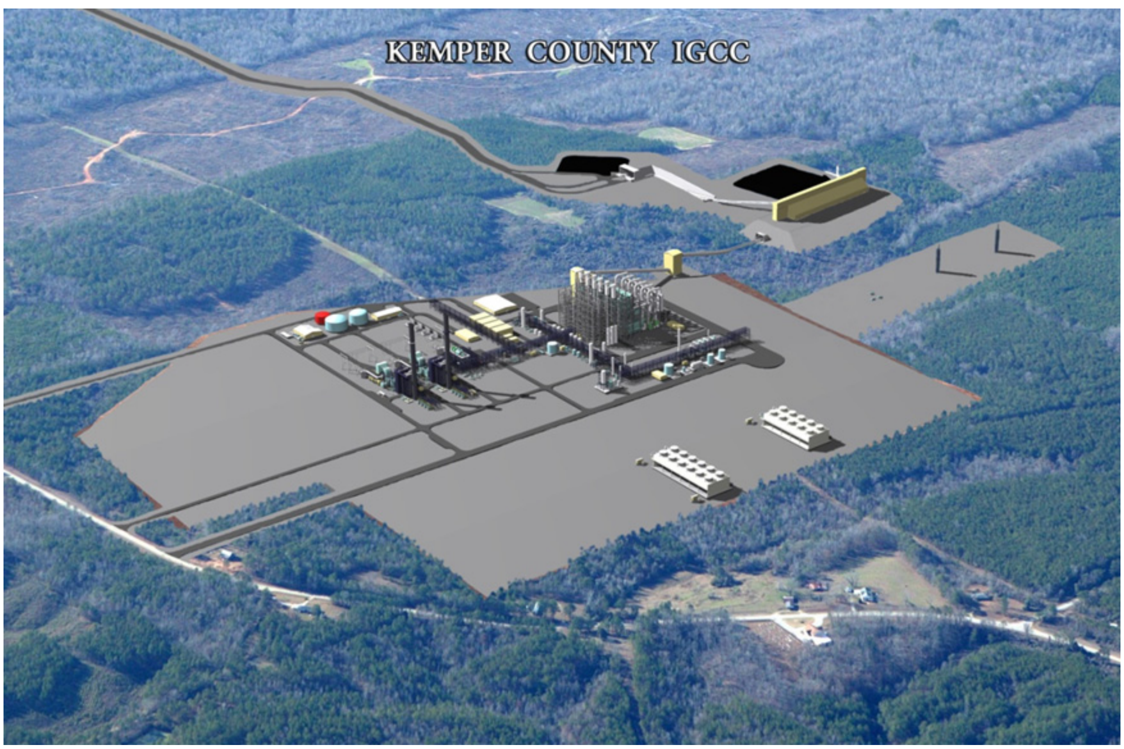
U.S. Department of Energy
in cooperation with
U.S. Army Corps of Engineers

KEMPER COUNTY IGCC PROJECT

DRAFT ENVIRONMENTAL IMPACT STATEMENT

DOE/EIS-0409D

VOLUME 1



November 2009

Office of Fossil Energy
National Energy Technology Laboratory

NETL NATIONAL ENERGY TECHNOLOGY LABORATORY

US Army Corps of Engineers

COVER SHEET

November 2009

LEAD AGENCY

U.S. Department of Energy (DOE)

COOPERATING AGENCY

U.S. Army Corps of Engineers (USACE)

TITLE

Kemper County Integrated Gasification Combined-Cycle (IGCC) Project, Draft Environmental Impact Statement (EIS) (DOE/EIS-0409D)

LOCATION

Kemper County, Mississippi

CONTACTS

Additional copies or information concerning this Draft EIS can be obtained from Mr. Richard A. Hargis, Jr., National Environmental Policy Act (NEPA) Document Manager, U.S. Department of Energy, National Energy Technology Laboratory, 626 Cochrans Mill Road, P.O. Box 10940, Pittsburgh, Pennsylvania, 15236-0940. Telephone: 412-386-6065. E-mail: Kemper-EIS@netl.doe.gov.

For general information on DOE's NEPA process, contact Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance (GC-20), U.S. Department of Energy, 1000 Independence Avenue, Southwest, Washington, DC, 20585-0103. Telephone: 202-586-4600, or leave a toll-free message at 1-800-472-2756.

ABSTRACT

This Draft EIS assesses the potential environmental impacts that would result from a proposed DOE action to provide cost-shared funding and possibly a loan guarantee for construction and operation of advanced power generation plant in Kemper County, Mississippi. The project was selected under DOE's Clean Coal Power Initiative to demonstrate IGCC technology. Mississippi Power also was invited to submit a formal application for a loan guarantee under the Energy Policy Act of 2005. The power generation components (i.e., coal gasifiers, synthesis gas [syngas] cleanup systems, combined-cycle unit, and supporting infrastructure) would convert coal into syngas to drive gas combustion turbines, and hot exhaust gas from the gas turbines would generate steam from water to drive a steam turbine. Combined, the three turbines would generate a nominal 582 megawatts (MW) of electricity. Although DOE funding would support only the IGCC power plant, the project would include new electrical power transmission lines and upgrades of some existing transmission lines, a surface lignite mine, a natural gas supply pipeline, a reclaimed water supply pipeline, and a carbon dioxide pipeline. The construction and operation of these facilities are considered connected actions in this Draft EIS.

The Draft EIS evaluates potential impacts of the proposed facilities on air quality, geology, water resources, floodplains, wetlands, ecological resources, land use, aesthetics, social and economic resources, waste management, noise, and human health and safety. The EIS also evaluates potential impacts on these resource areas for the no-action alternative, under which DOE would not provide cost-shared funding or a loan guarantee and the power plant and connected action facilities would likely not be built.

The U.S. Army Corps of Engineers is a cooperating agency in the preparation of this EIS and will consider the environmental impacts for the evaluation of Department of the Army permits in accordance with Section 404 of the Clean Water Act for stream and wetland disturbances related to the proposed mine, power plant project, power transmission lines, and pipelines.

In preparing the Final EIS, DOE will consider all comments received or postmarked during the 45-day public comment period that will begin when the U.S. Environmental Protection Agency publishes a Notice of Availability of this Draft EIS in the Federal Register. DOE will consider late comments to the extent practicable.

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LIST OF ACRONYMS AND ABBREVIATIONS

$/kW	dollar per kilowatt
°C	degree Celsius
°F	degree Fahrenheit
µg/L	microgram per liter
$\mu g/m^3$	microgram per cubic meter
µm/minute	micrometer per minute
µmhos/cm	micromhos per centimeter
10^6 gal/yr	million gallons per year
10^{-6} lb/MWh	0.00001 pound per megawatt-hour
10^6 scf/yr	million standard cubic feet per year
7Q10	7-day, consecutive low-flow with a 10-year return frequency
AAB	Jackson International Airport
AADT	average daily traffic
ac-ft	acre-foot
ADEM	Alabama Department of Environmental Management
AEGL	acute exposure guideline level
AERMOD	American Meteorological Society (AMS)/EPA Regulatory Model
AFM	acid-forming material
AGR	acid gas removal
ALOHA	Areal Locations of Hazardous Atmospheres
AM	amplitude-modulated
AMD	acid mine drainage
AMS	American Meteorological Society
ANSI	American National Standards Institute
APE	area of potential effect
AQI	air quality index
AQRVs	air quality-related values
ASHRAE	American Society of Heating,Refrigerating and Air-Conditioning Engineers, Inc.
AST	aboveground storage tank
ATV	average traffic volume
AUM/ac	animal unit month† per acre
BACT	best available control technology
BAT	best available technology
BBS	Breeding Bird Survey
BCD	Biological Conservation Database
BF	bottomland forest
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	best management practice
bpf	blows per foot
BPIP	Building Profile Input Program
BSSC	Building Seismic Safety Council
Btu/kWh	British thermal unit per kilowatt-hour
Btu/lb	British thermal units per pound
bu/ac	bushel per acre

C	active construction
CAA	Clean Air Act
$CaCO_3$	calcium carbonate
CAIR	Clean Air Interstate Rule
CBC	Christmas Bird Count
CCPI	Clean Coal Power Initiative
CCSP	U.S. Climate Change Science Program
CDHS	California Department of Health Services
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic foot per second
cfs/mi^2	cubic foot per second per square mile
cm	centimeter
cmbs	centimeter below surface
CNA	Central North America
CO	carbon monoxide
CO_2	carbon dioxide
COS	carbonyl sulfide
CPCN	Certificate of Public Convenience and Necessity
CT	combustion turbine
CWA	Clean Water Act
DAT	deposition analysis threshold
dBA	A-weighted decibel
dbh	diameter at breast height
DGPS	digital global positioning system
DO	dissolved oxygen
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DSM	demand-side management
Eagle Act	Bald and Golden Eagle Protection Act of 1940
ECT	Environmental Consulting & Technology, Inc.
EEOC	U.S. Equal Employment Opportunity Commission
EIA	Energy Information Agency
EIS	environmental impact statement
ELF	extremely low frequency
EMEPA	East Mississippi Electric Power Association
EMF	electric and magnetic field
EOR	enhanced oil recovery
EPA	U.S. Environmental Protection Agency
EPAct05	Energy Policy Act of 2005
EPT	Ephemeroptera + Plecoptera + Trichoptera
ERPGs	Emergency Response Planning Guidelines
ES&EE	Earth Science & Environmental Engineering
ESA	Endangered Species Act of 1973
F	open field
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FFPPA	Federal Farmland Protection Policy Act

FGD	flue-gas desulfurization
FHWA	Federal Highway Administration
FLAG	Federal Land Managers' Air Quality-Related Values Workgroup
FLM	Federal Land Managers
FM	frequency-modulated
FR	*Federal Register*
ft	foot (feet)
ft bls	foot below land surface
ft/day	foot per day
ft/day/ft	foot per day per foot
ft^2/day	square foot per day
ft^3	cubic foot
ft^3/hr	cubic foot per hour
ft-msl	feet above mean sea level
ft-NGVD	feet National Geodetic Vertical Datum
G	gas pipeline corridors
g/cm^3	gram per cubic centimeter
g/m^2/yr	gram per square meter per year
GAQM	Guideline on Air Quality Models
GCP	good combustion practice
GHG	greenhouse gas
GIS	geographical information system
GLO	General Land Office
gpd	gallon per day
gpd/ft	gallon per day per foot
gpd/ft^2	gallon per day per square foot
gpm	gallon per minute
gpm/ft	gallon per minute per foot
GPS	global positioning system
gr/dscf	grain per dry standard cubic foot
GS	G sand interval
GSA	Geological Society of America
H	hardwoods
H'	taxa diversity index
H_2	hydrogen
H_2O	water
H_2S	hydrogen sulfide
H_2SO_4	sulfuric acid
HABS	Historic American Building Survey
HAP	hazardous air pollutant
HAS	habitat assessment score
HCN	hydrogen cyanide
HDPE	high-density polyethylene
Hg_p	particle-bound mercury
HHV	higher heating value
HP	hardwood-pine
hr/yr	hour per year
HRSG	heat recovery steam generator
HUD	Department of Housing and Urban Development
Hz	Hertz

I-10	Interstate 10
I-20	Interstate 20
I-59	Interstate 59
IARC	International Agency for Research on Cancer
IBC	International Building Code
ICNIRP	International Commission on non-Ionizing Radiation Protection
IDLH	immediately dangerous to life or health
IGCC	integrated gasification combined-cycle
IRP	integrated resource plan
IRS	Internal Revenue Service
ISO	International Standards Organization
JS	J sand interval
KBR	Kellogg Brown & Root, Inc.
KCS	Kansas City Southern
Kf	soil erodibility of the fine-earth fraction (material less than 2 millimeters in size)
kg/ha/yr	kilogram per hectare per year
$kg/km^2/month$	kilogram per square kilometer per month
kg/m^3	kilogram per cubic meter
km	kilometer
kV	kilovolt
lb	pound
lb CO_2/MWh	pound of carbon dioxide per megawatt-hour
lb/ac	pound per acre
lb/ft^2	pound per square foot
lb/hr	pound per hour
lb/min	pound per minute
lb/MMBtu	pound per million British thermal units
lb/MWh	pound per megawatt-hour
lb/yr	pound per year
LCOE	levelized cost of electricity
L_{dn}	day-to-night sound level
L_{eq}	equivalent sound level
lf	linear foot
LOS	level of service
LPN	listing priority number
LWA	Lower Wilcox aquifer
MACT	maximum achievable control technology
MARIS	Mississippi Automated Resource Information System
M_b	body-wave magnitude
MBCI	Mississippi Band of Choctaw Indians
MCEQ	Mississippi Commission on Environmental Quality
MCL	maximum contaminant level
MDA	Mississippi Development Authority
MDAH	Mississippi Department of Archives and History
MDEQ	Mississippi Department of Environmental Quality
MDEQ SMCRA Regulations	Regulations Governing Surface Coal and Mining in Mississippi adopted by MDEQ's MCEQ
MDOT	Mississippi Department of Transportation
MDWFP	Mississippi Department of Wildlife, Fisheries, and Parks

MEI	Meridian Key Field Airport
meq/100g	milli-equivalent per 100 grams
mg/kg	milligram per kilogram
mg/L	milligram per liter
MGD	million gallons per day
mi^2	square mile
mills/kWh	0.1 cent per kilowatt-hour
Mississippi Power	Mississippi Power Company
MM5	Version 5 of the Penn State/NCAR Mesoscale Model
MMbtu/hr	million British thermal units per hour
mmhos/cm	millimhos per centimeter
MNHP	Mississippi Natural Heritage Program
MOA	Memorandum of Agreement
MODFLOW	Modular Three-Dimensional Finite Difference Ground Water Flow Model
mph	mile per hour
MS	Mississippi State Highway
MSDH	Mississippi State Department of Health
MSHA	Federal Mining Safety and Health Act
MSMRA	Mississippi Surface Mining and Reclamation Act of 1977
MW	megawatt
MWA	Middle Wilcox aquifer
MWh/yr	megawatt-hour per year
MWQCIIC	Mississippi's Water Quality Criteria for Intrastate, Interstate, and Coastal Waters
N_2	nitrogen
NAAQS	national ambient air quality standard
NACC	North American Coal Corporation
NADP	National Atmospheric Deposition Program
NAS	Naval Air Station
NCDC	National Climatic Data Center
NCEDC	Northern California Earthquake Data Center
ND	not detected above method detection limits
NEHRP	National Earthquake Hazards Reduction Program
NEIC	National Earthquake Information Center
NEPA	National Environmental Policy Act of 1969
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NETL	National Energy Technology Laboratory
New South	New South Associates, Inc.
NGCC	natural gas combined-cycle
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NIOSH	National Institute for Occupational Safety and Health
NO	nitrogen oxide
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRPB	National Radiation Protection Board
NSPS	New Source Performance Standards

NSR	New Source Review
NTU	nephelometric turbidity units
NWI	National Wetlands Inventory
NWS	Norfolk Southern Systems
O&M	operation and maintenance
OLF	outlying landing field
OLWR	Office of Land and Water Resources
OPC	Office of Pollution Control
OSHA	Occupational Safety and Health Administration
OUC	Orlando Utilities Commission
PAC	protection action criteria
PAC	process air compressor
PAH	polynuclear aromatic hydrocarbon
PC	pulverized coal
PCB	polychlorinated biphenyl
PGA	peak ground acceleration
PH	pine-hardwood
PHMSA	Pipeline and Hazardous Materials Safety Administration
PHWD	Pat Harrison Waterway District
PM	particulate matter
PM_{10}	particulate matter less than or equal to 10 micrometers
$PM_{2.5}$	particulate matter less than or equal to 2.5 micrometers
POM	polycyclic organic matter
POTW	publically owned treatment works
PP	planted pine
ppb	part per billion
ppm	part per million
ppmv	part per million by volume
ppmvd	part per million by dry volume
PRIME	plume rise model enhancement
PSC	Public Service Commission
PSD	Prevention of Significant Deterioration
PSDF	Power Systems Development Facility
psi	pound per square inch
psia	pound per square inch absolute
QA/QC	quality assurance/quality control
R	road
R/C	residential/commercial
RBA	rapid bioassessment
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RGM	reactive gaseous divalent mercury (Hg^{2+})
RHPP	Red Hills Power Project
RIMS	Regional Industrial Multiplier System
RMP	risk management plan
ROD	Record of Decision
RV	recreational vehicle

S	shrubland
s.u.	standard unit
SA	spectral acceleration
scf	standard cubic foot
SCR	selective catalytic reduction
SCS	Southern Company Services, Inc.
SFWMD	South Florida Water Management District
SIA	significant impact area
SIL	significant impact level
SIP	State Implementation Plan
SMCRA	Surface Mine Control and Reclamation Act
SMEPA	South Mississippi Electric Power Association
SNG	Southern Natural Gas
SO_2	sulfur dioxide
SO_3	sulfur trioxide
SO_x	sulfur oxides
SPCC	spill prevention, control, and countermeasure
SPLP	synthetic precipitation leaching procedure
SPR	strategic petroleum reserve
SPT	standard penetration test
STEL	short-term exposure limit
SWPPP	stormwater pollution prevention plan
syngas	synthesis gas
T	soil loss tolerance
t/1000t	ton of material
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TFM	toxic-forming materials
TGPL	Tennessee Gas Pipeline Company
THPO	Tribal Historic Preservation Officer
TMD	toxic material drainage
TMDL	total maximum daily load
tpd	ton per day
tph	ton per hour
tpy	ton per year
TRIG™	Transport Integrated Gasification
TSS	total suspended solids
TVA	Tennessee Valley Authority
TVAR	Tennessee Valley Archaeological Research
U.S. 45	U.S. Highway 45
U.S. 78	U.S. Highway 78
U.S. 80	U.S. Highway 80
U.S.C.	United States Code
UB	underburden
UHF	ultra high frequency
UIC	underground injection control
UNEP	United Nations Environment Programme
URE	unit risk estimate
URF	unit risk factors
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture

USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
V/m	volts per meter
VHF	very high frequency
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
Vittor	Barry Vittor & Associates, Inc.
VMT	vehicle-mile traveled
VOC	volatile organic compound
WGS	water gas shift
WHO	World Health Organization
WIC	Women, Infants, and Children
WMA	Wildlife Management Area
WMO	World Meteorological Organization
WPA	Works Progress Administration
WRAP	Wetland Rapid Assessment Procedure
WRDA	Water Resources Development Act
WRIR	Water Resources Investigation Report
WSA	wet gas sulfuric acid
WSS	Web Soil Survey
WWTP	wastewater treatment plant

1. PURPOSE AND NEED FOR AGENCY ACTION

1.1 INTRODUCTION

This environmental impact statement (EIS) assesses the potential environmental impacts of constructing and operating a power plant proposed by Southern Company, through its subsidiaries, Southern Company Services, Inc. (SCS), and Mississippi Power Company (Mississippi Power), and the opening and operating of a lignite mine proposed by North American Coal Corporation (NACC). Both facilities would be located adjacent to each other in east-central Mississippi. The proposed power plant would be built in Kemper County and would demonstrate an advanced integrated gasification combined-cycle (IGCC) generation system. The facility would convert lignite into a synthesis gas (syngas) for generating 582 megawatts (MW) (nominal capacity) of electricity, while reducing emissions of carbon dioxide (CO_2), sulfur dioxide (SO_2), oxides of nitrogen (NO_x), mercury, and particulates compared to conventional lignite-fired power plants. New transmission lines and transmission and distribution line upgrades, a natural gas pipeline, a reclaimed water pipeline, and a CO_2 pipeline would be constructed in connection with the power plant. NACC's proposed lignite mine would be located on adjoining properties in Kemper County but would extend into Lauderdale County. It would supply coal to the power plant under the terms of a sales contract. The power plant project would test the same IGCC technology that was originally proposed for a project near Orlando, Florida, and was previously selected for financial assistance by the U.S. Department of Energy (DOE) under the Clean Coal Power Initiative (CCPI) program. The site in Florida became unavailable when the host utility withdrew from the project because of uncertainty regarding regulation of greenhouse gas (GHG) emissions. Southern Company then proposed to DOE that it transfer the financial assistance originally awarded to the project in Orlando to this project, already sited in Kemper County. As described in this EIS, Southern Company has included carbon capture with the sale of the captured CO_2 for beneficial use in existing enhanced oil recovery (EOR) operations in Mississippi in its project plans.

DOE will consider the potential environmental impacts before deciding whether to release the remaining $270 million (of an original $294 million) in cost-shared financial assistance under the CCPI program to the power plant project. In addition, DOE will consider the potential environmental impacts before deciding whether to issue a loan guarantee pursuant to the Energy Policy Act of 2005 (EPAct05), in response to an application from Mississippi Power, for the power plant. The U.S. Army Corps of Engineers (USACE) is a cooperating agency for this EIS (see Letter of Understanding contained in Appendix A) and will consider potential environmental impacts during its evaluation of permit applications under Section 404 of the Clean Water Act (CWA) for stream and wetland disturbances related to the proposed mine, power plant, transmission lines, and pipelines.

Accordingly, this EIS evaluates the potential impacts of the proposed power plant project, the proposed mine, other connected actions, and reasonable alternatives. This EIS was prepared by DOE in compliance with the National Environmental Policy Act of 1969 (NEPA), as amended (Chapter 42, Part 4321, *et seq.*, United States Code [U.S.C.]), the Council on Environmental Quality (CEQ) NEPA regulations (Chapter 40, Parts 1500 through 1508, Code of Federal Regulations [CFR]), and the DOE NEPA regulations (10 CFR 1021).

1.2 CLEAN COAL POWER INITIATIVE

Coal is an abundant and indigenous energy resource and supplies almost 50 percent of the United States' electric power (Energy Information Agency [EIA], 2009a). Vital to the nation's economy and global competitiveness, demand for electricity is projected to increase by more than 30 percent by 2030. Based on thorough analyses conducted by the EIA, it is projected that this power increase can only be achieved if coal use is also increased (EIA, 2007). Furthermore, nearly half of the nation's electric power generating infrastructure is more than 30 years old, with a significant portion in-service for twice as long (EIA, 2009b). These aging facilities are (or soon will be) in need of substantial refurbishment or replacement. Additional capacity must also be put in-service to keep pace with the nation's ever-growing demand for electricity. Therefore, nearly half of the nation's electricity needs will continue to be served by coal for at least the next several decades. Given heightened awareness of environmental stewardship, while at the same time meeting the demand for a reliable and cost-effective electric power supply, it is clearly in the public interest for the nation's energy infrastructure to be upgraded with the latest and most advanced commercially viable technologies to achieve greater efficiencies, environmental performance, and cost-competitiveness. However, to realize acceptance and replication of these advanced technologies into the electric power generation sector, the technologies need to be *demonstrated* first, i.e., designed and constructed to industrial standards and operated at significant scale under industrial conditions.

Public Law 107-63, enacted in November 2001, first provided funding for the CCPI. The CCPI is the current multiyear federal program to accelerate the commercial readiness of advanced multipollutant emissions control, combustion, gasification, and efficiency improvement technologies to retrofit or repower existing coal-based power plants and for deployment in new coal-based generating facilities. The CCPI encompasses a broad spectrum of commercial-scale demonstrations that target today's most pressing environmental challenges, including reducing mercury and GHG emissions by boosting the efficiency at which coal is converted to electricity or other energy forms. The CCPI is closely linked with DOE's research and development activities directed toward creating ultraclean, fossil fuel-based energy complexes in the 21st century. When integrated with other DOE initiatives, the CCPI will help the nation successfully commercialize advanced power systems that will produce electricity at greater efficiencies, produce almost no emissions, create clean fuels, and employ CO_2 management capabilities. Improving power plant efficiency is a potentially significant way to reduce CO_2 emissions in the near- and mid-term. In the longer term, CCPI technologies employing CO_2 capture and storage, or beneficial reuse, will remove fossil-fueled power as a potential threat to global climate change (DOE, 2008b). Accelerating commercialization of clean coal technologies also positions the United States to supply these technologies to a rapidly expanding world market.

Congress provided for competitively awarded federal cost-shared funding for CCPI demonstration projects. In contrast to other federally funded activities, CCPI projects are not federal projects seeking private investment; instead, they are private projects seeking federal financial assistance. Under the CCPI funding opportunities, industry proposes projects that meet its needs and those of its customers and while furthering the national goals and objectives of DOE's CCPI. Demonstration projects selected by the CCPI program become private-public partnerships that satisfy a wide set of industry and government needs. Industry satisfies its short-term need to retrofit or repower a facility or develop new power generating capacity for the benefit of its customers. By providing financial incentives to the energy sector that reduce risks associated with project financing and technical challenges for emerging clean coal technologies, the government: (a) supports the verification of commercial readiness leading toward the long-term objective of transitioning the nation's existing fleet of electric power plants to more efficient, environmentally sound, and cost-competitive facilities (National Energy Technology Laboratory [NETL], 2006a); and (b) facilitates the adoption of technologies that can meet more stringent environmental regulation through more efficient power generation, advanced environmental controls, and production of environmentally attractive energy carriers and byproduct utilization.

Applications for demonstrations under CCPI Round 2 were evaluated against specific programmatic criteria, which include the following:

- Technical Merit—Scientific and engineering approach, data and other evidence to support technology claims, readiness of the technology, and potential benefits such as improved system performance, reliability, environmental performance, and costs.
- Feasibility—Appropriateness of proposed site(s), including availability and access to water, power transmission, coal transportation, facilities and equipment infrastructure, and permits; ability of the proposed project team to successfully implement the project; and soundness and completeness of the statement of work, schedule, test plan, milestones, and decision points.
- Commercialization Potential—Commercial viability relative to the scale of the project, potential for broad market impact and widespread deployment, and soundness of the commercialization plan, including experience of the project team.
- Adequacy of the Financial and Business Plan—Financial condition and capability of proposed funding sources, priority placed by management on financing the project, and adequacy of the applicant’s financial management system.
- Adequacy of the Repayment Plan—Ability to repay the governments cost share.

Consistent with the CEQ NEPA regulations (40 CFR 1500 through 1508) and DOE regulations (10 CFR 1021), DOE conducts a preliminary review of the potential environmental, health, safety, and socioeconomic impacts of proposed projects during the evaluation and selection process. This is the first of two reviews of projects’ potential impacts under NEPA; the review process is described in more detail in Subsection 1.7.

DOE selects projects for CCPI funding in a series of *rounds*, each of which starts with a funding opportunity announcement that asks project proponents to submit applications for federal cost-sharing for their demonstration projects. DOE issued the first CCPI funding opportunity announcement (Round 1) in March 2002. It issued a second funding opportunity announcement (Round 2) in February 2004. These funding opportunities focused on projects involving advanced coal-based power generation, including gasification, efficiency improvements, optimization through neural networking, environmental and economic improvements, and mercury control. The specific objectives for CCPI Round 2, as stated in the Financial Assistance Announcement DE-PS26-04NT42061, are as follows:

- Demonstrate advanced coal-based technologies that have progressed beyond the research and development stage to a point of readiness for operation at a scale that can be readily replicated in commercial practice within the electric power industry.
- Accelerate the likelihood of deploying the demonstrated technologies for widespread commercial use within the electric power sector.

Two technology priorities for CCPI Round 2 were gasification-based power generation systems and mercury control technology.

Thirteen applications for cost-shared demonstration projects were received in response to CCPI Round 2. Two of the 13 applicants proposed IGCC demonstrations. Four of the 13 applications were selected, including both IGCC demonstration projects, one of which was the project proposed by SCS, a subsidiary of Southern Company (NETL, 2006b). The selections were based on individual merit and represented a mix of technologies with the best potential to make progress toward the objectives of CCPI Round 2.

The project as originally proposed by SCS would have built and operated an IGCC power plant based on Transport Integrated Gasification (TRIG™) technology at a site owned by the Orlando Utilities Commission (OUC) located near Orlando, Florida. This project successfully proceeded to initiation of construction before the OUC withdrew from the project, apparently as a result of the possibility that new coal-fueled power plants would be required to install carbon capture and sequestration.The proposed Orlando project did not include these features. Southern Company, committed to demonstrating the proposed IGCC technology, subsequently proposed to use the technology in a planned power plant in Kemper County, Mississippi. DOE agreed to consider the change in project location. The Kemper County IGCC Project would be designed, constructed, operated, and owned by Mississippi Power, with technical support from SCS.

1.3 FEDERAL LOAN GUARANTEE PROGRAM

Projects selected for the CCPI program may also be eligible for federal loan guarantees. EPAct05 established the Federal Loan Guarantee Program for energy projects that employ innovative technologies. Title XVII of the EPAct05 authorizes the Secretary of Energy to make loan guarantees for a variety of projects, including projects that "avoid, reduce, or sequester air pollutants or anthropogenic emissions of GHGs" and "employ new or significantly improved technologies as compared to commercial technologies in service in the United States at the time the guarantee is issued" (Section 1703[a][1], 42 U.S.C. 16513). Mississippi Power submitted a pre-application to DOE and was invited to submit a formal application for a loan guarantee, which it filed on November 13, 2008.

1.4 PROPOSED ACTIONS

1.4.1 DOE

DOE proposes to provide an additional $270 million in cost-shared financial assistance under the CCPI program to the Kemper County IGCC Project. DOE's proposed action encompasses those activities that are eligible for cost-shared funding, including the construction of the onsite power plant components, such as the gasification island, the combined-cycle unit, and the auxiliary facilities (cooling tower, switchyard, syngas cleanup, and lignite handling after receipt from NACC). DOE has already provided a portion of the original funding ($24.4 million of an original $294 million) to Southern Company for cost sharing in the preliminary design and definition of the previous project near Orlando. In addition, DOE may issue a loan guarantee pursuant to the EPAct05.

The financial assistance would apply to the planning, design, permitting, equipment procurement, construction, startup, and a 4.5-year demonstration of the power plant technology. The loan guarantee would apply to the planning, design, permitting, equipment procurement, construction, and startup of the power plant. If approved for DOE loan guarantee, a portion of the power plant's construction costs would be funded through the U.S. Treasury Department's Federal Financing Bank. The loan would then be guaranteed by DOE, resulting in interest expense savings for Mississippi Power. DOE's remaining funding, estimated to be $270 million (approximately 15 percent or less of the total project cost, which is currently projected to be greater than $2 billion) would be applied under the terms and conditions of a negotiated modification to the original cooperative agreement between DOE and SCS. Because DOE's primary role would be to provide cost-shared financial assistance and a loan guarantee as circumscribed by the two federal programs described previously, the range of reasonable alternatives for meeting the programs' purpose and needs are limited in comparison to a situation in which DOE would own or control the project. The enabling legislation for CCPI did not grant DOE the programmatic authority to substitute its judgment for that of project proponent with regard to selecting alternative power plant sites or selecting alternative power plant technologies for a particular project. Under these constraints, DOE's reasonable alternatives are limited. First, it is limited to the projects that applicants propose. For purposes of NEPA, DOE evaluates the potential impacts of proposed projects pursuant to 10 CFR 1021.216. After selecting which proposals to pursue from all the applications received, DOE's alternatives are limited to *project-specific* alternatives that the applicant is considering for aspects such as facility location, pipeline routes, capture technologies, and sequestration sites, and to DOE's decision on whether or not to fund the project. The alternatives that DOE evaluated are described in Chapter 2, and their potential impacts are analyzed in remainder of this EIS. DOE will make its decisions on providing financial assistance, a loan guarantee, or both based on these analyses and other factors.

1.4.2 USACE

USACE is considering whether to issue Department of the Army permits pursuant to Section 404 of the CWA for proposed stream and wetland impacts resulting from the construction and operation of the power plant, mine, and other related facilities. The regulatory process would include the review and consideration of least environmentally damaging and practicable alternatives that would reduce the impacts to waters of the United States, over which USACE has jurisdiction. USACE will also consider compensation for unavoidable impacts on wetlands and streams or those resources known as waters of the United States. This, in turn, may include evaluating the effects of the anticipated activities on Okatibbee Lake and Wildlife Management Area (WMA), as well as any other federal interests located within and downstream of this EIS study area. In addition to this NEPA process, there will be separate reviews, consideration, and opportunities for public participation before USACE decides whether to issue any Department of the Army permits allowing impacts to waters of the United States, including wetlands and streams.

1.4.3 INDUSTRY PROPONENTS

Southern Company, through its subsidiaries Mississippi Power and SCS, proposes to plan, design, construct, and operate (for the 4.5-year demonstration period) a new coal-fueled power plant. In a connected action, NACC proposes to open and operate a lignite mine that would supply fuel to the power plant under the terms of a sales contract. Both the power plant and the mine would be located at a site in east-central Mississippi. The proposed power plant would demonstrate an advanced IGCC generation system and would be constructed in Kemper County; hence, it would be known as the Kemper County IGCC Project. New power transmission lines and power transmission and distribution line upgrades, a natural gas pipeline, a reclaimed water pipeline, and a CO_2 pipeline would be constructed in connection with the power plant project. NACC's proposed lignite mine would be located on adjoining properties, mostly in Kemper County but extending also into Lauderdale County. The proposed power plant would include carbon capture and would sell the captured CO_2, to a company in the oil and gas industry for use in EOR. The lignite mine and the power plant would be expected to have a commercial life of approximately 40 years.

The Kemper County IGCC Project would be constructed on a portion of an approximately 1,650-acre undeveloped site. The proposed facilities would demonstrate IGCC technology in a power plant consisting of two lignite gasifiers with gas cleanup systems, two gas combustion turbines (CTs), two heat recovery steam generators (HRSGs), a single steam turbine, and associated power plant facilities. Reclaimed municipal effluent from the city of Meridian would constitute the plant's principal source of water required for cooling tower makeup, steam cycle makeup, and other processes. One or more onsite deep wells would provide a maximum of 1 million gallons per day (MGD) of nonpotable ground water at times when supplies of reclaimed water were insufficient. The IGCC facility would produce syngas from lignite and use this syngas to fuel the two CTs. Hot exhaust gas from the CTs would generate steam from water in the HRSGs to drive the steam turbine. All three turbines would generate electricity. The CTs would be capable of operating on either syngas or natural gas. At full design capacity, the two new coal gasifiers are expected to use approximately 13,800 tons per day (tpd) of lignite to produce syngas. Combined, the three turbines would have a nameplate output of approximately 800 MW and generate a net summer peaking capacity of approximately 582 MW of electricity when duct firing natural gas in the HRSG. This combined-cycle approach of using gas turbines and a steam turbine in tandem increases the amount of electricity that can be generated from a given amount of fuel input.

While DOE proposes to partially finance a technology demonstration project that would consist of the gasifiers, syngas cleanup systems, CO_2 capture systems, two CT/HRSGs, a steam turbine, and supporting onsite facilities and infrastructure, this EIS also addresses the opening and operation of the neighboring lignite surface mine that would supply the project with fuel, a reclaimed water supply pipeline, associated transmission lines (and substations), CO_2 pipeline, and a natural gas pipeline as connected actions (i.e., closely related activities).

1.5 PURPOSES AND NEEDS FOR AGENCY ACTIONS

1.5.1 DOE

The purpose of DOE's action under the CCPI program is to demonstrate the feasibility of this selected IGCC technology at a size that would be attractive to utilities for commercial operation. The gasifier design is based on a technology that Southern Company, Kellogg Brown & Root LLC (successor in interest to Kellogg Brown & Root, Inc. [KBR]), DOE, and other industrial proponents have been developing since 1996 at the Power Systems Development Facility (PSDF) near Wilsonville, Alabama. The proposed TRIG™ IGCC technology is cost-effective when using low-heat content, high moisture, or high-ash content coals, including lignite. These coals constitute approximately one-half of the proven United States' and world's coal reserves.

The existing gasifier at the PSDF research facility is the largest of the type to be demonstrated, with a maximum coal-feed rate of 5,500 pounds per hour (lb/hr) or 66 tpd. The design and operating parameters of the basic technology are well understood from the experience gained during this gasifier's operation, and its potential advantages to the power industry have been well established. The technology is now ready to be demonstrated in a commercial-scale power plant to confirm these advantages, after which it would be expected to be widely deployed.

A successful demonstration would generate technical, environmental, and financial data from the design, construction, and operation of the facility to confirm that the technology can be implemented at a commercial scale. The cost-shared financial assistance from DOE would reduce the risk to the Southern Company team in demonstrating the technology at the level of maturity needed for decisions on commercialization.

The purpose of DOE's action with regard to the proposed issuance of a federal loan guarantee is to encourage early commercial use in the United States of new or significantly improved energy technology and reduce or eliminate emissions of GHGs pursuant to Title XVII of the EPAct05.

There are two principal needs addressed by DOE's proposed action. First, the project would satisfy the responsibility Congress imposed on DOE to demonstrate advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the United States (Section 1.2). Second, with regard to the proposed issuance of a federal loan guarantee, this action would fulfill DOE's mandate under the EPAct05 to issue loan guarantees to eligible projects that "avoid, reduce, or sequester air pollutants or anthropogenic emissions of GHGs" and "employ new or significantly improved technologies as compared to technologies in service in the United States at the time the guarantee is issued."

1.5.2 USACE

The purpose of USACE's proposed action is to fulfill its Congressionally mandated responsibilities related to dredging and filling wetlands and other waters of the United States under the Section 404(b)(1) Guidelines of the CWA.

When considering USACE's purpose and need for issuing a permit, USACE looks to the purpose and need for the project in terms of benefits to society based on approximately 21 public interest factors. In compliance with applicable regulations, USACE would consider the following, for both the power plant facility and the mine, before issuance of a Department of the Army permit pursuant to the Section 404(b)(1) guidelines:

- Basic Project Purpose—The basic project purpose serves as a basis for determining water dependency. For this action, the basic project purpose is to construct a coal-powered electrical facility connected with a mine, neither of which must be sited within or adjoining an aquatic environment. Therefore, the project may be considered non-water-dependent. Additionally, there appears to be no requirement for the project to be located in a special aquatic site in order to meet the basic project purpose.
- Overall Project Purpose—The overall project purpose is used as a basis for assessing the practicable alternatives for the proposal pursuant to the regulations. For this action, the overall project purpose is to construct and operate an IGCC power plant facility co-located with a lignite fuel supply (for purposes of fuel diversity and controlling the costs of electricity for the customers) and situated where projected future demands for electricity from the applicant can be met. In alignment with the applicant's project siting analysis, the lignite mine would be opened and operated in Kemper and Lauderdale Counties, Mississippi. In accordance with 33 CFR 320.4(q), "...when private enterprise makes application for a permit, it will generally be assumed that appropriate economic evaluations have been completed, the proposal is economically viable, and is needed in the market place..." Therefore, for the purpose of the permitting process, USACE's need, as stated by the overall project purpose, may be considered to be met. Mississippi Power and NACC will apply for Department of

the Army permits in accordance with 33 CFR 325. The mere fact that the project is economically viable does not guarantee the issuance of Department of the Army permits.

1.6 POTENTIAL PROJECT BENEFITS

Lignite coals provide attractive alternatives to bituminous coals for power generation because they have lower sulfur contents and lower costs and because they offer diversity in fuel supply to a power company that has other plants using bituminous coals. IGCC technology for power generation is expected to provide the industrial proponents with a power plant design that is reliable, low-cost, and environmentally cleaner compared to conventional lignite-fueled plants. The principal objectives of the industrial proponents are to: (1) demonstrate high availability, high thermal efficiency, low costs, and low emissions from the IGCC technology at a commercial scale; and (2) design, construct, and operate an advanced syngas cleanup system that includes sulfur removal and recovery; high-temperature, high-pressure particulate filtration; ammonia recovery; mercury removal; and carbon capture. The industrial proponents view the ability to use various types of coal while reducing emissions of pollutants and wastes as an integral part of a strategy to control costs and meet increasingly stringent environmental standards.

As a public utility, Mississippi Power has an obligation to provide reliable and economical electric power to its existing and future customers at the lowest reasonable cost. To meet this obligation, Mississippi Power conducts continuous long-range planning to predict its future power supply needs and evaluate available options, including conservation, to meet those needs. This planning effort considers a broad range of options in a fair and balanced manner to ensure reliability, minimize costs (and thereby minimize rates), and address key uncertainties faced by the company while meeting all environmental regulatory requirements and standards (Mississippi Power, 2009a).

The latest load forecast for Mississippi Power identifies an additional generation need of between 318 and 601 MW of base-load power beginning during the summer season of 2014. This Kemper County IGCC Project is intended to meet that generation need while demonstrating the proposed technology and a viable use of lignite as a fuel source. In addition, Mississippi Power and South Mississippi Electric Power Association (SMEPA) have signed a Letter of Intent to explore the acquisition of an interest in the proposed IGCC project by SMEPA. "The companies are negotiating a combination of a joint ownership arrangement and a purchase power agreement, which would provide [SMEPA] with up to 20 percent of the capacity and associated energy output from the plant" (Meridian Star, 2009).

The determination of a need for a new generation facility was the result of Mississippi Power's ongoing integrated resource plan (IRP) process. This process includes forecasting customer load and energy requirements; evaluating the capacity available to meet the load; developing, evaluating, and implementing efficiency and conservation programs; and, when a need is identified, evaluating the resources available to reduce or meet such need.

With regard to energy efficiency and conservation programs, also known as demand-side management (DSM) programs, Mississippi Power continuously seeks to expand or add DSM programs when it is in the best interest of its customers. *Active* DSM programs, such as the GoodCents® program and interruptible contracts for commercial customers, are those that are directly controlled by Mississippi Power and are currently used to defer approximately 76 MW of additional capacity. Mississippi Power expects to defer 96 MW by 2020 through existing and new DSM programs. DSM programs associated directly with changing customer energy use patterns are called *passive* programs and currently defer approximately 24 MW of additional capacity. These passive programs include providing advertising and collateral materials to customers as well as Mississippi Power's Energy Audit Program, where customers are offered personalized energy advice/assistance through either an in-home or Web-based audit.

The Kemper County IGCC Project would provide Mississippi Power with a cost-effective power plant to generate baseload electricity and meet growing customer needs. In addition to meeting Mississippi Power's generation need, the proposed project would also address several risks and strategic considerations identified in the IRP process. The first and foremost of these is fuel diversity. The Kemper County IGCC Project would enhance the fuel diversity and asset mix of Mississippi Power's generating fleet by mitigating the supply and price volatility risks associated with the predominant use of any one fuel source. Specifically, the proposed TRIG™ IGCC technology would allow Mississippi Power to use an additional fuel source: lignite, the cost of which is both lower and less volatile than that of natural gas and higher-ranked coals. The long-term lignite supply agreement associated with the project would provide a lower and more stable fuel price over the life of the plant for Mississippi Power's customers.

Other energy supply risk areas that would be potentially mitigated by the Kemper County IGCC Project include maintaining sufficient generation capacity to avoid shortages; geographic diversity to prevent excess damage and service reliability issues that can arise from natural disasters such as tropical storm events; and the possible loss of existing generating capabilities due to future climate change legislation.

To most economically serve its customers' needs, Mississippi Power's generation fleet must provide for a mix of generating capacity that best matches its customers' demand. Since demand fluctuates over the course of a day and varies greatly by day and by season, the appropriate mix of capacity contains baseload, intermediate, and peaking capacity. Baseload units (e.g., coal [including IGCC] and nuclear) are typically more expensive to build, maintain, and staff as compared to intermediate and peaking units but have a much lower fuel cost and are designed to operate most economically when operated continuously. They also require longer construction lead times. The intermediate and peaking units are less expensive to build and have more operational flexibility but are more expensive to operate, largely because of their much higher fuel cost. They are designed to serve the shorter daily periods of higher peak demands and to be operated only in those hours when loads are extremely high. Natural-gas-fueled combined-cycle and simple-cycle units typically fall into this category.

The geographic location of generating units is important in support of voltage regulation, security, and area protection. It is also important to consider locating units away from the coastal area to mitigate damage from severe tropical weather events. As Mississippi Power's experience after Hurricane Katrina showed, it is increasingly important to ensure service to important regional and national energy infrastructure such as the Chevron refinery in Pascagoula, Mississippi, and the numerous pipelines and compression stations throughout its service area.

Existing and anticipated environmental standards will require either significant investments in environmental control retrofits or the retirement of some of Mississippi Power's units. The likely capital-intensive environmental controls that may be needed include selective catalytic reduction (SCR), flue-gas desulfurization (FGD) systems (scrubbers), baghouses, and cooling towers. A lead time of 3 to 5 years is required to design and construct these controls, which means that decisions to commit to adding them need to be made over the course of the next few years.

An additional uncertainty is the anticipated imposition of standards to address climate change through reduction of GHG emissions, which primarily consist of CO_2. Although no such national standards have been imposed yet, the potential impact on Mississippi Power's customers could be significant, depending on their timing and requirements. Combined-cycle generating units that produce electricity with natural gas combustion produce less CO_2 than those that use traditional coal combustion. However, all plants might be expected to purchase allowances or pay carbon taxes proportional to their respective emission rates. Additionally, in planning for possible climate change standards, utilities with an existing coal fleet face two expensive options: (1) install costly CO_2 capture retrofits using technology still under development; or (2) retire existing coal generation and build new generating units.

The additional cost associated with climate change standards, coupled with the near-term decisions concerning additional environmental controls, require that Mississippi Power continue to monitor new developments closely and examine all of the possible impacts in an effort to make prudent decisions about its continued investment in its baseload coal fleet. These same considerations influence decisions on the type of units that Mississippi Power should select to meet its future generation needs.

As part of its initial economic evaluation of the project, in June 2006, Mississippi Power applied for certification by the Internal Revenue Service (IRS) for certain clean coal investment tax credits. The application for these tax credits described in some detail the specific IGCC technology to be constructed and identified lignite as the feedstock. Ultimately, in November 2006, DOE certified, and the IRS qualified, the Kemper County site, technology, and lignite feedstock under the Energy Policy Act for clean coal investment tax credits.

1.7 NEPA

In compliance with NEPA, DOE prepared this EIS for the Kemper County IGCC Project to inform its decisions regarding whether to provide financial assistance for project activities beyond preliminary design (including detailed design, construction, and operation of the proposed facilities) and whether to provide a loan guarantee to the project. In addition, this EIS will assist USACE in fulfilling its responsibilities for determining whether to grant permits under the CWA for stream and wetland impacts that would result from the project. DOE's policy is to comply fully with NEPA, giving early consideration to environmental values and factors in federal planning and decision-making. This EIS evaluates the environmental impacts of alternatives and connected project actions and facilitates public participation. DOE's actions with regard to any proposal, including financial awards, is limited prior to completion of the NEPA process (i.e., it will not provide funds or loan guarantees for project activities that could either have an adverse impact on the environment or limit the choice of reasonable alternatives).

