Hughes (1958) reported that four thin sections were taken for lignite in Kemper County. These thin sections were examined by the Special Coal Research Section of the U.S. Bureau of Mines. The main component found in these thin sections was a finely divided translucent humic matter.

Iron ore has been reported near the project area. The main iron-bearing unit is the Matthews Landing marl member of the Porters Creek Clay Formation. The ore is made up of concretions and irregularly shaped masses that tend to be ellipsoidal or disc like. The Matthews Landing marl topography is slight with low dips that would be favorable for strip mining. One mine has been reported in Kemper County in the southeast corner of the county, well outside of the proposed boundaries of the project (Hughes, 1958; Bicker, 1970; Booth and Schmitz, 1983).

Sand can be found in abundant amounts in the project area (Booth and Schmitz, 1983), but these areas are not favorably located for large economically workable sites. The Fearn Springs sand member of the Nanifalia formation comprises most of the larger sand deposits. These sands are relatively impure quartzose whose chief impurities include clay balls, muscovite, and limonite. The sand itself is mostly loose and scoopable; no crushing would be required (Hughes, 1958). However, only one site is permitted for mining of sand close to the proposed site. This mine lies north of Meridian in Lauderdale County (Thieling, 2008).

Bauxite has been reported near the project area (Hughes, 1958; Bicker, 1970; Booth and Schmitz, 1983). During World War II, nine carloads of ore were taken out of Kemper County, but only a negligible amount of ore is reported to remain. The original deposit was approximately 4 ft thick with approximately 6 ft of kaolin overlaying it (Hughes 1958).

There is an abundant amount of clay in the project area (Booth and Schmitz, 1983). There are seven active permits for clay mining in Kemper County, but none fall within the proposed project site for the lignite mine. (Thieling, 2008).

There are no producing hydrocarbon wells, nor any current permits in the project area (Mississippi Oil & Gas Board, 2008). Two wells were drilled in or within a mile of the project boundary. The first was drilled in 1956 in Section 11, Township 8 north, Range 15 east, northeast quarter, northeast quarter. The second well was drilled in 1957 in Section 20, Township 10 north, Range 15 east, southeast quarter, northeast quarter. Neither produced hydrocarbons (Hughes, 1958; Mississippi Oil & Gas Board, 2008).

3.4.5 SEISMOLOGY

3.4.5.1 Tectonic Setting

The proposed project area is located in the Central Gulf Coastal Plains with the Atlantic Coastal Plains on the east. Geographically, the power plant site is located in east-central Mississippi near the town of Liberty approximately 20 miles north of the city of Meridian within the Mississippi Embayment. The site is located within the North American crustal plate but not near any active continental crustal plates or tectonic boundaries.

3.4.5.2 Regional Geologic Structure and Faulting

The project area is located in southwest region of the Black Warrior Basin just north of the Buried Appalachian Techtonic Belt and east of the Buried Ouachita Tectonic Belt.

The Central Gulf Coast region is underlain by sedimentary formations of wedge-shaped deposits that thicken and have a gentle monoclonal dip seaward. The orientation is a result of the influence by the Gulf Coast geosynclinal trough, the Mississippi structural trough, and by four major upwarps: Sabine uplift, Monroe-Sharkey uplift, Jackson uplift, and Wiggins anticline. The beds generally dip approximately 40 ft per mile to the southwest around the project area (Figure 3.4-7). There are numerous smaller positive and negative structural anomalies that contribute to the formation of a complex structural pattern. No major surface faults have been identified in the project site area (Hughes, 1958). Hughes suggests that the subsurface Cretaceous formations in the project area may be faulted. The majority of recent seismic activity, however, is concentrated in the New Madrid seismic zone (Illinois through New Madrid and Caruthersville, Missouri, down through Blytheville to Marked Tree, Arkansas), affecting mostly the northwest part of Mississippi (Figures 3.4-8 and 3.4-9). Effects from the Appalachian thrust belt also contribute to the geologic structure of the project areas.

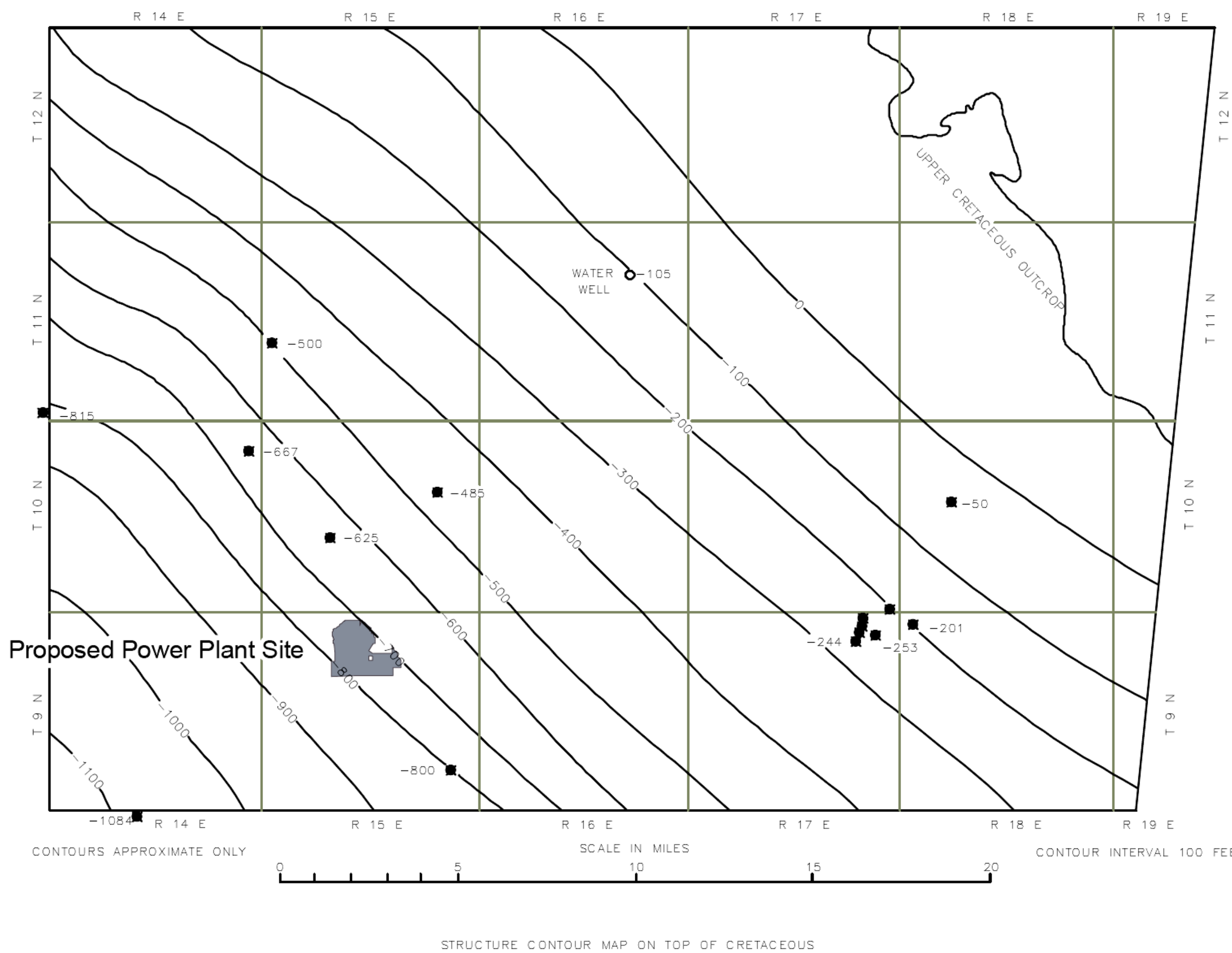


Figure 3.4-7. Structural Contour Map on Top of Cretaceous

Sources: Hughes, 1958. Mississippi Geological Survey Bulletin No. 84.

3.4.5.3 Earthquake History

Locations, relative magnitude, and density of earthquakes with magnitudes greater than 3.0 body-wave magnitude (M_b) near the proposed project site that are known to have occurred from 1973 to 2008 were obtained from a National Earthquake Information Center (NEIC) Web site that is based on a U.S. Geological Survey (USGS) seismic database. Those data indicate clusters of seismic activity in the Central Mississippi Valley, Illinois Basin (New Madrid Seismic Zone), Ouachita thrust belt to the west, and the Southern Appalachian thrust belt.

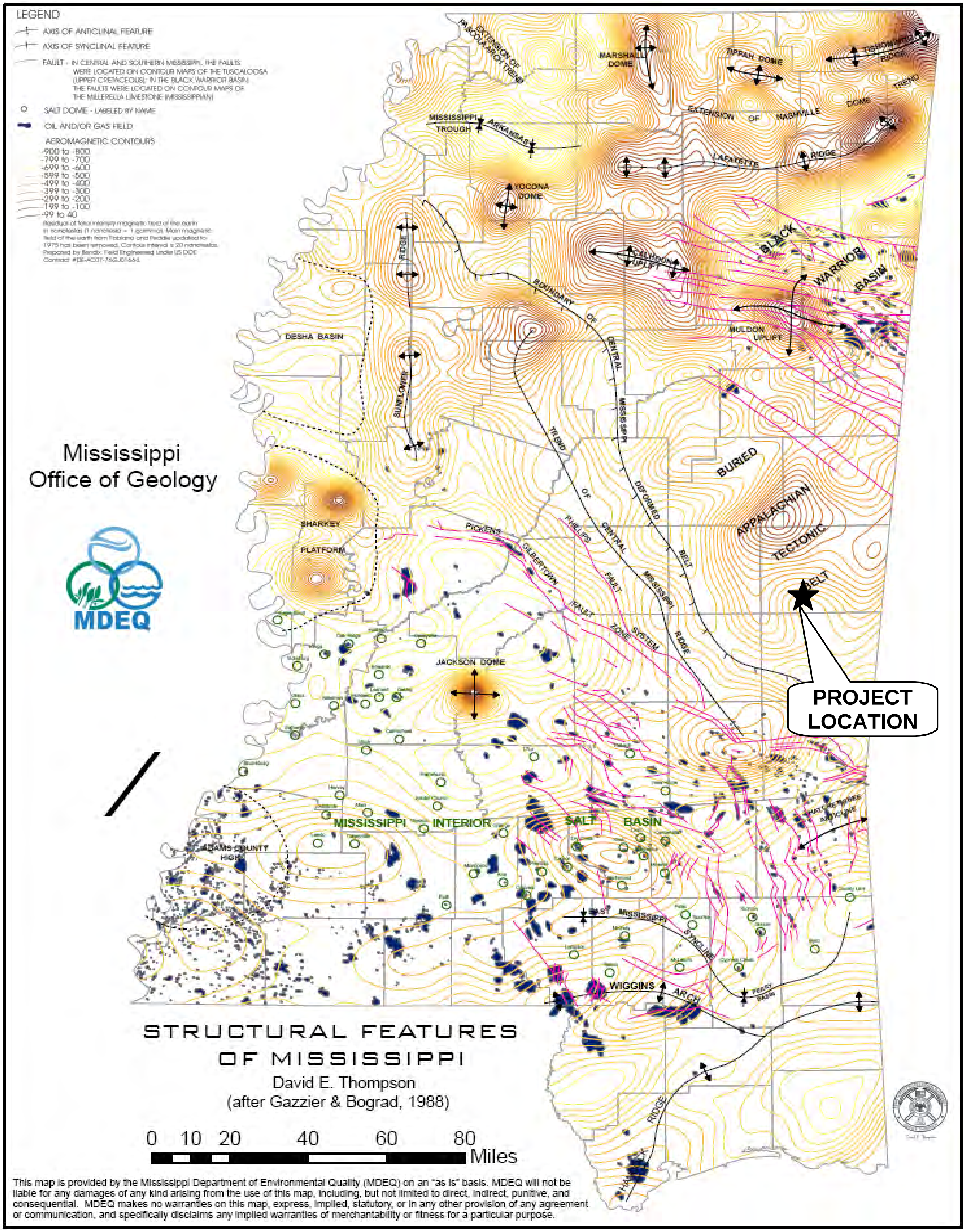


Figure 3.4-8. Structural Features of Mississippi
Source: MDEQ, 1988.

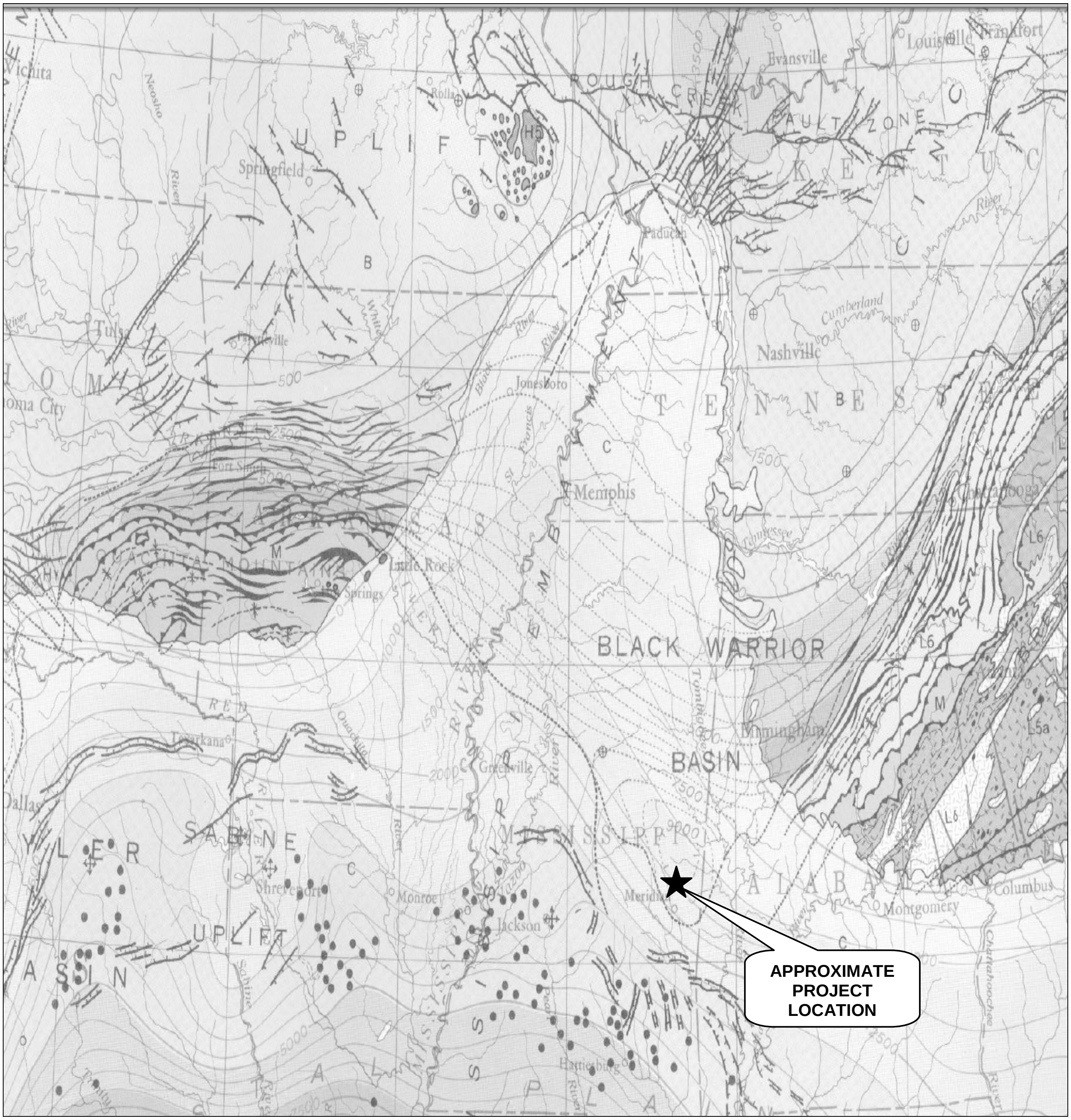


Figure 3.4-9. Tectonic Map near Project Area

Source: USGS, 1969.

The location and magnitude of a number of these earthquakes are based on effects reported rather than direct instrument measurements. Since the 1930s and 1940s, instrumental measurements and monitoring stations have been strategically installed and located (Figure 3.4-10) mostly in high seismic risk areas. Until recently these instruments were set up to measure only large events.

Due to the relative seismic stability of the central United States, few seismogrfaphs were installed in the area during early seismic programs. The relative sparsity of data from the country's interior represents a problem when analyzing patterns of seismicity, location, and fault plane solutions of large earthquakes (Geological Society of America [GSA], 1991). Historical and new data from existing stations and available records, however, can be used to compute and estimate seismic hazards to assess earthquake risk for the proposed project areas based on currently accepted standards. Unfortunately, no known attenuation relationships for the project area are readily available. Therefore, recommended methods and procedures included in the 2003 National Earthquake Hazards Reduction Program (NEHRP) Recommended Provisions for Seismic Regulations for New Buildings and Other Structures (Federal Emergency Management Agency [FEMA], 450) were used to make the assessment (Building Seismic Safety Council [BSSC], 2003).

Two historical earthquake datasets were tested for accuracy and completeness using Gutenberg-Richter's formula (1958) used to estimate the magnitude and total number of earthquakes in any given region and time period (GSA, 1991) and gave the following results for the project area:

$$\log_{10}N(m) = a\text{-}bm$$

where: $N(m)$ = number of earthquakes of magnitude *m* or greater per unit time.

a and b = constants.

The average inter-event time or recurrence interval for earthquakes of a particular magnitude ***m*** or greater is given by $1/N(m)$.

Table 3.4-4. Estimate of Earthquake Recurrence Rate in the Project Area

Range	Time Span	Magnitude Range (M_b)	a	b
1	1981 to 2008	3.3 to 6.0	2.91	-0.66
2	1973 to 2008	3.2 to 6.0	4.45	-0.92

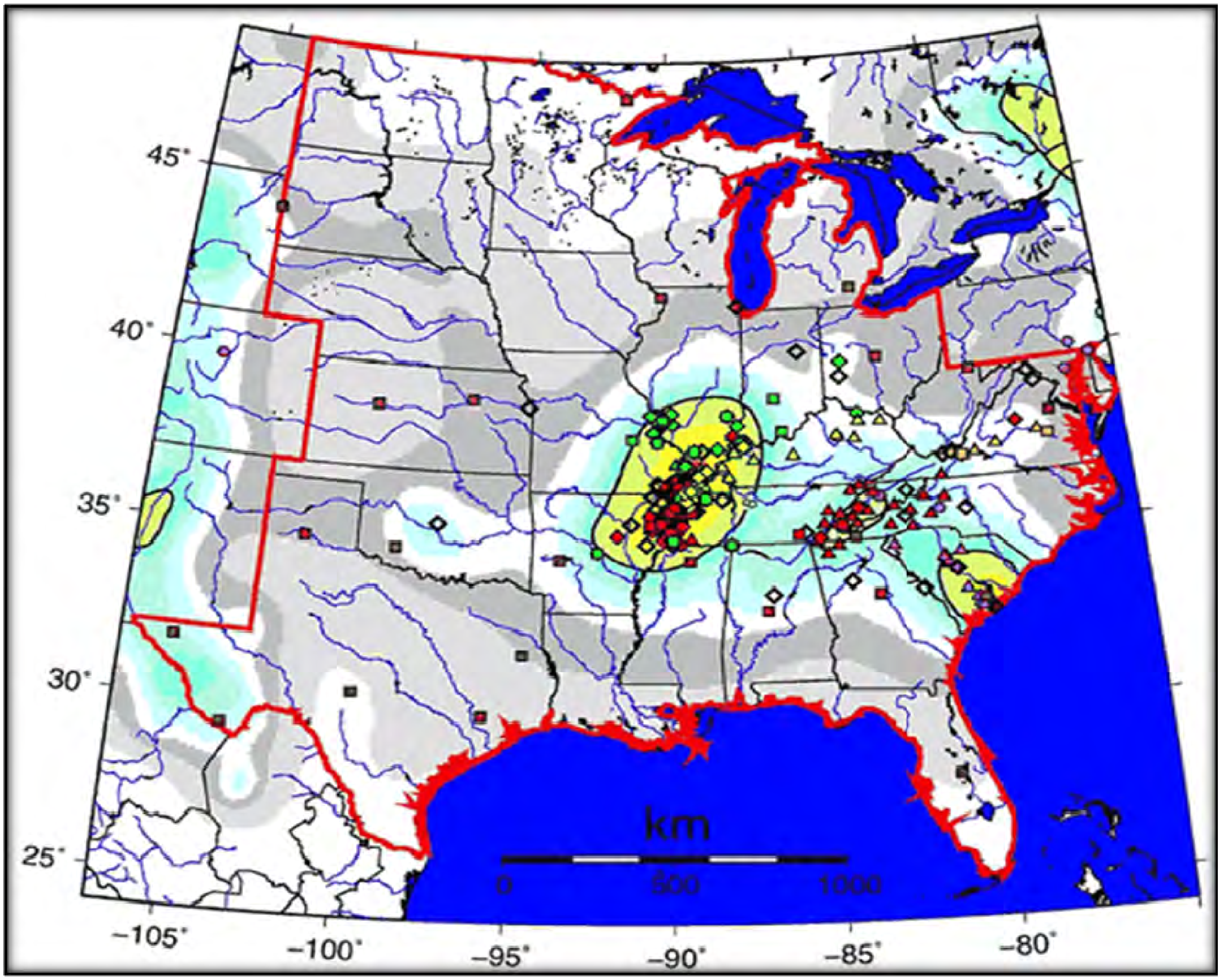
Source: NACC, 2009.

Table 3.4-4 was developed from the NEIC 1973 to 2008 database and an Northern California Earthquake Data Center (NCEDC) 1981 to 2008 database for earthquakes of magnitude greater than 3.0 M_b. (Earthquakes less than 3.0 M_b are considered imperceptible except by measuring instruments.) Since the "b" value in Range 2 is close to the typical "b" magnitude of -1.0, the dataset in Range 2 was included for reference in this analysis. That is, the NEIC database for 1973 to 2008 was determined to be most applicable for use in evaluating seismic hazard, as further described herein.

3.4.5.4 Seismic Source Zone Influencing Proposed Project Area

The seismic source zones relevant to the proposed project area are the New Madrid seismic zone to the north (most active and researched), Southern Appalachian thrust belt to the east, Ouachita thrust belt to the northwest, and the Charleston Southern Carolina seismic zone.

Patterns of earthquakes greater or equal to 3.0 M_b throughout the central United States include only one major cluster of activity that lies in the New Madrid fault zone, adjacent regions of the Wabash valley fault zones,



LEGEND

Station Map for the Mid-America region of the ANSS. Squares are broadband, triangles are shortperiod, and diamonds are strongmotion.

- Unfilled Diamonds: USGS National Strongmotion Program
- Red: CERI, The University of Memphis
- Green: St. Louis University
- Yellow: University of Kentucky
- Orange: Virginia Tech
- Purple: University of South Carolina at Columbia
- Brown: USGS National Seismic Network.

The underlay is the USGS seismic hazard map with 10% probability of exceedence in 50 years. The 8%g level is contoured.

Figure 3.4-10. Station Map for the Mid-America Region of the ANSS

Source: http://earthquake.usgs.gov/research/monitoring/anss/regions/mid/

and small regions of the Illinois basin and Ozark uplift. Earthquakes greater or equal to 4.5 M_b are generally associated with regions classified as rift zones, uplifts, basins, or former plate boundaries. There is no compelling evidence for long thoroughgoing seismically active zones at the project site. Earthquakes less than 4.5 M_b seldom cause any damage unless they are of very shallow depth and are situated immediately beneath a town (GSA, 1991).

3.4.5.5 Soil Amplification of Ground Motions and Ground Deformation Potential

The general soil properties for the proposed project area were determined based on the 2008 geotechnical study conducted by Aquaterra Engineering for NACC. The study involved the drilling of 20 boreholes across the proposed project mine study area. Field and laboratory analysis and testing of borehole samples for lithology and material properties show soil properties in the upper 100 ft to have undrained shear strengths greater than 2,000 pounds per square foot (lb/ft^2). Based on the 2003 NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures (FEMA 450) and the 2006 International Building Code (IBC) standards, the site soils can be classified as Class C (stiff soils to very dense soils and soft rock) (see Table 3.4-5).

Table 3.4-5. Site Classification for Seismic Design

Site Class	$\bar{v}_5$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$ *
E	<600 ft/s (<180 m/s)	<15	<1,000 lb/ft^2 (<50 kPa)
D	600 to 1,200 ft/s (180 to 360 m/s)	15 to 50	1,000 to 2,000 lb/ft^2 (50 to 100 kPa)
C	>1,200 to 2,500 ft/s (360 to 760 m/s)	>50	>2,000 lb/ft^2 (>100 kPa)

*If the $\bar{s}_u$ method is used and the $\bar{N}$ or $\bar{N}_{ch}$ criteria differ, select the category with the softer soils (e.g., Site Class E instead of D).

Sources: Building Seismic Safety Council, 2003.
NEHRP, 2008.

The 2003 NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures (FEMA 450) gives guidelines on the procedures for completing site classification, site coefficients, acceleration parameters, adjusted acceleration parameters, design acceleration parameters, and design response spectrum for seismic hazard analysis. Since the site soil classification was determined to be Class C, the general procedure will be used. The following parameters where ascertained following the guidelines and charts published for 0.2- and 1.0-second spectral response accelerations (5 percent of critical dumping) based on 2003 NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures (FEMA 450). As used in NEHRP's provisions, the following spectral acceleration parameters are coefficients corresponding to spectral accelerations in terms of g, the acceleration due to gravity:

Mapped Acceleration Parameters:

1. S_1 The mapped, maximum considered earthquake, 5-percent damped, spectral response Acceleration parameter at a period of 1 second
   = 9% g or 0.09g
2. S_S The mapped, maximum considered earthquake, 5-percent damped, spectral response Acceleration parameter at short periods
   = **21% g or 0.21g**

<u>Site Coefficients and Adjusted Acceleration Parameters</u>:

3. F_a Site class effect adjustment factor (soil amplification) for S_S (maximum considered earthquake, 5-percent damped, spectral response, acceleration parameter at short periods)
   = 1.2 (for a Site Class C)
4. F_v Site class effect adjustment factor (soil amplification) for S_1 (maximum considered earthquake, 5-percent-damped, spectral response, acceleration parameter at a period of 1 second)
   = 1.7
5. **S_{M1} the maximum considered earthquake, 5-percent damped, spectral response acceleration parameter at a period of 1 second adjusted for site class effects**
   $S_{M1} = S_1 \times F_v$ ***=0.153g***
6. **S_{MS} the maximum considered earthquake, 5-percent damped, spectral response acceleration parameter at short periods adjusted for site class effects**
   $S_{MS} = S_s \times F_a$ ***==0.252g***

<u>Design Acceleration Parameters</u>:

7. S_{D1} The design, 5-percent damped, spectral response acceleration parameter at a period of 1 second
   = **0.102 g**
8. S_{DS} The design, 5-percent damped, spectral response acceleration parameter at short periods
   = **0.168 g**

<u>Design Response Spectrum</u>:

9. T fundamental period of the building
   Determined from the approximate fundamental period T_a =0.1N=0.1 (single story concrete and steel moment resisting frame structures) and for straight line interpolation of the coefficient for upper limit C_u =1.70 for above S_{D1}
   $T = T_a \times C_u$=0.170 (seconds)
10. $T_0 = 0.2 S_{D1}/S_{DS}$
    = 0.121 (seconds)
11. T_L Long-period transition period. ***=12 (seconds)***
12. $T_S = S_{DI}/S_{DS}$. ***=0.607 (seconds)***
13. S_a The design spectral response acceleration at any period-calculated

Period(s)	0.04	0.12	0.17	0.20	0.30	0.40	0.50	0.61	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00
S_a	0.10	0.17	**0.17**	0.17	0.17	0.17	0.17	0.17	0.10	0.07	0.05	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Since the proposed site has S_S greater than 0.15 and S_1 greater than 0.04, based on FEMA 450 provisions (BSSC, 2003), site designs shall comply with NEHRP's provisions.

3.4.5.6 Earthquake Recurrence Estimates and Seismic Hazard

Using the less than 50 years life of mine and the earthquake data available is from several different historical sources, a probabilistic approach based on 2008 USGS seismic hazard maps for a 50-year return period was evaluated for comparison purposes to assess seismic hazard and risk for the proposed project areas. The charts yielded the following statistics for a 2-percent probability of exceedance in 50 years for the project area without site adjustments:

- 1-Hertz (Hz) spectral acceleration (SA) **0.06g**.
- 5-Hz SA **0.12g**.
- Peak ground acceleration (PGA) **0.07g**.

The estimates from NEHRP's recommended provisions give more conservative values and therefore were used in this evaluation. The results obtained may serve as a basis for civil planning, land use, zoning, and seismic building code regulations and may also help to determine risk-based earthquake insurance premiums.

3.5 SOILS

3.5.1 REGIONAL SETTING

Mississippi is entirely within the Gulf Coast Plain physiographic province of North America (USDA, 1999). Upland landscapes in the project area range from gently sloping to steep, with soils formed from the unconsolidated sands and clays of the Wilcox geologic group. The floodplains and terraces along streams are nearly level to gently sloping, with soils formed from alluvial sediments eroded from nearby uplands.

The soils in the proposed project area (Kemper, Lauderdale, Clarke, and Jasper Counties) occur within the North Central Hills and South Central Hills physiographic regions, parts of the Southern Gulf Coastal Plain (refer to Figure 3.4-2). Soils in the uplands range from nearly flat to very steep and are formed from unconsolidated marine sediments (sands, silts, clays, and some gravel) and thin loess (wind-blown silt) deposits. The bottomland soils of local streams are nearly level and derived from alluvial sediments that were eroded from nearby uplands (USDA, 2009a). Vegetative cover is mostly managed forestland with some areas of pasture, forage crops, row crops, and residential landscaping. Land use is primarily rural, low-density residential and some urban use in and around the city of Meridian. This subsection discusses the classification, description, productivity, use capability, and prime farmland status of the soils of the study area for the proposed Kemper County IGCC Project.

The soils of the southern Gulf Coastal Plain are mostly derived from unconsolidated marine sediments (sand, silt, clay, and gravel) and often have a silty surface layer of loess, a wind-blown deposit. Many of these soils have consolidated soils horizons called fragipans that may complicate farming, excavation, or subsurface construction activities. Bottomland soils are generally derived from recent sediments eroded from surrounding uplands (USDA, 2009a).

The description, laboratory analysis, and uses of the soils found in the project area are presented in greater detail in the published county soil surveys. The NRCS (USDA, 2009b) Web Soil Survey (WSS) online database contains current soil mapping data for the areas of interest. Thirty-nine soil series were obtained from the WSS and MARIS soil association data for the entire study area in Kemper, Lauderdale, Clarke, and Jasper Counties. They include the Annemaine, Arundel, Bibb, Bigbee, Boswell, Cahaba, Chastain, Cuthbert, Daleville, Eustice, Heidel, Iuka, Jena, Kinston Kirkville, Lauderdale, Leaf, Lucy, Mantachie, Mashulaville, McLaurin, Moorville, Ora, Prentiss, Quitman, Ruston, Savannah, Shubuta, Smithville, Stough, Sweatman, Tilden, Vimville, and Williamsville.

In addition, nonclassified soil map units for the study area include borrow pits and urban land. These soil series represent the most detailed soil map data available from NRCS for the specific project locations, including some soils of minor occurrence. Figure 3.5-1 depicts a generalized distribution of dominant soils for the proposed project area.

The predominant upland soils in the study area include the Sweatman, Smithdale, Susquehannah, Arundel, Lauderdale, Ora, and Savannah. These soils are well to excessively drained and range from nearly level to steep slopes. Much of the area of these soils is forested. The Smithdale and Sweatman series are deep, well-drained soils with moderate to moderately slow permeability. They are both found on ridges and hill slopes in the Southern Gulf Coastal Plain. The Susquehanna series is geographically common with these two soils and consists of deep, poorly drained soils with slow permeability. The Susquehanna series is found nearly level to steep soils on erosional uplands. Arundel and Lauderdale soils are usually associated with Sweatman soils within the vicinity of the project area on dissected uplands. These soils are both well drained with slow to moderately slow permeability. These two soils do differ in depth, with Arundel soils being moderately deep and Lauderdale soils being shallow.

The Ora and Savannah series consist of moderately well drained, moderate to moderately slow permeable soils with a fragipan. They are on upland terraces that range from nearly level to moderately steep.

Dominant soils on bottomlands and adjacent terraces along stream valleys include the Quitman, Stough, Daleville, and Jena. The bottomland soils are commonly flooded and poorly to well-drained. The Daleville series consists of poorly drained soils that formed in loamy marine or fluvial sediments. These soils have slow permeability and are on nearly level to gently sloping bottomlands and terraces. The Jena series consists of deep, well-drained, moderately permeable soils that formed in thick loamy sediments on recent alluvial plains. Most of the designated prime farmland soils are on the lower landscape positions on stream terraces. The Quitman and Stough soils are deep, gently sloping, somewhat poorly drained, moderately slowly permeable soils formed in loamy sediments.

3.5.2 POWER PLANT SITE AND MINE STUDY AREA

3.5.2.1 Soil Classification and Description

The description, laboratory analyses, and use suitability of the soils in the proposed power plant and mine study area are presented in greater detail in the published Soil Survey of Kemper County, Mississippi (USDA, 1999) and the published Soil Survey of Lauderdale County, Mississippi (USDA, 1983). More recently, all published NRCS soil survey information has been made available online at the NRCS WSS site (USDA, 2008b). While the WSS soil maps and map unit names are identical to those in the published soil surveys, WSS data and interpretations reflect the current state of soil science and conform to current National Cooperative Soil Survey standards. WSS identifies 39 map units and water within the project area. Table 3.5-1 lists each map unit by map symbol and name and its acreage and proportionate extent within the project area. The geographic locations of these map units are arranged by three land categories (prime farmland soils, other arable soils, and other land) for illustration on Figure 3.5-2.

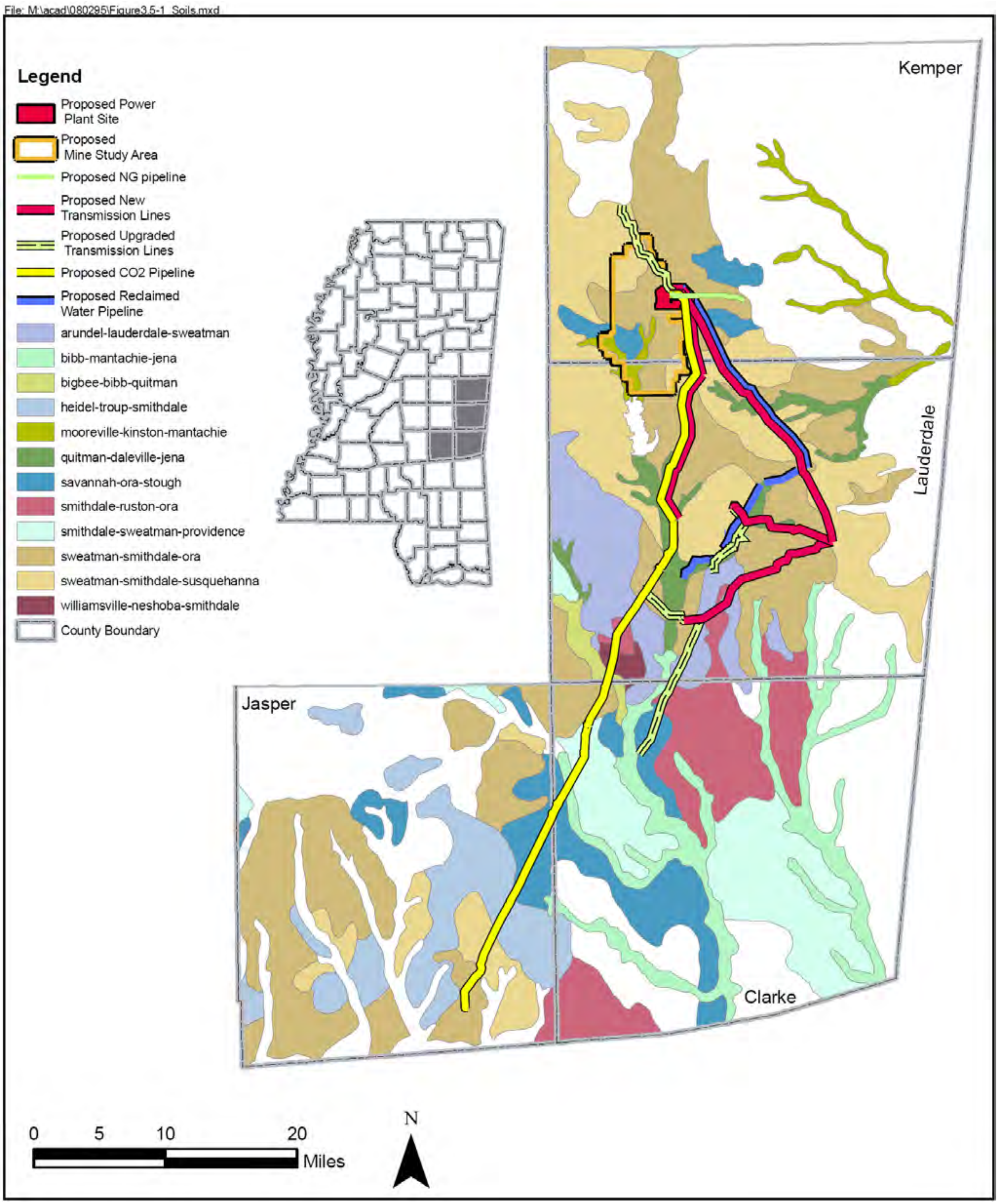


Figure 3.5-1. Soils Distribution for the Proposed Project Area
Sources: MARIS, 2008. ECT, 2009.

Table 3.5-1. Acreage and Proportionate Extent of Premining Soil Resources

Map Symbol	Map Unit Name	Acres	Percent
Aa	Annemaine fine sandy loam*	28.0	0.1
Da	Daleville sandy loam, frequently flooded	23.7	0.1
DJ	Daleville-Jena association, frequently flooded	4,250.6	13.6
Je	Jena fine sandy loam, occasionally flooded	141.0	0.5
Ka, Kr	Kirkville fine sandy loam, occasionally flooded*	881.5	2.8
Kb	Kirkville-Bibb complex, frequently flooded	73.2	0.2
Kn	Kinston loam, occasionally flooded	553.3	1.8
Kv	Kirkville fine sandy loam, frequently flooded	5.4	0.0
Ma	Mantachie loam, occasionally flooded	1,397.1	4.5
Mc	Mantachie loam, frequently flooded	116.2	0.4
Mo	Mooreville loam, occasionally flooded*	60.3	0.2
MV	Mooreville-Kinston-Mantachie association, frequently flooded	1,390.7	4.4
OrB	Ora fine sandy loam, 2- to 5-percent slopes*	17.2	0.1
OrB2	Ora fine sandy loam, 2- to 5-percent slopes, eroded*	35.5	0.1
OrC	Ora fine sandy loam, 5- to 8-percent slopes	137.8	0.4
OrC2	Ora fine sandy loam, 5- to 8-percent slopes, eroded	265.9	0.9
Pe	Pits-Udorthents complex	14.0	0.0
PnA	Prentiss loam, 0- to 2-percent slopes*	276.6	0.9
PnB	Prentiss loam, 2- to 5-percent slopes*	223.9	0.7
PtA	Prentiss fine sandy loam, 0- to 2-percent slopes*	9.7	0.0
QaA	Quitman silt loam, 0- to 2-percent slopes*	231.4	0.7
RnB, RuB	Ruston fine sandy loam, 2- to 5-percent slopes*	99.0	0.3
RnC2	Ruston fine sandy loam, 5- to 8-percent slopes, eroded	1,136.6	3.6
RuC	Ruston fine sandy loam, 5- to 8-percent slopes*	17.2	0.1
SaA	Savannah fine sandy loam, 0- to 2-percent slopes*	48.4	0.2
SaB	Savannah fine sandy loam, 2- to 5-percent slopes*	2,145.2	6.9
SaC	Savannah fine sandy loam, 5- to 8-percent slopes	25.8	0.1
SaC2	Savannah fine sandy loam, 5- to 8-percent slopes, eroded	129.2	0.4
SeD2	Smithdale fine sandy loam, 8- to 12-percent slopes, eroded	236.8	0.8
SeE2	Smithdale fine sandy loam, 12- to 17-percent slopes, eroded	125.9	0.4
StA	Stough fine sandy loam, 0- to 2-percent slopes	14.0	0.0
SmB2, SwB2	Sweatman fine sandy loam, 2- to 5-percent slopes, eroded*	636.1	2.0
SmC2, SwC2	Sweatman fine sandy loam, 5- to 8-percent slopes, eroded	2,792.1	8.9
SmD2	Sweatman fine sandy loam, 8- to 15-percent slopes, eroded	1,032.2	3.3
SwD2	Sweatman fine sandy loam, 8- to 12-percent slopes, eroded	1,951.5	6.2
SwF2	Sweatman fine sandy loam, 12- to 30-percent slopes, eroded	431.6	1.4
SW	Sweatman association, hilly	1,002.1	3.2
SX	Sweatman-Smithdale association, 5- to 12-percent slopes	5,193.5	16.6
SY	Sweatman-Smithdale association, 12- to 35-percent slopes	3,770.5	12.1
W	Water	339.1	1.1
	Total	**31,260.0**	**100.0**

*Soil map units designated as prime farmland soils by USDA NRCS; however, not historical prime farmland as defined by SMCRA and the Mississippi Surface Mining and Reclamation Act of 1977 (MSMRA).

Source: NACC, 2009.

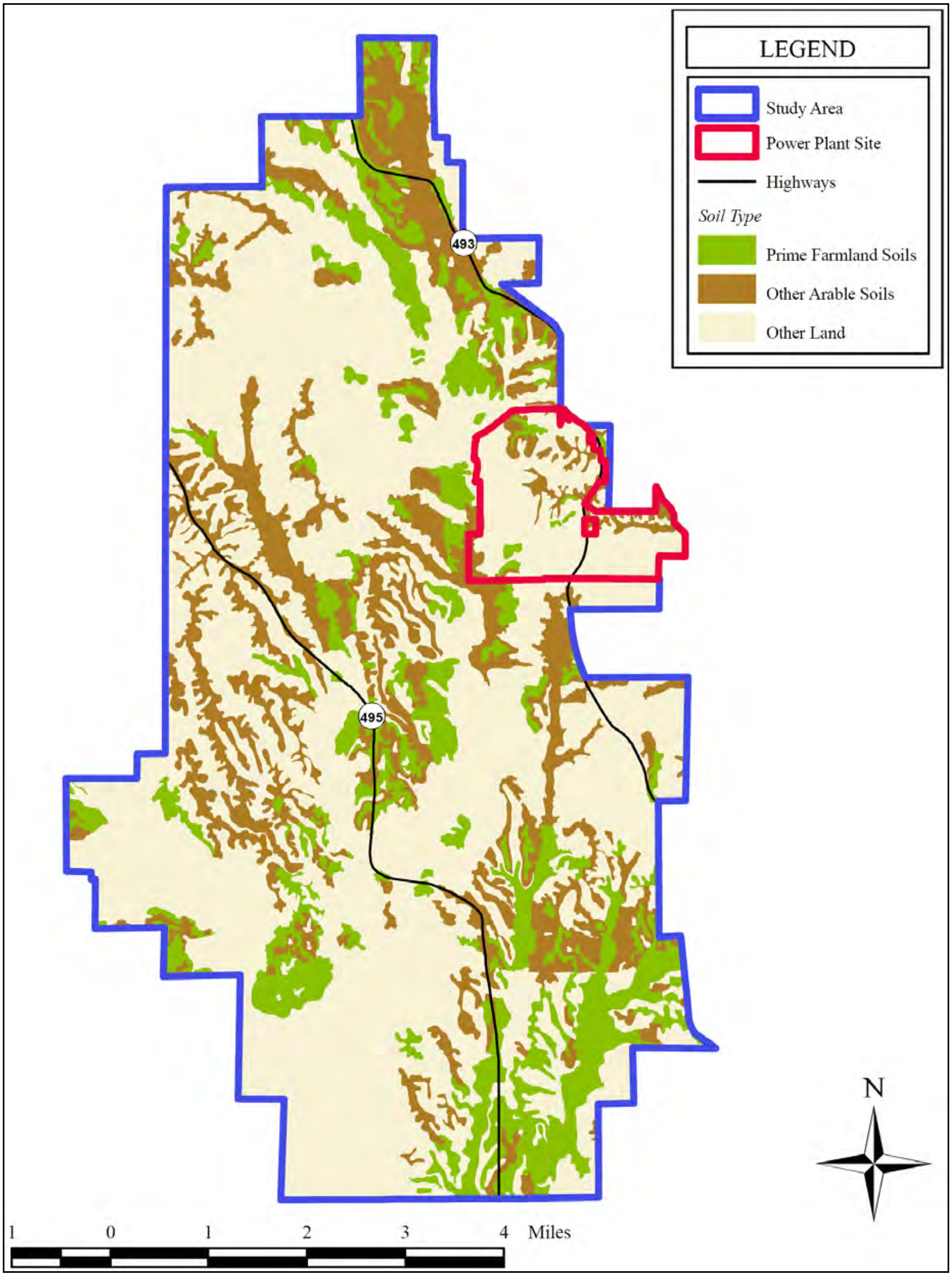


Figure 3.5-2. Geographic Locations of Soil Map Units
Source: NACC, 2009.

Upland soils comprise approximately 63 percent of the project area. Typically, these are well-drained soils on rolling to steep ridges and hillsides. The dominant upland soils are the Smithdale and Sweatman series (Table 3.5-1). Upland soils are highly weathered with distinct horizonation and are generally very strongly acid to strongly acid throughout the profile. Many areas have a thin surface layer (A horizon) because of past erosion. Surface texture is generally fine sandy loam, while subsoil textures include sandy clay loam, clay loam, silty clay, and clay. Most of the upland soils are in deciduous, pine, or mixed forest uses, with some of the less sloping areas being used for pasture and hay.

Soils on flood plains and terraces along streams comprise approximately 37 percent of the project area. These are nearly level to gently sloping, poorly drained to well-drained soils developed from alluvial sediments. The dominant flood plain soils are the Daleville, Jena, and Mantachie series, and the dominant soils on the terraces are the Savannah series (Table 3.5-1). The floodplain soils generally do not exhibit discernable horizonation and are generally very strongly acid to moderately acid throughout the profile. The soils on terraces are distinctly horizonated and are generally extremely acid to strongly acid throughout the profile. The floodplain and terrace soils generally have sandy loam or loam surface textures and loamy subsoil textures. Most areas of the floodplain soils are subject to common flooding, and most of the floodplain and terrace soils are in pasture, hay, and forest uses.

Hydric soils are soils that "formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (USDA, 2006). The more poorly drained floodplain soils (e.g., Daleville) in the project area fit this definition, and the relevant ranges of characteristics for several other floodplain soils (e.g., Mantachie) overlap the hydric soil definition. The processes of identifying and delineating wetlands pursuant to Section 404 of the CWA represent the primary applications of this definition in the project area. Detailed discussions of these processes are included in Section 3.11, Wetlands.

As background data for determining crop and forest production potentials and use limitations for the soils in the project area, a summary of selected physical and chemical properties is given in Table 3.5-2. These data are derived from the aforementioned published soil surveys (as available online at the NRCS WSS Web site [USDA, 2009b]). Several soil characteristics that could have important implications for land reclamation and postmining land use should be pointed out from these data.

With few exceptions, soils of the project area are very strongly acid to moderately acid, with a pH range of 4.5 to 6.0 throughout the profile. In terms of movement of air, moisture, and roots favoring plant growth, most project area soils presently have desirable textures and bulk densities. Exceptions are the Sweatman soils, which have clayey subsoils, and the Ora and Savannah soils, which have dense, compact (fragipan) layers in the lower subsoil.

The natural erodibility of the soils in the project area is represented by the K factors shown in Table 3.5-2. The higher the number, the more erodible the soil, based on experimentally measured soil losses from controlled fallow plots of specified slope length and steepness (Wischmeier and Smith, 1978). The most important soil property influencing the K factor is particle size distribution (soil texture); other important properties include organic matter content, soil structure, and permeability. Several project area soils are quite erodible, with K factors above 0.37. These soils have a relatively high silt content in the surface layer and/or relatively low permeability rates, reflective of the general increasing erodibility with increasing silt content and decreasing permeability rate. The soil loss tolerance (T) value is defined as the maximum average annual rate of soil erosion by water

Table 3.5-2. Selected Physical and Chemical Properties of Project Area Soils

Soil Series	Depth (inches)	Clay (percent)	Bulk Density (g/cm^3, moist)	Hydraulic Conductivity (μm/minute)	Available Water Capacity (inch/inch)	Linear Extensibility (percent)	Erosion Factors Kf	Erosion Factors T	Soil pH
Annemaine	0 to 6	10 to 20	1.30 to 1.55	4.23 to 14.11	0.12 to 0.16	0.0 to 2.9	0.28	5	4.5 to 6.5
	6 to 24	35 to 50	1.30 to 1.45	0.42 to 1.41	0.14 to 0.18	3.0 to 5.9	0.37		4.5 to 5.5
	24 to 36	35 to 60	1.25 to 1.40	0.42 to 1.41	0.14 to 0.18	3.0 to 5.9	0.37		4.5 to 5.5
	36 to 50	20 to 35	1.30 to 1.60	1.41 to 4.23	0.14 to 0.18	0.0 to 2.9	0.37		4.5 to 5.5
	50 to 80	5 to 25	1.40 to 1.60	1.41 to 14.11	0.14 to 0.18	0.0 to 2.9	0.32		4.5 to 5.5
Daleville	0 to 7	5 to 15	1.40 to 1.50	4.23 to 14.11	0.10 to 0.14	0.0 to 2.9	0.24	5	4.5 to 6.5
	7 to 62	20 to 35	1.40 to 1.50	0.42 to 4.23	0.16 to 0.20	3.0 to 5.9	0.37		4.5 to 5.5
Jena	0 to 7	10 to 20	1.30 to 1.70	4.23 to 14.11	0.12 to 0.20	0.0 to 2.9	0.28	5	4.5 to 6.0
	7 to 44	10 to 18	1.30 to 1.70	4.23 to 14.11	0.10 to 0.20	0.0 to 2.9	0.28		4.5 to 5.5
	44 to 60	5 to 20	1.35 to 1.65	14.11 to 42.34	0.08 to 0.14	0.0 to 2.9	0.24		4.5 to 5.5
Kirkville	0 to 7	10 to 20	1.30 to 1.50	4.23 to 14.11	0.15 to 0.15	0.0 to 2.9	0.28	5	4.5 to 5.5
	7 to 65	10 to 18	1.35 to 1.55	4.23 to 14.11	0.10 to 0.15	0.0 to 2.9	0.28		4.5 to 5.5
Kinston	0 to 12	5 to 27	1.30 to 1.50	4.23 to 14.11	0.14 to 0.20	0.0 to 2.9	0.37	5	4.5 to 6.0
	12 to 50	18 to 35	1.30 to 1.50	4.23 to 14.11	0.14 to 0.18	0.0 to 2.9	0.32		4.5 to 5.5
	50 to 60	18 to 35	1.30 to 1.50	4.23 to 14.11	0.14 to 0.18	0.0 to 2.9	0.32		4.5 to 5.5
Mantachie	0 to 8	8 to 20	1.50 to 1.60	4.23 to 14.11	0.16 to 0.20	0.0 to 2.9	0.28	5	4.5 to 5.5
	8 to 61	18 to 34	1.50 to 1.60	4.23 to 14.11	0.14 to 0.20	0.0 to 2.9	0.28		4.5 to 5.5
Mooreville	0 to 10	5 to 27	1.40 to 1.50	4.23 to 14.11	0.14 to 0.20	0.0 to 2.9	0.37	5	4.5 to 5.5
	10 to 71	18 to 35	1.40 to 1.50	4.23 to 14.11	0.14 to 0.18	3.0 to 5.9	0.28		4.5 to 5.5
Ora	0 to 5	10 to 18	1.45 to 1.55	14.11 to 42.34	0.10 to 0.13	0.0 to 2.9	0.28	3	3.6 to 5.5
	5 to 24	18 to 33	1.45 to 1.60	4.23 to 14.11	0.12 to 0.18	0.0 to 2.9	0.37		3.6 to 5.5
	24 to 54	18 to 33	1.70 to 1.80	1.41 to 4.23	0.05 to 0.10	0.0 to 2.9	0.32		3.6 to 5.5
	54 to 70	10 to 35	1.65 to 1.75	4.23 to 14.11	0.10 to 0.15	0.0 to 2.9	0.37		3.6 to 5.5
Prentiss	0 to 27	5 to 18	1.50 to 1.60	4.23 to 14.11	0.12 to 0.16	0.0 to 2.9	0.37	3	4.5 to 5.5
	27 to 60	5 to 18	0.80 to 1.50	4.23 to 14.11	0.12 to 0.16	0.0 to 2.9	0.37		4.5 to 5.5
	60 to 73	10 to 20	1.65 to 1.75	1.41 to 4.23	0.06 to 0.09	0.0 to 2.9	0.37		4.5 to 5.5
Quitman	0 to 7	5 to 15	1.35 to 1.65	4.23 to 14.11	0.15 to 0.24	0.0 to 2.9	0.28	5.0	4.5 to 5.5
	7 to 18	18 to 35	1.45 to 1.70	4.23 to 14.11	0.12 to 0.17	0.0 to 2.9	0.28		4.5 to 5.5
	18 to 72	18 to 35	1.45 to 1.70	1.41 to 4.23	0.11 to 0.17	0.0 to 2.9	0.28		4.5 to 5.5
Ruston	0 to 5	2 to 20	1.30 to 1.70	4.23 to 14.11	0.09 to 0.16	0.0 to 2.9	0.28	5	4.5 to 6.5
	5 to 16	18 to 35	1.40 to 1.70	4.23 to 14.11	0.12 to 0.17	0.0 to 2.9	0.28		4.5 to 6.0
	16 to 37	10 to 20	1.30 to 1.70	4.23 to 14.11	0.12 to 0.15	0.0 to 2.9	0.32		4.5 to 6.0
	37 to 85	15 to 38	1.40 to 1.70	4.23 to 14.11	0.12 to 0.17	0.0 to 2.9	0.28		4.5 to 6.0
Savannah	0 to 11	3 to 16	1.50 to 1.60	4.23 to 14.11	0.13 to 0.16	0.0 to 2.9	0.24	3	3.6 to 5.5
	11 to 28	18 to 32	1.45 to 1.65	4.23 to 14.11	0.11 to 0.17	0.0 to 2.9	0.28		3.6 to 5.5
	28 to 60	18 to 32	1.60 to 1.80	1.41 to 4.23	0.05 to 0.10	0.0 to 2.9	0.24		3.6 to 5.5
Smithdale	0 to 6	2 to 15	1.40 to 1.50	14.11 to 42.34	0.14 to 0.16	0.0 to 2.9	0.28	5	4.5 to 5.5
	6 to 36	18 to 33	1.40 to 1.55	4.23 to 14.11	0.15 to 0.17	0.0 to 2.9	0.24		4.5 to 5.5
	36 to 80	12 to 27	1.40 to 1.55	14.11 to 42.34	0.14 to 0.16	0.0 to 2.9	0.28		4.5 to 5.5
Stough	0 to 21	7 to 15	1.45 to 1.55	4.23 to 14.11	0.12 to 0.18	0.0 to 2.9	0.37	3	4.5 to 5.5
	21 to 29	8 to 18	1.45 to 1.50	1.41 to 4.23	0.07 to 0.11	0.0 to 2.9	0.37		4.5 to 5.5
	29 to 65	5 to 27	1.55 to 1.65	1.41 to 4.23	0.07 to 0.11	0.0 to 2.9	0.37		4.5 to 5.5
Sweatman	0 to 5	5 to 20	1.40 to 1.60	4.23 to 14.11	0.20 to 0.22	0.0 to 2.9	0.37	3	4.5 to 5.5
	5 to 30	35 to 55	1.40 to 1.50	1.41 to 4.23	0.16 to 0.20	3.0 to 5.9	0.28		4.5 to 5.5
	30 to 38	25 to 55	1.40 to 1.55	1.41 to 4.23	0.16 to 0.20	3.0 to 5.9	0.32		4.5 to 5.5
	38 to 60	5 to 15	1.40 to 1.55	1.41 to 4.23	0.10 to 0.18	3.0 to 5.9	0.28		4.5 to 5.5

Note: g/cm^3 = gram per cubic centimeter. Kf = soil erodibility of the fine-earth fraction (material less than 2 millimeters in size)
μm/minute = micrometer per minute. T = soil loss tolerance.

Source: USDA, 2009b.

(tons/acre/year) that can occur over a sustained period without affecting crop productivity (Wischmeier and Smith, 1978). T value estimates for soils of the project area range from 3 to 5 tons/acre/year (Table 3.5-2).

3.5.2.2 Soil Capability and Productivity

NRCS uses a land capability classification to rate soils for determining, in a general way, how suitable they are for most kinds of farming (USDA, 1961). This system groups soils according to potentials and limitations for long-term production of cultivated crops, pasture, range, or forest, without soil deterioration through erosion. There are three levels of soil groupings: capability class, subclass, and unit. The capability classes are designated by Roman numerals I through VIII. The risk of soil damage or limitation for use becomes progressively greater from Class I through VIII. In general, soils in Classes I through III are suitable for row crops, soils in Class IV are suitable for sown crops and possibly some row crops, and soils in Classes V through VIII are limited largely to pasture, woodland, wildlife, and other similar uses.

The capability subclasses indicate major kinds of limitations within the classes. Soils where the main limitation is risk of erosion are designated with the letter *e*. When the primary risk is excess water in the soil or on the surface, a *w* designation is shown. The letter *s* indicates that the soil is limited mainly because it is droughty, shallow, or stony.

As shown in Table 3.5-3, the soils with the highest production potential for corn, cotton, bahiagrass, common bermudagrass, and improved bermudagrass in the project area are Class IIw bottomland soils and Classes IIe, IIw, and IIIe upland soils. These include the soil series Annemaine, Jena, Mantachie, Mooreville, Ora, Prentiss, Quitman, Ruston, Savannah, and Stough. Within the project area, however, these soils have no recent history of extensive use for cultivated crops. Excess soil wetness and/or frequent flooding hinder agricultural use of most of the bottomland soils, such as the Class Vw Daleville, Kirkville, Mantachie, and Mooreville soils and the Class VIw Kinston soils. Soils of the uplands range from Class II to VII, but are mainly Classes IV and VI. The more severe limitations are due to steepness of slope, which increases the susceptibility of these soils to erosion if they are not maintained in a permanent cover. Almost all of the soils on steep slopes in the project are in forestry use.

Table 3.5-3. Land Capability and Crop and Pasture Productivity of Project Area Soils

Soil Series	Map Symbol(s)	Land Capability Class(es)*	Corn (bu/ac)	Cotton Lint (lb/ac)	Bahiagrass (AUM/ac)	Common Bermudagrass (AUM/ac)	Improved Bermudagrass (AUM/ac)
Annemaine	Aa	IIw	100	800	10.0	—	—
Daleville	Da, DJ	Vw	—	—	7.0	—	6.0
Jena	Je	IIw	85	700	—	7.0	12.0
Kirkville	Ka, Kb, Kr, Kv	Vw	—	—	7.5	6.0	—
Kinston	Kn	VIw	—	—	—	—	—
Mantachie	Ma, Mc	IIw, Vw	90	650	10.0	—	—
Mooreville	Mo, MV	IIw, Vw	90	750	10.5	—	12.0
Ora	OrB, OrB2, OrC, OrC2	IIe, IIIe,	80	700	9.0	—	8.5
Prentiss	PnA, PnB, PtA	IIw, IIe	85	750	9.0	—	9.0
Quitman	QaA	IIw	80	650	10.0	—	10.0
Ruston	RnB, RuB, RnC2, RuC	IIIe	65	600	9.5	5.5	12.0
Savannah	SaA, SaB, SaC	IIw, IIe, IIIe	80	700	9.0	—	8.5
Smithdale	SeD2, SeE2	IVe, VIe	55	400	8.0	5.0	9.0
Stough	StA	IIw	80	725	8.0	—	8.0
Sweatman	SmB2, SwB2, SmC2, SwC2, SmD2, SwD2, SwF2, SW, SX, SY	IIIe, IVe, VIe, VIIe	50	400	6.5	4.5	—

Note: bu/ac = bushel per acre.
lb/ac = pound per acre.
AUM/ac = animal unit month† per acre.

* e = primary risk is erosion.
w = primary risk is excess water.
s = primary risk is droughty, shallow, or stony.
†The amount of forage or feed required to feed an animal unit for a period of 30 days.

Source: USDA, 2009b. (Yields are those that can be expected under a high level of management. Absence of yield data indicates the soil is not suited for the crop.)

With approximately 78 percent of the project area in forestry use categories, a summary of the forest suitability and potential productivity (site index) of the native soils in the project area is given in Table 3.5-4. The potential suitability and productivity of the various soils for forest production are determined by two important ratings given in this table: suitability group (ordination symbol) and site index.

As indicated by Table 3.5-4, the soils that have the highest general suitability and site indices for production of both needleleaf (pines) and broadleaf (hardwood) forest species are those in the bottomlands. Upland soils are generally droughtier and less fertile and, therefore, have lower potential productivity for most forest types. Some soils, particularly those on bottomlands with fair to good internal drainage, have high potential for producing a variety of hardwood species including several oaks, yellow poplar, cottonwood, and green ash. Many of the upland and terrace soils (e.g., Prentiss, Quitman, Ruston, Smithdale, and Stough) have moderately high potential for producing loblolly pine and sweetgum.

Table 3.5-4. Forest Suitability and Potential Productivity of Project Area Soils

		Management Concerns				Potential Productivity	
Soil Series	Ordination Symbol(s)	Erosion Hazard	Equipment Limitation	Seedling Mortality	Plant Competition	Common Trees	Site Index
Annemaine	8W	Slight	Moderate	Slight	Moderate	American sycamore	90
						Loblolly pine	80
						Shortleaf pine	70
						Slash pine	80
						Sweetgum	80
						Yellow poplar	90
Daleville	10W	Slight	Severe	Severe	Severe	Loblolly pine	95
						Sweetgum	90
						Water oak	85
						Willow oak	80
Jena	11W	Slight	Severe	Moderate	Moderate	Loblolly pine	100
						Sweetgum	90
						Water oak	80
Kirkville	10W	Slight	Moderate	Severe	Moderate	Cherrybark oak	100
						Loblolly pine	95
						Sweetgum	100
						Water oak	100
Kinston	9W	Slight	Severe	Severe	Severe	Sweetgum	95
						Loblolly pine	100
						White oak	90
						Eastern cottonwood	100
						Cherrybark oak	95
Mantachie	10W	Slight	Severe	Severe	Severe	Cherrybark oak	100
						Eastern cottonwood	90
						Green ash	80
						Loblolly pine	98
						Sweetgum	95
						Yellow poplar	95
Mooreville	10W, 10A	Slight	Moderate	Severe	Moderate	Cherrybark oak	100
						Eastern cottonwood	105
						Green ash	80
						Loblolly pine	95
						Sweetgum	100
						Yellow poplar	100
Ora	8W	Slight	Slight	Slight	Moderate	Loblolly pine	83
						Shortleaf pine	69
						Sweetgum	80
Prentiss	9W	Slight	Slight	Slight	Moderate	Cherrybark oak	90
						Loblolly pine	88
						Shortleaf pine	79
						Sweetgum	90
						White oak	80
Quitman	10W	Slight	Moderate	Slight	Moderate	Loblolly pine	92
						Slash pine	90
						Sweetgum	93
Ruston	8A	Slight	Slight	Slight	Slight	Loblolly pine	91
						Longleaf pine	76
						Slash pine	91
Savannah	8W	Slight	Moderate	Slight	Moderate	Loblolly pine	81
						Shortleaf pine	76
						Southern red oak	75
Smithdale	8A, 8R	Moderate	Moderate	Slight	Slight	Loblolly pine	80
						Shortleaf pine	69

Table 3.5-4. Forest Suitability and Potential Productivity of Project Area Soils (Continued, Page 2 of 2)

		Management Concerns				Potential Productivity	
Soil Series	Ordination Symbol(s)	Erosion Hazard	Equipment Limitation	Seedling Mortality	Plant Competition	Common Trees	Site Index
Stough	9W	Slight	Moderate	Slight	Severe	Cherrybark oak	85
						Loblolly pine	90
						Slash pine	86
						Sweetgum	85
						Water oak	80
Sweatman	8C, 8R	Moderate	Moderate	Slight	Slight	Loblolly pine	83

Sources: USDA, 2009b.
USDA, 1999.
USDA, 1983.

3.5.2.3 Prime Farmland Soils

Prime farmland soils, as defined by NRCS, are soils that are best suited for food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the sustained economic production of high crop yields. Prime farmland soils may presently be in use as cropland, pastureland, rangeland, forestland, or other uses but cannot be urban or built-up land. The conversion of farmland and prime farmland soils to industrial and other nonagricultural uses effectively precludes farming the land in the foreseeable future. Recognizing the serious potential impacts on food and fiber production from such long-term land use trends, the Federal Farmland Protection Policy Act (FFPPA) was signed into law in 1981 (7 CFR 567), with subsequent amendments in 1984 and 1994 (7 CFR 658).

Within the project area, NRCS prime farmland soils are on nearly level to gently sloping (usually less than 5 percent) slopes. Other arable soils (usually on slopes of 5 to 12 percent) are not considered significant for production of agricultural crops within the project area. The 14 soil map units classified as prime farmland soils make up approximately 15 percent of the project area, with five map units (Savannah fine sandy loam, 2- to 5-percent slopes; Kirkville fine sandy loam, occasionally flooded; Sweatman fine sandy loam, 2- to 5-percent slopes, eroded; Prentiss loam, 0- to 2-percent slopes; and Quitman silt loam, 0- to 2-percent slopes) comprising approximately 89 percent of the total prime farmland soil acreage. Project area prime farmland soils are currently used primarily for pasture, hay, and tree production, with only minimal use (both current and historic) of these soils for production of cultivated crops.

3.6 SURFACE WATER RESOURCES

3.6.1 REGIONAL HYDROLOGIC SETTING

The proposed power plant site and mine study area are wholly within Kemper and Lauderdale Counties. Neshoba and Newton Counties lie to the west, while the Alabama state line forms the eastern border of Lauderdale and Kemper Counties. Lauderdale and Neshoba Counties are located completely within the Red Hills (also known as North Central Hills) physiographic region. Most of Kemper and Newton Counties are also located in the Red Hills physiographic region. The extreme northeast corner of Kemper County is located in the Flatwoods physiographic region, while the extreme southwest corner of Newton County is located in the Jackson Prairies physiographic region. Proposed electric transmission and CO_2 pipeline corridors extend south of Lauderdale County into Clarke and Jasper Counties.

The Red Hills physiographic region is characterized by rolling hills deeply dissected by streams, a characteristic that is evident throughout the mine study area and power plant sites (Telis, 1992). The region is underlain by unconsolidated sand and clay of the Wilcox and Claiborne Groups.

Surface watersheds and sub-basins in the project area are shown in Figure 3.6-1. The following subsections describe each of the project area basins and present summaries of flow rates.

3.6.1.1 Pascagoula River Basin

The proposed power plant site and mine study area are located in the Chunky River-Okatibbee Creek hydrologic unit (HUC 03170001). The Chunky River and Okatibbee Creek are headwater tributaries of the Pascagoula River Basin, which drains to the Gulf of Mexico. The main streams on the power plant site and mine study area, Okatibbee and Chickasawhay Creeks, generally drain from north to south. The confluence of these streams occurs within the mine study area immediately upstream of Okatibbee Lake. The Chunky River and Okatibbee Creek subsequently join downstream of Meridian to form the Chickasawhay River near Enterprise in northern Clarke County, forming the upper Chickasawhay River sub-basin. The Chickasawhay and Leaf Rivers join to form the Pascagoula River near Merrill.

The lower portions of the transmission line rights-of-way and the CO_2 pipeline right-of-way all cross the Chunky-Okatibbee, Upper Chickasawhay, and Lower Leaf River sub-basins. The CO_2 pipeline corridor terminus near Heidelberg is in the Lower Leaf River watershed (HUC 03170004).

Okatibbee Lake

Okatibbee Lake, located in Lauderdale County immediately south of the proposed lignite mine, is the largest surface impoundment in the Pascagoula River basin. Built by USACE in 1962, a 1.23-mile-long earthen dam extending 61 ft above the streambed is capable of impounding up to 142,350 ac-ft of water. Annually between May 15 and October 15, the reservoir pool is maintained at 344 ft-NGVD. At this elevation, the reservoir surface area totals 4,100 acres, stores 38,300 ac-ft of water, reaches 9 miles upstream, and has approximately 30 miles of shoreline. During the remainder of the year, the reservoir pool is maintained at 339 ft-NGVD, which reduces the pool area to 2,720 acres and the water stored to 21,400 ac-ft.

Developed as a flood control reservoir, the hydrologic characteristics of the contributing watershed are shown on Tables 3.6-1 through 3.6-3. The 98,500-acre reservoir watershed represents 64 percent of the land upstream of Meridian and 36 percent of the Pascagoula River basin. The summer pool elevation provides 42,590 ac-ft of flood storage capacity, which equates to 5 inches of runoff; the winter pool elevation provides 59,490 ac-ft of storage, which equates to 7 inches of runoff; and the maximum flood storage capacity of 142,350 ac-ft, which equates to the volume generated by a 16.5-inch storm event across the entire contributing watershed, is achieved by allowing the pool to rise to the overflow spillway elevation of 359 ft-NGVD. At this elevation, the flood pool extends into Kemper County. Downstream channel constraints are such that flows in excess of 1,200 cubic feet per second (cfs) exceed bankfull capacity; USACE reservoir operations procedures are designed around this limitation. Projected floods near bankfull stages can be reduced by approximately 3.5 ft in the reach downstream to Meridian by using USACE reservoir operations procedures.