DOE has developed an overall strategy for compliance with NEPA for the CCPI program consistent with CEQ regulations (40 CFR 1500 through 1508) and DOE regulations (10 CFR 1021). This strategy has two principal elements. The first element involved an open solicitation and competitive selection process to obtain a set of projects that best meets program needs. Applications are screened for compliance with a number of basic eligibility requirements that are defined by the program. The applications that meet the mandatory eligibility requirements constitute the range of reasonable alternatives available to DOE to meet the program's purpose and needs. These applications were evaluated more comprehensively. This comprehensive evaluation focused on the technical description of the proposed project, financial plans and budgets, potential environmental impacts, and other information that the applicants were requested to submit. Following reviews by technical, environmental, and financial panels, and a comprehensive assessment by a merit review board, DOE officials selected those projects that they concluded best met the program's purposes and needs. To aid in the environmental evaluation, the applicants provided information on the site-specific environmental, health, safety, and socioeconomic issues of their project. By broadly soliciting proposals to meet the programmatic purposes and needs for DOE action and by evaluating the potential environmental impacts associated with each proposal before selecting projects that would go forward to the second step in the NEPA process, DOE considered a reasonable range of alternatives for implementing CCPI.

The second step in the NEPA process consists of preparing more detailed NEPA analyses for each selected project. For this project, DOE determined that providing financial assistance or a loan guarantee (or both) to the proposed project would constitute a major federal action that may significantly affect the quality of the human environment. Therefore, DOE has prepared this EIS to assess the potential impacts on the human environment of the proposed action and reasonable alternatives. DOE has used information provided by Southern Company and NACC for the proposed project, as well as information provided by state and federal government agencies, subject-matter experts, and others. This EIS has been prepared in accordance with Section 102(2)(C) of NEPA, as implemented under regulations promulgated by CEQ (40 CFR 1500 through 1508) and as provided in DOE regulations for compliance with NEPA (10 CFR 1021). This EIS is organized according to CEQ recommendations (40 CFR 1502.10).

A Notice of Intent (NOI) to prepare this EIS and hold a public scoping meeting was published by DOE in the *Federal Register* (FR) on September 22, 2008 (73 FR 54569 through 73). The NOI invited comments and suggestions on the proposed scope of this EIS, including environmental issues and alternatives, and invited participation in the NEPA process. The NOI and other information to announce the public scoping meeting were sent to ten media outlets (seven newspapers, one television station [WTOK], and two radio networks) in six Mississippi counties. An advertisement publicizing the public scoping meeting was printed in the following newspapers: *Kemper County Messenger* (Thursday, October 9); *Meridian Star* (Wednesday, October 8, and Sunday, October 12); *Clarke County Tribune* (Wednesday, October 8); and *Jasper County News* (Wednesday, October 8). An information packet including the NOI was delivered to 171 stakeholders including federal, state, and local agencies and environmental groups to announce the meeting and solicit comments on the proposed project. Postcards publicizing the meeting were mailed to 1,440 residents and businesses within a 3-mile radius of the proposed power plant site and all landowners within both the life-of-mine area and the rights-of-way within 200 feet (ft) of the centerline of the proposed linear facilities for which routes were planned.

Publication of the NOI initiated the EIS process with a public scoping period for soliciting input to ensure that: (1) significant issues are identified early and appropriately addressed, (2) issues of little significance do not consume time and effort, and (3) delays occasioned by an inadequate EIS are avoided (40 CFR 1501.7). DOE held a scoping meeting in DeKalb, Mississippi, on October 14, 2008. The public was encouraged to provide oral comments at the scoping meeting and submit additional comments in writing to DOE by the close of the scoping period on October 23, 2008.

DOE received oral comments at the meeting and other comments via attendance registration cards, postal mail, e-mail, and telephone calls from members of the public, interested groups, and federal, state, and local officials. Appendix A contains correspondence with regulatory agencies. The responses assisted in considering additional issues to be analyzed in this EIS and in determining the level of analysis required for each of the issues. Issues raised during public scoping are identified in Subsection 1.8.2.

1.8 SCOPE OF THE EIS

This section summarizes the issues and alternatives identified and considered during the preparation of this EIS.

1.8.1 ISSUES IDENTIFIED PRIOR TO SCOPING PROCESS

The following issues were initially identified as requiring analysis and assessment in this EIS and were included in the NOI:

- Atmospheric Resources—Potential air quality impacts resulting from emissions during construction and operation of the proposed Kemper County IGCC Project and the connected actions (e.g., effects of ground-level concentrations of criteria pollutants and trace metals, including mercury, on surrounding areas and resource areas of special concern, such as Prevention of Significant Deterioration [PSD] Class I areas). Potential effects of GHG emissions.
- Water Resources—Potential effects of ground water withdrawals and discharges of effluents to surface waters. Potential water resources impacts resulting from construction and operation of the connected actions.
- Infrastructure and Land Use—Potential effects on existing infrastructure and land uses resulting from the construction and operation of the proposed Kemper County IGCC Project and connected action facilities. For example, potential traffic effects resulting from the proposed project and potential land use impacts of committing land to power plant use or temporary land use impacts of mining.
- Solid Wastes—Pollution prevention and waste management, including potential solid waste impacts caused by the generation, treatment, transport, storage, and management of ash and solid wastes.
- Visual Impacts—Potential aesthetic impacts associated with new stacks, mechanical draft cooling towers, two flare derricks, and other plant structures included in the IGCC plant and from the connected actions.
- Floodplains—Potential impacts (e.g., impeding floodwaters, redirecting floodwaters, onsite property damage) of siting structures and infrastructure within a floodplain.
- Wetlands and Streams—Potential effects to wetlands and streams due to construction and operation of the power plant and the connected action facilities.
- Ecological Resources—Potential onsite and offsite impacts to vegetation, terrestrial wildlife, aquatic wildlife, threatened and endangered species (other than broadly distributed and wide-ranging species such as the bald eagle and red-cockaded woodpecker; Price's potato bean is known to occur in the region), and ecologically sensitive habitats due to the construction and operation of the power plant and connected actions.
- Safety and Health—Construction-related safety, process safety, and management of process chemicals and materials.
- Construction—Potential impacts associated with noise, traffic patterns, and construction-related emissions.

- Community Impacts—Potential congestion and other impacts to local traffic patterns, socioeconomic impacts on public services and infrastructure (e.g., police protection, schools, and utilities), noise associated with project operation, and environmental justice with respect to the surrounding community.
- Cultural and Archaeological Resources—Potential impacts to such resources associated with construction of the project and connected actions.
- Cumulative Effects—The incremental impacts of the proposed project (e.g., incremental air emissions affecting ambient air quality) when added to other past, present, and reasonably foreseeable future actions, including the connected actions. This analysis includes potential impacts on global climate change.

1.8.2 ISSUES IDENTIFIED DURING SCOPING PROCESS

During the scoping process, comments received from the public expressed concerns relating to potential environmental, social, and other impacts that could result from the project, while others expressed a desire for consideration of alternatives to the proposed project, including technology alternatives and conservation. The comments on alternatives suggested considering alternatives to coal-based technologies (e.g., solar energy), as well as whether there is really a need for the project (i.e., consideration of the no-action alternative). The potential effects that the public expressed the most concern about were: (1) impacts on surface water and ecological resources (which would result primarily from construction and operation of the neighboring surface mine); (2) impacts on ground water resources that would be caused by ground water withdrawals by the generation facility; (3) air quality impacts due to air emissions from the proposed facilities, including criteria pollutants and hazardous air pollutants such as trace metals (e.g., mercury); (4) impacts (i.e., climate change) due to GHG emissions from the project; and (5) exacerbation of existing local traffic congestion. Other concerns that were expressed during the scoping process included potential human health risks due to air emissions including carcinogens from the proposed facilities; solid wastes, including disposition of ash and hazardous wastes; floodplain impacts, including flooding and drainage issues; protection of wetlands; ecological impacts, including potential loss of habitat and impacts to protected species; options to mitigate ecological and other impacts; impacts of temporary coal transport; social and economic impacts (positive and negative), including environmental justice; noise impacts; construction impacts; regulatory requirements; indirect (induced) impacts; cumulative effects; mitigation measures, including incorporation of carbon sequestration as part of proposed operations; construction of a proposed CO_2 pipeline in the vicinity of existing energy-related facilities and practices associated with operation of the existing facilities; and the use of alternative feedstock (e.g., biomass) by the proposed facilities.

DOE considered input obtained during the scoping process to add to the list of issues to be analyzed and to provide additional focus to analysis of previously identified issues. Table 1.8-1 lists the composite set of issues identified for consideration in this EIS (i.e., issues identified in the NOI and additional relevant issues identified during public scoping). Issues are analyzed and discussed in this EIS in accordance with their level of importance. The most detailed analyses focus on issues associated with air quality, water resources, and ecological resources.

Table 1.8-1. Issues Identified for Consideration in this EIS

Issues identified in the NOI			
Atmospheric resources	Visual impacts	Ecological resources	Community impacts
Water resources	Floodplains	Safety and health	Cultural resources
Infrastructure and land use	Wetlands	Construction	Cumulative effects
Solid wastes			
Additional issues identified during public scoping that expanded the scope of the assessment			
Impacts on Lake Okatibbee operations		Options for CO_2 capture, transport, and beneficial use and geologic storage	

Source: DOE, 2009.

1.8.3 ALTERNATIVES CONSIDERED

An EIS must analyze the range of reasonable alternatives to DOE's proposed action. The purpose of and need for the proposed action determines the range of reasonable alternatives. In this case, the purpose of and need for DOE action is defined by the CCPI program (and enabling legislation, Public Law 107-63) and the federal loan guarantee program (and enabling legislation, EPAct05). Given these programmatic purposes and needs, the reasonable alternatives prior to selection of this project would have been to select another project that applied to and met the eligibility requirements of the CCPI and loan guarantee programs. For these programs, other applications (and their potential environmental impacts) were considered during the evaluation and selection process. Given the selection of this project under both programs, DOE's decision is whether or not to provide financial assistance, a loan guarantee, or both. Therefore, this EIS analyzes in detail the project as proposed (proposed action), the proposed action as modified by the applicant or in response to conditions such as mitigation and the no-action alternative.

Under the no-action alternative, DOE would provide neither further financial assistance under the cooperative agreement nor a loan guarantee to the project. In the absence of this assistance, Mississippi Power could pursue two options. These options are analyzed under the no-action alternative. First, the gasifiers, syngas cleanup systems, and CT/HRSGs and supporting infrastructure could be built as proposed without DOE funding; this option is essentially the same as the proposed action. The connected actions would remain unchanged. However, this option is not likely given the cost and financial risk associated with such large-scale demonstration projects. Second, Mississippi Power could choose not to pursue the Kemper County IGCC Project. None of the connected actions would likely occur. This option would not contribute to the goal of the CCPI program, which is to accelerate commercial deployment of advanced coal technologies that provide the United States with clean, reliable, and affordable energy. Similarly, the no-action alternative would not contribute to the loan guarantee program's goals of facilitating energy projects that "avoid, reduce, or sequester air pollutants or anthropogenic emissions of GHGs" and "employ new or significantly improved technologies."

Project-specific alternatives considered by Mississippi Power in developing the proposed project are presented in this EIS. These alternatives include possible water supply sources and routes of linear facilities (transmission lines and pipelines) and alternative levels of CO_2 capture. Alternative analyses are described in Chapter 2 (Section 2.7), and their comparative impacts are presented in Chapter 4 (Section 4.4).

Several alternatives to the proposed project that were considered initially as candidates for analysis in this EIS (i.e., approaches that could be practical or feasible both technically and economically) have been dismissed from further consideration. These include alternative sites, alternative project size, alternative fuels, alternative plant layout on the site (the location of the plant footprint within the site boundaries), alternative power generation technologies, alternative mining methods and mine development plans, and options for CO_2 sequestration (e.g., saline aquifers versus sale of CO_2 for use in EOR operations). Each of these alternatives is described in Section 2.7.

This EIS describes and considers the site selection process, based on an analysis that was conducted by Mississippi Power. Mississippi Power found that the only reasonable site is the Kemper County site, based on location of accessible lignite reserves near Mississippi Power's service territory, proximity to infrastructure, topography, including avoidance of floodplains and wetlands, and available open space. The proposed project could be demonstrated at another site; however, site selection was governed primarily by benefits that could be realized by the companies participating in the project. The site selected for the project had to meet the project's technical needs. This EIS does not analyze in detail the alternative sites considered by Mississippi Power, because DOE agrees with Mississippi Power's conclusion that other sites are not reasonable alternatives.

Alternatives evaluated by NACC when developing the mine proposal are presented in the EIS and include potential alternative mine locations; avoiding disturbance of Okatibbee Creek and the USACE Okatibbee Lake WMA; mining methods, including overburden removal, lignite removal, lignite loading, and lignite transport; and reclamation methods in terms of topsoil removal and replacement. Additional mine-related alternatives evaluated by DOE include avoidance and minimization of mining and mine support facilities in floodplains and wetlands as required by DOE regulations.

The proposed project could be demonstrated using a smaller-sized plant. However, this alternative would not meet the project's purpose (Section 1.5) of demonstrating the transport gasification technology at a full commercial size. A smaller-sized plant would not be sufficiently large to achieve economies of scale and demonstrate the commercial viability of the technology. Furthermore, it would not meet the projected future peak demand for electricity.

DOE could demonstrate other technologies. However, these technologies would not demonstrate advanced power generation systems using IGCC technology for low-rank coals and would not meet DOE's need to demonstrate advanced coal utilization technologies with potential to address domestic energy needs (Section 1.5). Alternatives and the basis for their consideration or dismissal are discussed in detail in Chapter 2.

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2. THE PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

DOE has two proposed actions: first, to provide financial assistance and, second, to issue a loan guarantee to the proposed Kemper County IGCC Project at a site in Mississippi (see Section 1.4). The proposed actions are described in the Subsections 2.1.1 and 2.1.2, and connected actions are described in Section 2.2. Sections 2.3 and 2.4 address construction and operation plans, respectively, for the project. Resource requirements are summarized in Section 2.5, and Section 2.6 characterizes outputs, discharges, and wastes from the project. Finally, Section 2.7 presents the reasonable alternatives considered by DOE.

2.1.1 PROJECT SITE LOCATION AND GENERAL DESCRIPTION

The Kemper County IGCC Project would be located on a site in rural southern Kemper County. Figure 2.1-1 illustrates the site. The town of De Kalb, the Kemper County seat, is located 10 miles northeast of the site, while the city of Meridian in Lauderdale County is approximately 20 miles to the south. The Kemper-Lauderdale County line is 4 miles south of the site. The Alabama state line is approximately 23 miles east of the site.

The proposed IGCC electric generating facility would be constructed on a portion of an approximately 1,650-acre undeveloped site. Figure 2.1-2 depicts the site on a USGS topographic map. Figure 2.1-3 shows the site on an aerial photograph taken during the spring of 2008. (Both figures show a small parcel along Mississippi State Highway [MS] 493 [indicated with an X] that is not part of the site.) The site consists principally of uplands; however, there are some wetlands. The former consist mostly of managed pine timberlands, large portions of which have been clear-cut, while the latter are mostly mixed hardwood forests. The site's topography is characterized by undulating sand/clay hills, and land elevations vary from 400 feet above mean sea level (ft-msl) along a creek in the southwestern corner to 500 ft-msl in the northeastern corner. The site is characteristic of the surrounding area.

Chickasawhay Creek skirts the site's western boundary. The site is also intersected by several intermittent creeks. The small community of Liberty straddles MS 493 at the site's northern boundary. The recent aerial photograph (Figure 2.1-3) also shows a cleared area in the northeastern portion of the site where Mississippi Power has constructed a water supply test well.

The major permanent facilities of the proposed IGCC power plant, including certain supporting facilities and infrastructure, would likely occupy approximately 300 to 550 acres of the 1,650-acre site. Additional site acreage would be used during construction. Other portions of the site would be used for mine-related facilities, as discussed later, and would require approximately 350 more acres, some only temporarily.

2.1.2 TECHNOLOGY AND PROJECT DESCRIPTION

The proposed Kemper County IGCC Project would demonstrate air-blown coal gasification and syngas cleanup systems, which would be integrated with a standard combined-cycle power-generating unit to form an IGCC power plant. Syngas derived from coal in the gasifier would be used as the fuel for the combined-cycle power generating unit. In a combined-cycle unit, fuel gas is combusted in one or more CTs, and hot exhaust gas exiting the CTs is then used to heat water into steam to drive a steam turbine. The use of the CTs' exhaust heat to

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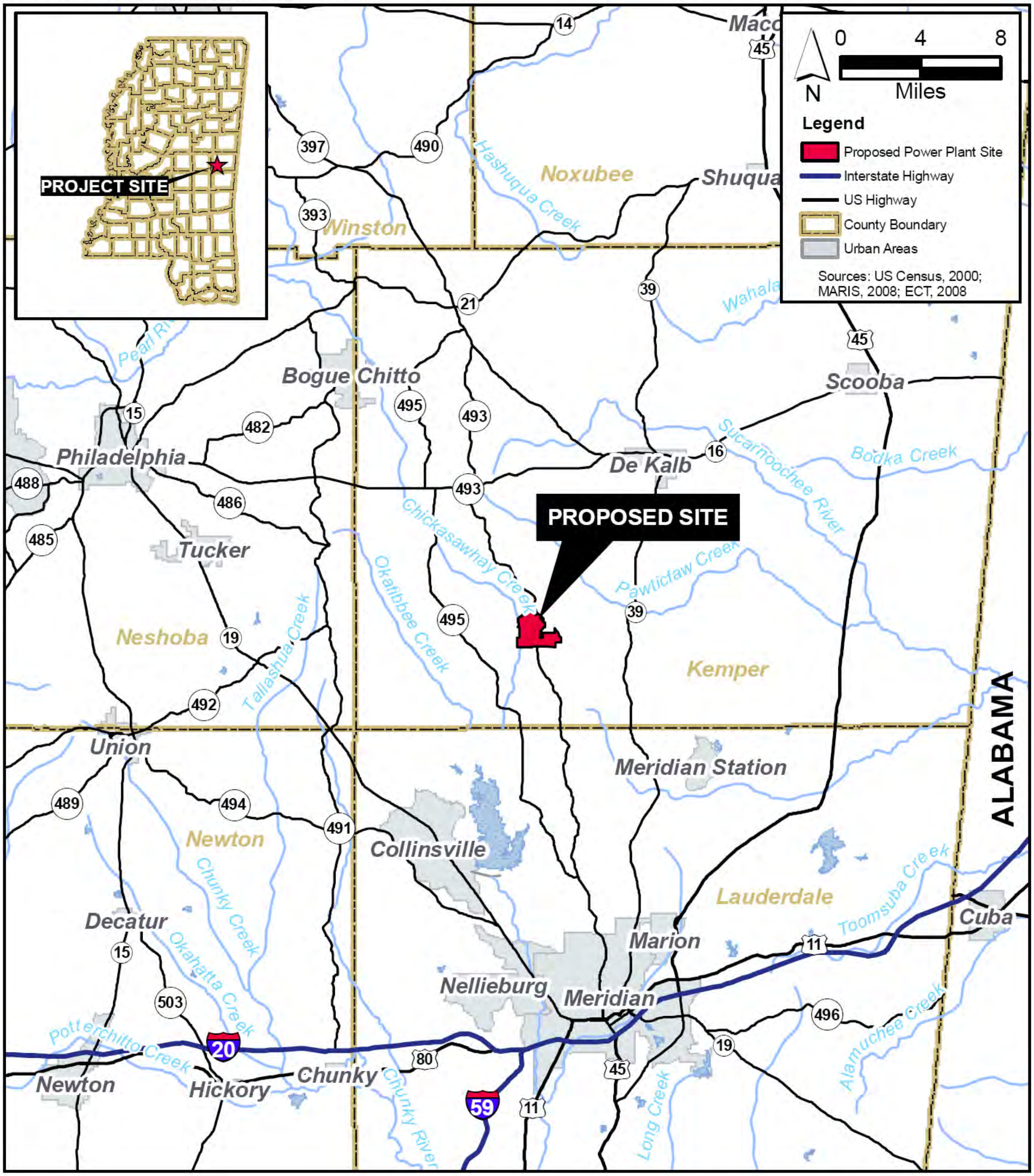

Figure 2.1-1. Location of the Proposed Kemper County IGCC Project Site

Sources: U.S. Census, 2000. MARIS, 2008. ECT, 2009.

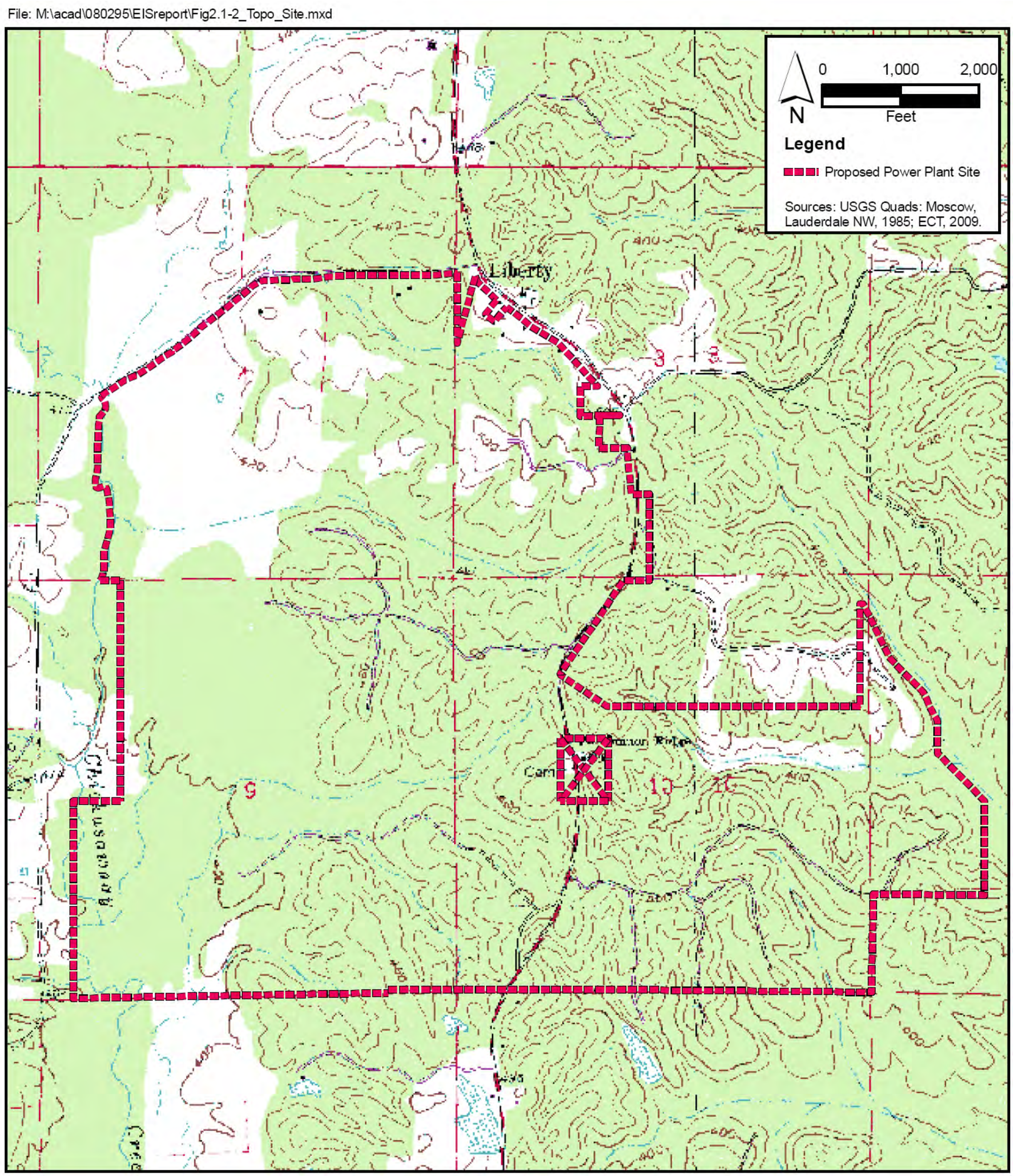

Figure 2.1-2. Topography of the Proposed Kemper County IGCC Project Site

Sources: USGS Quadrangles, Moscow, Lauderdale Northwest, 1985. ECT, 2009.

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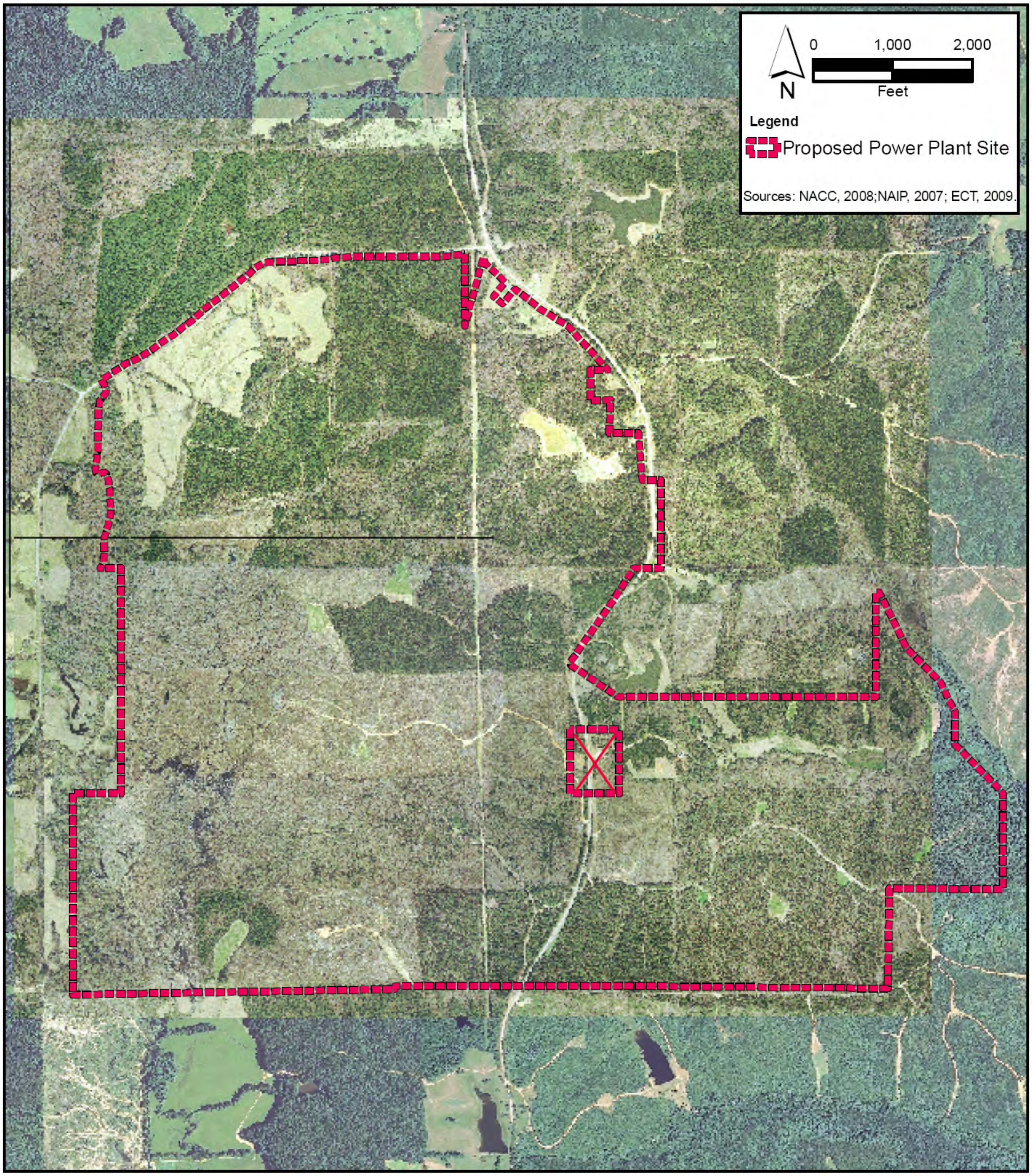


Figure 2.1-3. Aerial Photograph of the Proposed Kemper County IGCC Project Site
Sources: NACC, 2008. ECT, 2009.

power a steam turbine constitutes the combined-cycle approach, which is a proven and reliable method for increasing the amount of electricity that can be generated from a given amount of fuel. The two CTs and steam generator for the Kemper County IGCC Project would generate a nominal 582 MW (net) of electricity when duct firing natural gas in the HRSG. The project is expected to provide Mississippi Power customers a source of electricity that is reliable, low-cost, environmentally sound, and efficient. A key performance target for the proposed technology would be achieving gasifier availability of at least 80 percent without the use of a spare gasifier.

The facilities would convert lignite coal into syngas for generating electricity while reducing SO_2, NO_x, mercury, and particulate emissions as compared to conventional lignite-fired power plants. The plant would also capture a portion of the carbon from the syngas for compression and delivery for beneficial use in existing EOR operations in Mississippi to reduce CO_2 emissions from the facility (see Subsection 2.1.2.11).

The overall IGCC facilities can be divided into two major systems or components: lignite coal gasification and combined-cycle power generation. Figure 2.1-4 provides a flow diagram of the overall proposed project.

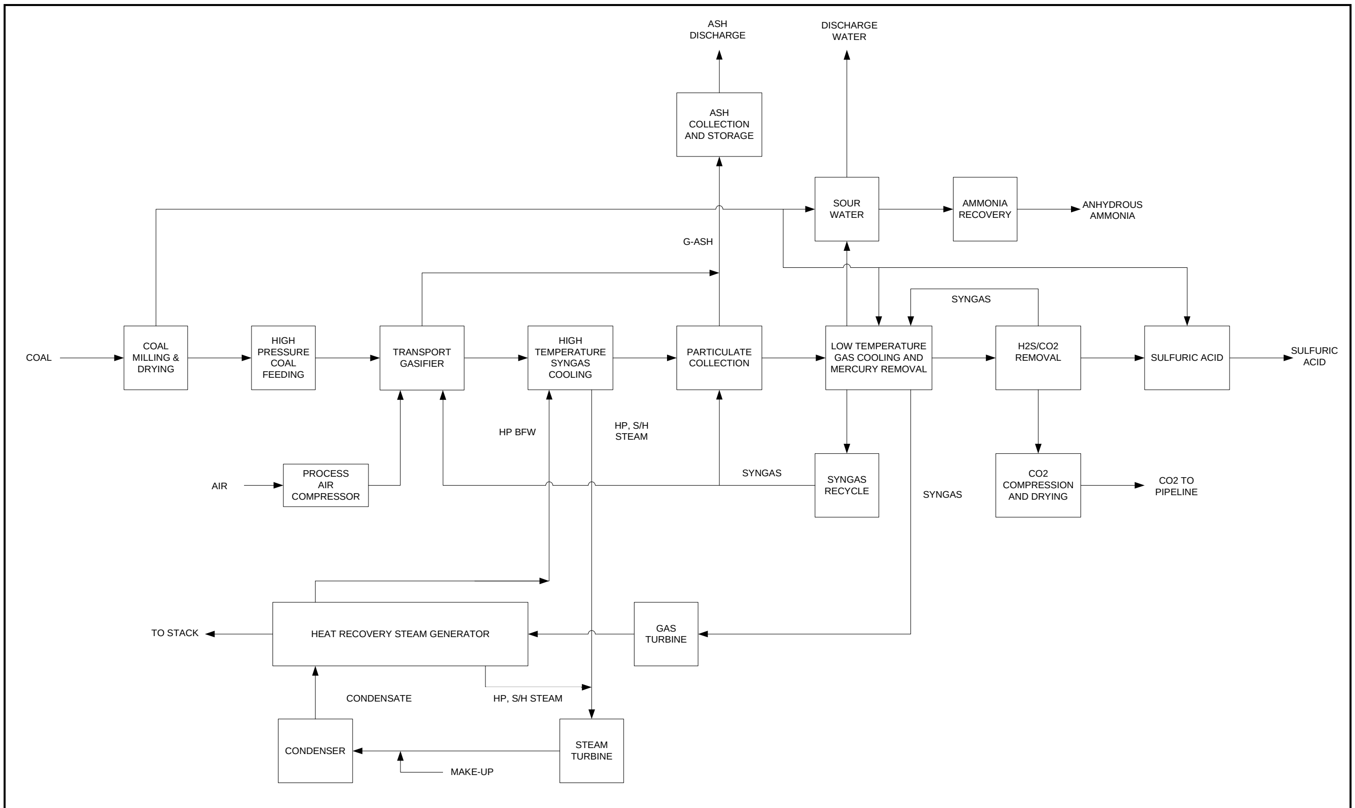


Figure 2.1-4. Process Flow Diagram of Proposed Kemper County IGCC Project
Source: SCS, 2008.

The gasification component would consist of two lignite coal gasifiers utilizing TRIG™ IGCC technology, syngas cleanup systems, a cooling tower, and other supporting infrastructure. The combined-cycle component's principal equipment would include two gas CTs, two HRSGs, a single steam turbine, a separate cooling tower, and associated support facilities. The CTs would be capable of operating on either natural gas or syngas. Reclaimed water from Meridian's municipal system would provide the main water supply required for cooling water makeup, steam cycle makeup, and other processes.

The air-blown TRIG™ gasifiers would be based on KBR's fluidized catalytic cracker design. Southern Company, KBR, and DOE have been developing the TRIG™ technology since 1996 at a research facility near Wilsonville, Alabama. At full design capacity, the new gasifiers would use an average of up to 13,800 tpd of lignite coal to produce syngas. The design coal feed rate to each gasifier would be approximately 290 tons per hour (tph). Most of the sulfur and other constituents in the coal would be removed from the syngas before delivery to the gas turbines. Each gasifier would produce the total syngas requirement for a single CT: approximately 425 tph of syngas with a lower heating value of approximately 2,240 British thermal units per pound (Btu/lb). The energy efficiency of the IGCC plant would be approximately 42 percent gross and 29 percent net based on HHV (SCS, 2009).

Among coal gasification technologies, the TRIG™ technology is one of the most cost-effective when using low-quality coal, including lignite, as well as coal with high-moisture or high-ash content. These coals comprise half the proven United States and worldwide reserves. The plant would be designed for operation on lignite coal, and a lignite surface mine would be located immediately northwest, west, and south of the power plant site.

The proposed project would reduce SO_2, NO_x, mercury, and particulate emissions by removing constituents from the syngas. The removal of nearly 100 percent of the fuel-bound nitrogen from the syngas prior to combustion in the gas turbines would result in appreciably lower NO_x emissions compared to conventional coal-fired power plants. The project is expected to remove up to 99 percent of the sulfur and more than 92 percent of the mercury. More than 99.9 percent of particulate emissions would be removed using a rigid barrier filter system (SCS, 2009).

The facility is planned for carbon capture systems sufficient to reduce CO_2 emissions by up to approximately 67 percent by removing carbon from the syngas during the gasification process. This level of CO_2 removal may be nominally identified as *65-percent removal* (or *natural gas equivalence*) because it would result in an average CO_2 emission rate of approximately 800 to 820 pounds per megawatt-hour (lb/MWh), which is nominally equivalent to the CO_2 emission rate from a natural gas-fired combined-cycle unit of approximately 800 to 850 lb/MWh. The CO_2 would be compressed and piped offsite for beneficial use via EOR. The CO_2 pipeline would be another of the project's connected actions. Because the planned CO_2 removal technology has not been commercially demonstrated at a facility like the proposed IGCC power plant, and in light of the anticipated evolving regulatory treatment of CO_2, short-term capture rates could vary from 0 percent (for example, due to a malfunction of the CO_2 compressor) up to the design of 67 percent. Annual average capture rates near 67 percent would be expected, and this design case provides the basis for the estimates in this chapter; however, the tables in this chapter also provide data on emissions and byproduct production rates for a range of CO_2 capture from 50 to 67 percent on an annual average basis.

The proposed project would discharge no process water effluent from the site. Ash generated by the gasifiers would be stored onsite and would be evaluated for beneficial use at the adjacent mine or for placement in an onsite management unit. Beneficial use of the ash could include industrial processes such as building roads, soil amendment, or for other uses as approved by MDEQ. Commercial grade anhydrous ammonia and sulfuric acid (H_2SO_4) would be recovered as byproducts and marketed. The markets for both ammonia and H_2SO_4 are well established. With regard to the H_2SO_4 market, purchasers of this byproduct would be available regionally. Moreover, in the event that market conditions existed where supply exceeded demand, H_2SO_4 would be sold at below-market rates to large users, such as the phosphate industry that normally generates H_2SO_4 onsite from elemental sulfur. If marketing of the anhydrous ammonia produced at the facility were not possible, the ammonia would either be used at this and other Southern Company generating plants in their SCR air emission control systems, or it would be recycled within the gasifier for oxidation and converted to nitrogen (N_2) and hydrogen (H_2) or water (H_2O).

Figure 2.1-5 provides the arrangement of the proposed IGCC power plant equipment on the site. Key equipment and facilities are identified. Note that some onsite facilities would be associated with the surface lignite mining operation, not the power plant itself; prominent among these would be permanent coal handling facilities, roads for hauling lignite to the point of transfer to the power plant, and warehouse, shop, and office buildings. A small portion of the initial mine area and two mining-related sedimentation ponds would occupy land within the site, as discussed subsequently.

Based on the layout shown in Figure 2.1-5, Figure 2.1-6 presents a computerized rendering of the proposed facilities superimposed on an aerial photograph of the site that faces generally southwest. The following subsections provide details of the key processes within the gasification and electrical power generation facilities.

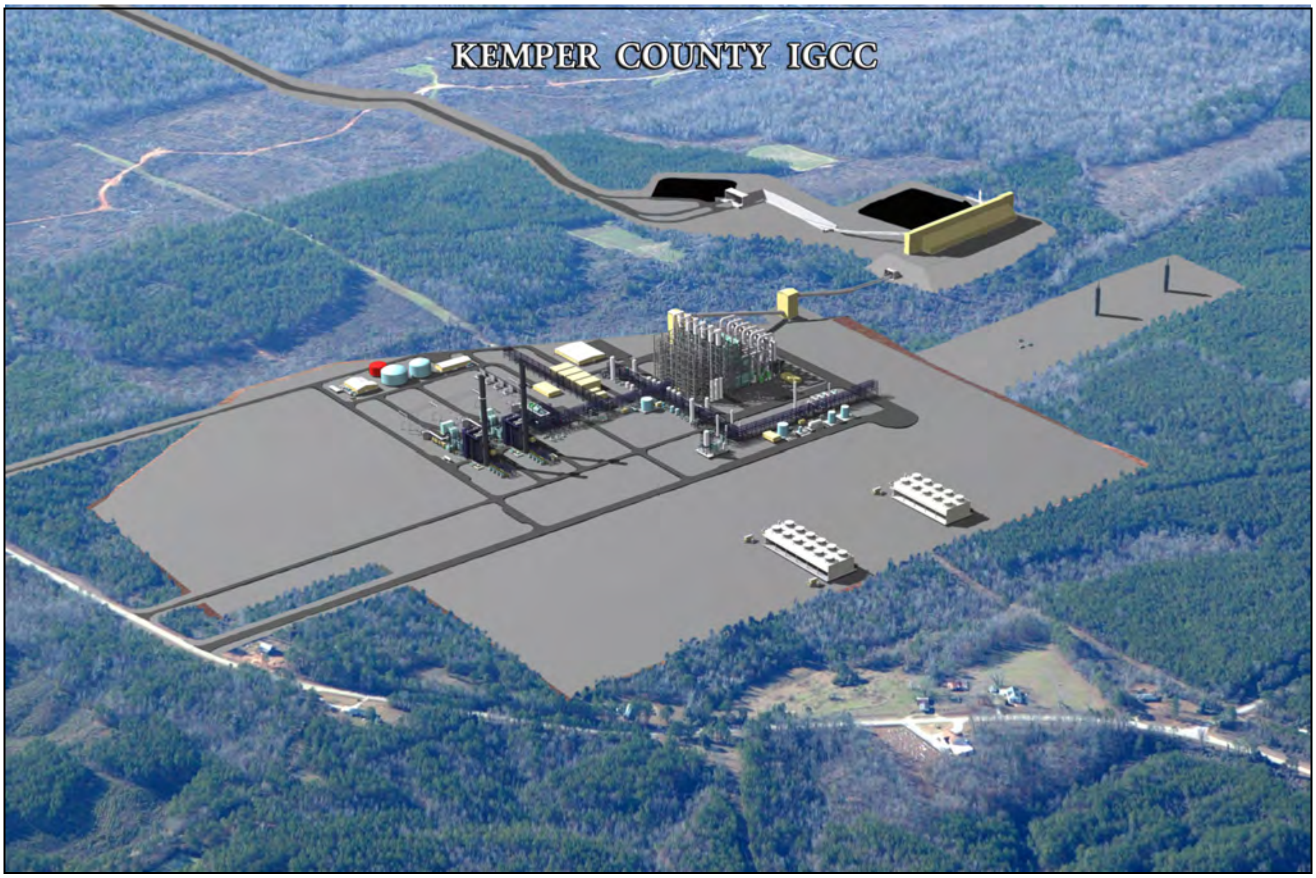


Figure 2.1-6. Concept Rendering of the Proposed IGCC Project Facilities
Source: SCS, 2009.

2.1.2.1 Lignite Receiving, Storage, Handling, and Feeding

The design of the IGCC plant is based on the use of lignite coal that would be mined at the adjacent surface mine (see Section 2.2). Off-road mining trucks would deliver lignite to a covered truck dump hopper, located adjacent to the power plant. An apron feeder would feed the lignite into the mill for primary crushing/sizing. A

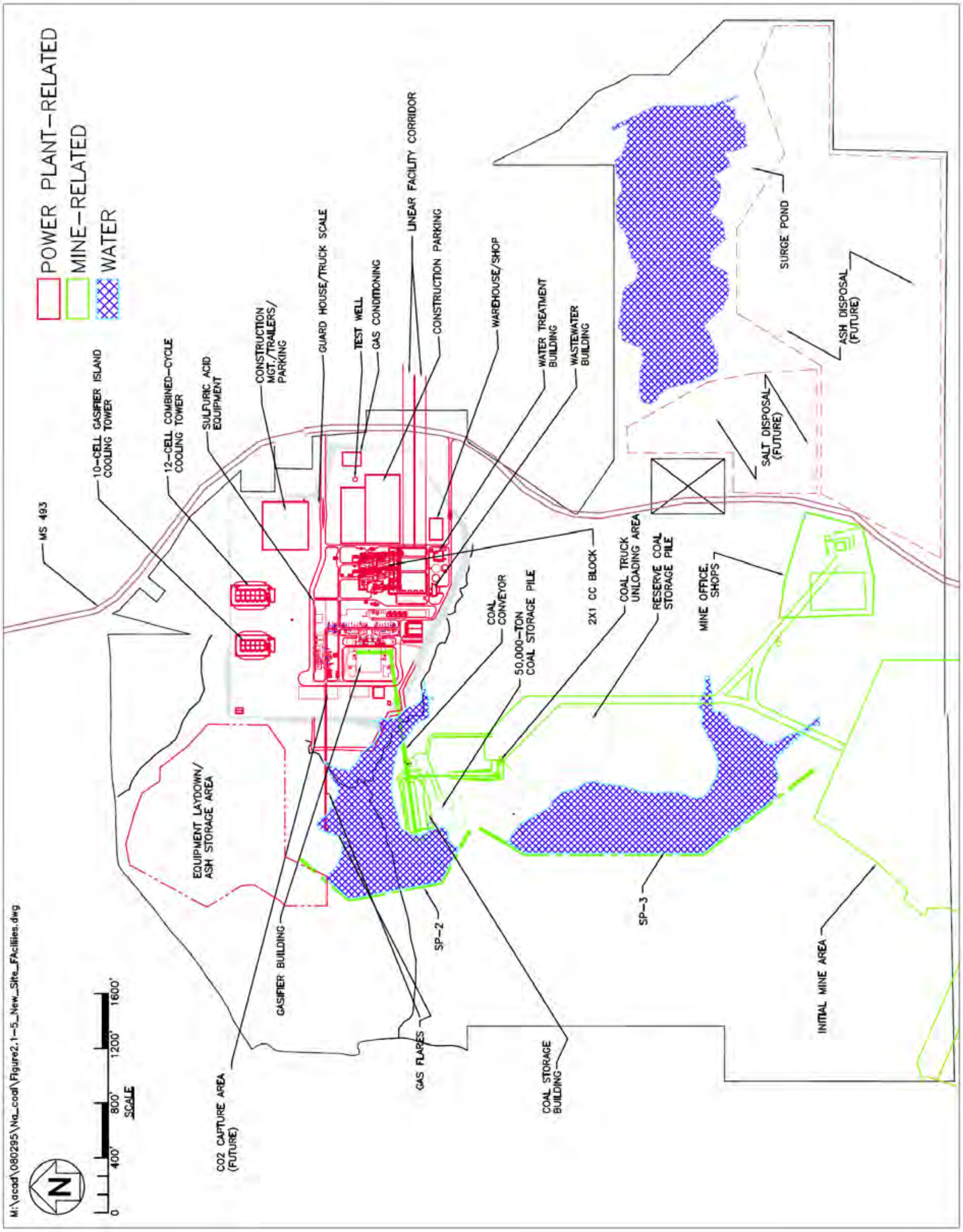


Figure 2.1-5. Planned Arrangement of Equipment and Facilities on the Kemper County IGCC Project Site

Sources: SCS, 2009. NACC, 2009. ECT, 2009.

conveyor would transfer the lignite to the secondary sizer. The crushed lignite would then be conveyed to the covered lignite barn and distributed in the barn by a traveling belt tripper. An emergency lignite pile would be located outside the barn. A redundant series of conveyors would reclaim the lignite from the barn with rotary plow feeders and convey the lignite to a transfer structure, which would load another set of conveyors and continue to the tripper conveyors to transfer the lignite from the mine into six silos located in the power plant.

At the power plant, lignite from the silos would be fed into a crusher and then into a fluid-bed dryer, where it would be dried to the specified moisture content. The lignite coal leaving the fluidized bed dryer would flow into the coal mill where it would be pulverized, and a conveying gas would carry the pulverized coal to the pulverized coal baghouse. The fluid-bed dryer exhaust gas would be sent to a multistage cyclone where any elutriated solids would be separated from the gas stream. These solids removed from the gas would combine with the elutriated solids leaving the coal mill and flow into the pulverized coal baghouse. The exhaust gas exiting the multistage cyclone would be sent to a venturi scrubber, where the gas would be cooled with cold water to condense the moisture from the wet coal. The condensed water would be used elsewhere in the gasification process. The cooled, saturated gas would be heated and sent back to the fluid-bed dryer. Any entrained coal fines in the multistage cyclone exhaust would be captured by the venturi scrubber and separated from the water by a belt filter press. The coal fines from the belt filter press would be added to the pulverized coal feed.

The pulverized coal baghouse would be located directly above the pulverized coal silo. The pulverized coal would be separated from the conveying gas and dropped into the pulverized coal silo. The gas exiting the baghouse would be sent through a fan and back to the coal pulverizer.

2.1.2.2 Transport Integrated Gasification (TRIG™)

Each of the two gasifiers would consist of an upright looped set of piping with a total height of approximately 185 ft (Figure 2.1-7). Lignite, which would be injected near the top of the mixing zone, and air, which would be fed into the bottom of the mixing zone, would mix with gasifier ash recirculated through the J-valve from the standpipe. Approximately 435 tph of compressed air would be supplied to the gasifier during operation. Oxygen in the air would be consumed by carbon present in the recirculating ash, forming primarily carbon monoxide (CO). This reaction would release the heat required to maintain vessel temperature. The hot recirculating ash would heat the lignite rapidly, minimizing tar formation, and the lignite would be converted to syngas.

Syngas and gasification ash would pass from the mixing zone up the riser and then to staged solids separation devices where larger, denser particles would be removed in stages and collected into the standpipe. The combined ash would pass down the standpipe and through the J-valve into the mixing zone, while the syngas would continue to the gas coolers and

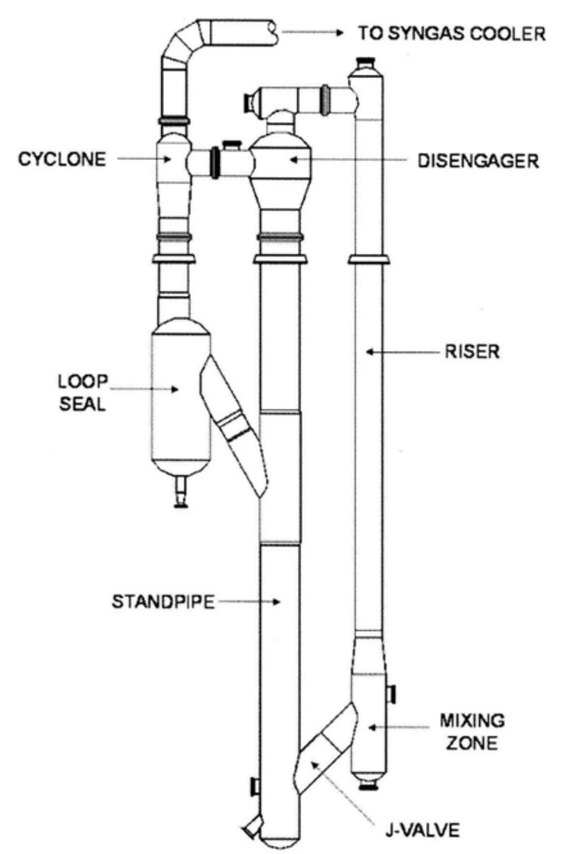


Figure 2.1-7. Side View of a Gasifier
Source: SCS, 2008.

filter devices. Since a vast majority of the solids would remain in the gasifier, gasification ash would be removed periodically from the gasifier to maintain constant gasifier bed inventory.

During gasifier startup, natural gas and/or fuel oil-fired burners would be used to heat the gasifier until reaching a sufficient temperature to initiate lignite feed. Because the exhaust gas from the burners would not be combustible, the exhaust gas would be vented to the startup stack instead of the flare. Once the gasifier reached a sufficient temperature during startup, the injection of lignite would begin, and the airflow would be reduced until the atmosphere in the gasifier formed a reducing environment rather than an oxidizing environment. Subsequently, the lignite would be gasified, and syngas would be produced. Because the flow of syngas would initially be insufficient to send to the CT, it would first be sent to the flare and burned after passing through particulate and mercury collection systems. As the gasifier reached a syngas production level sufficient to support the operation of the CT, the syngas would be routed through acid gas removal (AGR) systems and would then be diverted from the flare to the turbine.

The duration of the startup sequence could vary significantly, depending on a number of factors including the starting temperature of the gasifier. During a cold start, approximately 18 hours would elapse prior to sending syngas to the gas turbine due to the time required to heat the gasifier refractory. The typical startup period would include approximately 16 hours of exhausting gas through the startup stack and approximately 2 hours of combusting syngas in the flare.

2.1.2.3 High-Temperature Syngas Cooling

Syngas leaving each gasifier cyclone would pass via piping to a high-temperature syngas cooler that would lower the gas temperature before it enters a particulate filter system. The heat transferred would be used to raise the temperature of high-pressure superheated steam.

The syngas cooler would consist of three stages: an evaporator, a superheater, and an economizer. The evaporator would include a natural circulation steam drum operating at above steam turbine inlet pressure and at saturated temperature. The steam raised in the evaporator would be passed to a superheater that would heat the steam to the steam turbine inlet temperature. This steam would be mixed with superheated steam exiting the combined-cycle unit’s HRSG (Subsection 2.1.2.9) before passing into the steam turbine. Boiler feedwater would enter the economizer and would be heated to near saturation before entering the steam drum.

2.1.2.4 Particulate Collection

After cooling, syngas would pass via piping to the particulate filter system for final particulate removal. The filter system would use rigid, barrier-type filter elements to remove essentially all of the particulate matter (PM) in the syngas stream. Pulses of recycled, filtered syngas would be used to remove accumulated PM from the filters. Downstream of each filter element, a device would safeguard the CT from particulate-related damage in the event of a filter element failure.

Each of the two filter systems per gasifier would remove approximately 12.5 tph of PM from the syngas stream. The concentration of PM in the cleaned syngas is expected to be less than 0.1 part per million (ppm) by weight. The syngas streams would exit the filter vessels and flow to the low-temperature heat recovery system. The removed PM (fine ash) would be cooled and depressurized to ambient conditions before leaving the gasification facilities. This fine ash would then be managed as discussed in Subsection 2.6.3.2.

2.1.2.5 CO_2, Sulfur, and Mercury Removal

Carbon, sulfur, and mercury removal would begin in the low-temperature gas cooling section of the IGCC plant. To remove carbon from the syngas in the AGR system, approximately 90 percent of the CO in the syngas must first be converted to CO_2. This step would occur in a water gas shift (WGS) reactor, according to the equation $CO + H_2O \leftrightarrow CO_2 + H_2$.

The syngas leaving the gasifier and entering the WGS would not contain enough water to convert the necessary CO to CO_2. So, the syngas must first pass through a saturation column where the hot syngas would evaporate warm water, increasing the water content of the syngas. This saturation column would also remove essentially all chlorine and fluorine from the syngas. The purge water from the saturation column would go to the sour water system for removal of any dissolved gases. The syngas would flow through two WGS reaction vessels in series, producing a significant amount of heat, which would raise the temperature of the syngas. This heat would be recovered and used elsewhere in the gasification process and the syngas cooled to approximately 400 degrees Fahrenheit (°F).

To remove sulfur in the acid gas system, the syngas would then enter a carbonyl sulfide (COS) hydrolysis reactor. This step would be necessary, because the sulfur removal process operates best when COS in the syngas is first converted to hydrogen sulfide (H_2S). After the COS hydrolysis reactor, the syngas would pass through the low-temperature gas cooling area before entering a water scrubber for final ammonia removal via condensation. The syngas would then flow to the AGR process for H_2S and CO_2 removal. In this process, the syngas would be contacted with a solvent to remove H_2S from the syngas stream. The H_2S in the solvent would be stripped from the solvent and converted to concentrated H_2SO_4. The stripped solvent would be returned to the sulfur removal process. After the H_2S removal step, the syngas would then flow through a second solvent contactor where the CO_2 is removed from the syngas.

Following the H_2S and CO_2 removal processes, the syngas would be heated and then flow through a reactor containing alumina-based metal sulfide to remove mercury from the syngas. After mercury removal, the syngas would be heated to the temperature required for entering the gas turbine. Upon exiting the low-temperature gas cooling system and mercury removal, approximately 88 percent of the sweet syngas would flow to the CT, while the remaining 12 percent would pass to the syngas recycle system. Some of the recycled syngas would be sent to the pulse-gas reservoirs and used to pulse clean the high-temperature, high-pressure filters, while the remainder would be used for aeration in the gasifier and as an oxygen-deficient gas supply for auxiliary processes.

2.1.2.6 Sulfur and CO_2 Recovery

Sulfur removed in the AGR system would be recovered in the wet gas sulfuric acid (WSA) process. The acid gas containing H_2S would be converted to SO_2 with air in an incinerator. Steam would be generated in a waste heat boiler, and excess air, SO_2, and other combustion products would be carried through a catalytic converter where SO_2 would be catalytically oxidized into sulfur trioxide (SO_3). Finally, SO_3 would be condensed as concentrated H_2SO_4 in the WSA condenser.

Prior to compression the removed CO_2 stream must be dried to meet pipeline specifications. This could be achieved in several ways, but the facility would plan to accomplish this by passing the removed CO_2 stream through a standard gas desiccant drying unit. To meet pipeline specifications for delivery for EOR, the AGR process would be designed to ensure the purity of the CO_2 stream was approximately 99 percent with less than 1 percent inert gases. The CO_2 would then be compressed to the 2,100 pounds per square inch (psi) required to enter the pipeline. In the event the CO_2 is not placed into the pipeline, the CO_2 stream would be vented to the atmosphere through vent stacks located within the AGR system or the IGCC stacks.

2.1.2.7 Sour Water Treatment and Ammonia Recovery

As the syngas is cooled in the low-temperature gas cooling section described previously, water in the syngas would condense out. This water would remove most of the ammonia in the syngas as well as lesser amounts of CO_2, CO, and H_2S. This aqueous mixture would be removed from the syngas stream in a knockout drum and passed to the sour water treatment plant. The sour water treatment and ammonia recovery unit would treat approximately 275 gallons per minute (gpm) of water. The combined water flow would collect in a wastewater drum before passing to an activated carbon bed to remove any organic material.

Next, the sour water would be heated and passed to the steam-heated H_2S stripper where H_2S, hydrogen cyanide (HCN), CO, and CO_2 would be released, recompressed, and sent to the AGR section of the process. The water from the H_2S stripper would discharge to the steam-heated ammonia stripper to produce a concentrated ammonia solution. The water drawn from the bottom of the ammonia stripper would be sufficiently pure for plant reuse.

The concentrated ammonia solution would be processed further in an additional steam-heated stripper to increase the ammonia concentration to approximately 99.5 percent. The water drawn from the bottom of this column would also be sufficiently pure for plant reuse. The ammonia produced would be commercial-grade anhydrous ammonia. Excess anhydrous ammonia could be sold in the commercial market.

Provisions would be made to recycle the ammonia to the mixing zone of the gasifier for destruction if removal of the anhydrous ammonia by truck was to be delayed and the storage tank was approaching full. The recycling of ammonia would be straightforward. The sour water treatment plant would operate at higher pressure, so the ammonia would be at a pressure sufficient for it to be in a liquid state. Therefore, it would need only to be pumped to the gasifier and would enter the gasifier in the oxidizing zone for decomposition.

2.1.2.8 Flare

The IGCC power plant's gasification component would be equipped with one or two flare derricks. The flares would be used for combustion of syngas during startups, shutdowns, and plant upsets (e.g., a sudden shutdown of the combined-cycle unit's gas turbine) and to combust exhaust gases that could not be safely vented to the atmosphere during process upsets and emergencies. The flares might also be used to continuously combust smaller exhaust gas streams from various process vent streams associated with the gasification process.

The flare derricks would be approximately 150 ft tall and would be equipped with multiple natural gas-fired pilots with a total nominal rating of 6 million British thermal units per hour (MMbtu/hr). These pilots would operate continuously to ensure the flare is ready to combust syngas immediately in the event of a plant upset. While the pilots are operating, a flame would rise only a few feet above the top of the flare derricks. As discussed in Subsection 2.1.2.2, during gasifier startup, the flow of syngas would initially be insufficient to send to the CT, and it would first be sent to the flare. The typical startup period would include approximately 2 hours of combusting syngas in the flare. The height of the flame above the flare derrick would steadily increase during the startup period reaching a height of approximately 150 ft. Shutdowns would result similarly but in reverse. There would be approximately 20 startup and shutdowns per gasifier annually during the demonstration phase.

During a plant upset when the CT is operating at full load and syngas is safely routed to the flare, the flame height would rise approximately 200 to 300 ft above the top of the flare derricks. The flames would be nearly invisible during daylight hours, except for shadows from heat effects, while a bluish purple flame would be visible at night. It is expected that periods of operating the flare at full load (i.e., due to plant upsets) would be brief and infrequent, lasting approximately 2 hours. CTs firing natural gas might be expected to experience an upset approximately once or twice per year. Part of the demonstration project would include defining and minimizing the number of upset on this syngas fired CT. Figure 2.1-8 is an illustration of a typical flare derrick with a single flare, similar to what is planned for the proposed project.

2.1.2.9 Combined-Cycle Systems

The proposed combined-cycle system would include two CTs, each with a dedicated HRSG, and associated auxiliary, control, and other support systems and facilities. The heat input ratings of the two models are almost identical. The two CT/HRSG trains would supply steam to a single steam turbine. This arrangement of equipment is referred to as a 2-on-1 configuration, a standard configuration in the power industry. Figure 2.1-9 provides a schematic of a combined-cycle system, showing a CT, an HRSG, a steam turbine, and other key components.

Figure 2.1-8. Typical Flare Derrick with a Single Flare

Source: SCS, 2009.

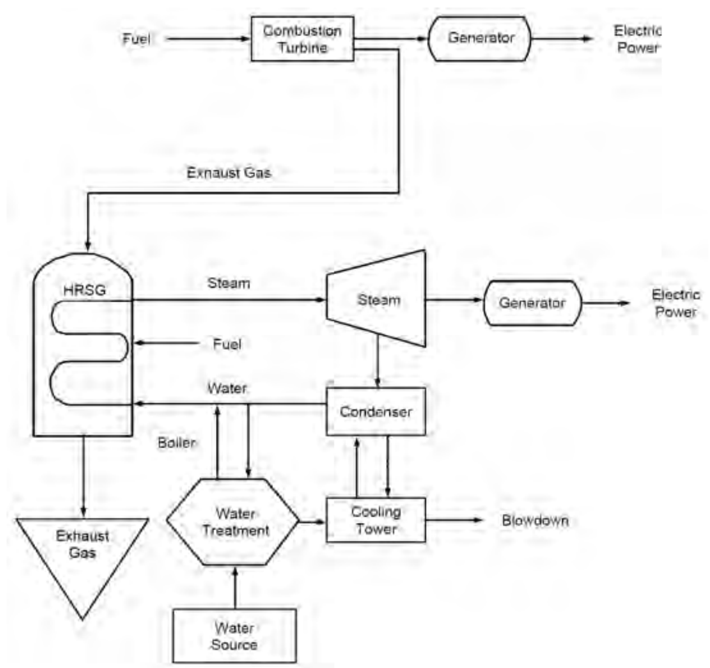


Figure 2.1-9. Conceptual Schematic of a Combined-Cycle System

Source: ECT, 2008.

The CTs would convert energy stored in the syngas (or natural gas) into mechanical energy using compressed hot gas (i.e., air and products of combustion) as the working medium. Each CT would deliver mechanical energy using a rotating shaft to drive an electrical generator, thereby converting a portion of the mechanical output to electrical energy. Initially, ambient air would be filtered and then compressed by the CT's compressor section, which would increase the pressure of the combustion air stream and also raise its temperature. The compressed combustion air would then be combined with syngas, which would be ignited in the CT's high-pressure combustor to produce hot exhaust gases. These high-pressure, hot gases would expand and drive the turbine section to produce rotary shaft power and electricity.

The heat in each CT's exhaust gases would be used to generate steam from water in an HRSG. The HRSG would be equipped with natural gas-fired duct burners to boost power generation capability during periods of peak demand. The steam would be used to drive a steam turbine and generator to produce additional electricity.

High-pressure superheated steam from the syngas cooler and the HRSG would enter the steam turbine. Steam exhausted from the high-pressure portion of the steam turbine would be reheated in the HRSG, expanded through the intermediate- and low-pressure portions of the steam turbine, and then condensed for reuse in the steam cycle of the HRSGs.

2.1.2.10 Cooling Towers and Makeup Water Pond

The IGCC facility would include two multi-cell cooling towers. The combined-cycle unit would be supported by a 12-cell wet mechanical-draft cooling tower to provide the cooling necessary to condense the steam that exhausts from the steam turbine and generator as well as provide additional equipment oil cooling. A water-cooled steam surface condenser would also be used, and the condensate would be collected in the hot well of the condenser and pumped back to the HRSG. Cooling water would be supplied to the surface condenser from the cooling tower. The gasifier system would be equipped with a separate, 10-cell wet mechanical-draft cooling tower to provide cooling for the gasifier equipment and processes. Multiple heat exchangers would be used to transfer the heat from the closed loop gasifier cooling water to the cooling tower circulating water.

To provide makeup supply water to the cooling system to replace water lost through evaporation, reclaimed effluent from two publically owned treatment works (POTWs) in Meridian, Mississippi, would be used. To provide for weather-related events and accommodate the seasonal variability of reclaimed water flow from the Meridian POTWs, Mississippi Power would construct an approximately 1,000 acre-foot (ac-ft) surge pond on the plant site to manage the supply of makeup water. If inadequate supplies of makeup water were available from the POTWs, nonpotable ground water from onsite wells would supplement the surge pond as necessary. The planned location of the surge pond on the plant site is indicated on Figure 2.1-5. The power plant's water supply plans are discussed further in Subsection 2.5.2.

2.1.2.11 Beneficial Use of CO_2 for EOR and Geologic Storage

CO_2 captured from the Kemper County IGCC power plant would be compressed onsite to approximately 2,100 psi. At this pressure the compressed CO_2 is in a dense phase, which means it behaves as a liquid. This *liquid* CO_2 would be delivered to an underground CO_2 pipeline. The CO_2 would be transported via this pipeline to a maturing oil field, where it would be injected by the owner of the oil field under a Class II Underground Injection Control (UIC) permit for EOR. CO_2 EOR is the process of injecting CO_2 into an oil reservoir for the purpose of producing additional quantities of oil from a mature oil field. Generally speaking, CO_2 EOR is conducted after primary (initial extraction) and secondary (waterflood) operations are complete or near complete. The oil remaining in the reservoir after primary and secondary operations is immobile due to several factors, including the surface tension that exists between the sand grains in the depleting formation and the oil, increased viscosity of the oil, and reduced pressure in the reservoir. The injection of CO_2 (typically injected in the dense phase) increases the reservoir pressure, reduces the surface tension, and reduces the viscosity, which results in the ability of the oil to become mobile and be recovered. The oil and CO_2 actually mix and have the possibility of becoming fully miscible in some reservoirs depending on the specific gravity of the oil, temperature of the reservoir, and reservoir pressure (SCS, 2009).

The primary benefit of CO_2 injection is to increase the pressure in the reservoir. Regardless of whether the oil and CO_2 are fully miscible, the oil and CO_2 mixture flow through the reservoir together and are brought to the surface together. The pressure decreases in this CO_2/oil mixture as it is brought to the surface. As a result, the CO_2 and oil begin separating. The majority of the separation is due to the CO_2 changing from the dense liquid phase back to a gas and breaking out of the oil. At the surface, the oil and CO_2 are separated through a series of vessels where the pressure is reduced even further. Heat is added to complete the separation of the oil and CO_2. The CO_2 is not vented but is captured, recompressed, and injected back into the reservoir, and the cycle, known as a sweep cycle, begins again. The oil is stored in surface tanks at near atmospheric pressures. The oil tanks are equipped with vapor recovery units that capture any minor amounts of CO_2 that remained in the oil after the separation process. The CO_2 injected in the oil recovery operations would be managed in this closed loop system. On an on-going injection volume basis, a percentage of the CO_2 would be physically or chemically trapped in the geological formation and stay in the reservoir permanently.

The majority of the CO_2 in EOR is sequestered by physical means. The CO_2 essentially replaces the oil, natural gas, and water volumes or get trapped in small pore spaces that are not interconnected to the effective pore space. Additionally, capillary forces also trap some of the CO_2. During each sweep cycle, more than approximately 50 to 67 percent of the injected CO_2 injected returns with the produced oil, while the CO_2 in the produced oil would be recycled and reused in the next sweep cycle in a closed loop (IPCC, 2005). Because this would be a closed system, during normal operations no CO_2 would be released to the atmosphere. After each sweep cycle, additional CO_2 would become sequestered in the geologic formation. Minute equipment leaks could occur and CO_2 could be vented during EOR plant upsets. The volume of CO_2 released in these incidents would be very small (less than 1 percent of the total of injected CO_2).

CO_2 captured from the proposed Kemper County IGCC Project would be transported via pipeline for EOR at existing oil fields in Mississippi. Mississippi Power is currently negotiating with the owner and operator of these existing oil fields to sell CO_2 from the project. This owner already conducts EOR operations at these fields, which are located in the Eutaw, Tuscaloosa, and Hosston formations The CO_2 could be injected from 5,000 to 12,000 feet below land surface (ft bls). Because the existing oil fields already conduct EOR activities, CO_2 received from the IGCC project would displace the oil field owner's current sources of CO_2, including naturally occurring CO_2 from the Jackson Dome.

2.2 CONNECTED ACTIONS

While the proposed Kemper County IGCC Project would consist of the gasifiers, syngas cleanup systems, two CT/HRSGs, a steam turbine, and other power plant facilities, the complete project would also include the construction and operation of a contiguous surface lignite coal mine, a reclaimed effluent supply pipeline, a natural gas supply pipeline, associated transmission lines (and substations), and a CO_2 pipeline, as connected actions.

Figure 2.2-1 shows the locations of these facilities; each is described in the following subsections. The pipelines and transmission lines are sometimes collectively referred to as *linear facilities*. Figure 2.2-2 provides a closer look at these facilities in and around Meridian.

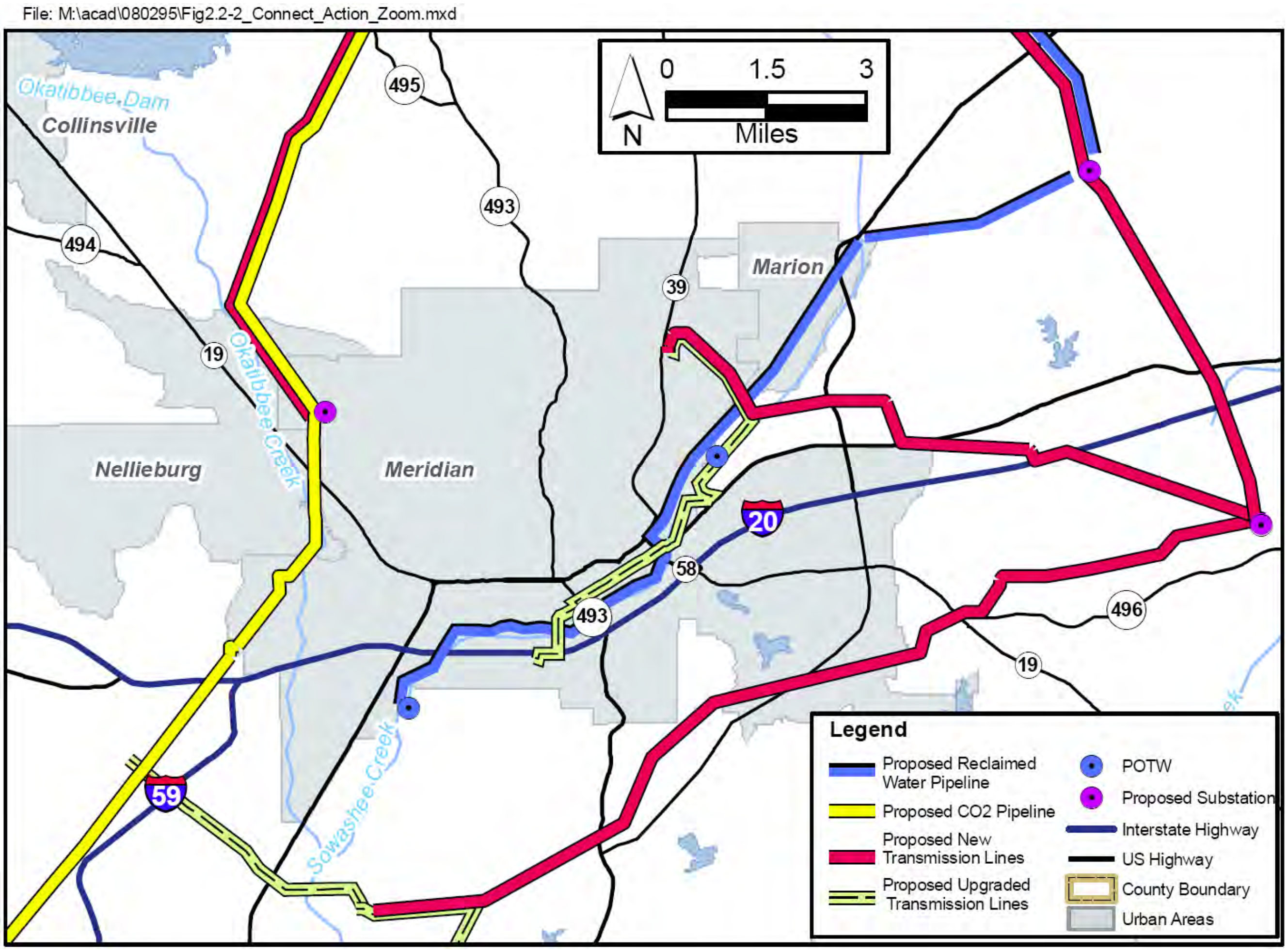


Figure 2.2-2. Proposed Connected Actions in the Vicinity of Meridian
Sources: U.S. Census, 2000. MARIS, 2008. ECT, 2009.

2.2.1 SURFACE LIGNITE MINE

The proposed lignite mine (known as the Liberty Fuels Mine) would be located adjacent to the power plant site (see Figures 2.2-1 and 2.2-3). Mining would occur on blocks of land within an approximately 31,000-acre area (mine study area), including approximately 1,400 acres within the boundary of the power plant site. The mine would be designed, permitted, constructed, and operated by NACC for the dedicated purpose of providing the primary source of fuel for the IGCC project. Approximately 4.3 million tons per year (tpy) of lignite would be produced to fuel the IGCC facilities described previously for up to 40 years (NACC, 2009).

Approximately 12,000 to 13,000 acres within the mine study area would be mined or disturbed to provide a 40-year supply of the primary lignite fuel to be utilized at the IGCC plant. To facilitate this production, the mine would operate up to 24 hours per day, 7 days per week, and potentially every day of the year. The mine operations

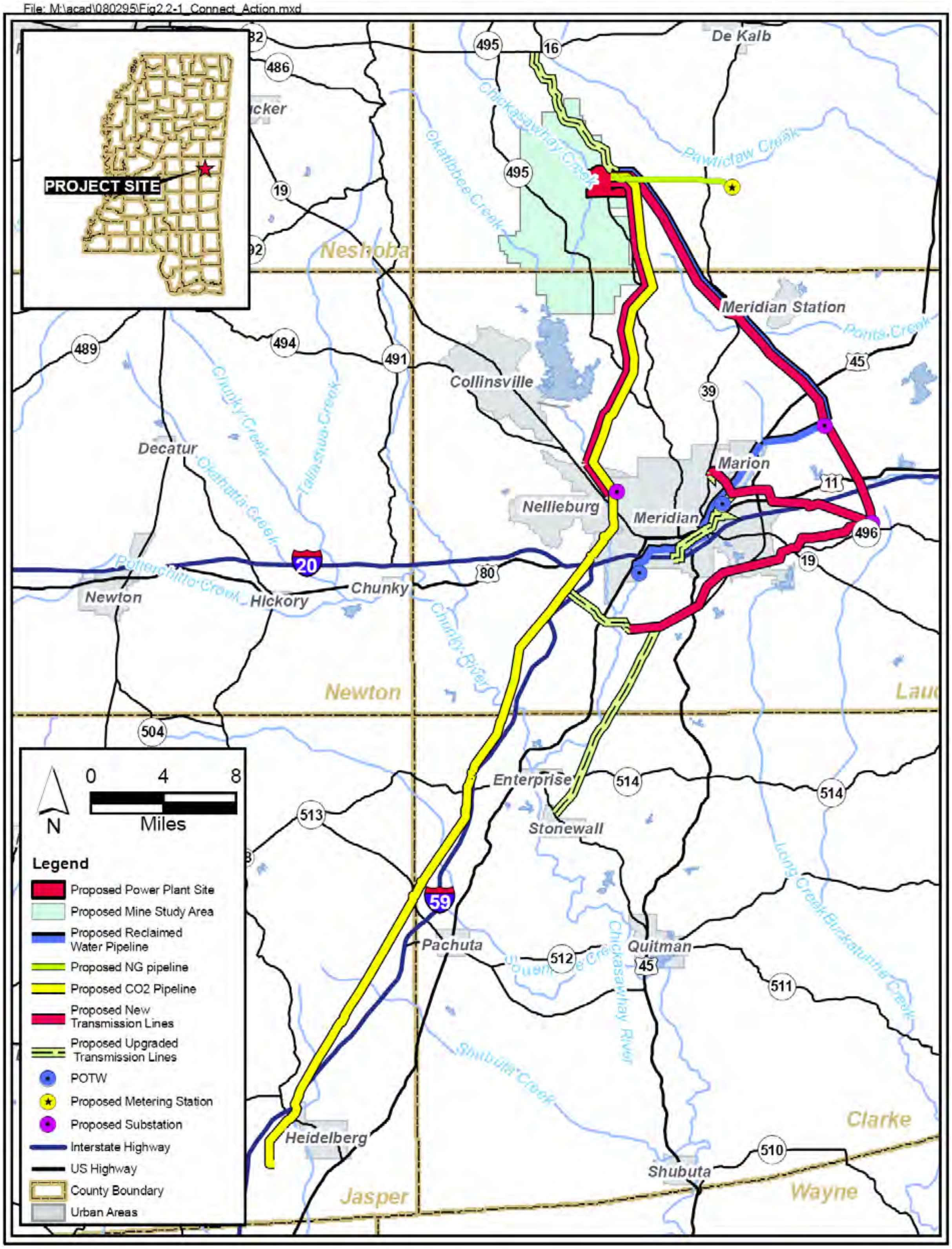


Figure 2.2-1. Locations of Proposed Connected Actions

Sources: U.S. Census, 2008. MARIS, 2008. ECT, 2009.

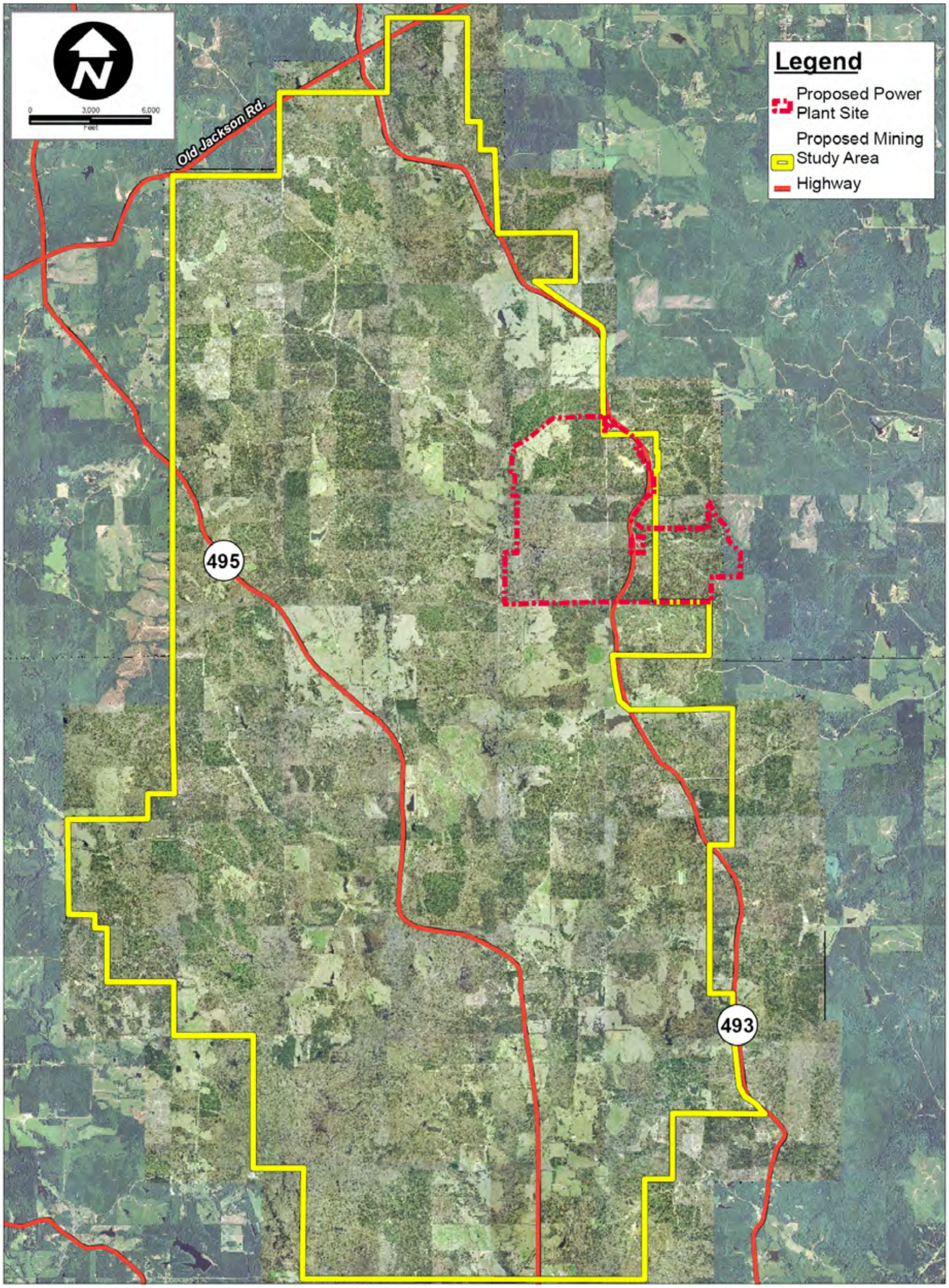


Figure 2.2-3. 2008 Aerial Photograph of Mine Study Area and Power Plant Site

Sources: NACC, 2008. SCS, 2008. ECT, 2009.

would include clearing the land of vegetation, structures, and rubble; uncovering and extracting the lignite; operation of lignite handling facilities; regrading and reclamation activities; construction and use of haul roads; and utilization of maintenance facilities and vehicles. Prior to any land disturbance activities associated with the mine, NACC would have to obtain certain regulatory approvals from the state of Mississippi and USACE, among others.

Due to the schedule for the construction of the mine, mine equipment, support structures, and lignite handling facilities, the first 6 to 8 months of operation of the IGCC, which would primarily encompass the startup and mechanical checkout of the facilities, would be fueled with lignite trucked from NACC's Red Hills Mine in Choctaw County (see Subsection 2.4.1).

There are two types of mining: underground and surface. Based on thickness and layering of the lignite seams, the composition of the overburden, and the energy content of the lignite, surface mining was determined by the owner of the proposed mine, NACC, to be the only practical mining method. Surface mining would maximize the recovery of the economical reserves (NACC, 2008).

2.2.1.1 General Description of the Surface Lignite Mine

Mining would result in two types of landscape disturbance. Actual mining—the uncovering and extraction of lignite—would disturb between 195 and 375 acres per year for up to 40 years, or a total of up to 11,250 acres or 36 percent of the mine study area. The second type of landscape disturbance would result from the installation of facilities and structures supporting the mining operation. Facilities would include lignite handling facilities, office, warehouse, mobile equipment maintenance shop, fuel farm complex, dragline assembly area, entrance and internal mine haul roads, employee and equipment parking areas, and electrical substations and distribution lines. Support structures would include: (a) diversion channels (DIV) to reroute rainfall runoff from undisturbed areas and existing streams away from and around active mining areas; (b) stormwater collection channels (CC) to collect runoff from mined or disturbed areas and route these flows into; (c) water treatment (i.e., sedimentation) ponds (SP) designed to treat water to meet MDEQ effluent limitations; and (d) flood protection levees intended to either contain runoff from disturbed lands or protect active mining areas from flooding. Up to 800 acres would be required for the mine support structures, with another 320 acres required for the mine support facilities.

Following lignite removal, approximately 275 acres per year of mined land would be graded to the approximate premining land surface elevations and planted with various types of vegetative cover. Physical completion of land reclamation would occur approximately 3 years after lignite extraction. Upon completion of mining operations, all mine support structures and facilities would be demolished and reclaimed as well.

Preapplication consultations between the mine operator (NACC) and DOE, USACE, Mississippi Department of Environmental Quality (MDEQ), U.S. Fish and Wildlife Service (USFWS), and U.S. Environmental Protection Agency (EPA) conducted in 2008 and 2009 have resulted in the preliminary conceptual mine plan shown in Figure 2.2-4 (see Section 2.7 for a description of the alternatives evaluated). As shown in Figure 2.2-4, eight mine blocks labeled A, B1, B2, C, D, E, F, and G have been identified as the lignite extraction areas within the mine site, with the overall advancement of mining proceeding sequentially from mine block A during the initial years, and mine block G representing the final years of mining.

Generally, mine blocks would be sized in lengths of 1 mile or so to allow mining to occur in long rows. For example, in the case of the conceptual plan initial mine block A, the dragline and other mining equipment

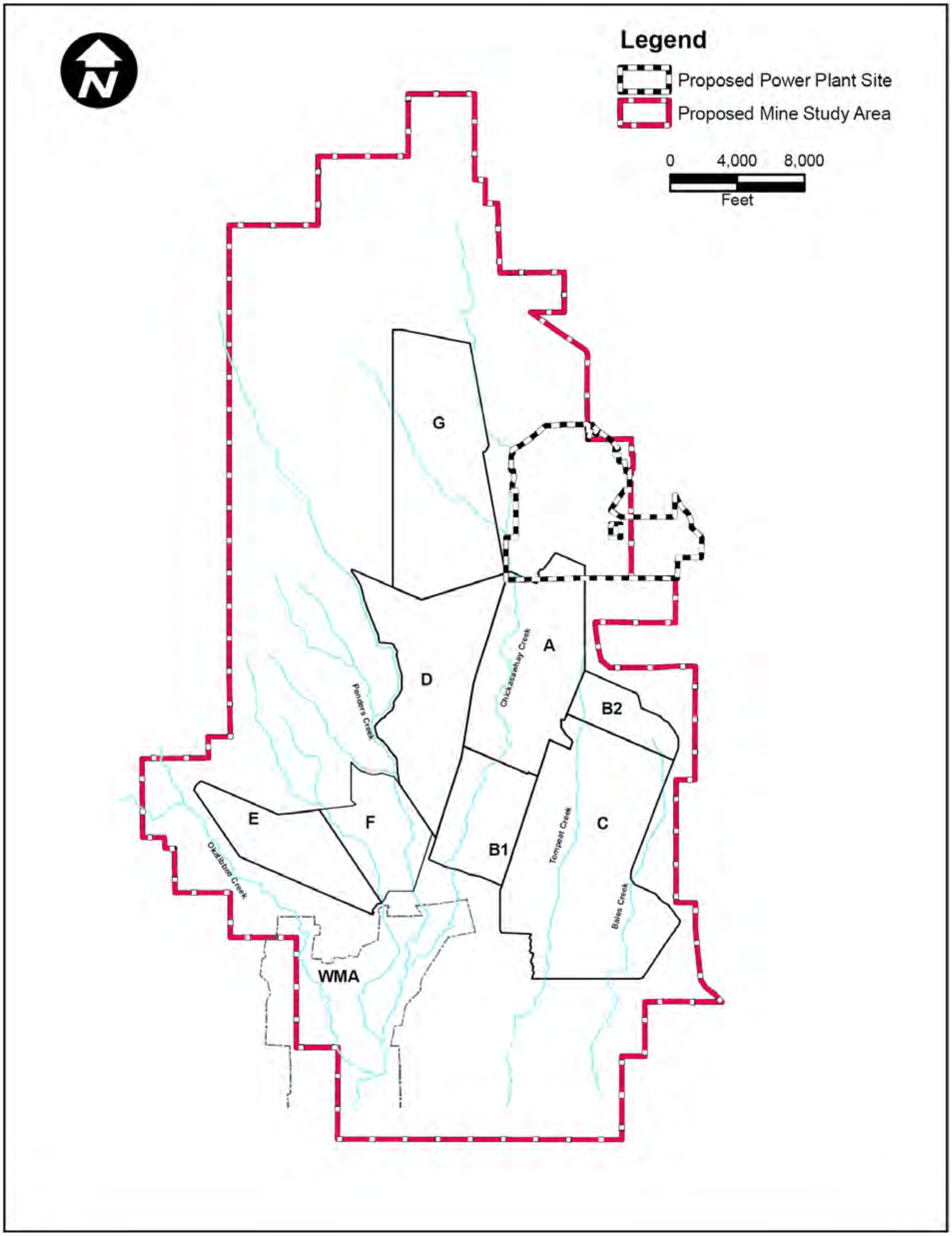


Figure 2.2-4. Conceptual Life-of-Mine Plan for Liberty Fuels Mine
Source: NACC, 2009.

would work back and forth along a north-northwest/south-southeast axis generally advancing from north to south during a 5- to 6-year period.

As the lignite reserves in the initial mine block are recovered, the subsequent mine block would be permitted and prepared for mining to provide an uninterrupted supply of lignite to the IGCC plant. The subsequent mine blocks would generally correspond in size to the initial mine block so as to provide sufficient mineable reserves to fulfill the project purpose. Whenever practicable, future mine blocks would be located adjacent to the existing mine block to provide for orderly development of the mineral resource, landscape reclamation design, and minimal long-distance relocation of mining equipment.

2.2.1.2 USACE Mine Plan Review

As is described in Subsections 3.6.2 and 3.11.1, the mine study area contains wetlands and streams that meet the definition of Waters of the United States and, therefore, fall within the jurisdiction of USACE. As more fully described in Chapter 7, NACC would be required to obtain a federal CWA Section 404 dredge-and-fill permit from USACE prior to disturbing any Waters of the United States. Concurrent with the preparation of this EIS by DOE, NACC is preparing an application to secure the CWA 404 permit necessary to authorize construction and operation of the mine. During the evaluation of NACC's application, USACE will determine whether impacts to Waters of the United States have been minimized, with issuance of a permit only occurring following such a determination by USACE. USACE's permit, if issued, could require NACC to avoid disturbing certain Waters of the United States located within the 31,000-acre mine study area to minimize impacts to the extent practicable.

This EIS was prepared on the assumption that all lignite reserves in each mine block would be recovered, including the reserves lying beneath Waters of the United States. In the event of permit conditions precluding complete recovery of the lignite reserves in one or more mine block(s), NACC would have to select additional blocks to be mined beyond those shown in Figure 2.2-4 to offset the lignite reserves left in the ground by the permit or ownership constraint. Selection of any additional areas proposed to be mined, if any, would be based on lignite quantity (i.e., recoverable tons per acre), quality, and depth; the haul distance to the coal preparation plant; and the degree of logistical constraints.

2.2.1.3 USACE Wetland and Stream Mitigation

For Waters of the United States, USACE and EPA have adopted rules for minimum numerical compensatory mitigation to completely offset any wetland functional losses remaining following completion of the impact minimization analysis described previously. The compensatory mitigation requirements include consideration of temporal losses and would be applied after USACE determined the type of mitigation that would be appropriate. The functional assessment method to be used will be the Wetland Rapid Assessment Procedure (WRAP) (Miller and Gunsalus, 1997) for determining wetland functional value losses. Final determinations for compensatory mitigation will be performed by USACE. Chapter 7 describes these regulations in more detail.

The USACE Mobile District published a draft of the standard operating procedures and guidelines in March 2009 (USACE, 2009) to address compensatory stream mitigation (included in full in Appendix B). This guidance provides standardized procedures and requirements for applying the 2008 EPA/USACE Mitigation Rule to proposed stream impacts. These procedures prescribe methods for assessing minimum compensatory requirements associated with proposed stream disturbances as well as for calculating the sufficiency of stream mitigation plans. Final determinations for implementation of these procedures would be performed by USACE.

2.2.1.4 Relationship of Minimum Standards to DOE's Decision-Making

In addition to the USACE requirements described previously, numerous mine design, construction, operation, and reclamation constraints would be imposed on NACC by applicable laws, regulations, and permit requirements, as is described in Chapter 7. Because NACC must comply with these requirements, they are factored into the analysis of impacts in Chapter 4 for the surface lignite mine.

Throughout the EIS, DOE's evaluations incorporate the requirements of these federal environmental protection programs into the proposed connected surface lignite mine. DOE's analyses, therefore, focus on the impacts that would occur after incorporating the impact avoidance, minimization, and mitigation measures applied by USACE's regulatory program. This EIS also analyzes additional mitigation measures that could be incorporated to minimize impacts.