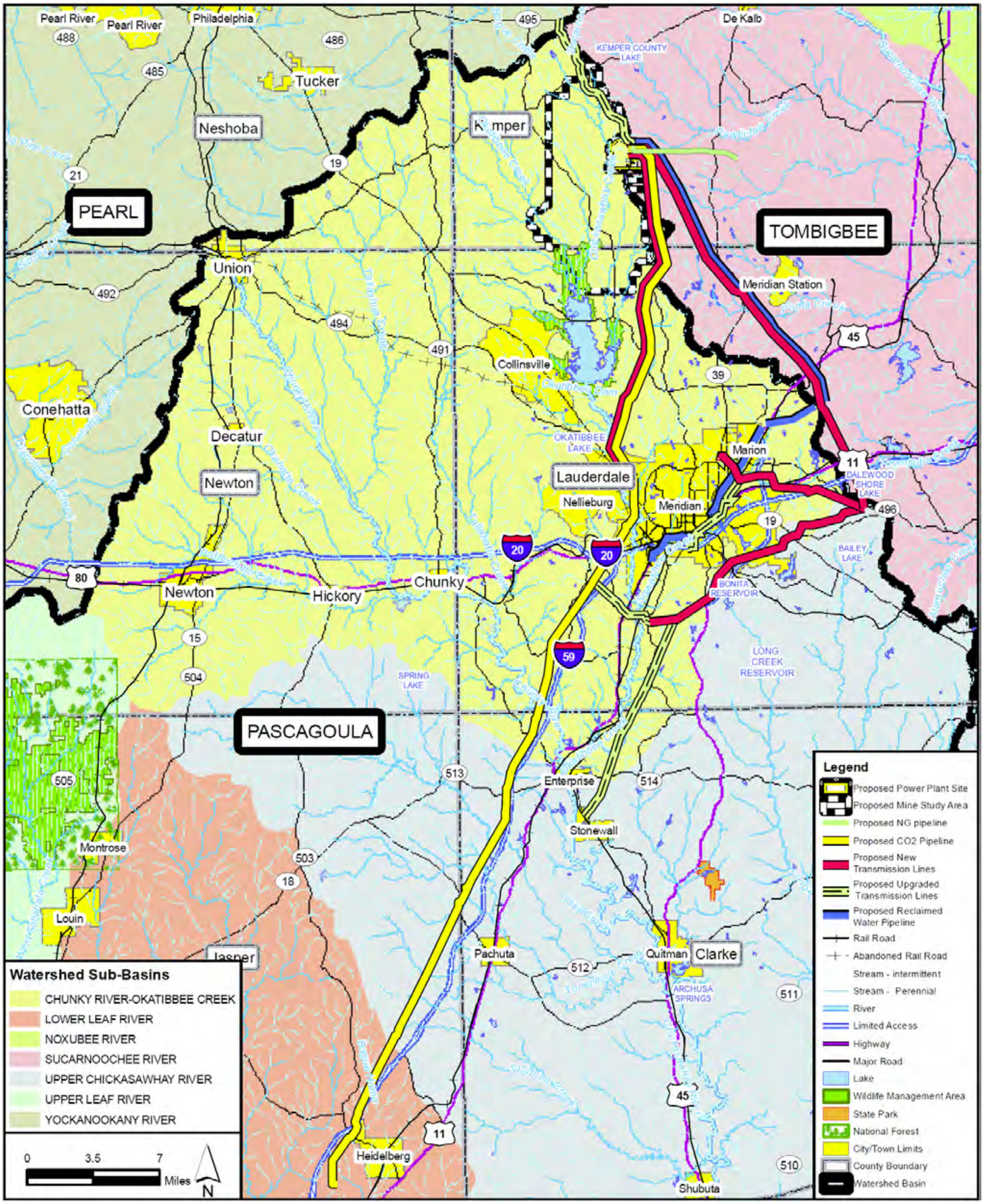


Figure 3.6-1. Watershed Basins and Sub-Basins in the Project Area
Sources: MARIS, 2008. ECT, 2008.

Table 3.6-1. Precipitation and Runoff 1961 to 1990 Okatibbee Creek Basin

	Normal Precipitation		Average Runoff		
Month	Inches	Percent of Normal Annual	Inches	Percent of Average Annual	Percent of Normal Precipitation
January	5.29	9.3	2.12	12.5	40
February	5.32	9.3	3.14	18.5	59
March	6.55	11.5	3.41	20.1	52
April	5.5	9.6	2.64	15.5	48
May	4.53	7.9	1.54	9.1	34
June	3.74	6.6	.52	3.0	14
July	5.56	9.7	.67	3.9	12
August	3.65	6.4	.37	2.2	10
September	3.46	6.1	.21	1.2	6
October	3.05	5.3	.18	1.1	6
November	4.4	7.7	.7	4.1	16
December	5.99	10.5	1.5	8.8	25
Annual	57.04	100	17	100	30

Source: USACE, 1997.

Table 3.6-2. Rainfall-Runoff Relationship for Okatibbee Creek*

Antecedent Conditions	Average Basin Rainfall (Inches) (Storm Total)	Average Runoff (Inches) 0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Wet	0	0.00	0.02	0.04	0.05	0.07	0.09	0.11	0.13	0.16	0.18
	1	0.20	0.23	0.25	0.28	0.31	0.35	0.38	0.43	0.47	0.52
	2	0.56	0.61	0.67	0.72	0.78	0.84	0.89	0.95	1.00	1.06
	3	1.12	1.17	1.24	1.29	1.35	1.40	1.47	1.53	1.59	1.65
	4	1.71	1.77	1.83	1.90	1.96	2.02	2.08	2.14	2.21	2.27
	5	2.34	2.40	2.47	2.54	2.60	2.67	2.74	2.80	2.87	2.94
	6	3.00									
Normal	0	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.10
	1	0.11	0.12	0.14	0.15	0.16	0.18	0.19	0.20	0.22	0.23
	2	0.25	0.26	0.27	0.29	0.30	0.32	0.33	0.35	0.36	0.38
	3	0.39	0.41	0.42	0.44	0.46	0.47	0.49	0.50	0.52	0.54
	4	0.55	0.57	0.59	0.60	0.62	0.64	0.65	0.67	0.69	0.70
	5	0.72	0.74	0.75	0.77	0.79	0.80	0.82	0.84	0.86	0.87
	6	0.89									
Dry	0	0.00	0.00	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.06
	1	0.06	0.07	0.08	0.09	0.09	0.10	0.11	0.12	0.13	0.14
	2	0.15	0.16	0.17	0.18	0.18	0.19	0.20	0.21	0.22	0.24
	3	0.25	0.26	0.28	0.29	0.30	0.32	0.34	0.35	0.37	0.38
	4	0.40	0.42	0.43	0.45	0.47	0.48	0.50	0.52	0.54	0.56
	5	0.58	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.74	0.77
	6	0.79									

*Based on the rainfall-runoff relationship of nearby reservoirs, which are considered representative of the Okatibbee area.

Source: USACE, 1997.

Table 3.6-3. Unit Hydrograph of Reservoir Inflow

Time (Hours)	Unit Hydrograph
0	0
6	900
12	1,300
18	2,550
24	2,580
30	3,420
36	2,390
42	1,250
48	860
54	580
60	390
66	230
72	90
78	20
84	0

Source: USACE, 1997.

Originally designed to supply Meridian with 13,100 ac-ft of water supply capacity, Okatibbee Lake has not been used for this purpose. Subsequently, Mississippi's Pat Harrison Waterway District (PHWD) purchased the water storage rights on Okatibbee Lake (Huntley, 2008). The agency provides recreational facilities and is responsible for managing rivers and tributaries in the Pascagoula River basin. PHWD accomplishes its mission through flood control, water management, and recreation. USACE also incorporates in its reservoir operations procedures for low-flow augmentation to offset the effects of drought. During average and above-average rainfall conditions, the reservoir can supply up to 25 MGD of water.

Recreational facilities on the lake and surrounding leased lands support swimming, camping, fishing, boating, hiking, and hunting. Recreational amenities include boat ramps, a marina, beaches, campgrounds, picnic areas, playgrounds, and hiking trails. MDEQ has classified Okatibbee Lake for recreation and water supply (MDEQ, 2007c). PHWD operates the Okatibbee Water Park, a recreational facility offering camping, fishing, swimming, picnicking, hiking, and boating.

MDEQ assessed Okatibbee Lake in its 2008 305(b) report (MDEQ, 2008b) for aquatic life use support. MDEQ reports that Okatibbee Lake was supporting the aquatic life use. MDEQ also reported secchi depth (0.62 meter), chlorophyll a (8.6), and total phosphorous (0.04 ppb) values. These parameters are commonly used in assessing lake productivity. According to MDEQ, Okatibbee Lake classifies as a eutrophic lake based on these parameters (*ibid.*).

Okatibbee WMA

The 6,883-acre Okatibbee WMA surrounds the lake to the north along Okatibbee and Chickasawhay Creeks, to the west and east along smaller tributaries, and to the south. The proposed lignite mine directly abuts the WMA north boundary.

The WMA was created by the Water Resources Development Act (WRDA) of 1986, Public Law 99-662, which enabled Okatibbee Lake to become a key component of the Tennessee-Tombigbee Waterway Wildlife Mitigation Project. The Okatibbee Wildlife Operational Management Plan was completed and approved in 1991, and wildlife management activities were implemented in fiscal year 1992. The project's plan was developed for approximately 1,352 acres, which includes three areas out-granted to the PHWD and the Meridian Naval Air Station (NAS) for public recreation.

The majority of the project's mitigation lands are being managed for a variety of nonconsumptive uses and are designated "no hunting" areas that allow for the conservation and enhancement of wildlife. The only area the project manages for consumptive use and opens to seasonal hunting is in the emergency spillway area consisting of approximately 50 acres of land developed for use by migratory birds.

Along with the project's resource management activities that evolved from the WRDA – Tennessee-Tombigbee Mitigation Program, the state of Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) is also responsible for an additional 6,900 acres of mitigated lands. The license agreement, signed in 1992, provides for total funding by Congress to enhance the project's wildlife areas. At present a 5-year plan of operation has been submitted. The primary goal of the plan is to develop and manage mitigation lands for diversity with maximum edge effect by establishing permanent openings on both pine and hardwood stands.

Sowashee Creek

The proposed power plant would use treated wastewater from the Meridian municipal treatment system as a source of makeup water. There are two wastewater treatment plants (WWTPs) that discharge to Sowashee Creek, a tributary of Okatibbee Creek. Sowashee Creek originates north of Meridian, Mississippi, flows south along the east side of Meridian, and then flows west-southwest along the south side of Meridian before joining Okatibbee Creek just south of Meridian. The total drainage area of Sowashee Creek is 86.36 square miles (mi^2) (MARIS, 2009b). The watershed contains 31.2 miles of perennial streams and 96.7 miles of intermittent/ephemeral streams. Sowashee Creek has been heavily impacted by wastewater discharges, nonpoint pollution, and urban runoff. It is part of the fecal coliform total maximum daily load (TMDL) for Okatibbee Creek (MDEQ, 1999) and has been listed on the state 303(d) list of impaired water bodies for failing to meet the aquatic life support designated use (i.e., biological impairment). Rapid bioassessments (RBAs) of Sowashee Creek in 2006 and 2008 resulted in scores of 36.7 and 42.9, below the reference minimum of 48.6 (MDEQ, 2009b).

3.6.1.2 Tombigbee River Basin

The CO_2 and transmission line corridors all traverse portions of the Sucarnoochee River subwatershed (HUC 03160202) as well, including the far western portions of the Pawticfaw Creek, Ponta Creek, and Loomsuba Creek drainage basins. Most of the streams that are encountered along the transmission line corridors in the Sucarnoochee River are intermittent headwater streams draining hilly topography. All of these streams are in the Tombigbee River Basin, which flows southerly through Alabama toward the Gulf of Mexico.

3.6.1.3 Flow Rates

Base flow yield in the southern part of the Red Hills is typically lower than 0.1 cubic foot per second per square mile (cfs/mi^2) due to the presence of clay of the Tallahatta Formation at the surface. USGS estimated 7-day, consecutive low-flow with a 10-year return frequency (7Q10) flows at regional area gauging stations are listed in Table 3.6-4 with drainage areas and yields (Telis, 1992).

Table 3.6-4. USGS 7Q10 Flowrates

USGS Gauging Station	Location	Drainage Area (mi^2)	7Q10 Flow (cfs)	Base Flow Yield (cfs/mi^2)
02475500	Chunky River near Chunky, Lauderdale County (Pascagoula Basin)	369	5.2	0.01
02476500	Sowashee Creek at Meridian, Lauderdale County (Pascagoula Basin)	52.1	0.5	0.01
02476530	Sowashee Creek at Meridian (Pascagoula Basin)	75.6	2.1	0.03
02476000	Okatibbee Creek at Meridian, Lauderdale County (Pascagoula Basin)	235	1.7	0.01
02476600	Okatibbee Creek at Arundel, Lauderdale County (Pascagoula Basin)	342	12	0.04
02477000	Chickasawhay River at Enterprise, Clarke County (Pascagoula Basin)	918	29	0.03
02467244	Pawticfaw Creek near Cullum, Kemper County (Tombigbee Basin)	38.9	4.7	0.12
02467300	Pawticfaw Creek near Porterville, Kemper County (Tombigbee Basin)	98.1	22	0.22

Source: Telis, 1992.

USGS has also published flood probabilities at four of the regional gauging stations based on the Pearson Type III probability distribution. USGS flood probability quantiles are listed in Table 3.6-5 (Landers and Wilson, 1991).

Table 3.6-5. USGS Flood Probabilities for Area Streams

USGS Gauging Station	Location	Flood Frequency Probabilities (cfs) 2-year (50%)	10-year (10%)	50-year (2%)	100-year (1%)
02475500	Chunky River near Chunky, Lauderdale County	8,570	22,900	40,000	47,500
02476500	Sowashee Creek at Meridian, Lauderdale County	2,750	6,820	11,500	16,000
02476600	Okatibbee Creek at Arundel, Lauderdale County	5,430	12,600	22,000	32,900
02477000	Chickasawhay River at Enterprise, Clarke County	15,500	37,700	66,600	91,500

Source: Landers & Wilson, 1991.

USGS-published mean flows and flow durations are listed in Table 3.6-6 (Telis, 1991). Yield based on the mean annual flow ranges from 1.23 to 1.49 cfs/mi^2. Mean annual flows are 11 to 47 times greater than the 95th-percentile flow durations, which is indicative of flashy hydrology due to rapid runoff and low base flows. Average annual rainfall for the region is 58.65 inches with an average annual runoff of approximately 20 inches per year (rainfall varies from average minimum of 3.28 inches during the drier months to a maximum of 16.47 inches during the wet months [NOAA, 2008b]).

Table 3.6-6. Flow Rates and Duration Estimates for Selected Stations in the Pascagoula Basin

USGS Gauging Station	Drainage Area (mi^2)	Mean Flow (cfs)	Yield (cfs/mi^2)	Flow Duration Percentile (cfs)						
				5%	10%	25%	50%	75%	90%	95%
02475500	369	491	1.33	2,170	1,60	450	155	52	24	16
02476600	342	508	1.49	1,730	1,400	670	199	100	62	48
02477000	918	1,238	1.35	5,070	3,160	1,310	456	169	89	63
02476500	52.1	65.5	1.26	246	130	54	18	5.1	2.2	1.4
02476000	235	288	1.23	1,320	768	275	83	24	9.4	5.0

*See Table 3.6-1 for locations of gauging stations.

Source: Telis, 1991.

3.6.2 POWER PLANT SITE AND MINE STUDY AREA SURFACE WATERS

Most of the area encompassing the proposed power plant site and mine study area is drained by Chickasawhay Creek and its tributaries, which flow generally north to south through the center of the mine study area (see Figure 3.6-2). Penders Creek, which joins Chickasawhay Creek, drains a west-central portion of the mine study area. The southwest portion of the mine study area is drained by Okatibbee Creek. The two creeks join to the south in Section 7 of Township 8 north, Range 14 east, in Lauderdale County. Tompeat and Bales Creeks drain the southeast corner of the site. These streams are all within the Pascagoula River Basin.

The headwaters of Pawticfaw Creek, located northeast of the power plant site, originate along the northern and eastern mine study area boundaries, flowing east to southeast. This stream is part of the Tombigbee River Basin.

As shown in the following tabular summary, there are 41.72 miles of perennial streams on the proposed mine study area. There are no perennial streams of the Pawticfaw Creek watershed within the mine study area boundary or power plant site. There are an additional 19.01 miles of intermittent streams on the mine study area, of which 0.73 mile is in the Pawticfaw Creek watershed. The remaining are in the Okatibbee, Chickasawhay, Tompeat, and Bales Creek watersheds. One mile of a perennial reach of Chickasawhay Creek is located within the power plant site; most of that length runs along the western boundary of the site. The power plant site also contains 1.2 miles of intermittent streams, of which 0.16 mile is in the Pawticfaw Creek watershed:

Watershed	Mine Study Area (miles)		Power Plant Site* (miles)	
	Perennial	Intermittent	Perennial	Intermittent
Chickasawhay Creek	24.62	16.03	0.99	1.05
Okatibbee Creek	6.88	0.00	0.00	0.00
Tompeat Creek	4.88	1.43	0.00	0.00
Bales Creek	5.34	0.82	0.00	0.00
Pawticfaw Creek	0.00	0.73	0.00	0.16
Total	41.72	19.01	0.99	1.21

*Included in mine study area totals.

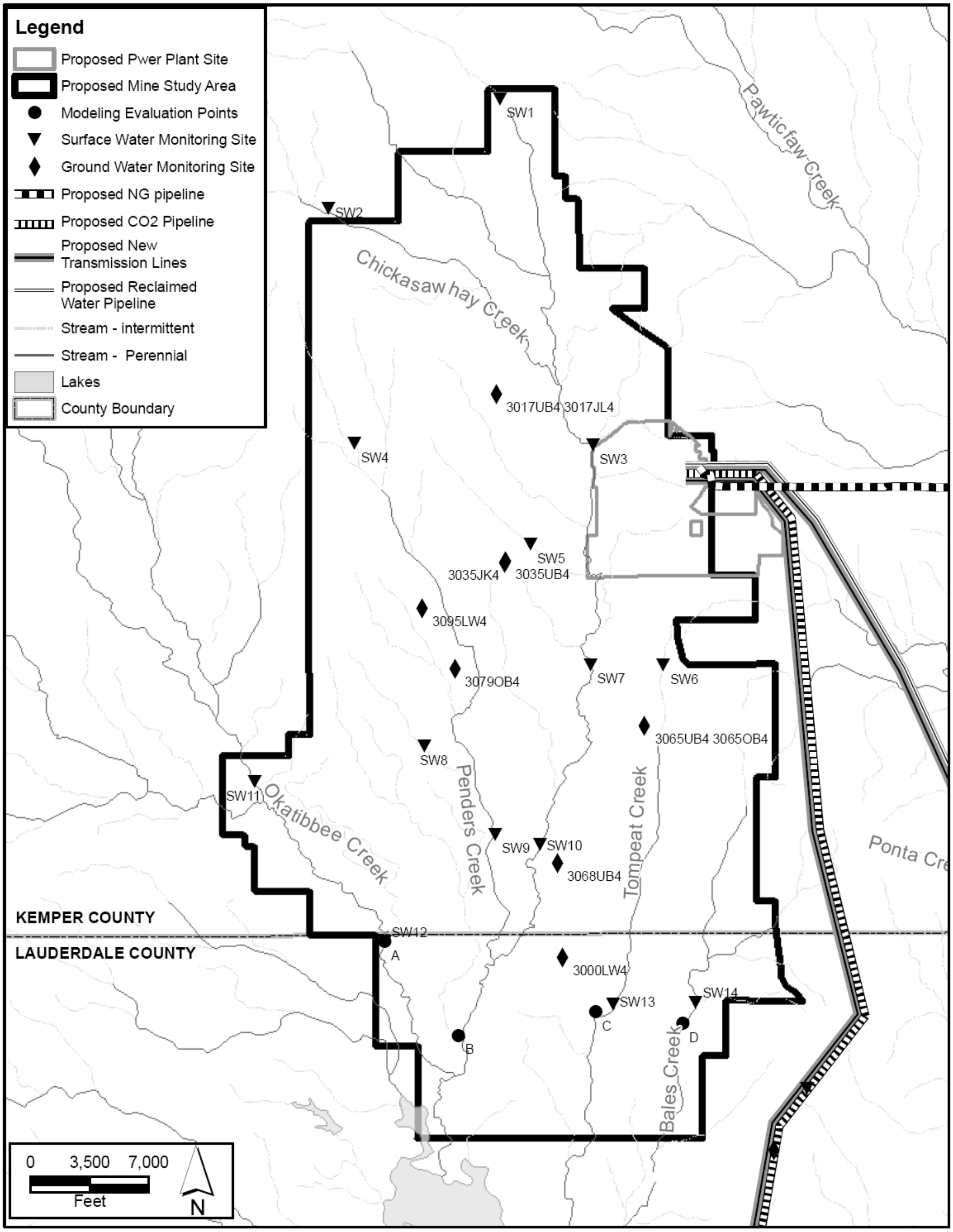


Figure 3.6-2. Surface Waters in the Vicinity of the Proposed Power Plant and Mine Study Area

Sources: MARIS, 2008. NACC, 2008. ECT, 2008.

Under a contract with NACC, Mississippi State University began measuring streamflows in creeks on the mine study area at the 14 locations shown in Figure 3.6-2 beginning in May 2008; monitoring is planned to continue indefinitely to support NACC's planned MDEQ Surface Mine Permit application. Monitoring devices consist of stage gauges at 12 locations and continuous stage-level recorders at stations SW-10 and SW-12. Velocity and flow measurements are conducted at each station on a biquarterly basis. Stage/flow regression curves have been developed.

Table 3.6-7 presents a summary of the flow measurement data collected to date. Although the period of record is less than 1 year, flows in the two largest onsite creeks, Okatibbee at stations 11 and 12 and Chickasawhay at stations 3 and 10, exhibit a distinct contrast. Despite a drainage area half the size, flows in Chickasawhay Creek were roughly equivalent on an average basis and 1.4 times greater during peak conditions than flows in Okatibbee Creek. Also, the Chickasawhay Creek average discharge per unit area was more than double the value for Okatibbee Creek. The reduced peak flow and average discharge per unit area values in Okatibbee Creek, if validated by continued monitoring, appear to be attributable to more riparian wetland floodplain forests along Okatibbee Creek, which provide flood attenuation capacity and increase evapotranspiration consumption. The latter are typical results. Larger watershed produce smaller flow rates per square mile due to larger in-channel storage volumes, longer times of concentration, and larger overbank flood storage capacity, some of it in the form of riparian wetlands. All of these factors result in greater evaporation and evapotranstiration.

Table 3.6-7. Summary of Flow Measurement Data

Station ID	Minimum Flow Measurement (cfs)	Maximum Flow Measurement (cfs)	Average of Flow Measurements (cfs)	Drainage Area (mi^2)	Average Discharge per Unit Area (cfs/mi^2)
SW-1	0.98	43.88	9.66	1.98	4.88
SW-2	0.21	35.55	5.04	2.30	2.19
SW-3	1.49	160.59	33.82	16.60	2.04
SW-4	0.08	6.72	2.03	0.89	2.28
SW-5	0.00	16.49	3.44	0.72	4.78
SW-6	0.00	2.38	0.57	0.19	3.00
SW-7	1.41	2.56*	1.99	22.98	0.09
SW-8	0.04	4.26	1.09	0.58	1.88
SW-9	0.00	102.31	25.79	8.35	3.09
SW-10	0.80	532.38	132.28	25.96	5.10
SW-11	0.46	210.37	62.52	52.89	1.18
SW-12	5.08	376.95	137.50	56.11	2.45
SW-13	0.00	169.78	34.25	3.85	8.90
SW-14	0.90	212.85	72.09	6.00	12.02

*No high flow event measured.

Source: NACC, 2009.

Tetra Tech, a consultant to NACC, developed a watershed model of Okatibbee, Chikasawhay, Penders, Tompeat, and Bales Creeks. To validate the model, Tetra Tech compared premining modeling results to regressions performed by the USGS (USGS Water Resources Investigation Report [WRIR] 91-4307). Modeling efforts served to estimate peak flows and the total runoff volumes generated by 24-hour rainfall events ranging from return periods of 2 years (4.4 inches) to 100 years (8.9 inches). Modeling results reported correspond to the location of the 14 surface water monitoring stations and computational points A through D located downstream of the mine study area, as shown on Figure 3.6-2.

Table 3.6-8 presents the premining watershed modeling results. These confirm that the much larger water Okatibbee Creek, having greater channel storage and longer concentration times, will have a lesser flow rate per

Table 3.6-8. Storm Event Peak Flows and Runoff Volume Modeling Results for Project Area Watersheds—Premining

	Storm Event	1	2	3	4	5
	Return Period (years)	2	10	25	50	100
	Duration (hours)	24	24	24	24	24
	Rainfall Depth (inches)	4.4	6.5	7.3	8.1	8.9
Station Number	Drainage Area (mi²)					
		Storm Event Peak Flows (cfs)				
A	56.11	4,819	9,728	11,717	13,758	15,840
B	39.53	4,755	10,020	12,146	14,328	16,503
C	3.85	688	1,401	1,687	1,980	2,278
D	6.00	1,018	2,086	2,517	2,959	3,408
SW-1	1.98	539	1,120	1,353	1,592	1,836
SW-2	2.30	708	1,461	1,763	2,071	2,385
SW-3	16.61	2,130	4,251	5,103	5,974	6,835
SW-4	0.91	316	654	789	927	1,067
SW-5	0.72	236	490	592	696	801
SW-6	0.19	72	149	180	211	243
SW-7	22.98	3,032	6,131	7,379	8,652	9,917
SW-8	0.58	239	494	596	701	807
SW-9	8.35	967	1,954	2,347	2,747	3,150
SW-10	25.96	3,366	6,958	8,417	9,911	11,387
SW-11	52.89	4,624	9,329	11,235	13,191	15,183
SW-12	56.11	4,819	9,728	11,717	13,758	15,840
SW-13	3.49	688	937	1,133	1,334	1,541
SW-14	5.65	1,018	1,664	2,016	2,377	2,746
		Storm Event Runoff Volume (ac-ft)				
A	56.11	5,119	10,136	12,163	14,242	16,362
B	39.53	3,554	7,059	8,477	9,933	11,420
C	3.85	353	695	834	976	1,121
D	6.00	544	1,076	1,292	1,513	1,739
SW-1	1.98	175	349	420	493	567
SW-2	2.30	206	410	492	577	663
SW-3	16.61	1,484	2,951	3,545	4,156	4,781
SW-4	0.91	81	161	194	227	262
SW-5	0.72	64	127	153	179	206
SW-6	0.19	17	34	40	47	54
SW-7	22.98	2,052	4,083	4,906	5,751	6,615
SW-8	0.58	51	102	123	144	166
SW-9	8.35	746	1,484	1,784	2,091	2,404
SW-10	25.96	2,314	4,609	5,539	6,494	7,469
SW-11	52.89	4,834	9,566	11,478	13,439	15,439
SW-12	56.11	5,119	10,136	12,163	14,242	16,362
SW-13	3.49	353	627	752	880	1,011
SW-14	5.65	544	1,006	1,209	1,416	1,629

Source: NACC, 2009.

square mile as observed in results for computation point "A" and "B." When peak flow estimates are normalized on a per-square-mile basis, Tompeat and Bales Creeks, which are relatively small and have shorter times of concentration, are twice as *flashy* as Okatibbee Creek. Based on these estimations, the Okatibbee Creek floodplain provides the majority of the flood storage capacity present on the mine study area, with Chickasawhay Creek providing the rest. The total runoff volumes estimated in Table 3.6-8 are consistent across the stations when normalized on a per-square-mile basis, which means little depressional storage (e.g., lakes or isolated depressional wetlands) is present on the mine site area or the contributing watersheds.

3.6.3 SURFACE WATERS PROXIMATE TO PROPOSED LINEAR FACILITY CORRIDORS

The proposed power plant would require 89 miles of new and upgraded electric transmission lines to supply power to the electric grid. A new natural gas pipeline, 6 miles in length, would also be required. In addition, CO_2 generated by the plant would be transmitted via a 61-mile pipeline to the vicinity of Heidelberg, Mississippi, for industrial uses. Combined, the new and upgraded electric transmission corridors (portions also including reclaimed water pipeline) would cross 37 perennial streams and 335 intermittent streams in the Chunky River-Okatibbee Creek, Upper Chickasawhay River, and Sucarnoochee River watersheds. The natural gas pipeline would cross ten intermittent streams in the Sucarnoochee River watershed. The CO_2 pipeline to Heidelberg would cross 88 perennial and 53 intermittent streams in the Chunky River-Okatibbee Creek, Upper Chickasawhay River, and Lower Leaf River (near Heidelberg) watersheds (Pascagoula River Basin), and the Sucarnoochee River (Tombigbee River Basin). The CO_2 pipeline would also cross the Chunky River, a state-designated Scenic River (discussed subsequently).

3.6.4 SURFACE WATER QUALITY AND USE

MDEQ's water quality standards specify designated uses for water bodies within the state. All perennial streams in the state of Mississippi are classified for fish and wildlife support (MDEQ, 2007). Other perennial streams in the region carrying other types of designations include the Chunky River from U.S. Highway 80 (U.S. 80) (town of Chunky) to the Chickasawhay River near the town of Enterprise (recreation) and the Chickasawhay River from near Stonewall to MS 84 at Waynesboro (recreation) (MDEQ, 2007). Okatibbee Lake, northwest of Meridian, is classified for public water supply and recreation. For all perennial streams classified with the fish and wildlife support use designation, the dissolved oxygen (DO) standard of 4.0 milligrams per liter (mg/L) is applicable (MDEQ, 2007). Use of water bodies on the proposed power plant site and mine study area currently is limited to artificial ponds that are used primarily for livestock watering. Some of the stock ponds may also have recreational value that is limited to private property ownership.

MDEQ assesses attainment of designated uses on a rotating 5-year water quality assessment cycle within the ten major drainage basins, including the Pascagoula River watershed (MDEQ 2004). MDEQ's biennial Section 305(b) water quality assessment reports identify creeks, streams, and rivers that fail to meet one or more uses during the corresponding monitoring cycles. Table 3.6-9 lists the creeks, streams, and rivers in the vicinity of the project area; the impaired uses; potential or identified sources of impairment; and TMDL year. The TMDL year is the date the TMDL was approved by EPA or is scheduled to be completed. Those water bodies have been listed on prior Section 303(d) lists.

Table 3.6-9. Water Bodies in the Project Vicinity

Water Body Name	Impaired Use	Pollutant	Listing Year	TMDL Year
Chunky River	Fish and wildlife	Biological impairment	2008	2020
Okatibbee Creek	Fish and wildlife	Biological impairment	2002	2020
Sowashee Creek	Fish and wildlife	Biological impairment	2008	2017
Chickasawhay River	Fish and wildlife	Sediment	1996	2005
Okatibbee Creek	Recreation	Fecal coliform	1996	1999

Sources: MDEQ 1999, 2005, 2007, and 2008.

The Chickasawhay River from Enterprise downstream to ta Creek was previously listed on Mississippi's 1996 303(d) list (MDEQ, 2005). MDEQ completed a TMDL for the Chickasawhay River in 2005 for biological impairment due to sediment (MDEQ, 2005). The 303(d) listed reach (MSUCHKRE1) extends from approximately the southern Clark County boundary (Eucutta Creek) upstream to the confluence of Okatibbee Creek and Chunky River (near Enterprise). However, the source assessment applies to the entire watershed draining to the impaired reach, including the mine study area and power plant site (except those portions draining east to the Sucarnoochee River watershed). MDEQ used a regional sediment yield analysis based on land uses, channel stability, and in-stream processes. Based on an approximation of the level of instability in the watershed and regional data, MDEQ estimated the existing sediment yield to be 1.21×10^{-2} to 2.66×10^{-2} tons per acre per day at the effective discharge. The target yield or TMDL was established at 5.38×10^{-3} to 6.54×10^{-3} tons per acre per day. All of the TMDL was allocated to the load allocation, or nonpoint sources of sediment. NPDES permitted discharges were considered to be negligible in this watershed by MDEQ. Achievement of the target yield would require a nonpoint source sediment yield reduction of up to 2.0×10^{-2} tons per acre per day.

MDEQ completed a TMDL for Okatibbee Creek (segment MS060M) for fecal coliform in 1999. The TMDL was evaluated for the reach from Sowashee Creek to the Chunky River. Seventeen miles of the waterway were listed as impaired for secondary contact recreation due to unacceptable levels of fecal coliform. The entire Okatibbee Creek watershed draining to the impaired reach (MS059OE) was also evaluated for sources of fecal coliform. The applicable water quality criteria and TMDL endpoint is a 30-day geometric mean of 200 fecal coliform per 100 milliliters during May through October. The TMDL specifies required reductions in fecal coliform loading of 50 percent for waste load allocations (NPDES permitted point sources), 75 percent for load allocations (nonpoint sources), and 50 percent for failing septic tanks.

MDEQ and USGS have monitored water quality in Okatibbee Lake between 1997 and 2004 (MDEQ, 2009a). MDEQ has conducted nutrient profiling as part of quarterly monitoring and special studies (MDEQ, 2009a). USGS has conducted more comprehensive sampling as part of the ambient statewide status and trends monitoring. Both agencies have sampled at the same two locations: one near the dam (540OKR01) and one downstream of Center Hill-Martin Road Bridge (540OKR02) (MDEQ, 2009b). Some parameters were analyzed via depth profiling, while others were analyzed at the surface and bottom of the profile only. Overall, Okatibbee Lake has acceptable water quality that is reflective of its watershed and is consistent with water quality of streams on the mine study area.

Okatibbee Lake thermally stratifies near the dam. Thermal stratification is much less pronounced or absent at times near the Center Hill-Martin Road Bridge. Some parameters (e.g., DO and pH) are influenced by the thermal stratification, while others are not (e.g., alkalinity and chloride). Due to thermal stratification in deeper water near the dam, part of the hypolimnion is unavailable to fish due to low DO (less than 4.0 ppm). Typical water temperatures range from approximately 30.0 degrees Celsius (°C) at the surface during the summer to approximately 10.0°C in the winter (MDEQ, 2009b).

Eleven metals (arsenic, copper, zinc, lead, nickel, cadmium, chromium, aluminum, mercury, selenium, and manganese) have been analyzed at the surface and bottom of the water column at both stations during 19 monitoring events between 1997 and 2001 (MDEQ, 2009b). Most of the metals were below detection limits in the water column at the surface and near the bottom. Manganese and aluminum were both detected in the water column at both stations. Manganese ranged from 57 to 1,840 microgram per liter (µg/L) over the course of monitoring. There was no consistent trend from the surface to the bottom of the profile; in some cases the concentrations were similar at the top and bottom; in others they were higher at the bottom or surface. Aluminum ranged from 44 to 2,140 µg/L over the course of monitoring. As with manganese, aluminum showed no clear trends from the surface to the bottom of the profile. Both metals were either similar or higher at the top or bottom during the same monitoring event. The presence of manganese and aluminum in the water column of Okatibbee Lake is not surprising given the association of these metals with clay soils in the watershed and that make up the bed of Okatibbee Lake. Iron, manganese, and aluminum all form oxides that are common in clay soils. Manganese concentrations found in streams on the mine study area ranged from 27 to 3,090 µg/L, which is consistent with concentrations found in Okatibbee Lake.

DO, TDS, total suspended solids (TSS), and pH were all within normal expected ranges (MDEQ, 2009b). Values for pH were generally circum-neutral, ranging from slightly alkaline to slightly acidic (5.71 to 8.24). Generally, the bottom of the water column had a lower pH than the surface. Values of pH found in the mine study area streams ranged from 5.15 to 7.23. TDS ranged from 23 to 325 mg/L in the mine study area streams. TDS at the surface in Okatibbee Lake ranged from 14 to 42 mg/L. TSS at the surface in Okatibbee Lake ranged from 1 to 30 mg/L. TSS was generally lower at the station near the dam. TSS in the mine study area streams ranged from 2 to 258 mg/L. DO at the surface in Okatibbee Lake ranged from 3.98 to 12.3 mg/L; DO was found to be less than 4.0 mg/L on only one occasion. DO at the bottom in Okatibbee Lake ranged from 0.2 to 12.0 mg/L and was routinely less than 4.0 mg/L.

Baseline water quality monitoring has been ongoing since May 2008 and is being carried out by Mississippi State University. The purpose of the monitoring is to establish the chemical characteristics and seasonal fluctuations of the surface waters located within and immediately adjacent to the study area. Field measurements, including pH, temperature, conductivity, DO, and turbidity, are being collected at 12 of the 14 surface water sites. Two of the surface water sites are equipped with continuous monitoring equipment that records stage, pH, temperature, conductivity, DO, and turbidity in 15-minute increments. Field water quality measurements are collected with a calibrated, multiparameter Troll® 9500. Field chlorine analysis is being conducted at each of the 14 surface water sites using a LaMott chlorine colorimeter capable of detecting chlorine concentrations greater than 0.01 mg/L.

Aliquots of surface water are being collected from each of the 14 surface water sites and submitted for laboratory analysis of a wide range of analytes including acidity, alkalinity, pH, TSS, total iron, total manganese, and TDS. These constituents are of particular importance for surface coal mines as they are indicators of water quality. Tables 1 and 2 of Appendix D summarize the results of the water quality monitoring program from May until October 2008.

The analytical results and field water quality data indicate surface water sites SW-1 through SW-14 exhibit waters of similar quality with small seasonal variations. Larger variations in water quality data are associated with stormwater runoff due primarily to increases in suspended solids. Acidity values ranged from 3 to 35 mg/L, while alkalinity values ranged from 2 to 54 mg/L. Field pH values ranged from 5.15 to 7.23, which are comparable to the laboratory-tested pH values that ranged from 5.2 to 7.7. Laboratory analysis of TSS indicated results ranged from less than 2 to 258 mg/L, while TDS concentrations ranged from 23 to 325 mg/L. Total iron concentrations ranged from 0.89 to 18.8 mg/L, and total manganese concentrations ranged from 0.0279 to 3.09 mg/L. Water quality monitoring for numerous organic pollutants including pesticides, polychlorinated biphenyls (PCBs), and VOCs revealed no concentrations above method detection limits with a lone exception of a chloroform concentration of 0.00114 mg/L on October 20, 2008, which was during base flow conditions.

The analytical results and field water quality data from samples collected from surface impoundment sites exhibit more overall variance than the water quality data from the streams. Appendix D, Table 3, summarizes the surface impoundments analyses. Acidity values ranged from less than 1 to 126 mg/L and averaged 6 mg/L, while alkalinity values ranged from less than 2 to 82 mg/L and averaged 12 mg/L. The TDS values ranged from 19 to 308 mg/L and pH ranged from 5.48 to 10.26.

Surface waters within and immediately adjacent to the project boundary have been inventoried. The uses of the impounded surface waters ranged from unused to livestock watering to personal recreation. Approximately 34 percent of the ponds are less than 1 ac-ft in volume. None of the surface impoundments are used for drinking water purposes according to the property owners interviewed as part of the inventory process. A total of 192 surface impoundments have been identified.

None of the surface waters within the proposed active mine study area are currently designated as public waterways by MDEQ's Office of Land and Water Resources (OLWR). (The only public waterway near the project area boundary is Okatibbee Lake. However, Okatibbee Lake is not within the proposed active mine study area.) There are no permitted surface water users within or adjacent to the project boundary. According to MDEQ, the nearest permitted surface water users are the Tombigbee River Valley Water Management District in Kemper County, Mississippi (Permit No. MS-SW-00303), and Mr. Morgan Johnson in Marion, Lauderdale County, Mississippi (Permit No. MS-SW-02874). Neither of these permits withdraws water within or downstream from the project boundary or are for consumptive use (Leach, 2008).

3.6.5 SPECIAL WATER BODY DESIGNATIONS

Mississippi's Scenic Streams Stewardship Program Act was enacted in 1999 to encourage volunteer river stewardship. The legislation does not require or mandate land uses or special regulations with designated water bodies. After designation, a landowner-based stewardship plan is created that identifies BMPs that will maintain water quality for recreation and fish and wildlife habitat.

The Chunky River received state scenic river designation in 2003. The CO_2 pipeline is proposed to cross through the Chunky River corridor near the Lauderdale-Clarke County line northwest of Enterprise.

The Mississippi's Water Quality Criteria for Intrastate, Interstate, and Coastal Waters (MWQCIIC) document, produced by MDEQ's Office of Pollution Control (OPC) and dated August 2007, provides water quality standards for all waters within the state of Mississippi. None of the streams or impoundments within or immediately adjacent to the project boundary are specifically listed in Section IV of the MWQCIIC; however, Okatibbee Lake, located approximately 1 mile downstream of the southern project boundary, is classified as a public water supply and is specifically listed in Section IV of the MWQCIIC (MDEQ, 2007). Since Okatibbee Lake is located within 50 stream miles of the southern project boundary, toxic pollutant numeric standards for water and organisms apply. The specific standards that apply for waters, all waters, and those designated for fish and wildlife are summarized in Appendix D, Table 4, while the numeric criteria for toxic pollutants are summarized in Table 5 of that same appendix.

Comparison of available baseline data to the water quality standards summarized in Tables 4 and 5 of Appendix D indicates most of the standards are currently being met with a few exceptions. Twelve of the 14 stream monitoring sites have recorded pH values less than 6.0, all of which were recorded during base flow or near base flow conditions. The pH values in a few of the surface water impoundments were below the minimum 6.0 standard, and several were above the maximum 9.0 standard. Only one impoundment had a pH greater than 10.0 and is attributable to excessive lime application by the property owner.

A DO value of 3.976 mg/L was measured in SW-3 during the May 23, 2008, sampling event. None of the remaining DO values in any of the stream sites were below the 5.0-mg/L daily average water quality standard. Results of the field monitoring of the impounded water sites indicated 35 percent of the DO values were below the 5.0-mg/L daily average standard; however, only 3 percent of the DO values were below the 4.0-mg/L instantaneous standard.

Several values for fecal coliform exceeded the monthly mean and maximum standards. The bacteria criteria are based on geometric means for several samples collected each month; usually a minimum of two samples per month are required. Although the existing data are not adequate to determine whether the bacteria criteria have been exceeded since the sampling intervals for fecal coliform have not been adequately met, several elevated values suggest that the standard may not be met.

Chlorine concentrations ranging from not detected above method detection limits (ND) to 0.19 mg/L have been recorded at SW-1 through SW-14. Both chronic and acute water quality levels of 0.011 and 0.019 mg/L, respectively, have been exceeded during some or all of the sampling events conducted at the various SW sites. Table 1 of Appendix D summarizes the minimum and maximum chlorine values detected at each of the 14 SW sites.

Only one organic pollutant was detected above method detection limits. A chloroform concentration of 0.00114 mg/L was detected from a sample collected from SW-14 on October 20, 2008, during base flow conditions. No other organic pollutants were detected above method detection limits at SW-14 nor at SW-1 through SW-13 during base flow or high flow conditions.

Laboratory analyses for dissolved metals indicates dissolved chromium concentrations ranged from ND to 0.00325 mg/L, dissolved copper concentrations ranged from ND to 0.00537 mg/L, dissolved lead concentrations ranged from ND to 0.00117 mg/L, dissolved nickel concentrations ranged from ND to 0.0045 mg/L, and dissolved zinc concentrations ranged from ND to 0.0487 mg/L. Some of the dissolved metals concentrations exceeded the chronic and/or acute water quality value listed in the MWQCIIC[1]. The dissolved copper concentration of 0.00537 mg/L detected in the sample collected from SW-8, during the high flow event, exceeded the chronic health standard of 0.005 mg/L. Dissolved lead concentrations ranging from 0.00118 to 0.00174 mg/L were detected in the samples collected from SW-1, SW-2, SW 4, SW-5, SW-7, SW-8, SW-9 SW-12, and SW-13, which meets or exceeds the chronic standard of 0.00118 mg/L. Concentrations of dissolved lead that exceeded or met the

[1] The acute and chronic criteria are based on total dissolved concentrations and are applied at the 7-day average low stream flow with a 10-year occurrence period. Some parameters are also subject to water effects ratio equations. The existing data are not equivalent to that required to determine whether the various criteria are exceeded.

chronic standard were from samples collected during high flow conditions at six of the nine sites. None of the remaining analytes listed in Table 5 of Appendix D were detected above method detection limits.

3.7 GROUND WATER RESOURCES

Table 3.4-1 identifies the stratigraphic units that are present in Mississippi. The various aquifers present beneath the proposed mine study area and power plant site are listed in descending order, along with the geologic/stratigraphic units that comprise those aquifers:

- Middle Wilcox Aquifer—Within the Tuscahoma formation and the Grampian Hills member of the Nanafalia formation, both of the Wilcox Group.
- Lower Wilcox Aquifer—Within the Gravel Creek Sand member of the Nanafalia formation of the Wilcox Group and the Naheola formation of the Midway Group.
- Eutaw-McShan Aquifer—Within the Eutaw Group.
- Gordo Aquifer—Within the Gordo formation of the Tuscaloosa Group.
- Coker Aquifer—Within the Coker formation of the Tuscaloosa Group.
- Massive Sand Aquifer—Within the Massive Sand of the Tuscaloosa Group.
- Lower Cretaceous Aquifer—Within the Washita-Fredricksburg undifferentiated and the Paluxy formation in the Lower Cretaceous series (Table 3.4-1).

The following subsections describe the ground water resources in terms of the regional hydrogeologic setting, ground water quality and use, and the hydrogeologic conditions present in the project areas.

3.7.1 REGIONAL GEOHYDROLOGIC SETTING

The various aquifers and associated geologic units dip to the southwest in the project region (Figure 3.4-4). Figure 3.7-1 schematically illustrates a hydrogeologic cross-section and the relations between aquifers and confining units in this general region (Strom and Mallory, 1995). As shown, the aquifers are typically separated by confining units, or aquitards. The Middle and Lower Wilcox aquifers are included within the area shown as Layer 1 in Figure 3.7-1.

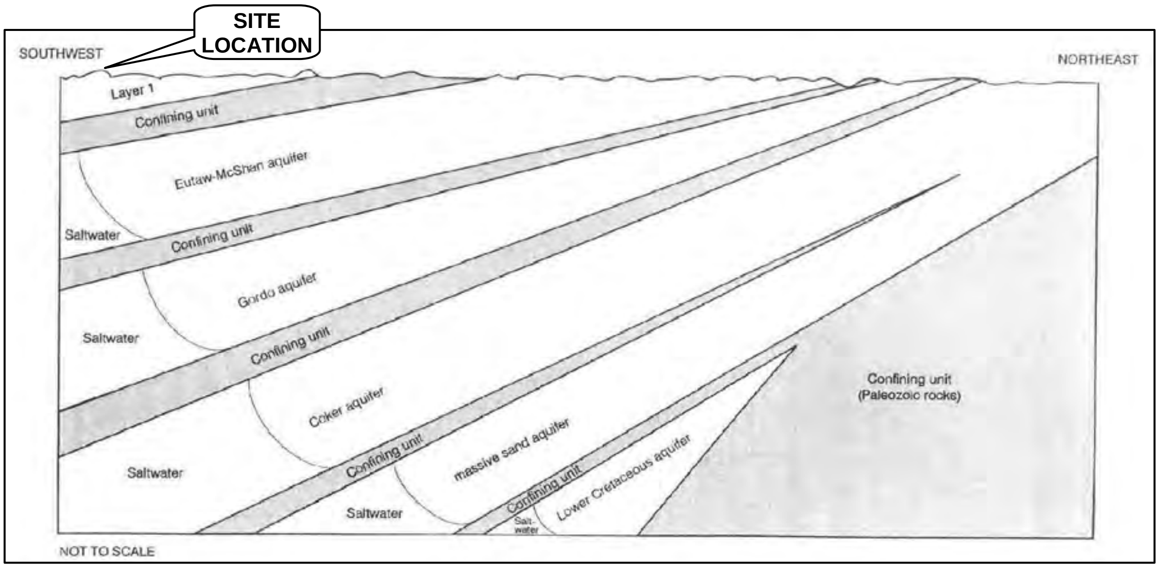


Figure 3.7-1. Hydrogeologic Cross-Section Schematic
Source: Strom and Mallory, 1995.

Various publications quantitatively describe the hydrogeologic characteristics of the aquifers present in the region of the project, including aquifer characteristics such as aquifer thicknesses, hydraulic conductivities, and transmissivities, and also leakance of the confining units (Newcome, 1971; Strom and Mallory, 1995; Mallory, 1993; Gandl, 1982; Hughes, 1958; Boswell, 1978; Strom, 1998). These hydrogeologic characteristics are essentially measures of the ability of a geologic unit to transmit water. TVA quantified and summarized the characteristics of the various aquifers and confining units in the general region of the project areas. That TVA work was performed pursuant to a ground water flow modeling effort for the RHPP FEIS (TVA, 1998). The RHPP site is located approximately 55 miles north-northeast from the power plant site. Table 3.7-1 lists the hydrogeologic characteristics values for the various aquifers and confining units as reported in the RHPP FEIS (TVA, 1998).

Strom and Mallory (1995) and Strom (1998) produced rigorous and calibrated ground water flow models that included the deeper aquifers in the region of the power plant site and mine study area. Table 3.7-2 presents estimates in descending hyrostratigraphic order of the aquifer characteristic values for the power plant site area based on the calibrated ground water flow model report by Strom (1998).

Strom and Mallory (1995) and Strom (1998) also produced potentiometric maps for the deeper aquifers, allowing estimation of ground water flow directions in the freshwater portions of the aquifers.

However, Strom and Mallory (1995) and Strom (1998) apply the freshwater-saltwater interface as a lateral no-flow boundary in their model layers, and they define this no-flow boundary as the location of a TDS concentration of 10,000 mg/L. For most of the deeper aquifers they modeled (Table 3.7-2), the project sites are located on the saltwater side of

Table 3.7-2. Estimated Aquifer Characteristic Values

Hyrostratigraphic Unit	Transmissivity (ft^2/day)	Leakance (ft/day/ft)
Confining unit		7 × 10E-9
Eutaw-Mcshan	2,000	
Confining unit		2 × 10E-7
Gordo	12,000	
Confining unit		1 × 10E-7
Coker	6,000	
Confining unit		2 × 10E-7
Massive Sand	17,000	
Confining unit		4 × 10E-7
Lower Cretaceous	125,000	

Note: ft^2/day = square foot per day.
ft/day/ft = foot per day per foot.

Source: Strom and Mallory, 1995.

Table 3.7-1. Summary of Aquifer Characteristics Values from RHPP FEIS

Hydrostratigraphic Unit	Model Layer Number	Top Depth (ft)	Bottom Depth (ft)	Layer Thickness (ft)	K_h (ft/day)	K_h/K_v	T (ft^2/day)	Basis
Lower Wilcox	1	300	450	150	14	10	2,040	Mean T estimated from reported aquifer tests (without Ackerman test result) in Choctaw County (Slack and Darden, 1991) and Test Hole 1 rig-supply well test
aquitard	2	450	1,065	615	1E-04	10	—	K_v = 1.E-05 ft/d assumed for aquitard per Strom and Mallory (1995)
aquitard	3	1,065	1,880	815	1E-04	10	—	K_v = 1.E-05 ft/d assumed for aquitard per Strom and Mallory (1995)
Eutaw-McShan	4	1,880	2,300	420	2.4	10	1,000	Median T for aquifer tests in Mississippi reported by Slack and Darden (1991)
aquitard	5	2,300	2,350	50	1E-04	10	—	K_v = 1.E-05 ft/d assumed for aquitard per Strom and Mallory (1995)
Gordo	6	2,350	2,730	380	25	10	9,400	Oakley's (USGS) estimate from Test Hole 1 geophysical log (R.W. Harden & Associates, lnc.,1997b)
aquitard	7	2,730	2,830	100	1E-04	10	—	K_v = 1.E-05 ft/d assumed for aquitard per Strom and Mallory (1995)
Coker	8	2,830	2,930	100	52	10	5,200	Estimated from recovery data for Test Well 2 step-test (personal communication R.W. Harden & Assoc., Inc.; May 6, 1998)
aquitard	9	2,930	2,960	30	1E-04	10	—	K_v = 1.E-05 ft/d assumed for aquitard per Strom and Mallory (1995)
Massive Sand	10	2,960	3,118	158	57	10	9,000	Estimated from recovery data for Test Well 2 step-test (personal communication R.W. Harden & Assoc., Inc.; May 6, 1998))
Massive Sand	11	3,118	3,275	157	57	10	9,000	Estimated from recovery data for Test Well 2 step-test (personal communication R.W. Harden & Assoc., Inc.; May 6, 1998)
Lower Cretaceous aquitard	12	3,275	3,475	200	1E-04	10	—	K_v = 1.E-05 ft/d assumed for aquitard per Strom and Mallory (1995)
Lower Cretaceous	13	3,475	3,620	145	22	10	3,200	Estimated from of geophysical log for Test Hole 2 (personal communication R.W. Harden & Assoc., Inc.; May 5,1998). T
Lower Cretaceous	14	3,620	4,020	400	22	10	8,800	Estimated from of geophysical log for Test Hole 2 (personal communication R.W. Harden & Assoc., Inc.; May 5,1998). T

Note: Storativity set to 1.0E-04 in confined portions of all aquifers and to 0.2 in outcrop areas.

Sources: TVA, 1998.
ECT, 2008.

the freshwater-saltwater interface; as such, ground water flow directions were not defined in this region for those deeper aquifers. Figure 3.7-1 provides a schematic illustration of this concept.

3.7.2 GROUND WATER QUALITY AND USE

3.7.2.1 Water Use

MDEQ regulates water use in Mississippi. Figure 3.7-2 shows the locations of ground water wells in the region, based on information provided to Environmental Consulting & Technology, Inc. (ECT), by MDEQ in August 2008 (MDEQ, 2008a). (MDEQ indicated that their water well inventory may not be completely accurate; additional wells certainly exist, and some of the wells identified have likely been abandoned.) This MDEQ information suggests that 1,285 wells may exist within a 20-mile radius of the proposed power plant site. For those water wells located within this 20-mile radius, the water well map also identifies geologic unit or aquifer within which each well is screened.

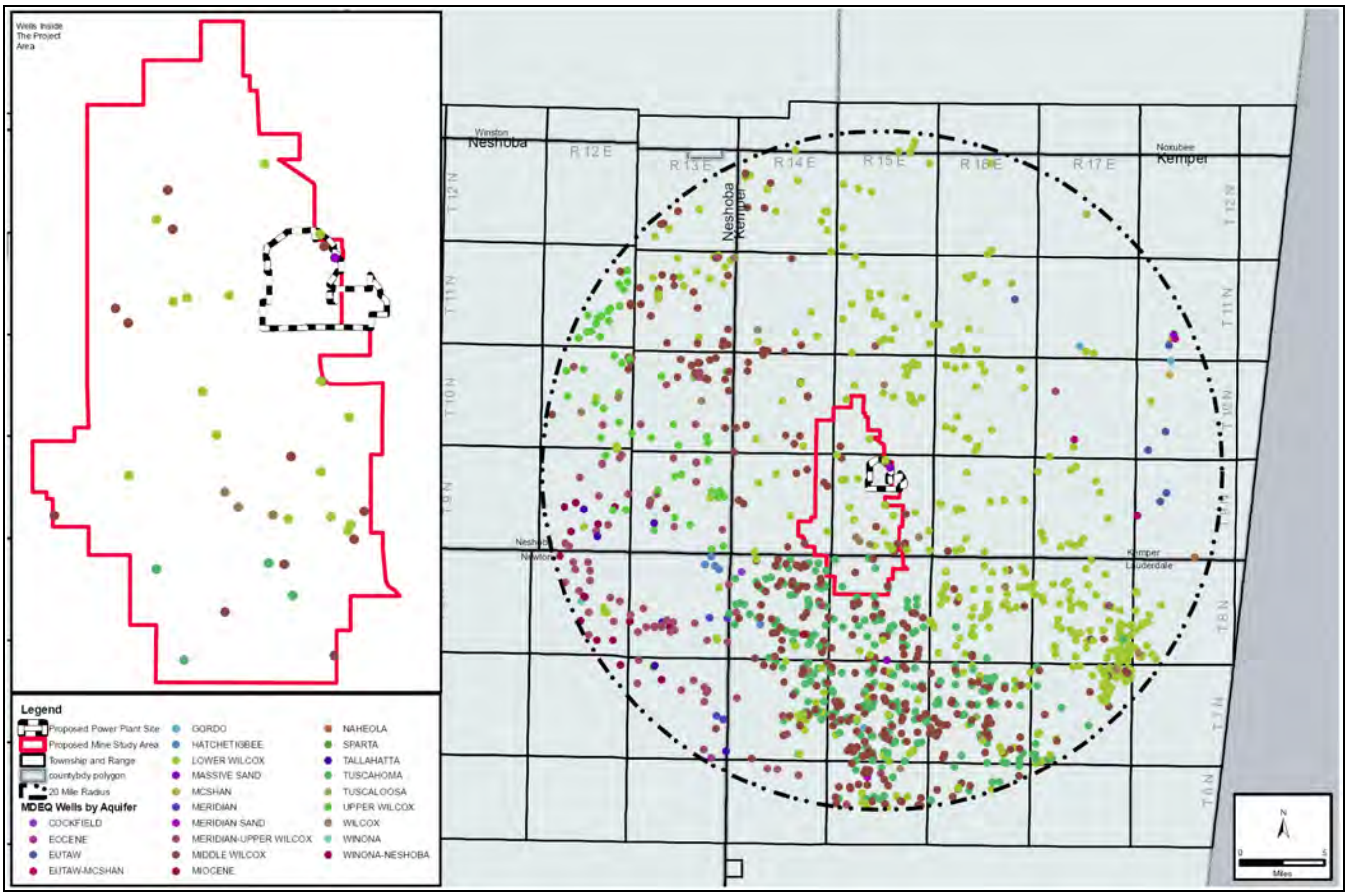


Figure 3.7-2. Water Well Location and the Aquifers Used for Water Supply

Sources: MDEQ, 2008. ECT, 2008.

From this MDEQ information, Table 3.7-3 identifies the aquifers that are used for water supply in the project region and provides an analysis of the number of wells completed in each aquifer. The following aquifers or aquifer systems are used for ground water supply (by at least one well) within 20 miles of the proposed site (in descending order):

- Miocene aquifer.
- Cockfield aquifer.
- Sparta aquifer.
- Winona-Tallahatta aquifer.
- Meridian-Upper Wilcox aquifer.
- Middle Wilcox aquifer.
- Lower Wilcox aquifer.
- Eutaw-McShan aquifer.
- Tuscaloosa aquifer system.

Table 3.7-3. Water Wells Located within 20 Miles from the Power Plant Site and the Aquifers Used

Geologic Unit (Descending Order)	Number of Wells	Principal Aquifer or Aquifer System	Total Number of Wells	Percentage of All 1,285 Wells (percent)
Miocene	2	Miocene aquifer	2	0.2
Cockfield	1	Cockfield aquifer	1	0.1
Sparta	1	Sparta aquifer	1	0.1
Winona	1	Winona-Tallahatta aquifer		
Tallahatta	6		20	1.6
Winona-Neshoba	13			
Meridian	4	Meridian-Upper Wilcox aquifer		
Meridian Sand	1			
Meridian-Upper Wilcox	88		155	12.1
Upper Wilcox	55			
Hatchetigbee	6			
Eocene	1			
Tuscahoma	253	Middle Wilcox aquifer		
Middle Wilcox	323		576	44.8
Wilcox	20	Lower Wilcox aquifer		
Lower Wilcox	488		509	39.6
Naheola	1			
Eutaw	7	Eutaw-McShan aquifer		
Eutaw-McShan	3		14	1.1
Mcshan	4			
Gordo	3	Tuscaloosa aquifer system		
Tuscaloosa	1		7	0.5
Massive Sand	3			

Note: See Figure 3.7-2 for well locations.

Sources: O’Hara, 1996. MDEQ, 2008. ECT, 2008.

The analysis in Table 3.7-3 shows that only 2 percent of the indicated wells are completed in aquifers situated above the Wilcox Group of aquifers. Those wells and aquifers are located downdip (southwest) from the project area, as those aquifers do not exist at the power plant site where the Wilcox Group outcrops at land surface (Figure 3.4-1). In contrast, more than 96 percent of the indicated wells are completed within the Wilcox Group of aquifers; specifically, the Meridian-Upper Wilcox aquifer (12.1 percent), the Middle Wilcox aquifer (44.8 percent), and the Lower Wilcox aquifer (39.6 percent). The deeper aquifers (the Eutaw-McShan aquifer and the Tuscaloosa aquifer system) combined account for only 1.6 percent of the indicated wells.

The Lower Wilcox aquifer is the source of water for several public water supply systems in the project region, including the Northwest Kemper Water Association; Collinsville Water Association, Inc.; North Lauderdale Water Association, Inc.; and Kipling Water Association, Inc. The Northwest Kemper, Collinsville, and Kipling Water Associations use the Lower Wilcox aquifer for all of their wells. North Lauderdale Water Association also has all its wells in the Lower Wilcox aquifer, except for one; it is located in the Middle Wilcox aquifer but shows no pumping rate (MDEQ OLWR, 2008).

Figures 3.7-3 and 3.7-4 show the locations of wells and springs, respectively, in and adjacent to the mine study area based on an inventory conducted by NACC. Table 3.7-4 summarizes the well and spring inventory results.

Table 3.7-4. Well and Spring Inventory Results

Use	Well Number	Percent of Total	Spring Number	Percent of Total
Not used	39	43	18	100
Abandoned	29	32	0	0
Domestic	21	23	0	0
Public supply	1	1	0	0
Recreation	0	0	0	0
Total	**90**	**100**	**18**	**100**

Source: NACC, 2009.

Although there are numerous private water wells in this area, approximately 75 percent of them have been abandoned or are no longer used. While most residents in this area use the public water supplies listed previously, 23 percent of all the local wells inventoried were still used for domestic water supply. Based on reported well depths, all inventoried wells in the mine study area appear to be completed in either the Middle or Lower Wilcox aquifer (except the Massive Sand aquifer well at the power plant site).

None of the 18 springs in the project area are used as water supplies. Sixteen of the springs had no measurable flow when surveyed. The remaining two springs had flows of less than 0.5 gpm.

3.7.2.2 Water Quality

Ground water quality within a given aquifer is typically freshest near the outcrop area where the aquifer is recharged by rainwater. Ground water salinity normally increases in areas stratigraphically down-dip from the outcrop recharge area (Gandl, 1982). In the project region, the down-dip areas are toward the southwest from the outcrop areas. This concept is schematically illustrated in Figure 3.7-1 (Strom and Mallory, 1995). The mine study area and power plant site are located within the outcrop recharge area of the Middle Wilcox aquifer.

Hughes (1958) reported ground water quality data from 16 different water wells located in Kemper County, along with each well location, depth, and aquifer. Those data indicated the ground water quality was very good and potable in the samples from the relatively shallow Tuscahoma formation (in the Middle Wilcox aquifer) and the Nanafalia formation (included in both the Middle and Lower Wilcox aquifers). In contrast, all of the deeper samples indicated relatively poor water quality that does not meet drinking water standards. These deeper samples were from the Eutaw formation from wells having depths ranging from approximately 900 to 1,800 ft bls. The Eutaw formation ground water samples indicated relatively high concentrations of sodium and chloride and TDS concentrations that ranged from 900 to 7,500 mg/L and averaged approximately 3,000 mg/L.

Ground water quality data are available for samples collected from test wells at the power plant site, as summarized in Table 3.7-5. These include ground water samples from the Lower Wilcox aquifer (depth of sample 360 ft bls) in November 2007 and from the Massive Sand aquifer in April 2008 (well screen from 3,360 to 3,440 ft bls; land surface elevation approximately +500 ft-NGVD). The results for the Lower Wilcox aquifer indicate potable fresh water conditions with a TDS concentration of 72 mg/L, chlorides of 1.9 mg/L, and specific conductance of 100 micromhos per centimeter (μmhos/cm). In sharp contrast, the results for the Massive Sand aquifer indicate saline water conditions with a TDS concentration of 23,000 mg/L, chlorides of 12,000 mg/L, specific conductance of 33,000 μmhos/cm, and a calculated ionic strength of 0.369. As a basis for comparison, the ionic strength and TDS concentration of seawater are typically approximately 0.68 and 35,000 mg/L, respectively.

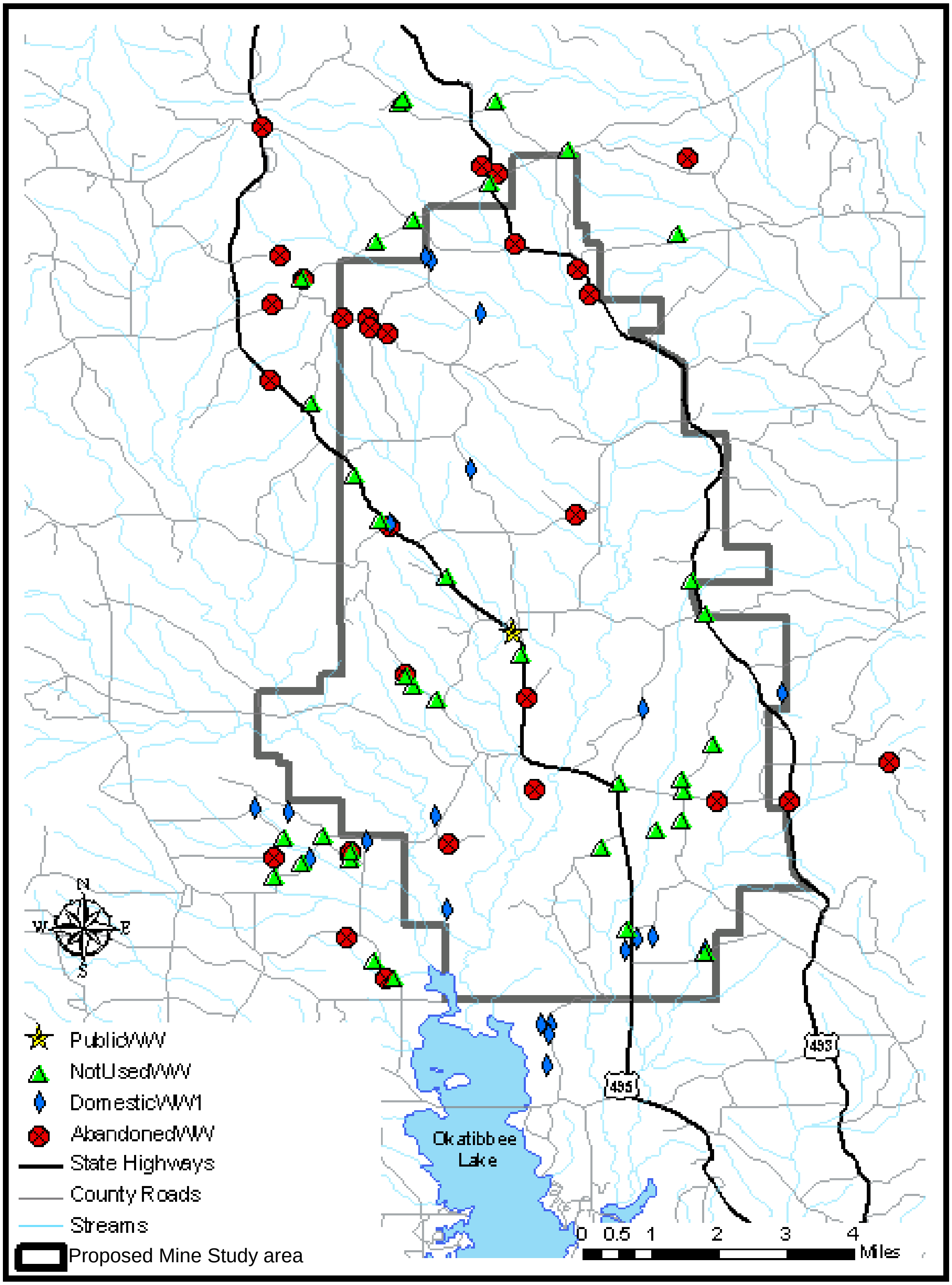


Figure 3.7-3. Locations of Water Wells in the Mine Study Area and Surroundings
Sources: MARIS, 2009. NACC, 2009.