2.2.2 NATURAL GAS SUPPLY PIPELINE

As mentioned previously, the Kemper County IGCC Project CTs would be capable of operating on natural gas as well as syngas, and the duct burners in the two HRSGs would fire only natural gas. While there is a 6-inch natural gas pipeline that intersects the power plant site, this pipeline is too small and operates at too low of a pressure to supply the needs of the proposed power plant. To meet the proposed project's supply requirements, a new gas lateral would be built to connect to an existing Tennessee Gas Pipeline Company (TGPL) interstate natural gas pipeline system that is located approximately 6 miles east of the site. Figure 2.2-1 showed the location of the planned new pipeline. The new pipeline would be 20 inches in diameter and would run generally due west from an interconnection with the TGPL pipeline north of Blackwater, Mississippi. A metering station would also be constructed at the point of interconnection with the existing pipeline, as shown in Figure 2.2-1. A gas conditioning facility would be located at the terminal point of the new pipeline located on the power plant site.

The permanent right-of-way for the new pipeline would be 50 ft wide, which is typical for a natural gas line of this size. The new pipeline would be placed in the center of the 50-ft right-of-way, which would allow personnel and equipment access to the pipeline for any future maintenance and inspection purposes.

An additional 25-ft-wide right-of-way would be secured temporarily for use during pipeline construction. The full, 75-ft construction right-of-way (50 ft permanent plus 25 ft temporary) would provide space for contractor equipment during pipeline installation and space needed for dirt storage. Additional temporary workspace would also be acquired in other areas, such as at road and stream crossings, to accommodate additional construction activities at these locations (additional equipment and dirt storage). Upon completing construction, the right-of-way would be restored and revegetated (see subsequent discussion). At that time, the temporary right-of-way would revert back to the landowner.

To provide good access to the right-of-way during construction, access roads would be necessary. Several access roads have been identified and surveyed for use by the pipeline contractor and would subsequently be used for in-service pipeline maintenance and operations. Generally, more access roads available to access a pipeline right-of-way are better both from construction and maintenance standpoints to allow the contractor to move equipment easily to and from the right-of-way. Access roads could either be a private road or a public road such as a county or state road. The proposed route of the natural gas pipeline would cross ten private roads and three public roads. Based on preliminary construction engineering, less than 1 mile of new access roads would need to be built, and approximately 6 miles of existing dirt roads would need to be upgraded to support pipeline construction (and subsequent maintenance).

Mississippi Power would negotiate in good faith with landowners to acquire all rights-of-way, including fee-owned parcels, rights-of-way, and easement rights-of-way necessary to support the project. In such negotiations, Mississippi Power would use all reasonable efforts to acquire the rights-of-way in an arms-length transaction. If such transaction could not be consummated, however, Mississippi Power would exercise its right of eminent domain arising under the Constitution and laws of the State of Mississippi. In the event that eminent domain were necessary to acquire the rights-of-way necessary to support the project, the amount of compensation paid to the landowner would be the value of the acquired right-of-way as determined by a jury in accordance with Mississippi law (Mississippi Power, 2009a).

2.2.3 ELECTRICAL TRANSMISSION LINES AND SUBSTATIONS

The proposed Kemper County IGCC Project site is located north of the nearest existing Mississippi Power transmission infrastructure. New transmission facilities, including appropriate lines and substations, would be constructed to interconnect the new power plant to the existing grid and provide firm transmission service for the plant's output. Mississippi Power conducted studies to evaluate alternative routes from among possible alternatives and selected the best routes for the new lines. Subsection 2.7.2.2 summarizes the procedures for the route alternatives evaluation/selection process.

The new transmission lines would include approximately 56 miles of new 230-kilovolt (kV) transmission and approximately 9 miles of 115-kV transmission. Rights-of-way up to 125 ft wide would be required for these new transmission lines. The IGCC plant would also require approximately 24 miles of existing 115-kV transmission lines to be upgraded. The new and upgraded transmission lines are in Kemper, Lauderdale, and Clarke Counties, as shown in Figure 2.2-1. Along with the new and upgraded transmission lines, three new substations would be built; these were also shown in Figures 2.2-1 and 2.2-2.

The new electrical transmission facilities would include:

- <u>West Feeder</u>—An approximately 19-mile-long, 230-kV line from the power plant to new three-breaker, 230-kV ring Lauderdale West switching station connecting to existing 230-kV system.
- <u>East Feeder</u>—An approximately 24-mile-long, 230-kV line consisting of 18 miles of line from the power plant to new four-breaker ring Lauderdale East switching station connecting to existing 230-kV system plus 6 miles of line from Lauderdale East switching station to new Vimville Substation.
- <u>Vimville Substation to Meridian North East</u>—An approximately 9-mile-long, 115-kV line from Vimville substation to the existing Meridian North East substation.
- <u>Vimville Substation to Plant Sweatt</u>—An approximately 13-mile-long, 230-kV line from Vimville substation to Plant Sweatt (existing power plant).

As noted in Subsection 2.2.2, Mississippi Power would negotiate in good faith to acquire all rights-of-way associated with the new transmission lines and substations. Eminent domain would be used only if necessary.

The electrical transmission facilities requiring upgrades would include:

- Meridian North East Substation to Meridian Primary Substation—An approximately 7-mile-long segment of existing 115-kV line that would require reconductoring.
- Plant Sweatt to Stonewall Substation—An approximately 13-mile-long segment of existing 115-kV line that would require reconductoring.
- Plant Sweatt to Lost Gap Substation—An approximately 4-mile-long segment of existing 115-kV line that would require reconductoring.

Based on preliminary engineering of the new and upgraded transmission lines, Mississippi Power anticipates that some new structures would be of the H-frame design, and some might be single-pole. Figure 2.2-5 provides some basic design details for the former.

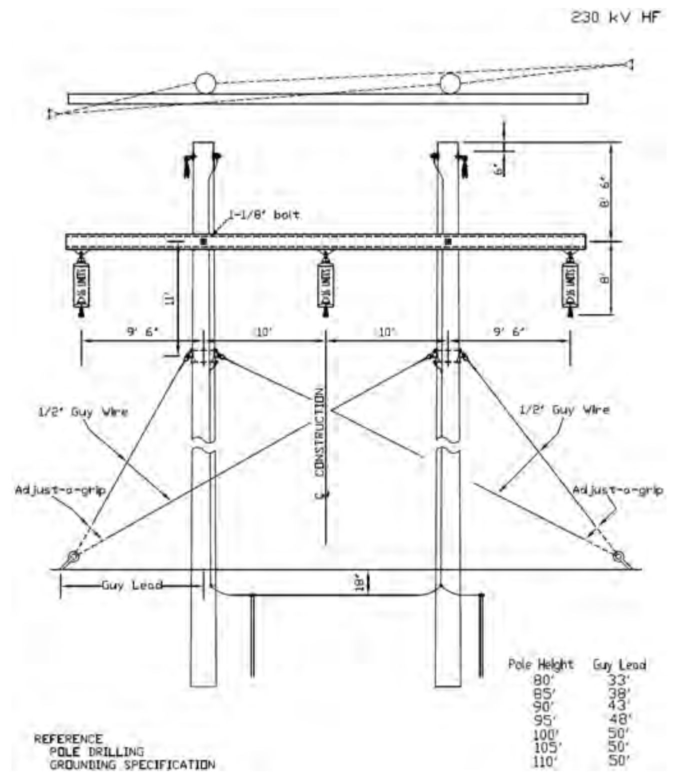


Figure 2.2-5. Design Details for H-Frame Transmission Line Structure

Source: Mississippi Power, 2009.

Some new access roads would need to be built (and some existing dirt roads would need to be upgraded) to support transmission line construction (and subsequent maintenance). The access points and roads for construction would be defined when more detailed engineering planning is completed.

There are three electrical substations proposed for this project: Lauderdale East, Vimville, and Lauderdale West, as mentioned previously; Figures 2.2-1 and 2.2-2 show their locations. The proposed site of the East Lauderdale Switching Station lies along the East Feeder and is located approximately 17.5 miles southeast of the power plant site. The site of the proposed Vimville substation lies another 6 miles south, or approximately 23.5 miles southeast of the plant site. West Lauderdale switching station would be located slightly east of the terminus of the West Feeder, approximately 19.3 miles south of the power plant site.

In addition to the new and upgraded electrical transmission facilities just described, construction of the power plant and lignite mine would require new and upgraded power lines. Electrical power needed to support site construction would require improvements to the existing distribution system. The likely means would involve upgrading existing lines that run south along MS 493 from MS 16, north of the site, as shown in Figure 2.2-1. As projected by East Mississippi Electric Power Association (EMEPA) (2009a), the necessary improvements would include:

- Total of 9.5 miles of upgrade from 12 to 25 kV.
- Portion (6 miles) also converted from single- and two-phase to three-phase.
- Other system changes, including minor substation modifications and replacement of some poles.

Another possibility to provide a portion of the onsite power would involve upgrading a 1.25-mile segment of line from Klondike, south of the site, running north along MS 493 to the site.

All of this work would involve only upgrades to existing distribution lines and would be carried out by EMEPA. No new rights-of-way would be required.

Finally, operation of the mine would have greater needs for power than could be provided by existing lines or the lines upgraded for construction. Operation of the mine would require bringing a new 161-kV transmission line down from TVA's existing 161-kV line that parallels MS 16 (NACC, 2009). TVA would engineer, build, and own this new transmission line, which would be approximately 9 to 10 miles long. TVA has not yet developed specific plans or mapped a proposed route. TVA's engineering and planning activities would not take place until needed to meet the schedule for mine operation. TVA's planning process would include environmental review, likely including a public hearing (EMEPA, 2009b).

2.2.4 RECLAIMED EFFLUENT PIPELINE

The primary source of makeup water for the IGCC facility would be reclaimed effluent transported via a pipeline from two Meridian, Mississippi, POTWs: the main plant (Meridian POTW), located near downtown Meridian on MS 11 South, and the smaller East Meridian facility, located northeast of downtown Meridian on Old U.S. Highway 45 (U.S. 45) North. Figures 2.2-1 and 2.2-2 show the locations of both POTWs. A new reclaimed water pipeline would therefore need to be installed to connect the two POTWs with the surge pond at the plant site. The proposed reclaimed water supply pipeline would run from the main Meridian POTW, in a generally northeasterly direction, in an existing city right-of-way that parallels Sowashee Creek, to the East Meridian POTW. The pipeline would continue in a northeasterly direction until intersecting the East Feeder transmission corridor at a point south of U.S. 45, then continue alongside the proposed new East Feeder electrical transmission lines to the power plant site. Where coincident with the proposed new East Feeder electrical transmission lines, the new pipeline would be constructed almost entirely within the new 200-ft corridor that would also contain the transmission lines. The total length of the new pipeline from the Meridian POTW to the power plant site would be approximately 29.5 miles. The portion of the distinct pipeline corridor (i.e., from Meridian POTW to the East Feeder corridor) would be approximately 13.5 miles in length, with approximately 4 miles of that being new right-of-way.

The combined reclaimed water supply pipeline system would be capable of carrying approximately 12 MGD of water to the power plant's makeup water surge pond. Although only preliminary engineering has been completed for this pipeline, it is anticipated that the pipeline would consist of a 30-inch diameter pipe within a permanent 50-ft right-of-way. An additional 25-ft easement would be required during construction. The type of pipe material has not been selected, but the most likely options would be either steel, ductile iron, or high-density polyethylene (HDPE). Similarly, current plans would not require the addition of pumping stations along the length of the line.

As noted in Subsection 2.2.2, Mississippi Power would negotiate in good faith to acquire all rights-of-way associated with the new reclaimed effluent pipeline. Eminent domain would be used only if necessary.

2.2.5 CO_2 PIPELINE

As discussed previously, Mississippi Power intends to capture up to 67 percent of the CO_2 that would otherwise be emitted into the atmosphere. As delivered from the power plant, the CO_2 would be separated from the other emission gases and concentrated to approximately 99 percent (by volume) or more, then compressed to a supercritical (dense phase) liquid. The liquid CO_2 would be piped through a new pipeline owned and operated by an oil and gas company. This pipeline would connect to an existing CO_2 pipeline system near Heidelberg, and the CO_2 would be beneficially used by the pipeline owner in EOR operations. As shown in Figure 2.2-1, the new CO_2 pipeline would be approximately 61 miles in total length and would have an expected 14-inch diameter (diameter could vary between 12 and 18 inches and would be finalized during future engineering studies).

The CO_2 pipeline would operate at a pressure of 2,100 psi and a temperature of 95°F and would have mainline block valves approximately every 20 miles (except for crossings of water bodies, where valves might be required on either side of the water body). The H_2S content of the piped CO_2 would be less than 10 parts per million by volume (ppmv), and total sulfur content would be less than 35 ppmv. The permanent right-of-way would be 50 ft wide.

From the plant site to the terminus near Heidelberg, the CO_2 pipeline right-of-way would be co-located with (and adjacent to) the proposed right-of-way for the western leg of the proposed new transmission line (West Feeder) for the first 19 miles. Both rights-of-way would fit within the 200-ft-wide study corridor. The pipeline would then extend beyond the West Feeder in a southwesterly direction for approximately 42 more miles, paralleling Interstate 59 (I-59) and an existing electrical transmission line right-of-way through Lauderdale, Clarke, and Jasper Counties, to its terminus just south of Heidelberg.

A pump station would be located at the origin of the line (power plant site) to pump the liquid CO_2. A meter station would be located at the terminal point of the new line. Some new access roads would need to be built to support pipeline construction (and subsequent maintenance). The access points and roads for construction would be defined after completion of more detailed engineering and planning.

As noted in Subsection 2.2.2, it is expected that the developer/owner of the CO_2 pipeline would negotiate in good faith to acquire all rights-of-way associated with the new pipeline. Eminent domain would be used only if necessary.

2.3 CONSTRUCTION PLANS

2.3.1 POWER PLANT

Although final, detailed design of all IGCC power plant components would not be completed until 2012, construction of the proposed IGCC power plant would begin in 2010. Construction would continue until the planned commercial operation date of May 2014. Preconstruction activities would begin with clearing and grading, and the site would be graded for stormwater runoff management. Site preparation would involve construction of load-bearing concrete piers and foundations for heavy and settlement-sensitive structures. Excavation would be performed for footings and grade beams. Soil removed during site preparation would be stored in stockpiles and later spread on finished graded areas. Following site preparation, other phases of construction would include mechanical installation, piping interconnection, electrical installation, and instruments and controls configuration. Subsection 2.5.1 discusses land requirements during construction and operation.

Construction materials would consist primarily of structural steel beams and steel piping, tanks, and valves. Locally obtained materials would include crushed stone, sand, and lumber for the proposed facilities and temporary structures (e.g., enclosures, forms, and scaffolding). Components of the facilities would also include concrete, ductwork, insulation, electrical cable, lighting fixtures, and transformers. Materials would be shipped from their point of origin by various means, including, rail, truck, barge, and blue-water (ocean-going) ship. However, it is expected that all materials would ultimately be delivered to the site by truck. Truck routes to the site would rely on major highway systems, primarily including Interstate 20 (I-20) from east or west, U.S. Highway 78 (U.S. 78) from Memphis, and Interstate 10 (I-10) and I-59 from New Orleans. Although the exact routing of construction materials and major equipment is still being determined, the primary routing of general cargo from these arteries is likely to arrive from points north or south along U.S. 45 and then west along MS 16 to the junction of MS 493, where they would turn south toward the worksite. The final routing would account for road conditions, size and weight restrictions, or approvals.

Figure 2.3-1 shows the anticipated power plant construction labor force over the 3.5-year construction period. During this time, an average of approximately 500 construction workers would be on the site during construction of the gasification facilities and the combined-cycle power-generating unit. Approximately 1,150 workers would be required during the peak construction period in the first half of 2012. Most construction would occur during daylight hours, with the majority of construction workers being present on the site between 7 a.m. and 5:30 p.m.

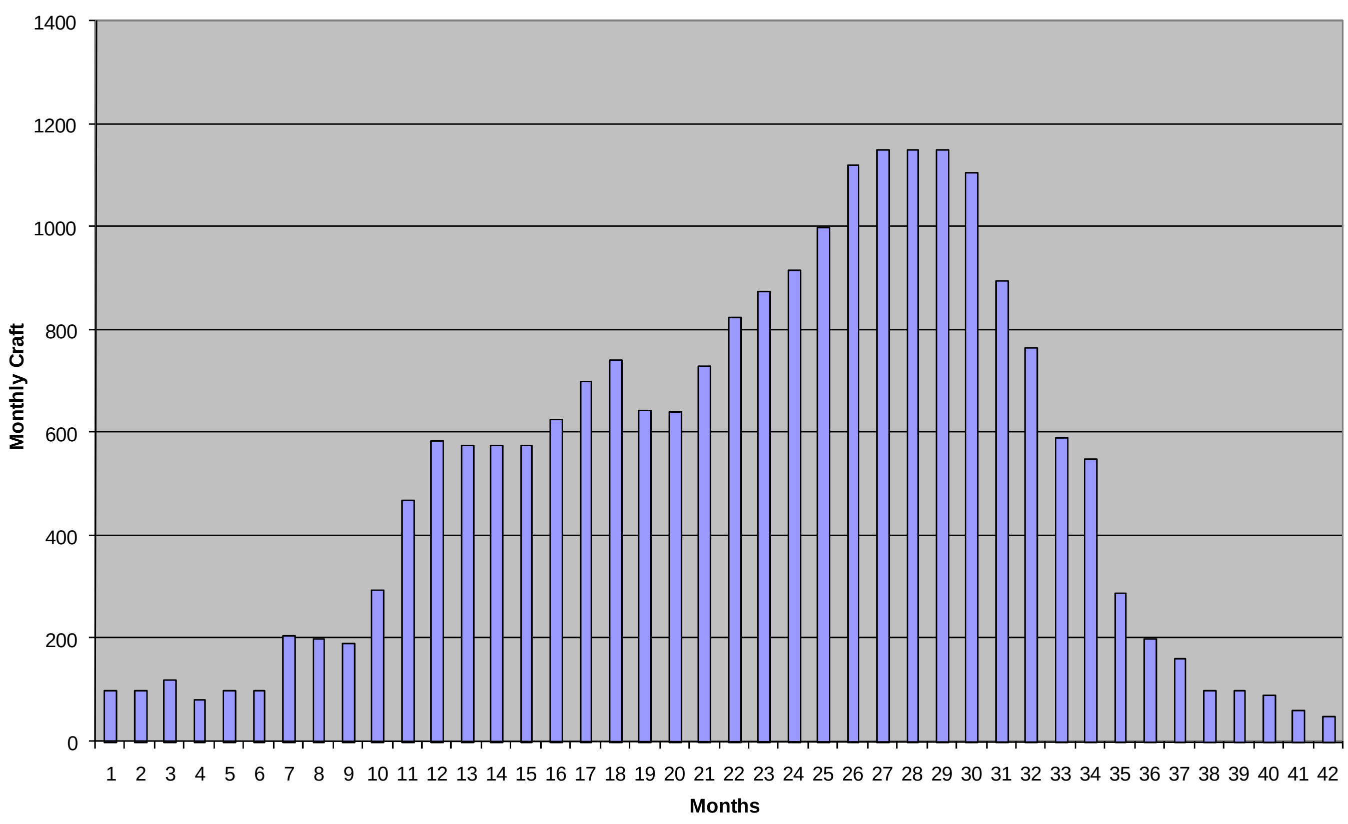


Figure 2.3-1. IGCC Power Plant Monthly Craft Labor Projection
Source: SCS, 2008.

One of the first preconstruction activities onsite would involve the relocation of a 6-inch natural gas pipeline that currently intersects the proposed IGCC power plant site. This pipeline is owned and operated by Southern Natural Gas (SNG). Mississippi Power intends to have SNG relocate this pipeline along the east side of the proposed plant site so that it would not interfere with subsequent construction of the plant. This relocation would be expected to take place in mid-2010. An approximately 8,500-ft-long portion of the existing pipeline would be replaced with a new segment of approximately 2 miles in length. The portion of the existing pipeline to be relocated would be left in place initially, then that portion interfering with power plant excavation and construction would be removed when full onsite activities commenced. The relocated route would roughly parallel and be west of MS 493. The relocated pipeline would be installed as close as possible to MS 493. The entire rerouted pipeline would be installed below ground. There would be no permanent aboveground appurtenances installed as part of the relocation.

The permanent right-of-way for the relocated pipeline is planned to be 40 ft, and the centerline of the pipeline would be located to allow personnel and equipment access for any future maintenance and inspection purposes. During construction, an additional 15 ft of temporary workspace would be obtained next to the permanent right-of-way. Upon completing construction, the right-of-way would be restored and revegetated (see further discussion of pipeline construction methods in Subsection 2.3.3).

2.3.2 SURFACE LIGNITE MINE

Construction activities associated with the proposed lignite surface mine (Liberty Fuels Mine) would commence in 2011 and continue through the first quarter of 2014, overlapping those of the IGCC power plant. Mine-related construction would consist of:

- Assembling the mining dragline to be used to excavate overburden and interburden.
- Construction of lignite handling and mine infrastructure facilities.
- Preparation of the initial mining area (hereinafter referred to as premining activities).

Figures 2.1-5 and 2.2-4 showed the locations proposed for these facilities. Details of the stages of mine construction are provided in the following subsections.

2.3.2.1 Dragline Assembly

The dragline for the proposed mine is presently in storage offsite. It would be necessary to assemble the dragline before mining could begin, and an assembly site of approximately 45 acres would need to be cleared, graded, and graveled to provide the area necessary to store and assemble the machine, which would be shipped to the site in parts by the truckload. Construction trailers and electric power also would be supplied to the assembly site, along with parts storage trailers. The dragline assembly site would be adjacent to the mine facilities described in the following subsections and within the plant site area.

2.3.2.2 Lignite Handling Facilities

The lignite handling facilities would consist of: (1) haul roads and bridges/culverts capable of supporting large off-road haul trucks, (2) an open lignite stockpile area, (3) one or more truck dumps (i.e., receiving hoppers),

(4) the primary crusher, (5) a secondary crusher, (6) conveyor belts, (7) crushed lignite storage barn, and (8) stormwater management (e.g., sediment control) ponds. Based on current plans, the lignite handling facilities would be located immediately southwest of the IGCC facilities within the plant site area, as shown on Figure 2.1-5.

The lignite handling facilities would have to be located and designed to meet a series of siting and performance standards adopted by the MDEQ Surface Mine Control and Reclamation Act (SMCRA) Regulations, as well as other federal, state, and local laws and regulations. Chapter 7 of the EIS more completely explains the applicability, scope, and procedural aspects of the regulatory oversight of the Kemper County IGCC Project. In addition to the MDEQ SMCRA Regulations, the lignite handling facility would be subject to MDEQ permits and operating performance standards that would regulate air emissions and water discharges. The proposed construction of haul roads in waters of the United States would have to be authorized as one component of the federal CWA Section 404 dredge-and-fill permit for the entire mine, which would be evaluated by USACE under its regulations as described in Subsections 2.2.1.2 and 2.2.1.3.

Two sediment control (i.e., stormwater management) ponds would be constructed at the locations shown on Figure 2.1-5 by damming two intermittent stream tributaries to Chickasawhay Creek. The stormwater management ponds would be sized to at least contain or treat the runoff from the 10-year, 24-hour precipitation event on the contributing drainage area in accordance with MDEQ SMCRA Regulations. To meet this criterion, the ponds, labeled SP-2 and SP-3, would occupy 36 and 50 acres, respectively. The impoundment structures (i.e., the dams) would be designed to meet the requirements of the MDEQ SMCRA and federal mine safety and health regulations with respect to dam stability and safety. In addition, other MDEQ regulations would apply technology and water quality-based numerical effluent limitations and aquatic life criteria to all water discharged from these ponds. Because the impoundment dams would be located in waters of the United States, the USACE Section 404 permit would have to authorize construction and operation of each impoundment.

2.3.2.3 Mine Facilities

The mine facilities would include an office building, warehouse, and maintenance shop. The maintenance shop would consist of service bays for the off-road haul trucks, bulldozers, front-end loaders, trackhoes, and other mobile equipment used in mining and reclamation. As shown in Figure 2.1-5, the mine facilities would be located in the southern portion of the plant site, along the west side of MS 493, with an internal mine road constructed to connect these facilities to the main mine haul road.

2.3.2.4 Premining Activities

During the construction of the facilities described previously, a series of steps would be undertaken by NACC to prepare initial mining block A for excavation and extraction. These actions would generally fall into two categories: surface water management/protection and mine dewatering.

Surface Water Management and Protection

NACC is proposing to design, construct, and operate several surface water management structures within initial mining block A to maintain the hydrologic balance and surface water quality. These would include stream diversion channels, stormwater runoff collection channels, and sedimentation ponds.

As will be described in Subsection 2.4.2, the initial mine block includes approximately 15,000 linear ft of Chickasawhay Creek (Mississippi Automated Resource Information System [MARIS], 2009b). Accordingly, NACC would include, in its USACE and MDEQ permit applications, plans to divert the flow in Chickasawhay Creek from the existing channel to a temporary diversion channel, as shown in Figure 2.3-2. The temporary diversion channel would be located to the west of the existing channel, generally below the 400-ft elevation contour in Sections 9, 16, 17, 20, and 29, Township 8 south, Range 15 east. The diversion channel would flow in a south-southwest direction, which will allow the diversion channel to receive flow from the intermittent tributary channels currently flowing into Chickasawhay Creek from the west.

In addition to the diversion of Chickasawhay Creek, five intermittent streams are present in the proposed initial mine study area, including a segment of Tompeat Creek upstream of its designation as perennial (MARIS, 2009b). These streams, which total approximately 8,800 ft in length, would be managed through interception, routing to a sedimentation pond, and discharge into Tompeat or Chickasawhay Creeks.

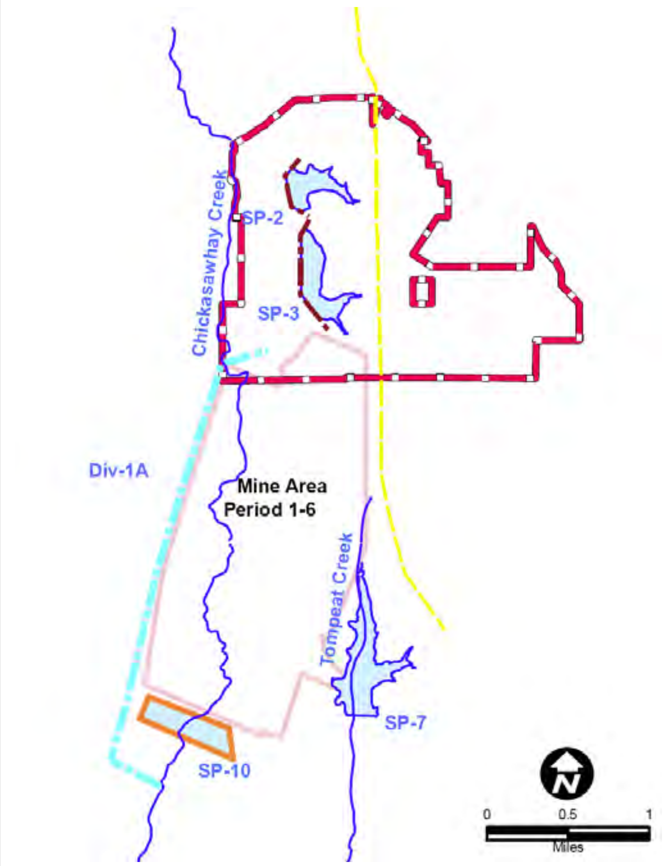


Figure 2.3-2. Initial Mining Area Water Management

Sources: NACC, 2009; ECT, 2009.

The Chickasawhay Creek diversion channel would be sized to safely pass the peak runoff generated by the 100-year, 6-hour precipitation event in accordance with MDEQ SMCRA Regulations. Generally, the diversion channel would consist of a wide, flat bed and gentle side slopes on the order of 3-ft horizontal to 1-ft vertical (3:1). The channel banks would be grassed. Figure 2.3-3 illustrates a diversion channel at NACC's Red Hills Mine.

Drainage from active portions of initial mining block A would be captured and routed to sedimentation ponds constructed by damming Tompeat Creek (i.e., SP-7) or excavating a below-grade structure in the Chickasawhay Creek floodplain (i.e., SP-10) (Figure 2.3-2). The approximate size of these areas, labeled SP-7 and SP-10, would be 90 and 58 acres, respectively. The SP-7 pond would be capable of containing the runoff generated by the 10-year, 24-hour precipitation event in accordance with MDEQ SMCRA Regulations. The SP-7 impoundment dam would be designed to meet the dam safety and stability rules established by the MDEQ SMCRA and federal mine safety and health regulations. In addition, USACE would have jurisdiction over both ponds due to their locations in waters of the United States.

Figure 2.3-3. Photograph of Diversion Channel at NACC's Red Hills Mine
Source: NACC, 2009.

Mine Dewatering

Often, surface mines need to dewater the areas to be excavated to maintain the side slopes and mine working surfaces between land surface and the base of the mine excavation to ensure safe working conditions. At the Liberty Fuels Mine site location, most of the overburden segments have low permeability, making advanced dewatering unnecessary. However, one overburden sand layer, referred to as J5, and the underburden layer, referred to as G5, would require management.

To address these hydrogeologic attributes, an advanced dewatering well network would be operated for approximately 1 year prior to initiating mining excavations. Well spacing would be on the order of 300-ft centers. Operation of the two well systems, one addressing the J sand and one addressing the G sand, would generate approximately 765 gpm, or 1.1 MGD, for approximately 1 year. The water generated would be discharged to Chickasawhay Creek.

2.3.2.5 Construction Schedule

Construction activities for the lignite handling facilities would commence in early 2012 and continue through the fourth quarter of 2013. The two sediment control ponds associated with the lignite handling facilities would be built in 2012. The dragline assembly site would be constructed in mid 2010. The dragline would be stored onsite until the first quarter of 2013 when assembly would commence. After an 18-month assembly period, the dragline would be ready to begin overburden removal operations in the second quarter of 2014. The two sediment control ponds and the stream diversions associated with the initial mining area would be built over an 18-month period beginning in early 2013 and extending through mid 2014. Construction of the mine facilities would begin in 2013 and extend through early 2014. The total mine construction workforce from 2012 through 2014 would vary from 45 to 155 people, depending on the overlap between the various construction projects.

2.3.3 LINEAR FACILITIES

Construction of the related linear facilities connected to the Kemper County IGCC Project would follow a similar schedule to the plant and mine facilities, beginning in 2011 and continuing through 2013. The construction of all linear facilities would generally begin with surveying and marking the centerline and outer limits of the proposed rights-of-way and necessary access roads.

For most linear projects, the right-of-way itself is used as access for construction, long-term maintenance, and emergency repairs. However, for this project, use of the right-of-way would not always be possible or practicable, and it is expected that additional access roads would be required to reach rural, isolated areas of some of the project corridors. Routes for all of these roads have not been identified at this time but would be coordinated with the affected landowners and sited to minimize environmental impacts. All proposed access roads would be surveyed for the presence of threatened and endangered species, wetlands, and cultural resources prior to any land clearing or disturbance, just as the main linear facility study corridors were. Construction of these roads would typically require the placement of clay to provide an adequate foundation and a cover of limestone gravel to prevent erosion.

Structural stormwater pollution controls as well as operational Best Management Practices (BMPs) would be installed prior to the beginning of any construction activities, including land clearing or site preparation. The purpose of these controls would be to prevent erosion of disturbed areas and the movement of sediment offsite. Examples of structural controls would include the placement of silt fencing at all locations where stormwater from any disturbed soils or denuded areas could leave the site and enter a small watershed as well as the use of stabilization practices on areas where construction has been completed. BMPs would include the proper management of onsite debris during construction, minimization of the exposure of significant construction materials to stormwater, and limiting the use of fertilizers for revegetation of disturbed areas.

Construction methods would be similar for each of the three planned underground pipelines. The first stage of construction would entail clearing the full width of the right-of-way (temporary plus final) of trees and brush. After clearing, the right-of-way would be leveled, or graded, so that equipment could operate safely. Next, the trench for the pipeline would be dug. Dirt removed during trenching would be placed on one side of the trench, while the opposite side would be used for pipeline welding operations and operation of other equipment. Weld areas would be radio-graphically inspected, coatings applied to welded areas, and the pipe lowered into the trench. In the event that HDPE pipe is selected as the preferred material for the reclaimed water pipelines, individual pipe segments would be joined using adhesives as opposed to welding. The previously removed soil would be used to fill the trench, and the pipeline would be filled with water and pressure-tested using pressures higher than the normal operating pressures. Typically, each pipeline would be covered by a minimum of 3 ft of soil. The pipeline would be buried deeper when needed to accommodate planned surface activities, or where it crossed under roadways or beneath bodies of water. After pipeline installation and testing, the line would be dewatered and the site thoroughly cleaned up. Finally, the right-of-way would be restored as close as possible to its original condition, including revegetation. Figure 2.3-4 illustrates some of the major activities associated with pipeline construction.

Clearing and Grading

Trenching

Laying Pipe and Backfilling

Revegetated Right-of-Way

Figure 2.3-4. Stages of Pipeline Construction
Source: SCS, 2009.

Construction of the new electrical transmission lines would vary from that of the pipelines in that there would be no grubbing of the cleared right-of-way. Trees and shrubs would be shear cut and mowed as necessary to ground level, with no removal of the stumps except where they would directly affect the placement of tower supports. Tower locations would be designed to avoid impacts to wetlands and other environmentally sensitive areas. With the right-of-way prepared, concrete foundations for the steel poles would be poured and allowed to cure, the poles would be erected, and the new conductors would be pulled into position, final connections made, and the line placed in service. For reliability and safety reasons, construction of the new and upgraded lines might require temporary circuit outages, depending on load studies and weather.

The portions of the transmission system requiring upgrades would make use of existing transmission rights-of-way. These rights-of-way have been well maintained, including road access, regular mowing, and danger tree trimming. In some areas, some additional tree clearing would be necessary for placement of the new structures and stringing of the new conductors. The current rights-of-way have adequate access roads, and new access roads would not have to be built. In a few instances, construction pads might have to be cut into the terrain to properly and safely operate large equipment, such as cranes and concrete trucks. These construction pads would be placed within the limits of the existing rights-of-way.

Each of the three new substation sites is larger in acreage than would be required for the new facilities. Each site has been mapped for wetlands and other ecologically sensitive features. As part of future design engineering, each site would be surveyed to determine the location and boundaries of the actual substation area and layout. Wetlands and sensitive areas of the site would be avoided to the extent possible. The substation construction areas would then be cleared, grubbed, and graded. Necessary foundations and drainage features would then be constructed on the site followed by the installation of electrical equipment, perimeter fencing and other security features, and infrastructure.

2.4 OPERATIONAL PLANS

2.4.1 POWER PLANT

After mechanical checkout of the proposed facilities, demonstration (including data analysis and process evaluation) would be conducted over a 4.5-year period from mid-2014 through 2018. During the demonstration, the test program would focus on achieving reliable plant operation (at least 80 percent gasifier availability) with high thermal efficiency, low emissions, equipment performance improvement, and low operation and maintenance costs. Workers would include a mix of plant operators, craft workers, managers, supervisors, engineers, and clerical workers. The IGCC facility would require skilled operations and maintenance personnel, with temporary construction or maintenance workers onsite for periodic outages and additional work. An average of approximately 20 vehicles would be used for operational activities on the site. Upon successful completion of the demonstration, commercial operation would follow immediately. The facilities would be designed for a lifetime of 40 years, including the 4.5-year demonstration period.

Staff size would vary between the demonstration period and the period of commercial operation. Operations staff would be assembled during the last 18 months of construction for training and to assist with startup of the facilities. The IGCC plant workforce would consist of approximately 105 employees. Of those 105 employees, 15 workers would provide support only during the startup and demonstration phases of the project, while 90 employees would be needed over the lifetime of the facilities (i.e., during startup, demonstration, and commercial operation).

The size of the day shift crew would range from 82 during startup and demonstration to 67 during commercial operation. The size of the night shift crew would be approximately 23 employees for the lifetime of the facilities. The staff would work two 12-hour shifts a day, with shift changes expected around 5:30 a.m. and 5:30 p.m.

During initial startup and ramp-up of the proposed IGCC project, the facility would receive lignite from the existing Red Hills Mine, located in Choctaw County, Mississippi. The Red Hills Mine is located on the same lignite formation as the design fuel and would supply lignite to the proposed plant for approximately 6 months. During this period of ramp-up, lignite would be delivered by commercial truck along public highways. The probable route from Red Hills to the Kemper County IGCC facility entrance would be via MS 15 south, MS 490 east, MS 397 south, and MS 493 south (total distance of approximately 70 miles; Subsection 3.14.2 provides details). The Red Hills Mine is located approximately 60 miles to the north-northwest of the proposed plant. An average of 50 to 60 trucks per day would be expected to make the round trip. Once the ramp-up period is completed, truck deliveries of lignite from the Red Hills Mine would cease.

2.4.2 SURFACE LIGNITE MINE

Operation of the Liberty Fuels surface lignite mine would commence in late 2013 with overburden removal in the mining block being prepared for mining, as described previously in Subsection 2.3.2.4. Overburden removal to uncover the initial lignite to be extracted would occur during IGCC plant start-up, with lignite extraction commencing concurrent with the completion of the IGCC startup phase.

Land clearing would occur in advance of mining using conventional construction equipment, with the unmarketable vegetation either burned or buried. Mining would consist of removing the overburden to expose the lignite. The primary overburden removal machine would be an electrically powered walking dragline with an 80-cubic-yard bucket. The dragline would be capable of moving overburden up to 100 ft thick and depositing it in previously mined areas. Overburden in excess of 100 ft would be removed by a front-end loader or trackhoe; it would be loaded into off-road trucks, hauled around the pit, and deposited into previously mined areas. In some situations, overburden in excess of 100 ft depth would be removed by bulldozers pushing the excess overburden material into the previously mined pit area. Interburden between the lignite seams would be removed by mobile equipment or by bulldozers in much the same manner. Figure 2.4-1 outlines in cross-section view a typical mining sequence at the proposed lignite mine.

Following overburden removal, the lignite would be loaded into trucks by a trackhoe, front-end loader, or continuous surface miner. The trucks would then transport the lignite to the lignite handling facilities via mine haul roads. These roads would be constructed of compacted fill with a surface material designed to support the weight of the fully loaded haul trucks. The mine would use water trucks to spray water on the roads to control fugitive dust.

Approximately 12,275 acres would be disturbed over the life of the mine. During the proposed 40-year life of mine (2013 to 2053), an average of 275 acres per year would be disturbed by lignite extraction. However, because physical reclamation would be completed within 3 years of lignite excavation, the number of acres in a disturbed state at any given time would range from 1,271 to 1,897 acres from 2014 through 2054. Table 2.4-1 presents NACC’s estimates of disturbed and reclaimed acres per year for the life of the mine.

Once delivered to the lignite handling facilities, the lignite would pass through the primary and secondary crushers, with the sized product conveyed to the storage barn. From the storage barn, the lignite would be conveyed from the mine to silos at the power plant that would supply the IGCC gasifiers.

2.4.2.1 Premining Activities—Future Mining Areas

As mining progresses across the portions of the initial mine block approved for disturbance by the USACE and MDEQ permits, it would be necessary for NACC to periodically modify the surface water management system and the mine dewatering systems. As mining approaches completion in the initial mine block, NACC would construct similar systems in the next mine block.

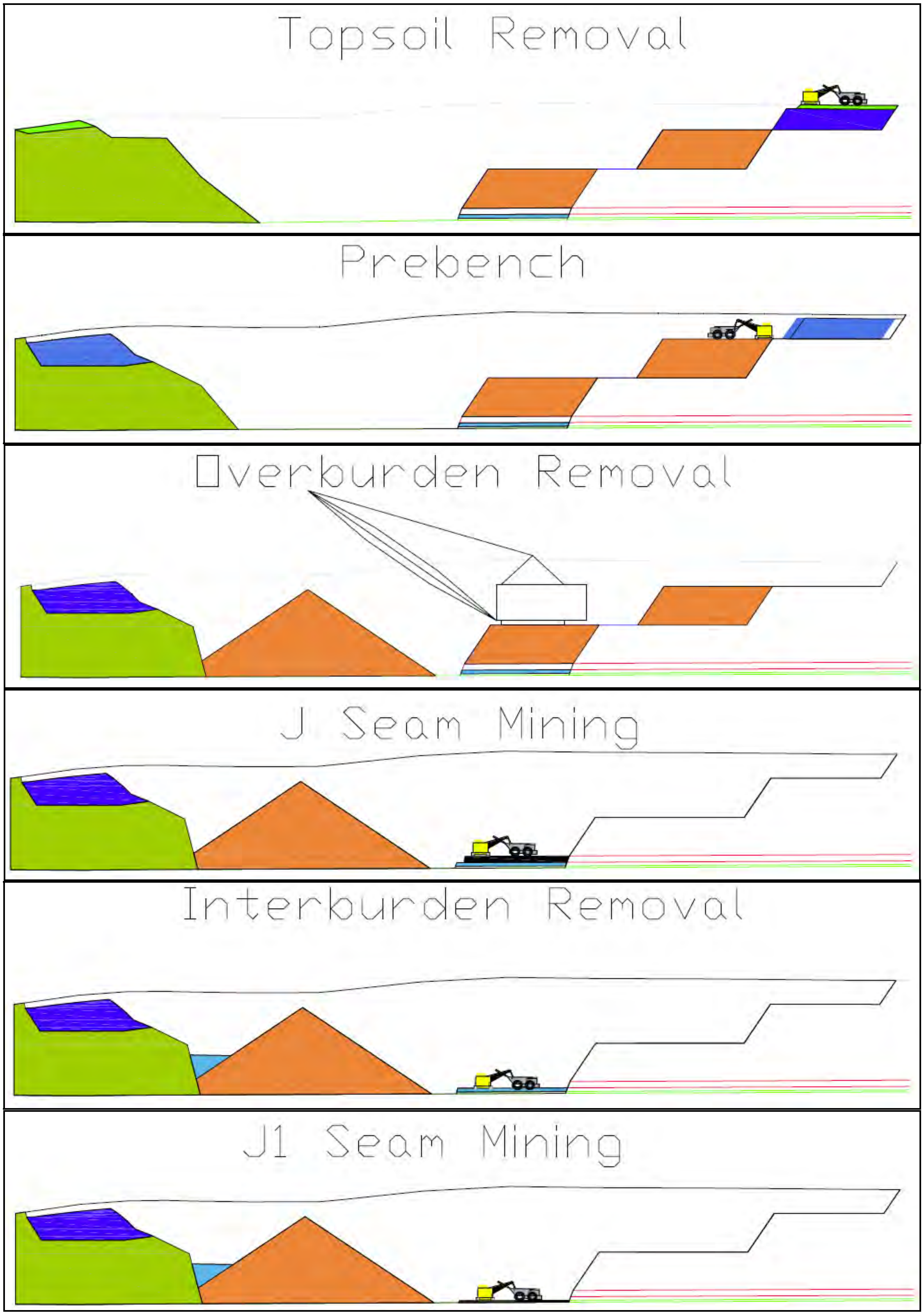


Figure 2.4-1. Typical Mining Sequence
Source: NACC, 2009.

Table 2.4-1. Liberty Fuels Mine—40-Year Mine Plan, Estimated Acres Disturbed

		Acres							
Period	Year	Mined	Ponds and Diversions	Facilities	Ponds Mined	Miscellaneous*	Total Disturbed	Reclaimed	Cumulative Disturbed
1	2012		123.00	320		12.30	455.30		455.30
2	2013	135.93	73.00			20.89	229.82		685.12
3	2014	271.86				27.19	299.05		984.17
4	2015	271.86				27.19	299.05	12.30	1,270.92
5	2016	271.86				27.19	299.05	156.82	1,413.14
6	2017	271.86				27.19	299.05	299.05	1,413.14
7	2018	271.86	51.00			32.29	355.15	299.05	1,469.24
8	2019	277.88			-26	27.79	279.67	299.05	1,449.86
9	2020	277.88				27.79	305.67	299.05	1,456.48
10	2021	277.88	127.00			40.49	445.37	304.15	1,597.70
11	2022	277.88				27.79	305.67	305.67	1,597.70
12	2023	263.76	91.00		-45	35.48	345.24	305.67	1,637.27
13	2024	263.76			-45	26.38	245.14	318.37	1,564.04
14	2025	263.76				26.38	290.14	305.67	1,548.51
15	2026	263.76				26.38	290.14	299.24	1,539.41
16	2027	263.76				26.38	290.14	290.14	1,539.41
17	2028	263.76				26.38	290.14	290.14	1,539.41
18	2029	263.76				26.38	290.14	290.14	1,539.41
19	2030	263.76				26.38	290.14	290.14	1,539.41
20	2031	263.76				26.38	290.14	290.14	1,539.41
21	2032	263.76	44.00			30.78	338.54	290.14	1,587.81
22	2033	312.60			-7	31.26	336.86	290.14	1,634.53
23	2034	312.60			-7	31.26	336.86	290.14	1,681.26
24	2035	312.60			-7	31.26	336.86	294.54	1,723.58
25	2036	312.60			-6	31.26	337.86	343.86	1,717.58
26	2037	312.60	66.00		-6	37.86	410.46	343.86	1,784.18
27	2038	262.20				26.22	288.42	343.86	1,728.74
28	2039	262.20				26.22	288.42	343.86	1,673.30
29	2040	262.20	20.00			28.22	310.42	350.46	1,633.26
30	2041	339.46			-6	33.95	367.41	288.42	1,712.25
31	2042	339.46	96.00		-6	43.55	473.01	288.42	1,896.83
32	2043	177.41				17.74	195.15	290.42	1,801.56
33	2044	177.41				17.74	195.15	373.41	1,623.31
34	2045	177.41				17.74	195.15	383.01	1,435.45
35	2046	177.41				17.74	195.15	195.15	1,435.45
36	2047	177.41				17.74	195.15	195.15	1,435.45
37	2048	177.41	96.00			27.34	300.75	195.15	1,541.05
38	2049	177.41				17.74	195.15	195.15	1,541.05
39	2050	177.41				17.74	195.15	195.15	1,541.05
40	2051	177.41				17.74	195.15	204.75	1,531.45
41	2052	177.41				17.74	195.15	195.15	1,531.45
42	2053	177.41				17.74	195.15	195.15	1,531.45
43	2054	0.00				0.00	0.00	195.15	1,336.30
44	2055	0.00				0.00	0.00	1,336.30	0.00
Total		**10,224.38**	**787.00**	**320**	**-161**	**1,101.14**	**12,271.52**	**12,271.52**	

*Acres for pit ends, roads, etc. (10 percent of total acres).