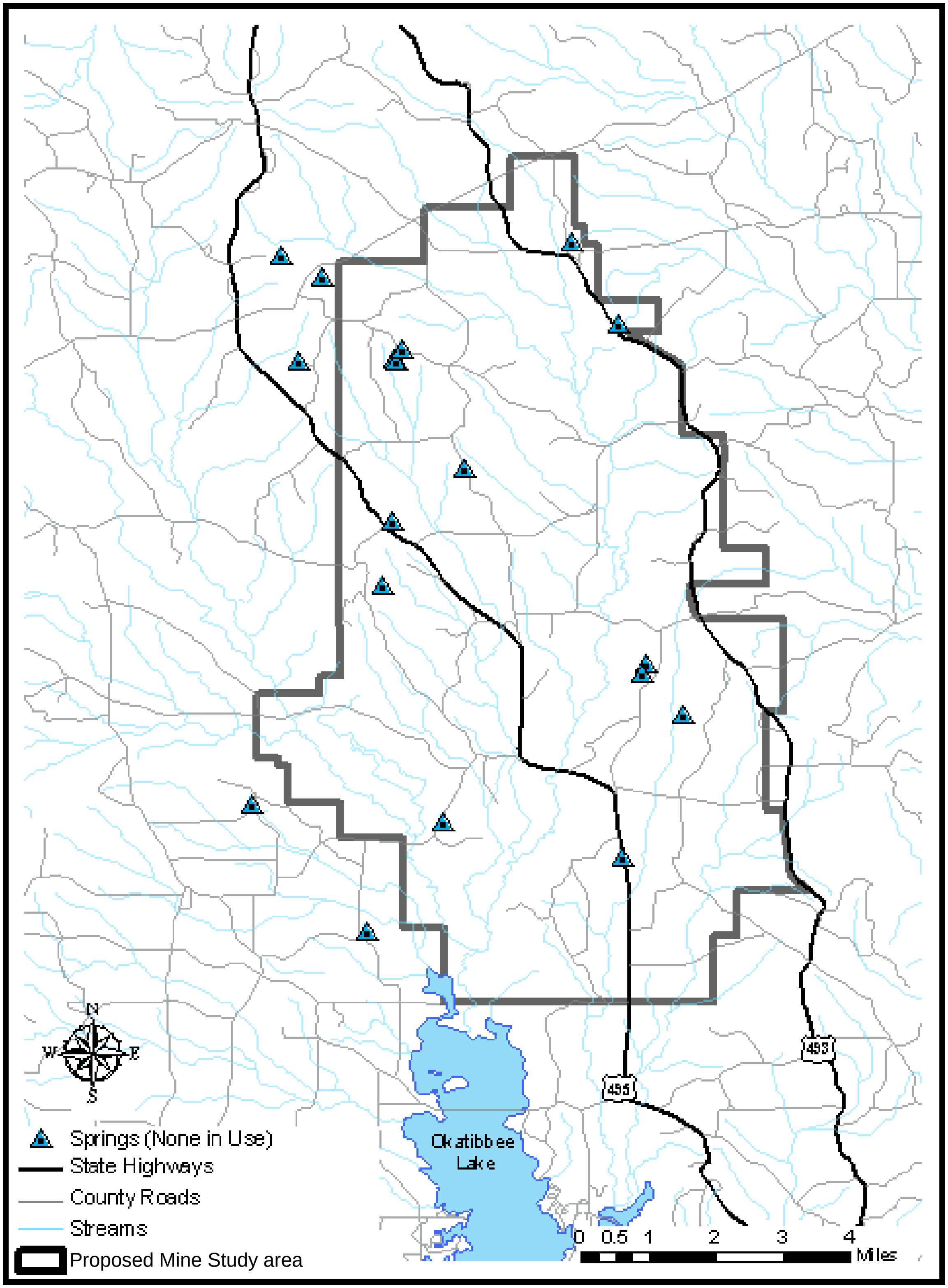


Figure 3.7-4. Locations of Springs in the Mine Study Area and Surroundings
Sources: MARIS, 2009. NACC, 2009.

Table 3.7-5. Ground Water Quality Data from Power Plant Site Test Wells

Parameter	Unit	Massive Sand Aquifer Kemper Production Well 50HR* (04/09/08)	Lower Wilcox Aquifer Kemper LW-1† (11/29/07)
Dissolved Gases in Water (unpreserved)			
Carbon dioxide	µg/L	250	370
Dissolved Gases in Water			
Methane	µg/L	4,000	N/A
Ethane	µg/L	<1.7	N/A
Ethylene	µg/L	<1.1	N/A
Total Metals			
Aluminum	mg/L	0.030*	<0.030
Barium	mg/L	10	0.069
Copper	mg/L	0.0028*	<0.0020
Iron	mg/L	5.6	5.6
Magnesium	mg/L	100	2.2
Manganese	mg/L	0.35	0.15
Calcium hardness as $CaCO_3$	mg/L	1,600	19
Magnesium hardness as $CaCO_3$	mg/L	430	9.2
Hardness as calcium carbonate	mg/L	2,100	28
SiO_2, silica	mg/L	19	27†
Calcium	mg/L	840	7.7
Potassium	mg/L	66*	3.2
Sodium	mg/L	6,400	5.3
Strontium	mg/L	50	0.17
Dissolved Metals			
Aluminum (dissolved)	mg/L	0.084*†	<0.030
Barium (dissolved)	mg/L	9.9	0.065
Copper (dissolved)	mg/L	<0.0020	<0.0020
Iron (dissolved)	mg/L	1.1	5.4
Magnesium (dissolved)	mg/L	110	2.2
Manganese (dissolved)	mg/L	0.37	0.15
Calcium hardness as $CaCO_3$	mg/L	1,800	18
Magnesium hardness as $CaCO_3$	mg/L	470	8.9
Hardness as calcium carbonate	mg/L	2,200	27
SiO_2, silica (dissolved)	mg/L	19	27
Calcium (dissolved)	mg/L	820	7.4
Potassium (dissolved)	mg/L	100	3.2
Sodium (dissolved)	mg/L	6,400	5.5
Strontium (dissolved)	mg/L	46	0.17
General Chemistry			
Color	color unit	280	8.9
Total alkalinity as $CaCO_3$	mg/L	150	46
Bicarbonate alkalinity as $CaCO_3$	mg/L	150	46
Hydroxide alkalinity	mg/L	<0.95	<0.95
Carbonate alkalinity as $CaCO_3$	mg/L	<0.95	<0.95
Chloride	mg/L	12,000	1.9*
Fluoride	mg/L	1.5†	0.081*†
Nitrate as N	mg/L	<0.021	<0.021
Phosphorus, total	mg/L	0.061*†	0.17
Sulfate	mg/L	<0.60	6.0

Table 3.7-5. Ground Water Quality Data from Power Plant Site Test Wells (Continued, Page 2 of 2)

Parameter	Unit	Massive Sand Aquifer Kemper Production Well 50HR* (04/09/08)	Lower Wilcox Aquifer Kemper LW-1† (11/29/07)
Sulfide	mg/L	<0.036	<0.036
Total organic carbon	mg/L	0.22*	2.4
pH	s.u.	6.93	6.31‡
Temperature	°C	21.6	18.1‡
Specific conductance	µmhos/cm	33,000	100
TDS	mg/L	23,000	72
TSS	mg/L	37	<5.0
Turbidity	NTU	6.6	0.61

Note: < = compound was analyzed for but not detected.
$CaCO_3$ = calcium carbonate.
N/A = not analyzed
µg/L = micrograms per liter.
mg/L = milligrams per liter.
s.u. = standard units
°C = degrees Celsius.
µmhos/cm = microhoms per centimeter.
NTU = nephelometric turbidity units.

*Kemper Production Well 50HR is located in the Massive Sand aquifer.
†Kemper LW-1 is located in the lower Wilcox aquifer.

*Reported value is between the laboratory method detection limit and practical quantitation limit.
†Analyte was detect in both the sample and associated method blank.
‡Sample held beyond the accepted holding time.

Sources: SCS, 2008.
ECT, 2008.

Therefore, this Massive Sand aquifer water sample has an ionic strength slightly more than half that of seawater (Pugh, 2008); the TDS concentration is approximately two-thirds that of seawater.

The spatial location of the 10,000-mg/L TDS concentration contour has been the subject of considerable research. This is because it has implications for UIC regulations, as it represents the freshwater-saltwater interface (Strickland and Mahon, 1986; Mallory, 1993; Strom and Mallory, 1995; Strom, 1998), and it is considered a no-flow boundary in ground water flow models for this region (Mallory, 1993; Strom and Mallory, 1995; Strom, 1998). Regional maps of TDS concentrations as a function of elevation have been published by Cushing (1966), Gandl (1982), and Strickland and Mahon (1986). Considering those publications along with onsite water quality data, the following are estimated TDS concentrations as a function of elevation at the power plant site area:

Elevation (ft-NGVD)	TDS (mg/L)	Source	Aquifer at Site
300	200	Onsite data	Middle Wilcox
140	70	Onsite data (see Table 3.7-4)	Lower Wilcox
-200	1,000	Gandl, 1982; Cushing, 1966	(in confining unit)
-750	3,000	Gandl, 1982	(in confining unit)
-2,000	10,000	Strickland and Mahon, 1986	Top of Gordo
-2,800	10,000	Gandl, 1982	Base of Coker
-2,900	23,000	Onsite data (see Table 3.7-4)	Top of Massive Sand

As shown for the proposed power plant site area, the elevation of 10,000 mg/L TDS may be approximately -2,000 ft-NGVD per Strickland and Mahon (1986), or perhaps approximately -2,800 ft-NGVD per Gandl (1982).

In addition to water use protection regulations of MDEQ, the Permit Board currently applies a policy that no potable water source is allowed to be used as a water supply for new (or expanded existing) power generation facilities in Mississippi (Millet, 2008). The water supply for the power plant project proposes to use saline ground water from the Massive Sand aquifer within the Tuscaloosa aquifer system for a portion of its process water.

Ground water quality data are also available for samples collected from numerous wells in the mine study area. These include ground water samples from eight wells completed in sand intervals within the Middle Wilcox aquifer, two wells in the Lower Wilcox aquifer, and seven springs originating from the Middle Wilcox aquifer. These water quality results were obtained by NACC and are summarized in Table 3.7-6 and described in the following paragraphs.

The Middle Wilcox sand data was acquired from eight monitoring wells drilled in the mine study area. The water is fresh with a TDS concentration ranging from 100 to 344 mg/L with an average TDS of 205 mg/L. Chloride concentrations ranged from 4 to 11 mg/L with an average of 6 mg/L. The pH of the water had a range of 6.0 to 7.7 standard units (s.u.) and had an average of 7.1 s.u. The secondary drinking water maximum contaminant levels (MCLs) were exceeded frequently for iron and magnesium. No primary MCLs for the inorganic constituents tested were exceeded in the Middle Wilcox aquifer.

The Lower Wilcox aquifer water chemistry data is based on two monitoring wells drilled within the mine study area. The Lower Wilcox aquifer is fresh with an average TDS of 73 mg/L and an average chloride concentration of 2 mg/L. The pH of the water samples were 6.3 and 6.4 s.u. No primary MCL for the inorganic constituents listed were exceeded, but the secondary drinking water MCLs were exceeded frequently for iron, magnesium, and aluminum.

Seven Middle Wilcox springs were sampled for water chemistry in the study area. Water discharged from springs was fresh with a TDS concentration ranging from less than 10 to 114 mg/L with a mean value of 70 mg/L. The pH levels measured in the field ranged from 5.0 to 6.7 s.u. with an average of 5.6 s.u. Chloride concentrations ranged from 2 to 23 mg/L, with an average of 7 mg/L. Secondary drinking water MCLs were exceeded frequently for iron, magnesium, and manganese, but no primary MCLs were exceeded for the inorganic constituents tested. Figure 3.7-4 shows locations of 18 springs mapped by NACC in the general area of the mine study area.

The ground water data in Table 3.7-6 is reflective of the sand intervals of the Wilcox aquifer. It is likely that water produced from less transmissive sand, sandy clay, and lignite intervals may have higher concentrations of dissolved minerals due to higher residence times.

3.7.3 PROJECT AREA HYDROGEOLOGY

Onsite well drilling and testing and borehole geophysical logging have been conducted on both the proposed power plant site and mine study area, providing site-specific information regarding the hydrogeologic units present, and aquifer characteristics values for the Massive Sand and Middle Wilcox aquifers. This subsection primarily describes the hydrogeologic studies conducted within the mine study area by NACC, which focused largely on the shallow Middle Wilcox aquifer. That information is supplemented by a summary of the hydrogeologic testing performed at the power plant site, which focused primarily on the much deeper Massive Sand aquifer. Finally, in consideration of all available hydrogeologic information, a conceptual model of the local hydrogeologic setting is presented at the end of this subsection.

Ground water investigations within the mine study area were performed to evaluate baseline conditions and the need for advance dewatering or depressurization. These studies have included measurements of the ground water potentiometric surface, aquifer testing, ground water sampling, and chemical analyses (Subsection 3.7.2). These studies were performed by Harden & Associates, a consultant to NACC.

The investigation of the Wilcox Group included installation of ten 4-inch test wells. Eight wells were installed in the Middle Wilcox aquifer at locations that are potential candidates for advance dewatering or depressurization. Two other wells were drilled in the deeper and more permeable Lower Wilcox aquifer to quantify the baseline water quality and water levels. Aquifer tests and water quality sampling were conducted on all wells in the Middle Wilcox aquifer. In addition, four 2-inch piezometers were also installed in the Middle Wilcox aquifer and used to monitor ground water levels during aquifer testing.

Table 3.7-7 identifies the ten test wells and summarizes relevant well details and hydrogeologic data results. Figure 3.7-5 provides the well locations.

Table 3.7-6. Ground Water and Spring Water Quality Data from the Mine Project Area

		Middle Wilcox			Lower Wilcox Aquifer			Middle Wilcox Springs			EPA	MCL Exceedences		
Parameters	Units	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	MCL*	Middle Wilcox	Lower Wilcox	Springs
Acidity	mg/L	N/A	N/A	N/A	N/A	N/A	N/A	9.00	25.00	16.40				
Alkalinity (as $CaCO_3$)	mg/L	37.00	249.00	140.29	37.00	44.00	41.33	<2.02	57.00	18.40				
Bicarbonate (as $CaCO_3$)	mg/L	37.00	249.00	140.29	37.00	44.00	41.33	5.00	62.00	22.20				
Carbonate	mg/L	0.00	0.00	0.00	0.00	0.00	0.00	<2	<2	<2				
Color	APC	<1	20.00	6.29	30.00	60.00	43.33	0.00	35.00	17.83				
Conductivity	mmhos/cm	0.10	0.49	0.28	0.09	0.11	0.10	N/A	N/A	N/A				
Conductivity (field)	mmhos/cm	0.11	0.53	0.31	111.00	126.90	121.60	1.39	137.60	47.96				
DO	mg/L	10.42	11.23	10.84	9.73	10.07	9.84	8.02	11.97	10.73				
Hardness as $CaCO_3$ (SM-2340B)	mg/L	26.40	230.00	115.20	22.00	32.00	26.63	N/A	N/A	N/A				
Nitrate+Nitrite-N	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	N/A	N/A	N/A	11.00			
Odor	DTU	2.00	4.00	1.14	<1	<1	<1	N/A	N/A	N/A				
pH	s.u.	6.10	7.50	7.03	5.90	6.40	6.13	N/A	N/A	N/A	6.5-8.5			
pH (field)	s.u.	6.04	7.74	7.07	6.29	6.38	6.35	4.98	6.66	5.59	6.5-8.5			
Phenols (total)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	N/A	N/A	N/A				
Resistivity	ohms/cm	2060.00	10200.00	4344.29	9520.00	11600.00	10276.67	N/A	N/A	N/A				
SO_4, total	mg/L	N/A	N/A	N/A	N/A	N/A	N/A	<1	6.27	2.25	250 (s)			
Turbidity	NTU	1.50	24.70	9.64	6.80	8.60	8.00	0.70	282.30	66.26				
Temperature	°F	66.11	69.94	68.09	69.66	70.80	70.42	63.19	75.60	67.04				
TDS	mg/L	100.00	344.00	204.71	72.00	74.00	73.00	<10	114.00	70.00	500 (s)			
Boron, total	mg/L	0.01	0.07	0.04	0.01	0.01	0.01	N/A	N/A	N/A				
Calcium, total	mg/L	4.60	75.80	34.57	6.42	10.10	8.02	0.166	10.30	3.29				
Chloride	mg/L	3.68	11.40	5.58	1.91	2.48	2.28	1.50	23.40	6.71	250 (s)			
Fluoride (without distillation)	mg/L	0.13	0.14	0.14	<0.1	<0.1	<0.1	N/A	N/A	N/A	4.00			
Magnesium, total	mg/L	3.61	9.86	7.03	1.46	1.71	1.61	0.36	4.85	2.26	0.5(s)		3	4†
Phosphorus, total	mg/L	0.17	0.45	0.25	0.03	0.05	0.04	N/A	N/A	N/A				
Potassium, total	mg/L	1.63	4.91	3.52	3.21	5.93	4.29	0.37	1.94	1.39				
Silicon as SiO_2, total	mg/L	2.55	5.49	3.91	13.90	14.50	14.30	N/A	N/A	N/A				
Sodium, total	mg/L	8.14	19.60	14.21	6.19	7.40	6.64	1.36	12.00	5.88				
Iron, dissolved	mg/L	0.13	1.79	0.76	2.90	8.13	4.67	N/A	N/A	N/A	0.3(s)	3	3	
Iron, total	mg/L	0.22	2.98	1.14	3.27	8.66	5.11	<0.1	1.65	0.84	0.3(s)	6	3	3†
Manganese, dissolved	mg/L	0.07	0.43	0.21	0.10	0.22	0.14	N/A	N/A	N/A				
Manganese, total	mg/L	0.07	0.43	0.20	0.09	0.21	0.13	0.36	4.85	2.26	0.5(s)			4
Aluminum, dissolved	mg/L	<0.1	<0.1	<0.1	<0.1	0.20	0.12	N/A	N/A	N/A	0.05 (s)	†	2†	
Arsenic, dissolved	mg/L	0.00	0.00	0.00	<0.001	<0.001	<0.001	N/A	N/A	N/A	0.01			
Barium, dissolved	mg/L	0.04	0.09	0.06	0.05	0.09	0.07	N/A	N/A	N/A	2			
Beryllium, dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	N/A	N/A	N/A	0.004			
Cadmium, dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	N/A	N/A	N/A	0.005			
Chromium, dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	N/A	N/A	N/A	0.1			
Cobalt, dissolved	mg/L	0.00	0.00	0.00	<0.001	0.00	0.00	N/A	N/A	N/A				
Copper, dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	N/A	N/A	N/A	1.3			
Lead, dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	N/A	N/A	N/A	0.015			
Mercury, dissolved	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	N/A	N/A	N/A				
Molybdenum, dissolved	mg/L	<0.001	0.00	<0.001	<0.001	0.00	0.00	N/A	N/A	N/A				
Silver, dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	N/A	N/A	N/A	0.1			

Note: For concentrations below detection limit, the avergage was calculated using half the detection limit value.

N/A = not measured.
APC = _______??__________
mmhos/cm = millimhos per centimeter.
DTU = daily temperature unit.
ohms/cm = ohms per centimeter.
mg/L = milligram per liter.
s.u. = standard unit.
NTU = nephelometric turbidity unit.
°F = degree Fahrenheit.

*Primary standard unless followed by (s), indicating secondary standard.
†Cannot be determined because detection limits exceed MCL.

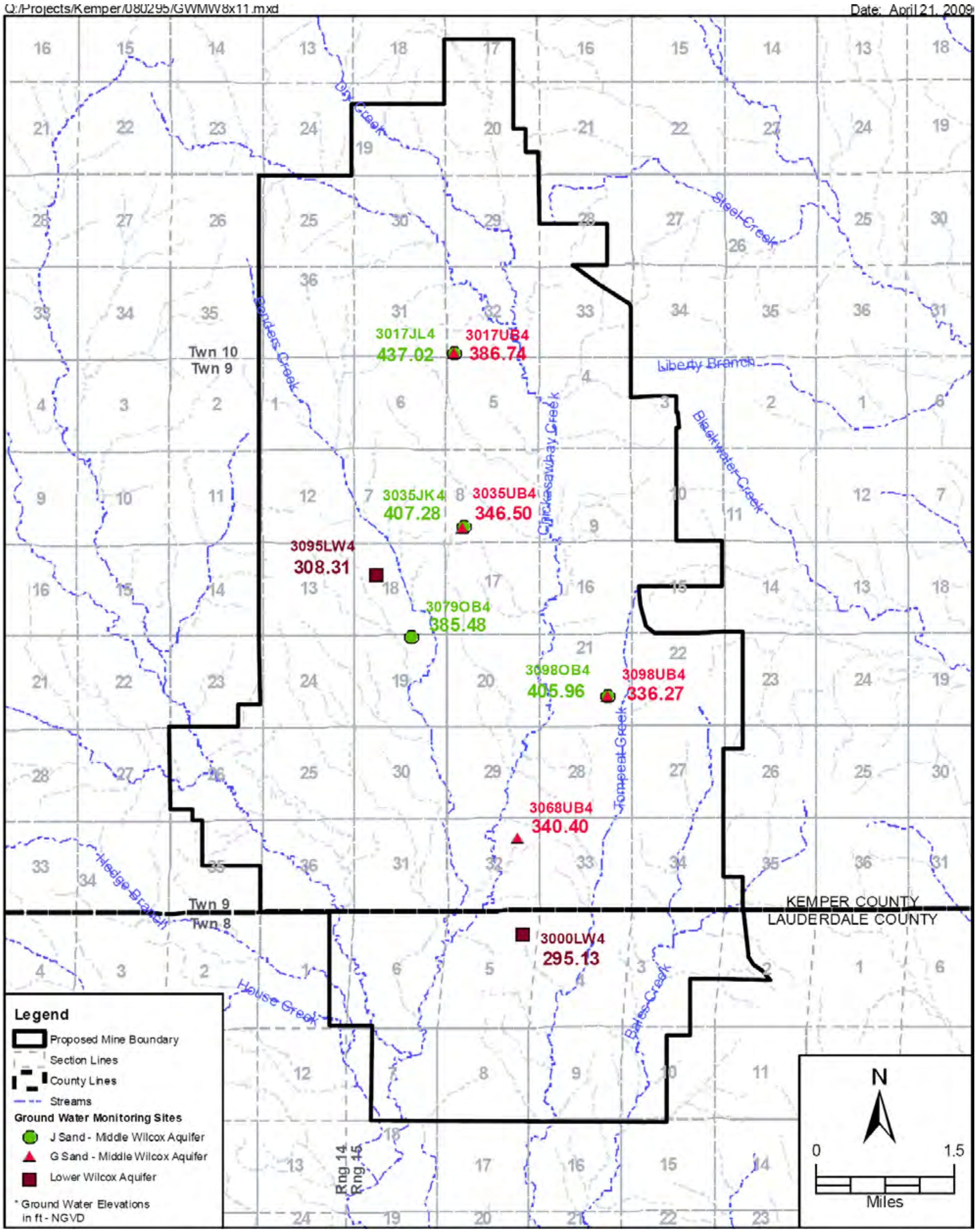


Figure 3.7-5. Water Level Elevations

Source: NACC, 2009.

Table 3.7-7. Wilcox Aquifers—Hydrogeologic Data from Test Wells

Test Well Identifi-cation	Aquifer *	Sand Unit	Sand Unit Thickness (ft)	Saturated Thickness (ft)	Land Surface Elevation (ft-NGVD)	Well Screen Elevation Interval (ft-NGVD)	Water Surface Elevation (ft-NGVD)	Date of Water Surface Elevation	Slug Test Transmissivity (ft^2/day)	Pump Test Transmissivity (ft^2/day)
3017JL4	MWA	J sand	38	31.2	492.82	405.82 to 441.82	437.02	09/11/08	47	NA
3017UB4	MWA	G sand	20	20	492.7	285.7 to 295.7	386.74	09/09/08	2.6	NA
3035JK4	MWA	J sand	33	33	494.51	362.51 to 380.51	407.28	09/10/08	NA	110
3035UB4	MWA	G sand	21	21	494.9	226.9 to 246.9	346.5	09/12/08	NA	46
3098OB4	MWA	J sand	45	17.63	487.33	388.33 to 431.33	405.96	09/15/08	NA	92
3098UB4	MWA	G sand	13	13	487.1	286.1 to 296.1	336.27	09/13/08	16	NA
3079OB4	MWA	J sand	28	28	450.14	348.14 to 380.14	385.48	09/13/08	32	NA
3068UB4	MWA	G sand	50	50	388.4	221.4 to 261.4	340.4	09/14/08	NA	600
3095LW4	LWA	NA	NA		455.96	38.96 to -11.04	308.31	09/28/08	NA	NA
3000LW4	LWA	NA	NA		437.26	10.26 to -39.74	295.13	09/29/08	NA	NA

*MWA = Middle Wilcox aquifer. LWA = Lower Wilcox aquifer.

Note: NA = not applicable.

Sources: NACC, 2009. ECT, 2009.

The mine study area is underlain by the Tuscahoma and Nanafalia Formations of the Wilcox Group (Figure 3.4-6). These formations are composed of interbedded sands, silty sands, sandy clays, clay, shale, and lignite. The mining is proposed to occur within the Middle Wilcox aquifer portion of the Wilcox Group of formations. The lowermost lignite seam proposed to be mined is the G seam, which occurs at the contact between the Grampian Hills member and the Gravel Creek sand member of the Nanafalia formation, as shown in Figure 3.4-6.

Within the intended mining depths of the proposed mine study area, two mappable sand intervals were identified within the Middle Wilcox aquifer that have the potential to provide minor supplies of ground water: the J sand interval (JS) and the G sand interval (GS). The JS lies above the J seam, has a maximum thickness of approximately 50 ft and an average thickness of 20 to 25 ft where it exists. The JS is present and may be capable of providing small ground water supplies in approximately one-third of the proposed mine study area. The GS underlies the G seam. It is present and capable of yielding small quantities of water to wells in approximately half of the proposed mine study area. The GS has a maximum thickness of approximately 50 ft and an average thickness of 15 ft. Based on the average structural dip of the middle Wilcox and topographic consideration, these sand intervals might crop out approximately 1 to 3 miles northeast of the proposed mine study area in a northwest to southeast trending belt. Although these sands are present in much of the proposed mine study area, available drill hole data suggests that both sands pinch out within a few miles of the mine study area boundary; therefore, it is unknown whether the JS or GS sands are laterally extensive enough to crop out. Numerous other sand beds exist within the overburden. However, according to NACC, the additional sand beds are generally discontinuous, apparently have low transmissivity and relatively poor quality water, and are therefore not considered to represent usable supply sources.

To estimate aquifer characteristic values of transmissivity, aquifer slug and pump tests were conducted on both the JS and GS with four tests completed in each of those sand intervals. Slug testing was conducted on the wells screened in thin sands and/or sands that exhibited low resistivity on geophysical logs. Aquifer pump tests were performed in wells that were screened in thicker sands and had high resistivities. The transmissivity results indicated by NACC are included in Table 3.7-7. The JS transmissivity ranged from 32 to 110 ft^2/day with an average of 62 ft^2/day for the four JS tests. The GS transmissivity ranged from 2.6 to 600 ft^2/day with an average of 170 ft^2/day for the four GS tests. No aquifer tests were performed at the two wells constructed in the Lower Wilcox aquifer.

Aquifer testing in the upper portion of the Massive Sand aquifer was performed by ES&EE at the power plant site. The test well has an 80-ft screen interval set from 3,362 to 3,442 ft bls. Two types of pumping tests were performed; step drawdown tests and a constant rate aquifer pumping test. The step drawdown tests were conducted at sequential pumping rates of 500, 800, 400, and 1,200 gpm; the results yielded specific capacity values of 21.8, 19.8, 28.9, and 16.5 gallons per minute per foot (gpm/ft) of drawdown, respectively (ES&EE, 2008). The constant rate aquifer pumping test was performed for 48 hours at a pumping rate of 800 gpm, while observing water levels in the pumping well and an observation well. A transmissivity estimate of 2,900 square feet per day (ft^2/day) was derived using the Hantush and Jacob (1955) analytical method. In addition, the results from the 500-gpm step drawdown test yielded a transmissivity estimate of 4,400 ft^2/day using the Hantush (1962) analytical method (ES&EE, 2008). These transmissivity results reflect testing of the upper 80 ft of the Massive Sand aquifer, whereas the total thickness of the Massive Sand aquifer is approximately 290 ft at the power plant site. The ground water modeling report by Strom (1998) shows a transmissivity of approximately 17,000 ft^2/day for the entire thickness of the Massive Sand aquifer in the immediate area of the project site.

Table 3.7-7 includes ground water elevation data for the eight Middle Wilcox aquifer test wells and the two Lower Wilcox aquifer test wells. Those ground water elevation data are illustrated spatially in Figure 3.7-5. Middle Wilcox aquifer water level data acquired from the JS and GS test wells in the mine study area indicate that the potentiometric surfaces for both JS and GS slope in a southwesterly direction, coinciding with formation slope. Most of the area is under confined conditions. Those ground water elevation data also indicated a significant downward hydraulic gradient between the JS and the GS within the Middle Wilcox aquifer; the nested wells show ground water elevations were 50 to 70 ft higher in the JS than in the GS. Similarly, the data indicate a downward hydraulic gradient between the GS of the Middle Wilcox aquifer and the Lower Wilcox aquifer. At the power plant site, the depth to the water level in the Middle Wilcox aquifer ranged from 42 to 64 ft bls (land surface elevation typically approximately 505 ft-NGVD, +/- 10 ft) in September 2007 in the 12 power plant site boreholes associated with the geotechnical investigation (ES&EE, 2007). In the Massive Sand aquifer, the static water level was 363 ft bls (i.e., elevation approximately 137 ft-NGVD) in the deep test well at the power plant site on March 19, 2008, based on the well driller report and well log (Layne-Central, 2008).

Eighteen springs were located in the mine study area based on the results of the water resources inventory; the locations of these springs are shown in Figure 3.7-4. Only two of the springs had measurable flow, while the other 16 were either dry or spring flow was not measurable. Based on the spring location and the regional physiography, it is likely that these springs are local features that occur where sandy soil caps hilltops. The springs are recharged by infiltration of precipitation, and the water moves laterally along the contact between the sandy soils and underlying clay. Springs emanate along hillsides at the lower elevations of the contact between the sandy soils and underlying clay.

The mine study area and power plant site are situated within the recharge area for the Middle Wilcox aquifer. The Middle Wilcox aquifer is recharged primarily by infiltration of rainwater and also by downward infiltration of surface water through creek beds under some circumstances. Water discharges from the Middle Wilcox aquifer via downward leakance to the Lower Wilcox aquifer, discharge to springs, discharge to creeks, and ground water pumpage from water supply wells.

The top of the permeable sands of the Lower Wilcox aquifer occurs at a depth of 300 ft bls (i.e., an elevation of 200 ft-NGVD) at the power plant site deep test well. At the two wells in the mine study area, the top of the Lower Wilcox aquifer occurs at depths of 360 and 400 ft bls (i.e., elevations of 96 and 37 ft-NGVD). Spatial extrapolation of those data suggest that the top of the Lower Wilcox aquifer occurs at a maximum elevation of approximately 160 ft-NGVD in the extreme northern section of the mine study area and a minimum elevation of approximately -20 ft-NGVD in the extreme southwest sections of the mine study area.

In summary, Table 3.7-8 presents a conceptual model of the local hydrogeologic setting. This conceptual model takes into consideration the best available data and other information presented in Sections 3.4 and 3.7. The elevations shown are tied to the deep test well located at the power plant site. For each hydrogeologic unit present, Table 3.7-8 lists the elevations of top and bottom, total thickness of the unit, total sand thickness of the aquifer, aquifer transmissivity, leakance of the underlying confining unit, and it also provides a water quality profile that shows TDS concentrations as a function of elevation.

Table 3.7-8. Conceptual Model of Local Hydrogeologic Setting

Elevation (ft-NGVD)	Hydrogeologic Unit	Thickness of Unit (ft)	Aquifer Total Sand Thickness (ft)	Aquifer Transmissivity (ft^2/day)	Leakance of Underlying Confining Unit (ft/day/ft)	Elevations (ft-NGVD) of TDS Concentrations (mg/L)
500 to 200	Middle Wilcox	300	170	1,000		TDS = 200 at 300
	confining unit				3 × 10E-6	
200 to -100	Lower Wilcox	300	250	5,000		TDS = 70 at 150
	confining unit				7 × 10E-9	TDS = 1,000 at -200 TDS = 3,000 at -750
-1,510 to -1,870	Eutaw-McShan	360	150	2,000		
	confining unit				2 × 10E-7	
-1,870 to -2,340	Gordo	470	230	12,000		TDS = 10,000 at ~ -2,300
	confining unit				1 × 10E-7	
-2,340 to -2,860	Coker	520	120	6,000		
	confining unit				2 × 10E-7	
-2,860 to -3,150	Massive Sand	290	260	16,000		TDS = 23,000 at -2,900
	confining unit				4 × 10E-7	
-3,150 to -4,650	Lower Cretaceous	1,500	1,000	125,000		
~ -4,650	(top of Paleozoic)					

Note: Each hydrogeologic unit dips to the southwest approximately 40 ft per mile; the indicated elevations are for the deep well at the power plant site.

Sources: Gandl, 1982. Strom and Mallory, 1995. Strom, 1998. ES&EE, 2007. Boswell, 1978. Cushing, 1966. Strickland and Mahon, 1986. NACC, 2009. ECT, 2009.

3.8 TERRESTRIAL ECOLOGY

3.8.1 REGIONAL SETTING

The project area is located within the Middle Coastal Plains section of the Southern Mixed Forest Province (McNab and Avers, 1994). Chapman *et al.* (2004) further divides the Middle Coastal Plains section into ecoregions. The power plant site, northern portions of the linear facilities, and the mine study area lie within the Southern Hilly Gulf Coastal Plain ecoregion; the southern reaches of the linear facilities cross the Buhrston/Lime Hills ecoregion. The Southern Mixed Forest Province including the ecoregions encompassing the project area is characterized by a humid subtropical climate with hot, humid summers and relatively mild winters. Precipitation averages 40 to 60 inches per year and is rather evenly distributed. Precipitation exceeds evaporation, but summer droughts occur. Snowfall is rare and melts quickly when it does occur.

Soils are generally deep and range from well to poorly drained. The dominant soil order in the Southern Mixed Forest Province is Ultisols, which are mineral soils containing no calcareous material anywhere within the soil (NRCS, 2008). Ultisols are typically red to yellow in color and acidic (often less than pH 5) and typically deficient in major nutrients such as calcium and potassium (*ibid*.). Locally, entisols are conspicuous. This soil order is comprised of soils that typically exhibit little or no evidence of the development of pedogenic horizons (strata). Entisols are usually sandy and shallow in depth. Inceptisols is the soil order often found on the floodplains of major streams in the region (McNab and Avers, 1994). This soil order includes soils of humid and subhumid regions with altered horizons that have lost bases of iron and aluminum but retain some weatherable minerals (NRCS, 2008). Inceptisols soils are the best of the major soil orders characteristic of the project area for growing crops.

The Middle Coastal Plains section is in the Coastal plains geomorphic province (McNab and Avers, 1994). The characteristic landform consists of moderately dissected topography formed by deposition of sediments onto a submerged continental shelf that was ultimately exposed by sea level subsidence. Elevation ranges from 80 to 650 ft; in the immediate project region elevation ranges from an average of 400 ft in the vicinity of the coal mine and power generating facility site in Kemper County to 350 to 450+ ft in the southern reaches of the linear facilities in Clarke and Jasper Counties. The area is characterized by a moderate density of small intermittent to medium perennial sandy-bottomed streams and associated rivers. The drainage pattern is dendritic and has developed on the moderately dissected plain, largely without bedrock structural control (*ibid*.).

The predominant climax vegetation is broadleaf deciduous and pine- or pine hardwood-dominated forests characterized by loblolly pine, shortleaf pine, and other southern yellow pine species with sweetgum, flowering dogwood, elm, red cedar, oaks, and hickories. In the project area, the pine-dominated communities are most conspicuous since much of the original forest cover was cleared and used for pine plantation. The hardwood component is dominant in some areas, particularly on moister soils and on steep slopes and ravines where pine cultivation is limited. Along waterways, floodplain forests dominated by a variety of hardwoods predominate. Intermixed with the forested lands are areas of pasture, hayfields, and minor cropland.

Barry Vittor & Associates, Inc. (Vittor), biologists performed all terrestrial and aquatic ecological surveys for the proposed mine study area on behalf of NACC. Vittor also delineated the wetlands and conducted listed species surveys on the power plant site (see Appendix E). ECT biologists conducted all other ecological surveys for the project, with the exception of the portion of the CO_2 pipeline corridor from Meridian to Heidelberg, which was surveyed by Eco-Systems, Inc., subcontractor to ECT.

3.8.2 POWER PLANT SITE

Typically, the region encompassing the plant site is dominated by several forest associations (Figure 3.8-1), including oak-hickory-pine forest typically comprised of post oak, blackjack oak, southern red oak, shortleaf pine, pignut hickory, and mockernut hickory; pine and pine-oak forest with longleaf pine, shortleaf pine, File: M:\acad\080295\Figure4.2-1_Landuse_Impacts.mxd

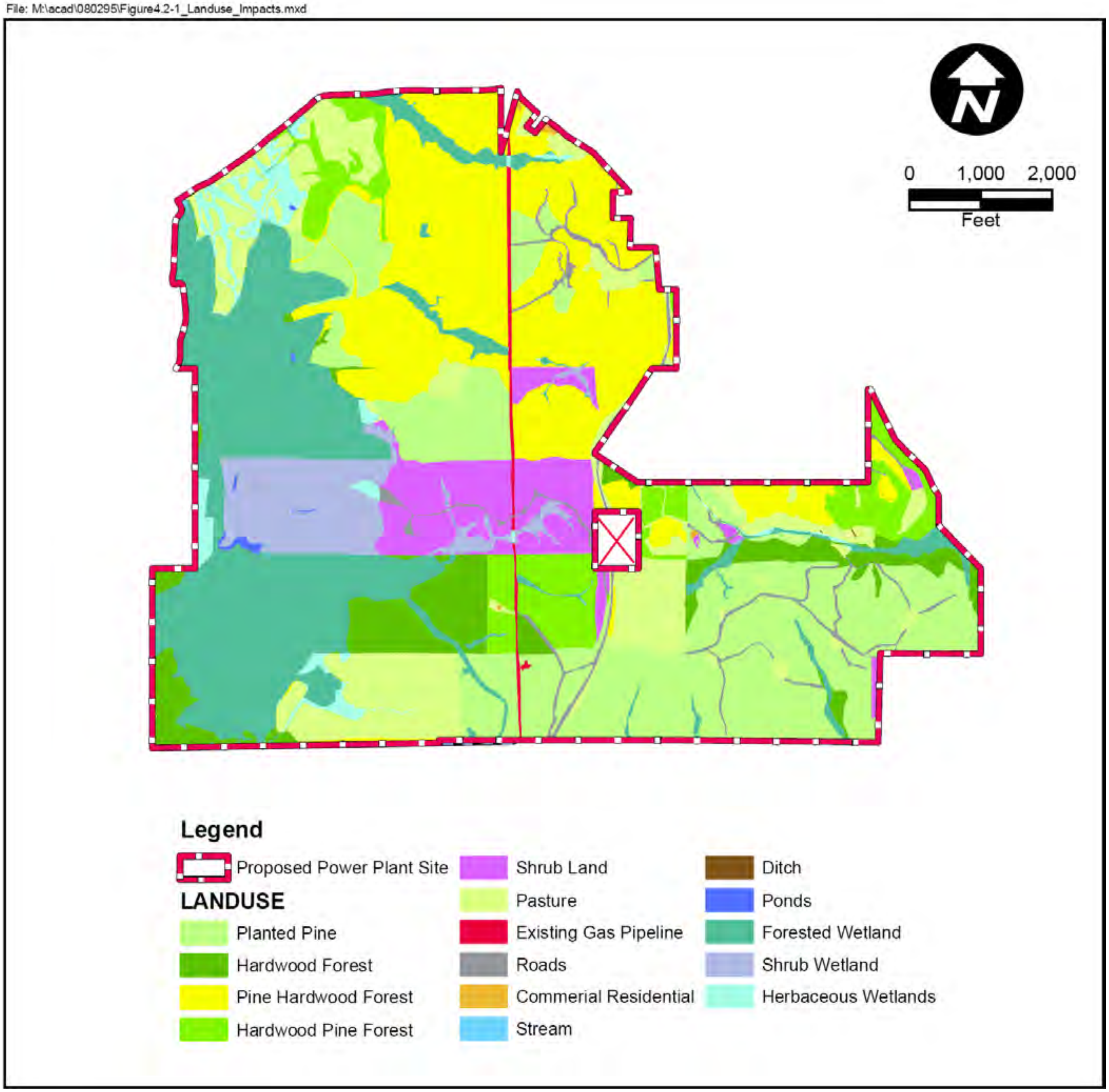


Figure 3.8-1. Vegetation/Land Use Types Identified Within the Power Plant Site
Sources: NACC, 2009. ECT 2009.

blackjack oak, sand post oak, and bluejack oak; and southern floodplain forest types such as cypress-gum swamp and/or bottomland hardwoods. At present, much of the native forest types on the plant site have been cleared and used for cultivation of pine. Site-specific information follows (Table 3.8-1).

3.8.2.1 Vegetation

Vegetation studies were conducted on the plant site in spring and summer 2008. There are 15 categories of vegetation communities on the proposed power plant site: planted pine, hardwood forest, pine-hardwood forest, hardwood-pine forest, shrubland, pasture, existing gas pipeline corridor, road, commercial/residential, stream, ditch, pond, forested wetland, shrub wetland, and herbaceous wetland. Table 3.8-2 lists the major vegetation types and area of each. Boundaries of the vegetation types were determined by inspections of a 2008 aerial photograph and verified by field observations. Planted pine comprises approximately 352 acres of the site and consists of pine plantations of various maturity levels. Hardwood forest comprises 104 acres. Pine-hardwood forest (an association in which the canopy of pine exceeds that of hardwoods) occupies approximately 337 acres of the power plant site. Hardwood-pine forest comprises approximately 101 acres of the site. Shrubland occupies approximately 92 acres. Pastures comprise 178 acres of power plant site. Existing gas pipeline corridor, road, residential/commercial development, ditch, stream, and pond occupy approximately 8.5, 27, 2, less than 0.5, less than 0.5, and 2 acres, respectively. Forested wetlands comprise approximately 331 acres. Shrub wetlands occur on approximately 76 acres. Herbaceous wetlands on the power plant site cover approximately 35.5 acres. No sensitive plant species (those listed by federal or state agencies as endangered, threatened, or rare) were observed on the power plant site. A description of the various vegetation communities observed onsite follows.

Table 3.8-2. Vegetation/Land Use Types Identified within the Power Plant Site

Land Use	Acres	Percent of Total
Planted pine	351.8	21.37
Hardwood forest	104.0	6.32
Pine-hardwood forest	336.7	20.46
Hardwood-pine forest	101.4	6.16
Shrubland	91.8	5.58
Pasture	178.0	10.81
Existing gas pipeline	8.5	0.52
Road	27.1	1.65
Commercial/residential	1.9	0.12
Stream	0.3	0.02
Ditch	0.08	0.00
Pond	2.1	0.13
Forested wetland	330.7	20.09
Shrub wetland	76.1	4.63
Herbaceous wetland	35.5	2.16
Total	**1,645.94**	**100.00**

Source: ECT, 2009.

Planted Pine

Planted pines, usually loblolly pine, comprise the majority of cover on the power plant site. Tracts of planted pine vary in age as well as the secondary cover. Recently harvested areas generally have sapling pines, but most of the cover is provided by thick natural regeneration of mixed hardwoods as well as shrub and herbaceous species and vines. Typical hardwoods present include tulip tree, red maple, sweetgum, winged elm, water oak, post oak, laurel oak, black locust, and hickories. Shortleaf pine, Hercules' club, and red cedar were frequent associates in these areas. Shrub cover included wax myrtle and various blueberries, including mayberry and farkleberry. Herbaceous cover and vines included bluestems, Japanese honeysuckle, ragweed, silkgrass, coral greenbrier, grape, witchgrasses, and panicgrasses.

Table 3.8-1. Plant Species Observed on the Lignite Mine Study Area and Power Generating Sites and Linear Facilities Corridors (Natural Gas Pipeline, Transmission Lines, and CO_2 Pipeline)

Scientific Name	Common Name
Trees	
Acer barbatum	Florida maple, southern sugar maple
Acer negundo	Box elder
Acer rubrum	Red maple
Acer saccharum	Sugar maple
Aesculus glabra	Ohio buckeye, horse chestnut
Aesculus pavia	Red buckeye
Albizia julibrissin	Silk tree, mimosa
Asimina triloba	Pawpaw
Betula nigra	River birch
Carpinus caroliniana	Blue beech, hornbeam, musclewood
Carya alba	Mockernut hickory
Carya aquatica	Water hickory
Carya cordiformis	Bitternut, swamp hickory
Carya glabra	Pignut hickory
Carya illinoinensis	Pecan
Carya ovata	Shagbark hickory
Catalpa bignonioides	Southern catalapa
Celtis laevigata	Sugarberry, hackberry
Cercis canadensis	Redbud
Cornus florida	Flowering dogwood
Crataegus marshallii	Parsley hawthorn
Diospyros virginiana	Persimmon
Fagus grandifolia	American beech
Fraxinus americana	White ash
Fraxinus pennsylvanica	Green ash
Gleditsia triacanthos	Honey locust
Ilex opaca	American holly, Christmas holly
Juniperus virginiana	Red cedar - eastern red cedar
Liquidambar styraciflua	Sweetgum
Liriodendron tulipifera	Yellow poplar -tulip tree
Magnolia acuminata	Cucumber tree
Magnolia grandiflora	Southern magnolia
Magnolia macrophylla	Bigleaf magnolia
Magnolia virginiana	Sweetbay
Malus sylvestris	Apple
Melia azedarach	Chinaberry
Morus rubra	Red mulberry
Nyssa aquatica	Water tupelo
Nyssa biflora	Swamp tupelo
Nyssa sylvatica	Black tupelo, black gum
Ostrya virginiana	Ironwood, hophornbeam
Oxydendrum arboreum	Sourwood
Persea borbonia	Red bay
Pinus echinata	Shortleaf pine
Pinus elliottii	Slash pine
Pinus palustris	Longleaf pine
Pinus taeda	Loblolly pine

Table 3.8-1. Plant Species Observed on the Lignite Mine Study Area and Power Generating Sites and Linear Facilities Corridors (Natural Gas Pipeline, Transmission Lines, and CO_2 Pipeline) (Continued, Page 2 of 10)

Scientific Name	Common Name
Planatus occidentalis	Sycamore, plane-tree
Populus deltoides	Poplar - eastern cottonwood
Prunus serotina	Black cherry
Pyrus calleryana	Callery pear
Quercus alba	White oak
Quercus coccinea	Scarlet oak
Quercus falcata	Southern red oak, Spanish oak
Quercus hemisphaerica	Darlington oak
Quercus incana	Bluejack oak
Quercus laurifolia	Laurel oak
Quercus lyrata	Overcup oak
Quercus margaretta	Sand postoak
Quercus marilandica	Blackjack oak
Quercus michauxii	Swamp chestnut oak
Quercus nigra	Water oak
Quercus pagoda	Cherrybark oak
Quercus phellos	Willow oak
Quercus rubra	Red oak
Quercus shumardii	Shumard oak
Quercus stellata	Post oak
Quercus velutina	Black oak
Robinia pseudoacacia	Black locust
Salix nigra	Black willow
Sassafras albidum	Sassafras
Taxodium distichum	Bald cypress
Tilia americana	American basswood
Triadeca sebifera	Chinese Tallow
Ulmus alata	Winged elm
Ulmus americana	American elm
Ulmus rubra	Red elm, slippery elm
Zanthoxylum clava-herculis	Hercules' club
<u>Shrubs</u>	
Alnus serrulata	Smooth alder
Amorpha fruticosa	False indigo, Indigo bush
Aralia spinosa	Hercules' club
Asimina parviflora	Smallflower pawpaw
Asimina triloba	Pawpaw
Baccharis halimifolia	Sea myrtle, groundsel bush
Callicarpa americana	American beautyberry, French mulberry
Cephalanthus occidentalis	Buttonbush
Cornus foemina	Stiff dogwood
Crataegus crus-galli	Cockspur hawthorne
Crataegus marshallii	Parsley hawthorne
Cyrilla racemiflora	Green titi
Euonymus americanus	Strawberry bush
Forestiera acuminata	Swamp privet
Hamamelis virginiana	Witch hazel
Hydrangea arborescens	Wild hydrangea

Table 3.8-1. Plant Species Observed on the Lignite Mine Study Area and Power Generating Sites and Linear Facilities Corridors (Natural Gas Pipeline, Transmission Lines, and CO_2 Pipeline) (Continued, Page 3 of 10)

Scientific Name	Common Name
Hydrangea quercifolia	Oakleaf hydrangea
Hypericum hypericoides	St. Andrew's cross
Ilex decidua	Possumhaw
Ilex glabra	Inkberry, bitter gallberry
Ilex vomitoria	Yaupon
Itea virginica	Virginia willow, sweetspire, tassel-white
Kalmia latifolia	Mountain laurel
Ligustrum sinensis	Chinese privet
Myrica cerifera	Wax myrtle, southern bayberry, candleberry
Poncirus trifoliata	Trifoliate orange
Prunus angustifolia	Chickasaw plum
Rhododendron sp.	Azalea
Rhododendron viscosum	Swamp azalea
Rhus copallinum	Dwarf or winged sumac
Rhus glabra	Smooth sumac
Rhus typhina	Staghorn sumac
Rosa caroliniana	Carolina rose
Rosa cf. virginiana	Virginia rose
Rosa multiflora	Multiflora rose
Rosa palustris	Swamp rose
Rubus argutus	Sawtooth blackberry
Rubus cuneifolius	Sand blackberry
Rubus flagellaris	Northern dewberry
Rubus trivialis	Southern dewberry
Sabal minor	Dwarf palmetto
Sambucus nigra ssp. *canadensis*	American black elderberry
Sesbania punicea	Purple rattlebox
Symplocos tinctoria	Common sweetleaf
Toxicodendron vernix	Poison Sumac
Vaccinium arboreum	Sparkleberry, farkleberry
Vaccinium corymbosum	Highbush blueberry
Vaccinium elliottii	Mayberry
Viburnum dentatum	Southern arrowwood
Viburnum nudum	Possomhaw viburnum
Viburnum sp.	Viburnum
Yucca aloifolia	Aloe yucca
Yucca filamentosa	Adam's needle
<u>Herbs</u>	
Adiantum pedatum	Northern maidenhair fern
Ageratum altissima	White snakeroot
Agrimonia pubescens	Soft agrimony
Agrostis scabra	Ticklegrass, fly-away grass
Agrostis spp.	Bent grasses
Allium canadense	Wild garlic
Alysicarpus vaginalis	White moneywort
Ambrosia artemisiifolia	Ragweed
Ambrosia trifida	Giant ragweed
Amphicarpaea bracteata	American hogpeanut

Table 3.8-1. Plant Species Observed on the Lignite Mine Study Area and Power Generating Sites and Linear Facilities Corridors (Natural Gas Pipeline, Transmission Lines, and CO_2 Pipeline) (Continued, Page 4 of 10)

Scientific Name	Common Name
Andropogon gerardii	Big Bluestem
Andropogon glomeratus	Bushy bluestem
Andropogon virginicus	Broomsedge bluestem
Apocynum cannabinum	Indian hemp
Arisaema dracontium	Green dragon
Arisaema triphyllum	Jack-in-the-pulpit, Indian turnip
Aristida sp.	Threeawn
Arnoglossum sp.	Indian plantain
Arundinaria gigantea	Giant cane
Arundinaria tecta	Switch cane
Asarum arifolium	Wild ginger
Asclepias perennis	Aquatic milkweed
Asclepias sp.	Milkweed
Asclepias tuberosa	Butterfly milkweed
Asplenium platyneuron	Ebony spleenword
Athyrium filix-femina	Common ladyfern
Avena sativa	Oats
Axonopus fissifolius	Common carpetgrass
Bidens bipinnata	Spanish needles
Bidens cernua	Nodding bur marigold
Boehmeria cylindrica	Falsenettle, small spice
Botrychium virginianum	Rattlesnake fern
Canna flaccida	Golden canna
Carex crus-corvi	Ravenfoot sedge
Carex glaucescens	Southern waxy sedge
Carex longii	Greenish-white sedge
Carex lupulina	Hop sedge
Carex sp.	Sedge
Carex stricta	Tussock sedge, Uptight Sedge
Chamaecrista nictitans	Sensitive partridge pea
Chasmanthium latifolium	Indian wood
Chasmanthium laxum	Slender woodoats
Chasmanthium sessiliflorum	Wild oats
Chrysopsis mariana	Maryland golden aster
Cirsium arvense	Canada thistle
Commelina virginica	Virginia dayflower
Conoclinium coelestinum	Blue mistflower
Conyza canadensis	Canadian horseweed
Coreopsis major	Greater tickseed
Coronilla varia	Crownvetch
Croton glandulosus	Venteconmigo
Croton michauxii	Michaux’s croton
Cuphea carthagenensis	Colombian waxweed
Cynodon dactylon	Bermuda grass
Cyperus croceus	Baldwin flatsedge
Cyperus distinctus	Swamp flatsedge
Cyperus odoratus	Rusty flatsedge
Cyperus polystachyos	Manyspike flatsedge

Table 3.8-1. Plant Species Observed on the Lignite Mine Study Area and Power Generating Sites and Linear Facilities Corridors (Natural Gas Pipeline, Transmission Lines, and CO_2 Pipeline) (Continued, Page 5 of 10)

Scientific Name	Common Name
Cyperus pseudovegetatus	Marsh flatsedge
Cyperus retrorsus	Retrorse flatsedge
Dalea purpurea	Purple prairie clover
Desmodium paniculatum	Panicled leaf ticktrefoil
Dichanthelium aciculare	Needleleaf rosette
Dichanthelium commutatum	Witchgrass
Dichanthelium dichotomum	Cypress witchgrass
Dichanthelium laxiflorum	Laxflower witchgrass
Dichanthelium scabriusculum	Wooly panic grass
Dichanthelium scoparium	Velvet panicum
Dichanthelium spp.	Witchgrasses
Digitaria ciliaris	Southern crabgrass
Digitaria serotina	Dwarf crabgrass
Diodia teres	Poor Joe
Diodia virginiana	Buttonweed
Dioscorea quaternata	Fourleaf yam
Dryopteris ludoviciana	Southern woodfern
Dulichium arundinaceum	Threeway sedge
Echinochloa colona	Jungle rice
Echinochloa crus-galli	Barnyardgrass
Eclipta prostrata	False daisy
Eleocharis baldwinii	Baldwin’s spikerush
Eleocharis sp.	Spikerush
Eleocharis tuberculosa	Cone-cup spikerush
Elephantopus caroliniana	Carolina elephants foot
Elephantopus tomentosus	Devil’s grandmother
Elymus canadensis	Canada wild rye
Eragrostis sp.	Lovegrass
Erechtites hieracifolia	American burnweed
Eremochloa ophiuroides	Centipede grass
Erigeron annuus	Eastern daisy fleabane
Eryngium yuccifolium	Rattlesnake master, button snake-root
Eupatorium capillifolium	Dogfennel
Eupatorium compositifolium	Yankeeweed
Eupatorium fistulosum	Joe-pye weed
Eupatorium mohrii	Mohr’s thoroughwort
Eupatorium perfoliatum	Boneset
Eupatorium purpureum	Joe-pye weed
Eupatorium rotundifolium	Roundleaf thoroughwort
Eupatorium serotinum	Lateflowering thoroughwort
Euphorbia corollata	Flowering spurge
Euphorbia pubentissima	False flowering spurge
Eurybia divaricata	White wood aster
Euthamia graminifolia	Lance-leaved goldenrod
Fimbristylis autumnalis	Slender fimbry
Gaillardia aestivalis	Turner Winkler’s blanket flower
Galactia sp.	Milkpea
Galium aparine	Stickywilly

Table 3.8-1. Plant Species Observed on the Lignite Mine Study Area and Power Generating Sites and Linear Facilities Corridors (Natural Gas Pipeline, Transmission Lines, and CO_2 Pipeline) (Continued, Page 6 of 10)

Scientific Name	Common Name
Galium circaezans	Licorice bedstraw
Galium tinctorium	Stiff marsh bedstraw
Geranium carolinianum	Carolina geranium
Glandularia canadensis	Rose vervain, sweet william
Galium obtusum	Bluntleaf bedstraw
Helenium amarum	Spanish daisy
Helenium autumnale	Common sneezeweed
Helianthus angustifolium	Swamp sunflower
Helianthus annuus	Sunflower
Helianthus mollis	Ashy sunflower
Helianthus simulans	Muck sunflower
Hexastylis arifolia	Little brown jug
Hydrocotyle umbellate	Manyflower marshpennywort
Hylodesmum nudiflorum	Naked flower ticktrefoil
Hypericum gentianoides	Orangegrass
Hypericum mutilum	Dwarf St. Johnswort
Impatiens capensis	Jewelweed
Imperata cylindrica	Cogongrass
Ipomoea sp.	Morning glory
Iris verna	Dwarf violet iris
Iris virginica	Virginia blueflag
Jacquemontia tamnifolia	Hairy clustervine
Juncus biflorus	Bog rush
Juncus canadensis	Canadian rush
Juncus cf. torreyi	Torrey’s rush
Juncus coriaceus	Leathery rush
Juncus dichotomus	Forked rush
Juncus effusus	Soft rush
Juncus marginatus	Grassleaf rush
Juncus polycephalus	Manyhead rush
Juncus tenuis	Slender rush
Kummmerowia striata	Japanese clover
Kyllinga brevifolia	Shortleaf spikesedge
Kyllinga odorata	Fragrant spikesedge
Lactuca floridana	Woodland lettuce
Leersia hexandra	Southern cutgrass
Leersia oryzoides	Rice cut grass
Leersia virginica	Whitegrass
Lespedeza cuneata	Sericea lespedeza
Lerspedeza sp.	Lespedeza
Lespedeza stipulacea	Korean clover
Liatris spicata	Dense blazing star
Lilium michauxii	Carolina lily
Lobelia cardinalis	Cardinalflower
Lobelia sp.	Lobelia
Lolium perenne	Perrennial ryegrass
Ludwigia decurrens	Wingleaf primrosewillow
Ludwigia linifolia	Southeastern primrosewillow

Table 3.8-1. Plant Species Observed on the Lignite Mine Study Area and Power Generating Sites and Linear Facilities Corridors (Natural Gas Pipeline, Transmission Lines, and CO_2 Pipeline) (Continued, Page 7 of 10)

Scientific Name	Common Name
Ludwigia microcarpa	Smallfruit primrosewillow
Ludwigia octovalvis	Mexican primrosewillow
Ludwigia palustris	Marsh seedbox
Luziola fluitans	Southern watergrass
Lycopus rubellus	Taperleaf water horehound
Macrothelypteris torresiana	Swordfern
Maianthemum racemosum	False Solomon's seal, false spikenard
Mecardonia acuminata	Axilflower
Medicago lupulina	Black medick
Micranthemum umbrosum	Baby tears
Microstegia vimineum	Nepalese browntop
Mitchella repens	Partridge berry
Monarda fistulosa	Wild bergamot, horsemint, beebalm
Muhlenbergia capillaris	Gulf muhly, hair grass
Neptunia pubescens	Puff
Nuttallanthus canadensis	Canada toadflax
Oenothera biennis	Common evening primrose
Onoclea sensibilis	Sensitive fern, bead fern
Oplismenus hirtellus	Basketgrass
Opuntia humifusa	Prickly pear
Osmunda cinnamomea	Cinnamon fern
Osmunda regalis	Royal fern
Oxalis corniculata	Creeping woodsorrel
Oxalis stricta	Wood sorrel
Panicum anceps	Beaked panicgrass
Panicum rigidulum	Redtop panicum
Panicum verrucosum	Warty panic grass
Panicum virgatum	Switchgrass
Paspalum dilatatum	Dallisgrass
Paspalulm sp.	Paspalum, crowngrass
Paspalum notatum	Bahiagrass
Paspalum urvillei	Vasey's grass
Phanopyrum gymnocarpon	Savannah panicgrass
Phegopteris hexagonoptera	Broad beechfern
Phryma leptostachya	Lopseed
Phyllanthus urinaria	Chamber bitter
Phytolacca americana	Pokeweed
Pilea pumila	Canadian clearweed
Pityopsis graminifolia	Narrowleaf silkgrass
Plantago aristata	Largebracted plantain
Plantago lanceolata	Narrowleaf plantain
Podophyllum peltatum	Mayapple
Polygala cruciata	Drumheads
Polygala incarnata	Procession flower
Polygonatum biflorum	Solomon's seal
Polygonum cespitosum	Oriental lady's thumb
Polygonum densiflorum	Denseflower knotweed
Polygonum hydropiper	Marshpepper knotweed

Table 3.8-1. Plant Species Observed on the Lignite Mine Study Area and Power Generating Sites and Linear Facilities Corridors (Natural Gas Pipeline, Transmission Lines, and CO_2 Pipeline) (Continued, Page 8 of 10)

Scientific Name	Common Name
Polygonum hydropiperoides	Swamp smartweed
Polygonum pennsylvanicum	Pennsylvania smartweed
Polygonum punctatum	Dotted smartweed
Polypremum procumbens	Juniperleaf
Polystichum acrostichoides	Christmas fern
Potamogeton sp.	Pondweed
Prenanthes altissima	Tall white lettuce
Prunella vulgaris	Common selfheal
Pseudognaphalium obtusifolium	Rabbit tobacco
Pteridium aquilinum	Bracken fern
Pterocaulon virgatum	Blackroot
Ranunculus sardous	Hairy buttercup
Rhexia alifanus	Savannah meadowbeauty
Rhexia mariana	Maryland meadow beauty
Rhexia sp.	Meadowbeauty
Rhexia virginica	Meadow beauty
Rhynchosia minima	Least snoutbean
Rhynchospora corniculata	Short bristle beakrush
Rhynchospora spp.	Beakrushes
Rudbeckia fulgida	Orange coneflower
Rudbeckia hirta	Black-eyed Susan
Rudbeckia laciniata	Cut-leaf coneflower
Ruellia caroliniensis	Carolina wild petunia
Ruellia humilis	Wild petunia
Rumex pulcher	Fiddle dock
Sabatia grandiflora	Large-flower rose-gentian
Saccharum giganteum	Sugarcane plume grass
Sagittaria latifolia	Broadleaf arrowhead
Salvia lyrata	Cancer weed, lyre-leaf sage
Sanguinaria canadensis	Bloodroot
Sanicula canadensis	Canadian blacksnakeroot
Saururus cernuus	Lizard’s tail
Schedonorus phoenix	Tall fescue
Schedonorus pratensis	Meadow fescue
Schizachyrium scoparium	Little bluestem
Scirpus atrovirens	Green bulrush
Scirpus cyperinus	Woolgrass
Scleria sp.	Nutrush
Scutellaria integrifolia	Helmut flower
Senna obtusifolia	Java-bean
Setaria lutea	Foxtail knotroot
Setaria parviflora	Marsh bristlegrass
Solanum carolinense	Carolina horsenettle
Solanum viarum	Tropical soda apple
Solidago altissima	Tall goldenrod
Solidago bicolor	Silverrod
Solidago caesia	Woodland goldenrod
Solidago canadensis	Canada goldenrod, meadow goldenrod

Table 3.8-1. Plant Species Observed on the Lignite Mine Study Area and Power Generating Sites and Linear Facilities Corridors (Natural Gas Pipeline, Transmission Lines, and CO_2 Pipeline) (Continued, Page 9 of 10)

Scientific Name	Common Name
Solidago gigantea	Late goldenrod
Solidago odora	Anise scent goldenrod
Solidago rugosa	Rough-leaved goldenrod
Solidago sp.	Goldenrod
Sonchus asper	Spiny sowthistle
Sonchus oleraceus	Common sowthistle
Sparganium americanum	American burwood
Sphagnum sp.	Sphagnum moss
Spiranthes vernalis	Spring lady’s tresses
Sporobolus compositus	Tall dropseed
Sporobolus indicus	West Indian dropseed
Strophostyles helvoa	Amerique-bean
Symphyotrichum concolor	Eastern silver aster
Symphyotrichum ericoides	Heath aster, white wreath aster
Symphyotrichum laeva	Smooth blue aster
Symphyotrichum lateriflorum	Small white aster
Symphyotrichum pilosus	Frost aster
Tephrosia spicata	Spiked hoary pea
Tephrosia virginiana	Goat’s rue
Thelypteris kunthii	Southern shield fern, wood fern, river fern
Thelypteris noveboracensis	New York fern, tapering fern
Tovara virginiana	Jumpseed
Trifolium pratense	Red clover
Trifolium repens	White clover
Triodanus perfoliata	Venus’ looking glass, clasp leaf
Tripsacum dactyloides	Eastern gama grass
Triticum aestivum	Wheat
Typha domingensis	Southern cattail
Typha latifolia	Cattail
Uvularia grandiflora	Bellword, merrybells
Uvularia sessilifolia	Wildcats, merrybells
Verbena brasiliensis	Brazilian vervain
Verbena hastata	Blue vervain
Verbena rigida	Tuberous vervain
Verbena scabra	Sandpaper vervain
Verbesina alternifolia	Wingstem
Vernonia gigantea	Giant ironweed
Viola soraria	Common blue violet, meadow violet
Viola spp.	Violets
Viola walteri	Prostrate blue violet
Woodwardia areolata	Netted chain fern
Woodwardia virginica	Virginia chainfern
Xanthium strumarium	Rough cocklebur
Zornia bracteata	Viperina
<u>Vines</u>	
Ampelopsis arborea	Peppervine
Apios americana	Groundnut
Berchemia scandens	Alabama supplejack

Table 3.8-1. Plant Species Observed on the Lignite Mine Study Area and Power Generating Sites and Linear Facilities Corridors (Natural Gas Pipeline, Transmission Lines, and CO_2 Pipeline) (Continued, Page 10 of 10)

Scientific Name	Common Name
Bignonia capreolata	Cross vine
Brunnichia ovata	American buckwheat vine
Campsis radicans	Trmpet creeper, trumpet vine
Clematis virginiana	Virgin's bower
Decumaria barbara	Woodvamp
Gelsemium sempervirens	Yellow jessamine, Carolina jessmine
Ipomoea sp.	Morning glory
Lonicera japonica	Japanese honeysuckle
Lygodium japonicum	Japanese climbing fern
Matelea cf gonocarpas	Angularfruit milkvine
Menispermum canadense	Common moonseed
Mikania scandens	Climbing hempvine
Parthenocissus quinquefolia	Virginia creeper
Passiflora incarnata	Passion flower, maypop
Passiflora lutea	Yellow passion flower
Pueraria montana	Kudzu
Rhynchosia minima	Least snoutbean
Smilax auriculata	Earleaf greenbriar
Smilax bona-nox	Saw greenbriar
Smilax glauca	Cat greenbriar
Smilax laurifolia	Laurel greenbrian
Smilax pumila	Sassparilla vine
Smilax rotundifolia	Bullbrier
Smilax smallii	Lanceleaf greenbriar - jackson vine
Smilax walteri	Coral greenbriar
Toxicodendron radicans	Eastern poison ivy
Trachelospermum difforme	Climbing dogbane
Vicia sp.	Vetch
Vitis aestivalis	Summer grape
Vitis palmata	Catbird grape
Vitis riparia	Riverbank grape
Vitus rotundifolia	Muscadine grape
Wisteria sinensis	Chinese wisteria

Sources: NACC, 2009.
ECT, 2009.

In medium-aged pine tracts, most have not been maintained and have subcanopy/shrub layers consisting of mixed hardwoods, with little herbaceous cover due to the density of shade. A small number of medium-aged pine tracts have no shrub layer and have been seeded with bahiagrass to stabilize the soils. These pine areas are also used as pasture.

Mature pine tracts display widely spaced pines, probably due to thinning. Most have a subcanopy of tulip trees and other hardwoods but are generally clear of shrubs and had negligible herbaceous cover. Within the tracts of pines are irregularly shaped food plots to attract and support wildlife, primarily white-tailed deer and turkey. Typical planted species in the food plots include timothy, oats, fescue, red clover, crownvetch, wheat, clover, and bahiagrass. Deer stands and hunters' shacks are common wherever food plots are present.

Hardwood Forest

Second-growth hardwood forest occurs along drainages where topographic features such as steep terrain and gullying make pine production and pasturage unfeasible. These forested tracts vary in width and length according to topography of the drainage. Typical trees along these streams include laurel oak, water oak, swamp chestnut oak, sweetgum, red maple, bigleaf magnolia, hickory, sugarberry, American beech, American holly, red mulberry, shortleaf pine, tulip tree, winged elm, and slippery elm. Black willow was noted growing in and along the streams.

Shrub cover varies from negligible to moderate and is composed of wax myrtle, Chinese privet (invasive species), beautyberry, swamp rose, and farkleberry. Typical vines observed include poison ivy, coral greenbrier, and various grapes.

Herbaceous species in the areas include scattered wildginger, little brown jug, Christmas fern, prostrate blue violet, giant cane, sedge, and woodoats. Low, moist to wet areas support netted chainfern and various sedges and beakrushes.

Pine-Hardwood Forest

Pine-hardwood forest describes those areas where various pines (usually loblolly but some shortleaf) comprise at least 60 percent cover in a forested community. This designation also describes those areas where the pine appears to have been or likely will be harvested. These areas do not appear to be actively maintained, and the hardwood component has been allowed to mature. Areas of pine-hardwood forest occurred in the central portion and southeast corner of the power plant site.

Pine-hardwood forests on the site were of intermediate to mature age. These areas were characterized by a distinct, usually closed canopy, discernable subcanopy in more mature forests, locally thick-to-sparse shrub layer, and generally sparse herbaceous layer. Trees in the intermediate-aged pine-hardwood areas averaged 50 to 80 ft tall and 1 to 2 ft in diameter at breast height (dbh), while the trees in the more mature pine-hardwood average 80 to 90 ft in height and 3 to 4 ft dbh.

Tree species noted in the pine-hardwood forests include red maple, sweetgum, mockernut hickory, pignut hickory, shagbark hickory, bitternut, loblolly pine, shortleaf pine, redbud, flowering dogwood, persimmon, blackgum, black cherry, tulip tree, scarlet oak, bluejack oak, white oak, southern red oak, willow oak, black oak, water oak, and winged elm. Shrubs found in the pine-hardwood areas include Hercules' club, beautyberry, St. Andrew's cross, wax myrtle, dwarf sumac, smooth sumac serrate-leaf blackberry, sand blackberry, southern dewberry, sparkleberry, mayberry, red buckeye, northern dewberry, and sassafras. Common vines occurring in the pine-hardwood association include Alabama supplejack, cross vine, trumpet creeper, yellow jessamine, Japanese honeysuckle, Virginia creeper, cat greenbriar, and muscadine grape. Herbaceous species seen include jack-in-the-pulpit, green dragon, little brown jug, variable panicgrass, slender woodoats, violet, Christmas fern, Canadian blacksnakeroot, basketgrass, mayapple, and giant cane.

Hardwood-Pine Forest

Hardwood-pine forests are similar in physiognomy and species composition as described for pine-hardwood forest. The distinguishing feature is that hardwoods dominate the canopy instead of pines.

Shrubland

The shrubland classification describes those areas that have been cleared of forest cover and have become dominated by a variety of shrubs and weedy herbs. Typical vegetation includes saplings of loblolly pine, red maple, sweetgum, shagbark hickory, redbud, flowering dogwood, persimmon, blackgum, black cherry, tulip tree, scarlet oak, bluejack oak, white oak, southern red oak, willow oak, southern red oak, water oak, and winged elm. Commonly observed shrubs include wax myrtle, sea myrtle, Chinese privet (invasive), winged sumac, serrate-leaf blackberry, sand blackberry, and dewberries. The herb flora is generally comprised of a variety of opportunistic species (weeds) including bahiagrass, fescue, broomsedge, little bluestem, threeawn, and Spanish needles, among numerous others.

Pasture/Hayfield

Pastureland is present in the northwestern section of the power plant site and east of MS 493. These areas are dominated by planted grasses, primarily bahiagrass and fescue, with various native grasses and forbs. The pastures are maintained by grazing, and the quality of the pastures indicates regular maintenance; the pastures east of MS 493 appear to be maintained more for wildlife usage than cattle. Aerial imagery shows hay bales in some of the pastures indicating dual functions for the land.

Existing Gas Pipeline Corridor

The existing natural gas pipeline corridor runs in a northerly/southerly direction and vertically crosses the power plant site roughly in the middle. This corridor is cleared of native vegetation and periodically maintained.

This land use designation describes those areas in which forests have been cleared and which are periodically maintained for use as gas pipeline rights-of-way. The resulting plant communities are typically shrub- or herb-dominated or a combination of both. Sapling tree species noted within the corridor include saplings or seedlings of loblolly pine, red maple, sweetgum, box elder, American beech, and a variety of other tree species. Common shrubs include wax myrtle, sea myrtle, Chinese privet (invasive), winged sumac, serrate-leaf blackberry, sand blackberry, and southern dewberry. Herbs include bahiagrass, bent grasses, fescue, ragweed, broomsedge bluestem, sensitive partridge pea, Canada thistle, Canadian horseweed, flatsedges, southern crabgrass, poor Joe, eastern daisy fleabane, dog fennel, common sneezeweed, Japanese clover, woodland lettuce, sericea lespedeza, Korean clover, black medic, Canada toadflax, wood sorrel, pokeweed, rabbit tobacco, bracken fern, Carolina horsenettle, Goldenrods, and spiny sowthistle.

Road

The road land use classification is used to describe all roads or possible trails within the power plant site including logging roads, gravel/clay roads, and paved roads. Any vegetation is on the sides of roads and usually consists of a variety of weedy herbaceous species or mowed roadsides dominated by grasses.

Commercial/Residential Development

This designation identifies those areas within the study area in which active or abandoned residential or commercial structures or associated facilities (barns, parking lots, garages, etc.) were observed. Generally, any vegetation is ruderal or consists of landscape plants or lawn grasses.

Stream

Natural streams and drainages vary in size from narrow, extremely shallow seasonal, or intermittent drainages often only several feet wide and less than 0.5 ft deep that drain or connect wetland areas. A typical drainage is a meandering stream 6 to 8 ft deep, 15 to 20 ft wide, with a single confined channel and vertical to slightly sloping banks. Water depth and flow varied considerably at the time of the survey. Many streams were not flowing at the time of the field survey, and any water in the stream consisted of a series of isolated pools of varying depths. Most of the drainages support little or no wetland vegetation. This is due primarily to the fact that most streams and drainages are heavily shaded by overhanging upland vegetation or logging debris that has been placed in the flowway. Another reason for the lack of wetland vegetation in channels is likely due to scouring of the bottom and sides of the flowways, discouraging the establishment of wetland plants. Wetland vegetation along streams and drainages is usually encountered at the edges of a drainage ditch exposed to full sun or in light shade with very low or gentle flow and along streams where sediment deposition as bars or levees has allowed vegetation to establish. Wetland vegetation was also noted along streams that flowed through or are bordered by wetland areas.

Species noted along edges and/or sides of stream banks were largely herbaceous. Species noted included dotted smartweed, climbing hempvine, shade mudflower, southern cutgrass, rushes, sedges, and woolgrass.

Ditch

Ditches vary from roadside drainages 6 to 10 ft wide and 1 to 2 ft deep with gentle sloping banks to ditches that were constructed for drainage within planted pine areas that are 4 to 5 ft wide and 6 inches or more deep with almost vertical slopes.

Nonroadside ditches are generally overshadowed by thick trees, shrubs, and vines. Consequently, the ditches support little, if any, wetland vegetation. Most of the roadside ditches support a variety wetland and transitional, primarily herbaceous species including unidentified grasses, sedges, rushes, broadleaf cattail, and woolgrass. Black willow grows in several ditches.

Pond

Several ponds are located within the plant site boundaries. They are dominated by soft rush, grassleaf rush, and seedbox. Most ponds have steep sides and little shallow edge to allow wetland vegetation to establish.

Forested Wetland

Native forests are present along drainages where wetness and flooding make pine production and pasturage unfeasible. These forested tracts vary in width and length according to topography of the drainage. Typical trees along the streams include sweetbay magnolia, swamp tupelo gum, water hickory, tuliptree, cherrybark oak, post oak, laurel oak, water oak, swamp chestnut oak, willow oak, white oak, green ash, bald cypress, sweetgum, black willow, red maple, bigleaf magnolia, hickory, sugarberry, winged elm, and slippery elm. American sycamore was also occasionally encountered, but this species was typically restricted to natural elevated sand levees along streams and creeks. American holly was a common midstory canopy tree species. Shrub cover varies from negligible to moderate and, depending on microtopography, is composed of wax myrtle, hardy orange, Chinese privet (invasive), beautyberry, swamp rose, St. Andrew's cross, bursting heart, farkleberry, and Elliot's blueberry. Ground cover frequently includes poison ivy, greenbrier, various grapes, woodoats, netted chainfern, Alabama supplejack, climbing dogbane, and various *Carex* and *Rhynchospora* species. Other frequently encountered herbaceous forb taxa include green dragon, jack-in-the pulpit, and jewelweed. Lizard's tail was found in wetter areas.

Shrub Wetlands

This community type has resulted from past clearing practices where trees in forested wetlands have been removed or have developed in areas where the surface has been scraped. At present, only sapling trees (especially loblolly pine and red maple) generally less than 4 inches dbh are present in association with serrate-leaf blackberry, resulting in a usually dense shrub stratum. Wetland herbs are conspicuous (usually weedy in nature), and density varies with the shrub cover. Common herbs occurring in these wetlands include sensitive fern, cypress witchgrass, cattail, soft rush, and sedge.

Herbaceous Wetland

Two small marshes are present on the power plant site. They are dominated by pasture grasses, as well as soft rush, grassleaf rush, and marsh seedbox. At the time of the field survey, the southeastern part of the site had been recently mowed as part of a pasture/hayfield.

3.8.2.2 Wildlife

The variety of plant communities on the proposed power plant site provides a number of wildlife habitats that would be used by terrestrial species. Terrestrial habitat types include mature hardwood/pine forests critical for larger mammals and birds requiring larger tracts of land, streams/wetlands important for amphibians, and pasture/cutover areas that would be used by ground nesting/foraging birds, small mammals, and reptiles.

ECT personnel conducted wildlife surveys of the power plant site in May 2008 and then again in October 2008 to characterize the dominant wildlife species using the site. The surveys were conducted throughout the day, including predawn to mid-morning, late afternoon through evening, and early night. Daytime surveys focused on birds and evidence of wildlife (i.e., tracks, scat, burrows). Early morning and evening surveys focused on birds, wildlife calls, and visual observations of animals. Table 3.8-3 provides the survey results.

The species identified all represent common wildlife species expected in the onsite habitats and in this region of Mississippi. No unusual wildlife observations were made.

Table 3.8-3. Wildlife Species Observed on the Power Plant Site (May and October 2008)

Common Name	Scientific Name	Evidence	Direct Observation
Amphibians			
Southern leopard frog	*Rana spherocephala*		✓
Reptiles			
Green anole	*Anolis carolinensis*		✓
Ground skink	*Scincella lateralis*		✓
Eastern box turtle	*Terrapene carolina*		✓
Common Garter snake	*Thamnophis sirtalis*		✓
Spotted kingsnake	*Lampropeltis getulus*		✓
Florida cottonmouth	*Agkistrodon piscivorus conanti*		✓
Birds			
Black vulture	*Coragyps atratus*		✓
Turkey vulture	*Cathartes aura*		✓
Sharp-shinned hawk	*Accipiter striatus*		✓
Red-shouldered hawk	*Buteo lineatus*	Calls, nest	
Wild turkey	*Meleagris gallopavo*	Tracks, calls	
Mourning dove	*Zenaida macroura*	Calls	✓
Yellow-billed cuckoo	*Coccyzus americanus*	Calls	✓
Common nighthawk	*Chordeiles minor*	Calls	✓
Whip-poor-will	*Caprimulgus vociferus*	Calls	
Ruby-throated hummingbird	*Archilochus colubris*		✓
Red-headed woodpecker	*Melanerpes erythrocephalus*		✓
Red-bellied woodpecker	*Melanerpes carolinus*		✓
Hairy woodpecker	*Picoides villosus*		✓
Downy woodpecker	*Picoides pubescens*		✓
Yellow-bellied sapsucker	*Sphyrapicus varius*	Feeding holes	
Loggerhead shrike	*Lanius ludovicianus*		✓
Yellow-throated vireo	*Vireo flavifrons*		✓
Blue jay	*Cyanocitta cristata*	Calls	✓
American crow	*Corvus brachyrhynchos*		✓
Carolina chickadee	*Parus carolinensis*	Calls	✓
Carolina wren	*Thryothorus ludovicianus*	Calls	
Bluegray gnatcatcher	*Polioptila caerulea*	Calls	✓
Gray catbird	*Dumetella carolinensis*		✓
Pine warbler	*Dendroica pinus*		✓
Prothonotary warbler	*Protonotaria citrea*		✓
Hooded warbler	*Wilsonia citrina*		✓
Northern parula	*Parula americana*		✓
Summer tanagers	*Piranga rubra*		✓
Northern cardinal	*Cardinalis cardinalis*	Calls	✓
Rufous-sided towhee	*Pipilo erythrophthalmus*	Calls	✓
Mammals			
Eastern gray squirrel	*Sciurus carolinensis*		✓
Striped Skunk	*Mephitis mephitis*	Tracks	
Opossum	*Didelphis virginiana*	Tracks	
Raccoon	*Procyon lotor*	Tracks, scat	
Nine-banded armadillo	*Dasypus novemcinctus*	Foraging holes	✓
Beaver	*Castor canadensis*	Dams	
Eastern cottontail	*Sylvilagus floridanus*	Tracks, scat	✓
Coyote	*Canis latrans*	Tracks, scat	✓
Bobcat	*Felis rufus*	Tracks	
White-tailed deer	*Odocoileus virginianus*	Tracks, scat	✓

Source: ECT, 2008.

The site has been logged and is currently used by hunters as numerous deer stands and planted food plots were present. White-tailed deer, turkey, and, to a lesser extent, eastern cottontail and gray squirrel were commonly observed game animals.

Wetlands, watercourses, and floodplain habitats onsite support typical species such as the southern leopard frog, cottonmouth, red-shouldered hawk, red-bellied woodpecker, prothonotory warbler, beaver, raccoon, and white-tailed deer.

Upland cutover forests and pine plantations support such typical species as eastern box turtle, common garter snake, blue jay, Carolina wren, northern cardinal, gray catbird, hairy woodpecker, American crow, vultures, sharp-shinned hawk, redheaded woodpecker, rufous-sided towhee, armadillo, bobcat, coyote, opossum, striped skunk, and white-tailed deer.

Slope forests tend to support typical wildlife species such as ground skink, bluegray gnatcatcher, blue jay, Carolina chickadee, American crow, vultures, red-shouldered hawk, summer tanagers, wild turkey, yellow-billed cuckoo, yellow-bellied sapsucker, eastern gray squirrel, opossum, striped skunk, and white-tailed deer.

Open pastures or recently cutover pine areas harbor species such as eastern box turtle, loggerhead shrike, mourning dove, common nighthawk, American crow, ruby-throated hummingbird, rufous-sided towhee, eastern cottontail, and white-tailed deer.

3.8.2.3 Threatened and Endangered Species

Vegetation

Species of federal concern include those listed as threatened or endangered by USFWS under the authority of the Endangered Species Act of 1973 (ESA), as amended. Plant and animal species of state concern are those identified on the special plant and animal lists maintained by the Mississippi Natural Heritage Program (MNHP) (2003). MNHP lists 21 plant species as species of special concern for Kemper County. One plant, Price's potato bean, is federally listed as threatened by USFWS. No threatened or endangered plant species or state species of special concern were observed on the proposed power plant site. Price's potato bean was actively sought since there is an occurrence record for Kemper County. This plant is most often found in open woods and along woodland edges in limestone areas, typically where bluffs are adjacent to creek or river bottoms. But, some populations have been found on roadsides or transmission line rights-of-way. Although roadside habitat exists onsite and the plant has the potential to occur, none were found.

Wildlife

Vittor was originally contracted by Mississippi Power to perform threatened and endangered species surveys for the Kemper County power plant site in 2007. Vittor conducted their assessments in March and October 2007, and their survey reports are included as Appendix E. Vittor's reports concluded that no listed wildlife species occurred on the site nor were any likely to occur based on known ranges and habitat types present. Additionally, Vittor's report did not find the site to be critical for the breeding, nesting, or resting habitats of birds protected under the Migratory Bird Treaty Act. ECT's survey of the site agreed with that finding.

At the beginning of the current study efforts, ECT requested from Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) a listing of known or potentially occurring listed species for the Kemper County site. MDWFP's reply to ECT's data request for listed species in Kemper and Lauderdale Counties is included as

Appendix F. USFWS's Mississippi field office was also contacted about the project, and guidance from them was received regarding federally listed species potentially occurring in the project area. Table 3.8-4 lists the species identified by MDWFP and USFWS and an assessment of their likelihood of occurrence onsite. The only listed wildlife species observed onsite was one individual sharp-shinned hawk. This species is currently listed as state critically imperiled (breeding only).

Table 3.8-4. Potential for Occurrence of Listed Wildlife Species on the Power Plant Site

Common Name	Scientific Name	Federal Status*	State Status*	Likelihood of Occurrence/Comments
Lagniappe crayfish	*Procambus lagniappe*	—	S1	Unlikely—Limited range in Sucarnoochee watershed only
Sharp-shinned hawk	*Accipiter striatus*	—	S1B	One individual observed on northwest portion of site
American black duck	*Anas rubripes*	—	S2N	Low—Open water habitat lacking
Rusty blackbird	*Euphagus carolinensis*	—	S2N	Low—Potential minimal habitat available in floodplains
Red-cockaded woodpecker	*Picoides borealis*	E	E (S1)	Low—Mature pine stands lacking onsite
Old field mouse	*Peromyscus polionotus*	—	S2, S3	Low—Prefers sandy open habitats, generally lacking onsite

* E = endangered.
S1 = critically imperiled because of rarity (5 or fewer occurrences).
S2 = imperiled (6 to 20 occurrences).
S3 = rare or uncommon (21 to 100 occurrences).
B = breeding status.
N = nonbreeding status.

Source: ECT, 2008.

3.8.3 MINE STUDY AREA

3.8.3.1 Vegetation

Historically, the majority of the study area property would have been dominated by an upland mixed hardwood forest community based on the presence of remnant vegetation. Areas along the floodplain of Chickasawhay Creek would have consisted of bottomland hardwood forest. Hardwoods still dominate the banks of the larger creeks and floodplain areas.

Typical for the region, a large portion of the project site is now currently managed for pine timber production and has been heavily impacted through logging activities. Conversion of hardwood and mixed stand types to pure stands of pine is a common land practice in the proposed mine study area. Large stands of similarly aged loblolly pine monoculture are found throughout the area. In areas where planted pines are tightly rowed, low biomass, undesirable species composition, and low species diversity among herbaceous and shrub layer plant species were noted.

Clearcut areas are also common throughout the study area. Many of these clearcuts are regenerating with young sweetgum, water oak, and wax myrtle. Herbaceous and groundcover species present in this clearcut area include broomsedge, sawtooth blackberry, and slender woodoats.

Pastureland was one of the most common terrestrial community types observed during surveys. Pasture is maintained in many areas throughout the mine study area for the purpose of feeding livestock.

Similar to the plant site discussed previously, the following community types occur in the mine study area: planted pine, hardwood forest, hardwood-pine forest, pine-hardwood forest, shrubland, pasture, roads, forested wetland, shrub wetland, and herbaceous wetland. The community types listed for the power plant site have similar vegetation associations. The detailed description of the plant site vegetative communities (Subsection 3.8.2.1) is applicable for communities found on the mine study area.

At the mine study area, the most prevalent terrestrial community or land use types observed were pine plantation, mixed oak-hickory-pine forest, bottomland hardwood forest, clearcut forest, and pastureland. The diversity of community types in the area provides habitat for a variety of wildlife species. Though most communities are similar to those seen on the plant site, some are different enough to warrant additional description. These are as follows.

Bottomland Hardwood Forest

Bottomland hardwood forests within the mine study area are found in the floodplains of creeks and near the confluence of large creeks. Mature bottomland forests in the study area typically exhibit a diverse composition of tree species. These forests provide corridors that are crucial to the movement of wildlife species. This community type also provides den and roost locations for birds, bats, and mammals. Ecologists observed some relatively large and contiguous bottomland hardwood communities associated with Chickasawhay, Penders, and Okatibbee Creeks; however, many of these bottomland forests have been altered by past storm damage (including Hurricane Katrina) and human activities such as logging, road construction, and artificial impoundments.

Clearcut Forest

Clearcut forests are another terrestrial community type commonly found in the mine study area. Clearcuts create edge habitat that is advantageous to wildlife, due to proximity of forage to cover. In the first few years following a clearcut, succulent stems of woody plants, forbs, and grasses provide ample forage for deer, turkey, rabbits, early successional songbirds, and rodents (Clemson University, 2000). Although clearcuts provide an initial benefit to wildlife, after several years, forbs and grasses are displaced by a thick shrub layer that has a diminished nutritional value. In addition to the loss of herbaceous forage after the first few years of succession, clearcuts are devoid of mast-producing hardwoods that provide a long-term food source beneficial to a wide variety of species. Due to the slow regeneration of hardwood species, there may be long periods of limited food availability between early and late stages of succession in clearcut areas.

3.8.3.2 Wildlife

Observations of wildlife species were documented by Vittor biologists during wetland delineations, endangered species surveys, and vegetative surveys performed between the months of June and October 2008. During pedestrian surveys Vittor biologists observed evidence (i.e., tracks, scat, burrows, vocalizations, visual observation of animals) that a wide range of mammalian, avian, reptilian, and amphibian species use the study area. Table 3.8-5 lists all of the wildlife species observed by Vittor biologists in the proposed study area in 2008. This list of species is not expected to reflect a full representation of all vertebrate species that possibly use the study area. Some of the limitations in documenting wildlife use of habitat types based on incidental encounters are the inability to survey all habitat types during the peak activity periods for all species and the random distribution of areas in the study in which species are observed.

Table 3.8-6 lists vertebrate species that, according to Natural Heritage records, may be permanent residents in the region and may use the study area but were not necessarily observed by Vittor biologists during the

Table 3.8-5. Wildlife Species Documented Within the Proposed Mine Study Area

Common Name	Scientific Name	Evidence of Utilization
Amphibians		
Southern toad	*Bufo Terrestris*	Visual observation
Cricket frog	*Acris sp.*	Calls
Bronze frog	*Rana clamitans clamitans*	Calls
Reptiles		
Green anole	*Anolis carolinensis*	Visual observation
Eastern box turtle	*Terrapene carolina*	Visual observation
Florida cottonmouth	*Agkistrodon piscivorus conanti*	Visual observation
Eastern ribbonsnake	*Thamnophis sauritus*	Visual observation
Timber rattlesnake	*Crotalus horridus*	Visual observation
Mammals		
Nine-banded armadillo	*Dasypus novemcinctus*	Burrow
Virginia opossum	*Didelphis virginiana*	Dead on road
Eastern gray squirrel	*Sciurus carolinensis*	Visual observation
American beaver	*Castor canadensis*	Visual observation
Bobcat	*Lynx rufus*	Visual observation
Coyote	*Canis latrans*	Scat
Wild boar	*Sus scrofa*	Tracks
Raccoon	*Procyon lotor*	Tracks, dead on road
White-tailed deer	*Odocoileus virginianus*	Visual observation
Eastern cottontail	*Sylvilagus floridanus*	Visual observation
Birds		
Wild turkey	*Meleagris gallopavo*	Visual observation
Northern bobwhite	*Colinus virginianus*	Calls, visual observation
Black vulture	*Coragyps atratus*	Visual observation
Turkey vulture	*Cathartes aura*	Visual observation
Red-shouldered hawk	*Buteo lineatus*	Calls, visual observation
Eurasian collared-dove	*Streptopelia decaocto*	Visual observation
Mourning dove	*Zenaida macroura*	Calls, visual observation
Common ground-dove	*Columbina passerina*	Calls, visual observation
Yellow-billed cuckoo	*Coccyzus americanus*	Calls, visual observation
Barred owl	*Strix varia*	Dead on road
Red-bellied woodpecker	*Melanerpes carolinus*	Calls
Downy woodpecker	*Picoides pubescens*	Calls
Hairy woodpecker	*Picoides villosus*	Calls
Northern flicker	*Colaptes auratus*	Calls, visual observation
Eastern wood-pewee	*Contopus virens*	Calls, visual observation
Eastern phoebe	*Sayornis phoebe*	Calls, visual observation
Loggerhead shrike	*Lanius ludovicianus*	Visual observation
White-eyed vireo	*Vireo griseus*	Calls, visual observation
Yellow-throated vireo	*Vireo flavifrons*	Calls, visual observation
Red-eyed vireo	*Vireo olivaceus*	Calls, visual observation
Blue jay	*Cyanocitta cristala*	Calls, visual observation
American crow	*Corvus brachyrhynchos*	Calls, visual observation
Barn swallow	*Hirundo rustica*	Used nest
Carolina chickadee	*Poecile carolinensis*	Calls
Tufted titmouse	*Baeolophus bicolor*	Calls, visual observation
Brown-headed nuthatch	*Sitta pusilla*	Visual observation
Carolina wren	*Thyrothorus ludovicianus*	Calls, visual observation

Table 3.8-5. Wildlife Species Documented Within the Proposed Mine Study Area (Continued, Page 2 of 2)

Common Name	Scientific Name	Evidence of Utilization
House wren	*Troglodytes aedon*	Visual observation
Blue-gray gnatcatcher	*Polioptila caerulea*	Visual observation
Eastern bluebird	*Sialia sialis*	Visual observation
Gray catbird	*Dumetella carolinensis*	Visual observation
Northern mockinbird	*Mimus polyglottos*	Calls, visual observation
Brown thrasher	*Toxostoma rufum*	Calls, visual observation
Pine warbler	*Dendroica pinus*	Visual observation
Summer tanager	*Piranga rubra*	Calls, visual observation
Eastern towhee	*Pipilo erythrophthalmus*	Visual observation
Northern cardinal	*Cardinalis cardinalis*	Calls, visual observation
Blue grosbeak	*Passerina caerulea*	Visual observation
Indigo bunting	*Passerina cyanea*	Visual observation
Brown-headed cowbird	*Molothrus ater*	Visual observation

Source: NACC, 2008.

Table 3.8-6. Wildlife Species that are Expected to Occur Within the Proposed Mine Study Area

Common Name	Scientific Name
Mammals	
Southern flying squirrel	*Glaucomys volans*
Eastern fox squirrel	*Sciurus niger*
Striped skunk	*Mephetis mephetis*
Cotton deermouse	*Peromyscus gossypinus*
Common muskrat	*Ondatra zibethicus*
Oldfield deermouse	*Peromyscus polionotus*
Hispid cotton rat	*Sigmodon hispidus*
Eastern harvest mouse	*Reithrodontomys humulis*
Golden mouse	*Ochrotomys nuttalli*
Eastern woodrat	*Neotoma floridana*
Southeastern myotis*	*Myotis austroriparius*
Big-eared bat	*Corynorhinus rafinesquii*
Eastern red bat	*Lasiurus borealis*
Hoary bat	*Lasiurus cinereus*
Little brown myotis	*Myotis lucifugus*
Seminole bat	*Lasiurus seminolus*
Evening bat	*Nycticeius humeralis*
Eastern pipistrelle	*Perimyotis subflavus*
Gray fox	*Urocyon cinereoargenteus*
Red fox	*Vulpes vulpes*
North American river otter	*Lontra Canadensis*
American mink	*Neovison vison*
Reptiles	
Snapping turtle	*Chelydra serpentina*
Slider	*Trachemys scripta*
Gopher tortoise†	*Gopherus polyphemus*
American alligator	*Alligator mississippiensis*
Birds	
Bald eagle‡	*Haliaeetus leucocephalus*
Canada goose	*Branta canadensis*
Wood duck	*Aix sponsa*
Mallard	*Anas platyrhynchos*
Northern shoveler	*Anas clypeata*
Canvasback	*Aythya valisineria*
Ring-necked duck	*Aythya collaris*
Lesser scaup	*Aythya affinis*
Bufflehead	*Bucephala albeola*
Hooded merganser	*Lophodytes cuculattus*
Pied-billed grebe	*Podilymbus podiceps*
Horned grebe	*Podiceps auritus*
American white pelican	*Pelecanus erythrorhynchos*
Great blue heron	*Ardea herodias*
Great egret	*Ardea alba*
Cooper’s hawk	*Accipiter cooperii*
Broad-winged hawk	*Buteo platypterus*
Red-tailed hawk	*Buteo jamaicensis*

Table 3.8-6. Wildlife Species that are Expected to Occur Within the Proposed Mine Study Area (Continued, Page 2 of 3)

Common Name	Scientific Name
American kestrel	*Falco sparverius*
American coot	*Fulica americana*
Chuck-will's-widow	*Caprimulgus carolinensis*
Killdeer	*Charadrius vociferus*
Wilson's snipe	*Gallinago delicata*
Ring-billed hull	*Larus delawarensis*
Forster's tern	*Sterna forsteri*
Rock pigeon	*Columbia livia*
Eastern screech-owl	*Megascops asio*
Chimney swift	*Chaetura pelagica*
Rufous hummingbird	*Selasphorus rufus*
Belted kingfisher	*Ceryle alcyon*
Red-headed woodpecker	*Melanerpes erythrocephalus*
Yellow-bellied sapsucker	*Sphyrapicus varius*
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker	*Picoides villosus*
Pileated woodpecker	*Dryocopus pileatus*
Red-breasted nuthatch	*Sitta canadensis*
Brown creeper	*Certhia americana*
Winter wren	*Troglodytes troglodytes*
Golden-crowned kinglet	*Regulus satrapa*
Ruby-crowned kinglet	*Regulus calendula*
Hermit thrush	*Catharas guttatus*
American robin	*Turdus migratorius*
European starling	*Sturnus vulgaris*
Cedar waxwing	*Bombicylla cedrorum*
Blue-winged warbler§	*Vermivora pinus*
Yellow-rumped (myrtle) warbler	*Dendroica coronata*
Chipping sparrow	*Spizella passerina*
Field sparrow	*Spizella pusilla*
Fox sparrow	*Passerella iliaca*
Song sparrow	*Melospiza melodia*
White-throated sparrow	*Zonotrichia albicollis*
Dark-eyed (slate-colored) junco	*Junco hyemalis*
Red-winged blackbird	*Agelaius phoeniceus*
Eastern meadowlark	*Sturnella magna*
Brewer's blackbird	*Euphagus cyanocephalus*
Common grackle	*Quiscalus quiscula*
Purple finch	*Carpodacus purpureus*
House finch	*Carpodacus mexicanus*
Pine siskin	*Carduelis pinus*
American goldfinch	*Carduelis tristis*
House sparrow	*Passer domesticus*
Acadian flycatcher§	*Empidonax virescens*
Great crested flycatcher§	*Myiarchus crinitus*
Eastern kingbird§	*Tyrannus tyrannus*
Purple martin	*Progne subis*
Wood thrush§	*Hylocichla mustelina*

Table 3.8-6. Wildlife Species that are Expected to Occur Within the Proposed Mine Study Area (Continued, Page 3 of 3)

Common Name	Scientific Name
Yellow-throated warbler§	*Dendroica dominica*
Prothonotary warbler§	*Protonotaria citrea*
Kentucky warbler§	*Oporornis formosus*
Common yellowthroat§	*Geothlypis trichas*
Hooded warbler§	*Wilsonia citrina*
Yellow-breasted chat§	*Icteria virens*
Bachman's sparrow§	*Aimophila aestivalis*
Indigo bunting§	*Passerina cyanea*
Orchard oriole§	*Icterus spurius*
Barn swallow§	*Hirundo rustica*

*Critically imperiled in the state of Mississippi. Natural Heritage records indicate element occurrences from Lauderdale County, Mississippi.
†Imperiled in the state of Mississippi. Natural Heritage records indicate element occurrences from Lauderdale County, Mississippi.
‡Critically imperiled in the state of Mississippi. Natural Heritage records indicate element occurrences from Kemper County, Mississippi.
§Neotropical migrant species.

Source: NACC, 2008.

field inspections. The NatureServe Explorer (NatureServe, 2008) Web site was referenced when generating the list of mammals, reptiles, and amphibians that may occur in the area. Vittor studied the distribution map of each species listed in the table and included only species that are possible permanent residents in Lauderdale and Kemper Counties, Mississippi. In compiling a list of possible breeding bird species that may use the area, biologists examined the USGS Breeding Bird Survey (BBS) data from two survey routes that are close in proximity to the study area in Lauderdale and Kemper Counties, Mississippi. In addition to the BBS data, the Lauderdale, Mississippi, Christmas Bird Count (CBC) conducted in coordination with the National Audubon Society (National Audubon, 2002) was referenced when evaluating the possible occurrence of bird species in the study area.

3.8.3.3 Threatened and Endangered Species

Vittor was contracted by NACC to perform a threatened and endangered species survey of the 31,000-acre study area during May through December 2008. An assessment of the natural communities was also performed to identify suitable habitat for these protected species and assess the likelihood of their occurrence within the project site.

Prior to conducting the field surveys, a literature review was performed to generate a list of both federal- and state-protected species that could possibly occur within the large study area. USFWS's list of Mississippi's federally protected species by county was consulted as the primary reference on potentially occurring species (http://www.fws. gov/southeast/ jackson/index.html). Turcotte and Watts (1999) was used as a source for information on federal- and state-protected bird species. Additionally, a data search request of MNHP's Biological Conservation Database (BCD) was made on March 27, 2007, to identify the nearest documented population of Price's potato-bean in Kemper County. Information from NatureServe (2008a and 2008b) was also used as a reference for federal- and state-protected species.

Table 3.8-7. Federally Protected Species that Potentially Occur in Kemper and Lauderdale Counties, Mississippi, and Surrounding Areas

Common Name	Scientific Name	Status*
Reptiles and Amphibians		
Eastern indigo snake	*Drymarchon corais couperi*	T
Black pine snake	*Pituophis melanoleucus lodgi*	C
Yellow-blotched map turtle	*Graptemys flavimaculata*	T
Ringed map turtle	*Graptemys oculifera*	T
Gopher tortoise	*Gopherus polyphemus*	T
Mammals		
Florida panther	*Puma concolor coryi*	E
Louisiana black bear	*Ursus americanus luteolus*	T
Gray bat	*Myotis grisescens*	E
Indiana bat	*Myotis sodalis*	E
Birds		
Wood stork	*Mycteria americana*	E
Bald eagle	*Haliaeetus leucocephalus*	EA
Least tern†	*Sterna antillarum*	T
Red-cockaded woodpecker	*Picoides borealis*	E
Flowering Plants		
Pondberry	*Lindera melissifolia*	E
Price's potato-bean	*Apios priceana*	T

*E = endangered. T = threatened. C = candidate species. EA = Eagle Act.
†Protection is only for inland breeding populations in Arkansas, Colorado, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana (Mississippi River and tributaries north of Baton Rouge), Missouri, Mississippi (along Mississippi River), Montana, North Dakota, Nebraska, New Mexico, Oklahoma, South Dakota, Tennessee, and Texas (except within 50 miles of the coast).

Source: USFWS, 2009.

Federally Protected Species

Table 3.8-7 gives a list of federally protected species documented from Kemper and Lauderdale Counties, Mississippi (compiled from USFWS's list of

Mississippi's federally protected species by county). This list also includes several additional federally protected species that could possibly occur in the area but are not listed for either county.

Price's potato-bean is the only federally protected species currently recognized as occurring in Kemper County, Mississippi. The electronic search of the MNHP's BCD on March 27, 2007, identified a population of Price's potato-bean located approximately 25 air miles northeast of the project. This threatened species was included as a target for survey due to the proximity of this population to the study area. A general discussion of the ecological requirements of Price's potato-bean and its likelihood for occurrence within the project site is discussed later in this subsection. Additional detailed information on the natural history and ecology of the species is given for reference in Appendix G (Kral, 1983; NatureServe, 2008b; and Woods, 2005).

Two species are listed from Lauderdale County: black pine snake and Louisiana black bear. Black pine snake is currently considered a candidate species for federal protection with a listing priority number (LPN) of 3, indicating imminent threats of high magnitude to the subspecies (U.S. Department of the Interior [DOI], 2007a). Louisiana black bear is federally protected under the ESA as a threatened species. Both black pine snake and Louisiana black bear are also state-protected in Mississippi (see State-Protected Species following this subsection).

Several additional federally listed species (see Table 3.8-2) were considered in the initial selection of target species, even though they are not indicated as occurring in either Kemper or Lauderdale Counties based on USFWS' county list of protected species. Many of these are wide ranging taxa that might possibly occur in the area. Examples include red-cockaded woodpecker, least tern, gray bat, and Indiana bat. The endangered pondberry is a widely distributed woody shrub with documented records from nine southeastern states (North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Arkansas, and Missouri). Populations in Mississippi occur west of the project site in Bolivar, Sharkey, Sunflower, and Tallahatchie Counties within the Delta Region of the state (NatureServe, 2008b). Given this species' scattered distribution and its similarity to two other taxa, there is a remote possibility of undetected and overlooked populations. For this reason the species was included as a target for the present survey.

Although not protected in Mississippi under the ESA, wood storks are federally protected in Florida, Alabama, Georgia, and South Carolina, states where the species is currently known to breed or nesting has been documented historically. Wood storks disperse widely following breeding, and wandering individuals can be found in Mississippi during late summer and fall.

Bald eagle is also included on this list even though it was recently delisted from the ESA in 2007. The species is protected federally through the Bald Eagle and Golden Eagle Protection Act of 1940, and certain restrictions apply to development and other activities around nest sites.

In addition, several other federally protected species (i.e., gopher tortoise, yellow-blotched map turtle, ringed map turtle, eastern indigo snake, and Florida panther) are listed in Table 3.8-2. These taxa were initially given consideration due to their state-protected status; however, their occurrence in the study area is not expected, and a brief reasoning for their exclusion from surveys is discussed under the section on state-protected species. A brief discussion of the red-cockaded woodpecker, least tern, wood stork, bald and golden eagle, and gray and Indiana bat follows.

Red-Cockaded Woodpecker (*Picoides borealis*)—ENDANGERED

The red-cockaded woodpecker is a resident of fire-maintained pine ecosystems (i.e., longleaf pine forest) of the Southeastern United States. The species typically requires old growth longleaf pine for its breeding cavities, but other pine species have also been utilized (Conner *et al.*, 2001).

Turcotte and Watts (1999) give county occurrences for red-cockaded woodpecker for Mississippi, but do not provide any point locality data or dates making it difficult to assess the exact location of colonies and whether they are still extant. They do report several specimens or photo records of red-cockaded woodpecker from Lauderdale County, although no confirmation of breeding is noted. No documented records of red-cockaded woodpecker are indicated from Kemper County in their work. Breeding has been documented in Noxubee County adjoining Kemper County to the north (Turcotte and Watts 1999). Due to the possibility of undetected colonies occurring within the two-county area, the species was included as a target for Vittor's field surveys.

Least Tern (*Sternula antillarum*)—THREATENED

The least tern is the smallest of North American tern species with a total body length of 8 – 9 inches and a maximum wingspan of 20 inches (Thompson *et al.*, 1997). The species was recently moved from the large speciose genus *Sterna* back into the previously recognized genus *Sternula* based on new phylogenetic evidence of relationships in the subfamily Sterninae. The currently accepted scientific name for least tern is now *Sternula antillarum* (Banks *et al*., 2006). The least tern forms a superspecies complex with the closely related little tern of Europe, yellow-billed tern and Peruvian tern of South America, Saunder's tern of the Indian Ocean, and fairy tern of Australia (Thompson *et al.*, 1997; species treated as members of *Sterna* in this reference).

Coastal populations of least tern in Jackson, Harrison, and Hancock Counties typically breed on sandy beaches containing a shell hash. Rooftop nesting has also been documented along the coast (Turcotte and Watts, 1999). Away from the coast, the least tern is only found breeding along the Mississippi River and its tributaries. Federal protection of the least tern under the ESA in Mississippi has only been designated for those for inland breeding populations (coastal populations are excluded). The nearest inland report to the proposed mine study area is from Oktibbeha County (confirmed sight record; Turcotte and Watts, 1999). This species is not expected to occur within the project boundaries as no suitable habitat exists, and it is not considered a target for survey.

Wood Stork (*Mycteria americana*)—ENDANGERED

The wood stork is federally protected under the ESA as an endangered species in Alabama, Florida, Georgia, and South Carolina. The species is not afforded protection under the ESA in Mississippi. Although the wood stork is not listed on the USFWS's list of Mississippi's federally protected species by county, individuals disperse widely into the Gulf States following breeding and wandering wood storks can be found in inland areas of Mississippi during mid- to late summer (Turcotte and Watts, 1999). No breeding has been documented for this species in the state (Turcotte and Watts, 1999; NatureServe, 2008a; Coulter *et al.*, 1999). NatureServe (2008a) does not indicate any element occurrences of wood stork from Lauderdale or Kemper Counties based on available natural heritage records. Turcotte and Watts (1999) show confirmed sight records for nearby Noxubee County located immediately north of Kemper County. The species is not expected to occur as a breeding resident within the project boundaries, although wandering individuals could occasionally be found during the summer months, especially around ponds and lakes. The presence of these nonresident dispersers, however, should not affect the development of the proposed project.

Bald Eagle (*Haliaeetus leucocephalus*) and Golden Eagle (*Aquila chrysaetos*)

The bald eagle was recently delisted from the ESA in 2007 (USFWS, 2007), but the species still receives federal protection through the Bald and Golden Eagle Protection Act of 1940 (Eagle Act) and also the Migratory Bird Treaty Act (USFWS, 2007). Copies of both the Eagle Act and the bird Migratory Bird Treaty Act can be viewed at: http://permits.fws.gov/ltr/ltrt.shtml. The bald eagle is also state-protected in Mississippi. Turcotte and Watts (1999) state that 15 bald eagles were raised in a hacking tower on Lake Okatibbee located in Lauderdale County north of Meridian. Portions of Lake Okatibbee occur within the study area.

The golden eagle is similarly protected under the Eagle Act of 1940. The species is also state-protected in Mississippi. Turcotte and Watts (1999) show confirmed sight record(s) of the golden eagle from Kemper County, although they do not indicate the number of observations or dates. The golden eagle does not breed in Mississippi and would only occur as a migrant or winter visitor in the state. Its presence would not affect the proposed project.

Gray Bat (*Myotis grisescens*) and Indiana bat (*Myotis sodalis*)—ENDANGERED

Both bat taxa are federally protected as endangered species under the ESA. NatureServe (2008a) indicates no natural heritage records of either the gray or Indiana bat from Mississippi. Knight *et al.* (1974) did not report any caves in Kemper County and only a single cave (Olmstead Cave) in Lauderdale County. Olmstead Cave is a low wet cave with less than 100 ft of passage. This cave is not considered suitable as a hibernacula for gray bat which typically overwinters in vertical caves. There are reports in the literature of occasional use of noncave sites by gray bats. Examples include roost sites located in storm sewers, mines, and buildings (NatureServe, 2008a). Gray bats have also been known to roost in the expansion joints of bridges. The two species are not expected to occur within the project site. For purposes of this study, no surveys for gray or Indiana bat were performed.

State-Protected Species

MDWFP is responsible for the regulation of protected nongame species in the state. A list of state-protected wildlife species protected in Mississippi was generated (Table 3.8-8) from the following state regulations posted on MDWFP's Web site:

> "All birds of prey (eagles, hawks, osprey, owls, kites and vultures) and other nongame birds are protected and may not be hunted, molested, bought, or sold. The following endangered species are also protected: black bear, Florida panther, gray bat, Indiana bat, all sea turtles, gopher tortoise, sawback turtles (black-knobbed, ringed, yellow-blotched), black pine snake, eastern indigo snake, rainbow snake and the southern hognose snake" (http://www.mdwfp.com/ Level2/Wildlife/ hunting_regs.asp).

Table 3.8-8 provides a tabular list of the state-protected birds of prey (all species previously documented in Mississippi), reptiles, and mammals. Nongame birds are not given in this table. Discussions of the state protected reptiles and mammals are given in the following.

Eastern Indigo Snake (*Drymarchon corais couperi*)

The eastern indigo snake is also federally protected as a threatened species. In Mississippi, there are records from Forrest, Hancock, Harrison, Jones, Perry, and Wayne Counties (NatureServe, 2008b). The distribution of this snake in the state occurs well south of the project site, and it is not expected to occur within the mine study area boundaries. It is not included as a target for survey.

Rainbow Snake (*Farancia erytrogramma*)

The rainbow snake is state-protected in Mississippi. Ernst & Ernst (2003) considered this species endangered in the state. The rainbow snake is not federally protected under the ESA. This secretive snake is typically found along coastal plain waterways such as "rivers, streams, canals, lakes, swamps, and tidal and freshwater marshes" of the southeast (Ernst & Ernst, 2003). Conant and Collins (1998) state that it appears to prefer swamp with bald cypress. NatureServe (2006) only lists records from as far north as Lamar County in Mississippi. Suitable habitat for the rainbow snake does not occur within the project boundaries, and it is not expected to occur there.

Black-Knobbed Map Turtle (*Graptemys nigrinoda*)

The black-knobbed map turtle is found in rivers and streams with moderate current and sandy or clay substrates in the upper Tombigbee, Tibbee, Middle Tombigee-Lubbub River drainages in Alabama and Mississippi, all of which are outside of the Chickasawhay River basin (NatureServe, 2006; Ernst *et al.*, 1994). This species is not expected to occur within the property boundaries of the study area.

Table 3.8-8. State-Protected Reptiles, Birds of Prey and Mammals

Common Name	Scientific Name
Reptiles	
Eastern indigo snake	*Drymarchon corais couperi*
Rainbow snake	*Farancia erytrogramma*
Southern hognose snake	*Heterodon simus*
Black pine snake	*Pituophis melanoleucus lodgi*
Yellow-blotched map turtle	*Graptemys flavimaculata*
Black-knobbed map turtle	*Graptemys nigrinoda*
Ringed map turtle	*Graptemys oculifera*
Gopher tortoise	*Gopherus polyphemus*
Birds*	
Black vulture	*Coragyps atratus*
Turkey vulture	*Cathartes aura*
Osprey	*Pandion haliaetus*
Swallow-tailed kite	*Elanoides fortifcatus*
White-tailed kite	*Elanus leucurus*
Mississippi kite	*Ictinia mississippiensis*
Bald eagle	*Haliaeetus leucocephalus*
Northern harrier	*Circus cyaneus*
Sharp-shinned hawk	*Accipiter striatus*
Cooper's hawk	*Accipiter cooperi*
Northern goshawk	*Accipiter gentilis*
Harris's hawk	*Parabuteo unicinctus*
Red-shouldered hawk	*Buteo lineatus*
Broad-tailed hawk	*Buteo platypterus*
Swainson's hawk	*Buteo swainsoni*
Red-tailed hawk	*Buteo jamaicensis*
Ferruginous hawk	*Buteo regalis*
Rough-legged hawk	*Buteo lagopus*
Golden eagle	*Aquila chrysaetos*
American kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine falcon	*Falco pererinus*
Prairie falcon	*Falco mexicanus*
Barn owl	*Tyto alba*
Eastern screech-owl	*Megascops asio*
Great horned owl	*Bubo virginianus*
Snowy owl	*Bubo scandiacus*
Burrowing owl	*Athene cunicularia*
Barred owl	*Strix varia*
Long-eared owl	*Asio otus*
Short-eared owl	*Asio flammeus*
Northern saw-whet owl	*Aegolius acadicus*
Mammals	
Florida panther	*Puma concolor coryi*
Black bear	*Ursus americanus*
Gray bat	*Myotis grisescens*
Indiana bat	*Myotis sodalis*

*Taxonomy and nomenclature of birds follows the American Ornithological Union's Checklist of North American Birds. 1998. Seventh Edition. Species list compiled from Turcotte and Watts (1999).

Source: NACC, 2009.

Yellow-Blotched Map Turtle (*Graptemys flavimaculata*)

This species is restricted to the Pascagoula River system and its associated tributaries. *G. flavimaculata* is typically found in wide rivers with strong currents with sandbars suitable for nesting (Ernst *et al.*, 1994). The species has been documented from the Upper Chickasawhay River basin as far north as Clarke County, Mississippi (NatureServe, 2006). There are no known occurrences of yellow-blotched map turtle from Kemper County, Mississippi, based on MNHP records (NatureServe, 2006). Due to the large geographic distance from the nearest populations, the species is not expected to occur within the project boundaries and was not included as a target. The yellow-blotched map turtle is also federally protected as a threatened species.

Ringed Map Turtle (*Graptemys oculifera*)

The ringed map turtle is also federally protected as a threatened species under the ESA. The species is restricted to the Pearl River drainage system in Mississippi and Louisiana (NatureServe, 2006; Ernst *et al.*, 1994). It is not found in the Chickasawhay River basin and is not expected to occur within the project boundaries.

Southern Hognose Snake (*Heterodon simus*)

MNHP considers *H. simus* extirpated from the state with no recent records reported from 1983 to 1998 (NatureServe, 2006). There are old records from Forrest, Pearl River, and Stone Counties in Mississippi, well north of the project site (NatureServe, 2006). Southern hognose snake is typically found in xeric sandhill communities with well-drained sandy soils (NatureServe, 2006), and these community types do not exist within the study area. It is not expected to occur within the project boundaries.

Black Pine Snake (*Pituophis melanoleucus lodingi*)

The black pine snake is not anticipated to occur within the study area. The species has only been documented as far north as Marion and Lamar Counties in Mississippi well south of the proposed project site. There are no known records of the black pine snake from either Kemper or Lauderdale Counties (NatureServe, 2006). The black pine snake is also considered a candidate species for federal protection with a LPN of 3, indicating imminent threats of high magnitude to the subspecies (DOI, 2007a).

Gopher Tortoise (*Gopherus polyphemus*)

NatureServe (2008b) indicates a previous element occurrence from Lauderdale County, Mississippi. The species is not included on USFWS' list of protected species occurring in Lauderdale County. The NatureServe Web site does not indicate the current status or number of occurrences from Lauderdale County, but the species is assumed to have been extirpated and is no longer occurring there.

Florida Panther (*Puma concolor coryi*)

The Florida panther is also protected as an endangered species under the ESA. This subspecies historically ranged throughout the southeastern United States including Mississippi; however, it is now restricted to a small area in south Florida (NatureServe, 2008b). It is not expected to occur within the project area given its restricted distribution.

Field Survey Methods

Two pairs of Vittor biologists conducted pedestrian surveys for threatened and endangered species throughout the proposed mine study area between the months of May and October 2008. Surveys were conducted during daylight hours only. Incidental observations of wildlife were also made during the surveys (Appendix H). Surveys for fossorial amphibian and reptile species were conducted by overturning logs and other debris. Vittor did not use either mist netting or harp traps to detect bat species that possibly use the proposed mine study area.

Results and Findings

Federally Protected Species

No federally protected species were detected. A discussion of the survey results for Price's potato-bean, red-cockaded woodpecker, wood stork, Louisiana black bear, and pondberry are provided in the following paragraphs. Species (including the bald eagle) that are protected by the federal Migratory Bird Treaty Act may use the mine site occasionally for foraging or roosting due to its size and multiple habitats, but it was concluded that the site provides no critical breeding, nesting, roosting, or staging areas for migratory birds.

Plants

Price's Potato-Bean (*Apios priceana*)—THREATENED

Since Price's potato-bean has been previously documented from Kemper County, a specific request was made to MNHP to identify the nearest element occurrence of *A. priceana* in their database. According to MNHP records, the nearest element occurrence in Kemper County is located approximately 25 air miles northeast of the project site and was last visited in 2001. Although no point locality data were provided for this element occurrence, the general location would place the record in the extreme northeast corner of the county. An examination of EPA's Level IV ecoregions of Mississippi (Chapman *et al.*, 2004) shows that this northeast portion of Kemper County contains two different Level IV ecoregions: Blackland Prairie (65a) and Flatwoods/Blackland Prairie Margins (65B). The study site is located well outside of these ecoregions in the Southern Hilly Gulf Coastal Plain (65d). Nearby populations of Price's potato bean in Mississippi and Alabama are not known to occur in this particular ecoregion and are restricted to the ecoregions found farther north of the project site. Additionally, the project falls within the drainage basin for the Chickasawhay River, for which there are no known records of this protected species. Price's potato-bean was not observed within the project boundaries, and suitable habitat for this species does not exist on the site (e.g. rocky woodlands with calcareous substrates). The species is not expected to occur inside the project site given its restricted distribution to those specific ecoregions found well outside the study area.

Pondberry (*Lindera melissifolia*)—ENDANGERED

No individuals of Pondberry or any other species of *Lindera* were observed. Given this species occurrence in areas to the west of the project site in the Mississippi Delta it is not expected to occur within the study area.

Wildlife

Red-Cockaded Woodpecker (*Picoides borealis*)—ENDANGERED

No individuals of red-cockaded woodpecker were observed within the project site. Large areas of the property are in loblolly pine timber production and appear to lack the necessary old growth trees required for breeding (the average stand age for most planted loblolly pine areas was estimated to be between 15 and 20 years). Based on a field assessment, the red-cockaded woodpecker is not likely to occur within the project boundaries, and suitable habitat for this species is not present.

Wood Stork (*Mycteria americana*)—ENDANGERED

No individuals of wood stork were observed during the field surveys, and the species is not expected to occur as a breeding resident within the project boundaries. The species is not afforded protection under the ESA in Mississippi.

Louisiana black bear (*Ursus americanus luteolus*)—THREATENED

No individuals of black bear were observed during our field survey, nor was any evidence (e.g., tracks and scat) noted of their presence. No den trees were noted in forested areas of the study site. It is remotely possible that wandering individuals could occasionally show up within the project boundaries, but their presence should not affect the proposed project.

State-Protected Species

A single road-killed specimen of barred owl was found. All owls are state-protected in Mississippi. The presence of this owl species should not affect the proposed project.

Two state-listed bird species, bald eagle and golden eagle, are discussed in further detail, given their protection under the federal bald eagle and golden eagle Act of 1940.

Bald Eagle (*Haliaeetus leucocephalus*) and Golden Eagle (*Aquila chrysaetos*)

No eagles of any species were seen during the field surveys of the mine study area. Additionally, no eagle nests were detected within the project boundaries.

The bald eagle was recently delisted from the ESA in 2007 (USFWS, 2007), but the species still receives federal protection through the Eagle Act and also the Migratory Bird Treaty Act (USFWS, 2007). Copies of both the Eagle Act and the bird Migratory Bird Treaty Act are can be viewed at: http://permits.fws.gov/ltr/ltrt.shtml. The bald eagle is also state-protected in Mississippi. Turcotte and Watts (1999) state that USACE initiated a hacking program beginning in 1992. As part of this effort, 15 bald eagles were raised in a tower on Lake Okatibbee located in Lauderdale County, north of Meridian (Turcotte and Watts, 1999). Portions of Lake Okatibbee occur within the study area. If any bald eagle nests are subsequently uncovered within the project boundaries, consultation with USFWS is recommended.

The golden eagle is similarly protected under the Eagle Act. The species is also state-protected in Mississippi. Turcotte and Watts (1999) show confirmed sight record(s) of the golden eagle from Kemper County, although they do not indicate the number of observations or dates. The golden eagle does not breed in Mississippi and would only occur as a migrant or winter visitor in the state. No individual golden eagles were observed, and the species is not expected to occur within the project boundaries except as an accidental vagrant.

Conclusions

The threatened and endangered species surveys revealed no evidence of any federally protected species within the 31,260-acre mine study area.

3.8.4 LINEAR FACILITY CORRIDORS, RIGHTS-OF-WAY, AND SUBSTATION SITES

All the proposed linear facilities and substations (see Figure 2.2-1) are located within the Southeastern Plains ecoregion, and the majority of the linear facilities would be located within the Southern Hilly Gulf Coastal Plain sub-ecoregion. Typically, this area was historically dominated by oak-hickory-pine forest with post oak, blackjack oak, southern red oak, shortleaf pine, pignut, and mockernut hickory; in the south, pine and pine-oak forest with longleaf and some shortleaf pine, blackjack oak, sand post oak, and bluejack oak; southern floodplain forest with cypress-gum swamp, bottomland hardwoods, and some loblolly pine. At present, much of the native forest types on the linear facilities corridors and substation sites have been cleared and used for cultivation of pine. South and west of Meridian, portions of the transmission line and CO_2 corridors traverse the Buhrston/Lime Hills sub-ecoregion. This area exhibits a distinct terrain that is more hilly and irregular than that characteristic of the Southern Hilly Gulf Coastal Plain type. This area of hills is part of a rugged, north-facing escarpment that extends into the middle of Alabama. Typically, the soils are well drained, loamy, and sandy on the narrow ridges and steep side slopes. Some of the streams have higher gradients and more rocky substrates than those crossed by the corridors in the Southern Hilly Gulf Coastal Plain sub-ecoregion (Omernik and Griffith, 2008).

Proposed linear facilities associated with the power plant include a natural gas pipeline, transmission lines (new and existing transmission lines to be upgraded) and associated substations, and a CO_2 pipeline. For ecological study purposes, all proposed new linear facilities rights-of-way proposed for upgrading corridors were 200 ft in width. The final rights-of-way for construction of the new transmission lines, natural gas pipeline, and CO_2 pipeline would ultimately be sighted within the confines of the 200-ft-wide study corridors.

The following subsections describe the terrestrial ecology of the approximately 156 miles of linear facilities corridors that were fully defined and surveyed. Approximately 13.5 miles of the reclaimed effluent pipeline corridor in the immediate vicinity of Meridian have been surveyed, but final reports of these field studies are not yet released. An approximately 9.5-mile stretch of existing electrical distribution line right-of-way along MS 493 from MS 16 to the site has not been surveyed. A route and corridor for the estimated 9- to 10-mile-long mine transmission line interconnection corridor between MS 16 and the site have not been demarcated. However, given the similar physiographic locations and features of the unsurveyed corridors, terrestrial ecological characteristics similar to those of the surveyed areas would be expected.

3.8.4.1 Vegetation

Seventeen vegetation/land use types were identified on the linear facilities study corridors that were surveyed in the field. The terrain in the northern two thirds of the corridor study area consists of dissected hills with gently to steeply sloping side slopes interspersed among dissected plains with some (rarely) wide floodplains. Numerous intermittent sandy-bottomed streams cross the region. Portions of the most southerly reaches of the transmission line and CO_2 corridors cross an area of strongly dissected hills and ridges with steep slopes drained by higher gradient streams with sandy or gravelly substrates.

The predominant vegetation/land use types crossed by the corridors are pine plantations and second-growth hardwood or pine hardwood forests. Only relatively small areas usually associated with streams at the bases of steep slopes harbor relatively undisturbed, natural hardwood or pine hardwood forest associations. Forested wetlands, shrub wetlands, and herbaceous wetlands are scattered within the corridors and are usually associated with small streams. The remaining vegetation/land use types are associated with agriculture or residential/commercial development and do not represent native ecosystems. The following presents a brief description of the vegetation/land use types identified within the study corridors during the May through November 2008 field studies. All plant species observed within the linear facility study corridors during the ecological studies are presented in Table 3.8-1. Table 3.8-9 lists the vegetation/land use types and area of each identified within the natural gas pipeline study corridor. Table 3.8-10 lists the vegetation/land use types and area of each that were observed within the transmission line study corridors. Table 3.8-11 lists the vegetation/land use types and area of each identified within the three substation study sites. Table 3.8-12 lists the vegetation/land use types and area of each that occur within the portion of the CO_2 pipeline study corridor not co-located with a transmission line corridor segment.

Table 3.8-9. Vegetation/Land Use Types Identified within the Natural Gas Pipeline Corridor

Land Use	Acres	Percent of Total
Planted pine	86.27	62
Hardwood forest	15.48	11
Pine-hardwood forest	20.65	15
Hardwood-pine forest	3.45	2
Shrubland	0	0
Pastures, hayfields, deerplots	0.8	1
Existing transmission line corridors	0.7	1
Existing gas pipeline line corridors	0	0
Roads	5.98	4
Residential or commercial development	0	0
Active construction	0	0
Streams, natural drainage	0.32	0
Ditches	0.05	0
Ponds	0	0
Forested wetlands	6.06	4
Shrub wetland	0.26	0
Herbaceous wetland	0.23	0
Total	**140.25**	**100**

Source: ECT, 2009.

Table 3.8-10. Vegetation /Land Use Types Identified within the Transmission Line Corridors (Both New and Existing)

Land Use	Acres	Percent of Total
Planted pine	482.47	26
Hardwood forest	301.92	16
Pine-hardwood forest	317..83	17
Hardwood-pine forest	131.00	7
Shrubland	10.89	1
Pastures, hayfields, deerplots	95.88	5
Existing transmission line corridors	217.87	11
Existing gas pipeline line corridors	2.13	0
Roads	45.47	2
Residential or commercial development	37.77	2
Active construction	11.04	1
Streams, natural drainage	37.87	2
Ditches	3.88	0
Ponds	7.95	0
Forested wetlands	95.27	5
Shrub wetland	28.47	2
Herbaceous wetland	54.01	3
Total	**1,881.72**	**100**

Source: ECT, 2009.

Table 3.8-11. Vegetation/Land Use Types Identified within the Substation Sites

Land Use	East Lauderdale		West Lauderdale		Vimville	
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total
Planted pine	29.8	80.31	0.00	0.00	32.81	89.41
Pastures, hayfields, deer plots	0.32	0.87	15.20	91.90	0.00	0.00
Existing gas pipeline corridor	3.14	8.46	0.00	0.00	0.00	0.00
Roads	0.34	0.92	0.00	0.00	0.35	0.96
Streams, natural drainage	0.01	0.03	0.90	5.19	0.08	0.21
Ditches	0.00	0.00	0.50	3.03	0.00	0.00
Shrub wetland	2.52	6.79	0.00	0.00	0.00	0.00
Herbaceous wetland	0.93	2.50	0.00	0.00	3.43	9.35
Total	**37.06**	**100**	**16.6**	**100**	**36.67**	**100**

Source: ECT, 2009.

Table 3.8-12. Vegetation /Land Use Types Identified within the CO_2 Pipeline Line Corridor Not Co-Located With the Transmission Line Corridor

Land Use	Acres	Percent of Total
Planted pine	219.08	22
Hardwood forest	2.5	0
Pine-hardwood forest	148.36	15
Hardwood-pine forest	178.7	18
Shrubland	2.25	0
Pastures, hayfields, deerplots	35.57	4
Existing transmission line corridors	163.64	16
Existing gas pipeline line corridors	5.5	1
Roads	25.04	2
Residential or commercial development	10.58	1
Active construction	6.27	1
Streams, natural drainage	3.21	0
Ditches	0	0
Ponds	4.61	0
Forested wetlands	145.48	14
Shrub wetland	18.22	2
Herbaceous wetland	45.65	4
Total	**1,014.66**	**100**

Source: ECT, 2009.

Planted Pine

Planted pine includes all areas actively managed or otherwise used to cultivate pines. It includes all areas within the corridors with pines of varying stages of maturity from recently cleared (where the intent is to likely replant soon) to mature, harvestable stands.

Tracts of planted pine or pine plantation occur throughout the Mississippi Power linear facilities study corridors. Tracts supporting planted pine varies considerably, but can be placed in three general categories: recently planted or reseeded areas, intermittent aged pine, and mature pine.

Recently planted pine and reseeded areas consist of scattered remnant trees and shrubs and trees and shrubs that are coppicing from trunks or sprouting from roots. Most of the vegetation cover consists of opportunistic herbaceous species. These areas also have considerable areas of bare soil.

Intermediate aged planted pine varies in species composition and structure throughout the transmission corridors depending on the age. Those areas that are planted and maintained generally had a closing or closed canopy of pine with few hardwoods and little, if any, understory or herbaceous layer. Reseeded areas usually have a closing or closed canopy consisting of a dense mixture of pine and hardwoods with a dense, impenetrable understory consisting of a mixture of shrubs, sapling trees, and vines with little, if any, herbaceous layer. Tree diameter in the intermediate pine plantation is usually less than 1 ft.

Mature planted pine has a closed canopy of pine with scattered co-dominant hardwood, with a sub-canopy of hardwoods and a very thin understory of shrubs and sapling trees and vines. Herbaceous species in these areas is almost nonexistent. Diameter of the pines in the mature planted pine areas is usually 2 to 3 ft.

Of the three types of planted pine occurring in the study corridors, the intermediate type is the most common followed by the recently planted and reseeded type. The oldest or mature planed pine is the least common.

Species found in the various planted pine areas are similar wherever pine plantation occurs throughout the linear facilities study corridors.

Tree species noted in the planted pine areas include loblolly pine, shortleaf pine, red maple, sweetgum, mockernut hickory, pignut hickory, shagbark hickory, redbud, flowering dogwood, persimmon, blackgum, black cherry, tulip tree, scarlet oak, bluejack oak, white oak, southern red oak, willow oak, black oak, water oak, sourweed, and winged elm.

Shrubs common to the planted pine areas include Hercules' club, beautyberry, St. Andrew's cross, wax myrtle, dwarf sumac, smooth sumac, serrate-leaf blackberry, sand blackberry, southern blackberry, sparkleberry, and mayberry.

Herbaceous species noted include ragweed, bushy bluestem, broomsedge, Indian hemp, giant cane, ebony spleenwort, threeawn, sensitive partridge pea, Maryland golden aster, Canadian horseweed, vente conmigo, Michaux's croton, retrose flatsedge, purple prairie clover, dogfennel, witchgrasses, southern crabgrass, poor Joe, devil's grandmother, American burnweed, bahiagrass, bracken fern, lovegrass, Carolina horsenettle, goldenrods, and asters.

Common vines occurring in the planted pine include Alabama supplejack, cross vine, trumpet creeper, yellow jessamine, Japanese honeysuckle, Virginia creeper, cat greenbriar, and muscadine grape.

Hardwood Forest

All forested lands are clearly dominated by a variety of usually deciduous hardwoods that are relatively natural in aspect, though likely representing second- or third-growth forests. Few old age trees (30+ inches dbh) were seen within the confines of the study corridors. Hardwood-dominated areas occur throughout the proposed linear facilities study corridors. The hardwood-dominated areas are variable and can be placed in three general categories including immature hardwoods, intermediate-aged hardwoods, and mature hardwoods.

The most common of the three types is the immature hardwoods type. It consists of a dense mixture of hardwood species, shrubs, and vines with little if any community structure. The dense mixture of trees, shrubs, and vines form a dense cover that inhibits the formation of an herbaceous layer. Trees in these areas tended to be under 20 ft tall and under 6 inches dbh.

Tree species noted in the immature hardwood-dominated areas include red maple, sweetgum, mockernut hickory, pignut hickory, shagbark hickory, bitternut, redbud, flowering dogwood, persimmon, blackgum, black cherry, tulip tree, scarlet oak, bluejack oak, white oak, southern red oak, willow oak, black oak, water oak, sourweed, box elder, Shumard oak, cucumber tree, and winged elm.

Shrubs found in the immature hardwood areas include Hercules' club, beautyberry, St. Andrew's cross, wax myrtle, dwarf sumac, smooth sumac, serrate-leaf blackberry, sand blackberry, southern blackberry, sparkleberry, mayberry, red buckeye, northern dewberry, sassafras, and rarely dwarf palmetto.

Common vines include Alabama supplejack, cross vine, trumpet creeper, yellow jessamine, Japanese honeysuckle, Virginia creeper, cat greenbriar, muscadine grape, poison ivy, and summer grape.

Intermediate-aged and mature hardwood areas tend to be different from the immature hardwood area by having more structure including a distinct canopy, often a subcanopy in the mature hardwoods, a locally thick to sparse shrub layer, and a generally sparse herbaceous layer. Shrubs and vines tend to be fewer in the intermediate-aged and mature hardwood areas. These areas tend to be more park-like and can be easily walked through. Trees in the intermediate-aged hardwood areas tend to be 50 to 80 ft tall and 1 to 2 ft dbh with the trees in the mature hardwood being 80 to 90 ft in height and 3 to 4 ft dbh.

The intermediate hardwood areas tend to have the most herbaceous species of the three hardwood categories. Species noted include, jack-in-the-pulpit, green dragon, little brown jug, variable panicgrass, slender woodoats, violet, Christmas fern, Canadian blacksnakeroot, basketgrass, devil's grandmother, mayapple, and giant cane.

Most of the ground cover in the intermediate hardwood and mature hardwood areas consists not of herbaceous species but vines including poison ivy and yellow jessimine. Large patches of these two species were encountered primarily in the intermediate aged hardwood areas.

Most of the hardwood areas are moist to mesic. Drier well-drained hardwood areas generally contain upland species such as blackjack oak, southern red oak, black oak, and hickories, including pignut and mockernut, respectively.

One area of mature hardwoods of special note is located just south of Lost Horse Creek (southeast of the intersection of Lizella and Fredrickson Roads) in Lauderdale County. The mature hardwood area is located on the northwest side of a steep hill and consists of two cover types. The down slope portion consists of a mixture of American beech and sugar maple. The upslope portion consists of a closed canopy of extremely tall hickories including pignut, bitternut, and shagbark hickory with a subcanopy of blackgum, cucumber tree, and younger hickories. Many of the hickories are 3 to 4 ft dbh and 70 to 80 ft tall. The understory throughout the two cover types consists of redbud, hop hornbeam, American hornbeam, American beautyberry, and mayberry. No herbaceous species were noted. This is the only area noted in the transmission corridor where mature hickories are the dominant canopy species.

It could not be determined if the area was original forest or extremely old second-growth. The area is fenced off from the surrounding areas. The area directly to the southeast is immature pine plantation with scattered mature hardwoods.

Pine-Hardwood Forest

Pine-hardwood forest describes those areas where various pines (usually loblolly but some shortleaf) comprise at least 60 percent cover in a forested community. This designation also describes those areas where the pine appears to have been or likely will be harvested. Though many areas appear to have been harvested for mature pine or will be harvested for pine in the future, these areas do not appear to be actively maintained and the hardwood component has been allowed to mature. Areas of mixed pine to hardwood are defined as those areas that have a tree canopy consisting of a minimum of 60-percent pine and a maximum of 40-percent hardwoods. Areas of pine-hardwood occur throughout the transmission line and gas line corridors. Pine-hardwood areas vary from immature to intermediate growth to mature trees.

The most common of the three types is the immature pine to hardwood type. It consists of a dense mixture of hardwood species, shrubs, and vines with little if any community structure. The mixture of trees, shrubs, and vines form a dense cover that prevents the formation of an herbaceous layer. Trees in these areas tend to be under 20 ft tall and under 6 inches dbh.

Tree species noted in the pine to hardwood areas include red maple, sweetgum, mockernut hickory, pignut hickory, shagbark hickory, bitternut, loblolly pine, shortleaf pine, redbud, flowering dogwood, persimmon, blackgum, black cherry, tulip tree, scarlet oak, bluejack oak, white oak, southern red oak, willow oak, black oak, water oak, sourweed, and winged elm.

Shrubs found in the pine-hardwood areas include Hercules' club, beautyberry, St. Andrew's cross, wax myrtle, dwarf sumac, smooth sumac, serrate-leaf blackberry, sand blackberry, southern blackberry, sparkleberry, mayberry, red buckeye, northern dewberry, and sassafras.

Common vines occurring in the pine-hardwood association include Alabama supplejack, cross vine, trumpet creeper, yellow jessamine, Japanese honeysuckle, Virginia creeper, cat greenbriar, muscadine grape, poison ivy, and summer grape.

Intermediate-aged and mature pine-hardwood areas tend to be different from the immature pine to hardwood area by having more structure including a distinct canopy, often a subcanopy in the mature hardwoods, a locally thick to sparse shrub layer, and a generally sparse herbaceous layer. Shrubs and vines tend to be fewer in the intermediate-aged and mature pine to hardwood areas. These areas tend to be more park-like and can be easily walked through. Trees in the intermediate-aged pine to hardwood areas tend to be 50 to 80 ft tall and 1 to 2 ft dbh, with the trees in the mature pine to hardwood being 80 to 90 ft in height and 3 to 4 ft dbh.

The intermediate pine-hardwood areas tend to have the most herbaceous species of the three hardwood categories. Species noted include jack-in-the-pulpit, green dragon, little brown jug, variable panic grass, slender woodoats, violet, Christmas fern, Canadian blacksnake root, basketgrass, devil's grandmother, mayapple, and giant cane.

Most of the ground cover in the intermediate and mature pine-hardwood areas consists not of herbaceous species but vines including poison ivy and yellow jessamine. Large patches of these two species were encountered primarily in the intermediate-aged pine-hardwood areas.

Hardwood-Pine Forest

Areas of mixed hardwood-pine are defined as those areas that have a tree canopy consisting of a minimum of 60-percent hardwoods and a maximum of 40-percent pine. Areas of hardwood-pine occur throughout the linear facilities study corridors. Hardwood-pine areas vary from immature to intermediate growth to mature trees.

The most common of the three types is the immature hardwood-pine-type. It consists of a dense mixture of hardwood species, shrubs, and vines with little if any community structure. The mixture of trees, shrubs, and vines form a dense cover that prevents the formation of an herbaceous layer. Trees in these areas tended to be under 20 ft tall and under 6 inches dbh.