Source: NACC, 2009.

The surface water management and protection systems would be designed for site-specific conditions to meet minimum MDEQ performance standards related to maintaining the hydrologic balance and water quality. Generally, the methods and techniques would be similar and in addition to those described previously in Subsection 2.3.2 and would include stormwater runoff control channels, stream diversion channels, flood protection levees, and sedimentation ponds and outfalls. Table 2.4-2 and Figures 2.4-2a through 2.4-2g illustrate the changes to the surface water management system as mining is proposed to advance from initial mining block A through final mining block G. If and as approved by MDEQ and USACE permits, NACC is proposing to construct and maintain up to 60,500 linear ft of temporary diversion channels to reroute existing stream flows in Chickasawhay Creek, Penders Creek, and unnamed tributaries to Chickasawhay and Bales Creeks. The diversion channels would be temporary and maintained until reclaimed stream channels would be capable of receiving upstream flows and drainage from the adjacent reclaimed watersheds. NACC is proposing to design and construct the diversion channels to safely pass flows generated by the 100-year, 6-hour storm event, which would meet or exceed MDEQ SMCRA Regulations. To meet water quality permit conditions, up to 56,000 linear ft of temporary stormwater runoff control channels would be constructed along the perimeter and within active mining areas. Flood protection levees with a total length of up to 54,000 linear ft would also be constructed. These levees would be designed to protect active mining areas from flooding in adjacent streams. The sedimentation ponds would be sized to contain runoff generated by a 10-year, 24-hour storm event. A total of seven additional sedimentation ponds could be constructed, with up to five of these built as below-grade excavated structures.

Mine dewatering activities would be similar to those described in Subsection 2.3.2. The principal differences would be the volume of water managed. As mining advances in previously dewatered areas, mine pit inflow rates would decrease to 100 gpm, a reduction in half from the initial volume. Well yields would decrease to approximately 1 gpm from more than 700 gpm initially. As mining moves from dewatered blocks into new blocks, dewatering volumes would temporarily rise.

2.4.2.2 Reclamation and Mitigation

Minimum reclamation and mitigation requirements would be imposed on NACC throughout the duration of the MDEQ and USACE permits. Generally, the MDEQ permit would control reclamation, and wetlands and stream mitigation would be subject to MDEQ and USACE permit conditions, if issued.

Upland Reclamation

Reclamation would be performed in accordance with the MDEQ SMCRA regulations. As required by these regulations, reclamation would occur contemporaneously as mining advances across each mine block. Completion of physical reclamation efforts, defined as planting of the final vegetative cover, would occur approximately 3 years after lignite extraction (see Table 2.4-2).

NACC's operation of the Red Hills Mine provides an example of what the rate of reclamation would be at the Liberty Fuels mine. The MDEQ permit requires completion of physical reclamation efforts are required to occur within 4.5 years at Red Hills. At Red Hills, the following mining and reclamation activities have occurred (NACC, 2009):

- Years of operation: 1998 to 2009.
- Total acres mined: approximately 1,045 acres.

Table 2.4-2. Summary of Mine Support Structures

	Diversion Channels				Levees				Sedimentation Ponds			
Earliest Year Built	Mine Block	Number/ Length (ft)	Latest Year Reclaimed	Maximum Years in Service	Number/ Length (ft)	Creek	Latest Year Reclaimed	Maximum Years in Service	Number/ Total Size (acres)	Wetland Acres	Watershed Controlled (acres)	Maximum Years in Service
2012	A	DIV1A/15,000	2033	21					SP2/36 SP3/50 SP7/90 SP10/58*	10 43 26 13	244 364 738 N/A	43 43 10 7
2019	B1 and B2	DIV1B/4,800	2033	14					SP1/36*	26	N/A	23
2023	C	DIV9/5,200	2040	17	LEV5/2,800	Unnamed tributary of Bales Creek	2040	17	SP8/90 SP9/104	8 23	2215 1575	17
2033	D	DIV15/5,000 CC4/20,700 CC5/19,000	2043	10	LEV6/19,600 LEV7/3,900	Chickasawhay	2043	10				
2038	E	CC6/7,400 CC9/3,600 CC7/8,900	2055	17	LEV1/11,200	Okattibbee	2055	17	SP11/53*	38	N/A	15
2040	F	DIV14/8500 CC10/11,400 CC11/7,000 DIV16/8,100	2055	15					SP14/27*	6	N/A	13
2043	G	DIV7/10,800 DIV8/3,100	2055	12	LEV2/11,300 LEV 3/5,200	Chickasawhay	2055	12	SP12/18* SP13/26*	12 26	N/A	12

Note: DIV = reroute diversion channel.
CC = stormwater collection channel within active mining area.
LEV = levee.
SP = sedimentation (water treatment) pond.

*Excavated, belowgrade structure.

Source: NACC, 2009.

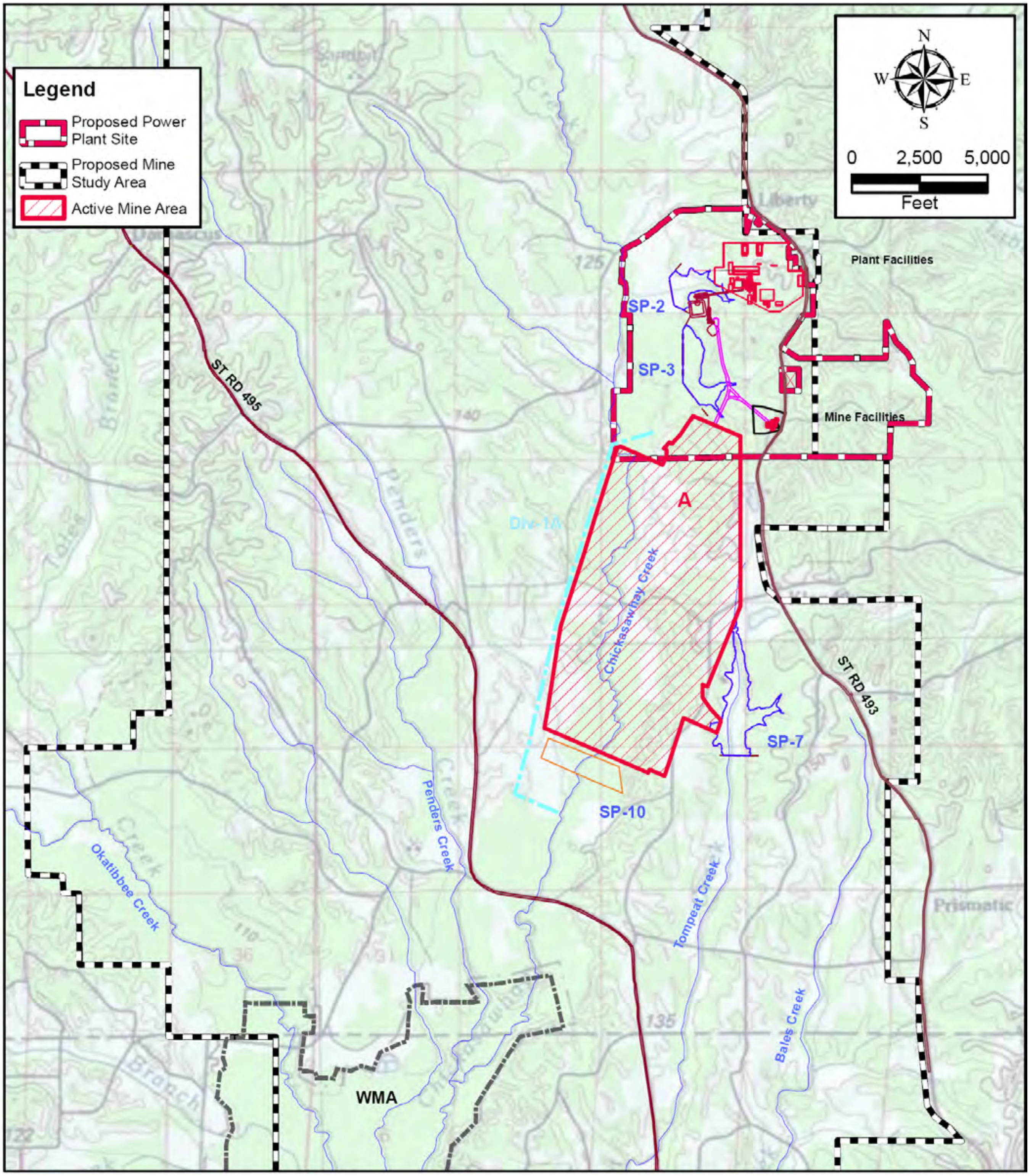


Figure 2.4-2a. Liberty Fuels Mine: Block A
Sources: NACC, 2009. ECT, 2009.

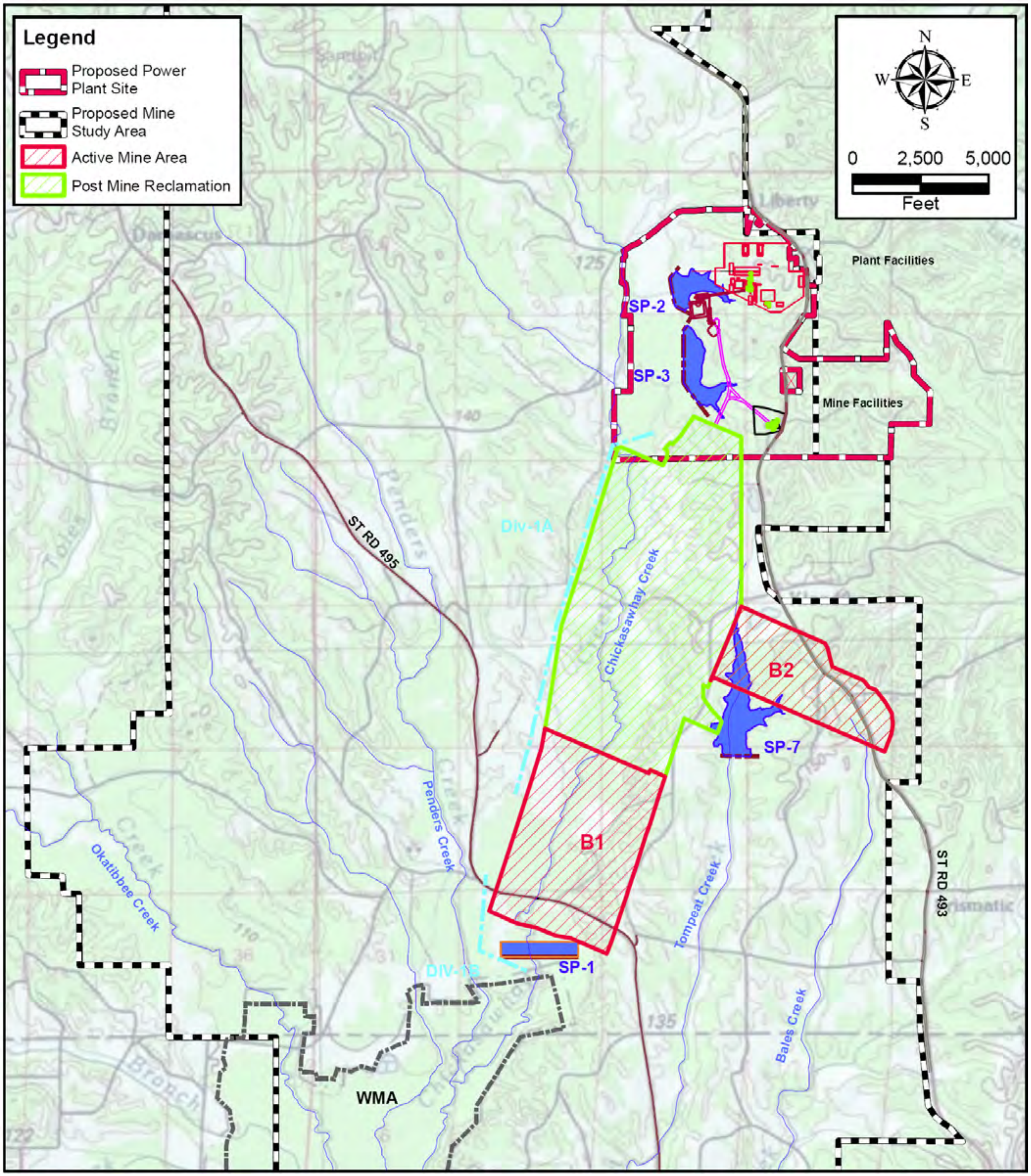


Figure 2.4-2b. Liberty Fuels Mine: Blocks B1 and B2

Sources: NACC, 2009. ECT, 2009.

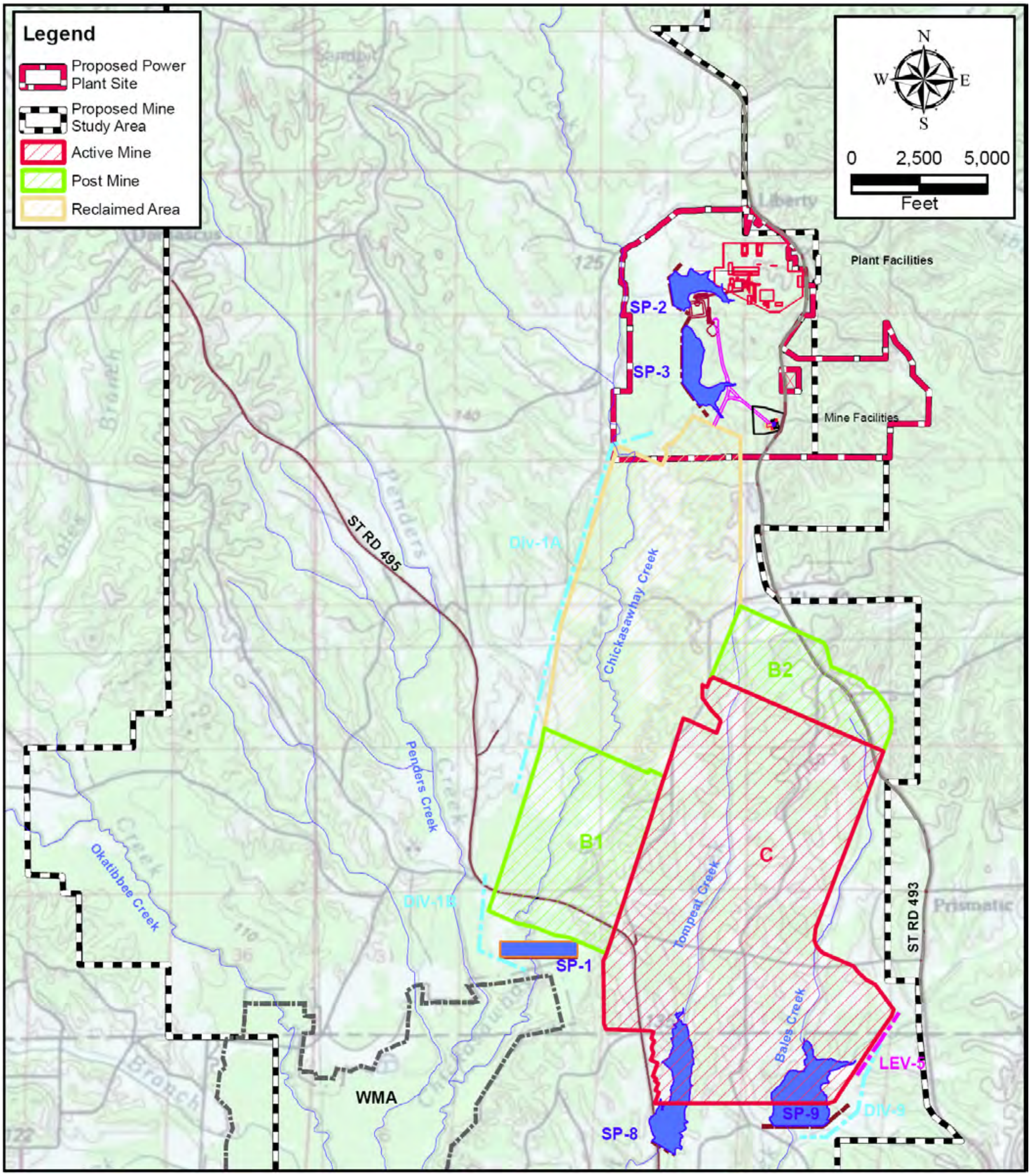


Figure 2.4-2c. Liberty Fuels Mine: Block C

Sources: NACC, 2009. ECT, 2009.

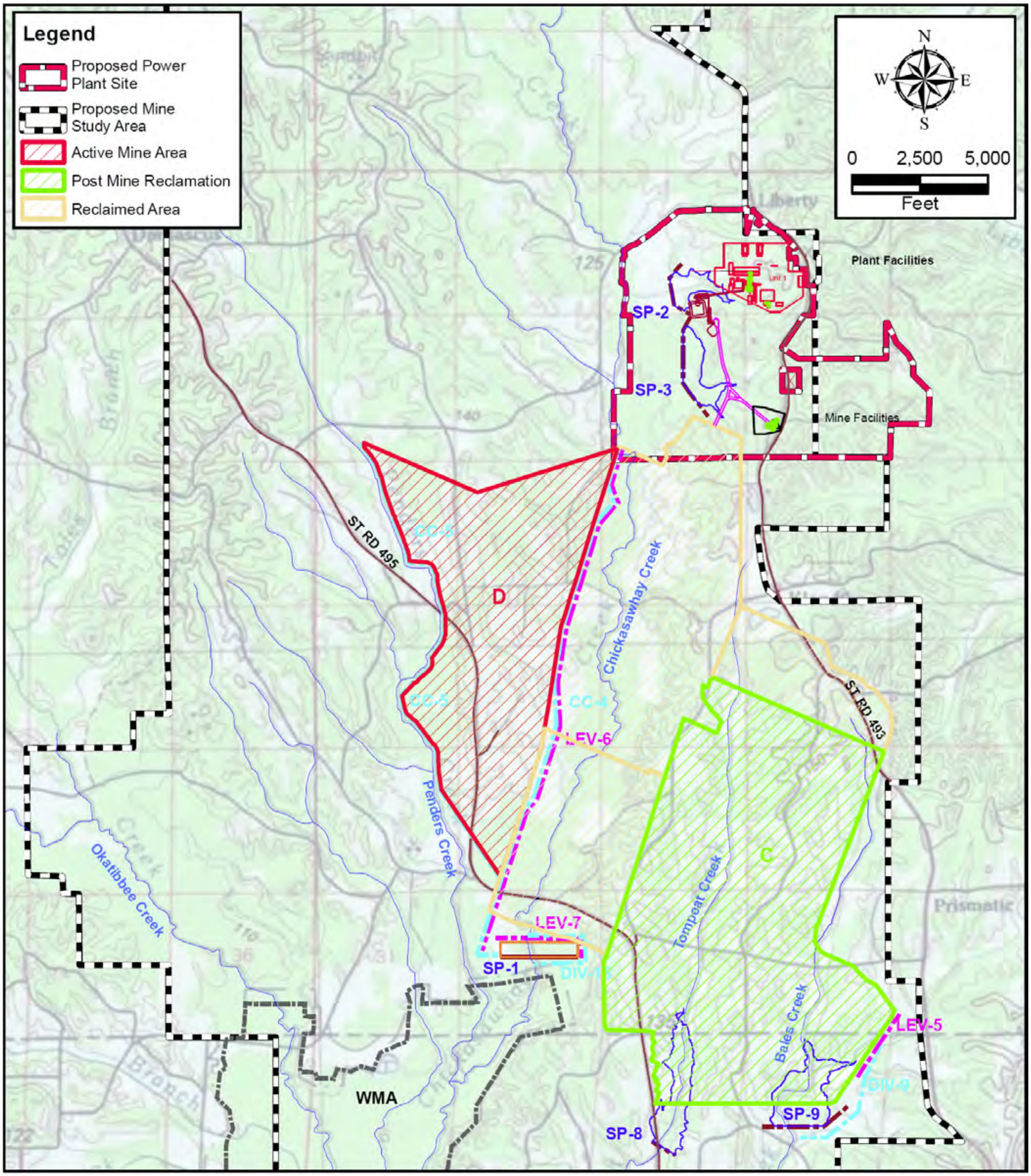


Figure 2.4-2d. Liberty Fuels Mine: Block D

Sources: NACC, 2009. ECT, 2009.

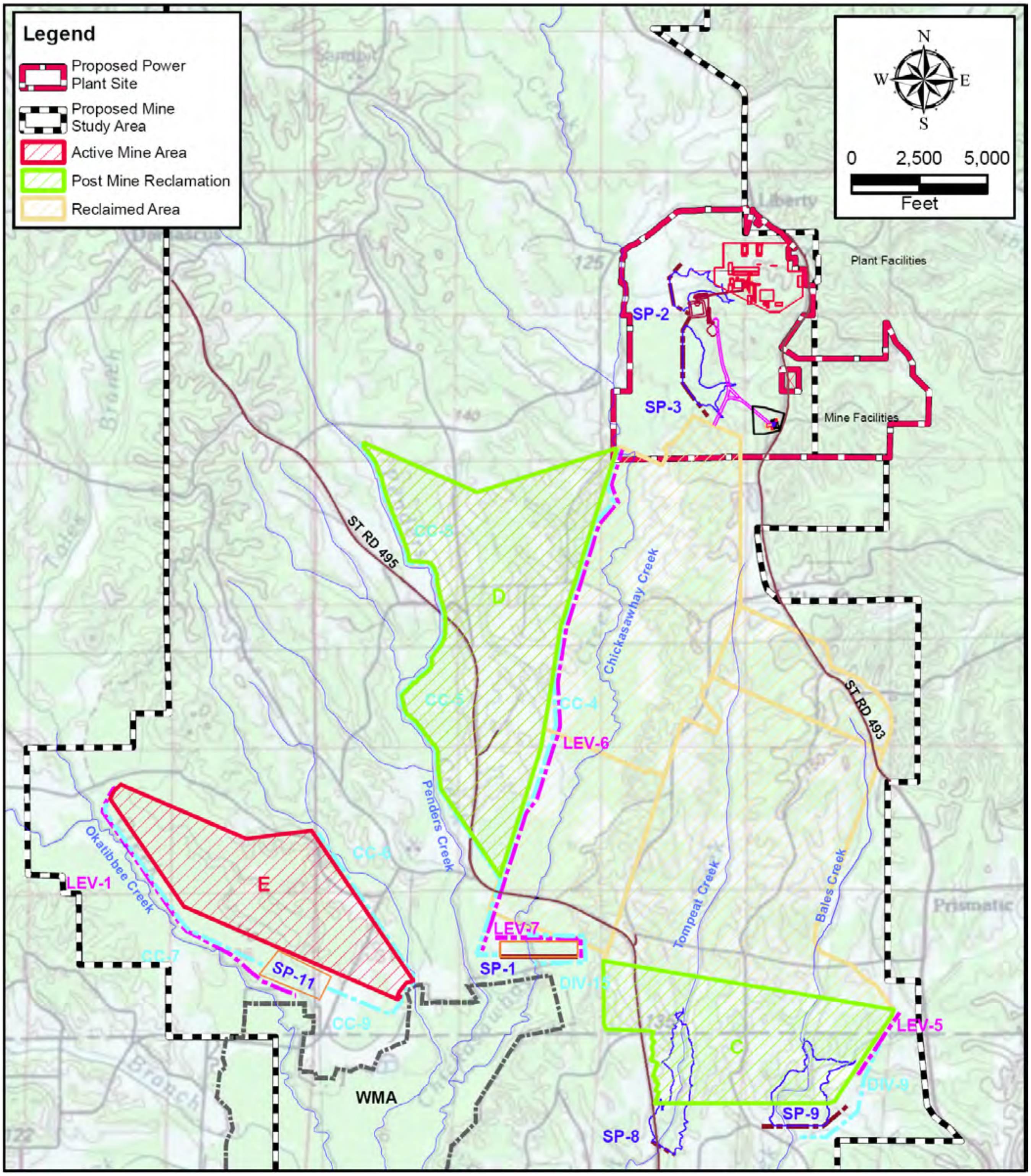


Figure 2.4-2e. Liberty Fuels Mine: Block E

Sources: NACC, 2009. ECT, 2009.

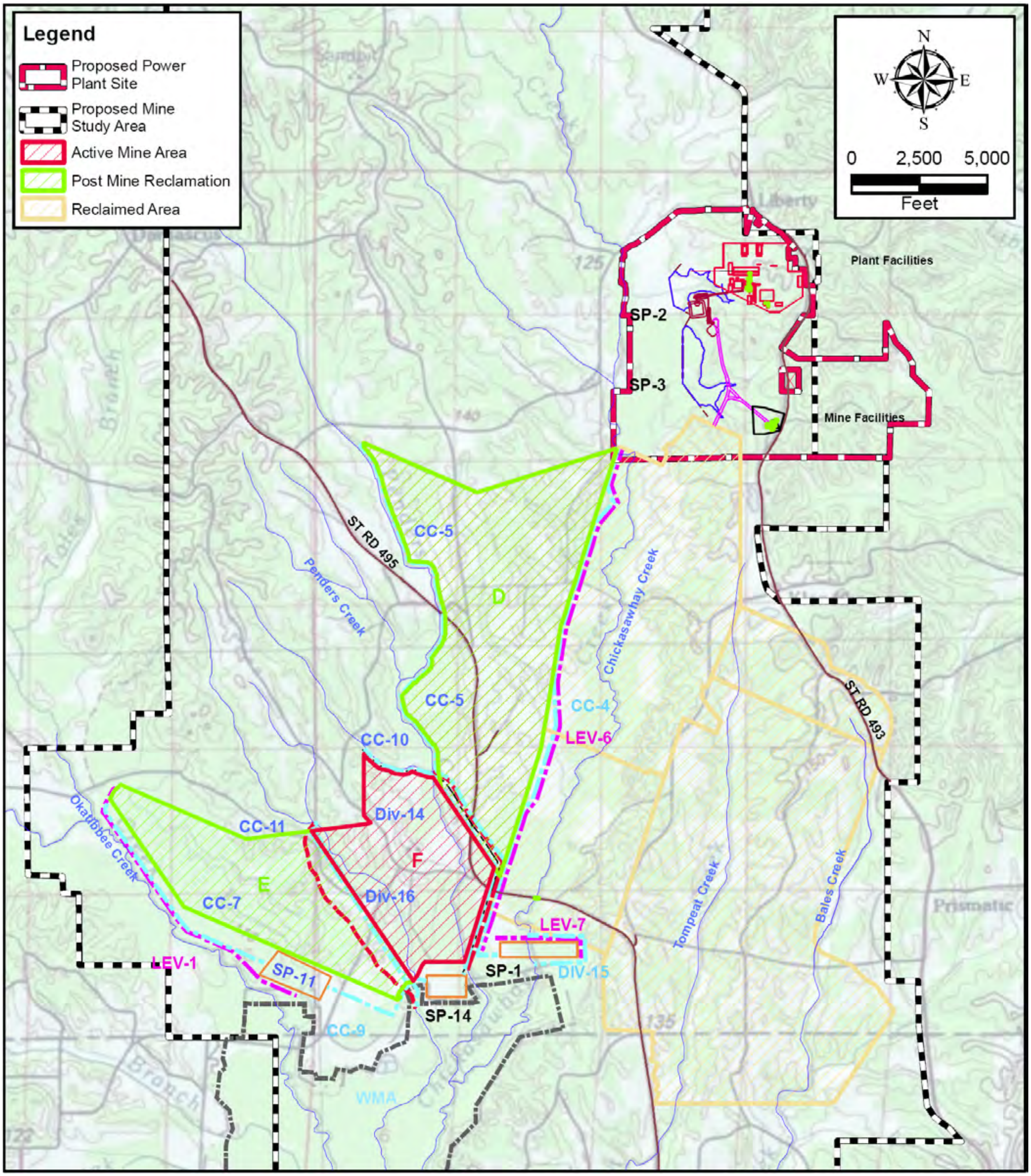


Figure 2.4-2f. Liberty Fuels Mine: Block F

Sources: NACC, 2009. ECT, 2009.

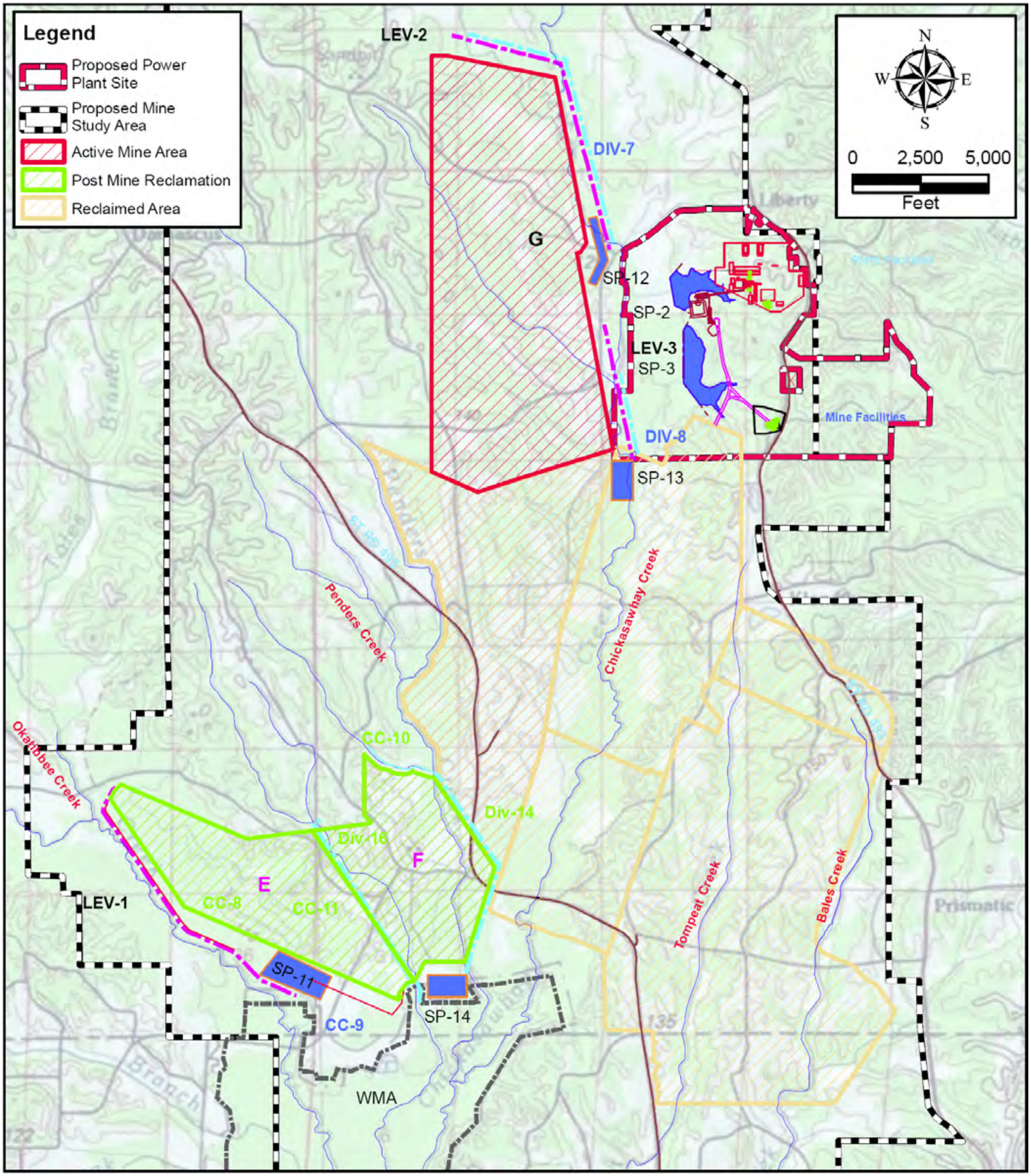


Figure 2.4-2g. Liberty Fuels Mine: Block G

Sources: NACC, 2009. ECT, 2009.

- Total nonmined acres disturbed: approximately 324 acres.
- Average annual mining rate: approximately 100 acres/year.
- Total acres reclaimed (completion of all physical work): approximately 784 acres.
- Average annual reclamation rate: approximately 100 acres/year.
- Total reclamation acres under reclamation variance (i.e., haul roads, sumps, ponds, etc.): approximately 100 acres.
- Nonvariance acres to be reclaimed: approximately 485 acres.

Reclamation would begin by grading the overburden spoil. Then a minimum of 4 ft of oxidized suitable plant growth material would be spread across the reclamation area. Small, low-compaction bulldozers would be used to prepare the reclamation area for seeding. The type of vegetation planted on the reclaimed landscape would be controlled by the MDEQ permit and landowner preferences where the mine operator does not own the surface rights. Depending on the time of year and planting conditions, a temporary or permanent vegetative cover would be planted into the reclamation area. Loblolly pine trees would be typically planted the winter after permanent ground cover has been established in areas to become pine plantations.

Sedimentation ponds would not be reclaimed until the disturbed contributing watershed area is reclaimed, vegetation requirements are met, drainage entering the pond meets applicable effluent limitation standards, and/or other sedimentation ponds are located downstream. None of the proposed sedimentation ponds would be planned as permanent features. However, all surface impoundments would be designed and constructed to meet MDEQ permanent impoundment engineering standards and would remain as permanent, recreational ponds at the discretion of the surface landowner, provided such permanent ponds are approved by MDEQ and USACE.

Figures 2.4-2a through 2.4-2g illustrate that the proposed mine plan will include mining disturbance where MS 493 and MS 495 are currently located. During EIS preparation consultations with DOE, NACC committed to reconstruction of both highways as part of the land reclamation process.

MDEQ SMCRA Regulations require return of the land surface to the approximate original contours. Based on information provided by NACC, up to 13 ft of lignite would be extracted to supply the IGCC gasifers. However, the overburden removed to expose the lignite would have an approximate 15-percent swell factor, which is the percentage expansion of the *in situ* volume when removed from its natural state. Because the swell factor would effectively offset the thickness of lignite extraction proposed, the net result would be land surface topography and elevations similar to existing conditions.

MDEQ SMCRA Regulations also require maintenance of the premining hydrologic balance and minimization of probable hydrologic consequences. Conformance with these requirements would require NACC to reestablish existing drainage patterns by contouring watersheds to their approximate premining boundaries and reclaiming stream valleys and floodplains to their approximate premining capacities and conditions. During preapplication consultations with USACE, NACC committed to restore all onsite streams disturbed by mining operations to their approximate premining locations.

Due to a lack of existing recoverable topsoil in the mine study area, NACC has indicated its intent to seek MDEQ approval to use oxidized overburden instead of native topsoil as an alternative, or topsoil substitute, in both uplands and wetlands. Subsection 4.2.3 addresses the effects of the proposed substitution.

Wetland Mitigation

Wetland mitigation would be conducted as required by the USACE permitting process. Both the type and magnitude of the mitigation required would be dependent on the type and magnitude of impacts authorized by USACE following completion of the avoidance and minimization analyses required under EPA Guidelines and a USACE/EPA Memorandum of Agreement more fully described in Chapter 7. All mitigation concerning impacts to wetlands would be properly coordinated by USACE during its evaluation process for Department of the Army permits.

With respect to the type of mitigation, USACE's 2008 Mitigation Rule establishes a hierarchy of preferred mitigation types, including mitigation bank credits, *in-lieu* fee fund programs, onsite in-kind restoration, onsite in-kind creation, etc. The mine operator has indicated its current preferences are onsite creation in-kind, onsite restoration in-kind, preservation within the Okatibbee Lake watershed but outside the immediate mine impact area, and in-kind mitigation (restoration) within the Okatibbee Lake watershed outside the immediate mine impact area.

USACE's 2008 Mitigation Rule establishes the minimum quantity of mitigation required, in the case of the Mobile District, by using the WRAP to quantify the wetland functional loss attributed to each type of impact (e.g., forested versus herbaceous systems), as well as the increase attributed to the mitigation activity proposed. Under these rules, the mitigation quantity would be sufficient if the proposed mitigation activities result in an increase in wetland functional values that more than offset the losses attributed to the impacts, including consideration of temporal loss.

With respect to wetland creation, NACC has provided the following conceptual approach to wetland creation at the Liberty Fuels Mine site, which is similar to the approach used at the operator's Red Hills Mine in Choctaw County, Mississippi, some 60 miles north of the IGCC site.

> *"Wetlands are generally created as part of the regrading and reclamation process. An area's watershed and postmine soil type are evaluated for their potential to sustain a wetland. Once determined feasible, a wetland is developed through regrading. Typically these are slightly incised depressional areas in order to achieve the target size and depth. The hydraulic properties of the postmine soils are expected to be favorable for wetland creation.*
>
> *Once the regrading (including the required placement of approved topsoil and subsoil substitute materials) is complete, the area is generally revegetated with native wetland species. Other plant species are planted as appropriate to provide temporary, immediate cover (to minimize erosion), food and cover for wildlife, and a source of decomposing plant material. The wetland 'behavior' or characteristics would be monitored to determine if it is developing the desired functions and values at an acceptable rate or if additional work is needed to do so. Additional work can include planting, modifying the plant mix, soil modification, or additional soil grading work"* (NACC, 2009).

Mitigation through enhancement or restoration of existing wetlands within the Lake Okatibbee watershed would be site-specific and subject to in-the-field verification according to USACE rules. NACC has yet to identify the proposed candidate sites; therefore, these alternative types cannot be evaluated in this EIS. Further evaluation would be performed by USACE during the permitting process.

Stream Mitigation

Stream mitigation would be conducted as required by the USACE permit. Both the type and magnitude of the mitigation required would be dependent on the type and magnitude of impacts authorized by USACE following completion of the avoidance and minimization analyses required under EPA Guidelines and a USACE/EPA Memorandum of Agreement more fully described in Chapter 7. Mitigation concerning impacts to streams will be coordinated during the USACE evaluation process.

USACE's Mobile District Stream Mitigation Standard Operating Procedures and Guidance provide the framework to be used to establish both the type and magnitude of mitigation required to offset the stream impacts authorized by the USACE permit, if any. The guidance provides a mechanism for calculating numerical losses due to impact and functional gains due to mitigation. The appropriateness of the type(s) of stream mitigation proposed by the mine operator would be evaluated on a case-by-case basis. Proposals by NACC, discussed conceptually in the following, would be evaluated as stream relocation mitigation under the Mobile Guidance (see Guidance, Subsection 5.1.1).

NACC has committed to recreate each of the streams removed by mining during preapplication consultations with USACE in 2009. Site- or stream-specific cross-section, plan, and profile design drawings would be developed as part of the USACE permitting process.

2.4.3 LINEAR FACILITIES

Permanent rights-of-way would be maintained for the proposed new transmission lines and associated substations, natural gas pipeline, reclaimed water supply pipeline from Meridian, and CO_2 pipeline. Existing rights-of-way for the upgraded sections of transmission line would continue to be maintained as required by the Southern Company Transmission Inspection Standards and the North American Electric Reliability Council. Operation of the linear facilities would generally include multiple types of inspections, as well as regularly scheduled mowing, clearing, herbicide application, and tree trimming. The gas and CO_2 pipelines would be mowed and inspected once per year per federal regulations.

All of the proposed and upgraded transmission lines would be maintained in accordance with the referenced policies, with the basic objective of ensuring every structure is inspected at least every 6 years. Mississippi Power's current transmission line inspection regime is as follows:

- Ground inspections are performed visually every 6 years by a contract employee immediately following mowing and clearing activities. The inspector installs and/or replaces guy markers and repairs broken ground wires as needed. Any critical problems are reported immediately; other deficiencies are noted in the Southern Transmission Operation & Maintenance (O&M) Program for routine follow-up.
- Ground line treatment inspections are performed on approximately 1/12 of Mississippi Power's wooden pole system every year. Although all design work has not been completed on the proposed transmission lines, it is not anticipated that any wooden poles would be used.
- Comprehensive walking inspections, also known as climbing inspections, are usually performed by company personnel or qualified linemen during normal operations and emergency repairs. Any critical problems are reported immediately; all other deficiencies are noted in the Southern Transmission O&M program for routine follow-up.
- Aerial inspections fall into two categories: (1) routine aerial inspections, and (2) comprehensive aerial inspections. Routine aerial inspections are performed by a contractor throughout the year on Mississippi Power's entire system, which would include the proposed facilities. If a critical situa-

tion is found, the inspector calls Mississippi Power to immediately notify them of the situation. All other situations are recorded in a monthly report. Although Southern Company Transmission Standards state that routine aerial inspections should be performed a minimum of four times per year, Mississippi Power routine aerial inspections occur a minimum of seven times per year. Southern Company Transmission Inspection Standards state that comprehensive aerial inspections are designed primarily for 230- and 500-kV structures. They are performed every 12 years for concrete structures and every 18 years for steel structures.

Vegetation control along the proposed and existing transmission rights-of-way would be accomplished through a 6-year cycle of mowing and clearing, as well as herbicide application:

Year	Activity
1	Mowing and clearing
2	Herbicide application
3	No action
4	Herbicide application
5	No action
6	No action
7	Start over (see Year 1)

A qualified representative would assess the condition of the right-of-way and review future planned activities to determine the scope of brush cutting that would be necessary. Rotary mowing equipment would be the preferred method for the complete cutting of all brush on the right-of-way. Hand cutting would be the preferred method in areas too wet to allow the use of low-ground-pressure rotary mowing equipment or where the scope of work calls for the selective removal of specific stems or the complete cutting of small areas of the right-of-way. Contract crews would remove all brush and debris from cultivated fields, pastures, waterways, lakes, ponds, ditches, roads, public road rights-of-way, trails, fences, and any other areas identified by Mississippi Power.

It might become necessary to intermittently trim trees and limbs that encroach on the right-of-way from the side. Mechanical side trimmers would be the preferred method for doing this, especially in rural areas where access and topography allow. Aerial lifts might be utilized in urban areas where trees have higher value and provide aesthetic benefit to the surrounding areas. Manual work, or climbing, would be limited to areas inaccessible to mechanized equipment.

Also, as a normal course of business, there might be times when it would be prudent to remove off-right-of-way trees that would have the potential to damage the proposed transmission lines. These are commonly referred to as *danger trees*. In Mississippi, a danger tree is defined as any tree, living or dead, which would pass within 5 ft of a conductor if it were to fall toward the conductor.

Herbicides would be applied to control vegetation that had the potential to interfere with electrical conductors or transmission structures and equipment. The scope of this work might range from the treatment of any and all vegetation on the right-of-way to the treatment of specific stems that might pose a threat to line reliability on selected segments of the right-of-way before the next scheduled treatment or vegetation management activity. The method and techniques of application would be determined by a qualified representative of Mississippi Power through field evaluation of the right-of-way to determine adjacent land use patterns, plant species, brush density, and soil and topographical characteristics of the area.

Herbicides might be applied to a right-of-way using a number of methods including aerial application, broadcast application, and low-volume application. Aerial application would typically be accomplished from a rotary-wing aircraft. The goal of aerial application would be to reduce the stem count and create an environment that would favor the establishment of low-growing species compatible with a transmission right-of-way.

Herbicides might also be broadcast evenly over the right-of-way in areas where brush density made it impractical to treat individual stems. The goal of broadcast application would be to reduce the stem count and create an environment that would favor the establishment of low-growing species that are compatible with a transmission right-of-way. After stem counts have been reduced to a manageable level by broadcast application, targeted applications using backpack sprayers or low-volume application might become the preferred method of application. Tall-growing stems with the potential to grow into electrical conductors would be individually treated to minimize the amount of herbicides used. Stems that were compatible with a transmission right-of-way would be left untreated.

Mississippi Power, and other operator/owners as appropriate, would also maintain the rights-of-way for the proposed pipelines in a similar fashion as the transmission lines to continuously provide easy access for maintenance, inspection, and emergency repairs. After placing the project pipelines in service, there would be regular tasks associated with their operation. Rights-of-way would be monitored to ensure the success of revegetation. To assure continued freedom of access, regular maintenance would include repairing washed-out or rutted areas, reseeding areas of unsuccessful vegetation growth, and mowing to prevent overgrowth. Regular maintenance would include patrolling the pipelines on a systematic basis, either on the ground or by air, to make sure that activities around the pipeline would not disturb or damage it in any way. Also, pipeline valves would be inspected and lubricated on a regularly scheduled maintenance interval. Signs would also be posted to indicate the location of the pipeline and provide a telephone number to call before any digging in the vicinity.

2.4.4 CONTINGENCY PLANS

The 4.5-year IGCC demonstration would most likely end in success. In that case, the commercial operation of the facilities would continue as planned and described previously. However, an unsuccessful demonstration remains a possible outcome. In this case, it is likely that either the power plant would be converted to a natural gas combined-cycle (NGCC) power plant, or it would continue commercial operation of the combined-cycle power-generating unit using the gasifiers to the extent possible, while using natural gas to serve the balance of the combined-cycle unit’s requirements not met by the gasifiers. Under any foreseeable outcome, the expected operating life of the power plant facilities would remain 40 years.

Assuming an unsuccessful demonstration followed by commercial operation of the combined-cycle unit using natural gas exclusively, the power plant’s use of coal would be replaced by increased use of natural gas. The plant would be capable of producing more electrical power due to less onsite demand (especially the gasification equipment). Lower emissions of most air pollutants from the power plant would result, and less water would be required for operations, as cooling water demand for NGCC project facilities would be reduced to 55 to 60 percent relative to IGCC due to the absence of demand by the gasification equipment. No carbon capture could be performed if the plant were operating on all natural gas. Less land would be required since less solid waste would be generated. For example, the potential future gasification ash management area on the east side of the site shown in Figure 2.1-5 would not be needed. The gasifiers and related equipment would no longer be required and would likely be dismantled and removed from the site. The byproducts generated by the IGCC plant would also no longer be produced. The number of power plant workers during operations would drop to 28, because the gasifiers and related equipment would no longer be required.