Tree species noted in the hardwood-pine areas include, red maple, sweetgum, mockernut hickory, pignut hickory, shagbark hickory, bitternut, loblolly pine, shortleaf pine, redbud, flowering dogwood, persimmon, blackgum, black cherry, tulip tree, scarlet oak, bluejack oak, white oak, southern red oak, willow oak, black oak, water oak, sourweed, and winged elm.

Shrubs found in the hardwood-pine areas include Hercules' club, beautyberry, St. Andrew's cross, wax myrtle, dwarf sumac, smooth sumac, serrate-leaf blackberry, sand blackberry, southern blackberry, sparkleberry, mayberry, red buckeye, northern dewberry, and sassafras.

Common vines occurring in the hardwood-pine community include Alabama supplejack, cross vine, trumpet creeper, yellow jessamine, Japanese honeysuckle, Virginia creeper, cat greenbriar, muscadine grape, poison ivy, and summer grape.

Intermediate-aged and mature hardwood-pine areas tend to be different from the immature hardwood-pine areas by having more structure including a distinct canopy, often a subcanopy in the mature hardwood-pine, a locally thick to sparse shrub layer, and a generally sparse herbaceous layer. Shrubs and vines tend to be fewer in the intermediate-aged and mature hardwood-pine areas. These areas tend to be more parklike and can be easily walked through. Trees in the intermediate-aged hardwood areas tend to be 50 to 80 ft feet tall and 1 to 2 ft dbh, with the trees in the mature hardwood being 80 to 90 ft in height and 4 to 5 ft dbh.

The intermediate hardwood-pine areas tend to have the most herbaceous species of the three hardwood categories. Species noted include jack-in-the-pulpit, green dragon, little brown jug, variable panicgrass, slender woodoats, violet, Christmas fern, Canadian blacksnakeroot, basketgrass, devil's grandmother, mayapple, and giant cane.

Most of the ground cover in the intermediate and mature hardwood-pine areas consists not of herbaceous species but vines including poison ivy and yellow jessamine. Large patches of these two species were encountered primarily in the intermediate-aged hardwood pine areas.

Shrubland

The shrubland classification describes those areas that have been cleared of forest cover and have become dominated by a variety of shrubs and weedy herbs. Typical vegetation includes loblolly pine, red maple, sweetgum, shagbark hickory, redbud, flowering dogwood, persimmon, blackgum, black cherry, tulip tree, scarlet oak, bluejack oak, white oak, southern red oak, willow oak, water oak, and winged elm. Commonly observed shrubs include wax myrtle, sea myrtle, Chinese privet, winged sumac, serrate-leaf blackberry, sand blackberry, and dewberries. The herb flora is generally comprised of a variety of opportunistic species (weeds) including bahiagrass, fescue, broomsedge, little bluestem, threeawn, Spanish needles, Vente conmigo, flatsedges, witchgrasses, crabgrasses, poor Joe, American burnweed, dogfennel, lance-leaved goldenrod, Canada goldenrod, sunflowers, orangegrass, morning glory, black medic, wild bergamot, puff, wood sorrel, beaked panicgrass, juniperleaf, bent grass, fescue, ragweed, sensitive partridge pea, Canada thistle, Canadian horseweed, eastern daisy fleabane, common sneezeweed, woodland lettuce, Japanese clover, sericea lespedeza, Korean clover, Canada toadflax, wood sorrel, switchgrass, pokeweed, rabbit tobacco, braken fern, foxtail knotroot, Carolina horsenettle, and spiny sowthistle.

Pastures/Hayfield

The pastures/hayfields classification identifies those lands crossed by the corridor where native forest has been cleared and the area is actively maintained for agriculture use, usually pasture for cattle or other livestock, hay production, or greenfields in areas managed for white-tailed deer hunting. The maintained pasture is dominated by grasses and weedy herb including bent grasses, common carpetgrass, bahiagrass, Canada thistle, dwarf crabgrass, fescue, Canadian horseweed, dogfennel, Carolina horsenettle, southern crabgrass, American burnweed, largebracted plantain, narrowleaf plantain, java-bean, smutgrass, and rough cocklebur.

Based on the remnant vegetation occurring in the cleared upland areas, it appears that most of these areas were formerly mesic to dry hardwood forest or planted pine. This classification also includes deer plots, cleared areas usually within forests that are planted with herbage attractive to deer and actively maintained by hunters. These greenfields are dominated by a monoculture of planted wheat.

Existing Transmission Line Corridor

This land use designation describes those areas in which forests have been cleared and which are periodically maintained for use as electrical transmission line rights-of-way. The resulting plant communities are typically shrub- or herb-dominated or a combination of both. Sapling tree species noted within the existing, maintained transmission line corridor include loblolly pine, red maple, sweetgum, box elder, American beech, white ash, American holly, mockernut, pignut hickory, shagbark hickory, redbud, flowering dogwood, persimmon, blackgum, black cherry, tulip tree, scarlet oak, bluejack oak, white oak, southern red oak, willow oak, water oak, black oak, and winged elm. Sapling trees would not typically be located within a transmission line right-of-wayand are removed as part of electric utilities' routine maintenance.

Common shrubs include wax myrtle, sea myrtle, Chinese privet, winged sumac, serrate-leaf blackberry, sand blackberry, and southern dewberry. Herbs include bahiagrass, bent grasses, fescue, ragweed, broomsedge, sensitive partridge pea, Canada thistle, Canadian horseweed, flatsedges, witchgrasses, crabgrasses, poor Joe, eastern daisy fleabane, dog fennel, common sneezeweed, Japanese clover, woodland lettuce, sericea lespedeza, Korean clover, black medic, Canada toadflax, wood sorrel, switchgrass, pokeweed, rabbit tobacco, bracken fern, foxtail knotroot, Carolina horsenettle, goldenrods, and spiny sowthistle.

Existing Gas Pipeline Corridor

The proposed linear facilities cross existing gas pipeline rights-of-way in several places. Like existing transmission lines rights-of-way, these corridors are cleared of native vegetation and periodically maintained. The vegetation communities are similar in structure and composition to those described previously for existing transmission line corridors.

Road

The roads land use classification is used to describe all road types crossed by the proposed linear facilities including logging roads, gravel/clay roads, and paved roads. Any vegetation is on the sides of roads and usually consists of a variety of weedy herbaceous species or mowed roadsides dominated by grasses.

Residential or Commercial Development

This designation identifies those areas crossed by the study corridors in which active or abandoned residential or commercial structures or associated facilities (barns, parking lots, garages, etc.) were observed. Generally, any vegetation is comprised of common weedy plant species or consists of landscape plants or lawn grasses.

Active Construction

This land use designation identifies areas in which structures are being built or have been recently cleared for what appears to be new construction. The recently cleared land in the developed area crossed by the corridors is dominated entirely by herbaceous species including a number of grass species such as broomsedges, little bluestem, goldenrods, and ragweed. All vegetation present consists of those adventive, weedy taxa that proliferate in disturbed areas.

Stream

Natural streams and drainages varied considerably in size ranging from very narrow, extremely shallow seasonal, or intermittent drainages often only several feet wide and less than 0.5 ft deep that drained or connected wetland areas to wide deep streams to large, perennially flowing streams such as Okatibbee Creek, which is 60 to 80 ft wide and several feet deep in places.

A typical drainage was a meandering stream 6 to 8 ft deep, 15 to 20 ft wide, with a single confined channel and vertical to slightly sloping banks. Water depth and flow varied considerably at the time of the survey. Many streams have no flow, and water in the stream consists of a series of isolated pools of varying depths. Others have minimal flow, while still others have moderate to heavy flow such as Okatibbee Creek. Many streams are blocked by beaver dams that back water up for considerable distances upstream. Many streams have multiple beaver dams, most in various states of disrepair.

Most of the drainages support little or no wetland vegetation. This is due primarily to the fact that most of the streams and drainages are heavily shaded by overhanging upland vegetation or logging debris that has been placed in the flowway. A second reason for the lack of wetland vegetation appears to be that many of the streams, besides being shaded, have flow regimes that scour the bottom and sides of the flowways discouraging the establishment of wetland plants. Wetland vegetation along streams and drainages is usually encountered along the edges of a stream or drainage exposed to full sun or in light shade with very low or gentle flow and along streams with zones of quieter water that allow sediment deposition or bars to form upon which vegetation could establish. Wetland vegetation was also noted along streams that flowed through or are bordered by wetland areas.

Many of the streams encountered south and west of Meridian, Mississippi, were entrenched several feet relative to the original depth. This entrenchment was likely a result of increased runoff from upland disturbances such as silvicultural harvesting and roadway construction, since very little residential development has occurred in this area, especially those areas south of Meridian, Mississippi. The entrenchment of the streams has affected the hydrology of the wetlands adjacent to the streams by lowering the water table and reducing wetland hydrology in areas where soils observed with hydric morphological features and hydrophytic vegetation are no longer supported by wetland hydrology. These small floodplains are no longer active and have essentially become elevated terraces many feet above the bankfull stage of these streams.

Species noted along the edges and/or sides of the banks of streams were largely herbaceous. Species noted included dotted smartweed, climbing hempvine, shade mudflower, southern cutgrass, rushes, sedges, and woolgrass.

Ditch

Ditches were encountered throughout the electrical transmission line and the gas pipeline corridors but were more frequently encountered in and near urban areas including Marion and Meridian. Ditches vary from roadside drainages 6 to 10 ft wide and 1 to 2 ft deep with gentle sloping banks to ditches that were constructed for drainage within planted pine areas that are 4 to 5 ft wide and 6 inches or more deep with almost vertical slopes.

Nonroadside and ditches in rural areas are generally overshadowed by thick trees, shrubs, and vines. Consequently, the ditches support little, if any, wetland vegetation. Most of the roadside ditches and the urban ditches support a variety of wetland and transitional, primarily herbaceous species including unidentified grasses, sedges, rushes, broadleaf cattail, and woolgrass. Black willow grows in several ditches.

Pond

Ponds of various types are the least encountered of all the features found in the linear facility study corridors. Ponds encountered include excavated cattle watering ponds and borrow ponds as well as ponds formed by the blockage of streamflow by a beaver dam. Ponds within the corridor support little if any wetland vegetation. Most of the ponds have steep sides and little or no shallow edge to allow wetland vegetation to establish.

Forested Wetland

Forested wetlands range from isolated systems to floodplain systems adjacent to smaller streams and larger, broad floodplain bottoms adjacent to Okatibbee Creek, Chunky River, and Souenlovie Creek. Most of the smaller forested wetlands encountered are at slightly lower elevations than adjacent uplands and had no standing water at the time of the survey. However, the larger floodplain bottoms exhibited signs of extended periods of inundation such as areas of standing water, high water marks, and drift lines. Many forested wetlands appear to receive most of their water from surface flow. Several forested wetlands areas are located at the base of steep hills and appear to receive most of their water from seepage. The remainder are confluent with streams, comprising the floodplain receiving most water from overflow.

The forested wetlands exhibit mostly closed canopies with occasional openings or gaps due to windthrow. They are dominated by a mixture of hardwood trees including bald cypress, red maple, swamp tupelo, black willow, sweetgum, tulip tree, and willow oak. Shrubs were sparse to locally dense and included buttonbush, stiff dogwood, small willows, and sawtooth blackberry. Herbaceous species vary from locally dense to scattered. Species noted include lizard’s tail, iris, sensitive fern, Canadian clearweed, *Carex* spp., dotted smartweed, Virginia buttonweed, and threeway sedge. Vines include Alabama supplejack, catbriers, grape, and woodvamp.

Shrub Wetland

This community type has resulted from past clearing practices where trees in forested wetlands are removed or have developed in areas where the surface has been scraped. At present, only sapling trees (especially loblolly pine and red maple) generally less than 4 inches dbh with serrate-leaf blackberry provide a usually dense shrub stratum. Wetland herbs, usually weedy in nature, are conspicuous, and density varies with the shrub cover. Common herbs occurring in these wetlands include sensitive fern, cypress witchgrass, cattail, soft rush, and bearded sedge.

Herbaceous Wetland

Most areas supporting herb-dominated transitional or wetland vegetation have resulted from recent clearing of forested wetlands or from scraping associated with logging activities. Common species include bearded sedge, soft rush, wool-grass, cattail, and occasionally bahiagrass, serrate-leaf blackberry, southern cutgrass, manyflower marshpennywort, Virginia buttonweed, redtop panicgrass, meadow beauties, common carpetgrass, swamp sunflower, goldenrods, sedges, soft rush, rushes, and unidentified grasses. Few areas exhibit vegetative zonation. Species diversity tends to be low compared to natural marshes.

3.8.4.2 Wildlife

Prior to the initiation of any fieldwork on the linear facility corridors, ECT obtained 2007 Natural Color Imagery aerial photography of the corridors from USDA and NRCS. ECT biologists familiar with photo-interpretation used these aerial photographs to initially identify the landforms based on the signatures. A soils map of the tract (Soil Surveys of Kemper, Lauderdale, Jasper, and Clarke Counties, Mississippi, NRCS, USDA, Issued 1999, 1983, 1965, respectively) and the National Wetlands Inventory (NWI) maps of the project site in Mississippi (USFWS, DOI) provided additional information concerning hydric and upland soils, vegetative cover, wetlands, water bodies, drainages, and wildlife concerns.

Tracking and watch lists for wildlife and plants, occurrence of state-endangered species by county, and the ecological communities list were downloaded from MNHP (Museum of Natural Science Web site, MDWFP; http://museum.mdwfp.com). The federal list of threatened and endangered species by county for Mississippi was downloaded from the USFWS Southeast Region Web site (http://www.fws.gov/southeast). Furthermore, a conservation resources biologist from MNHP provided additional information regarding occurrences of state or federally listed species and species of special concern that occur within 2 miles of the site of the proposed project and made other comments and recommendations based on known habitat preferences and geographical distribution. ECT also requested and received from MDWFP a listing of known or likely occurring wildlife species for the power plant site and linear facility corridor areas. The agency's responses to ECT's information requests are contained in Appendix F.

ECT biologists met with land agents of Mississippi Power as well as various property owners several times to verify property boundaries, locate access gates and roads, and for a general overview of land uses and incidental wildlife observations on the corridors.

Vehicular transects were conducted on all accessible trails and open fields. Pedestrian transects were used in areas where thick overgrowth of vegetation, forests, topography, or wetness prevented use of a vehicle. All linear facility corridors were surveyed by qualified biologists.

During inspection of the project corridors, plant communities or land uses were noted on the aerial photographs. All wildlife species sightings were recorded as well as all indirect signs or evidence of species occurrences, such as tracks, calls, scats, burrows, nests, dens, etc. All areas were searched for the presence or evidence of threatened and endangered plant and animal species. Early morning, midday, and evening/night surveys were conducted. Wildlife surveys continued from mid-June through mid-December 2008.

All wildlife observations from all corridors are included on Table 3.8-13. This list represents species common to the region and expected in the habitats found along the corridors. No unusual observations were made.

It is not expected these species solely depend on the narrow corridor habitats for their existence since most of these species are highly mobile. Also the habitats found along the corridors are common and occur off the corridor areas as well. Therefore, the species observed would be expected all along the corridor areas as well.

Evidence of listed wildlife species was also collected and is discussed in Subsection 3.8.4.3.

3.8.4.3 Threatened and Endangered Species

Vegetation

Based on reviews of the listed species databases for Kemper, Lauderdale, Jasper, and Clarke Counties maintained by MNHP, one federally listed plant species and 53 variously state-ranked plant species are known to

Table 3.8-13. Wildlife Observed Along Linear Facilities; Kemper, Lauderdale, Jasper, and Clarke Counties, Mississippi (June through November 2008)

Common Name	Scientific Name	Evidence	Observation
Amphibians			
Southern leopard frog	*Rana spherocephala*		Direct
Reptiles			
Eastern box turtle	*Terrapene carolina*		Direct
Gopher tortoise	*Gopherus polyphemus*	Burrow	
Black Racer	*Coluber constrictor priapus*		Direct
Gray rat snake	*Elaphe obsolete spiloides*		Direct
Speckled kingsnake	*Lampropeltis getula holbrooki*		Direct
Brown Snake	*Storeria dekayi*		Direct
Red-bellied snake	*Storeria occipitomaculata*		Direct
Eastern Ribbon Snake	*Thamnophis sauritus sauritus*		Direct
Common garter snake	*Thamnophis sirtalis*		Direct
Southern copperhead	*Agkistrodon contortrix*		Direct
Eastern cottonmouth	*Agkistrodon piscivorus piscivorus*		Direct
Birds			
Black vulture	*Coragyps atratus*		Direct
Wild turkey	*Meleagris gallopavo*	Tracks, calls	Direct
Bobwhite quail	*Colinus virginianus*	Calls	Direct
Killdeer	*Charadrius vociferus*	Calls	Direct
Yellow-billed cuckoo	*Coccyzus americanus*	Calls	Direct
Barred owl	*Strix varia*	Calls	Direct
Ruby-throated hummingbird	*Archilochus colubris*		Direct
Downy woodpecker	*Picoides pubescens*		Direct
Pileated woodpecker	*Dryocopus pileatus*	Calls	Direct
Eastern kingbird	*Tyrannus tyrannus*		Direct
Bluejay	*Cyanocitta cristata*	Calls	Direct
American crow	*Corvus brachyrhynchos*		Direct
Barn swallow	*Hirundo rustica*	nest	Direct
Carolina chickadee	*Parus carolinensis*	Calls	Direct
Tufted titmouse	*Parus bicolor*		Direct
Carolina wren	*Thryothorus ludovicianus*	Calls	
American robin	*Turdus migratorius*		Direct
Gray catbird	*Dumetella carolinensis*		Direct
Mockingbird	*Mimus polyglottos*	Calls	Direct
Northern parula	*Parula americana*		Direct
Yellow-rumped warbler	*Dendroica coronata*		Direct
Hooded warbler	*Wilsonia citrina*		Direct
Northern cardinal	*Cardinalis cardinalis*	Calls	Direct
Indigo bunting	*Passerina cyanea*	Calls	Direct
Red-winged blackbird	*Agelaius phoeniceus*		Direct
Meadowlark	*Sturnella magna*	Calls	Direct
Mammals			
White-footed mouse	*Peromyscus leucopus*	Tracks	
Eastern gray squirrel	*Sciurus carolinensis*		Direct
Raccoon	*Procyon lotor*	Tracks, scat	
Nine-banded armadillo	*Dasypus novemcinctus*	Foraging holes	Direct
Beaver	*Castor canadensis*	Dams	
Eastern cottontail	*Sylvilagus floridanus*	Tracks, scat	Direct
Swamp Rabbit	*Sylvilagus aquaticus*	Tracks	Direct
White-tailed deer	*Odocoileus virginianus*	Tracks, scat	Direct

Source: ECT, 2008.

occur within the four-county area in which the project is located. One plant, Price's potato bean, is federally listed as threatened by USFWS (see Appendix A). No threatened or endangered plant species or state species of special concern were observed during the detailed field studies conducted within the linear facilities corridors and substation sites in June, July, August, September, October, November, or December 2008. Price's potato bean was actively sought during detailed field surveys of the substation sites and linear facilities corridors since there is an occurrence record for Kemper County. This plant is most often found in open woods and along woodland edges in limestone areas, typically where bluffs are adjacent to creek or river bottoms. But some populations have been found on roadsides or power line rights-of-way. Although sub-optimal roadside and open woods habitat exists within the corridors or substation sites, none were seen.

Wildlife

Wildlife surveys that were conducted as described in Subsection 3.8.4.2 focused on collecting evidence of listed wildlife species and their likelihood of occurrence. Surveys were specifically designed to document the potential for occurrence for those species identified by MDWFP in their replies to ECT's data requests for the corridors in the multicounty region of Mississippi (Appendix F).

According to the agencies' review of the corridors, portions of the project corridors have the potential to have either federal- or state-listed species. These species are identified in Table 3.8-14 and discussed in the following paragraphs.

Gopher tortoise is listed by both USFWS and MDWFP. This animal prefers sandy, well-drained soils. Such habitats are generally lacking in the corridors, although one inactive tortoise burrow was found along one of the corridors in Lauderdale County. However, the tortoise's likelihood of occurrence is generally considered unlikely along the remainder of the corridors.

Black pine snake is listed as a candidate species for federal listing by USFWS and a species of concern by MDWFP. The agency indicated this species occurs in uplands with well-drained sandy soils, usually associated with longleaf pine habitats. These habitats are lacking in the corridors, and the species is therefore considered unlikely to occur.

Sharp-shinned hawk is a state-listed species of concern and was observed on the power plant site in Kemper County. It is possible this species could be found in suitable habitats along the corridors.

Red-cockaded woodpecker is listed by both USFWS and MDWFP as endangered. This animal requires open pine woodlands and savannas with large old pines for roosting and nesting. They nest and roost in clusters and require large old pine trees, which have a higher incidence of heartwood decay. Due to logging activities along many of the corridors, this type of mature pine habitat was only observed in a few small areas south of Meridian, Mississippi. Extensive pedestrian transects were walked through these areas, and no red-cockaded woodpeckers or their nest trees were observed. It is possible that this species occurs offsite and forages within the proposed corridor, but use of the area for nesting and roosting is unlikely.

Louisiana black bear is listed by USFWS and MDWFP as threatened. This animal requires large tracts of forestland (usually bottomland hardwoods) where they forage and den. Although this species is typically restricted to the delta regions of Louisiana, Mississippi, and Arkansas, sightings of this species in Mississippi outside the delta region are increasing. In fact, an observation of a Louisiana black bear was confirmed south of Meridian, Mississippi. Pedestrian transects were walked along the entire corridor, and no Louisiana black bear or

Table 3.8-14. Potential for Occurrence of Listed Wildlife Species Along the Proposed Linear Facility Corridors

Common Name	Scientific Name	Federal Status	State Status	Likelihood of Occurrence/Comments
Gopher tortoise	*Gopherus polyphemus*	T	E	Generally unlikely due to absence of habitat; one inactive burrow found in Lauderdale County
Black pine snake	*Pituophis melanoleucus lodingi*	C	S2	Unlikely; habitat lacking
Sharp-shinned hawk	*Accipiter striatus*	—	S1B	Possibly occurring; one individual observed on power plant site in Kemper County
American black duck	*Anas rubripes*	—	S2N	Open water habitats generally absent; unlikely to occur
Rusty blackbird	*Euphagus carolinus*	—	S2N	Unlikely to occur; habitat generally lacking
Red-cockaded woodpecker	*Picoides borealis*	E	E	Habitat absent; unlikely to occur
Bald eagle	*Haliaetus leucocephalus*	—	S1B/S2N	Nest sites absent from area; unlikely
Old field mouse	*Peromyscus polinotus*	—	S2/S3	Habitat generally lacking; unlikely to occur
Louisiana black bear	*Ursus americanus luteolus*	T	T	Large, bottomland forest habitats preferred; not likely to occur, although there are recent records from the Meridian area

Note: E = endangered.
T = threatened.

S1 = critically imperiled (5 or fewer occurrences).
S2 = imperiled (6 to 20 occurrences).
S3 = rare or uncommon (21 to 100 occurrences).

B = breeding status.
N = nonbreeding status

Sources: USFWS, 2008.
MDWFP, 2008.
ECT, 2008.

their sign (scat, tracks, scrapes, etc.) were observed. It is possible that this species uses the proposed corridor, but it does not comprise a major component of the habitat for this species.

American black duck is a state-listed species of concern. However the open water habitats preferred by this duck are not common along the corridors, especially within the narrow confines of the corridor boundaries. This species is considered unlikely to occur.

Rusty blackbird is a state-listed bird of concern found in woods or fields near water or marshes. Although some of these preferred habitats exist along the corridors, the bird's occurrence is considered unlikely.

Bald eagle was recently delisted by USFWS but is still listed by MDWFP as a species of concern. The bird prefers nest sites in large living trees near open water. No nests are known in proximity to any portion of the project site, and its likelihood for nesting in the corridors is considered unlikely. It is possible the birds may use portions of the corridors for occasional foraging or roosting.

Old field mouse is a state-listed rodent of concern found in well-drained sandy soils similar to the gopher tortoise. Since these habitats are generally lacking from the corridors, this species is considered unlikely to occur.

No evidence of any other listed species was found along the corridors. Additionally, the proposed linear corridors are relatively narrow, and none of the corridors cross areas that would be considered critical for migratory species, including those protected under the federal Migratory Bird Treaty Act.

MDWFP's response to ECT's data request also advised that one of the proposed routes crosses through the Okatibbee WMA in Lauderdale County as well as several rivers and streams that are important habitat for many rare aquatic species. These species are addressed in Section 3.9.

3.9 AQUATIC ECOLOGY

3.9.1 REGIONAL SETTING

MDWFP's MNHP maintains a list of threatened and endangered species by county as well as a list of special animals being tracked. Table 3.9-1 provides a list of aquatic species by county for the four counties in which the proposed power plant site, mine study area, and linear facilities would be located. The Pascagoula, Leaf, and Chickasawhay Rivers upstream to Oaky Creek (see Figure 3.6-1) in Clarke County (just downstream of the confluence of the Chunky River and Okatibbee Creek) have been designated as critical habitat for the gulf sturgeon (*Acipenser oxyrinchus desoti*) by USFWS (2003). The gulf sturgeon is an anadromous fish that live as adults in the marine and estuarine habitats of the Gulf of Mexico, but breed in freshwater rivers. Adult gulf sturgeon migrate up natal rivers in the spring to spawn in the upper reaches of rivers.

Table 3.9-1. State and Federal Status of Threatened/Endangered Species in Counties of Interest

County	Scientific Name	Common Name	State Status*	Federal Status*
Kemper	*Procambarus lagniappe*	Lagniappe crayfish	SC	
Lauderdale	*Percina aurora*	Pearl darter	LE	C
	Procambarus lagniappe	Lagniappe crayfish	SC	
Clarke	*Graptemys flavimaculata*	Yellow-blotched map turtle	LE	LT
Jasper	*Noturus munitus*	Frecklebelly madtom	LE	

*SC = special concern. LE = listed endangered. C = candidate for listing. LT = listed threatened.

Source: MNHP, 2002.

The lagniappe crayfish has been collected in the Sucarnoochee River watershed, including the Pawticfaw Creek, which borders the eastern edge of the plant and mine study area (Fetzner, 2005; Crandall *et al.*, 2001). This species is on the state of Mississippi's special animals tracking list because it is considered a sensitive species given its natural rarity and limited range. MNHP maintains a tracking list for special animals with the primary purpose of providing information for environmental assessments, assistance in the determination of natural area protection priorities, and prioritizing inventory and protection strategies (MNHP, 2002).

The pearl darter became a candidate species for the Federal Endangered Species Act in 1999 (USFWS 2008). It is currently only known to occur in navigable waters of the Pascagoula River drainage under the jurisdiction of USACE. Its current range and distribution is limited to isolated sites within approximately 144 miles of the Pascagoula drainage, including the Pascagoula, Chickasawhay, Chunky, Leaf, and Bouie Rivers (*ibid.*). The pearl darter prefers deeper uns and pools with larger substrate particle sizes in rivers and large creeks with moderate current, usually over sand and gravel substrates. Its range is thought to be limited by disturbances and water quality problems throughout the watershed (*ibid.*).

The frecklebelly madtom is only known to occur in the Pearl River. It inhabits rocky riffles of small to medium rivers and is often found near aquatic vegetation (Page, 2007).

The yellow-blotched map turtle is a federally listed threatened species. It is known to occur only in the Pascagoula River basin, including the Leaf, Chickasawhay, and Escatawpa Rivers and other tributaries (USFWS, 1990). The yellow-blotched map turtle requires rives that are large enough to allow sunlight to reach the river channel for several hours a day. Its preferred habitat includes moderate current, sand or clay substrates, sand bars and beaches, and large woody debris. A survey conducted by USFWS in 1989 resulted in observation of 43 and 60 yellow-blotched map turtles in the Chickasawhay River over a 20-mile survey area. The number of turtles observed was three to four per mile. USFWS estimated that the greatest abundance was between Wade and Vancleave on the Pascagoula River. USFWS has not designated critical habitat for this species.

3.9.2 OKATIBBEE LAKE

Although Okatibbee Lake was originally built as a flood control reservoir and is still operated for that purpose, it has also become an important regional recreational water body that supports a variety of wildlife. Fishing is a popular recreational activity. Okatibbee Lake supports populations of catfish, largemouth bass, striped bass, and other sunfishes (Centrarchids). Several thousand acres of land within the Okatibbee WMA surrounding the lake are flooded including woodlands. These flooded lands provide important aquatic habitat for a variety of wildlife including beavers, waterfowl, reptiles, and amphibians in addition to fish.

3.9.3 POWER PLANT SITE AND MINE STUDY AREA

In June 2008, Vittor completed stream RBA studies at eight sites. This work was performed on behalf of NACC and was designed to provide quantitative information necessary to characterize aquatic biological resources in the proposed lignite mine study area. Figure 3.9-1 depicts the locations of the stream study sites. Appendix I provides the detailed stream bioassessment results. Both DOE and USACE have conducted a preliminary review of the stream assessment information; however, neither agency has granted final approval, pending final review and response to comments.

3.9.3.1 Stream Habitat Quality and Biota

Physical/Chemical Conditions

Table 3.9-2 provides the physical/chemical data and habitat assessment score (HAS) for the eight sites. Water quality (temperature, DO, pH, and conductivity) was measured with a YSI Model 6600 multiparameter sonde unit. Physical/chemical parameters were generally similar for the sampling sites. However, the three sites with the lowest HAS (Tompeat Creek, Dry Creek Tributary, and Penders Creek South) also had the lowest DO measurements at the time of sampling, with Tompeat Creek having, by far, the lowest measurement (1.37 mg/L, 6.4-percent saturation). Water temperature ranged from 22.6 (Penders Creek South) to 25.8°C (Okatibbee Creek). Conductivity ranged from 22 (Chickasawhay Headwaters) to 68 µmhos/cm (Dry Creek Tributary). Stream ph ranged from 6.71 (Tompeat Creek) to 7.82 (Penders Creek South). The substrate type (based on Wolman pebble count data) was characterized as sand at six of the eight sampling sites. The Chickasawhay Plant site had a substrate characterized as sandy silt, and the Tompeat Creek site had a substrate characterized as silt/clay.

Habitat Assessments

The Kemper County stream sampling sites can be roughly grouped based on their HAS. Habitat assessments are used to characterize the quality of habitats found in a particular stream reach. The information obtained from a habitat assessment is necessary for the proper interpretation of water quality and benthic macroinvertebrate studies, because the kinds of organisms present are dependent on the type of habitat available, as well as the quality of the water in a stream. The information used in obtaining an HAS for a particular stream reach includes epifaunal substrate/available cover, pool substrate characterization, pool variability, degree and type(s) of channel alteration, sediment deposition, channel sinuosity, channel flow status, bank vegetative protection, bank stability, and riparian vegetation zone width. The habitat assessments were conducted according to MDEQ and EPA RBA protocols (MDEQ, 2001; Barbour *et al*., 1989).

The HAS is derived from the MDEQ Surface Water Habitat Assessment Field Data Sheet. A higher HAS indicates a stream reach with more available biological habitat, little instream disturbance, and an undisturbed riparian zone. Table 3.9-3 shows the HASs (broken down by habitat parameter) for the eight sampling sites. The maximum possible HAS for a stream site is 200 (Table 3.9-3). Five of the sites (Chickasawhay South,

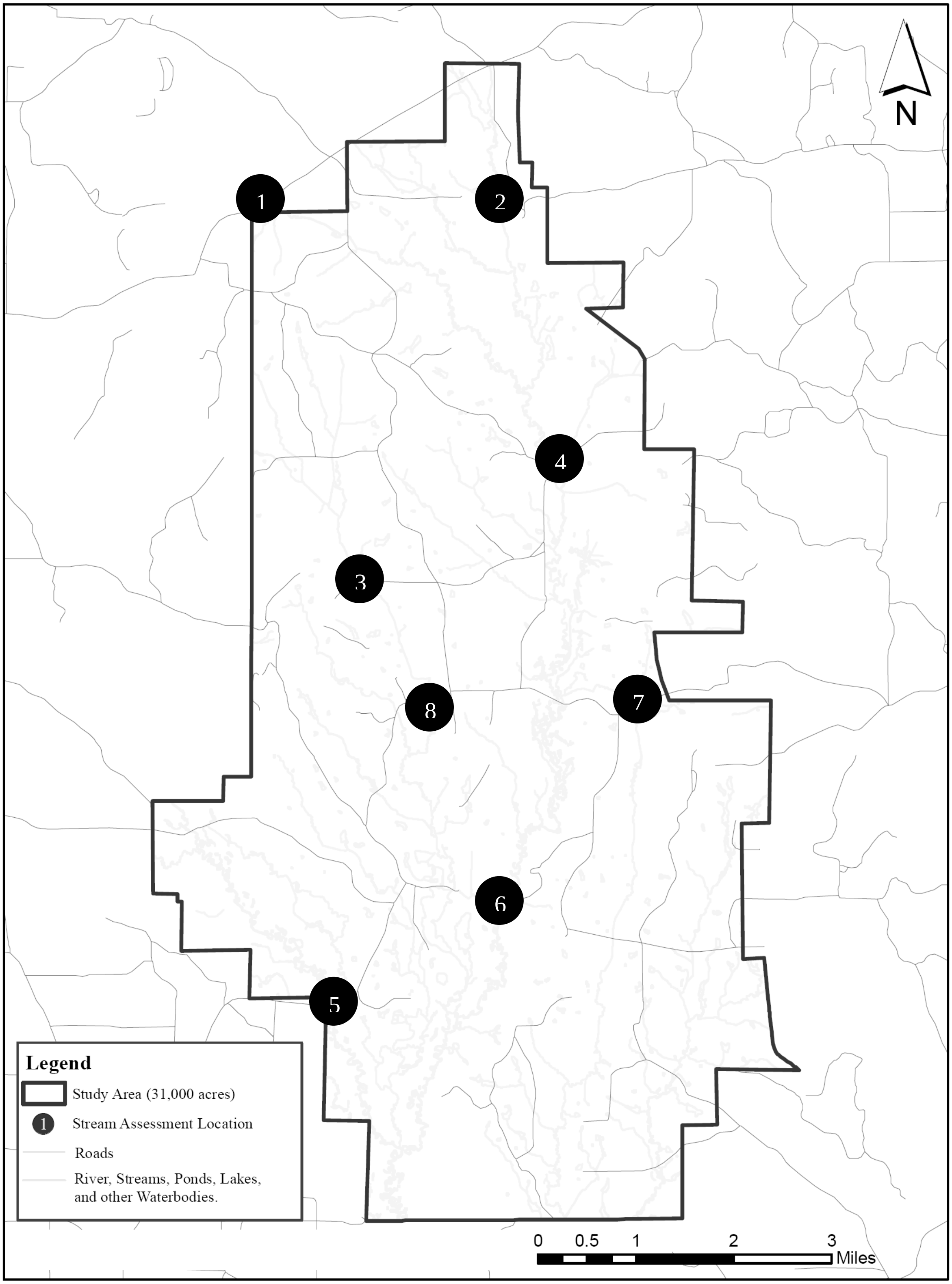


Figure 3.9-1. Stream Assessment Study Site Locations
Source: NACC, 2008.

Table 3.9-2. Physical/Chemical and Water Quality Data

Station	Station Description	Date Sampled	Station Location		Stream Width (meter)	Average Stream Depth (meter)	Water Temperature (°C)	Conductivity (µmhos/cm)	pH	DO (mg/L)	DO (% Saturation)	Substrate Type*	HAS
			Latitude	Longitude									
CHH	Chickasawhay headwaters	June 3	32°41'43"N	88°49'32"W	2	0.2	24.9	22	7.08	7.78	93.9	Sand	98
CHP	Chickasawhay plant	June 4	32°39'24"N	88°46'28"W	5	0.5	23.9	42	7.17	5.9	69.8	Sandy silt	112
CHS	Chickasawhay south	June 3	32°35'28"N	88°47'06"W	5	0.5	24.4	47	7.3	5.67	68	Sand	115
PCN	Penders Creek north	June 3	32°38'30"N	88°48'35"W	5	0.75	22.7	37	7.82	7.04	81.9	Sand	94
PCS	Penders Creek south	June 3	32°37'07"N	88°47'48"W	2.5	0.25	22.6	50	7.38	4.05	45.6	Sand	56
TPC	Tompeat Creek	June 4	32°37'16"N	88°45'39"W	1	0.2	24.1	49	6.71	1.37	16.4	Silt/clay	64
DCT	Dry Creek tributary	June 4	32°41'43"N	88°47'06"W	3	0.2	23.4	68	7.01	4.02	47	Sand	66
OKC	Okatibbee Creek	June 4	32°34'33"N	88°41'51"W	10	3	25.8	46	7.23	6.71	82.3	Sand	100

*Pebble count summary.

Source: NACC, 2009.

Table 3.9-3. HASs, June 2008

Habitat Parameter	Maximum Score	Chickasawhay Headwaters (1)*	Dry Creek Tributary (2)*	Penders Creek North (3)*	Chickasawhay Plant Site (4)*	Okatibbee Creek (5)*	Chickasawhay South (6)*	Tompeat Creek (7)*	Penders Creek South (8)*
Bottom substrate/ available cover	20	3	6	7	4	6	5	3	3
Pool substrate characterization	20	3	7	4	6	7	9	1	7
Pool variability	20	1	7	6	6	7	6	2	6
Channel alteration	20	5	6	14	16	15	14	3	5
Sediment deposition	20	16	6	14	11	11	11	3	11
Channel sinuosity	20	12	0	0	16	9	10	0	0
Channel flow status	20	18	16	18	18	18	18	16	16
Bank vegetative protection (left bank)	10	5	2	3	6	2	6	9	2
Bank vegetative protection (right bank)	10	5	2	3	6	2	6	9	2
Bank stability (left bank)	10	5	2	4	5	3	5	7	2
Bank stability (right bank)	10	5	2	4	5	3	5	7	2
Riparian vegetation zone width (left bank)	10	10	10	7	3	10	10	2	0
Riparian vegetation zone width (right bank)	10	10	0	10	10	7	10	2	0
Total	**200**	**98**	**66**	**94**	**112**	**100**	**115**	**64**	**56**

*Numbers in parentheses correlate to stream assessment study site locations shown on Figure 3.9-1.

Source: NACC, 2009.

Chickasawhay Plant, Okatibbee Creek, Chickasawhay Headwaters, and Penders Creek north) earned scores of 94 or higher (with the highest score being 115 for the Chickasawhay south site), while the remaining three sites (Dry Creek tributary, Tompeat Creek, and Penders Creek south) earned scores of 66 or lower (with the lowest score being 56 for the Penders Creek south site). Despite the variability in scores, bottom substrate/available cover scores, which measure the availability of actual substrates as refugia for aquatic organisms, were generally similar for all eight sampling sites (ranging from a low score of 3 at the Chickasawhay headwaters, Tompeat Creek, and Penders Creek south sites to a high score of 7 at the Penders Creek north site). These scores are relatively low when compared to a maximum bottom substrate/available cover score of 20 (Table 3.9-3). The high and low assessment scores for these sites were primarily driven by parameters such as riparian vegetation zone width, bank stability and vegetative protection, pool substrate characterization, and channel sinuosity, and not by the availability of suitable bottom substrate or available cover. Streams in the study area were generally diminished in habitat quality due primarily to a lack of substantial riparian zones and the presence of steeply incised stream banks; the riparian zones are typically narrow and lack three-tiered native vegetation including a forest canopy, shrubs, and herbaceous layers. These factors are likely the result of human interaction, primarily historic agricultural practices in those areas.

RBA and Benthic Communities

Macroinvertebrate sampling was conducted using the MDEQ's bioassessment protocols. D-frame dip nets were used to collect a composite macroinvertebrate sample from representative habitats in each reach. Each reach, approximately 100 meters in length, was divided into discrete habitat types (e.g., gravel/rock/cobble, snags/leaf packs/detritus, vegetated banks, submerged macrophytes, sand/silt). The extent of each habitat type in each reach was estimated (e.g., 40-percent snags, 40-percent sand/silt, 20-percent vegetated banks). Twenty dip net sweeps were collected from each reach, with the total number being apportioned among the representative habitat types with the exception that five jabs were taken from sand/silt for all stations. Material from the 20 sweeps was composited, preserved in 10-percent buffered formalin, and returned to the laboratory for further processing. Composite samples were inventoried in the laboratory, rinsed gently through a 0.5-millimeter mesh sieve to remove preservatives and sediment, stained with rose bengal, and stored in a 70-percent isopropanol solution for processing. Each composite sample was randomly subsampled to a targeted level of 200 (± 20 percent) organisms according to MDEQ (2001) and Barbour *et al*. (1989). All macroinvertebrates were identified to the lowest practical identification level, which in most cases was to species unless the specimen was a juvenile or damaged.

A cluster analysis for the eight sampling sites was performed using several metrics, including total number of taxa (taxa richness), percent dominant taxon (percentage of total individuals represented by the dominant taxon), number of Chironomidae taxa, percent Chironomidae, percent Tanytarasini Chrionomid taxa, number of Ephemeroptera + Plecoptera + Trichoptera (EPT) taxa, percent EPT taxa, EPT/Chironomidae taxa ratio, Shannon taxa diversity index (H'), and HAS. The metric data for each site are given in Table 3.9-4, and the cluster analysis is presented in Figure 3.9-2. The raw taxonomic data for each of the eight sites can be found in the Appendix J.

No unionid mussels were encountered at any of the eight sampling stations. The only bivalves observed during sampling were common fingernail clams (Family *Sphaeriidae*). Likewise, no crayfish species were observed during sampling at any of the eight monitoring stations.

Taxa richness data for the eight sampling sites are given in Table 3.9-4. Taxa richness typically declines with increasing stream perturbations. Taxa richness was lowest at the Tompeat Creek site, with 31 unique taxa

Table 3.9-4. Biological Metrics Data for the Kemper County Sampling Sites

Site Description*	Number of Taxa	% Dominant Taxon	Number of Chironomidae Taxa	% Chironomidae	% Tanytarsini	% Filterer	% Clingers	Number EPT Taxa	% EPT Taxa	EPT/Chiro	H'
Chickasawhay headwater (1)	38	23	18	80	23	27	16	5	13	7	2.78
Dry Creek tributary (2)	34	24	18	57	29	40	3	0	0	0	2.67
Penders Creek north (3)	42	43	18	79	15	14	2	5	12	5	2.42
Chickasawhay plant site (4)	41	15	21	66	18	26	24	5	12	24	3.13
Okatibbee Creek (5)	32	47	16	76	55	60	13	8	25	23	2.20
Chickasawhay south (6)	45	11	21	70	27	30	8	4	9	13	3.31
Tompeat Creek (7)	31	31	12	36	2	2	8	2	6	3	2.52
Penders Creek south (8)	32	19	20	83	26	27	27	3	9	5	2.80

*Numbers in parentheses correlate to stream assessment study site locations shown on Figure 3.9-1.

Source: NACC, 2009.

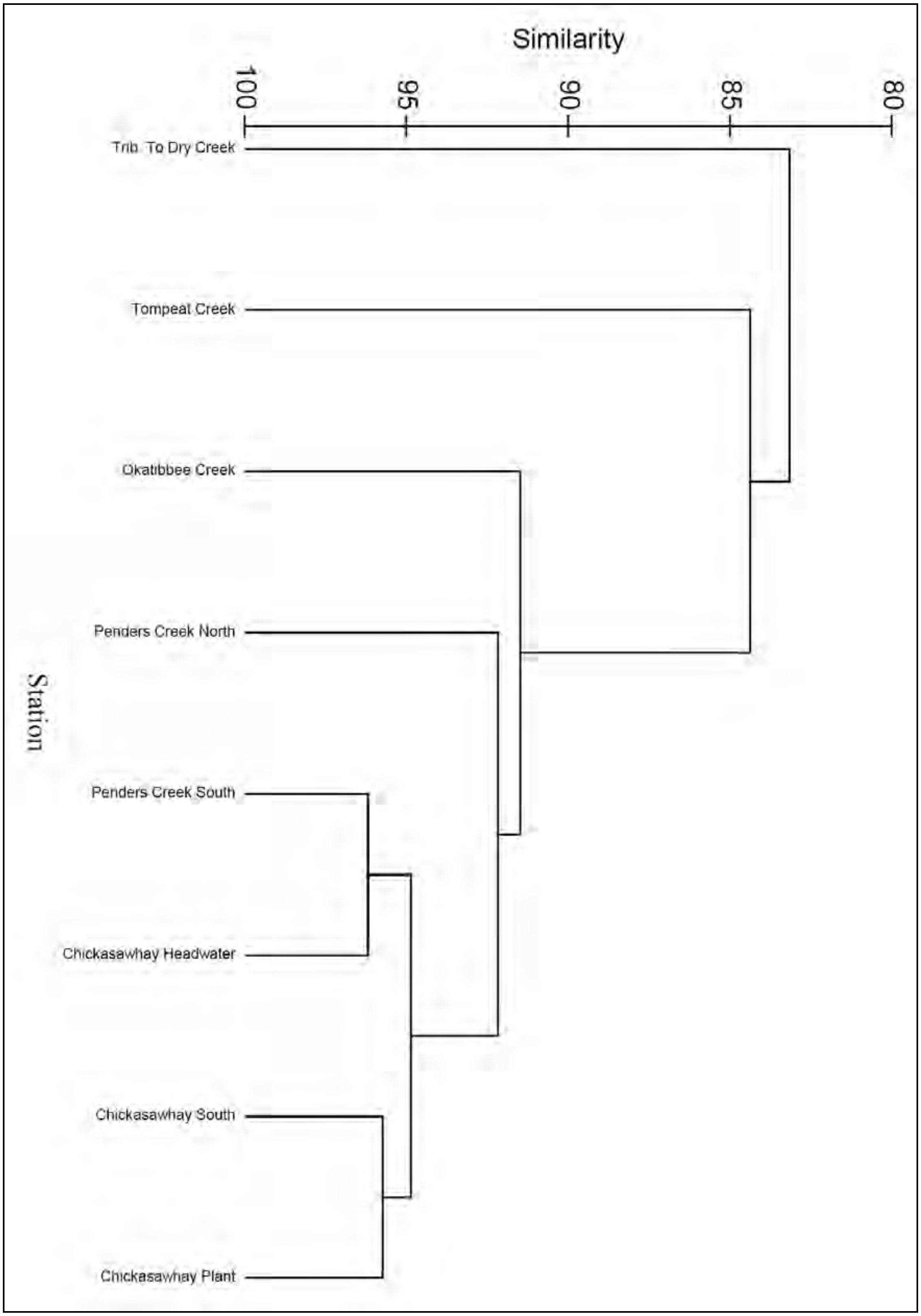


Figure 3.9-2. Cluster Analysis for Sampling Sites
Source: NACC, 2009.

identified at that site. All other sampling sites had higher numbers of taxa, with the highest number, 45, occurring at the Chickasawhay South site.

The numbers of Chironomidae taxa (midge larvae) for the eight sites are given in Table 3.9-4. The number of Chironomidae taxa typically declines with increasing stream perturbations. The number of Chrionomidae taxa was lowest at the Tompeat Creek site, with 12 taxa being collected. The highest numbers of Chironomidae taxa were collected at the Chickasawhay south and Chickasawhay plant sites, with 21 taxa being collected at both sites. The percent dominance of chironomids typically increases with stream perturbations, but a converse trend was seen at the mine study area sampling stations; percent dominance of chironomids ranged from 36 percent at the Tompeat Creek station to 83 percent at the Penders Creek south station. At least for the mine study area streams sampled, the percent dominance of chironomids does not seem to be a good indicator of stream health, as other metrics suggest that Tompeat Creek is more impacted than others. However, the Dry Creek tributary station had a higher percentage than all other sampling stations other than the Okatibbee Creek station, while other metrics suggest that the Dry Creek tributary is more impacted. The percentage of Tanytarsini chironomids also does not seem to be a good indicator of stream health, at least or the mine study area streams sampled.

The percentage of chironomids in the Tribe Tanytarsini is given in Table 3.9-4. Tanytarsini chironomids are small midge larvae that are variously filter-feeders or collector-gatherers. Typically the number of Tanytarsini chironomids declines with perturbations to a stream habitat. The percentage of Tanytarsini chironomids was extremely variable with the lowest percentage collected at the Tompeat Creek site (2 percent) and the highest percentage collected at the Okatibbee Creek site (55 percent).

Table 3.9-4 provides the number of EPT taxa and the percent of the assemblage represented by EPT taxa. EPT taxa are composed of Ephemeroptera (mayfly larvae), Plecoptera (stonefly larvae), and Trichoptera (caddisfly larvae). EPT taxa are typically sensitive to stream perturbations, and numbers decline with increasing disturbance. No EPT taxa were collected from the Dry Creek tributary site. The highest number and percentage of EPT taxa was collected from the Okatibbee Creek site (eight taxa, 25 percent of the assemblage).

Table 3.9-4 provides the EPT taxa/Chironomidae taxa ratio for each site. Typically the relative abundance of EPT taxa to Chironomidae taxa decreases with increasing stream perturbation. The EPT/Chironomidae ratio was 0 for the Dry Creek tributary (due to the lack of EPT taxa). The highest ratio, 24, was found at the Chickasawhay plant site.

Table 3.9-4 also presents the percent dominant taxon data. The percent dominance of a single taxon increases with increasing stream perturbation. The dominance of a single taxon was lowest at the Chickasawhay south site (11 percent), while a single taxon made up 47 percent of the assemblage at the Okatibbee Creek site. Taxa diversity (H') data are given in Table 3.9-4. Taxa diversity within a given assemblage is dependent on the number of taxa present (taxa richness) and the distribution of all individuals among those taxa (equitability or evenness). Taxa diversity typically declines with increasing stream perturbation. Diversity was lowest (2.20) at the Okatibbee Creek site and highest (3.31) at the Chickasawhay south site. HAS ranged from 56 (Penders Creek south) to 115 (Chickasawhay south).

Based on HAS and RBA metrics, it appears that the Tompeat Creek and Dry Creek tributary sites are the most impacted sites, exhibiting those characteristics indicative of historic human interaction (i.e., lack of legitimate riparian zone and steeply incised stream banks). Cluster analysis was performed by calculating the Bray-Curtis similarity coefficient for all pairs of sampling stations using the biological metrics (Clarke and Gorley, 2003). Clusters were formed using the group-average linkage method between similarities. Cluster analysis is a multivariate technique that attempts to determine natural groupings (or clusters) of sites based on the biological metrics. Cluster analysis for the eight sampling sites shows separation of the Tompeat Creek and Dry Creek tributary sites based primarily on a low percentage of sensitive organisms (Tompeat Creek) or the lack of EPT taxa collected (Dry Creek tributary) along with low HAS at both sites. Based on a high HAS, a high percentage of sensitive organisms, and a high number of EPT taxa, Okatibbee Creek appears to be the least impacted site. All other sites were generally similar with respect to the RBA metrics.

Available habitat for aquatic organisms varied little between these other sites and was either generally low in quality or lacking in overall area of available habitat, illustrating the importance of taking into account overall RBA metrics as well as HAS when drawing conclusions concerning overall habitat quality in a given study area.

3.9.3.2 Fish Communities

Table 3.9-5 provides fish community data for the eight sampling sites. Numbers of fish taxa, as well as numbers of individuals, varied greatly between stations. However, the three sites with the highest HAS (Chickasawhay south, Chickasawhay plant, and Okatibbee Creek) also had the highest numbers of taxa and individuals, with the Chickasawhay south site having the highest numbers (five taxa, 28 individuals). Of the 28 individuals, the majority (20) was made up of two species of shiner. The dominant species at this site was weed shiner (13 individuals) and blacktail shiner (seven individuals). Other species collected at the Chickasawhay south site included spotted bass (four individuals), bluegill (three individuals), and clear chub (one individual).

Weed shiner and blacktail shiner also dominated the fish community collected at the Chickasawhay plant site with 16 and 6 individuals collected, respectively. The other species collected at this site was bluegill (two individuals). The Okatibbee Creek fish community was also dominated by weed shiner and blacktail shiner with five and four individuals collected, respectively. Other species collected at the Okatibbee Creek site included blackspotted top minnow (one individual) and longnose shiner (one individual).

Very few fish were collected from the other sampling sites: five bluegill were collected from the Penders Creek north site; two bluegill and one spotted bass were collected from the Tompeat Creek site; and three western mosquitofish were collected from the Penders Creek south site. One weed shiner was collected from the Dry Creek tributary site, and one blacktail shiner was collected from the Chickasawhay headwaters site.

The number of fish collected can be a function of the amount of available cover at a particular site. However, fish collections are largely qualitative in nature, and correlations between fish community data and stream condition should not be assumed.

The following subsection summarizes the data obtained at each station during the field surveys. Stations were ranked by HAS and are described in rank order from highest to lowest score.

Chickasawhay South

Habitat Assessment

Chickasawhay South was sampled on June 3, 2008, and scored an HAS of 115. This station was distinguished by high scores on riparian vegetation zone widths for right and left banks, channel alteration, and channel flow status. The score for bottom substrate/available cover was relatively low.

Table 3.9-5. Fish Data Summary

Station*	Taxa	Common Name	SL†	TL‡	Weight
Chickasawhay headwaters (1)	*Cyprinella venusta*	Blacktail shiner	100	120	12.045
Dry Creek tributary (2)	*Notropis texanus*	Weed shiner	51	62	1.5243
Penders Creek north (3)	*Lepomis macrochirus*	Bluegill	Identified and released in the field		
	Lepomis macrochirus	Bluegill	Identified and released in the field		
	Lepomis macrochirus	Bluegill	Identified and released in the field		
	Lepomis macrochirus	Bluegill	Identified and released in the field		
	Lepomis macrochirus	Bluegill	Identified and released in the field		
Chickasawhay plant site (4)	*Lepomis macrochirus*	Bluegill	33	45	1.166
	Lepomis macrochirus	Bluegill	39	46	1.305
	Cyprinella venusta	Blacktail shiner	65	83	3.57
	Cyprinella venusta	Blacktail shiner	72	90	4.9084
	Cyprinella venusta	Blacktail shiner	50	61	1.443
	Cyprinella venusta	Blacktail shiner	43	52	1.0019
	Cyprinella venusta	Blacktail shiner	48	60	1.3595
	Cyprinella venusta	Blacktail shiner	40	51	0.7535
	Notropis texanus	Weed shiner	40	51	0.746
	Notropis texanus	Weed shiner	37	47	0.59
	Notropis texanus	Weed shiner	35	44	0.5337
	Notropis texanus	Weed shiner	37	45	0.5338
	Notropis texanus	Weed shiner	56	71	2.2774
	Notropis texanus	Weed shiner	37	45	0.554
	Notropis texanus	Weed shiner	40	52	0.8174
	Notropis texanus	Weed shiner	50	60	1.5675
	Notropis texanus	Weed shiner	44	55	0.8072
	Notropis texanus	Weed shiner	40	50	0.695
	Notropis texanus	Weed shiner	47	59	1.1594
	Notropis texanus	Weed shiner	43	52	0.895
	Notropis texanus	Weed shiner	35	45	0.5041
	Notropis texanus	Weed shiner	39	49	0.7124
	Notropis texanus	Weed shiner	35	45	0.5445
	Notropis texanus	Weed shiner	34	44	0.4179
Okatibbee Creek (5)	*Cyprinella venusta*	Blacktail shiner	51	65	1.8434
	Cyprinella venusta	Blacktail shiner	74	90	4.4854
	Cyprinella venusta	Blacktail shiner	37	50	0.6375
	Cyprinella venusta	Blacktail shiner	49	60	1.3866
	Fundulus olivaceus	Blackspotted top minnow	46	62	1.5153
	Notropis longirostris	Longnose shiner	40	50	0.6965
	Notropis texanus	Weed shiner	56	67	2.5952
	Notropis texanus	Weed shiner	43	53	0.736
	Notropis texanus	Weed shiner	40	49	0.5949
	Notropis texanus	Weed shiner	45	55	1.1079
	Notropis texanus	Weed shiner	42	49	0.6028
Chickasawhay south (6)	*Micropterus punctulatus*	Spotted bass	39	48	1.1443
	Micropterus punctulatus	Spotted bass	45	55	1.445
	Micropterus punctulatus	Spotted bass	43	53	1.4616
	Micropterus punctulatus	Spotted bass	50	61	2.1077
	Lepomis macrochirus	Bluegill	34	43	1.0542
	Lepomis macrochirus	Bluegill	27	32	0.4459
	Lepomis macrochirus	Bluegill	21	27	0.2147
	Cyprinella venusta	Blacktail shiner	37	47	0.6528

Table 3.9-5. Fish Data Summary (Continued, Page 2 of 2)

Station*	Taxa	Common Name	SL†	TL‡	Weight
	Cyprinella venusta	Blacktail shiner	60	72	2.4385
	Cyprinella venusta	Blacktail shiner	47	57	1.3816
	Cyprinella venusta	Blacktail shiner	53	66	1.9035
	Cyprinella venusta	Blacktail shiner	55	68	2.2459
	Cyprinella venusta	Blacktail shiner	32	47	0.6235
	Cyprinella venusta	Blacktail shiner	39	48	0.7683
	Notropis texanus	Weed shiner	49	61	1.6309
	Notropis texanus	Weed shiner	43	53	0.95
	Notropis texanus	Weed shiner	42	51	0.65901
	Notropis texanus	Weed shiner	36	44	0.5171
	Notropis texanus	Weed shiner	41	50	0.6074
	Notropis texanus	Weed shiner	53	66	1.5201
	Notropis texanus	Weed shiner	77	95	5.092
	Notropis texanus	Weed shiner	42	53	0.6951
	Notropis texanus	Weed shiner	42	50	0.6953
	Notropis texanus	Weed shiner	46	55	0.8252
	Notropis texanus	Weed shiner	41	52	0.7572
	Notropis texanus	Weed shiner	40	52	0.7314
	Notropis texanus	Weed shiner	55	71	1.9721
	Notropis winchelli	Clear chub	47	58	1.2257
Tompeat Creek (7)	*Lepomis macrochirus*	Bluegill	Identified and released in the field		
	Lepomis macrochirus	Bluegill	Identified and released in the field		
	Micropterus punctulatus	Spotted bass	Identified and released in the field		
Penders Creek south (8)	*Gambusia affinis*	Western mosquito fish	20	26	0.0816
	Gambusia affinis	Western mosquito fish	22	29	0.1391
	Gambusia affinis	Western mosquito fish	32	40	0.3933

*Numbers in parentheses correlate to stream assessment study site locations shown on Figure 3.9-1.
†Standard length (length from snout to caudal peduncle – base of the tail fin).
‡Total length (length from snout to tip of caudal [tail] fin).

Source: NACC, 2009.

RBA and Benthos

Forty-five taxa were collected at this site during sampling. Twenty-one of these taxa, 70 percent of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 27 percent were from the taxonomic tribe, Tanytarsini, an important indicator group due to their sensitivity to environmental impacts. Four of the total taxa collected (9 percent) were EPT taxa. This site had a taxa diversity (H') of 3.31.

Physical and Chemical Data

Chickasawhay south had a stream width of approximately 5 meters in the sampling area, with an average stream depth of 0.5 meter. Water temperature at the time of sampling was 24.4°C. Conductivity and pH were 47 µmhos/cm and 7.3, respectively. DO at this site was 5.67 mg/L (68-percent saturation) at the time of sampling. The substrate type (based on pebble count data) was sand.

Fish Collection

Five fish taxa (28 individuals) were collected at the Chickasawhay south site. The most numerous of these (13 individuals; 46 percent of total individuals) was the weed shiner. Other taxa collected included blacktail shiner (seven individuals), spotted bass (four individuals), bluegill (three individuals), and clear chub (one individual).

Chickasawhay Plant

Habitat Assessment

Chickasawhay plant was sampled on June 4, 2008, and scored an HAS of 112. This station was distinguished by high scores on riparian vegetation zone width on the right bank, channel alteration, channel sinuosity, and channel flow status. The score for bottom substrate/available cover was relatively low.

RBA and Benthos

Forty-one taxa were collected at this site during sampling. Twenty-one of these taxa, 66 percent of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 18 percent were from the taxonomic tribe, Tanytarsini. Five of the total taxa collected (12 percent) were EPT taxa. This site had a taxa diversity (H') of 3.13.

Physical and Chemical Data

Chickasawhay plant had a stream width of approximately 5 meters in the sampling area, with an average stream depth of 0.5 meter. Water temperature at the time of sampling was 23.9°C. Conductivity and pH were 42 µmhos/cm and 7.17, respectively. DO at this site was 5.9 mg/L (69.8-percent saturation) at the time of sampling. The substrate type (based on pebble count data) was sandy silt.

Fish Collection

Three fish taxa (24 individuals) were collected at the Chickasawhay plant site. The most numerous of these (16 individuals; 67 percent of total individuals) was the weed shiner. Other taxa collected included blacktail shiner (six individuals), and bluegill (two individuals).

Okatibbee Creek

Habitat Assessment

Okatibbee Creek was sampled on June 4, 2008, and scored an HAS of 100. This station was distinguished by high scores on riparian vegetation zone width for right and left banks, channel alteration, and channel flow status. This site received a lower HAS than previous sites based primarily on lower scores for bank stability and bank vegetative protection. The score for bottom substrate/available cover was relatively low, and similar to previous sites.

RBA and Benthos

Thirty-two taxa were collected at this site during sampling. Sixteen of these taxa, 76 percent of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 55 percent were from the taxonomic tribe, Tanytarsini. Eight of the total taxa collected (25 percent) were EPT taxa. This site had a taxa diversity (H') of 2.20.

Physical and Chemical Data

Okatibbee Creek had a stream width of approximately 10 meters in the sampling area with an average stream depth of 3 meters. Water temperature at the time of sampling was 25.8°C. Conductivity and pH were 46 µmhos/cm and 7.23, respectively. DO at this site was 6.71 mg/L (82.3-percent saturation) at the time of sampling. The substrate type (based on pebble count data) was sand.

Fish Collection

Four fish taxa (11 individuals) were collected at the Okatibbee Creek site. The most numerous of these (five individuals; 45 percent of total individuals) was the weed shiner. Other taxa collected included blacktail shiner (four individuals), blackspotted top minnow (one individual), and longnose shiner (one individual).

Chickasawhay Headwaters

Habitat Assessment

The Chickasawhay headwaters site was sampled on June 3, 2008, and scored an HAS of 98. This station was distinguished by high scores on riparian vegetation zone width for right and left banks, sediment deposition, and channel flow status. This site received a lower HAS than previous sites based primarily on low scores for pool substrate characterization and pool variability. The score for bottom substrate/available cover was relatively low, and similar to previous sites.

RBA and Benthos

Thirty-eight taxa were collected at this site during sampling. Eighteen of these taxa, 80 percent of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 23 percent were from the taxonomic tribe, Tanytarsini. Five of the total taxa collected (13 percent) were EPT taxa. This site had a taxa diversity (H') of 2.78.

Physical and Chemical Data

The Chickasawhay headwaters site had a stream width of approximately 2 meters in the sampling area, with an average stream depth of 0.2 meter. Water temperature at the time of sampling was 24.9°C. Conductivity and pH were 22 µmhos/cm and 7.08, respectively. DO at this site was 7.78 mg/L (93.9-percent saturation) at the time of sampling. The substrate type (based on pebble count data) was sand.

Fish Collection

One fish taxon (one individual), a blacktail shiner, was collected at the Chickasawhay headwaters site.

Penders Creek North

Habitat Assessment

Penders Creek north was sampled on June 3, 2008, and scored an HAS of 94. This station was distinguished by high scores on riparian vegetation zone width for right and left banks, channel alteration, and channel flow status. This site received a lower HAS than previous sites based primarily on a low score for channel sinuosity. The score for bottom substrate/available cover was relatively low, and similar to previous sites.

RBA and Benthos

Forty-two taxa were collected at this site during sampling. Eighteen of these taxa, 79 percent of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 15 percent were from the taxonomic tribe, Tanytarsini. Five of the total taxa collected (12 percent) were EPT taxa. This site had a taxa diversity (H') of 2.42.

Physical and Chemical Data

Penders Creek north had a stream width of approximately 5 meters in the sampling area, with an average stream depth of 0.75 meter. Water temperature at the time of sampling was 22.7°C. Conductivity and pH were 37 µmhos/cm and 7.82, respectively. DO at this site was 7.04 mg/L (81.9-percent saturation) at the time of sampling. The substrate type (based on pebble count data) was sand.

Fish Collection

One fish taxon (five individuals), bluegill, was collected at the Penders Creek north site.

Dry Creek Tributary

Habitat Assessment

Dry Creek tributary was sampled on June 4, 2008, and scored an HAS of 66. This station was distinguished by high scores on riparian vegetation zone width for the left bank, and channel flow status. This site received a considerably lower HAS than previous sites based primarily on a low scores for right bank riparian vegetation zone width, channel sinuosity, bank vegetative protection, and bank stability. The score for bottom substrate/available cover was relatively low, and similar to previous sites.

RBA and Benthos

Thirty-four taxa were collected at this site during sampling. Eighteen of these taxa, 57 percent of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 29 percent were from the taxonomic tribe, Tanytarsini. No EPT taxa were collected from this site, which had a taxa diversity (H') of 2.67.

Physical and Chemical Data

Dry Creek tributary had a stream width of approximately 3 meters in the sampling area, with an average stream depth of 0.2 meter. Water temperature at the time of sampling was 23.4°C. Conductivity and pH were 68 µmhos/cm and 7.01, respectively. DO at this site was 4.02 mg/L (47-percent saturation) at the time of sampling. The substrate type (based on pebble count data) was sand.

Fish Collection

One fish taxon (one individual), weed shiner, was collected at the Dry Creek tributary site.

Tompeat Creek

Habitat Assessment

Tompeat Creek was sampled on June 4, 2008, and scored an HAS of 64. This station was distinguished by high scores on bank vegetative protection and channel flow status. This site received a similar HAS to the Dry Creek tributary site and a considerably lower HAS than the other sites. The lower HAS at this site was based primarily on a low scores for riparian vegetation zone width, channel sinuosity, pool substrate characterization, pool variability, channel alteration, and sediment deposition. The score for bottom substrate/available cover was relatively low, and similar to previous sites.

RBA and Benthos

Thirty-one taxa were collected at this site during sampling. Twelve of these taxa, 36 percent of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 2 percent were from the taxonomic tribe, Tanytarsini. Two of the total taxa collected (6 percent) were EPT taxa. This site had a taxa diversity (H') of 2.52.

Physical and Chemical Data

Tompeat Creek had a stream width of approximately 1 meter in the sampling area, with an average stream depth of 0.2 meter. Water temperature at the time of sampling was 24.1°C. Conductivity and pH were 49 µmhos/cm and 6.71, respectively. DO at this site was 1.37 mg/L (16.4-percent saturation) at the time of sampling. The substrate type (based on pebble count data) was silt/clay.

Fish Collection

Two fish taxa (three individuals) were collected at the Tompeat Creek site. Two of these individuals were bluegill, and the other was a spotted bass.

Penders Creek South

Habitat Assessment

Penders Creek south was sampled on June 3, 2008, and scored an HAS of 56. This station was distinguished by a high score only on channel flow status. This site received a similar HAS to the Dry Creek tributary and Tompeat Creek sites and a considerably lower HAS than the other sites. The lower HAS at this site was based primarily on a low scores for riparian vegetation zone width, bank stability, bank vegetative protection, and channel sinuosity. The score for bottom substrate/available cover was relatively low, and similar to previous sites.

RBA and Benthos

Thirty-two taxa were collected at this site during sampling. Twenty of these taxa, 83 percent of the total individuals collected, were from the family Chironomidae. Of the Chironomidae, 26 percent were from the taxonomic tribe, Tanytarsini. Three of the total taxa collected (9 percent) were EPT taxa. This site had a taxa diversity (H') of 2.80.

Physical and Chemical Data

Penders Creek south had a stream width of approximately 2.5 meters in the sampling area, with an average stream depth of 0.25 meter. Water temperature at the time of sampling was 22.6°C. Conductivity and pH were 50 µmhos/cm and 7.38, respectively. DO at this site was 4.05 mg/L (45.6-percent saturation) at the time of sampling. The substrate type (based on pebble count data) was sand.

Fish Collection

One fish taxon (three individuals), western mosquitofish, was collected at the Penders Creek south site.

3.9.3.3 Threatened and Endangered Species

Vittor addressed aquatic threatened and endangered species (i.e., fish, mussels, and crayfish) in the approximately 31,000-acre study area. As part of this effort, RBAs were performed at eight different stream sites within the project boundaries. Surveys for aquatic macroinvertebrates (including protected species) and fish species were made at each of these sample locations. Unionid mussels and crayfish were also targeted. Data on stream characteristics were collected and used to assess the likelihood of occurrence of listed species within the project site based on their habitat requirements. In addition, incidental observations were made of study area streams in conjunction with wetland surveys.

Prior to conducting the stream RBAs and field surveys, a literature review was performed to generate a list of both federal- and state-protected aquatic species that could possibly occur within the 31,000-acre study area. USFWS's list of Mississippi's protected species by county was consulted as the primary reference on potentially occurring federally listed and candidate species (http://www.fws.gov/southeast/jackson/index.html). Additionally, USFWS' review of candidate species (DOI, 2007) was also used. MDWFP is responsible for the regulation of nongame species in the state, and their list of state-protected wildlife species was examined as a source of information on protected aquatic taxa in Mississippi. Ross (2001) was used as a source for information on listed and candidate fish species.

There are no state-protected aquatic species (with the potential exception of the aquatic turtles) based on the following nongame regulations from MDWFP:

> "All birds of prey (eagles, hawks, osprey, owls, kites, and vultures) and other nongame birds are protected and may not be hunted, molested, bought, or sold. The following endangered species are also protected: black bear, Florida panther, gray bat, Indiana bat, all sea turtles, gopher tortoise, sawback turtles (black-knobbed, ringed, yellow-blotched), black pine snake, eastern indigo snake, rainbow snake, and the southern hognose snake" (http://www.mdwfp.com/Level2/Wildlife/hunting_regs.asp).

An examination of USFWS' list of federally protected species revealed no documented occurrences of any endangered or threatened aquatic species for Kemper and Lauderdale Counties. Additionally, no federal candidate species are shown on this list for the two-county area. A broader inspection of a six-county area (Clarke, Jasper, Neshoba, Newton, Noxubee, and Winston Counties) surrounding the project site revealed no listed unionid mussels or crayfish species. Based on this list, no protected species of mussels or crayfish are expected to occur within the general vicinity of the study site. The lagniappe crayfish is considered a species of special concern (formerly a C2 species) but is not currently listed as a candidate species for federal protection (DOI, 2008). This species is presently only known from the Sucarnoochee River drainage system in Mississippi and Alabama with seven localities (element occurrences) from Kemper County and single occurrences from Lauderdale County, Mississippi, and Sumter County, Alabama (NatureServe, 2009). The Sucarnoochee River flows east into Alabama and is outside of the Chickasawhay Creek watershed, which drains south into the Pascagoula River basin. Based on its limited distribution outside of the Chickasawhay Creek drainage basin, the species is not expected to occur within the project site.

One candidate fish species, the pearl darter, was noted from Clarke County located well to the south of the proposed project site. The pearl darter is a candidate species for federal protection with an LPN of 5. The immediacy of threats to this species is currently considered to be nonimminent (DOI, 2007). Historically, the species was found within the Pascagoula and Pearl River drainages in Mississippi and Louisiana; however, it is now believed to be extirpated from the Pearl River drainage system. Within the Pascagoula River drainage basin, the species is considered rare and occurs in localized populations (DOI, 2008). Although the species is not known from Kemper or Lauderdale Counties, it was considered as a potential target for the survey. No individuals of pearl darter were encountered during the field surveys. Suitable habitat for this species (e.g., stream runs and riffles over gravel or bedrock substrate; Ross, 2001) does not exist within the study area, and the species is not expected to occur within the project boundaries.

No federally protected aquatic species were documented during the field surveys or the RBA sampling efforts. Additionally, no candidate species or species of special concern were observed. No species of unionid mussels or crayfish were found during the field surveys or RBA of project area streams.

3.9.4 LINEAR FACILITY CORRIDORS AND RIGHTS-OF-WAY

The project would require several linear facilities to support the power plant: a natural gas pipeline, electric transmission lines, a reclaimed water pipeline, and a CO_2 pipeline. Most of the proposed corridors for these linear facilities were surveyed for jurisdictional wetlands and surface water bodies in 2008 (see Subsection 3.8.4). The linear facilities would cross intermittent and perennial streams in the Pascagoula River, Chickasawhay River, and Sucarnoochee River watersheds. Surveys of 156 miles of the linear facilities corridors identified 37 upper perennial and 335 intermittent streams along all of the proposed corridors combined. The proposed electric transmission line corridors cross 213 intermittent streams and 37 upper perennial streams. The proposed natural gas pipeline corridor crosses ten intermittent streams in the Pascagoula River and Chickasawhay River watersheds and no perennial streams. The study corridor for the planned CO_2 pipeline to Heidelberg crosses 141 streams, including the Chunky and Lower Leaf Rivers. Fifty-three of the streams crossed by the CO_2 corridor are intermittent, while the remaining 88 are perennial. The Chunky River is a state-designated Scenic River. Although aquatic life sampling was not conducted in the identified streams, the aquatic life communities of the intermittent and perennial streams crossed by the proposed linear facility corridors are expected to be similar to that of the mine study area and power plant site given similarities in topography, soils, vegetation, and climate.

3.10 FLOODPLAINS

Floodplains are essential ecological components of streams. Floodplain functions include flood storage and flood flow conveyance, sediment storage, wildlife habitat, nesting habitat, water quality, and organic matter loading. The North Central Hills physiographic region is characterized by hilly ravine topography and rapid surface runoff. The soils, topography, and runoff characteristics result in the development of numerous intermittent streams that form in ravines and gulleys. These incised streams have little or no floodplain; flows are typically contained completely within the channel. The Chickasawhay Creek has a broad floodplain with associated wetlands on the mine study area. However, Chickasawhay Creek is incised. Therefore, it is not clear how often Chickasawhay Creek flood flows enter its floodplain. Okatibbee Creek is also incised and has a less defined and narrower floodplain than Chickasawhay Creek. The 100-year floodplain of Okatibbee Creek has been mapped by the FEMA. The Chickasawhay Creek floodplain has not been mapped.

3.11 WETLANDS/WATERWAYS

Wetlands within the overall project area were determined using a combination of aerial photograph interpretation, NWI maps, soils surveys, topographic maps, and rigorous field surveys. Field delineations were performed for all wetlands/other waters (waterways) on the plant site and within linear facilities study corridors and substation sites; for the mine study area, a combination of aerial interpretation and ground truthing was done to identify wetlands and waterways. For the plant site and linear facilities, all wetlands and waterways were delineated using the routine wetland determination method as outlined in the 1987 Wetland Delineation Manual. The jurisdictional boundaries of wetlands and waterways were marked with pink surveyor flagging and each point surveyed using a Trimble® global positioning system (GPS) unit with sub-meter accuracy. Any flagging was removed at the request of landowners after the boundary had been surveyed. Data on vegetation, hydrology, and soils was taken at the wetland/upland interface for most wetlands.

Wetlands within the project area are typically associated with stream channel floodplains. Wetland types are classified as forested wetlands, shrub wetlands, and herbaceous wetlands and the corresponding Cowardin system of wetland classification (Cowardin *et al.*, 1979) for the plant site and linear facilities. Waterways are categorized as streams, ditches, and ponds and the corresponding Cowardin classification, if applicable. The following describes the wetlands and waterways that were identified on the power plant site, mine study area, and linear facilities corridors and substation sites.

3.11.1 POWER PLANT SITE

Table 3.11-1. Wetland Types on Plant Site

Wetland/Waterways Type	Total Acreage
Forested (palustrine forested)	330.7
Shrub (palustrine scrub-shrub)	76.1
Herbaceous (palustrine emergent)	35.5
Ponds (lacustrine open water)	2.1
Streams (riverine, intermittent)	0.3
Total	**444.7**

Source: Vittor, 2009.

Wetland surveys of the power plant site were conducted in March, July, and August 2007 (see Appendix E). The delineations were conducted according to the methodology and criteria set forth in the 1987 USACE Wetland Delineation Manual, which requires the presence of hydric soils, a dominance of wetland vegetation, and wetland hydrology. Table 3.11-1 lists wetland types and acreages found in the project area. Appendix K provides detailed information on the comparative quality of the wetlands on the site. Both DOE and USACE have conducted a preliminary review of this wetlands assessment information; however, neither agency has granted final approval, pending final review and response to comments.

Jurisdictional wetlands occupy approximately 444.7 acres (approximately 27 percent) of the site. Wetlands throughout the site are usually associated with Chickasawhay Creek or tributaries thereof. The majority of the wetlands on the plant site are palustrine forested wetlands located within the floodplain of the main channel of Chickasawhay Creek, along the western site boundary. Other wetlands onsite are associated with smaller tributaries to Chickasawhay Creek. Wetlands within the central part of the site have been heavily impacted by clear cutting. Very few canopy trees remain in these areas, and logging slash was left in the wetlands. Many wetlands onsite have been further degraded by silt runoff from the highly erodible, cutover upland slopes. Portions of the wetlands in the northern part of the site have been converted to pasture. Wetlands in the southern part of the site are the least impacted. Figure 3.11-1 shows the location of the wetlands and waterways delineated on the power plant site. A preliminary jurisdictional determination form and wetland delineation verification data package is being prepared and will be submitted to the USACE, Mobile Division. This package will include details on the wetlands and waterways that were delineated on the plant site. The following provides an overview of the wetlands and general soils and hydrologic characteristics observed on the site.

The vegetation composition of the cutover wetlands is typically comprised of regenerating loblolly pine, red maple, sweetgum, and water oak in the sparsely remaining canopy, while the shrub and herbaceous layers are dominated by wax myrtle, broom sedge, slender wood oats, giant plume grass, greenbriar, soft rush, trifoliate orange, wooly bulrush, and saw-toothed blackberry. The undisturbed wetlands are vegetated by white oak, red maple, blackgum, green ash, sweetgum, water oak, willow oak, tulip tree, red cedar, American elm, Japanese honeysuckle, wax myrtle, trifoliate orange, blueberry, and Christmas fern. Wetland soils are poorly drained, characterized by low chroma sandy clays with redox concentrations (e.g., mottles, nodules, and concretions, and/or pore linings on root channels) and were saturated at or near the surface at the time of the survey. The hydric soils mapped as underlying the wetlands onsite include the Mooreville-Kinston-Mantachie Association and Kinston loam (NRCS, 2008). The dominant hydrologic indicators in these wetlands include surface water inundation, soil saturation within the upper 12 inches, drainage patterns, watermarks, water-stained leaves, and oxidized root channels.

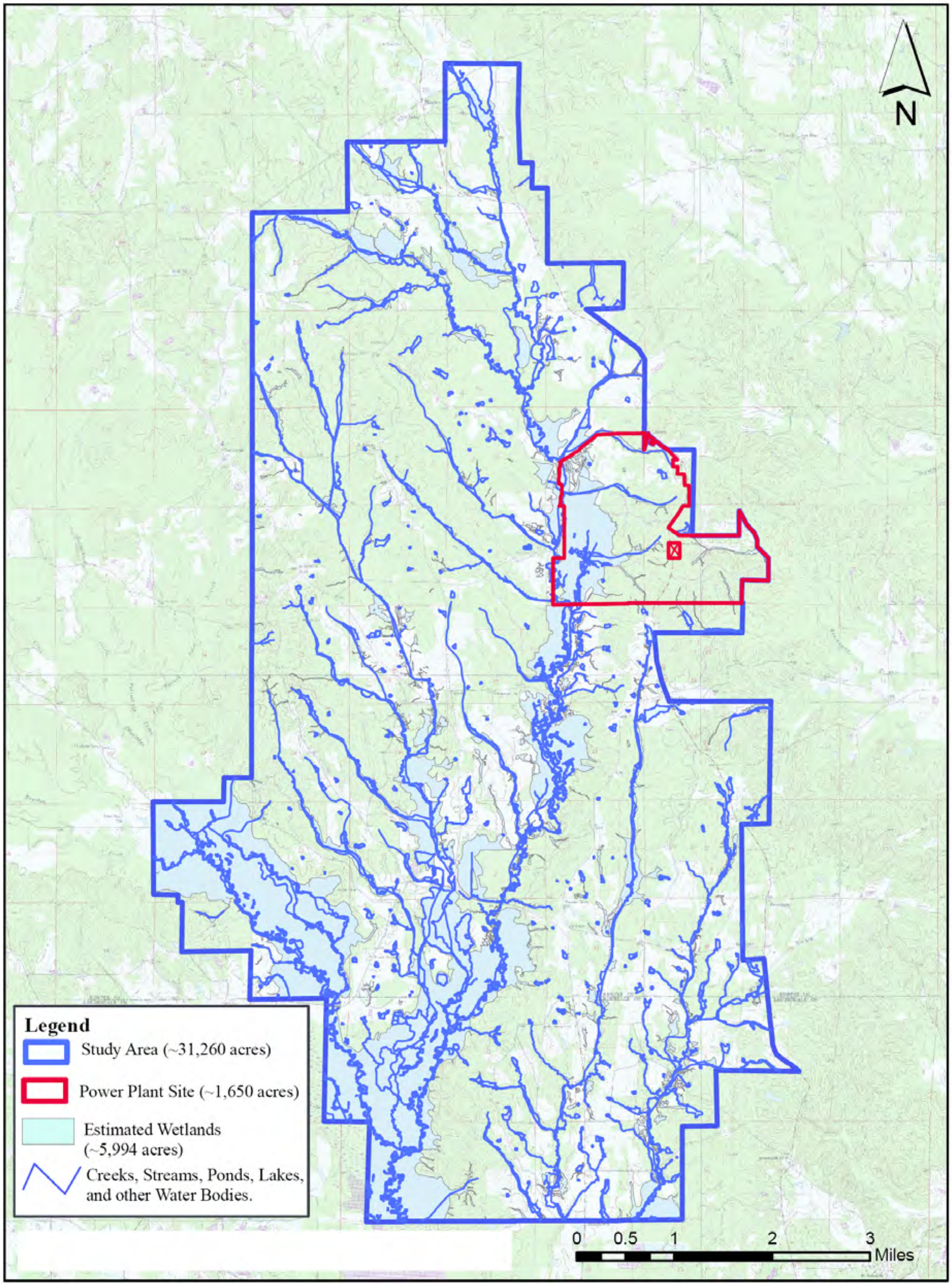


Figure 3.11-1. Spatial Distribution of Wetlands

Source: NACC, 2009.

3.11.2 MINE STUDY AREA

The wetland boundaries were estimated across the study area using field delineation and extensive point specific ground-truthing data (where access allowed) combined with desktop interpretation of high-resolution 2008 aerial imagery and state-of–the-art photogrammetrically generated topographic data. Geographic information systems (GIS) and soil survey data were also employed to aid in the desktop delineation of wetlands. Due to the limitations associated with interpretation of remotely sensed data, boundaries of mapped wetlands may vary slightly from actual conditions on the ground; however, based on comparisons of boundary data generated through desktop methods to actual ground measurements, any such variations are expected to be minor (i.e., essentially imperceptible at the scales of mapping and anticipated use of the data).

3.11.2.1 Field Assessments of Wetland Boundaries

Jurisdictional wetland boundaries delineated in the field were identified using the methods described and outlined in USACE's Wetland Delineation Manual (USACE, 1987). This manual emphasizes a three-parameter approach to identifying and delineating wetlands in the field: (1) the presence of hydric soils, (2) evidence of wetland hydrology, and (3) a predominance of hydrophytic vegetation. Standardized data sheets containing fields for each of these data metrics were used to help systematically and objectively identify jurisdictional wetlands during the survey. Data were collected in the field in both wetland and upland locations. An effort was made to specifically collect field data in those areas where the wetland boundary appeared subtle or ambiguous. Examples include *atypical situations* (areas in which one or more wetland parameter has been obscured by recent change or disturbance; also referred to as disturbed areas) and *problem areas* (wetland types in which the indicators of one or more parameter may be periodically lacking due to normal seasonal or annual variations in environmental conditions that result from causes other than human activities or catastrophic natural events; see field data sheets). Ninety sampling points were documented using the field data from over the 31,260-acre study area during the survey. Appendix K provides the wetlands quality assessment results for mine study area wetlands that were evaluated in the field.

At each sampling location, a test hole was dug using an auger to a maximum depth of 18 inches (46 centimeters [cm]). Observations were made on soil texture, the presence/absence of any hydrological indicators (e.g., oxidized root channels, mottling, soil saturation, etc.) and soil matrix color. Soil color was determined using the standardized notation given in the Munsell® Soil Color Charts (2000). Additional indicators of hydrology were also noted, such as the presence of water stained leaves, and observations of drainage patterns in wetlands. Finally, a brief list of the dominant vascular plant species was made for a 30-ft radius circle surrounding each test hole. Nomenclature, taxonomy, and the wetland indicator status for each plant taxon follows the USDA Plants Database (2003).

The spatial position of points occurring at the wetland boundary were fixed in the field using either a Trimble® Pro-XR or Pro-XRS GPS with real-time correction. Additionally, GPS points were taken for the location of each wetland and upland data sheet. Points were also collected to aid in the interpretation of color signatures shown on the aerial imagery and to indicate whether a broad general area occurred within a wetland or upland.

GPS line data were also taken to delineate the wetland boundary in open field areas where the lack of dense vegetation allowed for easy movement around the wetland edge. This was performed either on foot or by slowly driving around the perimeter of the wetland on a four-wheel, all-terrain vehicle.

3.11.2.2 Desktop Assessment of Wetland Boundaries

Soil Data

Spatial soil survey data for Kemper and Lauderdale Counties were downloaded from the MARIS Technical Center Web site (MARIS, 2009a). From this dataset, an estimated 9,231 acres of soils mapped as either frequently or occasionally flooded were identified within the project boundaries. This value also includes 339 acres mapped as open water (W) (i.e., surface water features such as ponds and lakes, both natural and manmade). These data were used to target specific areas for field visitation and to aid in the delineation of wetlands on the 31,260-acre study by identifying areas that may possibly contain hydric soils.

Aerial Imagery

Aerial imagery showing the project study area was collected during March 2008 and spatially georeferenced using GIS. Broad landscape features such as wetland drainage patterns in open fields and forested drains are visible on the aerial imagery. In some instances the ground-truthing data were able to field-verify certain aerial signatures. These data were all used to aid in the desktop delineation of the wetlands.

3.11.2.3 Results

Using a combination of the field-collected ground-truthing points, interpretation of aerial imagery, USGS 7.5-minute topographic quadrangles, spatial soil survey data, and 5-ft photogrammetrically generated topographic contour data, 5,994 acres of wetlands were mapped over the 31,260-acre study area (see Figure 3.11-1). This represents approximately 19 percent of the overall project area. Due to the limitations of aerial interpretation and hand-digitizing of the wetland boundaries, the wetland features depicted in Figure 3.11-1 may vary from actual conditions on the ground.

Vegetated wetlands across the study area can be broadly classified into categories that reflect specific physiognomic features such as the height, structure, and spacing of the canopy, dominant plant species composition, and the gross morphologies of their growth forms. For purposes of this study, three general wetland types were considered: forested, scrub, and herbaceous wetlands. Areas of nonvegetated open water were also included as a separate type. Table 3.11-2 provides acreages for each of these wetland types.

Table 3.11-2. Estimated Acreages for Forested, Shrub, and Herbaceous Wetlands and Open Water

Combined Category	Vegetation/Land Use Categories Included*	Acreage
Forested wetlands	BF, H, HP, PH, PP	4,978
Shrub wetlands	S	290
Herbaceous wetlands	C, F, G, R, R/C	580
Open water	SWD, SWP, and SWS	146

*See Table 3.11-3 for explanation of codes.

Source: SCS, 2009.

It is possible to identify several different vegetated wetland habitats within the three general categories based on the terrestrial vegetation and land use classification and mapping. The wetland polygon data were placed over the land use/vegetation map to get an estimate of wetland acreage occurring within each terrestrial land use category (i.e., bottomland forest, hardwood forest, hardwood-pine forest, pine-hardwood forest, pine plantation, shrubland, field, commercial/residential, transmission lines, roads, active construction, and gas pipeline corridors) (see Table 3.11-3). Although acreages of mapped wetlands occurring in the nonvegetated Open Water categories (i.e., ditches [SWD], ponds [SWP], and streams [SWS]) can be calculated (Table 3.11-4), these groups are not considered in the following discussions.

Table 3.11-3. Categories Used for the Vegetation/Land Use Mapping of the Study Area

BF	Bottomland forest.
PP	Planted pine—Areas actively managed or used to cultivate pines. Includes all areas in various stages of maturity from recently cleared (where the intent is to likely replant) to mature.
H	Hardwood forest—Dominated by native hardwoods; usually second growth but relatively natural in aspect.
PH	Pine-hardwood forest. Describes those areas where pine comprises the dominant cover in a forested community; includes those areas where pine is likely to be harvested but not maintained and the hardwoods allowed to mature.
HP	Hardwood-pine forest—Describes those areas where hardwoods comprise the dominant cover; usually relatively natural in aspect.
S	Shrubland—Areas cleared of forest and have become dominated by shrubs.
F	Field—Pastures, hayfields, deer plots. Areas cleared of forest cover and maintained in an herbaceous state. Includes old field vegetation.
TL	Existing transmission line corridors.
G	Existing gas pipeline corridors.
R	Roads—Includes logging roads and paved roads.
R/C	Residential or commercial development.
C	Active construction—Areas where active construction is taking place.
SWS	Streams, natural drainages.
SWD	Ditches—Usually upland cut but can occur in wetlands.
SWP	Ponds—Cow ponds, borrow ponds.

Source: SCS, 2009.

Vegetated wetlands occurring in each of the various vegetation/land use categories provided in Table 3.11-3 were classified as belonging to one of the three broad wetland types (forested, shrub, and herbaceous). Nonvegetated areas of open water are not included (ditches, ponds, and streams). A majority of the wetland acreage falls into seven of the land use/vegetation categories: bottomland forest (BF), planted pine (PP), hardwood forest (H), pine-hardwood forest (PH), hardwood-pine forest (HP), scrubland (S), and pasture/hayfields (F). A minority of the wetlands (approximately 10 acres) occurred in areas mapped as gas pipeline corridors (G), commercial/residential (R/C), roads (R), or active construction (C). No wetlands were mapped within the land use category transmission lines (TL).

Bottomland forest, hardwood forest, hardwood-pine forest, pine-hardwood forest, and planted pine are considered to be components of forested wetlands. Wetlands falling into the shrubland category were considered shrub wetlands. Wetlands occurring with pastures and open fields (land use catego-

Table 3.11-4. Estimated Acreages of Wetlands and Nonvegetated Areas of Open Water Occurring in the Study Area

Vegetation/Land Use Categories	Acreage of Wetlands
Bottomland forest	4,021
Active construction	2
Fields	570
Gas pipeline corridors	< 1
Hardwood forest	186
Hardwood-pine forest	127
Pine-hardwood forest	107
Pine plantation	537
Roads	7
Residential/commercial	< 0.1
Shrubland	290
Streams	80
Ditches	< 1
Ponds	66

Source: SCS, 2009.

ry F) were classified as herbaceous wetlands. A small minority of wetlands were mapped in the remaining nonvegetated land use categories (active construction, gas pipeline corridors, roads, and residential/commercial). These areas were included under herbaceous wetlands since in most cases they will be maintained in a nonforested state.

Forested Wetlands

Forested wetlands include those areas dominated by a tall tree canopy. Nearly 5,000 acres of wetlands were mapped under the category of forested wetlands. This includes areas classified as bottomland forest, planted pine, hardwood forest, hardwood-pine forest, and pine-hardwood forest on the terrestrial vegetation/land use map.

An estimated 4,021 acres of wetlands were classified as bottomland hardwood forest containing a wide diversity of woody plant taxa. Dominant canopy tree species in these areas include red maple, swamp chestnut oak, water oak, willow oak, cherrybark oak, sweetgum, and swamp tupelo. American sycamore was also occasionally encountered, but this species was typically restricted to natural elevated sand levees along streams and creeks. Sweetbay was infrequently encountered. American holly was a common midstory canopy tree species. Understory shrub species present in bottomland forest areas include St. Andrew's cross, bursting heart, and Elliot's blueberry. Woody vine species are represented by Alabama supplejack, cat greenbrier, climbing dogbane, and poison ivy. Bullbrier was common and tended to occur along the ecotonal zones between wetlands and uplands. The shaded understory of the bottomland forest communities was sparsely vegetated with herbaceous species. Slender woodoats tended to be the most common groundcover species in the bottomland forests. Other frequently encountered herbaceous forb taxa include green dragon, jack-in-the pulpit, and jewelweed. Lizard's tail was found in wetter areas. Fringing wetlands bordering streams were often vegetated with Christmas fern.

An estimated 537 acres of wetlands occurred in areas classified as planted pine. Wetlands occurring in these pine plantations were generally considered low quality forested wetlands. They typically contained managed loblolly pine and lacked a dense herbaceous understory component. Species of juncus (e.g., *J. effusus*, J. *coriaceus*, and *J. tenuis*) occur as scattered individuals in the pine plantation areas. Ferns such as ebony spleenwort are also common.

The mapped acreage of the remaining forested wetland types (hardwood forest, hardwood-pine forest, and pine-hardwood forest) represent a minority (approximately 7 percent) of the total wetland acreage combined. These wetlands exhibit many characteristics similar to those of bottomland forest wetlands within the study area. These three uncommon wetland types were often found in areas where bottomland forest and planted pine wetlands overlapped and shared some of the characteristics of each wetland habitat type. These wetlands were often adversely affected by human activities and adjacent land use.

Shrub Wetlands

Shrub wetlands included those wetland areas occurring in locations mapped as shrubland. These areas are primarily represented by regenerating clear-cuts. Approximately 290 acres of wetlands were mapped as shrub wetlands. Herbaceous species present in these systems include giant plumegrass , woolgrass, leathery rush, warty panicgrass, dogfennel, and the nonnative Vasey's grass. Woody shrub species dominate the landscape. Sawtooth blackberry is perhaps the most common species in the clear-cut areas. Other representative shrub taxa include groundsel bush, yaupon, wax myrtle, and young individuals of loblolly pine.

Herbaceous Wetlands

A small acreage (approximately 10 acres) was mapped in locations classified as active construction, gas pipeline corridors, roads, and residential/commercial. These areas were included under herbaceous wetlands since in most cases they will be maintained in a nonforested state.

Approximately 570 acres of wetlands were identified within areas of open field and pastures. These field wetlands typically occur as swales or sometimes ditchlike systems and are dominated primarily by herbaceous plant species. The wetlands are frequently mown, although the deeper ditchlike swales can be undisturbed. Native graminoid species (e.g., grasses, sedges, and rushes) are common components of these wetland systems. Soft rush typically occupies those areas within the interior portions of the swales that receive the greatest inundation. This species is often replaced by leathery rush along the slightly less wet fringing margins of the wetland near the upland boundary. Other native graminoid taxa present include velvet panicgrass, marsh flatsedge, woolgrass, and cone-cup spikerush. The composition of native forb taxa tends to be fairly diverse within the wet swales. Representative forb species present include helmet flower, buttonweed, spring lady's tresses, false daisy, swamp smartweed, and axilflower. Numerous nonnative herbaceous taxa are also relatively common in the wetland swale areas. Examples include dallisgrass, Vasey's grass, bahiagrass, tall fescue, hairy buttercup, and barnyard grass. Although several of these species are more typical of uplands, they are occasionally found along the disturbed edges of the swales.

Bottomland Forest

In the study area, bottomland forest wetlands most commonly occurred in the floodplains of major creeks and along their associated tributaries. These wetlands were often high quality due to a lack of frequent or significant human disturbance.

A majority of the medium and high quality bottomland forest wetlands occurred in the Chickasawhay and Okatibbee Creek floodplains outside the anticipated mine study areas. These wetlands were often part of large, contiguous tracts of forest that provide cover, forage, and travel corridors for wildlife species. Birds, mammals, reptiles, amphibians, and aquatic species are using bottomland forest wetlands. These wetlands often have a mature and diverse canopy comprised of predominantly native hardwood species and a ground cover that is sparsely vegetated (as a result of the low levels of sunlight associated with a mature canopy) with desirable native species. All the bottomland forest wetlands observed in the study area exhibited an adequate hydroperiod capable of supporting a viable wetland system. Water entering these wetlands was most commonly pretreated by natural undeveloped lands.

The lowest quality wetlands were located near the tributaries and creeks where human disturbance was more frequently documented. The buffers to these wetlands were often cleared of native forest and maintained as commercial timberland or cattle pasture. Hydrologic impacts resulting from the placement of ditches and culverts in wetlands were also more frequently documented in the bottomland forest wetlands, which are of low quality.

Planted Pine

Large stands of loblolly pine are commonly managed for commercial timber production by large industry and private landowners throughout the study area. Even-aged clear cutting is the most common method of harvest/regeneration practiced in these planted pine forests. Ten wetlands that occur in planted pine wetlands within the mine study area were evaluated. All planted pine wetlands evaluated were determined to be of low quality.

A majority of the loblolly pine stands were planted in dense, even rows and have closed canopies. Loblolly pine is a native species in the study area; however, they do not naturally occur in such high densities within wetlands. Monoculture pine stands inhibit the regeneration of native hardwood canopy species; therefore, planted pine wetlands are often considered to be low quality wetlands. Excessive shading of the understory and soil subsidence are conditions frequently observed in planted pine wetlands; in areas where these conditions exist, there are increased levels of undesirable plant species in the shrub and herbaceous layers, resulting in degraded quality of wetland ground cover. The frequent occurrence of mechanized land clearing, ditching, and placement of culverts in planted pine wetlands leads to poor wetland hydrology. Planted pine wetlands often have a limited adjacent upland food source for large mammals and offer little foraging or nesting opportunity to songbirds. Wildlife species were observed utilizing planted pine wetlands less frequently than any of the other forested wetland types.

Hardwood, Hardwood-Pine, and Pine-Hardwood Forest

The mapped acreage of these three forested wetland types represented a minority (approximately 7 percent) of the total wetland acreage combined. These wetlands exhibit many characteristics similar to those of bottomland forest wetlands within the study area. Pine-hardwood wetlands were evaluated at five locations. Hardwood-pine forest wetlands were evaluated at six different locations. Only two of the wetlands evaluated during the survey are categorized as hardwood forests. These three uncommon wetland types are often found in areas where bottomland forest and planted pine wetlands overlap and share some of the characteristics of each wetland habitat type. These wetlands are often adversely affected by human activities and adjacent land use.

Fields and Shrubland Wetlands

Twelve wetlands in fields and one shrubland wetland were evaluated. Pastureland, rangeland, and deer plots are common land use practices in the study area. These areas have low densities of canopy and shrub species and are often planted in nonnative grasses and forbs. Many of these wetlands occur in or adjacent to the floodplain of large creeks and around the perimeter of manmade ponds. The following site conditions observed during the evaluation of wetlands in the field land use category resulted in low quality relative to wetlands in other land use categories: low density of native wetland canopy species, high percentages of undesirable wetland ground cover species, reduced drainage as a result of manmade dams, altered hydrology due to the placement of ditches and culverts in wetlands, decreased quality of surrounding wetland/upland buffers, and a reduced capacity to pretreatment water entering the wetland system. The location of these wetlands is random due to the scattered distribution of landowners who use the land for agricultural and recreational purposes. The single wetland evaluated in the shrubland land use category was a low-quality wetland.

3.11.3 LINEAR FACILITY CORRIDORS, RIGHTS-OF-WAY, AND SUBSTATION SITES

Wetlands and waterways crossed by the linear facilities study corridors (the 156 miles surveyed) and present on the substation sites were delineated from June through December 2008. All new study corridors were a minimum of 200 ft in width; final rights-of-way will be placed within these 200-ft-wide corridors to avoid and minimize wetland impacts as far as practicable. In general the wetland resources in the region have been subjected to periodic perturbations due to the use of much of the land region for agriculture, particularly silvicultural operations. Wetlands have been logged and periodically cleared in conjunction with adjacent upland logging. Floodplains have been cleared and subject to sedimentation due to clearing of the floodplains and adjacent uplands. Some drainageways have been channelized (or entrenched), while others have been subject to sedimentation and flashing due to clearing in the watersheds. The wetlands and waterways crossed by the corridor study areas reflect this region-wide degradation, and observed impacts range from moderate to severe. No pristine wetland or floodplain communities were seen within the study area. As previously mentioned, all waters of the United States were delineated as per the 1987 delineation manual and surveyed using digital global positioning system (DGPS). The functional attributes of wetlands was evaluated using the WRAP methodology.

Due to the length of the linear facilities, they were segregated into logical components for discussion purposes. The linears were segregated into the natural gas pipeline segment, transmission line segments, CO_2 pipeline segment, and three substation parcels. A separate preliminary jurisdictional determination form wetland verification package has been prepared for each. These packages contain detailed information on the wetlands including types, locations, extent, routine wetland determinations data sheets for the upland/wetland interface, and functional assessments. The following is a summary of the character of the wetland and waterways encountered within each of the segments. As previously mentioned, more detailed data and maps are included in the wetland jurisdictional verification request packages that have been submitted to USACE.

3.11.3.1 Natural Gas Pipeline Corridor

Table 3.11-5 lists the wetland/waterway types found in this portion of the linear facilities. The natural gas pipeline corridor is approximately 5.8 miles in length and encompasses approximately 140.2 acres. Wetland types are classified descriptively and further identified under the Cowardin system of wetland classification (Cowardin *et al.*, 1979). Acreages were determined from DGPS survey data that were entered into a GIS and overlain on 2007 aerial photographs. Forested wetlands (palustrine forested wetland) is the dominant jurisdictional community in the natural gas pipeline corridor, followed by streams (riverine intermittent), shrub wetland (palustrine scrub-shrub wetland), herbaceous wetland (palustrine emergent wetland), and lastly, ditches.

Table 3.11-5. Wetland Types within the Natural Gas Pipeline Study Corridor

Wetland/Waterways Type	Total acreage
Forested (palustrine forested)	6.06
Streams (riverine intermittent)	0.32
Shrub (palustrine scrub-shrub)	0.26
Herbaceous (palustrine emergent)	0.23
Ditches	0.05
Total	**6.92**

Source: ECT, 2009.

Forested Wetland (Palustrine Forested)

Forested wetlands occur on approximately 6.1 acres within the natural gas pipeline study corridor area. They occur along the streams, generally. The composition varies depending on moisture and soils conditions. Typically, the canopy is dominated by red maple, sweetgum, loblolly pine, and swamp tupelo and occasionally tulip tree and water oak. The shrub stratum is usually dominated by sapling canopy species. Herbs are scattered and include *Carex* spp., sensitive fern, and soft rush. Rice cutgrass and wool-grass were observed in some wetlands. As typical for the region, most forested wetlands represent second-growth forest and have been degraded due to historic land uses, particularly silviculture. This has resulted in forests with immature canopies, numerous gaps, and decreased structural and compositional diversity.

Stream (Riverine Intermittent)

Most of the streams crossed by the study corridor are seasonally flowing drainages. All the streams encountered have well-defined banks and channels and vary from shallow (less than 1 ft deep) to deeply incised (several feet from the top of the bank to the channel). In most cases, deeply incised streams appear to infrequently overflow the banks, resulting in upland vegetation growing right up to the edge of the streambanks. Streams that frequently or periodically overflow their banks usually exhibit a discernible floodplain characterized by forested wetland vegetation; these streams are encountered infrequently within the study corridor. The channels are usually devoid of vegetation and sandy-bottomed. Water, if present at the time of the survey, was generally less than 1 ft in depth.

Shrub Wetland (Palustrine Scrub-Shrub)

Shrub-dominated wetlands occur on only 0.26 acre within the gas pipeline study corridor. In all cases, this wetland type has resulted from past clearing practices where trees were removed. At present, only sapling trees (especially loblolly pine and red maple) generally less than 4 inches dbh exist, with serrate-leaf blackberry providing a usually dense shrub stratum. Wetland herbs, usually weedy in nature, are conspicuous, and density varies with the shrub cover. Common herbs occurring in these wetlands include sensitive fern, cypress witchgrass, cattail, soft rush, and bearded sedge.

Herbaceous Wetland (Palustrine Emergent)

Herb-dominated wetlands are limited in extent within the study corridor, occurring on 0.23 acre. Most of these areas have resulted from recent clearing or scraping associated with logging activities. Common species include bearded sedge, soft rush, wool-grass, cattail, and occasionally bahiagrass, saw greenbrier, and serrate-leaf blackberry. All herbaceous wetlands within this corridor are of low quality.

3.11.3.2 Transmission Line Corridors

Table 3.11-6 lists the wetland/waterway types found in these portions of the linear facilities. The study corridors, in which the rights-of-way for the new transmission lines are proposed for construction as well as existing rights-of-way that are present but would require upgrading, total approximately 89 miles in length and encompasses approximately 1,882 acres. Six distinct jurisdictional types were identified within these corridors: three wetland types and three *other* waters. Wetland types are classified descriptively and further identified under the Cowardin system of wetland classifi-

Table 3.11-6. Wetland Types within the Transmission Line Study Corridors

Wetland/Waterways Type	Total acreage
Forested wetland (palustrine forested)	95.3
Herbaceous wetland (palustrine emergent)	54.0
Streams (riverine perennial and intermittent)	37.9
Shrub wetland (palustrine scrub-shrub)	28.4
Ponds (lacustrine excavated)	8.0
Ditches	3.8
Total	**227.4**

Source: ECT, 2009.

cation (Cowardin *et al.*, 1979). Acreages were determined from DGPS survey data that were entered into a GIS system and overlain on 2007 aerial photographs. Forested wetlands constitute the largest jurisdictional type.

Forested Wetland (Palustrine Forested)

Small areas of forested wetlands were frequently encountered throughout the transmission line study corridors. Forested wetlands ranged from isolated systems to systems adjacent to streams and comprising the floodplain. Collectively, forested wetlands occur on approximately 96.1 acres.

Most of the forested wetlands encountered were at slightly lower elevations than adjacent uplands and did not have standing water at the time of the survey. Many forested wetlands appear to receive most of their water from surface flow. Several forested wetlands areas are located at the base of steep hills and appear to receive most of their water from seepage. The remainder are confluent with streams, comprising the floodplain receiving most water from overflow.

The forested wetlands exhibited mostly closed canopies with occasional openings or gaps due to windthrow. They are dominated by a mixture of hardwood trees including red maple, swamp tupelo, willow, sweetgum, tulip tree, and willow oak. Shrubs were sparse to locally dense and included buttonbush, stiff dogwood, small willows, and sawtooth blackberry. Herbaceous species varied from locally dense to scattered. Species noted include lizard’s tail, iris, sensitive fern, Canadian clearweed, *Carex* spp., dotted smartweed, Virginia buttonweed, and threeway sedge. Vines included Alabama supplejack, catbriers, grape, and woodvamp.

Herbaceous Wetland (Palustrine Emergent)

Herb-dominated wetlands were identified on 53.3 acres within the study corridors. Herbaceous wetlands were frequently encountered within the electrical transmission and pipeline corridor. Typically, they resulted from clearing of other wetland types.

Most herbaceous wetlands noted in the power line corridor are low moist to wet areas located in cattle pastures. Other herbaceous wetlands are located in existing cleared and maintained power line corridors and are the result of clearing during the construction of the corridors. These wetlands established in the moist to wet areas created during clearing and are maintained as herbaceous wetland by the maintenance removal of trees and shrubs.

Species noted include southern cutgrass, manyflower marshpennywort, Virginia buttonweed, redtop panicgrass, meadow beauties, common carpetgrass, swamp sunflower, goldenrods, sedges, rushes, and unidentified grasses.

Stream (Riverine Intermittent and Perennial)

Natural, unaltered drainages were encountered throughout the electric transmission and gas line corridors. Rarely, a stream that had been channelized was encountered. Streams occupy approximately 36.2 acres within the study corridor.

Natural streams and drainages varied considerably in size ranging from very narrow, extremely shallow seasonal, or intermittent drainages often only a few feet wide and less than 0.5 ft deep, which drained or connected wetland areas to wide deep streams to large, perennially flowing streams such as Okatibbee Creek, which is 60 to 80 ft wide and several feet deep in places.

A typical drainage was a meandering stream 6 to 8 ft deep, 15 to 20 ft wide, with a single confined channel and vertical to slightly sloping banks. Water depth and flow varied considerably at the time of the survey. Many streams had no flow, and water in the stream consisted of a series of isolated pools of varying depths. Others had minimal flow, while still others had moderate to heavy flow such as Okatibbee Creek. Many streams were blocked by beaver dams, which backed up water for considerable distances upstream. Many streams had multiple beaver dams, most in various states of disrepair.

Most of the drainages support little or no wetland vegetation. This is due primarily to the fact that most of the streams and drainages are heavily shaded by overhanging upland vegetation or logging debris which has been placed in the flowway. A second reason for the lack of wetland vegetation appears to be that many of the streams, besides being shaded, have flow regimes that scour the bottom and sides of the flowways discouraging the establishment of wetland plants. Where wetland vegetation along streams and drainages is encountered, it is usually along the edges of a stream or drainage exposed to full sun or in light shade with very low or gentle flow and along streams with zones of quieter water that allow sediment deposition or bars to form upon which vegetation could establish. Wetland vegetation is also noted along streams that flow through or are bordered by wetland areas.

Species noted along the edges and/or sides of the banks of streams are largely herbaceous. Species noted include dotted smartweed, climbing hempvine, shade mudflower, southern cutgrass, rushes, sedges, and wool-grass.

Shrub Wetland

Shrub wetlands were infrequently encountered in the electrical transmission and gas pipeline corridors. Wetlands dominated by shrubs occur on approximately 28.9 acres within the transmission line study corridors. Most of the shrub wetlands encountered are due to clearing of historically present plant communities to tree clearing in formerly forested wetlands. Shrub wetlands within those portions of the study corridors where transmission lines have been previously constructed are the result of clearing during the initial construction within the corridor. The wetlands are established in the moist to wet areas created by wetland forest clearing or scraping of upland areas and are maintained as shrub swamps by the periodic maintenance removal of danger trees (all trees more than 14 ft in height). Shrub wetlands in areas of the study corridors that do not support existing transmission lines have developed in areas that have been disturbed by silvicultural activities.

Shrub wetlands varied from areas that were completely dominated by dense shrubs to areas that were predominately shrub-dominated with scattered open areas dominated by herbaceous species. Most shrub wetlands were dominated by sapling trees including loblolly pine, sweetgum, blackgum, tulip tree, box elder, and shrubs, primarily buttonbush and sawtooth blackberry. Open herbaceous areas are dominated by soft rush, sugarcane plumegrass, climbing hempvine, wool-grass, and dotted smartweed.

Pond (Lacustrine Excavated)

Ponds of various types were the least encountered of all the features found in the transmission line study corridors. Ponds occur on approximately 8 acres within the study corridors. Ponds encountered included cattle watering ponds, borrow ponds, and ponds or small lakes formed by the blockage of flow by a beaver dam.

Ponds within the corridor support little if any wetland vegetation. Most of the ponds have steep sides and little or no shallow edge to allow wetland vegetation to establish.

Ditch

Ditches were encountered throughout the electrical transmission line and the gas pipeline corridors but were more frequently encountered in and near urban areas including Marion and Meridian.

Ditches vary from roadside drainages 6 to 10 ft wide and 1 to 2 ft deep with gentle sloping banks to ditches that were constructed for drainage within planted pine areas that were 4 to 5 ft wide and 6 inches or more deep with almost vertical slopes.

Nonroadside ditches in rural areas are generally overshadowed by thick trees, shrubs, and vines. Consequently, the ditches support little, if any, wetland vegetation.

Most of the roadside ditches and urban ditches support a variety of wetland and transitional, primarily herbaceous species including unidentified grasses, sedges, rushes, broadleaf cattail, and woolgrass. Black willow grows in several ditches.

3.11.3.3 CO_2 Pipeline Corridor

Table 3.11-7 lists the wetland/waterway types found in this corridor (from northwest Meridian south to the Heidelberg area). Six distinct jurisdictional types were identified within this corridor: three wetland types and three *other* waters. Wetland types are classified descriptively and further identified under the Cowardin system of wetland classification (Cowardin *et al.*, 1979). Acreages were determined from DGPS survey data that were entered into a GIS system and overlain on 2007 aerial photographs. Forested wetlands constitute the largest jurisdictional type.

Table 3.11-7. Wetland Types within the CO_2 Pipeline Corridor Portion Not Co-Located with the Transmission Line Corridor

Wetlands/Waterways Type	Total acreage
Forested Wetland (palustrine forested)	145.5
Herbaceous wetland (palustrine emergent)	45.7
Streams (riverine perennial and intermittent)	3.2
Shrub Wetland (palustrine scrub-shrub)	18.2
Ponds (excavated)	4.6
Ditches	0.0
Total	**217.2**

Source: ECT, 2009.

Forested Wetland (Palustrine Forested)

Small to large areas of forested wetlands are frequently encountered throughout the linear study area. Forested wetlands range from isolated systems to small floodplain systems adjacent to streams and larger bottomland hardwood floodplains of larger tributaries. Collectively, forested wetlands occur on approximately 145.5 acres.

Most of the forested wetlands encountered were at slightly lower elevations than adjacent uplands and did not have standing water at the time of the survey. Many forested wetlands appear to receive most of their water from surface flow. Several forested wetlands areas are located at the base of steep hills and appear to receive most of their water from seepage. The remainder are confluent with streams, comprising the floodplain receiving most water from overflow.

The forested wetlands exhibit mostly closed canopies with occasional openings or gaps due to windthrow. They are dominated by a mixture of hardwood trees including red maple, swamp tupelo, willow, sweetgum, tulip tree, overcup oak, river birch, sycamore, bald cypress, swamp chestnut oak, green ash, American elm, and willow oak. Shrubs are sparse to locally dense and include buttonbush, small willows, wax myrtle, giant cane, and saw-tooth blackberry. Herbaceous species vary from locally dense to scattered. Species noted include lizard's tail, iris, sensitive fern, Canadian clearweed, *Carex* spp., dotted smartweed, Virginia buttonweed, handsome Harry, netted chain fern, cinnamon fern, bog hemp, and threeway sedge. Vines include Alabama supplejack, catbriers, grape, ladies eardrop vine, and woodvamp.

Herbaceous Wetland (Palustrine Emergent)

Herb-dominated wetlands are identified on 45.7 acres within the CO_2 study corridor. Herbaceous wetlands are frequently encountered within the CO_2 pipeline corridor. Typically, they result from clearing of other wetland types.

Most herbaceous wetlands noted in the power line corridor are low moist to wet areas located in cattle pastures. Other herbaceous wetlands are located in existing cleared and maintained power line corridor and are the result of clearing during the construction of the corridor. These wetlands establish in the moist to wet areas created during clearing and are maintained as herbaceous wetland by the maintenance removal of trees and shrubs.

Species noted include southern cutgrass, manyflower marshpennywort, Virginia buttonweed, redtop panicgrass, meadow beauties, common carpetgrass, swamp sunflower, goldenrods, cattails, giant plumegrass, sedges, rushes, and unidentified grasses.

Stream (Riverine Intermittent and Perennial)

Natural, unaltered drainages were encountered throughout the CO_2 pipeline corridor. Rarely, a stream that had been channelized was encountered. Streams occupy approximately 3.2 acres within the study corridor.

Natural streams and drainages vary considerably in size ranging from very narrow, extremely shallow seasonal, or intermittent drainages often only a few feet wide and less than 0.5 ft deep, which drain or connect wetland areas to wide deep streams, to large, perennially flowing streams such as Okatibbee Creek, Chunky River, and Souenlovie Creek, which are each 60 to 80 ft wide and several feet deep in places.

A typical drainage was a meandering stream 6 to 8 ft deep, 5 to 15 ft wide, with a single confined channel and vertical to slightly sloping banks. Water depth and flow varied considerably at the time of the survey. Many streams have no flow, and water in the stream consists of a series of isolated pools of varying depths. Others have minimal flow, while still others have moderate to heavy flow such as Okatibbee Creek. Many streams are blocked by beaver dams, which back up water for considerable distances upstream. Many streams have multiple beaver dams, most in various states of disrepair.

Most of the drainages support little or no wetland vegetation. This is primarily because of the fact that most of the streams and drainages are heavily shaded by overhanging upland vegetation or logging debris that has been placed in the flowway. A second reason for the lack of wetland vegetation appears to be that many of the streams, besides being shaded, have flow regimes that scour the bottom and sides of the flowways discouraging the establishment of wetland plants. Where wetland vegetation along streams and drainages is encountered, it is usually along the edges of a stream or drainage exposed to full sun or in light shade with very low or gentle flow and along streams with zones of quieter water that allow sediment deposition or bars to form upon which vegetation could establish. Wetland vegetation is also noted along streams that flow through or are bordered by wetland areas.

Many of the streams encountered south and west of Meridian, Mississippi, are entrenched at ratios below 1.4 according to Rosgen's stream classification. This entrenchment is likely a result of increased runoff from upland disturbances such as silvicultural harvesting and roadway construction, since very little residential development has occurred in this area, especially those areas south of Meridian, Mississippi. The entrenchment of the streams has affected the hydrology of the wetlands adjacent to the streams by lowering the water table and reducing wetland hydrology in areas where soils observed with hydric morphological features and hydrophytic vegetation are no longer supported by wetland hydrology. These small floodplains are no longer active and have essentially become elevated terraces many feet above the bankfull stage of these streams.

Species noted along the edges and/or sides of the banks of streams are largely herbaceous. Species noted include dotted smartweed, climbing hempvine, shade mudflower, southern cutgrass, rushes, sedges, and wool-grass.

Shrub Wetland

Shrub wetlands are infrequently encountered in the CO_2 pipeline corridor. Wetlands dominated by shrubs occur on approximately 18.2 acres within the CO_2 pipeline study corridor. Most of the shrub wetlands encountered are because of clearing of historically present plant communities or tree clearing in formerly forested wetlands. Shrub wetlands within those portions of the study corridors where transmission lines have been previously constructed are the result of clearing during the initial construction within the corridor. The wetlands are established in the moist to wet areas created by wetland forest clearing or scraping of upland areas and are maintained as shrub swamps by the periodic maintenance removal of danger trees (all trees more than 14 ft in height). Shrub wetlands in areas of the study corridors that do not support existing transmission lines have developed in areas that have been disturbed by silvicultural activities.

Shrub wetlands vary from areas that are completely dominated by dense shrubs to areas that are predominately shrub-dominated with scattered open areas dominated by herbaceous species. Most shrub wetlands are dominated by sapling trees including loblolly pine, black willow, sweetgum, box elder, and shrubs, primarily buttonbush, poison sumac, Chinese tallowtree, inkberry, smooth alder, and sawtooth blackberry. Open herbaceous areas are dominated by soft rush, sugarcane plumegrass, climbing hempvine, wool-grass, handsome Harry, swamp smartweed, and dotted smartweed.

Pond (Lacustrine Excavated)

Ponds of various types are the least encountered of all the features found in the CO_2 pipeline study corridor. Ponds occur on approximately 4.6 acres within the study corridor. Ponds include cattle watering ponds, borrow ponds, and ponds or small lakes formed by the blockage of flow by a beaver dam.

Ponds within the corridor support little if any wetland vegetation. Most of the ponds have steep sides and little or no shallow edge to allow wetland vegetation to establish.

Ditch

Ditches are encountered throughout the CO_2 pipeline corridor but are more frequently encountered in and near urban areas near Meridian.

Ditches vary from roadside drainages 6 to 10 ft wide and 1 to 2 ft deep with gentle sloping banks to ditches that were constructed for drainage within planted pine areas that are 4 to 5 ft wide and 6 inches or more deep with almost vertical slopes.

Nonroadside ditches in rural areas are generally overshadowed by thick trees, shrubs, and vines. Consequently, the ditches support little, if any, wetland vegetation.

Most of the roadside ditches and urban ditches support a variety of wetland and transitional, primarily herbaceous species including unidentified grasses, sedges, rushes, broadleaf cattail, and woolgrass.

3.11.3.4 Substation Sites

Table 3.11-8 lists the wetland/waterway types found within the boundaries of the substation sites. The substation sites collectively encompass approximately 90.2 acres. Wetland types are classified descriptively and further identified under the Cowardin system of wetland classification (Cowardin *et al.*, 1979). Acreages were determined from DGPS survey data that were entered into GIS and overlain on 2007 aerial photographs. Herbaceous wetland (palustrine emergent) is the dominant jurisdictional community in the substation sites, followed by shrub wetland (palustrine scrub-shrub), streams (riverine intermittent), and lastly, ditches.

Table 3.11-8. Wetland Types within the Substation Sites

Wetlands/Waterways Type	Total acreage
Herbaceous wetland (palustrine emergent)	4.36
Streams (riverine perennial and intermittent)	0.99
Shrub Wetland (pulustrine scrub-shrub)	2.52
Ditches	0.50
Total	**8.37**

Source: ECT, 2009.

Herbaceous Wetland (Palustrine Emergent)

Herb-dominated wetlands were identified on 4.36 acres within the three substation sites. Typically, they result from clearing of other wetland types and are encountered within tracks of land that were recently cleared and newly seeded for pine plantation and within the electrical transmission corridor. The latter are located in the existing cleared and maintained power line corridor and are the result of clearing during the construction of the corridor. These wetlands established in the moist to wet areas created during clearing and are maintained as herbaceous wetlands by the maintenance removal of trees and shrubs. Species noted include manyflower marshpennywort, Virginia buttonweed, giant cane, meadow beauties, common carpetgrass, golden rods, sedges, rushes, and unidentified grasses.

Shrub Wetland (Pulustrine Scrub-Shrub)

Shrub-dominated wetlands collectively occur on 2.52 acres within the substation sites. In all cases, this wetland type has resulted from past clearing practices where trees were removed. At present, only sapling trees (especially loblolly pine, red maple, and black willow) generally less than 4 inches dbh with serrate-leaf blackberry, southern bayberry, and brook-side alder provide a dense shrub stratum. Wetland herbs, usually weedy in nature, are conspicuous, and density varies with the shrub cover. Common herbs occurring in these wetlands include sensitive and netted ferns, sedges, and rushes.

Stream (Riverine Perennial and Intermittent)

Natural, unaltered drainages and streams were encountered throughout the substation sites. They collectively occupy approximately 0.99 acre within the three substation sites. Natural streams and drainages vary considerably in size ranging from very narrow, extremely shallow seasonal or intermittent drainages with banks only several feet wide and less than 1 ft deep, which drained or connected wetland areas, to large perennially flowing stream such as Loper Creek, with banks of approximately 30 to 40 ft wide and 15 to 20 ft deep in places. Water, if present at the time of the survey, was generally less than 1 ft deep, with the exception of Loper Creek, which had standing water several feet in depth. Typically, upland vegetation extends to the stream banks. The channels are usually devoid of vegetation and sandy-bottomed. Smooth alder, black willow, red maple, and sweetbay are the dominant hardwoods surrounding the shallow intermittent drainages. Wax myrtle and blackberry are frequent constituents of the shrub layer. Soft rush, golden rod, bushy bluestem, and common smartweed grow on the banks. Loper Creek's banks are surrounded by a native secondary forest, which consists of laurel oak and red maple in the canopy; giant cane, Chinese privet, and blackberry in the shrub layer; and river oats and typical pasture grasses serve as groundcover.

Ditch

Upland cut ditches were encountered in the pasture and collectively occur on 0.5 acre of the substation sites. They are approximately 8 ft wide and 1 ft deep with average slopes of approximately 4:1. Vegetation found in ditches is mostly comprised of soft rush, common smartweed, and various planted grasses typical of pasture, such as bahiagrass and fescue.

3.12 LAND USE

3.12.1 REGIONAL SETTING

The principal components of the project (i.e., the power plant, associated lignite surface mine, and linear facilities) would be located in eastern Mississippi and concentrated in southern Kemper County. This part of Mississippi is largely rural and sparsely populated. Meridian, located south of the power plant and mine study area in Lauderdale County, is the largest city in the area. Figure 3.12-1 shows 2003 land use of the area, with the high- to medium-density urban and medium-density urban areas highlighted. The remainder of the area shown is classified under various rural or nonurban categories, including agriculture-cropland, forests, nonforested land, and water. As Figure 3.12-1 illustrates, a low percentage of land in the project area is characterized as urban.

Kemper County is approximately 490,600 acres or 766 mi^2 in size. Approximately 84 percent of the county is in forestland (Mississippi State University Extension Service, 2000, personal communication), of which approximately 75 percent is used for commercial forests (Soil Survey, 1999). There are two incorporated communities: DeKalb comprising approximately 3.3 mi^2 and Scooba comprising approximately 2.5 mi^2. The extent of forestland in Kemper County differs from that of the state as a whole, which has 54.9 percent in forestland (U. S. Bureau of Census, 2003). Approximately 2,600 acres of the county are in federal lands (part of the Meridian NAS). A portion of the Mississippi Band of Choctaw Indians Reservation is located along the western boundary

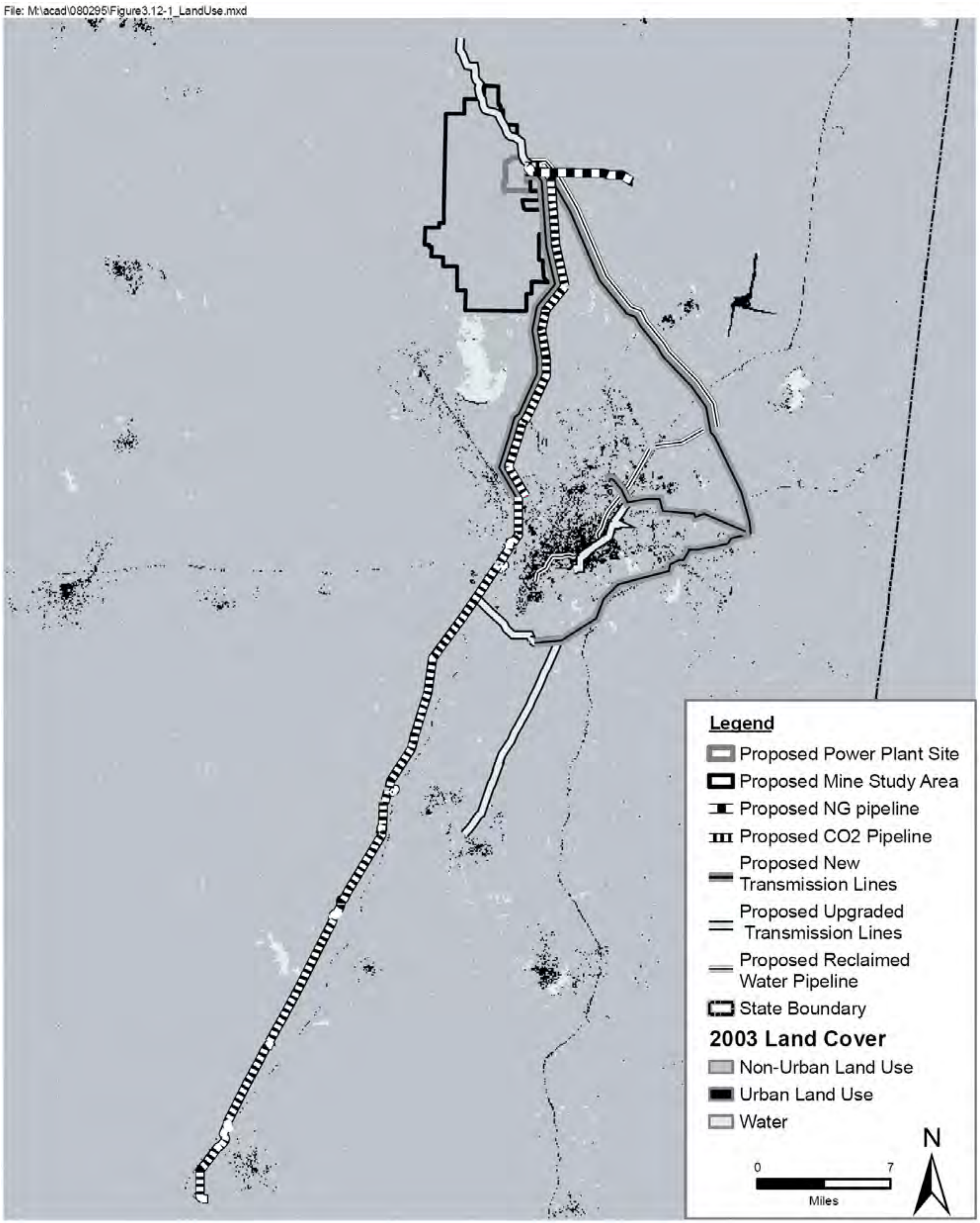


Figure 3.12-1. Land Use

Sources: MARIS, 2003. Mississippi Power Company, 2008. ECT, 2008.

of the county. Currently, TVA operates the Kemper combustion turbine plant located approximately 13 miles northwest of the proposed power plant site. The plant has four diesel-fired turbines (natural gas and low sulfur fuel) capable of producing 340 MW.

3.12.2 POWER PLANT SITE AND MINE STUDY AREA

Figure 3.12-2 shows the land use of the proposed power plant site and mine study area. The proposed power plant site consists of approximately 1,650 acres, most of which is forested. There are no residences or habitable structures located on the site. The remaining acreage is pasture, wetlands, roads, ponds, and natural gas pipeline corridors. With the presence of an electrical power generation plant in Kemper County, electrical power generation is an allowable use in Kemper County.

Based on photointerpretation of 2008 aerial photography and field inspections during spring, summer, and fall 2008, four primary land use/land cover categories were identified within the larger project area (i.e., power plant site and mine study area). These are listed in Table 3.12-1 and illustrated on Figure 3.12-2.

Table 3.12-1. Power Plant and Mine Area Land Use*

Land Use/Land Cover Classification	Acres	Total Acres	Percent
Commercial, residential, utility		566.6	1.8
Active construction	144.9		
Gas pipeline corridors	16.0		
Roads	309.8		
Residential or commercial development	95.9		
Forestry		24,368.4	78.0
Bottomland forest	9,454.0		
Hardwood forest	2,174.6		
Hardwood-pine forest	3,692.6		
Pine-hardwood forest	2,237.6		
Planted pine forest	5,740.3		
Shrub land	1,069.3		
Pasture and hayland		5,907.2	18.9
Water bodies		417.7	1.3
Ditches	2.0		
Ponds	328.8		
Streams	86.9		
Total		**31,260.0**	**100.0**

*Based on photointerpretation of 2008 aerial photography and field inspection during spring through fall 2008.

Source: NACC, 2009.

Primary land use categories include the following:

- Forestry—Occupying approximately 78 percent of the project area, this category consists of lands used for the long-term production of wood, wood fiber, or wood-derived products. Based on level of management (which varies considerably) and vegetation, six types of forestlands were identified within the project area: bottomland forest, hardwood forest, hardwood-pine forest, pine-hardwood forest, planted pine forest, and shrubland. Detailed descriptions of the plant communities associated with each of these types are provided in Section 3.8, Terrestrial Ecology.
- Pasture and Hayland—Occupying approximately 19 percent of the project area, this category consists of land used primarily for the long-term production of adapted, domesticated forage plants that are grazed by livestock or cut and cured for hay. It also includes some minimally managed areas of native grasses that are used for grazing or are cut and cured for hay.

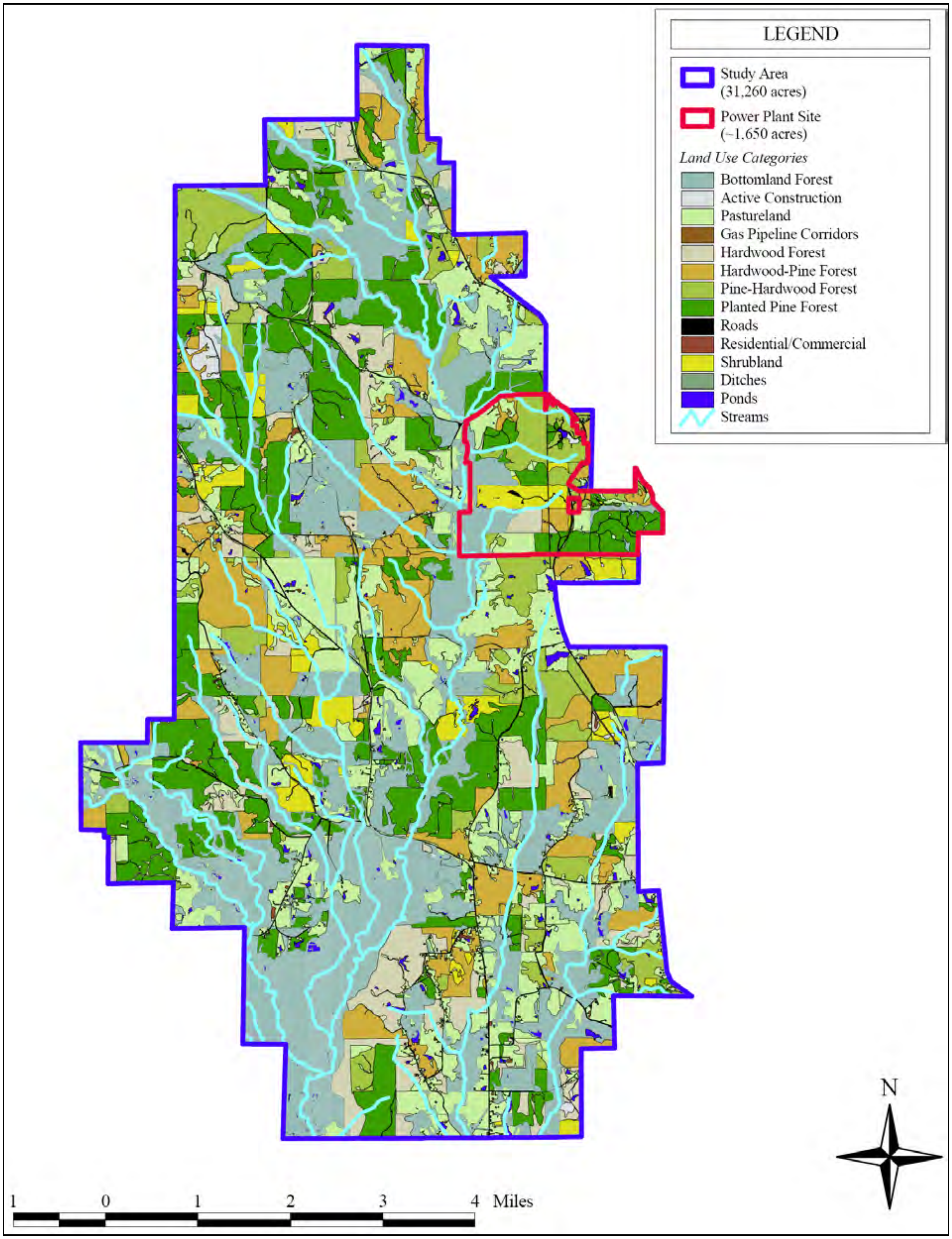


Figure 3.12-2. Land Use
Source: NACC, 2009.

- Commercial, Residential, Utility—Less than 2 percent of the project area currently is in commercial, residential, or utility uses, which include active construction, gas pipeline corridors, and roads, as well as residences, churches, and cemeteries. Most of the land classified in this category is on or near the various public roads that traverse the project area. Land occupied by cultural and historical resources is described in more detail in Section 3.18, Cultural and Historic Resources.
- Water Bodies—Slightly more than 1 percent of the project area consists of water bodies, primarily ponds constructed to store water for use by livestock. Also included in this category are the larger streams (e.g., Chickasawhay Creek) traversing the project area, which are described in more detail in Section 3.11, Wetlands.

Currently, there are 132 houses, 40 mobile homes, and 12 churches located on the proposed mine study area. Other structures are primarily agriculturally related buildings on the small farms located in the area. There are only minor commercial uses located at several of the crossroads in the proposed mine study area.

3.12.3 LINEAR FACILITY CORRIDORS, RIGHTS-OF-WAY, AND SUBSTATIONS

The proposed transmission line corridors comprise approximately 1,882 acres, most of which are forested, approximately 11 percent are existing corridors, and less than 5 percent are roads or developed with residential or commercial uses. There is no residential or commercial development in the 140-acre natural gas pipeline corridor; this proposed corridor predominantly traverses forested lands. The southernmost 6 miles of the reclaimed water pipeline corridor from the Meridian POTW to the East Meridian POTW would use an existing city right-of-way paralleling Sowashee Creek but would traverse some urban areas. The rest of the planned corridor to its intersection with the East Feeder transmission line corridor would transition to rural, forested land. The proposed CO_2 pipeline corridor from northwest Meridian to the Heidelberg area is mostly forested and parallels an existing transmission line right-of-way over most of its 42 miles.

There are three proposed substation sites identified as East Lauderdale, West Lauderdale, and Vimville. The East Lauderdale and Vimville substation sites are predominantly planted pine, and the West Lauderdale site is primarily field/pasture. There is no residential or commercial development currently associated with any of the three proposed substation sites.

3.13 SOCIAL AND ECONOMIC RESOURCES

This section presents information describing the social and economic resources of the project area. In this case the area is defined to include Neshoba County, which borders Kemper County's west side. Neshoba County is the location of the city of Philadelphia, which is the second largest city in the project area. It is anticipated that some construction workers and facility operations staff would locate to and/or commute from Philadelphia (in addition to Meridian). Therefore, in this context, the social and economic resources of Neshoba County are relevant to the discussion.

3.13.1 POPULATION AND DEMOGRAPHY

Kemper County, in which the proposed power plant would be located, has an estimated population of 10,211 as of 2006 (Mississippi Development Authority [MDA], 2007). Table 3.13-1 provides past and projected population for Kemper, Neshoba, and Lauderdale Counties; figures for the entire state are also provided.

Table 3.13-1. Population

County	1970	1980	1990	2000	2006	2011 (Projected)
Kemper	10,233	10,148	10,356	10,453	10,211	10,356
Lauderdale	67,087	77,285	75,555	78,161	77,261	93,551
Neshoba	20,802	23,789	24,800	28,684	29,975	29,882
Mississippi (statewide)	2,216,912	2,520,638	2,573,216	2,844,658	2,928,401	3,006,277

Sources: U.S. Census Bureau, 2000. MDA, 2007.

As shown, Kemper County is a sparsely populated county, whose population has essentially not changed since 1970—and is currently not projected to change over the next several years. By contrast, the population of Lauderdale County has grown by 15 percent from 1970 to 2006 and is projected to continue growing, and Neshoba County has grown by 44 percent during the same time period. Clarke and Jasper Counties, within which would be located segments of the linear facilities associated with the power plant project, are, like Kemper County, more sparsely populated. The populations of these two counties were 17,549 (Clarke) and 17,873 (Jasper) in 2006; the population of each of these counties is projected to decline slightly by 2011.

Table 3.13-2. Population by Race, 2000 (percent)

County	White	Black	Other	Hispanic
Kemper	39	58.1	2.9	0.7
Lauderdale	57.4	40.7	1.9	14.8
Neshoba	63.8	21.5	13.2	1.5
Mississippi (statewide)	60.1	37.4	2.5	1.6

Source: U.S. Census Bureau, 2000.

The population of the state as a whole has grown 32 percent from 1970 to 2006 and is projected to increase in population by another 2.7 percent from 2006 to 2011. The population of Lauderdale County is projected to increase at a rate (21 percent) that is significantly higher than that of the state as a whole. The population of Neshoba County is projected to decrease slightly.

Table 3.13-2 provides information regarding the racial makeup of Kemper, Neshoba, and Lauderdale Counties and Mississippi as a whole.

The populations of both Kemper and Lauderdale Counties include more minorities in total than does the state. The population of Neshoba County includes 12.5 percent identified as Native American.

Table 3.13-3. Employment Data (2000)

County	Labor Force	Employment	Employment Outside County	Percent of Employment	Unemployed	Unemployment Rate (percent)
Kemper	4,408	4,027	2,308	57.3	381	8.6
Lauderdale	34,567	32,522	2,583	7.9	2,045	5.9
Neshoba	12,951	11,952	2,901	24.3	731	4.9*
Mississippi (statewide)	1,314,514	1,239,859	—	—	74,295	5.7

*2005 rate.