The power plant would no longer require the lignite mine under this scenario, although the independent commercial operation of the mine could continue. Nonetheless, lignite coal shipments to the gasifiers would cease, which would likely reduce the scale of operations at the proposed mine.

The status of the lignite surface mine would be uncertain following an unsuccessful demonstration. If the power plant was converted to NGCC and Mississippi Power no longer purchased lignite from the mine, NACC would most likely actively pursue alternative customers/markets. Possible opportunities for an existing lignite mine would include supplying a traditional coal-fired power plant (e.g., pulverized coal) or activated carbon production (lignite is a good feedstock). If no other customer could be found, NACC would close the mine and perform all of the postmining reclamation activities that would be required under MDEQ SMCRA Regulations. Absent another lignite customer, the number of mine workers could drop from 213 down to 12 to 15, because the mine would no longer be required to support the IGCC plant, and the mine would be conducting final reclamation and maintenance of postmined lands.

Assuming unsuccessful demonstration followed by continued commercial operation of the combined-cycle unit using the gasifiers to the extent possible, while using natural gas for the balance, the proposed facilities' operations and resource requirements would fall between those described for successful demonstration and those for NGCC, just described. Less lignite and water would be used and less ash, filter cake, H_2SO_4, CO_2, and anhydrous ammonia would be produced. Less lignite would need to be delivered to the power plant than when the gasifiers were operating at availability levels planned during the demonstration period. The lignite mine would operate at a lesser rate to support the IGCC power plant, unless it could continue full-scale commercial operations for other customers. Disposal requirements and/or transportation offsite for commercial sale of H_2SO_4 and anhydrous ammonia would correspondingly be reduced. As with the NGCC outcome, during periods when the gasifiers were not operating, cooling water demand for project facilities would be almost 50 percent less than under the successful outcome. Also under this outcome, there would likely be somewhat fewer workers at the mine due to the lessened demand for lignite.

2.5 RESOURCE REQUIREMENTS

Table 2.5-1 summarizes the operating characteristics, including resource requirements, for the proposed IGCC facilities.

2.5.1 LAND AREA REQUIREMENTS

Figure 2.2-1 showed the power plant site and all of the connected actions. Each of these would require land. Table 2.5-2 summarizes the expected land area requirements by component (all entries are approximate).

Figure 2.5-1 shows areas of the power plant site that would potentially be impacted by construction of various onsite facilities. The IGCC power plant and other associated permanent facilities would occupy a total of up to approximately 550 acres of the 1,650-acre power plant site. The 550 acres include the main gasification and power generation equipment, reclaimed water makeup pond, stormwater management facilities, cooling towers, flares, byproduct and ash storage areas, buildings and roads, and onsite portions of pipelines and transmission lines. Approximately 200 more acres of land would be required during construction for equipment/material laydown, storage, assembly of site-fabricated components, staging of material, a parking lot to accommodate construction workers' vehicles, facilities to be used by the construction workforce (i.e., offices and sanitary facilities), and buffer areas.

Table 2.5-1. Principal Full Load Operating Characteristics of the Proposed Kemper County IGCC Project*

Operating Characteristics	Nominal Value/Range
Generating capacity (MW) (net)†	582
Capacity factor (%)‡	85
Power production (MWh/yr)	4.3×10^6
Coal consumption (tpy)§◊	4.2×10^6 to 4.3×10^6
Natural gas consumption (10^6 scf/yr)**◊◊	5,800
Fuel oil consumption (10^3 gal/yr)**	124
Water requirements	
Reclaimed water (MGD)	6.2 to 6.9
Nonpotable ground water (MGD)	0.0 to 0.7
Reclaimed gasifier water (MGD)	1.0
Potable ground water (MGD)	0.003
Air emissions (tpy)‡‡	
SO_2◊	570 to 590
H_2SO_4	55
NO_x◊	1,800 to 1,900
PM_{10}◊	450 to 470
CO◊	890 to 980
VOCs◊	130 to 150
CO_2 emissions (tpy)◊ §§	1.8×10^6 to 2.6×10^6
Process wastewater (gpm)	0
Solid wastes (10^3 tpy)	
Filter cake††	3 to 15
Byproducts (10^3 tpy)	
CO_2◊	2,500 to 3,500
Anhydrous ammonia◊	21 to 22
Gasification ash◊	550 to 560
H_2SO_4◊	132 to 139

Note: MWh/yr = megawatt-hour per year.

*All values estimated based on stated capacity factors and average operating conditions using syngas and not meant to be representative of any specific time period.
◊Range estimates the characteristics expected when operating between 50- and 67-percent carbon capture on an annual basis.
†Generating capacity represents full load with duct burners firing.
‡Capacity factor is percentage of energy output during period of time compared to energy that would have been produced if equipment operated continuously at maximum power throughout entire period.
§Based on lignite coal from Liberty Fuels Mine in Mississippi with an average heating value.
**Assuming ten plant startups per year.
◊◊Assuming constant use of duct burners at stated capacity factor.
††Range includes process water supply cases with and without supplemental ground water from the Massive Sand aquifer.
‡‡Potential facilitywide emissions with IGCC operating on syngas at stated capacity factor.
§§Average CO_2 emissions from IGCC operating on syngas with continuous duct burner operation at stated capacity factor. Continuous duct burner firing contributes approximately 0.3×10^6 tpy to the total CO_2 emissions presented. Continuous duct burner firing CO_2 emissions presented to provide upper bound of potential operating conditions.

Source: SCS, 2009.

Some mining-related facilities would be located on the power plant site. The permanent (e.g., coal handling and processing) and temporary (portion of initial mine area and construction staging) land use associated with the mine would total approximately 350 acres.

The study area for the proposed surface mine is approximately 31,000 acres, which includes approximately 1,400 acres within the boundary of the power plant site. Approximately 40 percent of the land within these 31,000 acres would be secured for mining and mining-related uses through leases or purchases. The land would either be secured from the surface landowner or the tract would not be mined or disturbed by mining impacts. In addition, churches that are in use and dedicated cemeteries would be mined around and remain undisturbed.

Table 2.5-2. Summary of Expected Land Area Requirements

Location	Acres
Power plant	750
Onsite coal handling and mine operation facilities	350
Surface lignite mine area	<13,000
Natural gas pipeline	<50
New electrical transmission lines and substations	1,000
Reclaimed water pipeline	185
CO_2 pipeline	375
Total	**15,710**

Sources: SCS, 2009; NACC, 2009; ECT, 2009.

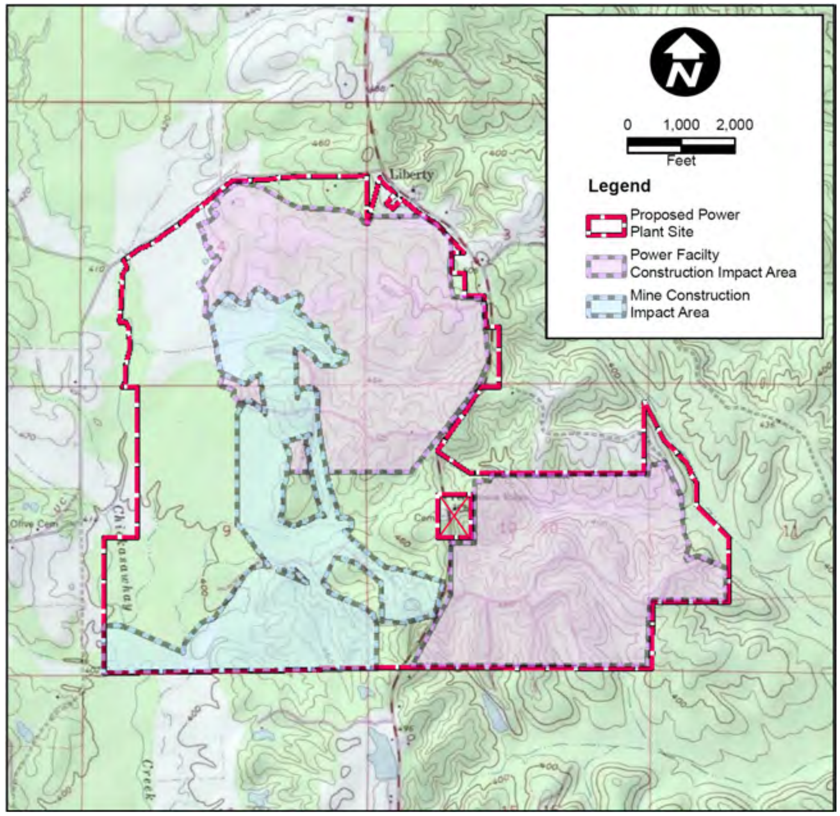


Figure 2.5-1. Areas of Kemper County IGCC Project Site Potentially Impacted

Sources: SCS, 2009. NACC, 2009. ECT, 2009.

As discussed previously (see Table 2.4-2 and related text), during the proposed 40-year life of mine, an average of 275 acres per year would be disturbed by lignite mining. Disturbed acres associated with mining over the 40-year period would total approximately 12,000 to 13,000 acres. However, the number of acres in a disturbed state at any given time would range from approximately 1,300 to 1,900 from 2014 through 2054.

Each of the linear facilities would have permanent land requirements as well as temporary needs for land during construction. The totals given in Table 2.5-2 reflect the approximate permanent new rights-of-way required for each facility (existing rights-of-way of transmission lines that would be upgraded are not included as these would not represent a new land requirement). Additional land would be required temporarily for equipment staging during construction. In addition, each linear facility would require some land for permanent, new access roads; the roads would be needed during construction, but would also be used for facility access for maintenance. More detailed engineering studies, which would be completed closer to facility construction, would be needed to estimate access road land requirements. However, the land requirements would be consistent with standard practices for siting such linear facilities and would not likely change the estimates given in Table 2.5-2 by any significant amounts.

2.5.2 WATER REQUIREMENTS

Potable water would be used during construction of the proposed power plant facilities for various purposes including personal consumption and sanitation, concrete formulation, preparation of other mixtures needed to construct the facilities, equipment washdown, general cleaning, dust suppression, and fire protection. Potable water associated with construction activities would be obtained from ground water drawn from permanent onsite wells. Portable toilets would minimize requirements for additional sanitary water during construction. Ground water from the shallower Lower Wilcox aquifer using two or more onsite wells would be the water source for potable uses (e.g., drinking water, restrooms, showers). It is expected that the ground water would receive treatment for iron removal and would also be treated with a biocide. Potable uses would consume an estimated 3,000 gallons per day (gpd). During power plant operation, water for potable needs would be obtained from these onsite wells.

Figure 2.5-2 presents a simplified process water balance diagram for the proposed IGCC facilities. When operating on syngas the 10-cell gasification system cooling tower and the 12-cell combined-cycle unit cooling tower would need approximately 5,000 gpm of water as makeup (based on annual requirements). This would replace cooling tower evaporative losses and blowdown (i.e., water discharged from the cooling tower to limit the concentration of total dissolved solids [TDS]). Approximately 55 percent of the cooling water demand would result from the combined-cycle unit's operation, while the remaining 45 percent would be attributable to the gasification facilities. Approximately another 13 to 14 gpm of water droplets would escape beyond the cooling towers' drift water eliminators to the atmosphere. Water conservation measures would include recycling process wastewater streams from both the gasifier and combined-cycle systems to the cooling towers.

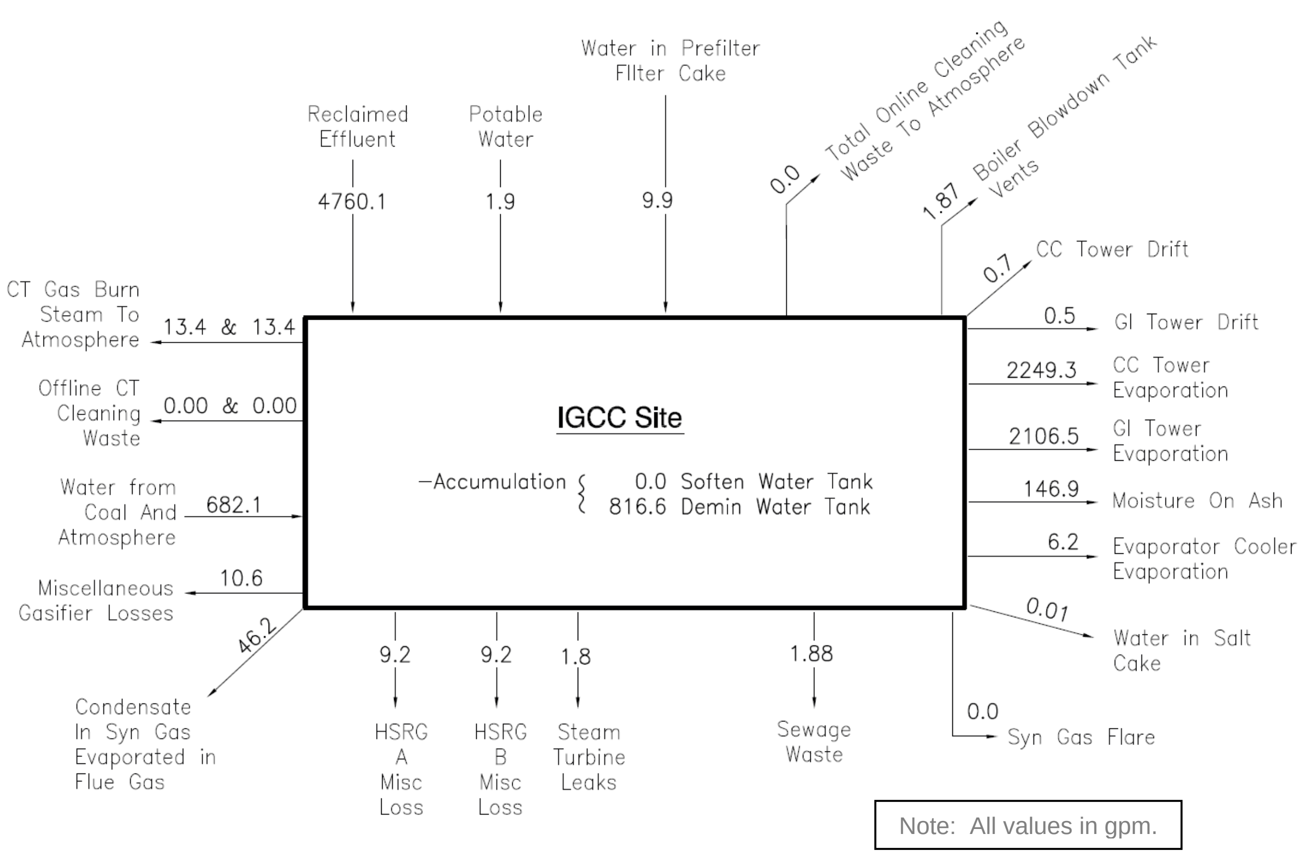


Figure 2.5-2. Overall IGCC Plant Water Balance

Sources: SCS, 2009. ECT, 2009.

Reclaimed water from two POTWs (Meridian and East Meridian) would supply the principal nonpotable water requirements for the IGCC power plant. Moisture from the lignite coal and recycled process water would also be collected and used to supplement the nonpotable supply. If necessary, ground water from the nonpotable Massive Sand aquifer would also be available. The main water uses would be cooling of both the gasification and combined-cycle systems, along with other service water needs, including boiler makeup. Most water consumption would result from cooling tower evaporation. As discussed elsewhere, recycling of various internal plant wastewater streams would occur wherever possible to reduce overall demands for new supply.

Reclaimed effluent from Meridian would be expected to supply up to an average of 6.9 MGD by 2015. This supply would be supplemented with approximately 0.98 MGD of water reclaimed from the gasifier process. Together, these sources would be expected to fully satisfy the nonpotable demands of the proposed IGCC facility. Reclaimed water from Meridian would be transported to the site via a reclaimed water pipeline, as discussed previously in Subsection 2.2.4. In the event of a shortfall in the amount of water available from the POTW water sources, additional power plant water could be supplied from an onsite well drilled to approximately 3,300 ft bls into the Massive Sand aquifer. This well and a backup well would each have the nominal capacity to withdraw approximately 930 gpm.

Reclaimed effluent from the two Meridian POTWs would supply the reservoir (surge pond) located on the portion of the site east of MS 493 (see Figure 2.1-5). This water would then be pumped to the IGCC power plant as needed. The onsite reservoir would provide a supply of water that would be available in the event of short-term disruptions or reductions in flow from the POTWs. (Ground water could also supplement plant water supplies on a short-term basis, as noted previously, but its poorer quality would make it much less desirable.) Based on a preliminary design of the onsite water storage reservoir, it would cover approximately 75 acres and would have a volume of approximately 500 million gallons. An earthen dam would be constructed on the east side of the reservoir with a top of dam elevation of 406 ft. The overall dam height would be approximately 36 ft. The maximum high water elevation would be 396 ft, and the low water elevation would be 376 ft.

Table 2.5-3 presents raw water quality information for both the POTW and ground water sources. Table 3.7-5 will provide additional information on ground water quality. As shown in Table 2.5-3, the ground water from the onsite Massive Sand aquifer test well was found to have a high concentration of TDS. The implications of this are discussed in Subsections 2.7.2.1 and 4.4.1.

Table 2.5-3. Estimated Makeup Supply Water Characteristics

Constituent	Reclaimed Effluent	Massive Sand Aquifer
TSS (mg/L)	11	37
TDS (mg/L)	251	23,000
pH (s.u.)	6.5 to 8.4	6.9
Copper (mg/L)	0.006	0.003

Note: TSS = total suspended solids.
TDS = total dissolved solids
mg/L = milligram per liter.
s.u. = standard unit.

Sources: SCS, 2009.
ECT, 2009.

The main Meridian wastewater treatment plant was expanded to its present configuration in 1982. There is one National Pollutant Discharge Elimination System (NPDES)-permitted discharge, designated as Outfall 001, from the plant into Sowashee Creek. This water is treated to secondary standards. During periods of heavy rainfall, the Meridian treatment plant receives volumes in excess of its treatment capability. These excess volumes are routed through a series of three aerated ponds and a settling basin, then, after chlorination, to the final discharge pipe and outfall (this would be considered treatment to primary standards).

Mississippi Power would draw from both sources of treated effluent at the main plant (i.e., use effluent treated to primary standards on some occasions, as well as that treated to secondary standards). In preparation for use in the cooling towers, the reclaimed water from Meridian may be filtered, chlorinated, and the pH adjusted with H_2SO_4. Alternatively, the reclaimed water may be chlorinated and softened via a cold lime softener prior to addition to the cooling towers. The process chosen would depend on future water analyses developed as the plant design progressed.

Chemicals for biocide, scaling, and corrosion inhibition would be injected into the cooling tower water. Chlorine would be fed continuously into the system as a biocide. H_2SO_4 would be injected to reduce alkalinity, thereby controlling scaling. Calcium, phosphate, and silica scale inhibitors would likely be used in the cooling water also.

During construction of the mine-related facilities, water would be required for personal potable consumption and sanitation, concrete formulation, equipment washdown, dust suppression, fire protection, general cleaning, and construction of facilities including but not limited to pond dams, haul and access roads, buildings, service areas, and parking areas. Nonpotable water for construction activities would be obtained from existing livestock watering ponds and tanks that would be disturbed or removed by the mining and mine related activities. Potable water associated with construction and mine operation would be obtained from ground water wells drilled onsite to service the mine activities.

During mine operation, water for operations, dust suppression, fire protection, cleaning, sanitation, and equipment wash down would be obtained from onsite ground water wells, from existing stock ponds on land controlled by the mine, and from sediment ponds constructed by the mine operator for the management of surface and ground water.

The linear pipelines (natural gas, reclaimed water, CO_2) would require hydrostatic testing prior to being placed in operation. Water sufficient to fill and pressure test a section of pipeline would be required to conduct this testing. Typically, water for pressure testing would be supplied from nearby surface water sources and discharged to the right-of-way upon completion of each test.

2.5.3 FUEL AND OTHER MATERIAL REQUIREMENTS

The new gasifiers would operate on lignite, consuming a total of up to approximately 5.1 million tpy to produce syngas, based on continuous plant operation. At the expected IGCC plant annual capacity factor of 85 percent, the gasifiers would consume approximately 4.3 million tpy of lignite. The heating value of the lignite would average approximately 5,300 Btu/lb, and the average sulfur content would be approximately 1 percent. Table 2.5-4 presents a range for the expected composition of the lignite coal.

Table 2.5-4. Characteristics of Lignite Coal Expected to be Received for the Proposed Kemper County IGCC Project

Lignite Composition (As Received)		Average	Design Basis Range*	
			Minimum	Maximum
HHV	Btu/lb	5,290	4,765	5,872
Moisture	%	45.5	42.20	50.00
Ash	%	11.95	8.61	17.00
Sulfur	%	0.99	0.35	1.70
Nitrogen	%	0.48	0.33	0.61
Carbon	%	31.53	28.10	35.68
Hydrogen	%	1.98	1.73	2.40
Oxygen	%	7.57	4.17	10.47
Chlorine	ppm	116	45	295
Mercury	ppm	0.077	0.027	0.187
Fluorine	ppm	28.7	8.6	79.6

*Composition based on higher heating value. Table denotes ranges of individual constituents for all samples, not total compositions of any given sample.

Source: NACC, 2009.

The gas CTs would be capable of continuous, full-load operation firing either syngas or natural gas. ral gas used in the CTs and duct burners, and potentially for coal gasifier startup, would be supplied by the new pipeline discussed previously. Natural gas would not be stored on the site. When operating on natural gas, the combined-cycle power-generating unit would consume approximately 4.8 million standard cubic feet (scf) of natural gas per hour at full load with duct burners operating.

Part of the CO_2 capture system would require use of solvent to strip off the CO_2 for concentration and compression. Although the solvent would be recycled and reused in the capture process, some continuous losses would occur. Accordingly, the IGCC plant would expect to consume approximately 10,000 to 11,000 gallons per year of solvent. In addition, small quantities of process chemicals, paints, degreasers, and lubricants would be consumed, similar to the volumes used at any industrial facility. Materials such as chlorine, H_2SO_4, anti-scalant and anti-foam chemicals, and sodium hydroxide would be used at the power plant. These materials would be stored in diked tanks or enclosures at the following approximate storage capacities: one 12,000-gallon tank of H_2SO_4 for cooling tower treatment, one 12,000-gallon tank of H_2SO_4 for raw water treatment, and one 12,000-gallon tank of caustic for raw water treatment; one 30,000-gallon tank of caustic for sour water treatment; and one 12,000-gallon tank of hypochlorite for water treatment. Also, the site would require a fuel oil tank of approximately 40,000 gallons, a solvent tank for AGR processes of 580,000 gallons, and a hydrogen peroxide tank for H_2SO_4 production of 12,000 gallons. In addition, several other tanks containing less than 500 gallons of specialty water treatment chemicals, such as corrosion inhibitors, would also be included in the plant design. The site would also likely have a number of smaller tanks and reservoirs for lubricating/machine oils to support various items of rotating equipment. These lubricating oil tanks would total approximately 10,000 gallons of storage capacity. Finally, approximately 1,200 cubic feet (ft^3) of alumina-based metal sulfide spheres used for mercury removal would be replaced approximately once every 3 years. Approximately 13,300 ft^3 of activated carbon would be used for sour water treatment each month.

Diesel fuel, gasoline, and bulk lubricants would be stored in aboveground storage tanks (ASTs). Small amounts of specialty nonhazardous lubricants might be stored in smaller containers, such as 55-gallon drums. Equipment fuels and lubricants would likely be stored near the mine office/shop complex. All ASTs and drum storage areas would be enclosed by secondary containment units to contain the 10-year, 24-hour rainfall event and spillage from leaks. ASTs would be checked by on-shift crews and inspected routinely for leaks, corrosion, and other maintenance problems in accordance with a site-specific spill prevention, control, and countermeasure (SPCC) plan.

The lignite mine would consume oils/lubricants, antifreeze, diesel fuel, gasoline, and flocculent. The volume of diesel and gasoline used would fluctuate from year to year but, on an annual basis, would generally be between 2 and 3 million gallons and between 40,000 and 45,000 gallons, respectively. In addition, the volume of oils/lubricants and antifreeze use would average, on an annual basis, between 70,000 and 90,000 gallons and between 8,000 and 9,000 gallons, respectively. Flocculent would be used in the sediment ponds as necessary to increase the rate at which the sediment settled out of the water prior to discharge authorization. It is anticipated that, at the peak of pond operation, up to 30,000 gallons of flocculent would be used annually (dependent upon the number of ponds constructed and the intensity, duration, and frequency of rainfall events). As with the IGCC power plant, small quantities of process chemicals, paints, degreasers, and lubricants would be consumed. Tank sizes for most of these fluids would typically range between 5,000 and 10,000 gallons. Diesel would probably be stored in tanks of between 50,000 and 250,000 gallons.

There would be small amounts of paints, cleaners, adhesives, and other chemicals in spray cans stored at the shop and in the mine warehouse for normal heavy equipment maintenance. Normally, less than 20 gallons of paint in pint, quart, gallon, or 5-gallon cans would be kept onsite. Spray cans of paints and cleaners would be kept in fireproof cabinets in the shop and would be completely used and decanted prior to disposal. Large vehicle and small rechargeable batteries would be recycled with a reputable battery recycler.

2.6 OUTPUTS, DISCHARGES, AND WASTES

Table 2.5-1 included a summary of the most noteworthy discharges and wastes for the proposed power plant facilities.

2.6.1 AIR EMISSIONS

During construction of the IGCC plant, mine, and linear facilities, air emissions would result principally from two sources. First, workers' vehicles, heavy construction vehicles, delivery trucks, diesel generators, and other machinery and tools would generate mobile source and area source emissions of NO_x, volatile organic pounds (VOCs), and other typical products of combustion. Second, fugitive dust would result from land disturbance activities including excavation, soil storage, and clearing and grading earthwork.

During operation of the proposed IGCC plant, a number of sources would emit varying types and quantities of air pollutants (Appendix C provides details). Handling and storage of coal and gasification ash would generate fugitive particulate emissions. Coal would be delivered from the adjacent mine areas by trucks traveling on plant haul roads. The coal would be dumped into a hopper located within a stilling shed equipped with wet suppression. Also, key drop points and crushers would be equipped with water sprays and/or foggers. Much of the coal handling operation would be conducted in full to partial enclosures. Baghouses would be used at the milling and drying operations and crushed coal storage silos.

Gasification ash conveyors would be enclosed, and ash would be sprayed with water to reduce potential fugitive dust emissions during handling. The ash would be delivered from the ash loading area to designated storage or disposal areas by trucks traveling on plant haul roads.

Fugitive emissions of gaseous compounds could be generated from the facilities due to leaks from equipment such as valves, compressor seals, and flanges. These emissions would be minimized by proper maintenance practices. In addition, area gas detectors would be used to alert plant staff of fugitive gas emissions.

The WSA system would have the potential to emit NO_x, SO_2, and H_2SO_4 mist. Thermal NO_x would be generated in the process during the oxidation of the H_2S-rich acid gas stream to SO_2. A small fraction of the SO_2 produced in this process would not be further oxidized (to SO_3 and ultimately H_2SO_4) and would be released as SO_2 through the process vent stack. H_2SO_4 mist would be controlled using a mist eliminator; however, a small amount would be released through the process vent stack.

The facility would also include ancillary equipment that would potentially contribute air emissions. These sources would include the two cooling towers, AGR process vents, and miscellaneous combustion sources. These other combustion sources would include emergency fire pump engines and an auxiliary boiler. These sources would have the potential to release combustion byproducts including NO_x, VOC, and CO along with other trace emissions. The cooling towers would have the potential to release PM. The AGR process vents would have the potential to release low concentrations of CO and trace emissions of sulfur compounds.

Most emissions would result from combustion of syngas in the gas CTs during normal operations. The exhaust gas would be released to the atmosphere via the 325-ft HRSG stacks. Table 2.6-1 presents HRSG stack emissions at full load; annual emissions in this table are conservatively based on continuous year-round operation (100-percent capacity factor). Table 2.6-1 also presents the range of expected short-term rates for CO_2 capture between 50 and 67 percent. The principal pollutants would be SO_2, NO_x, PM, CO, and VOCs. Trace emissions of other products of combustion would include formaldehyde, toluene, xylene, carbon disulfide, acetaldehyde, mercury, beryllium, benzene, arsenic, and others. The list of trace compounds present in flue gas from syngas combustion is based on measurements made at the Louisiana Gasification Technology IGCC project (Radian, 1995). Flue gas would also include CO_2 and other GHGs (see Section 6.1 for additional discussion).

Table 2.6-1. Anticipated Maximum Air Emissions from Each HRSG Stack*

Pollutant	Short-Term Syngas (lb/hr)†	Short-Term Natural Gas (lb/hr)†	Maximum Potential Annual (tpy)‡
SO_2	14 to 15	1.9	62 to 66
PM_{10}	52 to 55	24	228 to 241
CO	105 to 117	158	692
NO_x	210 to 226	39	920 to 990
VOC	18 to 19	21	92
H_2SO_4 mist	1.8 to 2.0	0.3	7.9 to 8.8
Lead§	0.013	—	0.057
Antimony	0.013	—	0.056
Arsenic	0.0098	—	0.043
Beryllium	0.0030	—	0.013
Cadmium	0.014	—	0.060
Chromium	0.012	—	0.054
Cobalt	0.0026	—	0.012
Manganese	0.014	—	0.061
Mercury	0.0037	—	0.016
Nickel	0.018	—	0.080
Phosphorous	0.011	—	0.049
Selenium	0.014	—	0.061
Acenapthalene	0.000085	—	0.00037
Acetaldehyde	0.023	0.13	0.59
Acrolein	0.0022	0.017	0.076
Benzene	0.022	0.057	0.25
Benzo(a)anthracene	0.0000075	—	0.000033
Benzo(e)pyrene	0.000018	—	0.000079
Benzo(g,h,i)perylene	0.000031	—	0.00014
Carbon disulfide	0.15	—	0.64
Ethylbenzene	0.01	0.071	0.31
Formaldehyde	0.10	0.35	1.5
2-Methylnapthalene	0.0012	—	0.0053
Napthalene	0.0016	0.0020	0.0086
Polynuclear aromatic hydrocarbons	0.00019	0.0015	0.0064
Toluene	0.027	0.21	0.92
Xylenes	0.026.0	0.20	0.88

*All emissions estimates based on worst-case operating scenarios, typically resulting from full-load operation with duct burner firing.

†The short-termed emission rates presented reflect the range associated with CO_2 capture of from 50 to 67 percent for criteria pollutants and H_2SO_4 and the maximum for the HAPs.

‡Annual emissions conservatively assume continuous, year-round operation using higher of syngas or natural gas hourly emission rate.

§The difference in emission rates between a CO_2 capture rate of 50 and 67 percent for the pollutants listed in this table from lead to xylenes is insignificant, and therefore no range is presented.

Sources: Mississippi Power, 2009a. SCS, 2009. ECT, 2009.

Water droplets would also escape from the cooling towers and would constitute particulate emissions. These droplets would contain some dissolved salts, which could be deposited as the droplets evaporate. Drift eliminators would minimize these emissions.

Air emissions would also be released through the startup stack and flares. During gasifier startups, exhaust gas would be released through the startup stack, and syngas would be combusted in the flare (see Subsection 2.1.2.8). Synthesis gas and gasification process gases might also be directed to the flares during malfunction, breakdown, or upset conditions such as trips of the CT/HRSG system or gasification processes to allow safe release of gases during recovery from such conditions. The flare might also be used to combust various process gases during normal operations of the gasifier, such as pressure relief valves. The duration of syngas combustion would vary depending on the type of upset.

There would be no stationary sources of particulates within the proposed life-of-mine boundary. All emissions would occur as a result of fugitive dust from haulroads, stockpiles, and exposed mine soils. The high annual precipitation and the high-moisture content of the overburden being moved would likely provide some natural control of fugitive dust emissions.

In addition to the natural control of fugitive dust emissions, fall distances at transfer or material dumping points would be minimized to the greatest extent practical. Personal safety, machinery clearance, and line-of-sight capabilities of machine operators would dictate minimum fall distances. Fugitive dust emissions would be controlled from haul roads and access roads by water trucks. Chemical dust suppression and road construction amendments, such as calcium chloride and lignum sulfonate, or other approved road bases, including gasification ash (subject to agency approval), might be used.

Other particulate emission controls would include:

- Scraping and compacting unpaved roads to stabilize the surface as necessary.
- Restricting unauthorized vehicles on other than established roads.
- Minimizing the area of disturbed land.
- Prompt revegetation of regraded lands.
- Reducing the length of time between initial disturbance and revegetation or other soil stabilization.
- Maintenance of lignite stockpiles. All lignite that is stored in lignite stockpiles would be sealed and compacted by both rubber-tired and track-type dozers. By sealing the pile, conditions conducive for spontaneous combustion would be minimized. The lignite stockpiles would continuously be monitored, and if smoldering or burning lignite is observed, it would be promptly extinguished. In addition, all water trucks located onsite would be equipped with water/foam cannons for the specific use of fighting fires. Using the program outlined, the Red Hills Mine has had very few smoldering lignite events. For these cases, the lignite was extinguished by digging up the smoldering lignite and promptly spreading it out on the surface. It should be noted that the lignite to be mined at the Liberty Mine is in the same formation that is being mined at Red Hills.

2.6.2 LIQUID DISCHARGES

During power plant operation, the proposed IGCC facilities would produce various process wastewaters, all of which would be discharged to treatment and/or reuse systems. No process wastewater streams or water treatment discharges would be released from the power plant site. The principal water management requirements necessary to ensure no process liquids leave the site would be maximum reuse of all water streams. Between 800 and 2,000 gpm of low-volume wastes (e.g., boiler blowdown, sour water cleanup wastes, oil/water separator wastes, condensation from the air compressors, gasifier-stripped water, evaporative cooler blowdown, brine concentrator, and crystallizer condensate) would be conveyed to the cooling tower recycle basin to supplement cooling tower makeup. Depending on plant operation, between 150 and 350 gpm of demineralizer first-pass reverse osmosis concentrate would be piped to a wastewater treatment facility for evaporation. Condensate from the wastewater treatment facility would be recycled back to the cooling tower basin. The resulting salt cake would be disposed of in an appropriate manner.

Potentially contaminated stormwater would be routed to conveyances and directed to onsite stormwater retention ponds. Runoff from areas associated with industrial activity, including the lignite storage area and equipment areas, would be routed for oil separation and suspended solids removal. Stormwater collected outside the developed areas of the power plant site would be discharged in accordance with an NPDES general stormwater permit.

Chemical tanks would be surrounded by secondary containment. Spilled chemicals would be neutralized in place, collected, and shipped offsite for proper disposal. Collected water containing oils (e.g., stormwater runoff, equipment washdown water) would be sent to an oil/water separator to remove the oil and then to the reclaim sump for reuse.

Domestic and sanitary wastewater generated by power plant operations personnel would be discharged to a new septic system and absorption field that would be constructed near the new facilities. The system would be designed to handle 3,000 gpd.

Chemical wastes would be generated from periodic cleaning of the HRSGs and turbines. These wastes would consist of alkaline and acidic cleaning solutions, turbine washwaters, and HRSG washwaters. These wastes likely would contain high concentrations of heavy metals. Chemical cleaning would be conducted by specialized contractors who would be responsible for removal of associated waste products from the site to an appropriate treatment, storage, or disposal facility.

Within the adjacent mine, the primary source of liquid discharges would result from surface water control structures. All surface drainage, including stormwater runoff, from disturbed areas would be passed through a sedimentation pond. A series of stormwater runoff control channels and sedimentation control ponds would be constructed prior to initiation of surface mining activities. As the mining advances, additional sedimentation control ponds would be constructed as needed to control runoff from disturbed areas and would meet discharge water quality standards. Approximate locations of these sedimentation ponds and other water control structures within the mine study area were shown on Figures 2.4-2a through 2.4-2g.

These mine sedimentation ponds would be designed, constructed, and maintained in accordance with the performance standard requirements of Section 5327 of the MDEQ SMCRA Regulations. The water quality of the ponds' contents would be monitored on a regular basis following storm events. When the water quality meets required effluent limitations, the contents would be discharged to the gated level. Between storm events, the ponds would be maintained at or below the gated level. Sedimentation ponds would not be removed until the disturbed area had been restored, the vegetation requirements had been met, the drainage entering the ponds met applicable effluent limitation standards, and/or new impoundments had been installed downstream. None of the presently conceived ponds would be planned as permanent features. However, all surface impoundments would be designed and constructed to meet permanent impoundment engineering standards and could remain as permanent, recreational ponds at the discretion of the surface landowner and in accordance with MDEQ and USACE permits, if issued.

In addition, clean-water diversions of Chickasawhay Creek, Bales Creek, portions of Pender’s Creek, and their tributaries around the proposed mine boundaries and sedimentation ponds would be constructed. These diversions would not constitute discharges but would be regulated under the Liberty Fuels Mine mining permits required by MDEQ and USACE, if issued.

Sanitary waste from mine facilities would be processed and treated onsite and discharged into the local receiving streams if and as authorized by the facility’s NPDES permit. A small, extended aeration package plant or an equivalent technology plant would be designed for the expected volume of effluent discharge. Effluent volume between 2,500 and 5,000 gpd would be expected. Portable chemical toilets would be located throughout the active mining area. These units would be rented and serviced by outside vendors. The wastewater generated from these units would be pumped out, treated, and disposed in accordance with state regulations.

Wastewater from mining vehicle wash facilities would be treated through the sedimentation ponds, if and as authorized by the NPDES permit. Additional waste streams such as used oils, lubricants, or solvents would be recycled or undergo disposal in accordance with all local, state, and federal regulations. Secondary containment systems would be provided for fuel and lubricant storage areas and an SPCC plan would be developed and implemented for the site-specific mining operations, consistent with CWA requirements.

Liquid discharges from the linear projects would include stormwater and periodic discharges of water used for hydrostatic testing of the CO_2, natural gas, and reclaimed water pipelines. These discharges would be managed in accordance with NPDES permitting obligations.

2.6.3 BYPRODUCTS AND SOLID WASTES

2.6.3.1 Construction

During construction of the proposed power plant and the supporting facilities, potential waste would include earth and land clearing debris, metal scraps, electrical wiring and cable, surplus consumable materials (e.g., paints, greases, lubricants, and cleaning compounds), packaging materials, and office waste. In general, the construction wastes would be typical of the construction of any large industrial facility. Any potentially reusable materials would be retained for future use, and the recyclable materials would periodically be collected and transferred to recycling facilities. Metal scraps unsuitable for reuse would be sold to scrap dealers, while the other remaining materials would be collected in dumpsters and periodically trucked offsite by a waste management contractor for disposal in a licensed landfill. Other materials would include packaging material (e.g., wooden pallets and crates), support cradles used for shipping of large vessels and heavy components, and cardboard and plastic packaging.

No hazardous waste generation would be anticipated during construction. If any hazardous waste, as defined under the Resource Conservation and Recovery Act (RCRA), were generated as a result of project construction, such wastes would be characterized and managed in accordance with RCRA regulations. Construction contractors would be required through their contract to handle all of their solid waste in accordance with all state and federal rules and regulations.

2.6.3.2 Operation

During operation of the proposed IGCC power plant facilities, the primary byproducts would be gasification ash, anhydrous ammonia, CO_2, and H_2SO_4. The gasification process would produce a total of approximately 75 tph of gasification ash from accumulation of noncombustible mineral material originally present in the lignite. The gasification ash would come from two sources: the gasifiers and the filter systems. The ash from the gasifiers would be larger, approximately 100 microns in diameter, have a carbon content typically less than 3 percent, and look similar to a dark colored sand. The gasifiers would produce approximately 25 tph, or 1,000 cubic feet per hour (ft^3/hr). The particulate from the filter system would be finer than the gasifier solids (typically around 20 microns). It would have a carbon content of approximately 15 to 20 percent; it would have a dark gray to black appearance and have the consistency of talcum powder. The flowrate of this particulate would be approximately 50 tph, or approximately 4,000 ft^3/hr.

Based on an 85-percent capacity factor, approximately 560,000 tons of ash would be produced annually. All ash would be depressurized and cooled before entering the atmospheric ash silo. Water would be added to the solids as necessary for dust control prior to being transported by truck. Both gasifier and filter ash would be transported by truck to the ash management unit located in the northern portion of the plant site along Liberty Road. The ash would be classified as industrial/special waste in the state of Mississippi, and the ash management unit would be subject to the permit requirements and regulations of MDEQ. To reduce long-term ash storage needs, Mississippi Power would try to market ash for beneficial use in industrial processes such as building roads, soil amendment, or for other uses as approved by MDEQ. Figure 2.1-5 also shows a possible future ash disposal area on the portion of the site east of MS 493. This area would not be needed unless insufficient quantities of ash were sold.

Ash samples were collected from gasification tests conducted at the pilot-scale gasifier at the Power Systems Development Facility near Wilsonville, Alabama. These tests used a lignite feedstock mined from the Wilcox Group at the Red Hills, Mississippi, mine, which is expected to be similar to the lignite that would be produced for the proposed IGCC project. Although the ash generated in these tests involved lignite from a different mine and a pilot-scale gasifier, it is the most representative material available. Tests of these ash samples indicate that the gasification ash would meet toxicity requirements for nonhazardous material. There is no expectation that the ash would be ignitable, corrosive, or reactive Therefore, the ash would not be classified as hazardous. Table 2.6-2 summarizes the results of the test gasification ash characterization.

Table 2.6-2. Pilot-Scale Gasification Ash TCLP Data

	Coarse Ash		Fine Ash		Composite Sample*		
	Total Metals (mg/kg)	TCLP (mg/L)	Total Metals (mg/kg)	TCLP (mg/L)	Total Metals (mg/kg)	TCLP (mg/L)	TCLP Limits (mg/L)
Antimony	<4.8		<4.3		<9.8		
Arsenic	4.2	<0.020	38	0.042	34	0.043	5.0
Barium	410	1.1	1100	1.9	850	1.5	100
Beryllium	3.6		8.5		7.1		
Cadmium	<0.48	<0.0050	2.0	0.036	1.5	0.0071	1.0
Chromium	42	0.020	95	<0.010	84	<0.010	5.0
Cobalt	7.1		18		16		
Copper	100		230		160		
Mercury	<0.0038	<0.00056	0.0073	<0.00056	0.0052	<0.00056	0.2
Lead	4.3	<0.010	79	<0.010	52	<0.010	5.0
Nickel	22		48		42		
Selenium	2.0	<0.020	26	<0.020	17	0.042	1.0
Silver	<0.95	<0.010	<0.86	<0.010	<2.0	<0.010	5.0
Thallium	<1.9		<1.7		<3.9		
Vanadium	160		320		250		
Zinc	8.4		26		28		

Note: mg/kg = milligram per kilogram.
mg/L = milligram per liter.
TCLP = toxicity characteristic leaching procedure.

*Composite sample is 55-percent fine ash and 45-percent coarse ash by weight.

Source: SCS, 2009.

Anhydrous ammonia (approximately 98.5- to 99.5-percent pure) would be produced as a byproduct of the lignite coal gasification process and stored in a pressure vessel. The ammonia would be produced from the gasifier at a rate of up to 70 tpd during normal operations. There will be a pressurized anhydrous ammonia tank(s) operating at approximately 300 pounds per square inch absolute (psia) and at ambient temperature. The tank(s) would be sized for 5 days' storage, or approximately 400 tons. Some ammonia would be used onsite in the SCR process in the HRSGs, but the majority of it would be trucked offsite, marketed, and sold commercially. A conventional tanker truck holds approximately 18 tons of anhydrous ammonia, so there would be approximately four tanker trucks produced per day.

When operating on syngas, CO_2 would be captured, compressed, and marketed for EOR. The IGCC unit would capture approximately 9,600 tons of CO_2 per day on average. The CO_2 would be compressed and delivered to a dedicated pipeline interconnected with an existing CO_2 network serving regional oil producers.

The gas cleanup system would produce liquid H_2SO_4 approximately 93-percent pure. The quantity of H_2SO_4 produced would depend on the sulfur content of the coal. Under average conditions, approximately 450 tpd would be produced from the WSA system. If the worst-case (i.e., highest) percent sulfur lignite was being converted to syngas, H_2SO_4 production would rise to approximately 760 tpd. The H_2SO_4 would be stored as a liquid at ambient temperature and pressure. Onsite tanks would be sized for 10 days' storage under average conditions, or approximately 5,000-ton storage capacity. The H_2SO_4 would be commercial grade and would also be trucked offsite, marketed, and sold commercially. A conventional tanker truck will hold approximately 25 tons of H_2SO_4, so under average conditions, there would be 20 trucks per day. Under worst-case sulfur coal conditions, this would require up to 33 trucks per day.

Solid wastes from the power plant would include solids from water and wastewater treatment systems (e.g., sour water treatment), demineralizer resin beds, the filtration system in the sulfur process, used air inlet filters, and other maintenance-related wastes such as rags, broken and rusted metal and machine parts, defective or broken electrical materials, and empty containers. Spent activated carbon would likely be recycled. A filter cake would be produced by the brine crystallizer wastewater filter press. The filter cake would be the largest volume solid waste generated during IGCC operations. From 3,000 to 15,000 tpy would be produced, and it would be collected in a storage bin and trucked to an offsite solid waste disposal facility. Other nonhazardous solid wastes would also be transported offsite for disposal in a licensed landfill. Any waste determined to be hazardous under RCRA regulations would be transported offsite by a licensed contractor to a RCRA-permitted treatment and disposal facility or returned to the manufacturer for treatment and recycling.

The power plant would produce salt in rough proportion to the amount of the highly saline ground water used. The salt concentration in the ground water would be lowered to an acceptable level before using the water in the plant, and a salt cake would be produced. Since reclaimed water, which has a low TDS concentration (see Table 2.5-3), is anticipated to be available to meet the plant's needs and ground water would only be used infrequently, if ever, salt production over the life of the plant would likely be small. Figure 2.1-5 shows an area east of MS 493 for future salt disposal. Based on the reclaimed water supply plan, it is unlikely this area would be needed for salt disposal.