Source: MDA, 2007.

3.13.2 EMPLOYMENT AND INCOME

Table 3.13-3 shows employment in Kemper, Neshoba, and Lauderdale Counties and the state overall according to the 2000 Census.

As the information in Table 3.13-3 shows, the percentage of Kemper County workers employed at locations located outside Kemper County was 57 percent in 2000; the percentage of Lauderdale County workers employed outside that county was, by contrast, less than 8 percent. The unemployment rates of Kemper and Lauderdale Counties exceeded that of the state in 2000, although only slightly in Lauderdale County. The average commute time of Kemper County workers is 31.1 minutes, which exceeds the statewide average commute time of 19.9 minutes (MDA, 2007).

Table 3.13-4. Percentage Employment by Sector

Sector	Kemper	Lauderdale	Neshoba	Mississippi (Statewide)
Manufacturing	23.5	14.8	21.0	18.3
Construction	7	5.9	8.9	7.6
Agriculture*	8.3	1.8	5.1	3.4
Retail	9.8	13.3	12.2	11.8
Health Care	11.7	16.9	12.8	11.1
Public administration	4.7	5.2	4.6	5.1
Education	9.3	8.1	8.2	9.1
Total percent	74.3	66.0	72.8	66.4

*Agriculture, forestry, fishing, hunting, and mining.

Source: MDA, 2007.

Table 3.13-4 presents the distribution of jobs within seven industries. Kemper County has a greater percentage of employment in these seven industries than Lauderdale and Neshoba Counties and the state as whole, indicating less diversity in employment by occupation.

The median household income and per capita income figures provided in Table 3.13-5 also indicate that the more rural Kemper County differs from Lauderdale County and the state as a whole with significantly lower income levels. The percentages of individuals below the poverty level are similar for the three subject counties and the state.

Table 3.13-5. Income and Poverty Levels

County	Median Household Income (1999)	Per Capita Income	Individuals Below Poverty Level	Percent Below Poverty Level
Kemper	$24,292	$11,985 (1999)	2,606	26 (1999)
Lauderdale	30,545	18,900 (2006)	Not available	25.5 (2006)
Neshoba	28,300	14,964 (1999)	Not available	24.2 (1999)
Mississippi (statewide)	31,596	18,165 (2006)	Not available	21.1 (2006)

Sources: U.S. Census Bureau, 2000. MDA, 2007.

3.13.3 HOUSING

Table 3.13-6 summarizes household data for the subject counties and the state as a whole.

The more rural Kemper County differs markedly from Lauderdale and Neshoba Counties and the state in the much higher percentage of owner-occupied households and the much lower median value of owner-occupied homes. There are relatively few rental units in Kemper County and a relatively high vacancy rate in Neshoba County.

Table 3.13-6. Household Characteristics, 2000

County	Households	Owner Occupied	% Owner Occupied	Renter Occupied	Vacant	Vacancy Rate (%)	Persons per Household	Median Value of Owner Occupied
Kemper	4,533	3,275	83.8	634	624	13.8	2.57	$48,400
Lauderdale	34,745	20,586	65.9	10,639	3,520	10.1	2.28	75,600
Neshoba	10,668	7,547	72.9	2,799	2,161	17.3	2.78	70,700
Mississippi (statewide)	1,161,953	756,967	65.1	289,467	115,519	9.9	2.63	75,635

Source: U.S. Census Bureau, 2000.

Meridian has 28 apartment complexes according to the East Mississippi Business Development Corporation. According to a spokesperson for the Philadelphia, Mississippi, Community Development Partnership (2008), there are approximately 15 to 20 apartment complexes in this area.

3.13.4 LOCAL GOVERNMENT REVENUES AND EXPENDITURES

Mississippi counties receive revenue from two major sources: ad valorem taxes and state-shared intergovernmental revenues. During fiscal year 2002, Kemper County received a total of $2.7 million (31.4 percent) in ad valorem taxes, $3.3 million (38.4 percent) from state-shared revenues, and $2.6 million in other revenue. State collection sources include gaming fees and tax, alcoholic beverage tax, oil severance tax, auto tag fees, natural gas severance tax, and petroleum tax. The remaining portion of county revenues comes from sources such as service charges, intergovernmental revenues, interest payments, fines, license and permit fees, and other miscellaneous sources. The corresponding numbers for Lauderdale County are $16.9 million (55.8 percent) in ad valorem taxes, $5.6 million (18.5 percent) from state-shared revenues, and $7.2 million in other revenue and for Neshoba County, $5.5 million (60.4 percent) in ad valorem taxes, $2.2 million (24.2 percent) from state-shared revenues, and $1.4 million in other revenue (U.S. Census Bureau, 2008).

The same source indicates that county expenditures for fiscal year 2002 are as follows:

Expenditure	Kemper County		Lauderdale County		Neshoba County	
	Thousand $	Percent	Thousand $	Percent	Thousand $	Percent
Education	—	0	147	0.7	348	6.1
Welfare	55	0.8	315	1.5	92	1.6
Hospitals	—	0	—	0	—	0
Health	127	1.9	5,030	23.9	215	3.8
Highways	2,932	43.1	6,477	30.7	2,158	37.7
Police protection	507	7.5	4,688	22.3	1,223	21.4
Correction	2,494	36.7	1,611	7.6	420	7.3
Natural resources, parks	120	1.8	1,118	5.3	563	9.8
Sewerage and solid waste	232	3.4	—	0	304	5.3
Interest on general debt	334	4.9	1,681	8.0	394	6.9
Total	**6,801**	**100.1**	**21,067**	**100**	**5,717**	**99.9**

Source: U.S. Census Bureau, 2008.

The U.S. Census Bureau information indicates that Kemper County receives a disproportionate share of its revenue from other sources compared to Lauderdale and Neshoba Counties. Similarly, Kemper County spends more of its revenue on corrections and less on police protection and natural resources, parks, and recreation. The largest expenditure of revenue in Kemper County is for highways.

3.13.5 COMMUNITY/PUBLIC SERVICES

3.13.5.1 Schools

In Kemper County there are two elementary schools (East Kemper and West Kemper), one high school (Kemper County High School), and one vocational complex in Kemper County. The total student enrollment in grades 1 through 12 for the start of the 2008-2009 school year is 1,400, with each school at or below capacity. West Kemper Elementary, Kemper County High School, and Stennis Vocational Technical Schools are located in the town of DeKalb, and East Kemper Elementary is located in the town of Scooba (MDA, 2007 and 2008).

In Lauderdale County there are 6,654 students in nine schools (three elementary, three middle, and three high schools) enrolled in Lauderdale County in 2007. All schools in the county have addresses in Meridian except for West Lauderdale High School in Collinsville (MDA, 2007).

There are two elementary schools, two middle schools, and two high schools in Neshoba County. The 2005-2006 school year enrollment was 4,200 students (Greatschools, 2008).

Both a community college and a branch campus of Mississippi State University are located in Meridian to provide college opportunities to local area residents.

3.13.5.2 Water and Wastewater Services

There are no central, public wastewater treatment plants located or operated in Kemper County. There are four water plants operated by the Northwest Kemper Water Association, a public utility, that provide potable water to parts of Kemper County and four other counties. The proposed electrical power generation plant is located in the *certified* area of this utility, indicating that potable water is to be provided by this water association. According to the plant's manager (2008), there is a total of 13.28 MGD of capacity provided by the four plants. The current utilization is between 8 and 9 MGD. The proposed power plant would be provided potable water through a 4-inch diameter water line located in the right-of-way of MS 493.

The city of Meridian operates two water treatment plants, North Meridian and B Street plants, with a combined capacity of 16.5 to 17 MGD. According to a city spokesperson (2008), the current use is approximately 9.5 MGD. The city operates a wastewater treatment plant with a capacity of 13 MGD and a current use of approximately 9.2 MGD (City of Meridian, 2009). Lauderdale County does not have any public water or wastewater facilities.

The city of Philadelphia has one water treatment plant operated by Philadelphia Utilities. The plant has a capacity of 3.2 MGD and a current utilization of 1.4 MGD (City of Philadelphia, 2008). A wastewater treatment plant operated by Philadelphia Utilities will expand from its current capacity of 1.34 to 2.15 MGD by January 31, 2009. The current plant's use is 1.3 MGD (*ibid.*). The only other facility in Neshoba County is the Pearl River Community wastewater treatment plant, which provides treatment for the Choctaw Indian Reservation only.

3.13.5.3 Police Protection

Police protection in Kemper County is provided by the Kemper County Sheriff's Office and the DeKalb and Scooba Police Departments. There are six full-time deputies with the Sheriff's office, five full-time police officers with the DeKalb Police Department, and two full-time and four part time officers with the Scooba Police Department (2008). Police protection in Lauderdale County is provided by the city of Meridian Police Department with 115 sworn officers (there are additional part-time and sworn reserve officers and 16 nonsworn support employees) and the Lauderdale County Sheriff's Department with one major, two lieutenants, two sergeants, and 20 deputies (www.meridian.com and www.lauderdalesheriff.com). Neshoba County has police protection provided by the Philadelphia Police Department with 25 sworn officers, 8 auxiliary officers, and 14 support employees and from the Neshoba County Sheriff's Department with 16 deputies (2008).

3.13.5.4 Fire Protection and Emergency Medical Service

Fire protection is provided in Kemper County by nine volunteer fire departments located throughout the county. There are an estimated 150 volunteer fire fighters. Currently, emergency medical services are provided by the private company TransCare. TransCare operates one ambulance stationed in DeKalb.

Philadelphia has two career fire stations with 31 firefighters augmented by 12 volunteer firefighters. Neshoba County has 12 volunteer fire stations with approximately 120 to 180 volunteer firefighters. Neshoba General Hospital has four ambulances available for emergency medical services (Fire Station No. 1, 2008). Meridian has eight career fire stations with 103 firefighters (Central Fire Station, 2008). Lauderdale County has 22 volunteer fire stations with 390 volunteer firefighters (Lauderdale County, 2008). The closest stations to Kemper County are the Bailey Station (Rural Route 1, Bailey) and Sam Dale Station (11037 MS 39 North). Metro Ambulance Service in Meridian provides ambulance service in Lauderdale County with eight ambulances during the day and six ambulances at night (Metro Ambulance, 2008).

3.13.5.5 Health Care

There are three hospitals in Meridian: Rush Foundation Hospital with 215 beds, Riley Hospital with 140 beds, and Jeff Anderson Regional Medical Center with 260 beds. These facilities are located approximately 20 to 25 miles from the proposed electrical power generation plant site and provide emergency services. The Neshoba County General Hospital has 82 beds, has emergency service, and is located in Philadelphia approximately 25 miles from the proposed power plant site.

Table 3.13-7. Environmental Justice Data for the United States, Mississippi, Kemper County, and Census Tracts within 7-mile Radius of Proposed Plant Site

Location	Percent Minority	Percent Below Poverty Level (Year)
United States	33.6*	12.7 (2004)†
Mississippi	39.1*	19.3 (2004)†
Kemper County	61.0‡	21.5 (2004)†
Census Tract 030200 (Kemper County)	50.3§	23.8§
Census Tract 030100 (Kemper County)	65.3§	25.9§
Census Tract 010302 (Lauderdale County)	9.1§	6.48§
Census Tract 010301 (Lauderdale County)	17.1§	12.2§
Census Tract 010202 (Lauderdale County)	25.2§	11.6§

*All persons who identified themselves in categories other than white alone in U.S. Census data from 2006.
†Individuals below the poverty level as defined by the U.S. Census Bureau in 2004.
‡Data from U.S. Census Bureau, 2000.
§Data from MARIS, 2008.

Sources: U.S. Census, 2008. MARIS, 2008.

3.13.6 ENVIRONMENTAL JUSTICE

Table 3.13-7 lists the percentages of total population that are classified as *minority* and *below poverty level* for the United States, the state of Mississippi, Kemper County, and the census tract in which the proposed plant is located (030200 in Kemper County). Other census tracts in Kemper (030100) and Lauderdale Counties (010301, 010302, and 010202) that are within a 7-mile radius of the proposed plant are also included in the table. Figure 3.13-1 shows the relative location of the proposed Kemper Power Plant to the five census tracts. The data provided are primarily from the U.S. Census of 2000, but some have been updated to 2004. Both census tracts in Kemper County (030200 and 030100) have higher percentages of minorities and population below poverty level than in the United States and the state of Mississippi, and, therefore, represent an environmental justice community. Conversely, the three census tracts in Lauderdale County show that percentage of minority and below poverty level are less than national and state averages.

3.13.7 NATIVE AMERICAN TRIBAL LANDS

The Mississippi Band of Choctaw Indians (MBCI) is a group of Native Americans with reservation lands located near the proposed project area. Local MBCI communities include Bogue Chitto, Tucker, Pearl River, and Conehatta (see Figure 3.13-2).

The Bogue Chitto reservation is located on the boundary separating Kemper and Neshoba Counties. The reservation consists of 5,885 acres located along Bogue Chitto Creek approximately 13 miles northwest of the proposed power plant site.

The 1,271-acre Tucker Indian reservation is located in Neshoba County approximately 15 miles west of the plant site.

The Pearl River reservation, consisting of 14,164 acres, is where the Chief and the central government of MBCI are located. The reservation is located in Neshoba County west of the town of Philadelphia, approximately 24.5 miles from the proposed plant site.

The Conehatta reservation, located in Newton County, consists of 3,744 acres of land. The distance from the reservation to the site of the proposed power plant is approximately 30 miles.

MBCI is an established sovereign political entity that has its own governmental agencies, including lawmaking, judicial, security (police), education (school system), and public utilities, among others. The MBCI Tribal government works both independently and in conjunction with the state of Mississippi and the United States government on a case-by-case basis. The tribe has six elementary, one middle, and one boarding high school. The schools are accredited by the state of Mississippi Board of Education. Students must be at least one-quarter Native American to attend these schools.

MBCI established, owns, and operates the Silver Star and Golden Moon Resort Casinos located west of Philadelphia as sources of employment and income for Native Americans. These gaming establishments, constructed after passage of the Indian Gaming Regulatory Act by Congress in 1988, have grown and prospered and are also a major source of income for tribal projects.

DOE has sought input from and consulted with Native American tribes for this EIS. Those efforts began with communications by letter seeking to identify those tribes with potential interests in the area of the proposed project. The letters were followed by telephone contacts, and several tribes expressed varying levels of interest.

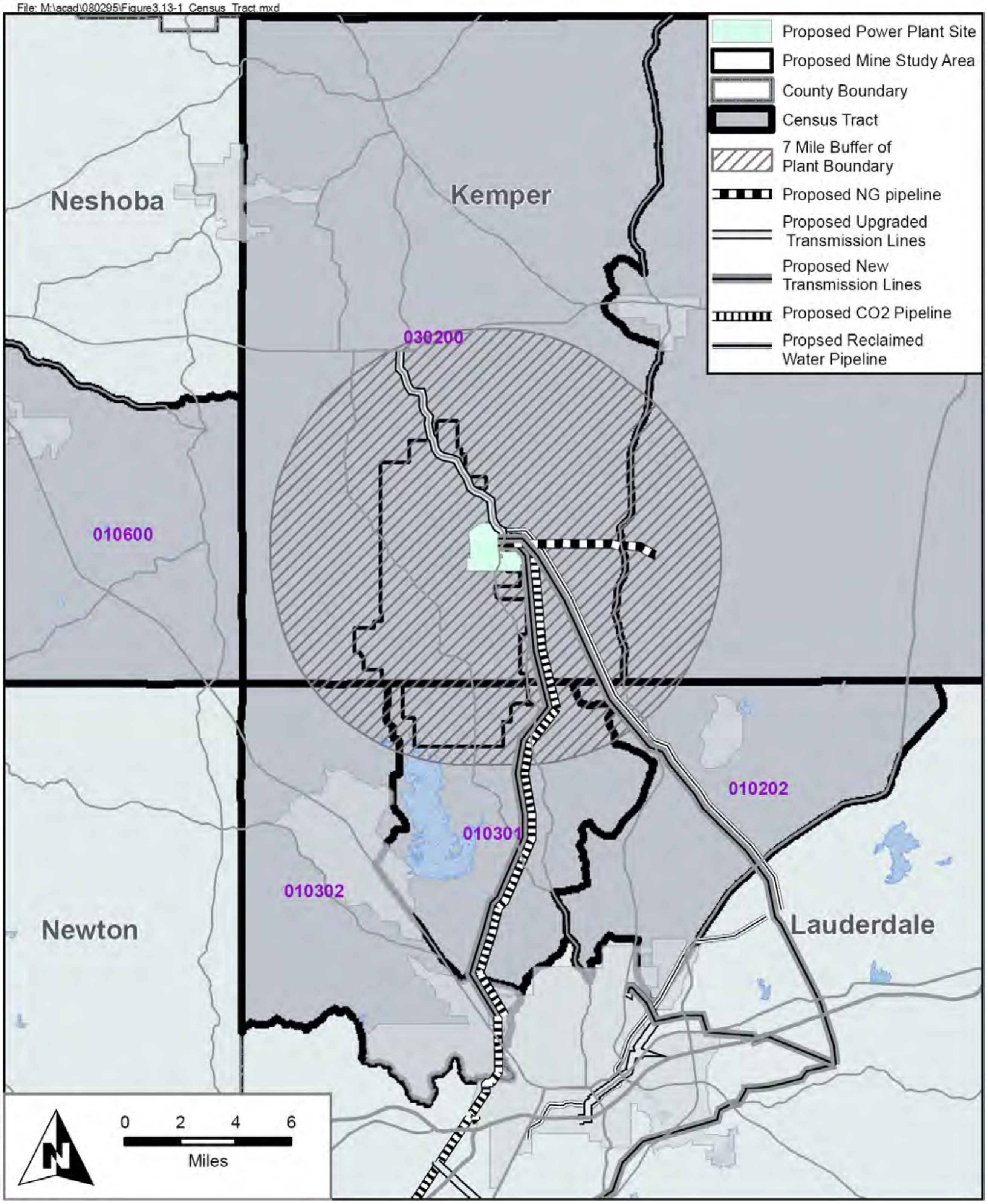


Figure 3.13-1. Census Tracts within a 7-Mile Radius of the Proposed Plant Site

Sources: U.S. Census, 2000. MARIS, 2008. ECT, 2008.

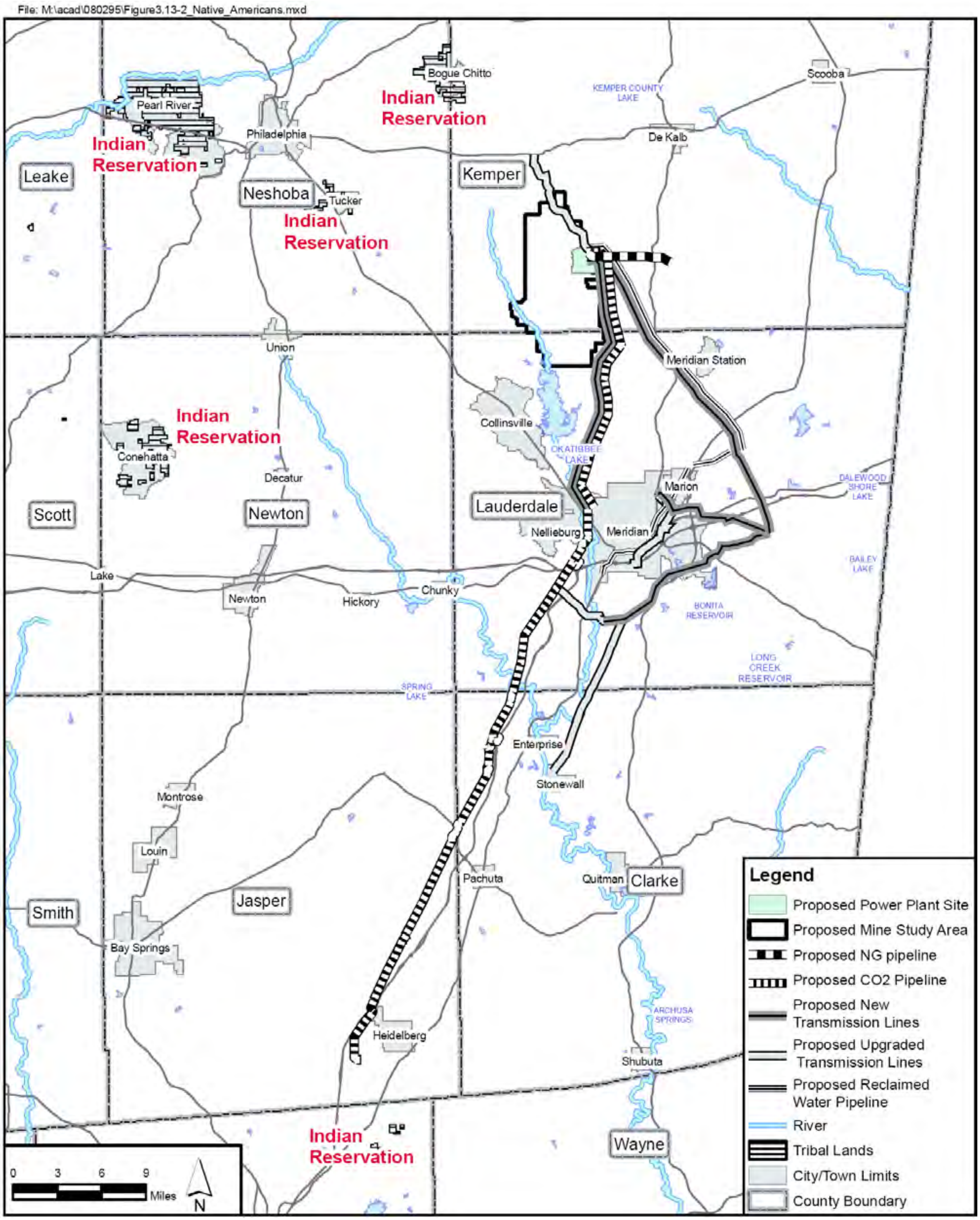


Figure 3.13-2. Native American Reservation Lands in the Vicinity of the Project Area

Sources: MARIS, 2008. ECT, 2008.

Subsequently, DOE held a consultation meeting with representatives of two tribes: the Mississippi Band of Choctaw Indians and the Choctaw Nation of Oklahoma. Appendix L includes key documents related to DOE's consultations with Native American Tribes.

3.14 TRANSPORTATION INFRASTRUCTURE

3.14.1 REGIONAL SETTING

The proposed power plant site, mine study area, and utility corridors (electric transmission lines, natural gas pipeline, reclaimed effluent pipeline, and CO_2 pipeline) are located within Kemper, Lauderdale, Clarke, and Jasper Counties near to the Mississippi/Alabama state line. An initial route for lignite coal deliveries will be from the Red Hills Mine in Choctaw County through Winston County and northern Kemper County to the proposed plant site. The transportation infrastructure includes federal, state, and local county primary and secondary highways and roads; rail lines; airports; and even nearby ports (Tennessee-Tombigbee waterway north and east of the site). The transportation infrastructure is described in the following subsections.

3.14.2 ROADWAYS

Several two-laned paved and gravel roads form the boundaries and also bisect the project area (see Figure 3.14-1). The primary highways in Kemper County that serve as site boundaries include MS 493 on the east, MS 495 (partially) on the west, and Old Jackson Road on the north. In Lauderdale County, the southern end of the mine study area is bordered by Center Hill Road approximately 1.5 miles to the south. The proposed project area is within Mississippi Department of Transportation (MDOT) District 5. Principal highways and connectors of project-related interest include the following:

- MS 493 (Old Jackson Road to Arkadelphia Road)—MS 493 is a paved, two-laned roadway classified as a major collector by MDOT. The road is located on the eastern side (see Figure 3.14-1) of the proposed power plant site and mine study area and would be a key corridor for workers commuting to the site during construction, the transportation of construction materials and machinery to the site, and the transportation of operational workers to the site after completion of construction activities.

  The average traffic volume (ATV) in vehicles per day is currently 400 just north of the plant site and 460 just north of Bethel Church Road to the south.
- MS 493 (Arkadelphia Road to I-20/59)—MS 493 continues in a southerly direction in Lauderdale County through downtown Meridian and eventually intersects I-20/59. MS 493 remains two-laned as it enters Meridian as 24th Street. The ATV is 2,400 just north of the Bailey community.
- MS 495—MS 495 intersects the mine study area. This roadway is a paved, two-laned roadway classified as a major collector by MDOT. The roadway runs through rural areas of Kemper County and is lightly traveled. This roadway could be used by workers commuting to the site, but would not be expected to be used as a route for hauling heavy equipment unless needed for mining equipment transport. ATV for this segment is approximately 506.
- Old Jackson Road (MS 493 to MS 39)—Old Jackson Road, located to the north of the mine study area, is a two-laned, paved road from MS 493 easterly to MS 39 just south of DeKalb. The road is

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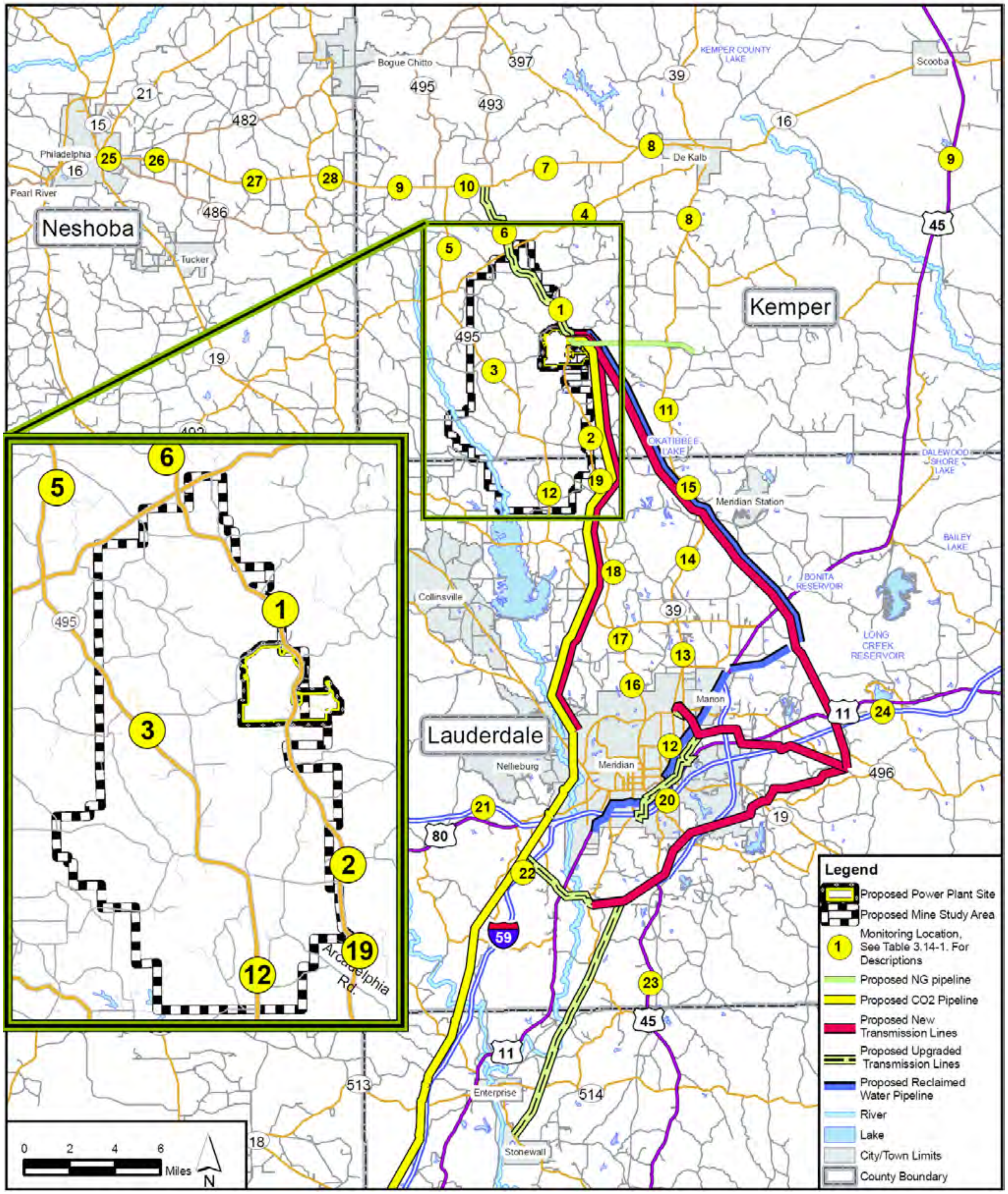

Figure 3.14-1. Road Map Showing Selected Traffic Volume Monitoring Locations

Sources: MARIS, 2008. ECT, 2008.

located in a rural community and is classified as a major collector by MDOT. This road is available for use by personnel accessing the site from points east. The ATV for this segment of road is approximately 690.

- MS 16 (Philadelphia to MS 39)—MS 16 runs east-west between DeKalb and Philadelphia. This is a two-laned, paved highway classified as a minor arterial by MDOT. The road is available for use by workers commuting from the community of Philadelphia during construction and operating phases of the project. The ATV for this segment (in Kemper County) is approximately 2,400.
- MS 16 (DeKalb to Scooba)—MS 16 runs east from DeKalb to Scooba. The highway is paved and two-laned. This roadway could serve as a connector from Old Jackson Road to U.S. 45. The ATV on this segment varies from 3,300 near DeKalb to 2,100 just west of Scooba.
- MS 39 (Meridian to DeKalb)—MS 39 is a two-laned, paved highway classified as a minor arterial. The posted speed limit varies from 30 to 55 miles per hour (mph) in this segment. MS 39 serves as a link from Meridian to DeKalb and might be used by project personnel to reach the site. The ATV for this road (in Kemper County) varies from 1,900 to 2,400 depending on the subsegment monitored.
- U.S. 45 (Scooba Area)—U.S. 45 is a major north-south artery located in eastern Kemper County. This highway is four-laned and paved and classified as a principal arterial. This road might serve as a major arterial for the transport of heavy equipment and machinery from points north, reaching the plant site by using MS 16 and Old Jackson Road to intersect with MS 493. This route would not be used by construction or operational personnel.
- I-20/59 (Meridian Area)—The major east-west artery in the vicinity of the project area is I-20/59 located 20 miles to the south. This interstate segment is four-laned and paved. This interstate connects to Birmingham, Alabama, to the northeast; Jackson, Mississippi (I-20), to the west; and New Orleans, Louisiana (I-59), to the southwest. This roadway might serve as a major arterial for the transport of heavy machinery and construction supplies in the vicinity of the site. The ATV for I-20/59 in downtown Meridian is 31,000. The ATV to the east of town is 25,000, and the count after the two highways split is 21,000 (I-20) and 17,000 (I-59). This interstate would not be used by construction or operational personnel for daily commuting.

Figure 3.14-2 depicts the initial lignite coal delivery from the Red Hills Mine to the proposed plant site entrance on MS 493. Principal highways and connectors comprising the initial coal delivery route are:

- MS 9 (Red Hills Mine Site to MS 12)—MS 9 is a paved, two-laned roadway classified as a minor arterial by MDOT. This roadway will be used to route the truck traffic from Pensacola Road on which the Red Hills Mine site is located to MS 12. The 2007 ATV was 1,900 north of the intersection with Pensacola Road south to the intersection of MS 9 with MS 415 and 3,300 from this intersection to the intersection of MS 9 with MS 12.
- MS 12 (MS 9 to MS 15)—MS 12 is a paved, two-laned roadway classified as a minor arterial by MDOT. This approximately 500-ft portion of the route will be used to route trucks from MS 9 east to MS 15. The traffic count in 2007 was 4,100.

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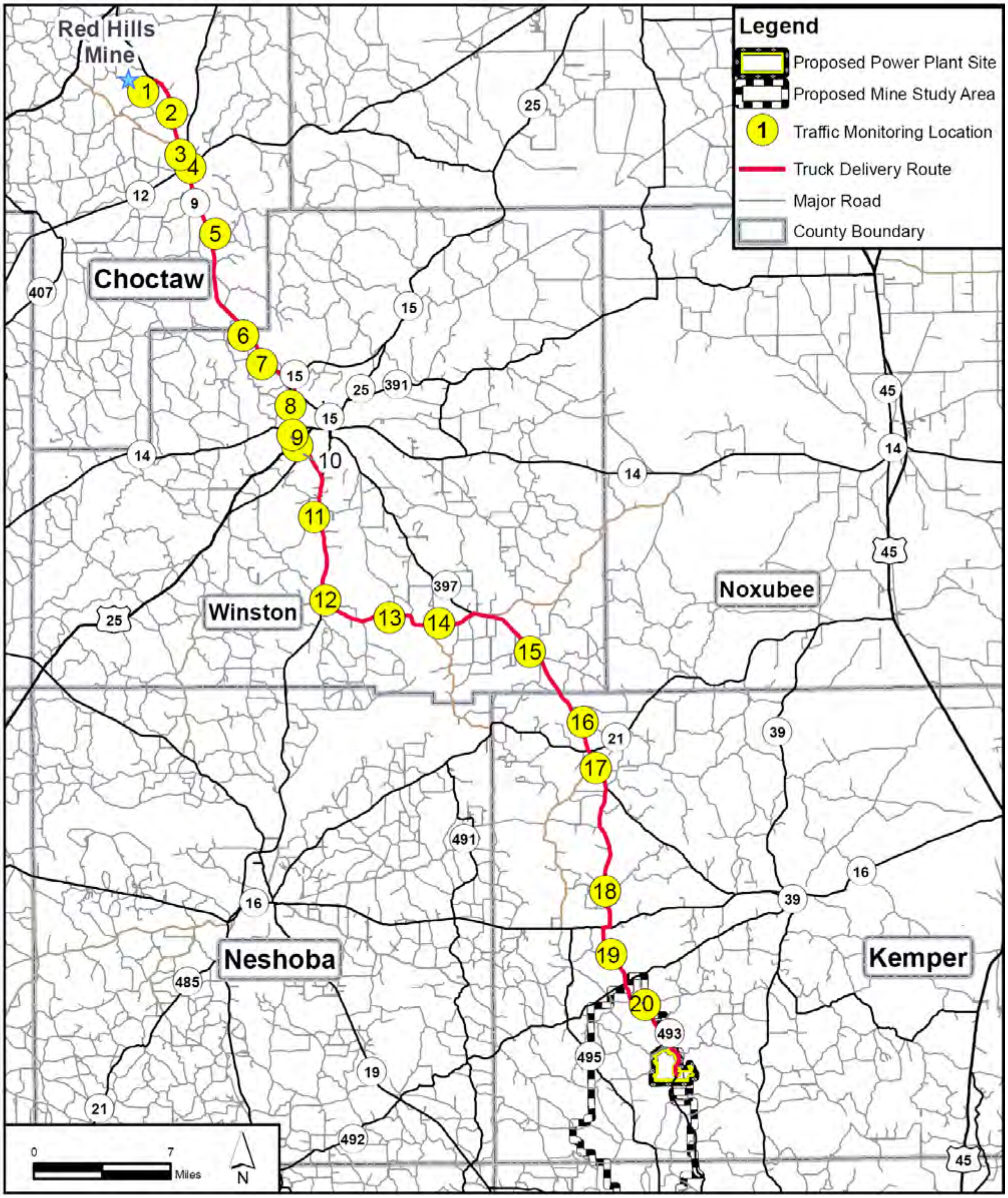

Figure 3.14-2. Selected Traffic Volume Monitoring Locations, Initial Lignite Coal Delivery Route

Sources: MARIS, 2008. ECT, 2008.

- MS 15 (MS 15 to MS 490)—MS 15 is a paved, two-laned roadway except for a four-laned section west of Louisville. This highway is classified as a minor arterial by MDOT. Use of this highway allows truck traffic to bypass downtown Louisville. Traffic counts in 2007 ranged from 1,800 north of Ackerman to 7,300 to the west of Louisville.
- MS 490 (MS 15 to MS 397)—This east-west oriented route is a paved, two-laned roadway classified as a major collector by MDOT. The 2007 ATVs varied from 1,900 near Noxapater to 770 near MS 397.
- MS 397 (MS 490 to MS 493)—MS 397 is a paved, two-laned roadway classified as a minor arterial by MDOT. The 2007 ATVs ranged from 1,000 from MS 490 south to the Kemper county line to 750 from the Kemper County line south to Preston to 1,400 from Preston south to Linville Road.
- MS 493 (MS 397 to MS 16)—MS 493 is a paved, two-laned roadway classified as a major collector by MDOT. The traffic count in 2007 was 200.

A literature search was performed to determine current usage on the roads serving as boundaries and also throughout the study area. Traffic counts were available for other roads and highways (MDOT, 2008), both those that serve as the site boundaries and those that lead both directly or indirectly to surrounding cities and major thoroughfares and arterial highways connecting to surrounding geographic regions. Table 3.14-1 provides traffic counts for selected roads that could be used during construction and operation of the project facilities. Figure 3.14-1 shows the locations where traffic volumes were provided by MDOT or were determined as described in the following. (These locations are keyed by number to Table 3.14-1.) Similarly, Table 3.14-2 provides traffic counts for the initial lignite coal delivery route. Figure 3.14-2 depicts the locations where traffic volumes were provided by MDOT, and these locations are keyed to Table 3.14-2.

No official transportation counts were found for secondary roads within the immediate area of the proposed power plant site and mine study area, so an alternate method was used to estimate traffic volumes. The numbers of houses on the various roads were determined using aerial survey maps, and an average of ten vehicle trips per day per dwelling was assumed based on trip generation data (Mehra and Keller, January 1985). All paved and gravel roads within the power plant site and mine study area, along with the estimated traffic volumes, are identified in Table 3.14-3.

Table 3.14-3. Estimated Traffic Volumes for Roads in the Immediate Power Plant and Mining Area

Road Name	Construction	Number of Houses*	Estimated Daily Traffic (Vehicles/Day)
Bethel Church	Paved	21	210
Frazier Grove	Paved	8	80
Foreman Toles	Paved	17	170
Ft. Stephens	Paved	15	150
Liberty	Paved	3	30
Wooten	Paved/gravel	14	140
Galloway	Paved/gravel	9	90
Davis-Ishee	Paved/gravel	8	80
Kittrell Swamp	Gravel	4	40
Little Hopewell	Gravel	2	20
Salters	Gravel	1	10
Leon Moore	Gravel	2	20
Gibson	Gravel	3	30
Hardy	Gravel	4	40
Murphy	Gravel	2	20
Vick-Jackson	Gravel	4	40
Cummings	Gravel	1	10
Rusty Wright	Gravel	2	20
Charles Chisolm	Gravel	1	10
S. McKee	Gravel	1	10
Jim Ward	Gravel	1	10
Larry Hurt	Gravel	2	20

*Estimated using aerial photography.

Source: ECT, 2008.

Table 3.14-1. Selected Traffic Counts in Kemper and Lauderdale Counties

Location on Map	Monitoring Site Description	Number of Lanes	Year	ATV (Vehicles/Day)	LOS D AADT
Kemper County					
(1)	MS 493 from Blackwater Road north to Old Jackson Road	2	2003	428	
			2005	410	
			2006	340	
			2007	420	1,700
(2)	MS 493 from Blackwater Road south to county line	2	2005	460	
			2006	460	
			2007	460	1,700
(3)	MS 495 from Old Jackson Road south to county line	2	2005	500	
			2006	500	
			2007	520	1,700
(4)	Old Jackson Road from DeKalb west to MS 493	2	2005	680	
			2006	690	
			2007	690	1,700
(5)	MS 495 from MS 16 south to Old Jackson Road	2	2005	500	
			2006	500	
			2007	550	1,700
(6)	MS 493 from Old Jackson Road north to MS 16	2	2005	590	
			2006	400	
			2007	420	1,700
(7)	MS 16 from MS 493 east to MS 397	2	2005	2,600	
			2006	2,400	
			2007	2,700	13,900
(8)	MS 16 from MS 397 east to DeKalb	2	2005	3,000	
			2006	3,100	
			2007	3,100	13,900
(9)	MS 16 from county line east to MS 495	2	2005	2,400	
			2006	2,400	
			2007	2,400	13,900
(10)	MS 16 from MS 495 to MS 493	2	2005	2,300	
			2006	2,300	
			2007	2,300	13,900
(11)	MS 39 from county line north to Blackwater Road	2	2005	1,900	
			2006	1,900	
			2007	1,900	7,900
Lauderdale County					
(12)	MS 39 from US 45 north to 52nd Street	4	2005	6,400	
			2006	6,400	
			2007	5,900	34,000
(13)	MS 39 from 52nd Street to Bailey-Topton/Dogwood Lake Road/Briarwood School Road Northeast	4	2005	9,300	
			2006	9,400	
			2007	9,400	34,000
(14)	MS 39 from Bailey-Topton/Dogwood Lake Road/Briarwood School Road Northeast north to John C. Stennis Drive	4	2005	4,400	
			2006	4,500	
			2007	4,500	34,000
(15)	MS 39 from John C. Stennis Drive north to county line	2	2005	2,800	
			2006	2,900	
			2007	2,500	7,900
(16)	MS 493 from North Hills Street north to Windsor Road	2	2005	4,300	
			2006	4,300	
			2007	4,100	17,000

Table 3.14-1. Selected Traffic Counts in Kemper and Lauderdale Counties (Continued, Page 2 of 2)

Location on Map	Monitoring Site Description	Number of Lanes	Year	ATV (Vehicles/Day)	LOS D AADT
(17)	MS 493 from Windsor Road to Bailey-Topton/Dogwood Lake Road/Briarwood School Road Northeast	2	2005	3,100	
			2006	3,100	
			2007	3,100	17,000
(18)	MS 493 from Bailey-Topton/Dogwood Lake Road/Briarwood School Road Northeast north to Center Hill Road	2	2005	1,600	
			2006	1,600	
			2007	2,400	1,700
(19)	MS 493 from Center Hill Road north to county line	2	2005	460	
			2006	470	
			2007	470	1,700
(20)	I-59, west of intersection with U.S. 45	4	2005	31,000	
			2006	32,000	
			2007	33,000	N/A
(21)	I-20, approximately 2 miles west of split from I-59	4	2005	17,000	
			2006	17,000	
			2007	18,000	N/A
(22)	I-59, approximately 2 miles south of split from I-59	4	2005	17,000	
			2006	17,000	
			2007	18,000	N/A
(23)	U.S. 45, approximately 1 mile north of Clarke County boundary	4	2005	7,800	
			2006	7,800	
			2007	7,800	N/A
(24)	I-59/20, just west of Lauderdale-Toomsuba Road interchange	4	2005	25,000	
			2006	25,000	
			2007	26,000	N/A
Neshoba County					
(25)	MS 16 from MS 19 west to MS 486	4	2005	15,000	
			2006	18,000	
			2007	17,000	34,000
(26)	MS 16 from MS 486 west to MS 482	2	2005	7,300	
			2006	6,600	
			2007	6,700	13,900
(27)	MS 16 from MS 482 west to MS 491	2	2005	3,800	
			2006	3,100	
			2007	3,300	13,900
(28)	MS 16 from MS 491 west to county line	2	2005	2,600	
			2006	2,700	
			2007	2,700	13,900

Note: (X) = location of traffic count keyed by number on Figure 3.14-1.
N/A = not applicable for community.
ATV = average traffic volume.
LOS = level of service.

Sources: MDOT, 2008.
ECT, 2008.

Table 3.14-2. Traffic Counts for Initial Lignite Coal Deliveries

Location on Map	Monitoring Site Description	Number of Lanes	Year	ATV (Vehicles/Day)	LOS D AADT
Choctaw County					
(1)	Pensacola Road from Red Hills Mine northeast to MS 9	2	2005	310	
			2006	320	
			2007	260	1,700
(2)	MS 9 from Pensacola Road south to MS 415	2	2005	1,900	
			2006	1,900	
			2007	1,900	7,900
(3)	MS 9 from MS 415 south to MS 12	2	2005	3,300	
			2006	3,000	
			2007	3,300	7,900
(4)	MS 12 from MS 9 northeast to MS 15	2	2005	4,000	
			2006	4,100	
			2007	4,100	7,900
(5)	MS 15 from MS 12 south to county line	2	2005	2,500	
			2006	2,600	
			2007	2,600	7,900
Winston County					
(6)	MS 15 from county line south to McMillan	2	2005	3,300	
			2006	3,300	
			2007	3,300	7,900
(7)	MS 15 from McMillan south to South Ackerman Road	2 to 4	2005	2,400	
			2006	2,500	
			2007	2,600	34,000
(8)	MS 15 from South Ackerman Road south to MS 14	4	2005	6,500	
			2006	6,600	
			2007	7,300	34,000
(9)	MS 15 from MS 14 south to Old Robinson Road	4	2005	4,500	
			2006	4,600	
			2007	4,800	34,000
(10)	MS 15 from Old Rodman Road south to south Church Avenue	4 to 2	2005	5,200	
			2006	5,200	
			2007	4,400	34,000
(11)	MS 15 from South Church Avenue south to MS 490	2	2005	4,400	
			2006	4,500	
			2007	4,500	7,900
(12)	MS 490 from MS 15 east to Union Ridge Road	2	2005	1,700	
			2006	1,700	
			2007	1,900	7,900
(13)	MS 490 from Union Ridge Road east to Enon Road	2	2005	990	
			2006	1,000	
			2007	870	7,900
(14)	MS 490 from Enon Road east to MS 397	2	2005	780	
			2006	730	
			2007	770	7,900
(15)	MS 397 from MS 490 south to county line	2	2005	1,000	
			2006	1,000	
			2007	1,000	1,700
Kemper County					
(16)	MS 397 from county line south to MS 21	2	2005	770	
			2006	780	
			2007	750	1,700
(17)	MS 397 from MS 21 south to MS 493	2	2005	1,300	
			2006	1,300	
			2007	1,400	1,700
(18)	MS 493 from MS 397 south to MS 162	2	2005	240	
			2006	240	
			2007	200	1,700
(19)	MS 493 from MS 16 to Old Jackson Road	2	2005	590	
			2006	400	
			2007	420	1,700
(20)	MS 493 from Old Jackson Road to plant entrance	2	2005	410	
			2006	340	
			2007	350	1,700

Sources: MDOT, 2008.
ECT, 2008.

3.14.3 RAILROADS

There are two main rail lines located in Kemper, Lauderdale, Clarke, Jasper, and Neshoba Counties. The railroad companies are Kansas City Southern (KCS) and Norfolk Southern Systems (NWS) (MDOT, 2008). The nearest railroad lines to the proposed plant site in Kemper County (see Figure 3.14-3) include:

- KCS—This company has the largest rail presence in the area with lines east, west, and south of the project area. To the west, a line runs north-south between the towns of Philadelphia and Union and further south. The line is approximately 17 miles west of the boundary of the proposed mine study area and 21 miles from the power plant site.

  On the east, there is a KCS rail line between Meridian and Scooba and further north. In Scooba, the line would be approximately 19.5 miles from both the power plant site and mine study area. In addition, a spur has been extended to the Meridian NAS from the mainline track. The NAS spur is approximately 12.5 miles from the plant site and 9.7 miles from the nearest boundary of the mine study area.

  There is a KCS line to the south of the project area extending from Meridian to Jackson and further west. In the Meridian area, the line is approximately 20 miles from the proposed plant site and 13 miles from the mine study area boundary. In addition, another rail line runs south to the town of Quitman.

  There is a rail distribution yard in Meridian and marshalling yard located in Union. For the KCS line, the main freight centers would be Meridian, Union, Philadelphia, or Scooba.
- NWS—Runs from Meridian in a northeasterly direction toward Tuscaloosa, Alabama, and south-southwesterly toward Laurel, Mississippi. A rail distribution center is located in Meridian, and a marshalling yard is located in Laurel. The NWS line would primarily be accessible from the Meridian station. This rail line is approximately 20 miles from the proposed plant and approximately 13 miles from the nearest boundary of the mine study area.

Meridian is the key rail distribution yard in the vicinity of the proposed power plant site and mine study area.

3.14.4 AIRPORTS

Several airports are located within a 120-mile radius of the proposed power plant site and mine study area, some of which are shown on Figure 3.14-3 and described in Table 3.14-3. The major commercial service airports in the vicinity include Key Field Regional Airport in Meridian, Golden Triangle Regional Airport, Tupelo Regional Airport, and Jackson-Evers International Airport. These commercial airports have airfreight and jet capability. An airport is considered capable of handling airfreight and jet service when it has a minimum 5,000-ft hard-surfaced, lighted runway. Key Field at Meridian has the longest runway (10,003 ft) in Mississippi.

3.15 WASTE MANAGEMENT FACILITIES

There is one sanitary landfill currently permitted and approved by the state of Mississippi for operation in Kemper County. The facility is located in Sections 16 and 17, Township 11 north, Range 17 east, northeast of

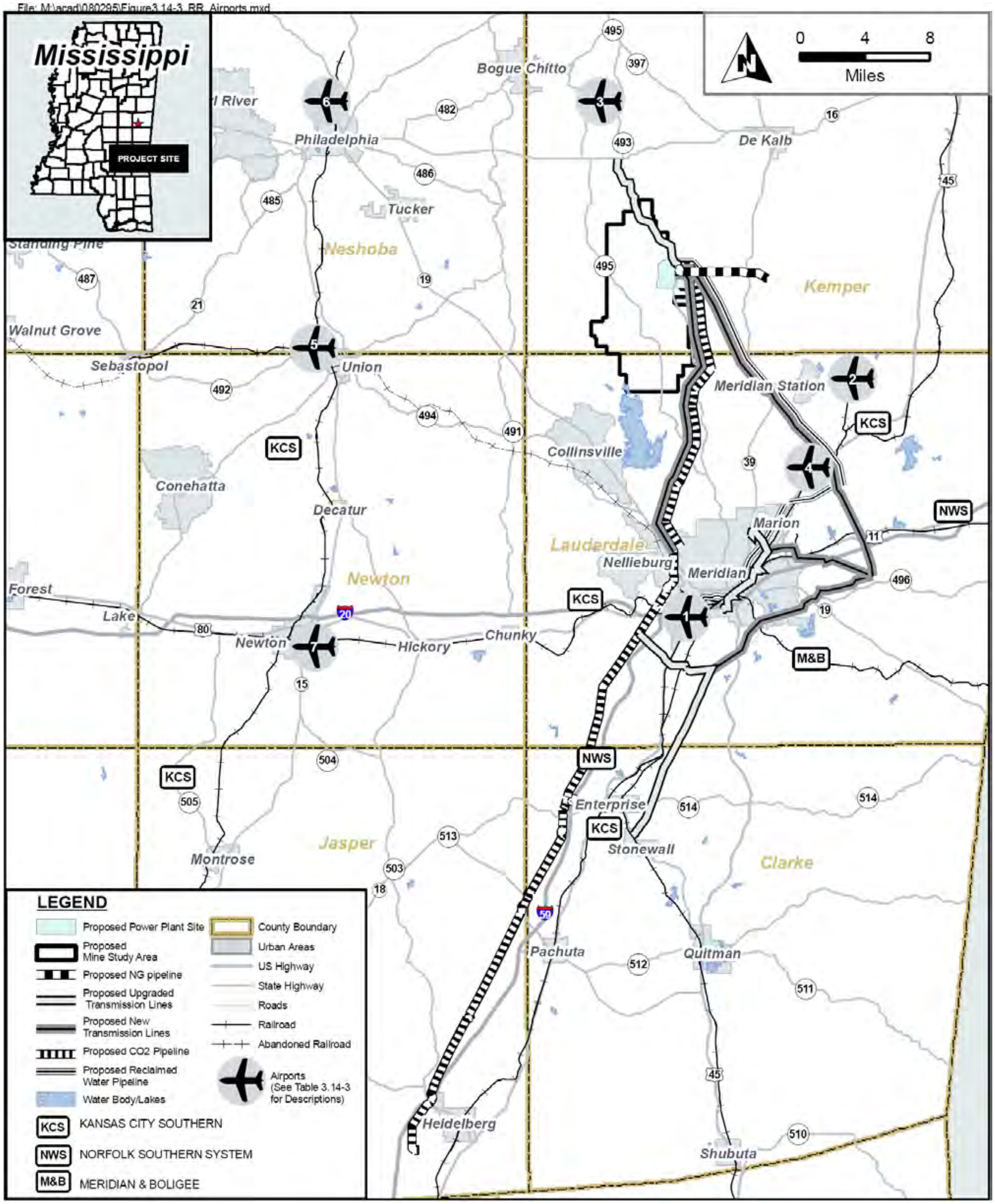

Figure 3.14-3. Airports and Railroads in the Vicinity of Proposed Kemper County IGCC Project Area

Sources: U.S. Census, 2000. MARIS, 2008. ECT, 2008.

Table 3.14-3. Selected Airports Located Within 120 Miles of the Proposed Plant Site and Mine Study Area

Airport Name	ID	Location	Description	Miles to Plant Site	Miles to Mining Site Boundaries
Key Field (1)	MEI	Meridian, Lauderdale County	Commercial air service; 10,003 × 150-ft runway asphalt/concrete; airfreight and jet capable; attended	20.6	13.6
Meridian NAS, John S. McCain Field (2)	NMM	Lauderdale County northeast of Meridian	Military training base; private use; three runways 8,002 ×200-ft concrete; airfreight and jet capable; attended	9.7	6.8
Joe Williams Naval Auxiliary Landing Field (NALF) (3)	NJW	Kemper County north of EIS area	Military private use; 7,976 × 150-ft asphalt/concrete; airfreight and jet capable; attended	10.3	5.3
Topton Air Estates (4)	OMSO	Lauderdale County northeast of Meridian	Private; 3,200 × 100-ft asphalt; unattended	14.2	8.8
Union Municipal Airport (5)	3MS9	Northern Newton County west of EIS area	Private use; 2,550 × 200-ft turf; unattended	20.6	17.1
Philadelphia Municipal Airport (6)	MPE	Neshoba County northwest of EIS area in town of Philadelphia	Public use; 5,001 × 75-ft asphalt; airfreight and jet capable; attended	23.1	18.1
Fairview Farms*	3MS8	Scooba, Kemper County	Private use; 3,600 × 60-ft turf, unattended	20.1	19.4
Easom Field (7)	M23	Newton, Newton County	Public use; 3,000 × 75-ft asphalt; attended	31.5	25
Golden Triangle Regional Airport *	GTR	Near Columbus, Lowndes County	Commercial air service; 6,497 × 150-ft asphalt; airfreight and jet capable; attended	78	75
Jackson-Evers International Airport*	JAN	Jackson, County	Commercial air service; 8,500 × 150-ft asphalt; airfreight and jet capable; attended	120	113
Tupelo Regional Airport(*)	TUP	Tupelo, Lee County	Commercial air service; 6,500 × 100-ft asphalt; airfreight and jet capable; attended	116	113

Note: (X) = location on Figure 3.14-3.

*Not shown on Figure 3.14-3.

Source: ECT, 2008.

DeKalb on MS 16, approximately 15 miles northeast of the proposed power plant site. The landfill recently received a grant from the state to expand capacity from 8.17 to 22.37 acres within a total property area of 102 acres (Kemper County Solid Waste Landfill, LLC. 2008). The landfill expansion area is currently under construction.

The landfill, although operating under the name of Kemper County Solid Waste Landfill, LLC, is a private facility. The operating company works closely with the Kemper County Board of Supervisors and has received assistance from the county with expansion plans and grants.

The landfill accepts household waste along with yard trimmings, tree rubbish, and construction debris. For solid waste disposal, the landfill operates under permit SW0350010428. The landfill also serves as a collection site for waste tires and asbestos-containing materials (Kemper County Solid Waste Landfill, LLC, 2008). The landfill has a permit to incinerate and dispose of hurricane debris from storms along the coastal areas of the state but, to date, has received minimal waste from these potential sources.

Hazardous waste generated in Kemper County is not accepted by the sanitary landfill. The nearest hazardous waste disposal facility is in Emelle, Alabama, located approximately 17 miles east of the Kemper County landfill. The hazardous waste facility is operated by Chemical Waste Management, Inc., a subsidiary of Waste Management, Inc.

3.16 RECREATION RESOURCES

Developed recreational facilities within the immediate vicinity of the proposed Kemper power plant site and mine study area include Okatibbee Lake and WMA and Kemper County Lake.

3.16.1 OKATIBBEE LAKE AND WMA

The WMA, located in Kemper and Lauderdale Counties, surrounds Okatibbee Lake and adjoins the southern boundary of the proposed mine study area. The WMA is located approximately 4.7 miles south of the proposed power plant site. The WMA and lake receive water flows primarily from Chickasawhay Creek, which runs north-south through the proposed mine study area, Okatibbee Creek, which intersects part of the western portion of the proposed mine study area, and other minor tributary streams. The two larger streams join to form Okatibbee Lake (see Figures 3.6-1 and 3.6-2). The lake and WMA were created by USACE, Mobile District, as part of a flood reduction project authorized by Congress in 1962 (USACE, 2008). USACE has licensed rights for the management of hunting and fishing in the WMA to MDWFP. The WMA consists of 6,883 acres used for the recreational hunting of many species of game, including deer, turkey, and waterfowl, along with other small game.

The Okatibbee Lake area (4,144 acres) is used for fishing, boating, camping, and other outdoor recreational activities. The lake also has five beaches, one marina, and several small campgrounds and public use areas containing picnic tables, restrooms, and other facilities. The lake is located adjacent to the town of Collinsville and approximately 7 miles northwest of Meridian.

3.16.2 KEMPER COUNTY LAKE AND OTHER AREA RESOURCES

Kemper County Lake is located approximately 10 miles north of the proposed power plant site and 6.5 miles from the nearest boundary of the proposed mine study area. The lake, opened in 1984, is managed by MDWFP and has two fishing piers, boat ramps, camping sites, picnic areas, and other amenities. The 652-acre lake offers excellent fishing and boating activities.

On the proposed plant site and mine study area, the primary recreational activity is deer hunting, followed by turkey and other small game hunting. Most of the hunting is by landowners and their guests and by members of hunting clubs that have leased parcels of land. Fishing opportunities are available in Chickasawhay and Okatibbee Creeks and in small farm ponds.

Other recreational areas within 40 miles of the proposed site include Nanih Waiya WMA (22.5 miles northwest), Tallahalla WMA (37.5 miles southwest), and Bonita Lake Park (20 miles south). There are also golf courses located in Meridian, Philadelphia, and other nearby communities and parks with organized adult and youth sports activities.

3.17 AESTHETIC AND VISUAL RESOURCES

The aesthetic character of a site reflects a number of the topics covered previously in this chapter such as cultural resources, land use, and recreation resources. The visual characteristics of the proposed power plant site, mine study area, and linear corridors are not unique to Kemper County, eastern Mississippi, or the state as a whole. In general, Kemper County is rural with only 4,533 households in an area of 766 mi^2, or approximately one household for every 108 acres. Subtracting the approximate number of households and square miles in DeKalb and Scooba reduces the density to one household per 123 acres. Approximately 84 percent of the county is involved in forestry. As a result, the landscape of unincorporated Kemper County appears as a range from clear-cut lands to mature forests with only occasional residences, many with additional, agriculturally related buildings or sheds generally located along two-laned rural roadways.

3.18 CULTURAL AND HISTORIC RESOURCES

3.18.1 REGIONAL SETTING

To fully identify and understand how cultural and historical properties might be potentially impacted by the proposed power plant project, the proposed mine, and connected actions, it is important to understand the historical context of the larger region within which such properties developed and existed. A discussion of that regional historical context, ranging from the Paleoindian period to the twentieth century, follows.

From what little is known about the Paleoindian period (10,000 to 8,000 B.C.), archaeologists tend to agree that the Paleoindian groups lived in a band level society, were nomadic, and were hunters and foragers. Although the population density was low, it is believed that, toward the end of the Paleoindian period, the population density increased significantly (Walthall, 1980). Many southeastern researchers argue that eastern Paleoindian groups may have based their subsistence economies on the exploitation of extinct big game, given that many sites are located in prime megafaunal habitats (i.e., major river systems) (Gardner, 1974; Goodyear *et al.*, 1979; Williams and Stoltman, 1965).

The Archaic period (8,000 to 1,000 B.C.) marked the beginning of cultural adaptations to more modern environmental conditions. Although there was a large degree of continuity in adaptations between the Paleoindian and Archaic periods, sea levels rose during the Archaic, which led to increasingly productive river systems and, in response, changing lifestyles (Smith, 1986). The Archaic period generally is further divided into the Early Archaic, Middle Archaic, and Late Archaic, which are differentiated by changing environment, technology, cultural organization, and complexity.

During the Early Archaic period sea levels rose, and the deciduous forest community extended northward on the previously exposed Gulf Coastal Plain (Watts, 1969 and 1971). Thus, Early Archaic environmental adaptations probably were similar to those that occurred in the later stages of the Paleoindian period. Middle Archaic sites tend to be small scatters that probably represent camps of mobile foragers who were exploiting patchy resources. It is during the Middle Archaic that there is first evidence of intensified inter and intra-societal interaction. A trade in ceremonial Benton points and “turkey tail” points has been documented for northeastern Mississippi (Johnson and Brookes, 1989). The Late Archaic period represents the first cultural adaptation to an essentially modern environment. During the Late Archaic period, the mid-south witnessed the beginnings of indigenous plant domestication. Remains of domesticated squash, gourds, and sunflower have been recovered from states located in the mid-south. By the end of the Archaic period, networks existed for the trade of exotic items (Muller, 1983).

The Gulf Formational period (1,200 to 100 B.C.) marks the Archaic-Woodland transition in the southeastern coastal plain (Walthall and Jenkins, 1976). Gulf formational cultures exhibit some specific characteristics of Woodland peoples (such as the use of ceramics), but appear to have preserved a Late Archaic economic system. During the earlier portion of this period in eastern Mississippi, fiber-tempered ceramic technology was acquired as a by-product of trade between the Stallings Island and Orange cultures of the South Atlantic coast and the Poverty Point culture of the lower Mississippi River Valley.

Fully developed Woodland period (100 B.C. to A.D. 900/1000) characteristics were not apparent in the region until what is traditionally defined as the Middle Woodland period in other areas of the eastern United States. While pottery manufacturing occurred during the Gulf Formational period, the economy did not become more like a Woodland stage economy until 100 B.C. The beginnings of the Woodland period have been traditionally defined by not only the appearance of pottery but also evidence of permanent settlements, intensive collection and/or horticulture of starchy seed plants, differentiation in social organization, and specialized activities (National Park Service [NPS], 2008).

In central Mississippi, the Middle Woodland period saw the introduction of burial mound ceremonialism, sand-tempered ceramics, and interregional trade from the Crab Orchard culture of western Kentucky and Tennessee and the Illinois Valley Hopewell. This area also received some influence from the Marksville culture of the lower Mississippi River Valley. Subsistence was based primarily on intensive seasonal hunting and gathering (NPS, 2008). By A.D. 400 burial mound construction ceased. After A.D. 600, there is evidence of maize horticulture and bow-and-arrow technology.

The Mississippian period (A.D. 1000 to A.D. 1600), which culminated in the Contact period, was marked by complex social and political organization, maize horticulture or agriculture, substructure mounds arranged around plazas, and shell-tempered ceramics. Populations concentrated on fertile floodplains of major river valleys to accommodate increasing reliance on agricultural food production. This period also provides evidence of increasing trade by ruling elites who used surplus resources to produce craft goods to exchange for nonlocal prestige items. Such items symbolized their claim to political power and higher social and economic position (Barker and Pauketat, 1992).

During the protohistoric period, an important tribe of the Muskhogean stock occupied present-day Mississippi. Ethnically they belonged to the Choctaw branch of the Muskhogean family, which included the Choctaw, Chickasaw, and Hunt peoples, their allies, and some small tribes, all of whom lived along the Yazoo River. This tribe was first mentioned by name in 1675 when a Spanish priest warned about the fearsome “Chata” while attempting to prevent settlement away from established missions in Florida. The Choctaws' first sustained contact with Europeans came in 1699 with the establishment of the French settlement of Iberville in Louisiana. For the next 65 years the Choctaw and French were fast allies, fighting alongside one another against the English and their Indian allies (Carleton, 2002).

After the end of the French and Indian War in 1763, the French ceded all of their territory east of the Mississippi River to the English and all the lands west to the Spanish. At this time, the Choctaw had a varying relationship with the English, which ended with the American Revolution and the expulsion of the English. At that time, the Choctaw started a long relationship with the United States (Carleton, 2002).

The expansion of the new nation brought pressures for more land, and the federal government turned its attention to land held by American Indians. Like all other Indian tribes, the Choctaws were placed in the position of negotiating over their lands. Their first treaty with the United States, reaffirming the Choctaw boundaries and recognizing them as a sovereign nation, was signed in 1786. Although Mississippi gained statehood in 1817 based on the strength of its southwestern settlements around Natchez and the Mississippi River, the east-central part of the new state was at this time still controlled by the Choctaw Indians. These Indians acted as a buffer to continued settlement from the east. Undeterred, European settlers encroached on this Choctaw territory, aided in their efforts by a series of federal treaties between 1801 and 1830 known as the Choctaw Cessions. These treaties ultimately wrested more than two-thirds of the state from the Choctaws and forced them to relocate to Oklahoma on the infamous Trail of Tears. The 1830s Treaty of Dancing Rabbit Creek, which added more than 10 million acres to state control, not only memorialized the final land cession of the era, but also set the stage for the creation of the three counties (Lauderdale, Clarke, and Jasper), in which the proposed plant, mine, and connected actions would be located (Fairly *et al.*, 1988; Historic Clarke County, Inc., n.d.; Gonzales, 1973).

The area of Lauderdale, Clarke, and Jasper Counties in east-central Mississippi is a region characterized by a history built on agriculture, timber production, and the railroad. The eastern part of the state was settled later in the nineteenth century than western areas along the Mississippi River. The terrain was rugged and for the most part less fertile than the state's famed Delta region. The eastern region of the state struggled to survive in the antebellum era, in contrast to western counties whose plantation economies thrived during the era of King Cotton. It was not until the construction of the railroads in the late 1850s that the region's economy began to grow in a brief window of opportunity that was quickly closed by the destruction caused by the Civil War. As the war progressed and the Union gained control of the western theater and the Mississippi River by 1863, state government records were moved from Jackson to Meridian for safekeeping. Meridian was even made the state capital for one month during this time (Works Progress Administration [WPA], 1938). The following year, in February of 1864, General William T. Sherman's troops stormed into Meridian to destroy the town and the railroads that made it a strategic Confederate garrison. After a week in the area, Sherman's troops had demolished the railroads for miles in all directions. Other small towns, such as Enterprise and Quitman in Clarke County, were also burned and looted (Historic Clarke County, Inc., n.d.).

Following the cessation of hostilities, reconstruction marked a period of uncertainty, fear, and violence across Mississippi and in Meridian. Two outcomes of the war, however, were certain. One was that the Union was preserved and the right of secession as a legitimate expression of state sovereignty had been repudiated. The second was that the "peculiar institution" of slavery, which underpinned the state's economy and culture, was abolished. Mississippi was readmitted into the Union in 1870, 5 years after the close of the war, but the state's political and economic systems remained in turmoil. Race relations reached a nadir, sparking violence across the state, to include a race riot in Meridian in 1871, followed by another in Marion in 1881. Adding to the disorder and backlash against Republican rule in Washington and the continued occupation of the state by Federal troops, Meridian suffered a yellow fever epidemic in 1878 that depopulated the town (WPA, 1938; Historic Clarke County, Inc., n.d.).

Following the devastation of war and reconstruction, the area slowly reemerged to a new “Golden Age” between 1890 and 1930. During this time Meridian capitalized on timber, cotton, and its location at the intersection of three railroads to turn itself into a major southern rail center. Smaller villages located on rail lines outside of Meridian, including Enterprise, Pachuta, and Heidelberg in Jasper and Clarke Counties, shared in the general prosperity as they exported timber and farm goods.

Postwar industrial development also spread to surrounding counties around Lauderdale. Cotton mills were established in Stonewall and Enterprise in Clarke County in 1867 and 1885. The county’s largest manufacturing boom was based on lumber, with mills in Enterprise, Quitman, and Shubuta, as well as a spoke factory, planing mills, turpentine stills, and a shingle factory. The lumber boom was temporary, however, as clear-cutting severely depleted the counties’ timber by 1930. Poor timber management also resulted in severely eroded land, making what would have been only marginal cropland even less suited to agriculture (Historic Clarke County, Inc., n.d.).

Several trends converged in the twentieth century to end the post-Reconstruction boom period in east Mississippi. The Great Depression hit at a time when the region’s timber supply was badly depleted and lumber companies began to go out of business. According to one historian of Lauderdale County, “in combination with this dwindling timber supply, major soil erosion, and falling cotton prices resulted in an economically distressed population” (McCullouch, 1954).

Despite such economic reverses within the larger region during this period, the Jasper County town of Heidelberg enjoyed, for its part, a unique period of prosperity. Heidelberg’s roots originated with W.I. Heidelberg, a German immigrant who granted an easement through his property for the construction of the New Orleans & Northeastern Railroad. Heidelberg built his home in the area in 1878 and later opened a cotton gin and store that served as the basis of the railroad-oriented community. The community incorporated in 1884, taking the name of Heidelberg. It remained a sleepy town that relied on farming and timber exports until oil was discovered there in December 1943. The Gulf Oil Company began drilling test wells in the area in the late 1930s. The discovery of oil changed life in little Heidelberg as its population jumped from 400 to more than 600 almost overnight. All available housing was quickly filled, with many people spilling over to live in nearby Laurel, the largest town in the county, as well as Sandersville, Pachuta, and Eucutta. Gulf Refining Company became the major oil producer in the field and eventually built housing for its employees (McCullouch, 1954; Edmonds, 1999).

Heidelberg, however, proved an exception to the general rule. Due to a number of factors, the economic fortunes of small towns and rural areas in the region generally declined throughout the remainder of the twentieth century, although Meridian managed to remain an important rail center with a timber industry that is still a major component of the local economy. The railroad and timber continue to figure prominently in the Meridian economy, but the city has diversified considerably since the middle of the twentieth century. Today, the city has robust health care and retail sectors, as well as military facilities that employ thousands of residents.

3.18.2 NATIONAL REGISTER OF HISTORIC PLACES

The National Register of Historic Places (NRHP), administered by NPS, is the official list of historic places worthy of preservation. The National Register Web site (http://www.nps.gov/history/NR/) states that:

> "The National Register is the official federal list of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, engineering, and culture. National Register properties have significance to the history of their community state, or the nation. Nominations for listing historic properties come from State Historic Preservation Officers, from Federal Preservation Officers for properties owned or controlled by the United States Government, and from Tribal Historic Preservation Officers for properties on tribal lands. Private individuals and organizations, local governments, and American Indian tribes often initiate this process and prepare the necessary documentation. A professional review board in each state considers each property proposed for listing and makes a recommendation on its eligibility. National Historic Landmarks are a separate designation, but upon designation, NHLs are listed in the National Register of Historic Places if not already listed."

Properties may be listed if their age, integrity, and significance meet evaluation criteria. The NRHP database provides locations and identifying information on NRHP sites in the vicinity of proposed Kemper County IGCC Project facilities. Figure 3.18-1 depicts these locations.

3.18.3 POWER PLANT SITE

A cultural resources survey of the proposed power plant site was conducted in 2007 and described in a report by Vittor (2008). This report was initially submitted to the Mississippi Department of Archives and History (MDAH) in August 2008 and was subsequently revised. The survey identified six archaeological sites and one standing historic structure found on the site. Some artifacts were recovered, mostly ceramics, glass bottles and glass fragments, and lithic material (quartzite flakes). The report concluded that all six "sites lack the integrity needed for inclusion on the NRHP" and recommended no further testing. Similarly, the historic structure was found to be ineligible "due to its lack of architectural integrity and lack of historical significance."

In a letter dated October 24, 2008 (included in Appendix M), MDAH concurred, based on the revised report, that the six archaeological sites were ineligible for listing. However, MDAH did not concur with the report's conclusion regarding the standing structure; rather, MDAH determined that this structure, the Goldman House, which was likely completed between 1890 and 1910 and last occupied in 1973, was:

> "potentially eligible for listing as a local example of a vernacular rural house with late Victorian details. As such, demolition of this resource would be an adverse effect. To mitigate the adverse effect, it is our recommendation that HABS-level documentation (including measured drawings and archival photographs) would, at a minimum, be appropriate mitigation."

This abandoned house, shown in Figure 3.18-2, is located in the south-central portion of the proposed power plant site.

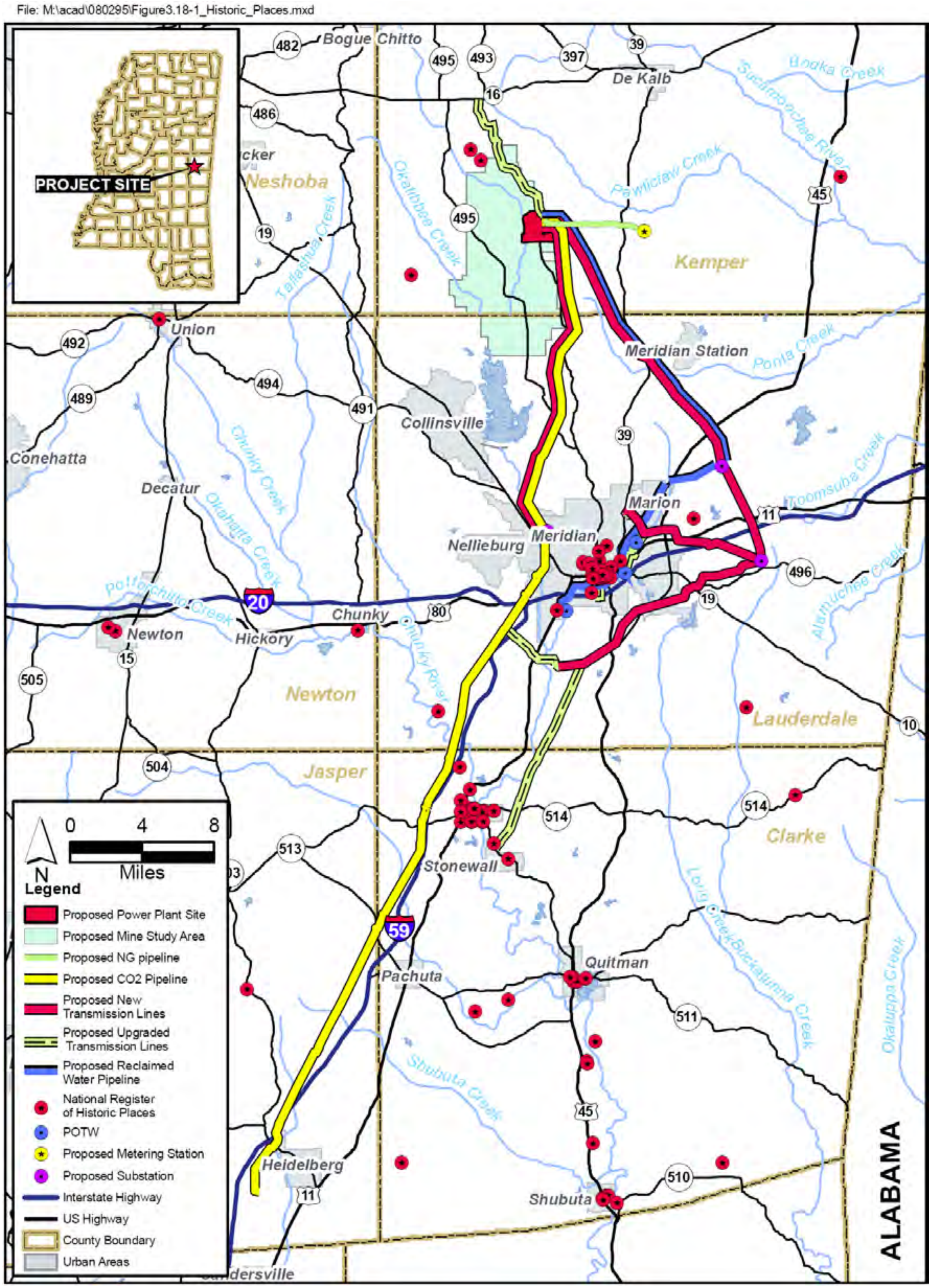

Figure 3.18-1. Listed Historic Places in the Project Counties

Sources: U.S. Census, 2000. NPS, 2007. MARIS, 2008. ECT, 2009.

Figure 3.18-2. Front View of Goldman House
Source: Vittor, 2008.

3.18.4 MINE STUDY AREA

Surveys of portions of the potential mine study area proposed by NACC were carried out by the Cobb Institute of Archaeology at Mississippi State University (Rafferty *et al.*, 2009) consistent with a research design that was approved by MDAH. The surveys included background research, extensive field surveys, and artifact analysis.

The report presented the results of a systematic, intensive archaeological survey of roughly 6,500 acres (approximately 21 percent) of the proposed lignite mine study area, as shown in Figure 3.18-3.

To obtain information on the diversity of site locations in the area, the survey was stratified by soil slope categories. The overall mine study area has four such categories. The preliminary survey covered between 19 and 22 percent of each of the four strata within the mine study area. So, it can be concluded that the archaeological sites resulting from the preliminary, partial survey should be representative of most of the kinds of sites that will be found in the ongoing survey that will ultimately cover 100 percent the proposed mine study area. Efforts to complete the full survey continue and are anticipated to be completed later in 2009 (contingent upon land access). The final report on all of the Phase I work, covering 100 percent of the proposed mine study area, is anticipated to be completed by mid-2010. That future report will include National Register significance assessments for archaeological sites, cultural landscapes, and standing structures in the mine study area. These latter include houses, stores, and bridges, the recording and assessment of which will be done by an architectural historian.

Fieldwork methods used in the preliminary haeological survey followed the approved plan, with shovel testing at 30-meter intervals in all areas covered with forest, pasture, or other vegetation and that had slopes between 2 and 8 percent. Floodplain areas were tested using a tractor-mounted auger, with holes being placed at 500-meter intervals. No evidence of buried soil horizons or artifacts was found in the augering program. Land with a greater than 8-percent slope was not shovel-tested but was inspected on foot to identify any nested areas of lesser slope.

One-hundred-seventy archaeological sites were found in the preliminary survey. Artifact analyses were done to extract chronological, use, and technological data for each assemblage. Detailed analysis of aboriginal- and historic-period pottery, glass, projectile points, and lithic debitage was performed. The 170 sites found in the preliminary sample included 44 dating to the prehistoric/protohistoric/historic Indian periods, 91 that contained historic components only, and 35 that produced evidence of both aboriginal- and historic-period artifacts.

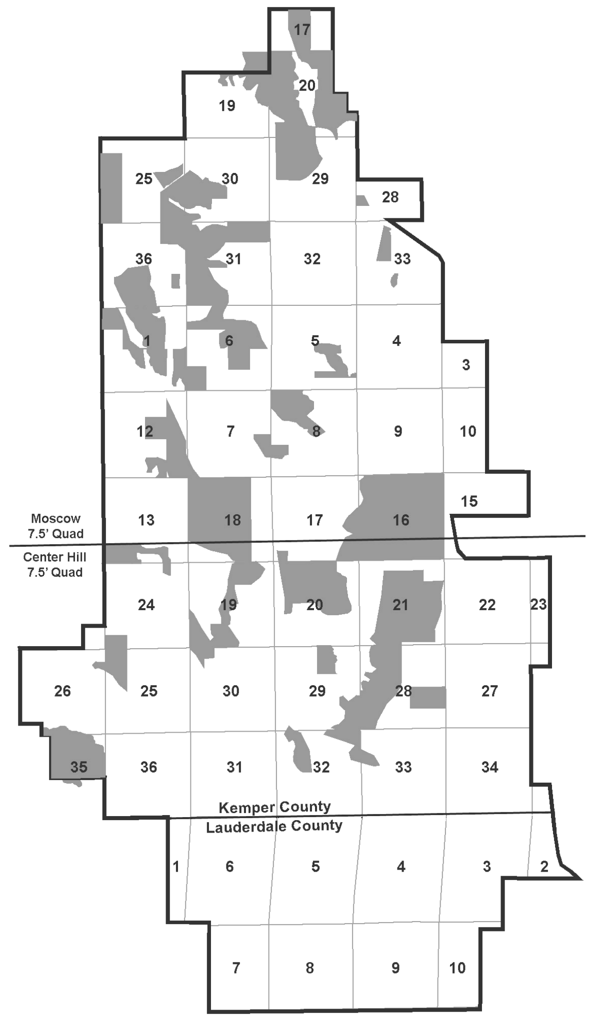

Figure 3.18-3. Potential Mining Area Boundary and Areas Surveyed

Source: Rafferty *et al.*, 2009.

The preliminary survey represents part of an overall Phase I effort, the goal of which is to find, record, and assess the significance of as many archaeological sites and standing structures as possible within the project area. Significance will be linked to NRHP eligibility statements, as required under Section 106 of the National Historic Preservation Act. A plan for significance assessment of archaeological sites is included in the appended report, but such assessments cannot be made until the completion of the full survey. Significance will be assessed by using information on occupational duration and intensity, combined with measures of the richness and evenness of artifact classes in each assemblage.

3.18.5 LINEAR FACILITY CORRIDORS AND RIGHTS-OF-WAY

3.18.5.1 Introduction and Approach

Phase I cultural resources surveys were completed for the 156 miles of known and defined study corridors and rights-of-way planned for transmission lines and pipelines. All surveys were carried out consistent with research designs that were approved by MDAH. The surveys included background research at MDAH in Jackson and at local libraries, extensive field surveys, and artifact analysis.

Intensive archaeological field surveys were carried out in all parts of the survey corridors, and shovel tests were performed except in steeply sloped areas, wetlands, highly disturbed areas, or other areas of low probability, where only reconnaissance surveys were conducted. The full width of each corridor was visually inspected. For the 200-ft-wide (60-meter) corridors, shovel tests were conducted at 30-meter intervals along two parallel transects spaced 30 meters apart. All exposed ground surfaces and sloped topography were visually inspected. Judgmental shovel tests were excavated on landforms not covered by the initial transect grids. Shovel tests were 30 cm in diameter and excavated to sterile subsoil. The soil from all tests was screened through 0.25-inch hardware cloth for artifact recovery. Tests yielding cultural materials were given a discrete number, and locations were placed on project field maps. Artifacts recovered were bagged by provenience.

In addition to new transmission lines and gas pipelines, some existing electrical transmission line rights-of-way would be used for this project. These existing transmission lines would be upgraded to carry added load due to the addition of the new power plant (see Section 2.2). The methodology used in these existing corridors (all of which are less than 200 ft wide) was less intensive than that used for new lines, but reconnaissance surveys of the entirety of the existing rights-of-way were conducted. In addition, intensive close-interval shovel testing was conducted in high probability areas.

When artifacts were found in a shovel test, additional shovel tests were excavated at a 5- to 10-meter interval in a cruciform pattern until two negative tests were reached in each direction. Site boundaries were not determined beyond the confines of the corridor boundaries. However, some determination of potential site size was made based on topography and other factors. When a site was found on the ground surface where visibility is 75 percent or greater, the boundaries were determined by the extent of the artifacts. Judgmental shovel tests were excavated within surface scatters to determine site depth and integrity.

A site was defined by the presence of artifacts from the same broad cultural period, pre-1958, with the following combinations: three or more artifacts from a 30-meter surface area, two or more artifacts from a shovel test that are not co-joinable, or one artifact from a shovel test and one from the surface within a 20-meter radius. Also considered was the presence of surface features, such as wells, chimney falls, or house piers. An isolated find was defined by the discovery of two or fewer artifacts found within a 30-meter radius or artifacts that were obviously redeposited.

Field notes and stratigraphic information were kept for all shovel tests. Information about each shovel test location was recorded on a form detailing soil depth and description, as well the presence or absence of artifacts. Past land alteration such as plowing, timbering, borrow pits, erosion, etc., were recorded. Archaeological sites were mapped, noting the locations of positive and negative shovel tests, vegetation, obvious disturbances, above-ground features, topography, water sources, and other features deemed important by the field director. Sufficient information was gathered to fill out a state site form and determine National Register eligibility status. Photographs were taken of sites and field conditions as necessary. Archaeological sites and isolated finds were documented on project field maps, and their Universal Transverse Mercator (UTM) coordinates were recorded using a handheld GPS unit.

Standard laboratory methodology was used, and the most relevant resources were identified and interpreted (Blitz, 1985; McGahey, 2000; and Mooney, 1997). Artifacts found during the survey were washed, catalogued, and analyzed. Reports detailing project findings for each corridor segment have been submitted for review to MDAH and the Tribal Historic Preservation Officer (THPO) of the Mississippi Band of Choctaw Indians.

Architectural surveys were also completed. All structures within proximity to the edges of all linear facility corridors and considered to be within the area of potential effect (APE) for the proposed lines were photographed and recorded in accordance with the guidelines as specified in Instructions for Completing the Mississippi Historic Resources Inventory Form (MDAH, 2006). A Historic Resources Inventory Form was completed for each structure older than 50 years in age and within the APE of the proposed lines had detailing its location and a recommendation concerning eligibility for listing on the NRHP. All structure forms were included in an appendix of final reports as well as individual forms submitted to MDAH for placement in county inventories.

Archaeological sites and architectural resources were evaluated based on criteria for NRHP eligibility specified in DOI Regulations (36 CFR 60). Cultural resources can be defined as significant if they "possess integrity of location, design, setting, materials, workmanship, feeling, and association" and if they:

- Are associated with events that have made a significant contribution to the broad pattern of history (Criterion A).
- Are associated with the lives of persons significant in the past (Criterion B).
- Embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction (Criterion C).
- Have yielded, or may be likely to yield, information important in prehistory or history (Criterion D).

Criteria A, B, and C are usually applied to architectural resources, but can apply to archaeological sites. Archaeological sites are generally evaluated relative to Criterion D. NPS (1995) defines two requirements for archaeological sites to be eligible under Criterion D: the site must have, or have had, information to contribute to our understanding of human history or prehistory; and the information must be considered important. To evaluate a resource under Criterion D, the National Register Bulletin Guidelines for Evaluation and Registering Archeological Properties (Little *et al.*, 2000) lists five primary steps to follow:

1. Identify the property's data set(s) or categories of archaeological, historical, or ecological information.
2. Identify the historic context(s), that is, the appropriate historical and archaeological framework in which to evaluate the property.
3. Identify the important research question(s) that the property's data sets can be expected to address.
4. Taking archaeological integrity into consideration, evaluate the data sets in terms of their potential and known ability to answer research questions.
5. Identify the important information that an archaeological study of the property has yielded or is likely to yield.

3.18.5.2 Survey Results

The study corridors for the planned natural gas pipeline and new electrical transmission lines and the existing rights-of-way for planned transmission line upgrades were surveyed by Tennessee Valley Archaeological Research (TVAR). TVAR produced three reports addressing segments of these facilities (TVAR, 2009a, b, and c). All of these reports were submitted to MDAH for review. MDAH subsequently concurred with the findings presented in each of these reports. Appendix M includes MDAH's letters of concurrence.

During the course of its field tigations, TVAR recorded 53 new sites and 43 isolated finds. Seven of the 53 sites were considered potentially eligible for listing on NRHP, as summarized in Table 3.18-1 and as discussed next. All of the potentially eligible sites were considered as such based on Criterion D.

Table 3.18-1. Archaeological Sites Identified by TVAR as Potentially Eligible for NRHP listing

State Site Number	Field Site Number	Site Type	Size (meter)	Depth (cm)
22Ke611	Km002	Historic Choctaw	50 × 40	30
22Ld773	La041	Late Archaic Native American	80 × 30	60
22Ld780	La060	prehistoric Native American	50 × 30	100
22Ld783	La064	prehistoric Native American	190 × 30	90
22Ld790	La074	prehistoric Native American	90 × 30	50
22Ld794	La081	prehistoric Native American	90 × 20	70
22Ck666	Cl002	Late Middle Archaic and Late Archaic Native American	80 × 30	100
22Ke611	Km002	Historic Choctaw	50 x 40	30

Source: TVAR, 2009a, b, and c.

Within the natural gas pipeline corridor (including the proposed metering station site and pipeline access roads) a total of three sites and five isolated finds were identified. None of the sites were considered potentially eligible for NRHP listing.

As described in Subsection 2.2.3, the four segments comprising the proposed new transmission line study corridors are West Feeder, East Feeder, Vimville substation to Meridian Northeast, and Vimville substation to Plant Sweatt.

The West Feeder corridor from the power plant site to a proposed new Lauderdale West switching station would also include a collocated CO_2 pipeline. A total of 11 sites and 9 isolated finds were identified on the West Feeder corridor. None of the sites were considered potentially eligible for NRHP listing.

The East Feeder would connect the power plant to a proposed new Lauderdale East switching station, then from the Lauderdale East switching station to a proposed new Vimville substation. A total of 9 sites and 10 isolated finds were identified within this corridor. One site, 22Ke611, is considered potentially NRHP-eligible.

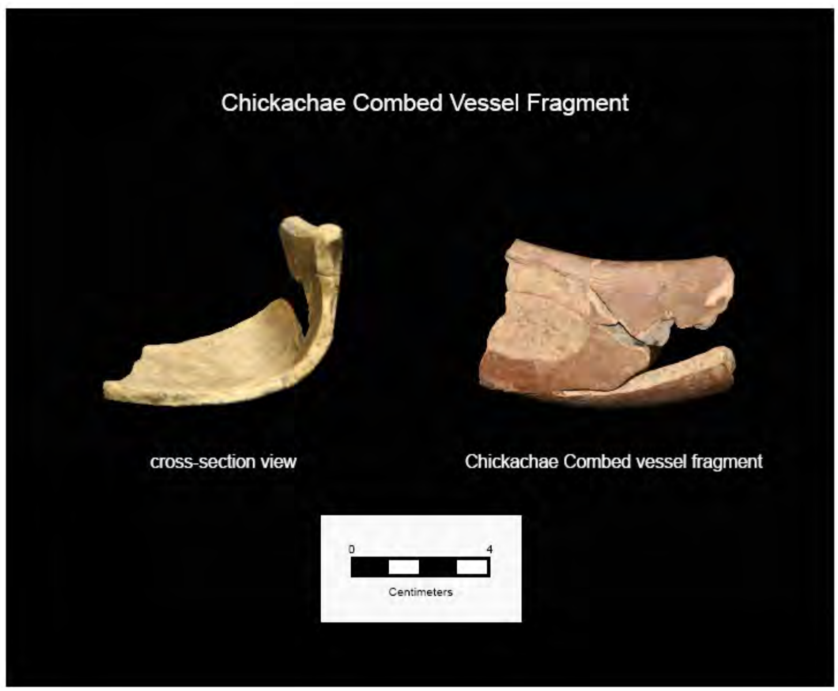

Figure 3.18-4. Chickachae Combed Vessel Fragment Recovered from Shovel Testing at Field Site Km002
Source: TVAR, 2009b.

Site 22Ke611 clearly extends eastward outside the corridor. In all, eleven shovel tests were excavated, eight of which contained American Indian artifacts, many of which can be directly correlated to a historic Choctaw occupation. Artifacts from 22Ke611 included a Chickachae Combed vessel fragment (Figure 3.18-4), a Chickachae Combed rim, an incised sand-tempered sherd, 13 shell and sand-tempered sherds, four sand-tempered sherds, three shell-tempered sherds, fired clay, daub, and Tallahatta Quartzite debitage (Blitz, 1985). The site appears to have received very little disturbance. Diagnostic pottery indicated that the site has a historic Choctaw Indian component, and site characteristics fit within descriptions of Choctaw settlement patterning (Blitz, 1985).

The Vimville substation to Meridian northeast corridor would connect the new Vimville substation to the existing Meridian northeast substation. Three archaeological sites and three isolated finds were identified within this corridor. One of these sites, 22Ld794, was considered possibly eligible for NRHP. At the time of the survey, this prehistoric Native American site was in a pasture. There was no surface visibility at the site during the survey. Ten-meter delineation shovel tests were excavated in a cruciform pattern from the original shovel test. Artifacts recovered from the site included 59 pieces of Tallahatta Quartzite debitage and two chert flakes. No diagnostic artifacts were excavated during the survey; therefore, no cultural affiliation could be assigned to Site 22Ld794.

Within the Vimville substation to plant Sweatt corridor, a total of four archaeological sites and four isolated finds were identified. None of the sites were considered potentially eligible for NRHP listing.

As described in Subsection 2.2.3, the proposed project would require upgrading existing electrical transmission lines within three existing rights-of-way: Meridian Northeast substation to Meridian primary substation, Plant Sweatt to Stonewall substation, and Plant Sweatt to Lost Gap substation.

Within the Meridian Northeast substation to Meridian primary substation right-of-way, a total of six sites and three isolated finds were identified. One of these archaeological sites, 22Ld773, was considered potentially eligible for NRHP. This site is best described at this time as a prehistoric American Indian site. At the time of the survey, the site was in a pasture that inhibited surface visibility. The site was delineated linearly north-south at 10-meter intervals from the original shovel test. Due to disturbances within the existing right-of-way, no east-to-west delineations were conducted. Artifacts excavated from Site 22Ld773 included a Tallahatta Quartzite late Archaic Ledbetter point fragment (McGahey, 2004), two biface fragments, and approximately 75 pieces of debitage of the same material. One piece of chert debitage was also excavated from the site.

Within the Plant Sweatt to Stonewall substation right-of-way, a total of 10 sites and 6 isolated finds were identified. Two sites were considered potentially eligible for NRHP listing. One, 22Ck666, likely extends further east-to-west beyond the right-of-way. Site 22Ck666 is best described at this time as a prehistoric American Indian occupation. At the time of the survey, the site was in a pasture, limiting any surface visibility. Ten-meter delineation shovel tests were excavated linearly from the original shovel test. Lithic artifacts excavated at the site included a core, a biface fragment, primary and secondary reduction debitage, and two hafted bifaces. The hafted bifaces projectile points most closely resemble the middle Archaic Denton and late Archaic Wade bifaces (McGahey, 2004). Both specimens are made from Tallahatta Quartzite. Ceramic artifacts include five course sand tempered sherds with no diagnostic attributes.

The other site along the Plant Sweatt to Stonewall substation line considered potentially eligible for NRHP listing was Site 22Ld790. The site likely extends both east- and westward beyond the project right-of-way and is bordered on the northern side by wetlands. At the time of the survey the site was in a pasture inhibiting surface visibility. The site was delineated linearly north-south at 10-meter intervals from the original shovel test. Artifacts recovered consisted of 118 pieces of debitage. Five of these were chert, and the remaining specimens were Tallahatta Quartzite. The site has experienced only minimal disturbance.

A total of seven sites and three isolated finds were identified within the Plant Sweatt to Lost Gap substation transmission line right-of-way. Two sites, 22Ld780 and 22Ld783, were considered potentially eligible for the NRHP. Site 22Ld783 is best described as a prehistoric American Indian lithic scatter. At the time of the survey, the area within the corridor was a pasture used for livestock, and there was evidence of past land terracing. Surface visibility was minimal. Background research using the DOI Bureau of Land Management (BLM) General Land Office (GLO) database showed no record of the first land patent for this parcel (BLM, 2008). According to the property owner, the area was used as an "old Choctaw camp" and was a place where stone tools were often found. Modern debris was observed on the surface at the wood line located between the transmission line and the creek. Debitage from the site primarily consisted of Tallahatta Quartzite debitage; however, both coastal plain and Citronelle chert flakes were present within the assemblage. The site has a high artifact density and depth of artifact recovery.

Site 22Ld780 within the Plant Sweatt to Lost Gap substation line was also considered potentially NRHP-eligible. The site is a prehistoric American Indian lithic scatter and likely extends east- and westward beyond the right-of-way boundaries. The site is situated along the floodplain of an intermittent creek. At the time of survey the site was being used as a pasture, resulting in poor ground visibility. Shovel testing identified the site consisting primarily of Tallahatta Quartzite debitage. An animal stable was situated in the middle of the right-of-way and presumably in the middle of the site. In three shovel tests excavated at the site, artifacts were identified as deep as 1 meter.

A total of 169 architectural elements were recorded by TVAR during the course of its Phase I survey. It was the recommendation of TVAR that Structures 18b, 24a, 25b, and 41a be considered potentially eligible for NRHP listing, as they appear to be representative of distinctive architectural styles and no obvious modifications (Table 3.18-2). All four of these structures are located on the Meridian Northeast substation to Meridian primary substation line within Meridian city limits.

Table 3.18-2. Architectural Sites Identified by TVAR as Potentially Eligible for NRHP Listing

Structure Number	Name	Location Description	Date
18b	Classical cottage-style residence	Meridian, Mississippi, C Street between Rubush and 26th Avenue	
24a	Symmetrical one-story shotgun house	Meridian, Mississippi, C Street between 24th and 25th Avenue	
24b	Single-family Queen Anne Cottage	Meridian, Mississippi, corner of C Street and 24th Avenue	
41a	Art Deco gas station	Meridian, Mississippi, corner of A Street and 11th Avenue	

Source: TVAR, 2009a, b, and c.

Structure 18b is a classical cottage-style residence with horizontal siding and a brick foundation. The home possesses a complex asphalt shingle roof with a front-facing gable and a shed roof over the front porch. Other features include one-over-one, double-hung windows and a glass-paneled door.

Structure 24a is a symmetrical one-story, double shotgun house with an asphalt shingle, pyramidal roof. A shed roof shelters the front porch, which spans the full width of the house and has a brick foundation and piers with wooden columns above. The home has three-over-one, double-hung windows with elongated panes in the upper portion.

Structure 25b is a single-family dwelling in the Queen Anne Cottage style. The home possesses an asphalt-shingled, pyramidal roof with a front-facing gable over a three-sided bay and a shed roof over the front-facing entrance porch. The porch has thin, square wooden columns. The home sits upon a brick foundation. Windows are one-over-one, double-hung units.

Structure 41a is a gas station in the Art Deco style. The structure possesses a large overhead garage door, fixed windows, and a covered main door. Corners of the exterior walls are rounded, and horizontal detailing occurs near the parapet. The building appears to be abandoned.

The 200-ft-wide study corridor for the southern 40 miles of the planned CO_2 pipeline (i.e., the portion of the corridor beyond that portion co-located with the west feeder corridor) was surveyed by New South Associates, Inc. (New South). New South produced a documentary report (New South, 2009), which was submitted to MDAH for review. By letter (included in Appendix M), MDAH provided notification that the agency concurred with New South's findings and recommendations, as summarized in the following paragraphs.

During the course of its Phase I survey, New South identified 33 archaeological sites and 20 isolated finds, along with six architectural resources that are 50 years old or older that were identified and assessed for their NRHP eligibility. Of the corridor's 33 archaeological sites identified, one was recommended as eligible, 13 were recommended as potentially eligible (see Table 3.18-3), and 19 were considered not eligible. Of the six architectural resources identified, three (summarized in Table 3.18-4) were recommended as eligible to NRHP under Criterion C as significant examples of vernacular types in rural Lauderdale, Clarke, and Jasper Counties. All three eligible architectural resources are located immediately outside the study corridor. Another architectural resource, an abandoned circa-1940 farmhouse and collapsed barn (Survey Site #10), is also cross-referenced as an archaeological site (22CK651). Due to its severely deteriorated condition and lack of physical integrity, it was recommended as not eligible as an architectural resource or as an archaeological resource.

Table 3.18-3. Archaeological Sites Identified by New South as Eligible or Potentially Eligible for NRHP Listing

State Site Number	Field Site Number	Site Type	Size (meter)	Depth (cm)
22LD743	SG-4-01	Undiagnostic prehistoric lithic artifact scatter and historic artifact scatter	80 × 40	50
22LD744	SG-6-01	Late Archaic period and undiagnostic prehistoric lithic artifact scatter and residual sherd	60 × 50	110
22LD745	SG-6-02	Undiagnostic prehistoric lithic artifact scatter and residual sherd	20 × 40	50
22LD746	SG-6-03	Undiagnostic prehistoric lithic artifact scatter	20 × 25	60
22LD748	SG-7-01	Late Archaic/early Woodland period prehistoric lithic artifact scatter	20 × 20	70
22LD750	SG-9-03	Woodland prehistoric lithic and ceramic artifact scatter	10 × 30	70
22LD752	SG-9-06	Undiagnostic prehistoric lithic artifact scatter	20 × 30	70
22LD755	SG-10-01	Middle to late Archaic period prehistoric lithic artifact scatter	60 × 60	130
22CK653	SG-11-04	Early to mid-twentieth century historic artifact scatter	70 × 60	60
22CK657	SG-13-02	Undiagnostic prehistoric lithic artifact scatter	10 × 20	100
22CK659	SG-14-02	Undiagnostic prehistoric lithic artifact scatter	35 × 20	70
22CK660	SG-14-03	Undiagnostic prehistoric lithic artifact scatter	40 × 20	40
22JS671	SG-19-01	Undiagnostic prehistoric lithic artifact scatter	40 × 20	70
22JS674	SG-23-01	Woodland period prehistoric lithic and ceramic artifact scatter	130 × 20	80

Source: New South, 2009.

Table 3.18-4. Architectural Sites Identified by New South as Potentially Eligible for NRHP Listing

Survey Number	Name	Location Description	Date
1	Pleasant Grove Missionary Baptist Church	Paulding Road, Lost Gap, Mississippi	1930
2		South side of MS 513 just west of I-59 Interchange, Clarke County	Circa 1930
9		6018 MS 18 West, Jasper County	Circa 1930

Source: New South, 2009.

Archaeological Site 22LD755 is a mid- to late Archaic site that was recommended as eligible for NRHP. The site's dimensions were found to be 60 meters north-south by at least 60 meters east-west within the corridor. The site appeared to continue outside the corridor to the east and west. This site exhibited evidence that recent looting had occurred. There was a cut into the bank of the Chunky River that extended approximately 20 meters onto the landform exposing soils and lithic artifacts. Shovel size and shaped holes were present in and along the cut bank, and lithic artifacts were observed in small piles near these areas. A total of 15 shovel tests were placed at the site, and 12 contained artifacts. A surface inspection and collection was made in the exposed areas. No diagnostic artifacts were observed on the surface. It was suspected that the looters collected any diagnostic projectile points/knifes and, therefore, none were recovered during the current survey. A total of 401 lithic artifacts were recovered from the surface and from shovel tests excavated; artifacts were recovered between 0 to 130 centimeters below surface (cmbs). A proximal and medial portion of a projectile point/knife was recovered but could not be clearly identified by type; it is believed to date to the mid- or late Archaic periods.

Sites recommended as potentially eligible for the NRHP include 22CK653, 22CK657, 22CK659, 22CK660, 22JS671, 22JS674, 22LD743, 22LD744, 22LD745, 22LD746, 22LD748, 22LD750, and 22LD752.

Site 22CK653 is an early to mid-twentieth century historic artifact scatter likely associated with a farmstead. A total of 82 artifacts were recovered from shovel tests, and most were identified as kitchen remains including glass and ceramics. Eleven architectural artifacts were recovered including five brick fragments, five nail fragments, and one piece of flat glass, indicating the likelihood that a house or other building once stood here. Fragments of a tobacco tin were also recovered. A possible subsurface feature was encountered in one shovel test. At approximately 60 cmbs, burned clay and a dense charcoal lens were encountered. The function of the feature was unclear. A large circular depression approximately 2 by 2 meters in size was observed between three trees. The nature of the depression was unclear, and no artifacts were found in association with the feature. It is possible that the depression is a well.

Site 22CK657 is an undiagnostic prehistoric lithic scatter. It probably continues west outside of corridor. Due to the size and slope of the landform, only one additional shovel test was excavated east of the initial positive test. Both shovel tests contained a total of 26 pieces of lithic debitage. Artifact density from the initial positive shovel test was moderately high and appeared to yield artifacts from two separate levels or cultural strata (0 to 30 and 30 to 100 cmbs).

Site 22CK659 is a prehistoric lithic artifact scatter. A total of 85 artifacts were recovered from the shovel tests, including 61 Tallahatta quartzite lithic artifacts, 20 unmodified sandstone fragments, and four pieces of hardened clay or daub.

Site 22CK660 is a prehistoric lithic artifact scatter, possibly extending outside the corridor to the west. A total of 12 lithic artifacts were recovered, including six shatter fragments, two flake fragments, one interior flake, one primary flake, one biface thinning flake, and one core. Site 22CK660 is separated from 22CK659 by what appears to be a breach in the landform. It is possible that the two sites are related or were once the same site.

Site 22JS671 is an undiagnostic prehistoric lithic scatter. It is possible that the site continues to the west, outside the corridor. A total of eight lithic artifacts were recovered, including one chert uniface fragment and three chert shatter fragments.

Site 22JS674 is a Woodland period lithic and ceramic scatter. The site continues west outside the corridor. A total of 30 prehistoric artifacts were recovered including two sand tempered sherds and three residual sherds. The ceramic artifacts recovered were collected from between 10 and 30 cmbs, while lithics appeared to be present between 60 and 70 cmbs.

Site 22LD743 was found to consist of an undiagnostic prehistoric lithic and ceramic scatter. The site was believed to continue outside of the project area to the west. A total of 42 prehistoric artifacts were recovered, including 38 lithic artifacts, two prehistoric ceramics, and two red ochre fragments. Of the lithic artifacts recovered, two projectile point/knife fragments were recovered. Unfortunately, they were unidentifiable as to type.

Site 38LD744 is a late Archaic lithic artifact scatter and residual sherd. The site appears to extend outside the corridor to the west. A total of 224 lithic artifacts were recovered. The lithic material was identified as Tallahatta quartzite, with the exception of one chert biface fragment. One projectile point/knife, a late Archaic stemmed point, was recovered, along with one residual sherd and one fragment of fossilized animal bone.

Site 38LD745 is an undiagnostic prehistoric lithic scatter and residual sherd. The site is essentially surrounded by wetlands. A total of 62 pieces of prehistoric lithic debitage were recovered, as well as one residual sherd.

Site 22LD746 is an undiagnostic prehistoric lithic scatter. Eighty-eight lithic artifacts were recovered including one core and a Stage 2 biface.

Site 38LD748 is a late Archaic/early Woodland period lithic scatter. A total of five lithic artifacts were recovered including a complete projectile point/knife to a depth of 70 cmbs. The point resembled late Archaic/early Woodland styles with a triangular blade and long rounded contracting stem. The stem was longer than the blade, and it was found likely that the blade was modified from its original length to the current form.

Site 22LD750 is a Woodland lithic and ceramic scatter. A total of 24 lithic artifacts were recovered as well as one decorated sand-tempered sherd of an undetermined type.

Site 22LD752 is an undiagnostic lithic scatter. A total of 24 lithic artifacts were recovered including 10 interior flakes, seven flake fragments, four biface thinning flakes, and three shatter fragments down to 70 cmbs.

With respect to architectural resources, the Pleasant Grove Missionary Baptist Church and Cemetery (architectural survey Site #1), dating to around 1930, was found to be an eligible architectural resource. The church features a metal gable-front roof with a squat pyramidal steeple, brick exterior, and an L-shaped floor plan formed by a circa 1950 ell addition on the north elevation. The cornerstone states that the church congregation was first organized on September 19, 1869, by Reverend Daniel Webster. The present church was built in 1930 during the tenure of Reverend J.J. Spinks, Pastor. Just south of the church is the Pleasant Grove Baptist Church Memorial

Garden Cemetery, which is primarily a modern cemetery with only a handful of grave markers that predate 1950. This church was recommended eligible for the NRHP under Criterion C as a significant example of an early twentieth century vernacular brick church in rural Lauderdale County.

Architectural survey Site #2, a circa 1930 bungalow, is a frame, one-story, gable-front dwelling with a metal roof, vinyl siding, a concrete block foundation, and rectangular floor plan. This property was recommended eligible for the NRHP under Criterion C as a good example of an early twentieth century bungalow, a common folk dwelling type in rural parts of the south and Lauderdale County.

Survey Site #9 is a one-story circa 1930 bungalow farm house just south of Orange, Mississippi, which has a front-gable roof with asphalt shingles, asbestos shingle siding, a concrete block foundation, two-over-two double-hung windows, and a rectangular floor plan. This property was recommended eligible for the NRHP under Criterion C as a good example of an early twentieth century bungalow, a common folk dwelling type in rural parts of the south and Jasper County.

Finally, two modern cemeteries were also identified in or near one portion of the corridor: the James E. Bishop Alms Cemetery and the Meridian Memorial Gardens Cemetery. Both of the cemeteries contain marked burials, and the boundaries are defined. The original route for the CO_2 pipeline study corridor passed through the Meridian Memorial Gardens Cemetery. However, after the initial survey, Mississippi Power rerouted the corridor to go around the Meridian Memorial Gardens Cemetery and through a small wooded area that divides the two cemeteries. A subsequent survey found these new corridor areas to be sloping and eroded. Moreover, the slopes have been partly excavated to create level areas for the cemeteries. Shovel testing in the unexcavated areas exposed only truncated and/or wet soil profiles. Since the cemeteries are modern and appear to contain recent interments, they were not evaluated as historic properties or archaeological sites.

3.19 NOISE

3.19.1 NOISE CONCEPTS

Noise is defined as "unwanted sound," which implies sound sure levels that are annoying or disrupt activities in which people are gaged. The human sense of hearing is subjective and highly variable tween individuals. Noise regulations and guidelines set quantitative limits to the sound pressure level (measured with sound analyzers and predicted with computer models) to protect people from sound exposures that most would judge to be annoying or disruptive.

Table 3.19-1. Subjective Effect of Changes in Sound Pressure Levels

Change in Sound Level	Apparent Change in Loudness
3 dBA	Just perceptible
5 dBA	Noticeable
10 dBA	Twice (or half) as loud

Source: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) Handbook—Fundamentals, Atlanta, 1989.

Sound metrics are used to quantify sound pressure levels and describe a sound's loudness, duration, and tonal character. A commonly used descriptor is the A-weighted decibel (dBA). The A-weighting scale approximates the human ear's sensitivity to certain frequencies by emphasizing the middle frequencies and deemphasizing the lower and higher frequency sounds. The decibel is a logarithmic unit of measure of sound. A 10-decibel change in the sound level means a 10-fold change in sound pressure, which roughly corresponds to a doubling or halving of perceived loudness. A 3-dBA change in the noise level is generally defined as being just perceptible to the human ear. Table 3.19-1 provides the subjective effect of different changes in sound levels.

Sound level measurements sometimes include the analysis and breakdown of the sound spectrum into its various frequency components to determine tonal characteristics. The unit of frequency is the hertz, measuring the cycles per second of sound waves, and typically the audible frequency range from 16 to 16,000 Hz is broken down into 11 (full octave) or 33 (third octave) bands. A source is said to create a pure tone, also called a prominent discrete tone in some noise regulations, if the one-third octave band sound pressure level in the band with the tone exceeds the arithmetic average of the sound pressure levels of the two contiguous one-third octave bands by 5 dBA for center frequencies of 500 Hz and above, by 8 dBA for center frequencies between 160 and 400 Hz, and by 15 dBA for center frequencies less than or equal to 125 Hz. Examples of pure tone sounds are a backup alarm on a large motor vehicle, siren on an emergency vehicle, or squeaky ventilation fan.

Table 3.19-2. Typical Sound Levels and Human Response

Activity	dBA	Effect
Jet engine	140	Painfully loud
Jackhammer	130	Threshold of pain
Auto horn (3 ft)	120	Maximum vocal effort
Loud rock band	110	Extremely loud
Firecrackers, chain saw	100	Very loud
Heavy truck (50 ft), lawnmower	90	Very annoying, hearing damage (8 hrs)
Hair dryer, busy street	80	Annoying
Noisy restaurant, busy traffic	70	Telephone use difficult
Normal conversation, dishwasher	60	
Normal suburban area	50	Quiet
Quiet suburban area, quiet office	40	
Rural area, library	30	Very quiet
Wilderness area	25	
Just audible	10	
Threshold of audibility	0	

Sources: Noise Pollution Clearinghouse (<www.nonoise.org>), 2008.
American Speech-Language-Hearing Assoc. (<www.asha.org/public/hearing/ disorders/noise.htm>), 2008.
ECT, 2008.

Human response to environmental noise, including annoyance, is very subjective. Table 3.19-2 presents some sound levels associated with typical activities or situations and relates the sound level (dBA) to an estimated effect. The degree of disturbance or annoyance would vary with the individual and the situation. For example, sleep interference might occur in some individuals at much lower noise levels than would cause disturbance during daytime. Noise levels continuously varying over a wide range, impulsive noises (e.g., pile driving), and high-pitched noise might annoy more than random tone, steady-state noise.

The term equivalent sound level (L_{eq}) represents the equivalent or average sound energy level as measured continuously over a specified time period. L_{eq} is a single descriptor based on the average acoustic intensity over a specified period of time. EPA has selected the L_{eq} as one of the best environmental noise descriptors because of its reliable evaluation of pervasive, long-term noise, simplicity, and good correlation with known effects of noise on individuals (EPA, 1974).

3.19.2 NOISE REGULATIONS AND GUIDELINES

There are no Mississippi state regulations pertaining to noise. Kemper County has no ordinances pertaining to noise beyond basic prohibitions of nuisances.

EPA has published residential guidelines (EPA, 1974) on environmental sound levels to protect public health and welfare. Because noise is usually associated with annoyance, criteria levels are based on community surveys of people's tolerance to noise. Different types of land uses also exhibit different sensitivities to noise. The EPA sound level guidelines do not provide an absolute measure of noise impact, but rather a consensus on potential community interference. It should also be noted that in any noise environment, some people may always be annoyed regardless of the sound level. The EPA residential guidelines are designed to protect against:

- Hearing loss—70 dBA 24-hour L_{eq}.
- Outdoor activity interference and annoyance—55 dBA L_{dn}.

EPA suggests 55 dBA day-to-night sound level (L_{dn}) as an overall design goal for residential development. As a goal, the 55 L_{dn} is not enforceable and does not consider economic considerations or engineering feasibility. EPA observes that maintenance of an outdoor L_{dn} not exceeding 55 dBA will permit normal speech communication and protect against sleep interference (EPA, 1971). A 55-dBA L_{dn} is equivalent to a 24-hour average L_{eq} level of 48.6 dBA. The EPA guidelines are proposed for use as one benchmark in evaluating sounds from the IGCC plant and are summarized in Table 3.19-3.

Table 3.19-3. EPA Noise Guidelines to Protect Public Health and Welfare with Adequate Margin of Safety from Undue Effects

For Protection Against . . .	Outdoor Guideline (dBA)
Activity interference, annoyance, and sleep disturbance on residential property	55 L_{dn} (equivalent to 48.6 L_{eq})
Hearing damage	70 L_{eq} (24 hours)

Source: Tech Environmental, 2009.

The Department of Housing and Urban Development (HUD) has also established guidelines for evaluating noise impacts on residential land uses. The guidelines summarized in Table 3.19-4 suggest what are acceptable noise levels at residential locations. According to HUD regulations, sites where the L_{dn} does not exceed 65 dBA are acceptable for housing. Sites where the L_{dn} is between 65 and 75 dBA are classified by HUD as normally unacceptable but may be approved if additional sound attenuation is designed into new housing. Sites where the L_{dn} exceeds 75 dBA are classified by HUD as unacceptable. The L_{dn} 65-dBA HUD guideline is proposed for use as one benchmark in evaluating the IGCC plant. L_{dn} 65 dBA is equivalent to a 24-hour L_{eq} level of 58.6 dBA.

In the absence of state and local noise regulations, EPA and HUD residential noise guidelines, L_{dn} 55 dBA and L_{dn} 65 dBA, respectively, will be used to evaluate sound impacts from the IGCC plant.

Table 3.19-4. HUD Guidelines for Evaluating Sound Effects on Residential Properties

Acceptability for Residential Use	Outdoor Guideline Levels (dBA)
Acceptable	65 L_{dn} (equivalent to 58.6 L_{eq})
Acceptable with design attenuation	65 to 75 L_{dn}
Unacceptable	Greater than 75 L_{dn}

Source: Tech Environmental, 2009.

3.19.3 AMBIENT SOUND LEVELS

3.19.3.1 Power Plant Site and Mine Study Area

The acoustic environment in the vicinity of the Kemper County IGCC Project site is a product of other human activities typical of a rural area and natural sources. To gauge the combined impacts of these sources, background sound levels were measured for brief periods at a number of locations on or in the immediate vicinity of the proposed power plant site and mine study area. These data, collected at locations shown in Figure 3.19-1 are presented in Table 3.19-5.

Table 3.19-5. Ambient Sound Survey Results (September 17 and 18, 2008)

Location	Date	Time	Duration (min)	Range of Noise Levels (dBA)	L_{eq} (dBA)	Prevailing Noise Sources
1	09/17	11:30	21	17.8 to 81.2	50.8	Insects, passing vehicles, bird calls, jet overflights (distant)
	09/18	20:15	23	39.6 to 81.2	52.6	Insects, passing vehicles, jet overflights (distant)
2	09/17	12:10	23	25.3 to 68.1	35.3	Insects, breeze in tree-tops, bird calls
3	09/17	13:00	22	29.4 to 79.3	50.1	Passing vehicles, insects, breeze in trees, jet overflights (distant), birds
4	09/17	13:40	21	29.8 to 72.2	44.7	Passing vehicles, breeze in trees, insects, jet overflights (distant)
5	09/17	14:25	21	33.6 to 78.6	53.8	Numerous passing vehicles, insects, birds, plane overflight

Source: ECT, 2009.

The ambient sound level data summarized in Table 3.19-5 were collected under conditions of light breeze (daytime) to still (night). Wider variability in measured levels was found at four of the five locations (all but Location 2), where passing vehicles and other brief events caused higher maximum levels and greater disparity relative to the lowest levels. Average sound levels varied according to the distance from the highway and levels of existing traffic; average sound levels (L_{eq}) varied from 35 to 54 dBA. Maximum sound levels from roadway traffic ranged from 72 to 81 dBA. For one measurement without roadway traffic (Location 2), an L_{eq} of 35 dBA was recorded. This is a typical sound level for a rural area. Generally speaking, the measured sound levels in the area could be characterized as typical of a rural area having some human activity, based on a comparison with the typical peak sound levels presented previously in Table 3.19-2.

3.19.3.2 Linear Facility Corridors and Rights-of-Way

Given the limited potential of the transmission facilities and pipelines to result in any noise impacts once constructed, no measurements of background noise were undertaken in or near the rights-of-way. However, the existing levels of ambient noise would be expected to vary with location and level of human activity. Those portions of the rights-of-way passing through isolated, rural areas would likely have L_{eq} values in the 30s much of the time. Those portions intersecting or closer to areas of greater human activity (e.g., the Meridian area) would have higher ambient noise levels.

3.20 HUMAN HEALTH AND SAFETY

3.20.1 PROJECT AREA PUBLIC HEALTH AND SAFETY

The Mississippi State Department of Health (MSDH) compiles data and information on the health and safety of state residents (www.msdh.state.ms.us). Relevant information and statistics were assembled and reviewed. Data on selected reportable diseases are reported by MSDH for the years 2002 through 2006 by public health districts.

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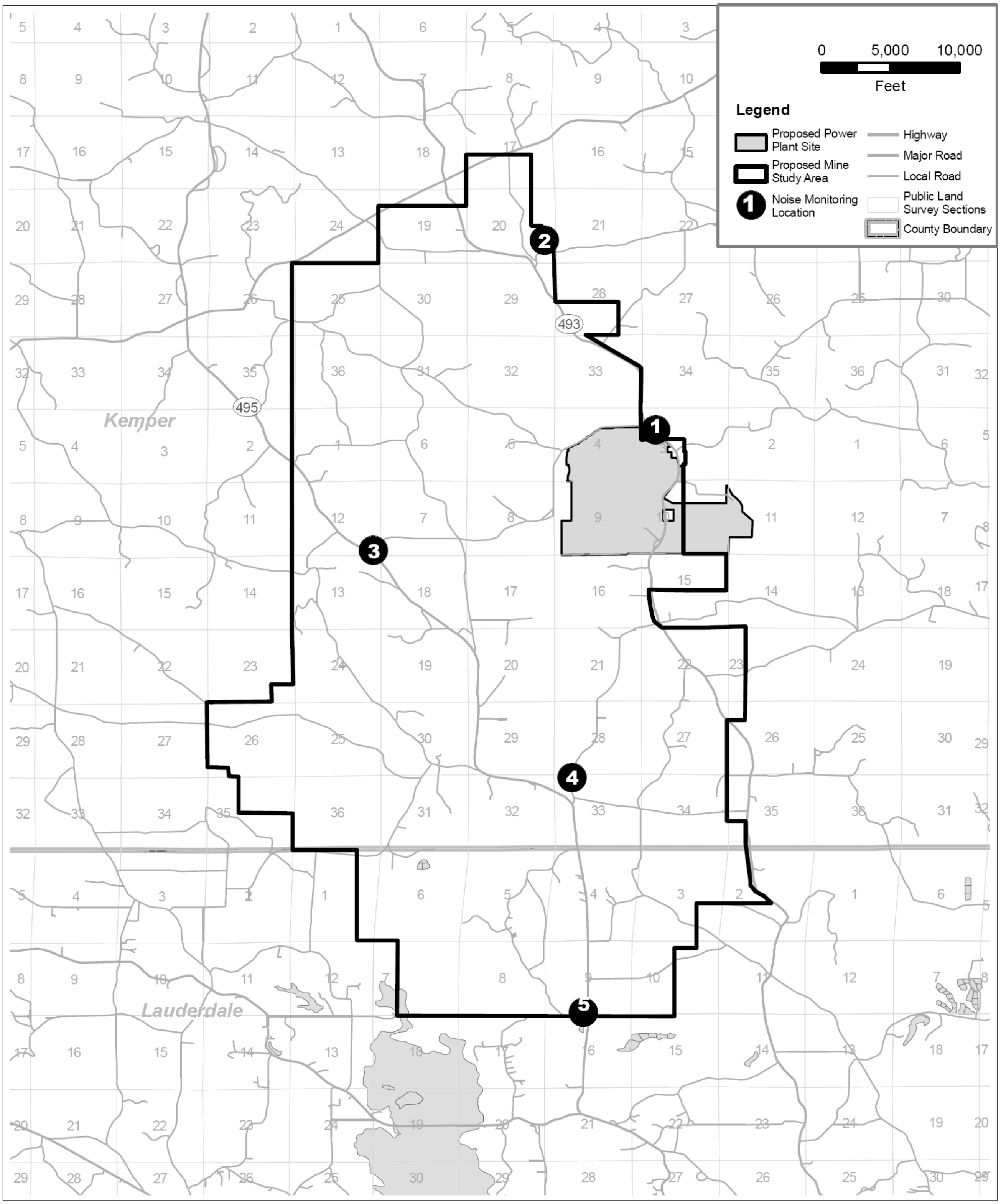


Figure 3.19-1. Ambient Sound Survey Locations

Sources: MARIS, 2008. ECT, 2008.

Cause of death is another indicator of key issues associated with public health and safety. As reported by MSDH, in 2006 and 2007, the top three leading causes of death in the state were heart disease, malignant neoplasm (cancer), and accidents. Motor vehicle accidents, poisoning, and falls were the predominant types of accidents. Table 3.20-1 summarizes 2007 data for the state and Kemper, Lauderdale, and Neshoba Counties. Additional data and details for 2007 and data for previous years are also available on the MSDH Web site.

Table 3.20-1. Rates of Selected Causes of Death for 2007 (per 100,000 Population)

Cause	State of Mississippi	Kemper County	Lauderdale County	Neshoba County
Heart diseases	274.8	277.0	277.6	314.2
Malignant neoplasms	203.2	237.4	236.0	168.7
Accidents	61.0	69.2	67.4	69.4
Motor vehicle	30.6	39.6	35.0	23.2

Source: MSDH, 2006 and 2007.

3.20.2 AIR QUALITY AND PUBLIC HEALTH

The quality of ambient air plays an important role in the health of the public. Exposure to pollutants is associated with numerous effects on human health, including increased respiratory symptoms, hospitalization for heart or lung disease, and even premature death. Children are particularly vulnerable to environmental influences because of their narrow airways and rapid respiration rate. Compared to adults, children's fast metabolism, ongoing physical development, and daily behavior place them at increased risk from exposure to environmental pollutants. A World Health Organization (WHO) review (2003) concluded that the body of epidemiological evidence was sufficient to assign causality for mortality and morbidity to various forms of outdoor air pollution.

Vehicle emissions, fossil-fuel combustion, chemical manufacture, and other sources add gases and particles to the air people breathe. The CAA required EPA to set NAAQS for six pollutants considered harmful to public health and the environment:

- PM_{10}/$PM_{2.5}$—Many scientific studies have linked breathing PM_{10}/$PM_{2.5}$ to a series of health problems, including aggravated asthma, increases in respiratory symptoms (e.g., coughing and difficult or painful breathing), chronic bronchitis, decreased lung function, and premature death.
- SO_2—SO_2 causes a wide variety of health and environmental impacts because of the way it reacts with other substances in the air. When SO_2 reacts with other chemicals in the air to form tiny sulfate particles that are breathed, they gather in the lungs and are associated with increased respiratory symptoms and disease, difficulty in breathing, and premature death. Particularly sensitive groups include people with asthma who are active outdoors, children, the elderly, and people with heart or lung disease.
- CO—The health threat from CO is most serious for those who suffer from heart disease (e.g., angina, clogged arteries, or congestive heart failure). For a person with heart disease, a single exposure to CO at low levels may cause chest pain and reduce that person's ability to exercise; repeated exposures may contribute to other cardiovascular effects. Even healthy people can be affected by high levels of CO. People who breathe high levels of CO can develop vision problems, reduced ability to

work or learn, reduced manual dexterity, and difficulty performing complex tasks. At extremely high levels, CO is poisonous and can cause death.

- NO_2—NO_2 or its reaction products have effects on breathing and the respiratory system, may cause damage to lung tissue, and may result in premature death. Small particles formed from NO_2 penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease such as emphysema and bronchitis and aggravate existing heart disease.
- Ozone—Ground-level ozone triggers a variety of health problems including aggravated asthma, reduced lung capacity, and increased susceptibility to respiratory illnesses like pneumonia and bronchitis.
- Lead—Lead causes damage to the kidneys, liver, brain, nerves, and other organs. Exposure to lead may also lead to osteoporosis (brittle bone disease) and reproductive disorders. Excessive exposure to lead causes seizures, mental retardation, behavioral disorders, memory problems, and mood changes. Low levels of lead damage the brain and nerves in fetuses and young children, resulting in learning deficits and lowered intelligence. Lead exposure causes high blood pressure and increases heart disease, especially in men. Lead exposure may also lead to anemia.

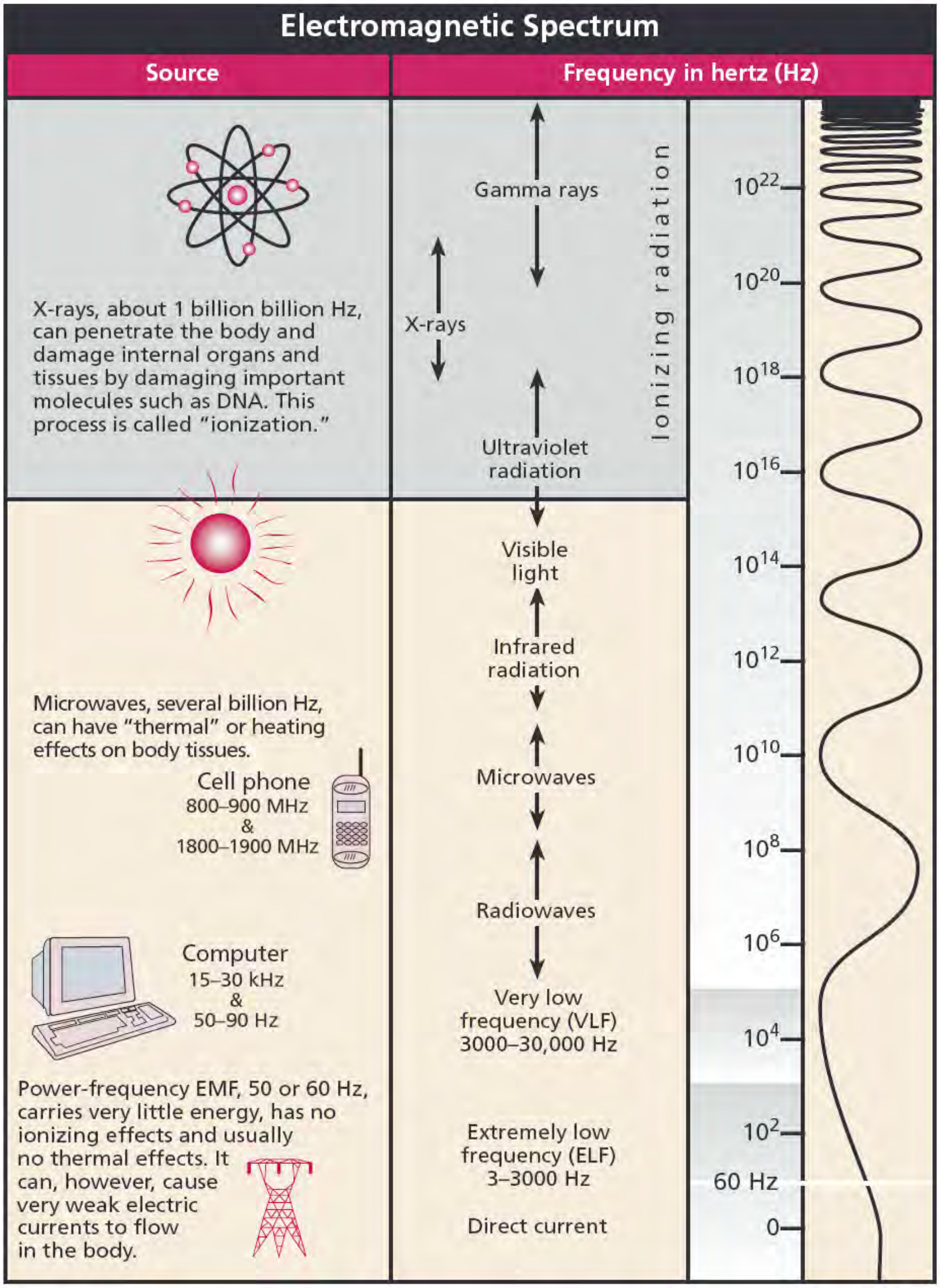
Air quality in Kemper County and the surrounding region of interest for the proposed project is described in Subsection 3.3.2. The AQI (discussed in Subsection 3.3.2) provides standardized means of communicating health information associated with daily ambient levels of ground-level air pollutants. As shown in Figure 3.3-3, the region's air quality, based on last 3 years of data, could be described as good to moderate; there have been few days with an AQI higher than 100 (i.e., indicating air quality that might be unhealthy for sensitive groups).

3.20.3 ELECTRIC AND MAGNETIC FIELDS

3.20.3.1 Background

Electric and magnetic fields (EMF) are a natural result of using electricity, and EMF are present wherever electricity is used. The voltage on a conductor (an electrical wire or a power line) creates an electric field. Current flowing through a conductor creates a magnetic field. As a result, EMF come from many sources, such as the wiring in houses and businesses, home appliances, office equipment, and the transmission and distribution lines that deliver electricity to users.

Energy is distributed across the electromagnetic spectrum, which is depicted in Figure 3.20-1. X-rays, visible light, microwaves, radio waves, and EMF are all forms of electromagnetic energy. One property that distinguishes different forms of electromagnetic energy is the frequency, expressed in hertz. Power-frequency EMF, in the range of 50 or 60 Hz, carries little energy, has no ionizing effects, and usually has no thermal effects. Various forms of electromagnetic energy can have very different biological effects. Some types of equipment or operations simultaneously produce electromagnetic energy of different frequencies. Welding operations, for example, can produce electromagnetic energy in the ultraviolet, visible, infrared, and radio-frequency ranges, in addition to power-frequency EMF. Microwave ovens produce 60-Hz fields of several hundred milliGauss, but they also create microwave energy inside the oven that is at a much higher frequency (approximately 2.45 billion Hz). The oven casing shields the higher frequency fields inside the oven, but not the 60-Hz fields. Cellular telephones communicate by emitting high-frequency EMF similar to those used for radio and television



The wavy line at the right illustrates the concept that the higher the frequency, the more rapidly the field varies. The fields do not vary at 0 Hz (direct current) and vary trillions of times per second near the top of the spectrum. Note that 10^4 means 10 x 10 x 10 x 10 or 10,000 Hz. 1 kilohertz (kHz) = 1,000 Hz. 1 megahertz (MHz) = 1,000,000 Hz.

Figure 3.20-1. The Electromagnetic Spectrum
Source: NIEHS, 2002.

broadcasts. These radiofrequency and microwave fields are quite different from the extremely low frequency (ELF) EMF produced by power lines and most appliances.

Electric fields are produced by voltage and increase in strength as the voltage increases. The electric field strength is measured in units of volts per meter (V/m). Magnetic fields result from the flow of current through wires or electrical devices and increase in strength as the current increases. Magnetic fields are measured in units of gauss (G) or tesla (T). Both the electric and magnetic fields decrease rapidly with distance from the source (e.g., distance from the transmission line, distribution line, household wiring, or appliance). The strength of the magnetic field under a transmission line is primarily a function of the amount of current carried by the line and the height of the conductors above the ground. The electric field is primarily a function of the voltage impressed on the line and conductor height above the ground. Consequently, the electric field near the transmission line is relatively constant over time, but the magnetic field fluctuates depending on customer demand for power.

3.20.3.2 Health Implications

After more than 30 years of research, the scientific community has not found that exposure to power-frequency EMF causes or contributes to any disease. This is reflected in the findings of more than 140 scientific reviews of EMF sponsored by various state and federal governmental agencies and by international public health organizations.

Many of the questions about possible connections between EMF exposures and specific diseases have been successfully resolved due to an aggressive international research program. However, potentially important public health questions remain about whether there is an association between EMF exposures and certain diseases, including childhood leukemia and a variety of adult diseases (e.g., adult cancers and miscarriages). As a result, some health authorities have identified magnetic field exposures as a possible human carcinogen (the same designation given to engine exhaust, coffee, and welding fumes, for example). These conclusions are consistent with the following published reports: the National Institute of Environmental Health Sciences (NIEHS) (1999), the National Radiation Protection Board (NRPB) (2001), the International Commission on non-Ionizing Radiation Protection (ICNIRP) (2001), the California Department of Health Services (CDHS) 2002, and the International Agency for Research on Cancer (IARC) (2002).

In 2002, IARC issued a report on EMF based on epidemiology studies (which try to identify a relationship between a disease and being a member of some population grouping by using statistics). On the basis of what it called “limited evidence” from some epidemiology studies, IARC concluded that power frequency magnetic fields should be classified “possibly carcinogenic” as to childhood leukemia, but IARC also concluded that controlled laboratory research provided “inadequate evidence” of any such a risk. IARC did not conclude that EMF actually causes or contributes to childhood leukemia or any other cancer or disease. Later in 2002, NIEHS established an ongoing EMF Web site. The NIEHS Web site says that epidemiology research provides only “weak scientific support” for a relationship between EMF and childhood leukemia and there is a lack of supporting evidence for such a relationship from laboratory research. NIEHS concluded that it would not list EMF as an exposure “reasonably anticipated” to cause cancer, and that conclusion remains unchanged.

And in June 2007, WHO issued a comprehensive evaluation of EMF health issues based on its own independent review of the research (WHO, 2008). WHO noted that some statistical studies suggest an association between EMF and childhood leukemia, but ultimately concluded that controlled laboratory studies do not provide any support for that association, and no cause-and-effect relationship has been established. In short, WHO concluded that EMF have not been established as a cause of any disease or illness.

3.20.3.3 Regulatory Requirements

Occupational limits for the portion of the electromagnetic spectrum defined as the radio frequency/microwave region have been established by the Occupational Safety and Health Administration (OSHA) to prevent tissue heating (29 CFR 1910.97). No federal regulations have been established specifying environmental limits for the ELF fields from electrical transmission lines. The state of Mississippi also has no regulations pertaining to ELF or EMF from transmission lines.

3.20.3.4 Existing Conditions

Figure 3.20-2 illustrates electrical transmission lines in the area of the proposed power plant and the proposed new or upgraded lines.

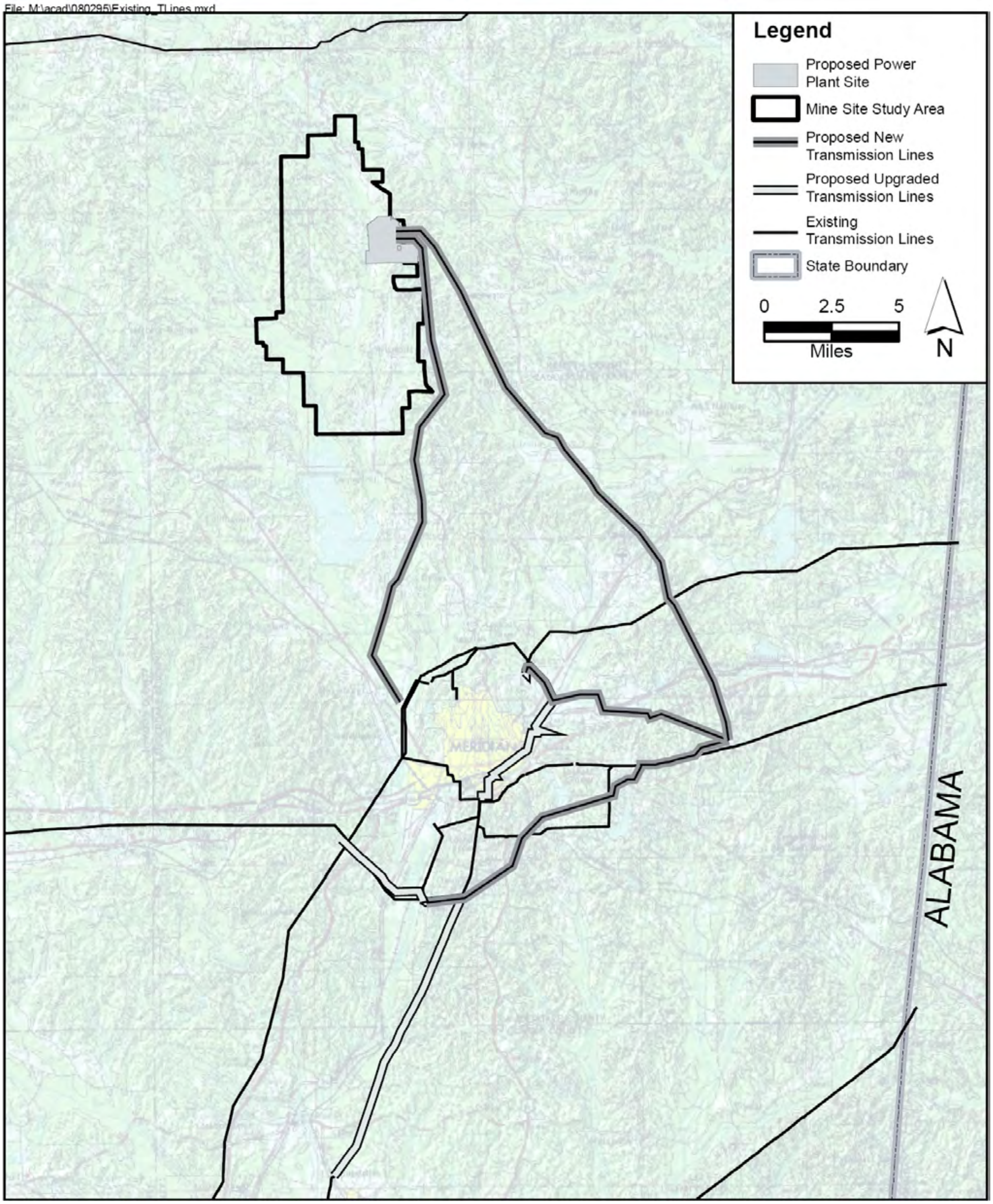


Figure 3.20-2. Existing Electrical Transmission Lines

Sources: MARIS, 2009. ESRI, 2009. ECT, 2009.

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