During the mining operation, clearing activities (pushing noncommercial trees and brush) and removing abandoned structures, such as old barns and houses, would generate solid waste. This waste could consist of brush, tree trunks and limbs, old lumber, waste tin, and roofing material. This waste could be eliminated by: (1) burning it, (2) disposing of the nonhazardous rubbish in a mined-out pit, or (3) hauling it offsite to a registered landfill. On an annual basis, this would be less than 500 tons. The mine would be handling approximately 50 million tons of overburden and lignite; thus, the rubbish would be an insignificant quantity.

In addition to process wastes, solid wastes generated during operation of both the power plant and mine would include used office materials and packaging materials. Most office and shop wastes would be placed in dumpsters for removal by a local waste disposal contractor for final disposal at a local landfill. These wastes would include lunchroom garbage, paper, cardboard, plastic packaging, and empty cans and bottles. The disposition of these items would be similar to that discussed previously for these materials during the construction period.

2.6.4 TOXIC AND HAZARDOUS MATERIALS

Construction and operation of the proposed power plant and supporting facilities would involve potentially toxic or hazardous materials and wastes generated from the typical industrial uses of paints, solvents, lubricating oils, and similar products. Any such wastes determined to be hazardous under RCRA regulations would be transported offsite by a licensed contractor to a RCRA-permitted treatment and disposal facility or returned to the manufacturer for treatment and recycling.

At the proposed IGCC plant, most liquid hydrocarbon streams would be recovered and processed to extinction in the gasifiers. Some spent liquid hydrocarbon streams of sufficiently high value would be sent offsite for mineral recovery and recycling. Used oils collected from the oil/water separator and used oil filters from the gas CTs would be transported offsite by a licensed contractor for recycling or disposal.

The proposed CO_2 capture system would require approximately 18,000 ft^3 of water gas shift catalyst, which would be replaced approximately every 2 years. The active metal on this catalyst would typically be cobalt with a molybdenum promoter. The base material would vary depending on the catalyst vendor. Approximately 2,500 ft^3 of alumina-based catalysts used to convert carbonyl sulfide to hydrogen sulfide for sulfur removal would require replacement approximately once every 3 years. Both the water gas shift and carbonyl sulfide catalysts would be regenerated and reused, to the extent possible. If it were not possible to regenerate these catalysts, they would be managed as hazardous waste, in which case a licensed hazardous waste contractor would remove these materials for offsite disposal.

Approximately 1,200 ft^3 of alumina-based metal sulfide spheres used for mercury removal would be replaced approximately every 3 years. These alumina and carbon materials would likely be characterized as hazardous waste. Accordingly, they would be managed, removed, and disposed by a licensed hazardous waste contractor. Up to approximately 13,300 ft^3 of activated carbon used for sour water treatment would be generated each month. This material would be removed from the units by the vendor and processed for regeneration and removal of the contaminants. Regenerated carbon would then be placed back into the treatment units. Recovered contaminants would be disposed of by the vendor or recycled. Finally, the WSA process would utilize approximately 25,000 ft^3 of alkali promoted vanadium catalyst to convert SO_2 to SO_3. This catalyst would be screened every 2 years, with approximately 20 percent of the total volume being replaced with fresh catalyst. Recovered catalyst would undergo disposal by the vendor or be recycled.

A filter cake would be generated by the sulfur and CO_2 removal processes. This cake would be principally composed of piping residue with some metallic constituents present. The amount produced would be small, likely less than 100 pounds (lb) per day. If the filter cake were characterized as a hazardous waste, it would be managed, removed, and disposed of by a licensed hazardous waste contractor.

During operation of the proposed mine, waste paints, solvents, oil, fuel, cleaners, adhesives, lubricants, greases, or other similar wastes would be handled in accordance with all applicable hazardous waste, nonhazardous waste, and/or used-oil regulations. Oil would be drained into approved containers in the shop during regular maintenance of heavy equipment. Used oil would then be collected, stored in an AST, and provided to a responsible used-oil dealer for recycling. Used grease from draglines and shovels might also be mixed with oil for recycling or would be sent to an offsite facility that could specifically recycle used greases.

Under RCRA, the mining operations would likely qualify as a conditionally exempt small-quantity generator of hazardous wastes. It is expected that approximately 200 gallons per year of solvent would be used, primarily in the shop for cleaning purposes, in parts washing stations and aerosol spray cans. A recycling program would be in place to handle the solvent waste stream. A licensed hazardous waste disposal contractor would be used where necessary to remove larger quantities of hazardous waste, if generated.

The power plant and mine facilities would implement a program to reduce, reuse, and recycle materials to the extent practicable. All light bulbs would be treated as hazardous waste, if appropriate, and transported to properly licensed facilities for disposal. The facilities would have an SPCC plan (40 CFR 112) addressing the accidental release of materials to the environment.

2.7 ALTERNATIVES

The purposes and needs for a federal action determine the reasonable alternatives for the NEPA process. Congress established the CCPI Program with a specific purpose—to accelerate commercial deployment of advanced coal-based technologies that can generate cleaner, reliable, and affordable electricity in the United States by authorizing DOE to provide financial assistance to private projects selected through a competitive process. Similarly, Congress established a loan guarantee program to encourage private entities to pursue energy projects that "avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases" and "employ new or significantly improved technologies as compared to commercial technologies in service in the United States at the time the guarantee is issued" (Section 1703[a][1], 42 United States Code (USC) § 16513). DOE's preferred alternative (to provide cost-shared funding and a loan guarantee) would fulfill the purposes and meet the needs of these programs by demonstrating the viability of the energy technologies (i.e., coal gasification, syngas cleanup systems, and supporting infrastructure integrated into a combined-cycle power-generating unit). The preferred alternative would result in the impacts, both beneficial and adverse, discussed in this EIS. Any reasonable alternative to the proposed action must also be capable of satisfying the purposes and needs of these two federal programs. In addition, it must be an alternative that was the subject of an application that a private proponent submitted to DOE that meets the requirements of the CCPI and loan guarantee programs. The project proponent provides the majority of funding and bears the primary responsibility for designing and executing the project. DOE's primary action as to these programs is to decide which projects it will give assistance to from among the eligible proposals submitted. Unlike a project initiated and operated by DOE, it does not have the ability to make decisions concerning the location, layout, design, or other features of the project. In other words, DOE must select among the eligible projects submitted to it; DOE cannot design its own project and compel a private entity to implement. DOE uses the procedures established in its NEPA regulations, specifically those in Section 1021.216, to identify and consider the potential environmental impacts of the eligible projects submitted in making its selections.

In addition to the analysis and consideration of reasonable alternatives that meet the federal goals, CEQ NEPA regulation 40 CFR 1502.14[d] requires that DOE analyze and consider a no-action alternative. The no-action alternative in this context represents a decision by DOE to refrain from providing financial assistance and a loan guarantee to the project. For purposes of this EIS, DOE assumes that such a decision would prevent the project from being built, and analysis of the impacts of the no-action alternative described in the EIS are based on this assumption. In actuality, there is some possibility that Mississippi Power and SCS would proceed with the project without federal participation. The no-action alternative also represents what would occur if DOE had selected another project or decided not to assist any projects with financial assistance or loan guarantees. As is the case with most no-action alternatives, it would not meet the purpose and need for federal action as established by Congress through the CCPI and loan guarantee programs.

2.7.1 NO-ACTION ALTERNATIVE

Under the no-action alternative, DOE would not provide cost-shared funding or a loan guarantee for the design, construction, and demonstration of the proposed Kemper County IGCC Project. Without DOE participation, Southern Company and Mississippi Power could pursue two options. First, Mississippi Power could continue with the proposed IGCC project without federal participation. DOE believes that option is unlikely, because the financial risks and costs of deploying a new type of IGCC power system are significant. Furthermore, the costs and risks of adding a carbon capture system and pipeline would probably exceed the revenue from sales of CO_2 for use in the EOR industry. In any event, if the project applicants were to proceed with the project but without DOE participation, the direct, indirect, and cumulative impacts would be essentially the same as the proposed action that is analyzed in this EIS.

Second, the applicants could choose not to pursue the IGCC project and, instead, meet future energy and capacity needs from other sources. Under this scenario, the proposed IGCC facility would not be built. It is also unlikely that the lignite mine would be built nor the linear facilities associated with the proposed project. As a consequence, none of the direct impacts associated with the preferred alternative would occur, whether adverse or beneficial. In addition, the chances for more rapid commercialization of the gasification facilities (alone or integrated with the combined-cycle facilities to form IGCC technology) would diminish, because utilities and industries tend to prefer known and demonstrated technologies. Moreover, this scenario would not achieve the CCPI program’s goal of accelerating commercial deployment of advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the United States. Similarly, this outcome would not contribute to the loan guarantee program’s goals of advancing energy projects that “avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases” and “employ new or significantly improved technologies.”

2.7.2 PROJECT-SPECIFIC ALTERNATIVES UNDER CONSIDERATION

While they do not constitute alternatives to DOE’s decision whether to provide cost-shared funding or a loan guarantee, Mississippi Power is considering certain project-specific alternatives that would affect the project’s potential environmental impacts. The impacts of the project-specific alternatives are analyzed in this EIS.

2.7.2.1 Alternative Sources of Water Supply

As discussed in Subsection 2.5.2, the planned source of the IGCC power plant’s cooling and other nonpotable water is reclaimed effluent from two POTWs located in Meridian, south of the plant site. The reclaimed water would be delivered to the site via pipelines. Some nonpotable ground water might be used in the infrequent cases when too little effluent was available.

Mississippi's ground water regulations require the new power generating facilities use nonpotable water. The principal ground water source available at the IGCC project site would be saline ground water withdrawn from the Massive Sand aquifer. Ground water from the deep Massive Sand aquifer could supply all the power plant's requirements, and Mississippi Power and SCS investigated this option to the extent of installing a test supply well and conducting a pumping test (refer to Section 3.4). While the aquifer was determined to be capable of yielding sufficient amounts of water for plant requirements (see Section 4.4), the quality of the water was found to be very poor, with a TDS concentration of approximately 23,000 ppm. The use of this ground water as the sole source would create a number of engineering and other issues in the IGCC plant systems and would also have adverse environmental effects.

First, withdrawing and piping water of such high salinity would impose costs for materials and maintenance. Well casings would deteriorate and require abandoning and replacing wells more frequently than otherwise, for example. Affected plant systems would need to be designed and engineered especially to make use of this water.

Second, the high solids concentration would result in large quantities of solid waste (principally salt cake) requiring management and disposal. Both added costs as well as potential environmental impacts associated with disposal (e.g., landfilling) would result.

Third, use of this saline water in the IGCC plant's cooling towers would result in some amount of salt drift. As discussed in Section 4.4, the deposition of cooling tower salt drift would potentially impact some sensitive vegetation on the plant site and in the immediate surroundings. Salt deposited on the ground would also have some potential to impact local surface waters via stormwater runoff.

To summarize, ground water would be an option for providing the sole supply for the IGCC plant's needs for water. However, the use of reclaimed water is currently considered to be preferable, barring unforeseen limitations on its availability, as the engineering issues, costs, and environmental impacts of ground water use would be greater.

2.7.2.2 Alternative Linear Facility Routes

As described in Section 2.2, the new linear facilities that the project would require are a natural gas pipeline, electrical transmission lines, a reclaimed effluent pipeline, and the CO_2 pipeline. The preferred route for the natural gas pipeline was determined by reviewing the shortest route (running directly east from the power plant site to the existing large-diameter gas supply pipeline), then surveying and field-inspecting the route to adjust for areas to avoid (e.g., wetlands) as referenced in Mississippi Power's procedures.

Mississippi Power employed its Transmission Line Routing and Design Procedure (Mississippi Power, undated) in the selection of routes for the other linear facilities. For the longer new transmission lines and CO_2 pipeline, at least two alternative routes were developed and evaluated using available mapping and aerial photographs to select the primary route. The alternative routes were identified and evaluated considering factors that included:

- Avoidance of built-up and densely developed areas, including residential areas, buildings, bridges, airports, cemeteries, landfills, and irrigation systems.

- Avoidance of environmentally sensitive or problematic areas, such as wetlands, rivers, lakes, landfills, and contaminated sites; known locations of culturally or historically significant sites or areas; and known locations of sensitive species or their habitats.
- Avoidance of difficult terrain or other conditions that would pose engineering, construction, operating, or economic concerns or maintenance and reliability issues.
- Use of existing rights-of-way.

Once the primary routes were identified, a preliminary route was developed. Noteworthy features of some of the preliminary routes are:

- The routes for new transmission lines generally approximate the shortest distance between the required end points, thus minimizing length and land affected while still avoiding built-up or sensitive areas.
- Routes of the West Feeder and CO_2 pipeline coincide to minimize impacts.
- Routes of the East Feeder and the reclaimed water pipeline would coincide to minimize impacts.
- The portion of the CO_2 pipeline route south of the end point of the West Feeder is adjacent and parallel to an existing Mississippi Power transmission line right-of-way to minimize impacts.

Importantly, Mississippi Power might revise or amend the route for one or more of its linear facilities, although the analysis of impacts provided herein should cover any impacts resulting from any such revisions to those routes. Moreover, Mississippi Power might not control final routing authority regarding the CO_2 pipeline, and other private entities ultimately responsible for owning and operating that line to transport CO_2 might require some changes to the route. Again, it is not expected that any such route changes would result in the aggregate to any significant differences in the analysis of impacts discussed in this document.

2.7.2.3 Alternative Levels of CO_2 Capture

Through the course of project development, Mississippi Power has considered a range of alternative levels of CO_2 capture: 25, 50, 67, and greater than 67 percent (Mississippi Power, 2009; SCS, 2009). As stated in DOE's Notice of Intent, Mississippi Power initially had planned to capture 25 percent of the CO_2 in the syngas. At a 25-percent capture rate, either an amine removal system or another solvent-based system could be used for CO_2 removal without a water-gas-shift reactor. This rate would have represented a significant advancement in commercial scale CO_2 capture in the power industry, but it would not meet the *California Standard* or natural gas equivalency. Mississippi Power determined that higher capture rates, if achievable, would improve the viability of the project.

In subsequent discussions with MDEQ, Mississippi Public Service Commission (PSC), and DOE, Mississippi Power decided that a minimum of 50-percent capture would be economically feasible. A PSD permit application based on this level of capture was submitted to MDEQ in May 2009. A 50-percent capture rate would be equivalent to the California Standard emission rate of 1,100 pounds of carbon dioxide per megawatt-hour (lb CO_2/MWh). At this rate the annual CO_2 emissions would be approximately 2.6 million tons. The CO_2 removal system would require a minimum of a single train of water-gas-shift reactors and a Selexol (or similar) system for

CO_2 removal. Parasitic load would be 90 to 100 MW, or approximately 12 to 15 percent of the gross plant capacity.

More recently, Mississippi Power developed a design case based on 67-percent CO_2 capture, which would result in CO_2 emissions from the plant approximately equivalent to emissions from a natural gas-fired combined-cycle unit generating the same amount of power. A modified PSD permit application based on this design case was submitted to MDEQ in September 2009. A 67-percent capture rate (the design basis for this EIS) would yield an emission rate of approximately 800 lb CO_2/MWh and would be considered natural gas equivalency. At this rate the annual CO_2 emissions would be approximately 1.8 million tons. The CO_2 removal process to achieve this level of capture would require two trains of water-gas-shift reactors and a Selexol (or similar) system for CO_2 removal. Parasitic load would be 100 to 115 MW, or approximately 14 to 17 percent of the plant's gross capacity.

Mississippi Power also evaluated higher rates of CO_2 capture. A theoretical limit on the amount of CO_2 removal would be approximately 80 percent, with 90-percent water-gas-shift and a Selexol (or similar) system for CO_2 removal. This high level of removal would require polishers or other additional equipment. The major concern with higher removal rates was that gas turbine design and operation at higher hydrogen contents of syngas has not evolved sufficiently to confidently design the plant for commercial operation. Also, Mississippi Power determined that capture levels higher than 67 percent would not be economically feasible (i.e., the ability to provide power to utility customers at a reasonable price), as additional process equipment and step changes in parasitic load would be necessary.

Although the 67-percent capture case is expected to be the normal operating condition for the project, operating characteristics covering the range from 50 to 67 percent were presented in Table 2.5-1. While higher CO_2 removal rates would further reduce some collateral emissions at the same time, more lignite coal would be consumed to meet the higher capture target, and somewhat greater emissions overall would be expected for the two cases. Since the air quality modeling and other environmental impacts were already completed for the 50-percent capture case, these impacts are provided in this EIS (Chapter 4) to represent the impacts associated with this alternative level of CO_2 capture.

2.7.3 PROJECT ALTERNATIVES CONSIDERED BY DOE AND THE PROJECT'S PROPONENTS

2.7.3.1 Alternative Project Applications Considered by DOE in the CCPI Round 2 Procurement Process

The project satisfies the purposes and needs for federal action as set forth in the CCPI funding opportunity announcement that DOE issued in February 2004 (Section 1.2). Program factors considered in DOE's project selection process included the desirability of projects that collectively represent a diversity of technologies, use of a broad range of United States' coals, and locations throughout the United States. DOE did not constrain the proposals with regard to site or technology, except that projects must primarily use coal to be eligible for funding.

DOE also considered the potential environmental impacts of the projects submitted for consideration in CCPI Round 2. The applications included responses to an environmental questionnaire (Section 1.7). The responses contained information about the site-specific environmental, health, safety, and socioeconomic impacts of each project. Based on the evaluation criteria discussed in Section 1.2, including environmental impacts, DOE selected four projects proposing four different energy technologies, including the technology proposed for the Kemper County IGCC Project, for possible award of financial assistance for a portion of the project's costs.

Because DOE's role in these private projects is limited to providing cost-shared funding and a loan guarantee to a project, DOE's decision is limited to selecting or rejecting the project as proposed by the proponent. DOE may, however, approve the cost-shared funding or loan guarantee contingent upon incorporating mitigation to reduce potential impacts of the project as proposed by the applicant.

2.7.3.2 Alternative Sites

Mississippi Power's power plant site selection effort and its decision to locate an IGCC facility in Kemper County were completed approximately 2 years prior to Southern Company's request to DOE to transfer the funding for a CCPI demonstration project from the cancelled project in Orlando, Florida. Mississippi Power's proposal for transferring the financial assistance to this project concluded that the only reasonable alternative was the Kemper County project because it was already underway and had the ability to meet the eligibility requirements of the CCPI Round 2 funding opportunity. By the time Mississippi Power proposed the Kemper project as a replacement for the Orlando Project in the CCPI program, Mississippi Power had already entered into formal agreements with the IRS regarding the Kemper project's eligibility for tax credits.

Well before Southern Company sought to transfer the financial assistance available under CCPI Round 2 to this project, DOE had already certified, and the IRS had already qualified, the Kemper County project under the EPAct05. Specifically, in June 2006, Southern Company applied to DOE to be certified to the IRS for certain clean coal investment tax credits. As part of that certification, DOE required Southern Company to demonstrate that it had ownership or control over the specific site where it intended to apply those credits. In accordance with the process for qualifying for available investment tax credits, DOE certified this project, including the specific site to the IRS. In November 2006, the IRS accepted the project and proposed a closing agreement with Southern Company conditioning the tax credits on, among other things, locating the project in Kemper County. Without the investment tax credits, Mississippi's Kemper County project may not be economically feasible.

Prior to locating its project in Kemper County and seeking investment tax credits for it, Mississippi Power considered a range of generating options, including a variety of technologies and fuels. As its planning review progressed, Mississippi Power identified lignite as an abundant, economic, local resource that would provide consistent long-term fuel pricing, reliability of supply, and diversification of Mississippi Power's fuel stock. Further evaluation of lignite revealed that due to the higher transportation costs associated this lower heating value fuel, only a mine-mouth location would be economically viable for a lignite-fired unit. Accordingly, Mississippi Power focused its review of possible sites on the following:

- Location of accessible lignite reserves near Mississippi Power's service territory (see Figure 2.7-1).
- Proximity to infrastructure, including Mississippi Power's electrical transmission facilities and natural gas supply.
- Topography, including the location of floodplains and wetlands.
- Available open space.

Working with NACC, Mississippi Power identified three general areas in Kemper County that might be suitable: the proposed location and two additional areas a few miles to the north. NACC compared the lignite reserve at the proposed mine location to the other potential areas. Criteria used in this comparison included the following:

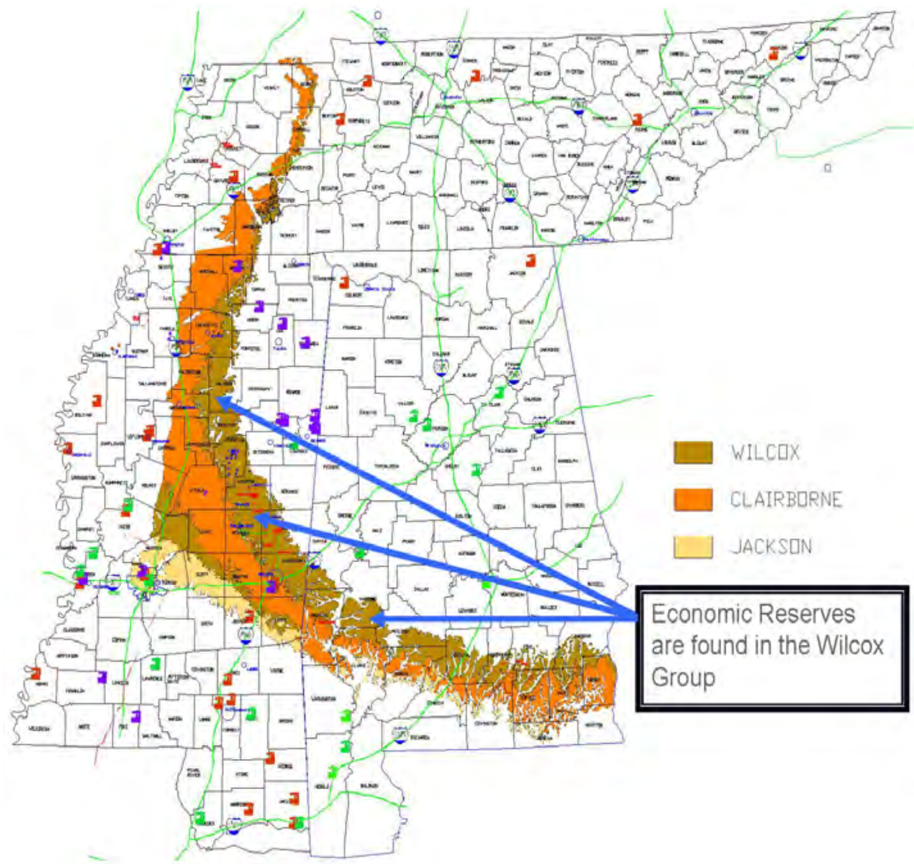


Figure 2.7-1. Lignite Bearing Strata of Mississippi, Alabama, and Tennessee

Source: MARIS, 2009.

- Size of recoverable reserve sufficient to supply a nominal 500- to 600-MW generation facility for at least 40 years.
- Economy of mining, based on the total depth of overburden (nonlignite materials above and between seams of lignite), thickness of the lignite seams, quality of the lignite, competing surface land uses, and initial mine development costs.
- Location of the reserve in relation to connecting the proposed generation facility to the electrical distribution system.
- Reliability of data available indicating the presence of sufficient economic reserves.

In each of these categories, the site of the proposed reserve—the southernmost area of the three candidates—ranked equal to or higher than other potential reserve sites for this particular project. The southernmost site was also selected since it would be most proximate to Mississippi Power service territory and existing infrastructure and would require the shortest linear support facilities. Otherwise, the three sites were generally similar in terms of topography, wetlands, and floodplains. Thus, Mississippi Power viewed the ability to minimize the nominal lengths of the linear support facilities as a means of reducing the project's overall cost and environmental impact. Furthermore, NACC had also independently identified the southernmost area in 2002 as a potential mine location and had already gathered specific developmental information on the site.

Two possible locations of an immediately adjacent power plant were examined: one on the western side and one on the eastern side of the lignite seam. Based on available open space, topography, including floodplains and apparent wetlands, and proximity to infrastructure, Mississippi Power selected the proposed site on the east side in early 2006.

In summary, once lignite was identified as the fuel/feedstock for the facility, the location of accessible and economic lignite reserves near Mississippi Power's service territory governed the location of the mine. The project proponent selected the site for the power plant in early 2006 based on proximity to infrastructure, topography, including avoidance of floodplains and wetlands, and available open space. Later in 2006, Mississippi Power applied for and received DOE and IRS approval for investment tax credits for a lignite-fired IGCC power plant at this site. Finally, in 2008, Southern Company proposed to DOE that it transfer the financial assistance originally awarded to the project in Orlando to this project, already sited in Kemper County.

2.7.3.3 Alternative Power Generation Technologies

Other power generation technologies were considered but dismissed because they did not meet the CCPI program's purpose and needs or those of the applicant. The proposed project was selected to demonstrate coal gasification, syngas cleanup systems, and supporting infrastructure, which would be integrated with the combined-cycle power-generating unit to form IGCC technology. Other CCPI projects were selected to demonstrate other coal-based technologies. The projects not selected under the CCPI Program were DOE's alternatives prior to the time of selection and were considered at that point in DOE's decision-making process.

The use of other technologies and approaches not applicable to coal (e.g., natural gas, wind power, hydropower, nuclear power, solar energy, and conservation) would not meet the CCPI program's goal or loan guarantee program's goal of accelerating commercial deployment of advanced coal-based technologies that can generate clean, reliable, and affordable electricity in the United States. Furthermore, no funds appropriated by Congress to DOE under the CCPI program can be spent on technologies that do not use coal as a primary power source. DOE distributes financial support provided by Congress to demonstrate alternative technologies, such as solar energy, through other programs.

Mississippi Power could use the native lignite in coal-based technologies other than IGCC. The alternative technologies include subcritical pulverized coal (PC), supercritical PC, and ultra-supercritical PC. As discussed previously, the IGCC application was selected by Mississippi Power as the best option in accordance with the company's generation planning process. As noted previously, Mississippi Power's closing agreement with the IRS under EPAct05 for investment tax credits conditions receipt of those credits on the use of IGCC technology and lignite. Notably, both EPA (2006) and DOE (2007a) have examined the comparative costs and performance of IGCC and these other technologies. Both studies developed performance characteristics based on standard, commercial plant designs at generic greenfield sites. Neither study lends itself perfectly to the Kemper IGCC project since they examine only oxygen-blown gasifiers (as opposed to air-blown TRIG™). And the reports present relatively less comparative information addressing low-rank coals like lignite, given the very limited use of these coals in IGCC units to date. However, the main purpose of the CCPI program is to facilitate the movement of promising technologies to the commercial marketplace through demonstrations like Kemper, where a low-rank coal would be demonstrated in just such a promising new technology.

Table 2.7-1 presents a summary of the comparisons found in the EPA report for lignite and subbituminous coals. All of the information shown in this table assumes no capture of CO_2 emissions. EPA adds discussion of CO_2 capture and sequestration and compares IGCC to supercritical PC, noting that the "comparison highlights the potential advantage for IGCC to capture and sequester CO_2 at significantly lower costs than PC technologies."

Table 2.7-1. Overview Comparison of IGCC and Other Coal-Based Technologies—EPA

	Lignite Coal				Sub-Bituminous Coal			
	IGCC Solid Feed Gasifier	Subcritical PC	Supercritical PC	Ultra Supercritical PC	IGCC Slurry Feed Gasifier	Subcritical PC	Supercritical PC	Ultra Supercritical PC
Performance								
Net thermal efficiency, % (HHV)	39.2	33.1	35.9	37.6	40.0	34.8	37.9	41.9
Net heat rate, Btu/kWh (HHV)	8,707	10,300	9,500	9,065	8,520	9,800	9,000	8,146
Gross power, MW	580	544	544	546	575	541	541	543
Internal power, MW	80	44	44	46	75	41	41	43
Fuel required, lb/hr	689,720	815,906	752,535	720,849	484,089	556,818	517045	460,227
Net power, MW	500	500	500	500	500	500	500	500
Environmental Impact lb/MWh								
NO_x (NO_2)	0.375	0.568	0.524	0.498	0.326	0.543	0.500	0.450
SO_2	0.150	0.814	0.751	0.714	0.089	0.589	0.541	0.488
CO	0.225	0.947	0.873	0.830	0.222	0.906	0.832	0.750
PM*	0.053	0.114	0.105	0.100	0.052	0.109	0.100	0.090
VOC	0.013	0.026	0.024	0.022	0.013	0.025	0.023	0.020
Solid waste‡	218	331	306	291	45	73	67	60
Raw water use	5,270	9,960	9,200	8,710	5,010	9,520	8,830	7,870
SO_2 removal basis, %	99	95.8§	95.8§	95.8§	97.5	87**	87**	87**
NO_x removal basis†	15 ppmvd @ 15% oxygen	0.06 lb/MMBtu	0.06 lb/MMBtu	0.06 lb/MMBtu	15 ppmvd @ 15% oxygen	0.06 lb/MMBtu	0.06 lb/MMBtu	0.06 lb/MMBtu
Costs††								
Total plant cost $/kW	$2,000	$1,255	$1,333	$1,432	$1,630	$1,223	$1,299	$1,395
Total plant investment $/kW	$2,260	$1,378	$1,463	$1,566	$1,840	$1,343	$1,426	$1,526
Total capital requirement $/kW	$2,350	$1,424	$1,511	$1,617	$1,910	$1,387	$1,473	$1,575
Annual operating cost, $1,000s	$34,000	$29,640	$30,940	$32,440	$29,700	$28,300	$29,600	$31,100

Note: HHV = higher heating value.
Btu/kWh = British thermal unit per kilowatt-hour.
lb/MWh = pound per megawatt-hour.
NO_2 = nitrogen dioxide.
$/kW = dollars per kilowatt.
ppmvd = part per million by dry volume.
lb/MMBtu = pound per million British thermal units.

*Particulate removal is 99.9 percent or greater for the IGCC cases and 99.8 percent for bituminous coal, 99.7 percent for sub-bituminous, and 99.9 percent for lignite for the PC cases. The emission rates shown include the overall filterable PM only.
†A percent removal for NO_x cannot be calculated without a basis, i.e., an uncontrolled unit, for the comparison. Also, the PC and IGCC technologies use multiple technologies (e.g., combustion controls, SCR). The NO_x emission comparisons are based on emission levels expressed in ppmvd at15-percent oxygen for IGCC and lb/MMBtu for PC cases.
‡Solid waste includes slag (not the sulfur product) from the gasifier and coal ash plus the gypsum or lime wastes from the PC system.
§A relatively low SO_2 removal efficiency of 95.8 percent represents low lignite sulfur content of only 0.64 percent. Higher removal efficiencies are possible with increased coal sulfur content.
**A relatively low SO_2 removal efficiency of 87 percent represents low sub-bituminous coal sulfur content of only 0.22 percent. Higher removal efficiencies are possible with increased coal sulfur content.
††All costs are based on 4th quarter 2004 dollars.

Source: EPA, 2006.

Table 2.7-2 summarizes the results of DOE's comparisons. DOE examined cases for three existing IGCC systems (again, all oxygen-blown) and subcritical and supercritical PC, all with and without CO_2 capture. These were among the conclusions contained in the DOE report:

- Energy Efficiency—IGCC has higher efficiency than the PC cases, even without CO_2 capture. The addition of CO_2 capture to the PC cases has a much greater detrimental impact on efficiency than CO_2 capture in the IGCC cases.
- Water Use—IGCC requires less water than the PC technologies, and the addition of CO_2 capture increases IGCC water use much less than for PC.

- Cost—PC plants have lower capital costs than IGCC absent CO_2 capture; adding capture gives IGCC the cost advantage. PC has the lowest levelized cost of electricity (LCOE) (including fixed, variable, fuel, and capital costs) without capture, while the higher capture costs for PC technologies flip the cost advantage to IGCC.
- Environmental Performance—IGCC has lower overall air pollutant emissions than PC.

Table 2.7-2. Overview Comparison of IGCC and Other Coal-Based Technologies—DOE

	Unit	IGCC*		Subcritical PC		Supercritical PC	
CO_2 capture		No	Yes	No	Yes	No	Yes
Gross power output	MW	754	711	583	680	580	663
Net power output	MW	633	530	550	550	550	546
Net efficiency	%	39.5	32.1	36.8	24.9	39.1	27.2
Net heat rate	Btu/kWh	8,636	10,645	9,276	13,724	8,721	12,534
Raw water usage	gpm	3,851	4,426	6,212	12,187	5,441	10,444
Total plant cost	million $	1,166	1,323	853	1,591	866	1,567
Total plant cost	$/kW	1,841	2,496	1,549	2,895	1,575	2,870
LCOE	mills/kWh[2]	77.9	106.3	64.0	118.8	63.3	114.8
CO_2 emissions	10^3 tpy†	3,803	407	3,865	570	3,631	516
	lb/MMBtu	199	20.6	203	20.3	203	20.3
	lb/MWh‡	1,440	164	1,780	225	1,681	209
	lb/MWh§	1,714	202	1,886	278	1,773	254
SO_2 emissions	tpy†	228	189	1,613	Negligible	1,514	Negligible
	lb/MMBtu	0.012	0.0095	0.085	Negligible	0.085	Negligible
	lb/MWh‡	0.086	0.076	0.743	Negligible	0.701	Negligible
NO_x emissions	tpy†	1,101	947	1,331	1,966	1,250	1,784
	lb/MMBtu	0.057	0.049	0.07	0.07	0.07	0.07
	lb/MWh‡	0.417	0.385	0.613	0.777	0.579	0.722
PM emissions	tpy†	136	140	247	365	232	331
	lb/MMBtu	0.0071	0.0071	0.013	0.013	0.013	0.013
	lb/MWh‡	0.052	0.057	0.114	0.144	0.107	0.134
Lead emissions	lb/yr†	22	23	44	64	40	58
	lb/TBtu	0.571	0.571	1.14	1.14	1.14	1.14
	10^{-6} lb/MWh‡	4.14	4.54	10.0	12.7	9.45	11.8

Note:
Btu/kWh = British thermal unit per kilowatt-hour.
$/kW = dollar per kilowatt.
mills/kWh = 0.1 cent per kilowatt-hour.
lb/MMBtu = pound per million British thermal units.
lb/MWh = pound per megawatt-hour.
lb/TBtu = pound per 10^{12} British thermal units.
10^{-6} lb/MWh = 0.000001 lb per megawatt-hour.

*Averages of three oxygen-blown IGCC systems.
†Capacity factors of 80 percent for IGCC, 85 percent for PC.
‡Based on gross output.
§Based on net output.

Sources: DOE, 2007a.
ECT, 2009.

The information presented in the EPA report generally supports all of the conclusions drawn from the DOE report.

2.7.4 PROJECT ALTERNATIVES DISMISSED FROM FURTHER CONSIDERATION BY PROJECT PROPONENTS

The following subsections discuss project alternatives and options for the connected actions that were initially identified and considered by the project proponents.

2.7.4.1 Alternative Size

Mississippi Power's IRP is the fundamental supply and demand planning process used to ensure that its customers continue to receive reliable service at the lowest practical cost through a mix of resources that meet current and future environmental requirements and that account for risk. The IRP projects a need of between 318 and 601 MW for baseload power by the summer peak season of 2014 (Mississippi Power, 2009a).

The IRP process involves an evaluation of existing generating units, including the scheduled and potential retirement dates for those units, expected future customer and load growth, strategic considerations, demand-side management opportunities, and a preliminary screening of the various generating technologies available to meet any additional capacity requirements. The resulting needs, if any, are filled through an evaluation of both supply-side and demand-side options using marginal cost analysis. This approach ensures that both supply-side and demand-side options are included in the resource plans when it is economic to do so. When a need for a new supply-side resource is identified, the IRP process serves as the starting point for developing site-specific resource alternatives as part of the generation screening process.

When the IRP indicates a need for a new supply-side resource, the generic supply-side resource technologies identified in the IRP become the basis for the detailed screening and evaluation process used to determined the most cost-effective new supply-side option. In developing these plans, however, it is important to realize that, due to economies of scale, generating resources are typically built in economic capacity blocks that could result in a short-termed period of excess capacity.

After evaluating the resource need and considering the demand-side resource options and site-specific supply-side alternatives, the results of Mississippi Power's generation screening and resource selection process indicated that the Kemper County IGCC Project was the most economic generation resource alternative to meet the identified need in the 2014 timeframe.

2.7.4.2 Alternative Fuels

Because the design of the entire plant is highly dependent on the design fuel, the use of alternative coals (e.g., bituminous coal) is not possible for this proposed lignite project. In addition, the overall project premises the efficient and economical supply of lignite coal from the adjacent surface mine. The heating value of lignite is substantially lower than that of other coals. Thus, although plentiful, more lignite is necessary to release a given amount of energy, which makes transportation costs particularly high for lignite. Accordingly, transporting lignite from another location, even relatively short distances, is not economic for the long-term operation of the proposed plant. Thus, using coal from another location was not considered practical.

Additionally, the use of biomass feedstock is not considered feasible because of problems related to high-moisture content, relatively low-energy content, material handling issues, and material consistency issues. Although pilot-scale research using biomass feedstock with IGCC technology is ongoing within Southern Company, biomass is not planned for the proposed facilities due to the challenges and uncertainties associated with material preparation and with feeding biomass into pressurized systems. In addition, firing biomass would not meet the goals of the CCPI program. Other DOE programs are focused on developing alternative fuel technologies.

2.7.4.3 Alternative Plant Layout

Steps to establishing the IGCC plant site arrangement included a review of available space for the facility at a macro level. As part of site selection, the site area was overlaid with a rectangular area of 60 to 80 acres, representing the minimum space sufficient for the combined gasifier system and power block. Several locations on the site were preliminarily determined to be of sufficient size and at an elevation above the 100-year floodplain and with comparable amounts of site improvements required. With each of the locations considered for the footprint, companion areas in excess of 100 acres were also identified for potential placement of ash storage. With several potential configurations initially possible, the site as proposed was deemed to have sufficient space and flexibility to allow continued development through continued engineering design and layout studies.

The proposed IGCC plant layout would have a similar set of engineering constraints and design requirements as other simple-cycle and combined-cycle plants that Southern Company has designed and constructed (SCS, 2009). Ideally:

- The CT machine axes are aligned parallel to each other and with the steam turbine axis.
- All of the generator step-ups for the combined-cycle block are in a line that is perpendicular to the generator axis.
- The HRSGs are on the opposite side of a CT from the generator, but on the same axis.
- The cooling towers associated with the HRSGs are reasonably close and aligned to the steam turbine. The cooling towers should be in an advantageous direction (downwind) and at a sufficient distance to minimize drift to the power block. One cooling tower is required per combined-cycle block. Cooling towers must also be at a minimum of 1,000 ft from roads or highways.
- Condensate storage tanks, a water plant, and administration/control building are located adjacent to the unit.
- Adequate buffer area is provided between surrounding properties and the power block and associated equipment. As with the simple-cycle and combined-cycle layouts, the buffer area for an IGCC facility will vary depending on local surroundings. Minimizing offsite noise is an important factor in providing buffer.

The proposed gasification component would also require its own 10-cell cooling tower that would also have to be located a minimum of 1,000 ft from roads or highways. The proposed IGCC plant also would need to include coal handling facilities and provisions for ash storage onsite, as discussed elsewhere. NACC's coal handling facilities, including settling ponds, would also need to fit within the 1,650-acre site. Another constraint on this site is the presence of low areas, including wetlands associated with Chickasawhay Creek, covering much of the western area of the site.

As discussed in Subsection 2.5.3, the onsite facilities would include an approximately 75-acre pond or reservoir to store reclaimed effluent received by pipeline from the Meridian POTWs. The proposed reservoir location was chosen based on space availability, topography, and possible future expansion considerations. The existing topography on the eastern side of the proposed plant property contains a natural valley-shaped area. This area, when dammed from one end, would form a natural reservoir or pond area. The advantageous topography would lend itself to a cost-effective means of storing a large quantity (approximately 500 million gallons) of water.

Building and operating a series of tanks in an upland area with the capacity to provide adequate water supply storage would be prohibitively expensive. Excavation of upland areas to create the reservoir (e.g., south of the IGCC plant) would be less expensive than tanks, but still prohibitively expensive and thus not feasible. In addition, because of the limited upland space available within the plant property, both of these water storage methods would interfere with possible future expansion considerations. Thus, it would not be feasible to store a sufficient quantity of water onsite other than in a reservoir at the proposed location.

The proposed layout incorporating all of these facilities was shown in Figure 2.1-5. As this layout showed, meeting the basic design constraints would limit the possible options for placing equipment and facilities on the site. The proposed layout would meet the principal criteria (discussed previously), provide space for water and waste storage (if needed), and still avoid impacts to the western portion of the site.

2.7.4.4 Alternative Mining Methods

Alternative methods for lignite extraction have been excluded from further consideration because no discernable difference in impacts would result from practicable surface mining methods. Underground mining would result in reduced impacts at the land surface. However, underground mining would only be practicable where the mineral reserve was deep below the land surface and within consolidated lithology. As described in Section 3.4, the lignite reserves in Kemper County are shallow and lie beneath unconsolidated strata of sands and clays. Underground mining is not technically feasible at this location.

2.7.4.5 Alternative Mine Development Plans

During the preparation of this EIS and as a result of preapplication consultations with USACE, NACC responded to DOE and USACE comments and input by revising the mine development plan, the proposed configuration for which was shown in Figure 2.2-4. The following subsections describe the alternatives that were considered.

Alternative Mine Plan "A"

Alternative mine plan "A" would recover the most lignite by maximizing the recovery of the lignite resource and maximizing the economy of the mining technique. This mine plan was based primarily on lignite characteristics and associated recovery economics. The most economically viable lignite reserves were identified, a 40-year mine plan was developed, and water control structures, including sediment ponds, diversions, and levees, were designed (see Figure 2.7-2).

This plan would establish a water containment and diversion system that would capture inflowing fresh water in a large pond on the north end (R-1) and divert the water around the west of the mine disturbance area through a series of ponds and diversions. The discharge would then flow into the Okatibbee Creek at the west end of the mine block labeled YR21 to YR25 and would then flow through the WMA into Lake Okatibbee.

A large sediment pond (SP-1) would be designed immediately south of the mine blocks, in the WMA, to capture the water runoff from the mine disturbance area. This pond would discharge directly into Lake Okatibbee. In addition, surface water coming onto the project area, north of the plant site, would be diverted southeast of the plant site to the Tombigbee watershed.

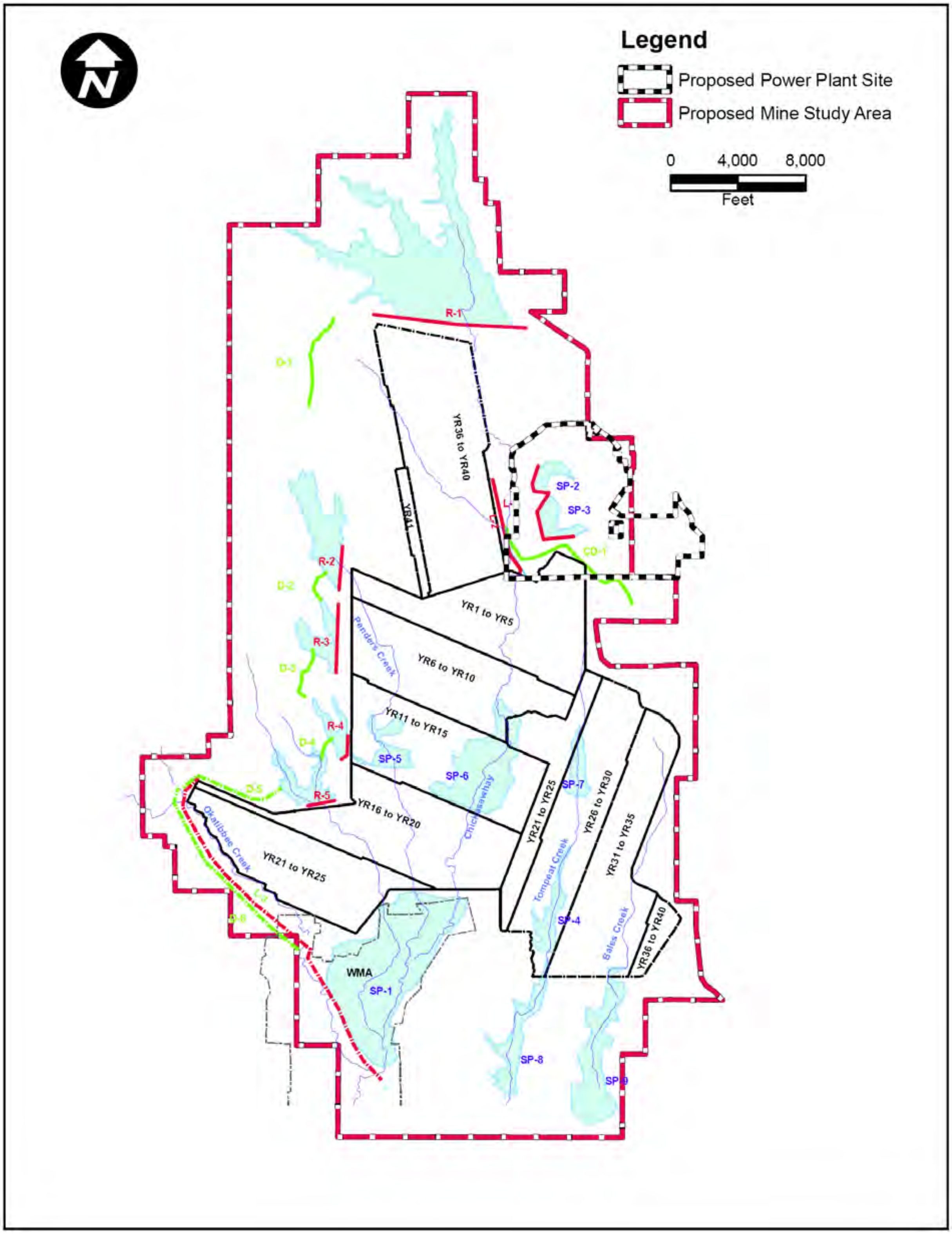


Figure 2.7-2. Alternative Mine Plan "A"
Source: NACC, 2009.

Once water was diverted, mining would initiate in the middle of the project area and would advance to the south with pits that extend almost the entire width of the mine blocks. In addition, prior to year 21 of mining, Okatibbee Creek would be diverted south of its current location to accommodate mining in and through that area. Alternative mine plan "A" would maximize the footprint of the mine impacts and represent a large wetland disturbance due, in part, to the disturbance of Okatibbee Creek and the WMA.

Alternative Mine Plan "B"

A subsequent mine plan (Figure 2.7-3) was developed to account for hydrologic impacts to the WMA and Okatibbee Creek. This mine plan would be similar to the previously discussed Plan "A," but under this alternative the southwestern mine block, labeled YR21 to YR25, would be shifted north to avoid disturbance to Okatibbee Creek and the associated riparian wetlands. Consequently, disturbance to the WMA and associated wetlands would be avoided by reducing the size of SP-1 and moving the pond north of the WMA, immediately south of the mine blocks. The benefit of this alternative would be in the reduction of the impact to Okatibbee Creek and the WMA. This plan would still contemplate the full east-west pit extension that extends the temporal disturbance to Chickasawhay Creek.

Alternative Mine Plan "C"

A third alternative (Figure 2.7-4) was developed to further protect the overall project-area hydrologic balance while still maximizing economic lignite recovery. The reservoir on the north end of the project area (R-1) would be eliminated, and the fresh water drainage would be controlled through a series of ponds on the west side of the mine blocks. This clean water would drain to Lake Okatibbee via Okatibbee Creek. The mine blocks would be reoriented from the previous full east-west extension to three east-west panels to minimize impacts to the individual watersheds. Because of the three panels, Chickasawhay Creek would be diverted in a step-wise manner, thus minimizing the duration of impact in any given area. Additionally, water inflow on the northeast side of the project area would be managed in a series of diversions and levees, thereby retaining all surface water within the Chickasawhay drainage basin. This alternative would allow for mining of economically viable lignite reserves in the southwest corner of the mine study area. The lignite in this area is high quality and has a low recovery ratio. Because of the low recovery ratio of overburden to lignite, less overburden would be disturbed for a comparable volume of lignite.

Alternative Mine Plan "D"

This alternative, which is the proposed mine plan discussed in Subsection 2.2.1 and shown in Figure 2.2-4, was designed to be more protective of the project area hydrologic balance. However, this alternative would preclude the recovery of a substantial volume of economically viable reserves as a result of avoiding portions of the Penders Creek basin and the area immediately northeast of Okatibbee Creek.

The large sediment pond north of the project area and the series of ponds on the west side of the mine blocks included in all prior alternatives would be eliminated. Inflows from the north would flow to Lake Okatibbee though a series of clean water diversions and levees and would no longer be diverted around the west side of the reserve blocks. Therefore, this plan would no longer divert water into the section of the Okatibbee Creek by mine blocks YR21 to YR25. It would also eliminate the need for the large pond on the south side of the mine

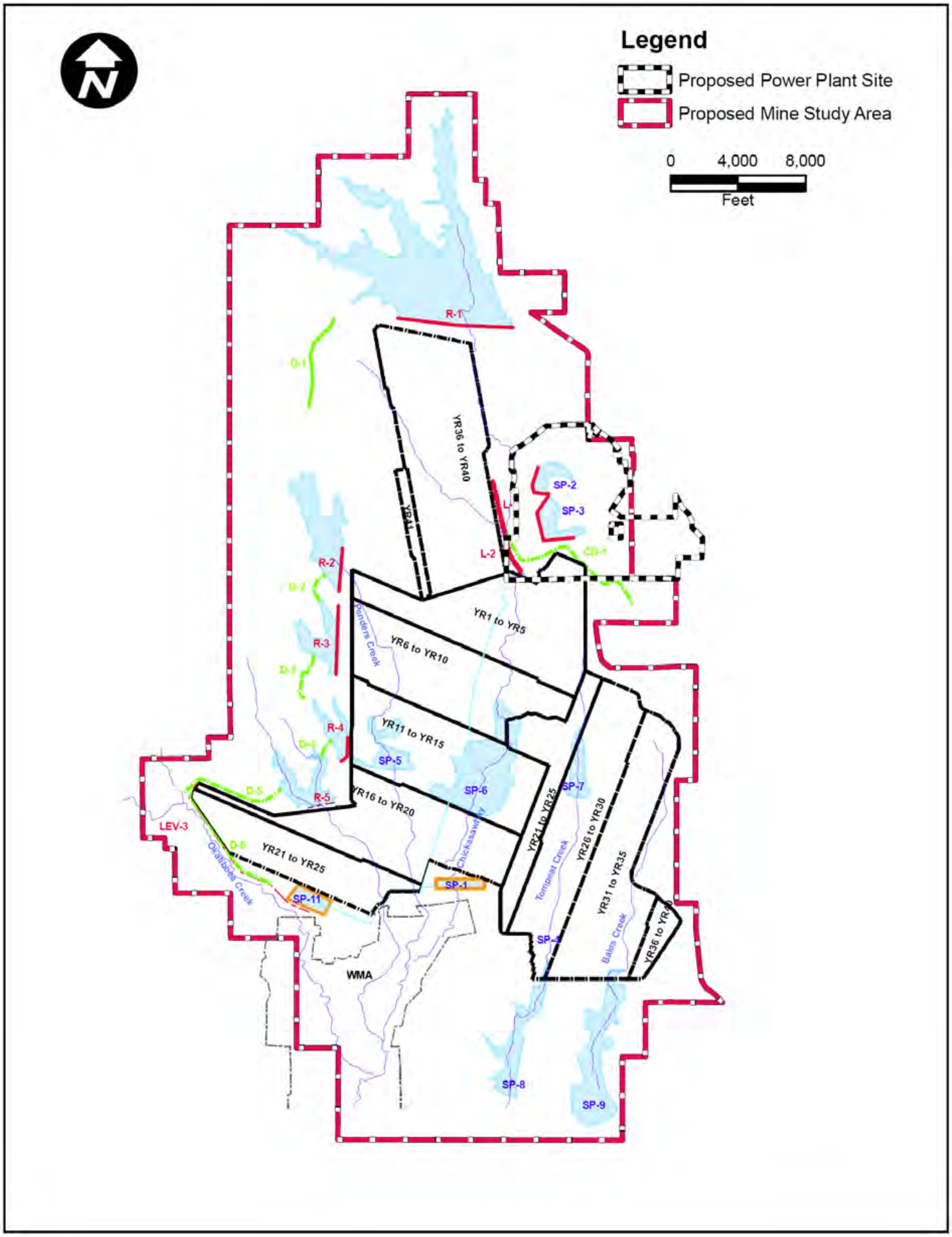


Figure 2.7-3. Alternative Mine Plan "B"
Source: NACC, 2009.

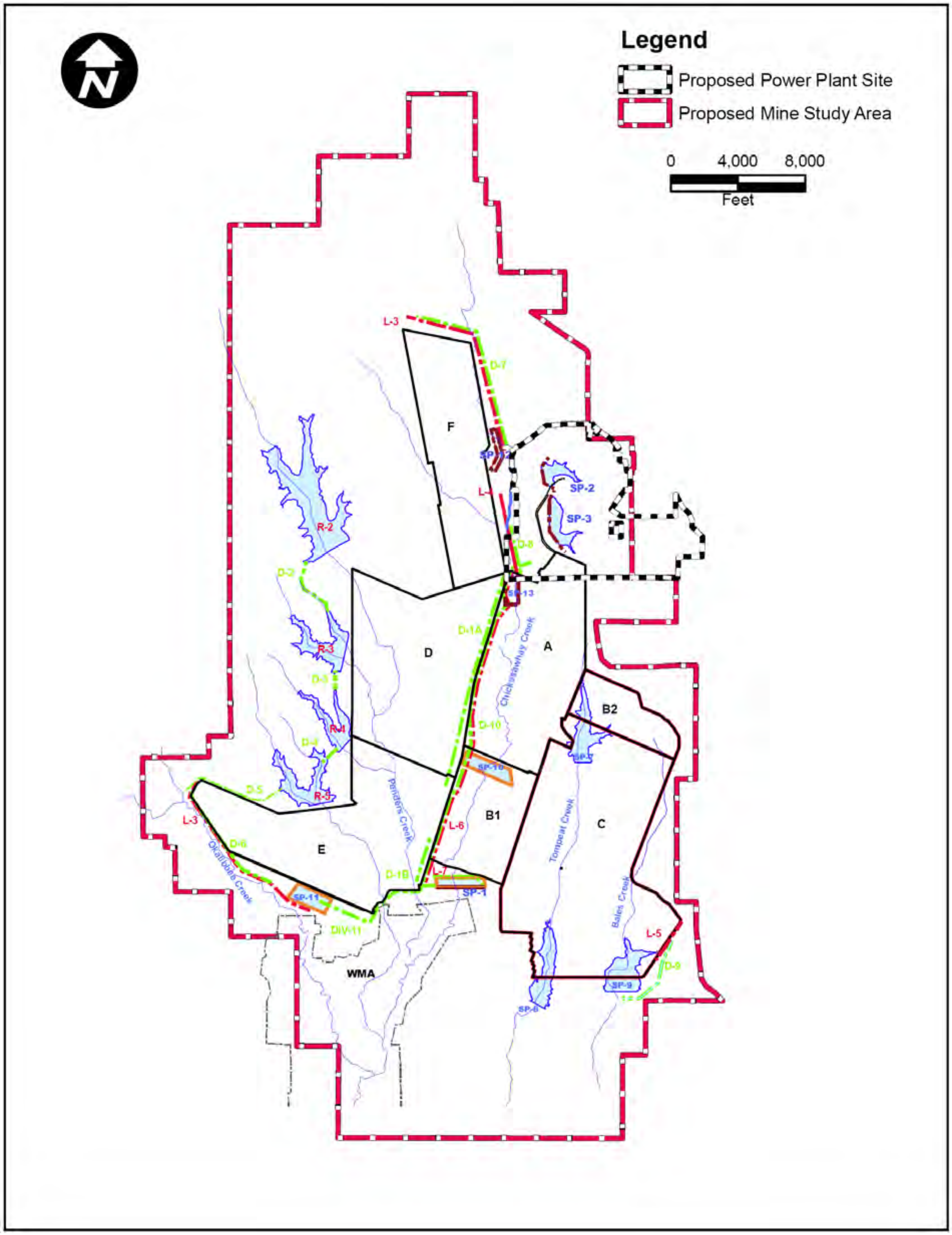


Figure 2.7-4. Alternative Mine Plan "C"
Source: NACC, 2009.

blocks in the WMA. In addition, it would change the sequence of mining on the west side of the mine blocks by not mining the reserves on the west side of the main channel of Pender's Creek (in block D) to minimize the impact to the streams and to offset from Okatibbee Creek to avoid a large portion of the wetlands associated with Okatibbee Creek.

This alternative would minimize wetland and floodplain impacts compared to the other alternative mine plans. However, approximately 10.0 million tons of lignite would remain in the ground. Long-term operational costs would increase as a result of having to mine lignite from higher ratio (overburden to lignite) reserves with less favorable recovery economics.

2.7.4.6 Alternative Means of CO_2 Sequestration

The Kemper County IGCC Project would intend to capture approximately 67 percent of the carbon from the produced syngas as CO_2. The recovered CO_2 would then be compressed to the required pressure and exit the gasification facility in a pipeline. The CO_2 would be transported via pipeline to an existing oil field for beneficial use in EOR and geologic storage.

To investigate practical options for managing the captured CO_2, Mississippi Power commissioned a study to characterize the carbon storage and sequestration opportunities for the captured CO_2 from the proposed IGCC plant (Pashin *et al.*, 2008). In this study, an evaluation of the deep subsurface geology was performed, which included the compilation and interpretation of a large volume of geophysical, stratigraphic, and structural information from wells and seismic profiles. Geologic sequestration opportunities were characterized by defining the fresh-water aquifers that need to be protected, delineating confining strata, and analyzing saline reservoirs that can safely store a large volume of CO_2 over geological time.

Geologically, Kemper County lies at a crossroads of North American geology where the juncture between the Appalachian and Ouachita orogenic belts is on-lapped by poorly consolidated Mesozoic strata of the Gulf of Mexico Basin (Thomas, 1985; Hale-Erlich and Coleman, 1993). The geology is diverse and contains basic geologic formations in proximity to the proposed IGCC plant that are potentially favorable for geologic sequestration. However, the potential and quality of these formations cannot be determined sufficiently. Significant field efforts at the site would need to be performed before a geologic framework could be developed. This effort would include reservoir modeling, the drilling and logging of an exploratory test well, and seismic analysis.

Equally important, in contrast to EOR, which is an accepted and demonstrated commercial technology, commercial-scale geologic sequestration must overcome significant legal, commercial and regulatory barriers beyond validating sequestration geology including: (1) property rights (pore ownership and issues of trespass), (2) a unified regulatory framework for large-scale underground injection and geologic storage, and (3) long-term liability issues related to the maintenance and monitoring of closed sites (SCS, 2009).

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.

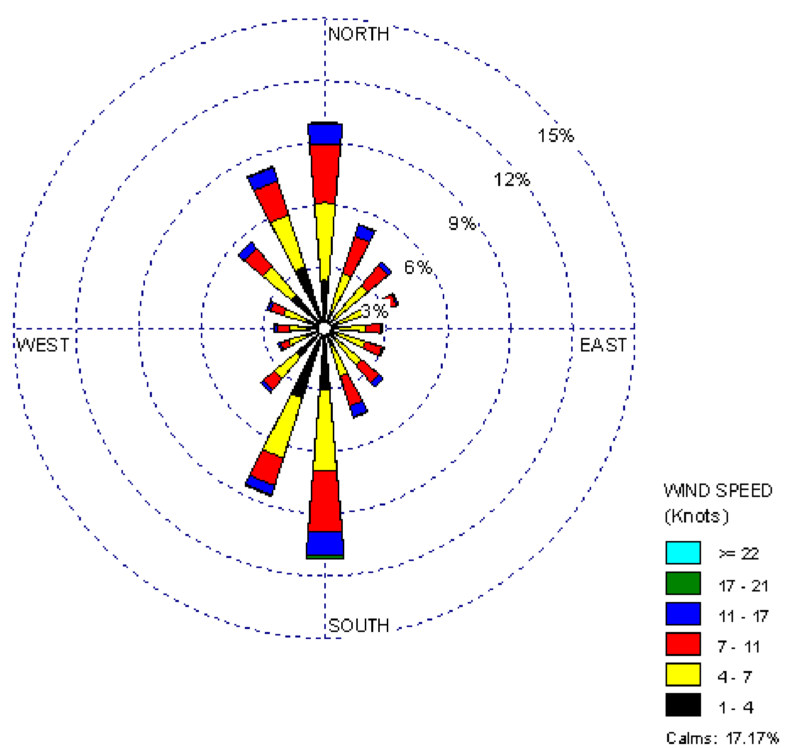


Figure 3.3-1. 5-year Wind Rose for Meridian Key Field Airport (1991 to 1995)

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 [$\mu g/m^3$] unless otherwise stated)

Pollutant	Averaging Periods	National Standards: Primary	National Standards: 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 $\mu g/m^3$, 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 4^{th} 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 ($\mu g/m^3$). The averages for the 2006 to 2008 period at the Lauderdale and Lowndes monitoring sites were 12.5 and 12.6 $\mu g/m^3$, respectively. The average for the 2004 to 2006 period at the rural Sumter site was 11.7 $\mu g/m^3$. 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 ($\mu g/m^3$)				
	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 98^{th} percentiles of the 24-hour averages does not exceed 35 $\mu g/m^3$. The most recent averages for Lauderdale, Lowndes, and Sumter sites were 28, 27, and 28 $\mu g/m^3$, respectively. Table 3.3-5 shows the most recent years of $PM_{2.5}$ 24-hour average values for these monitors.

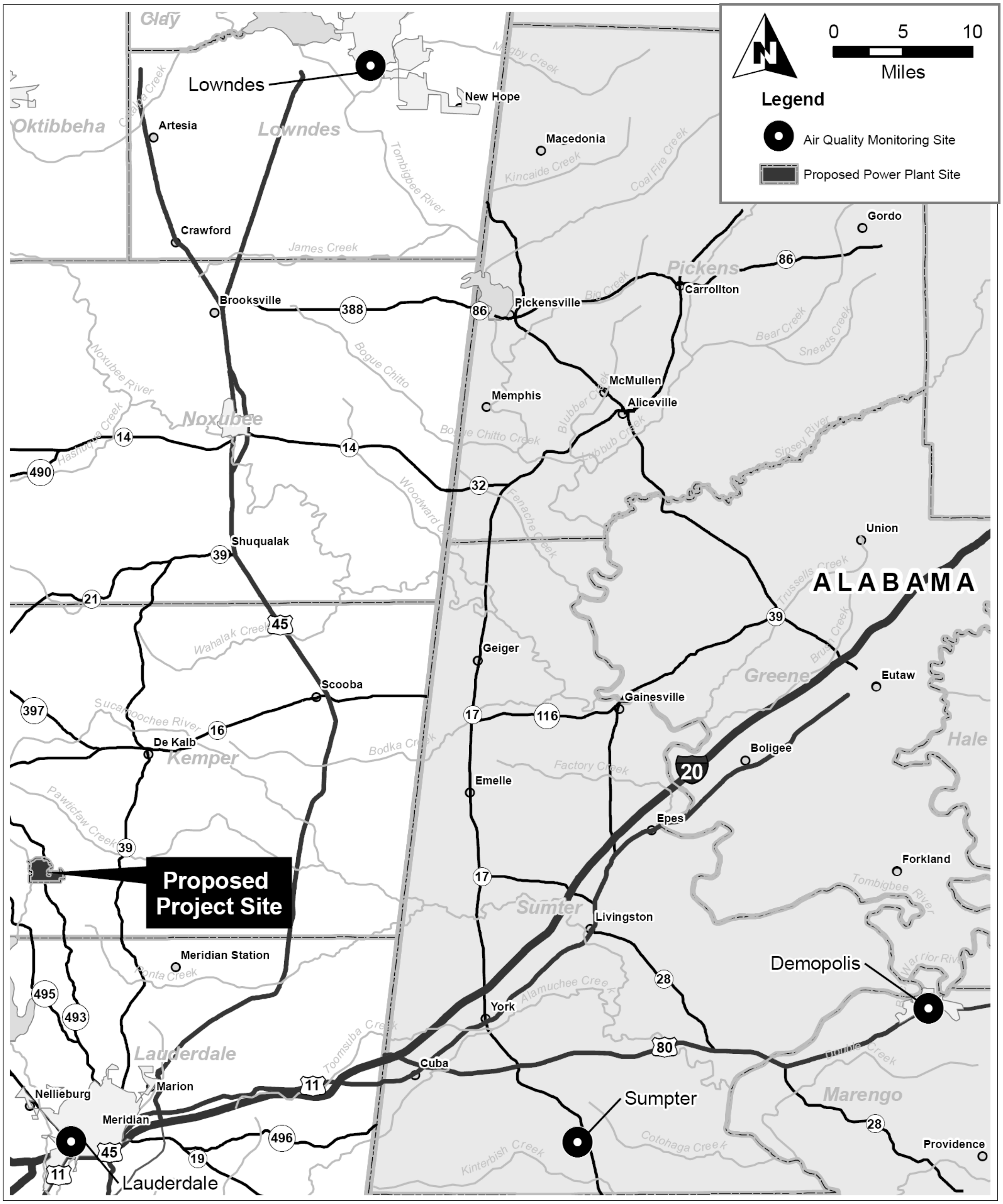


Figure 3.3-2. Location of Ambient Air Quality Monitors

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-$\mu g/m^3$ 24-hour NAAQS.

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

	3-year Average 98^{th} Percentiles ($\mu g/m^3$)				
	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

Year	24-hour Concentrations ($\mu g/m^3$)			
	1^{st} High	2^{nd} High	3^{rd} High	4^{th} 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.

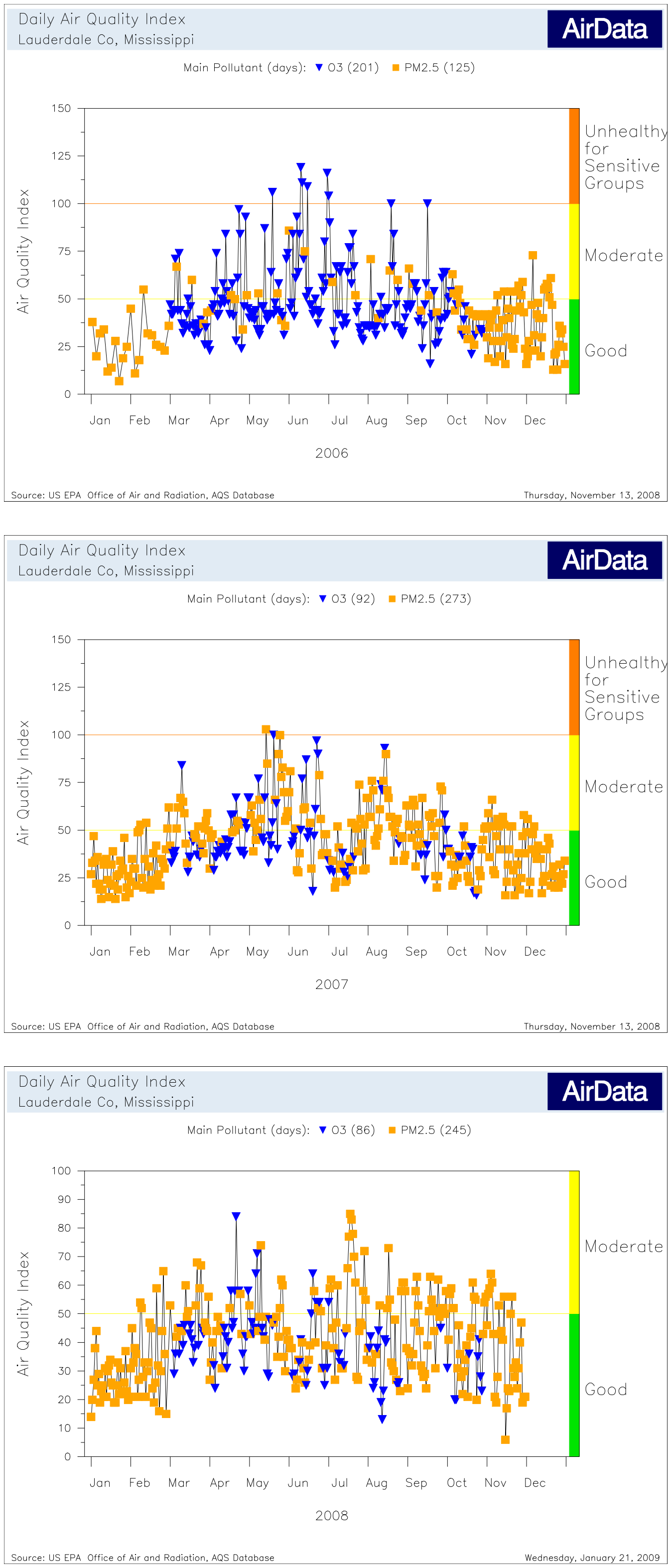


Figure 3.3-3. AQI Charts for Lauderdale County—2006 through 2008

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

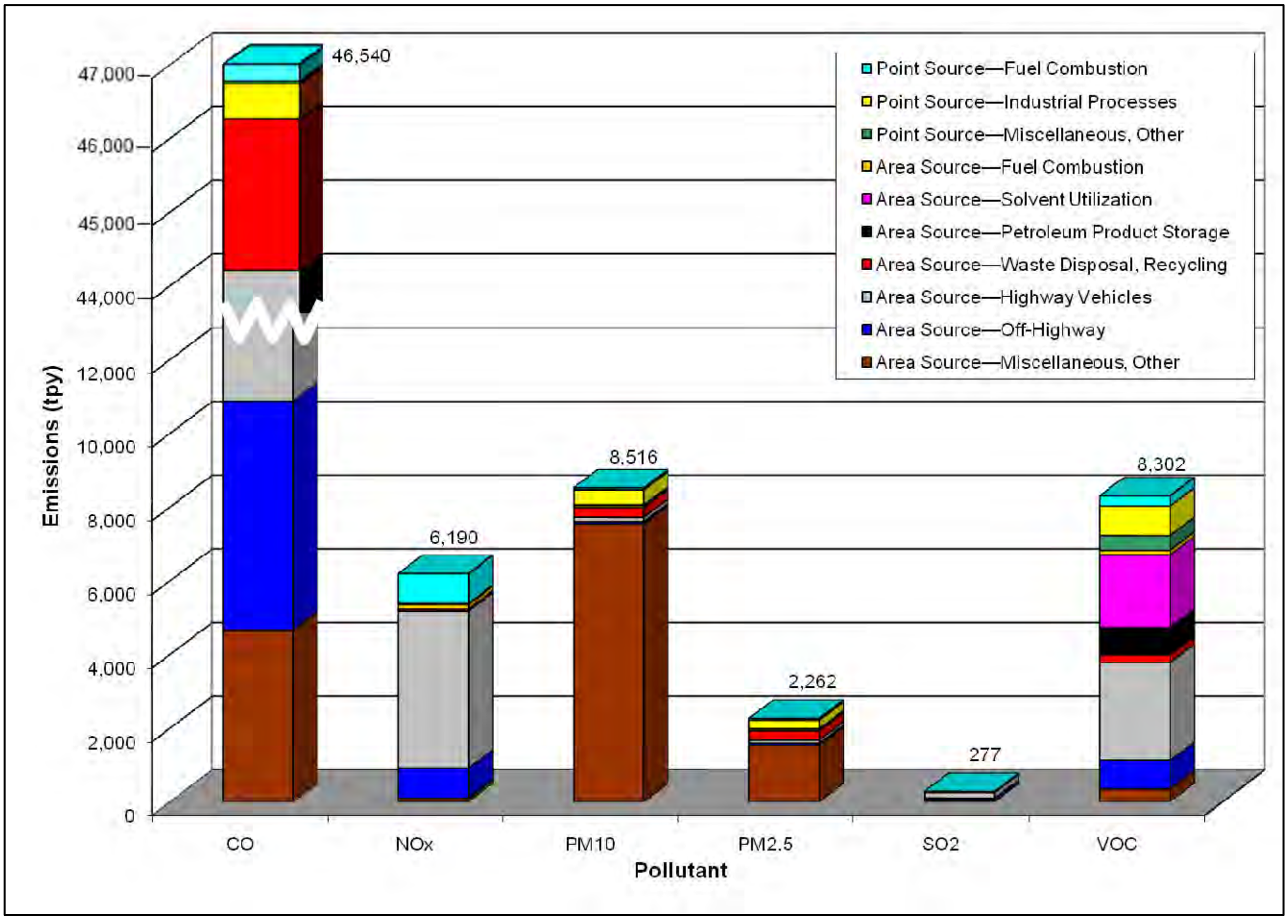


Figure 3.3-4. Existing Emissions in Kemper and Lauderdale Counties (2001)

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.

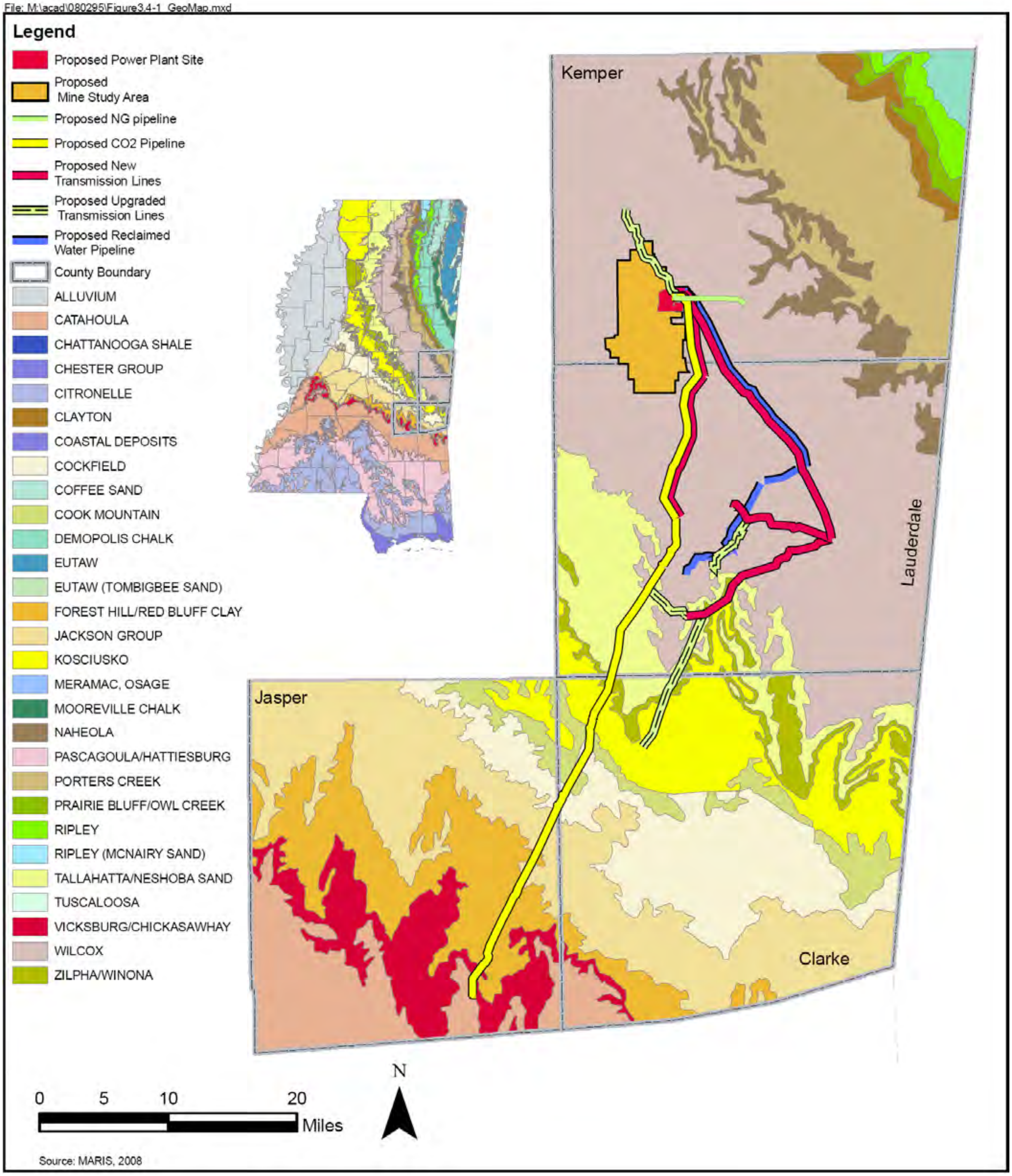


Figure 3.4-1. Surface Geology Map of Mississippi
Sources: MARIS.state.ms.us, Surface Data, 2008. ECT, 2008.

Table 3.4-1. Geologic Units in Mississippi

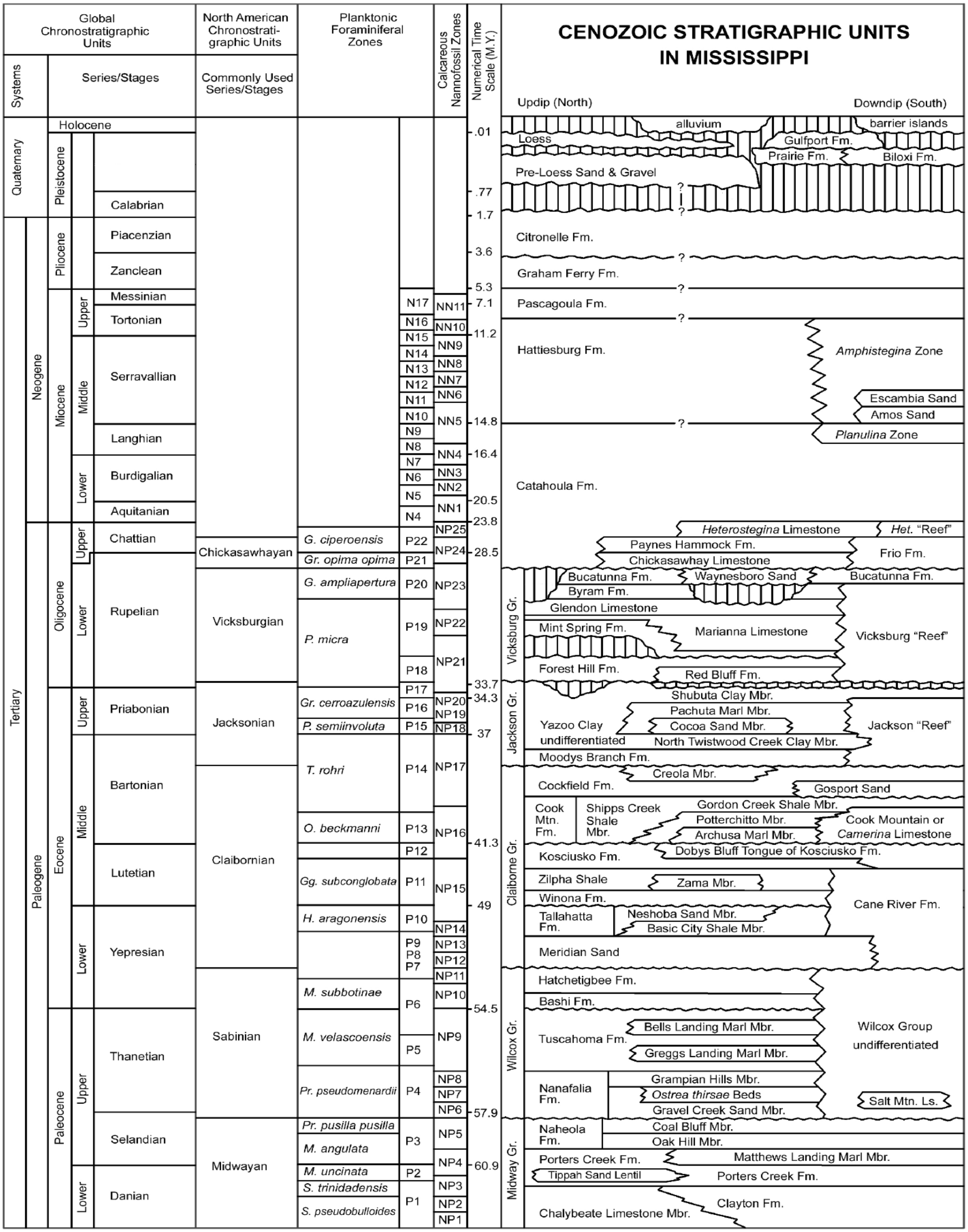
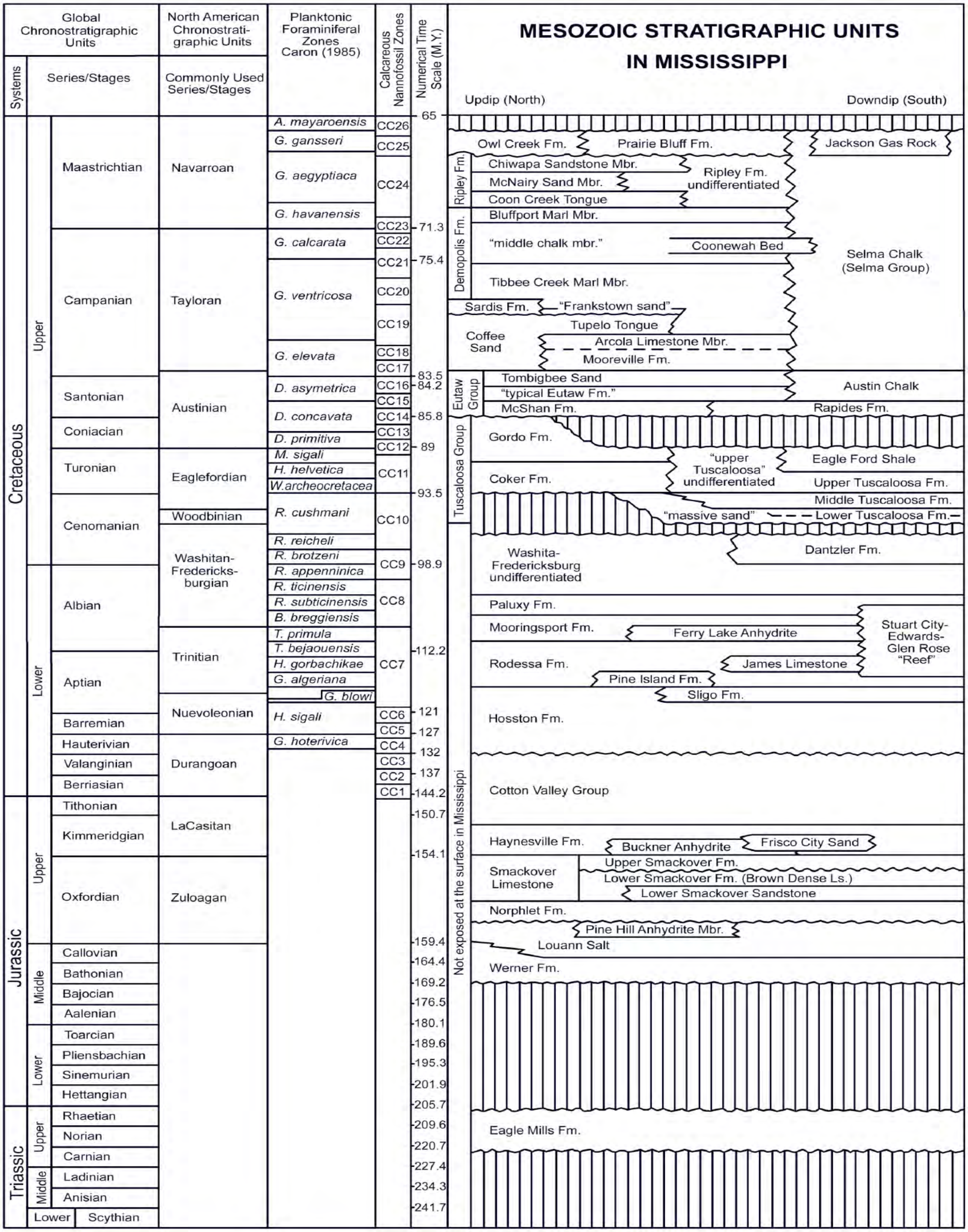


Table 3.4-1. Geologic Units in Mississippi (Page 2 of 2)



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

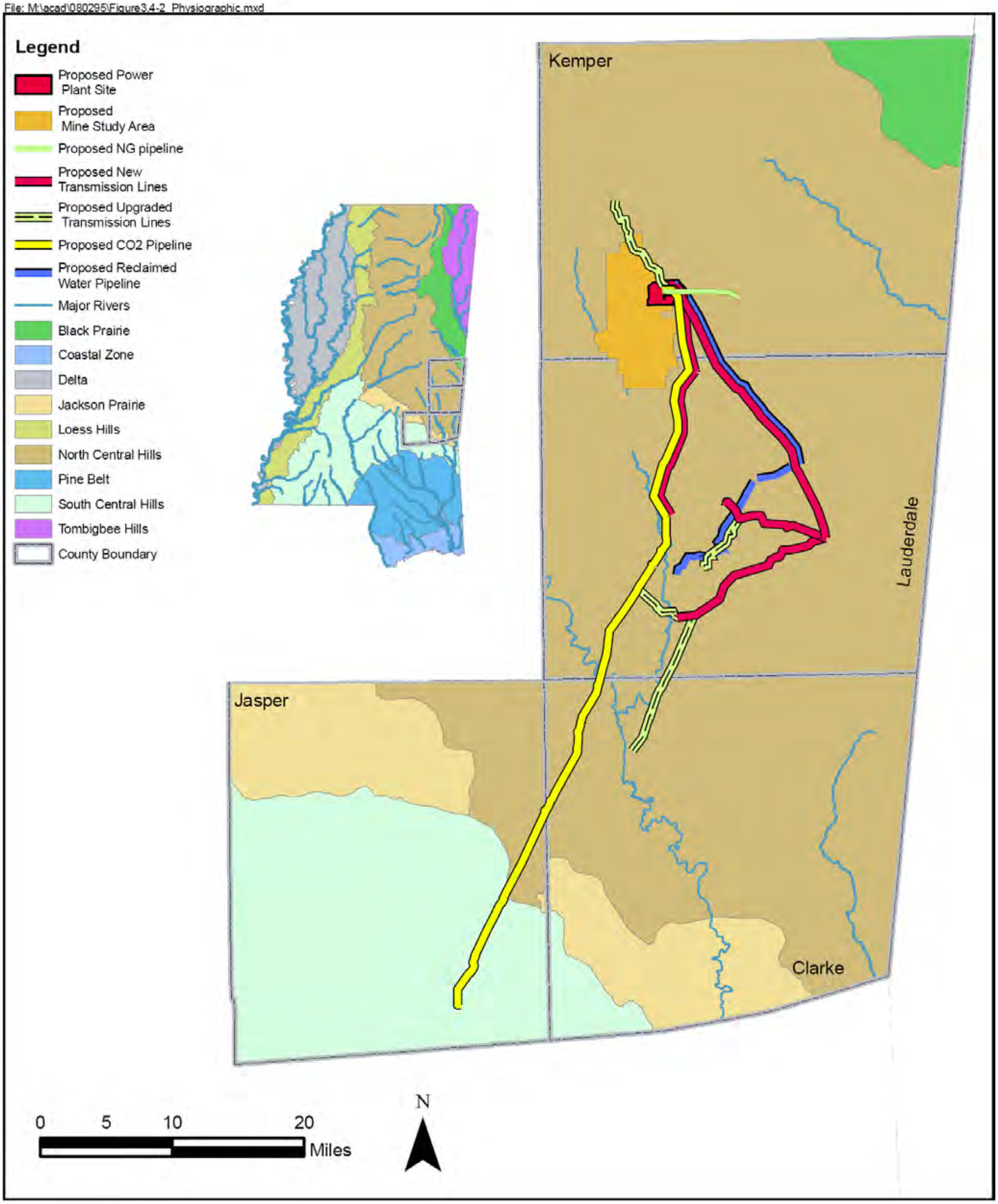


Figure 3.4-2. Physiographic Provinces of Mississippi
Sources: MARIS, 2008. ECT, 2008.

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

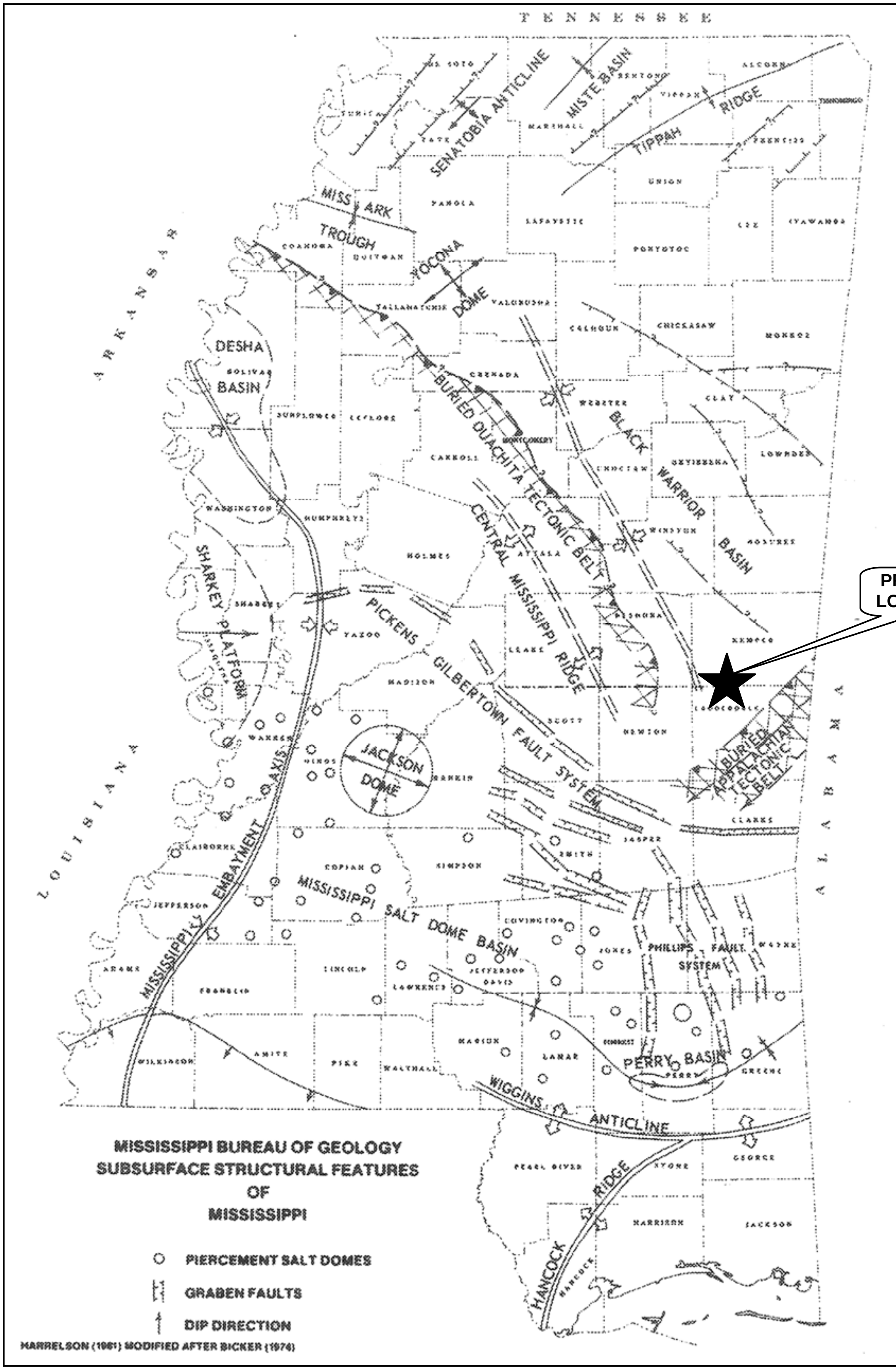


Figure 3.4-3. Subsurface Structural Features of Mississippi

Sources: TVA, 1998. ECT, 2008.

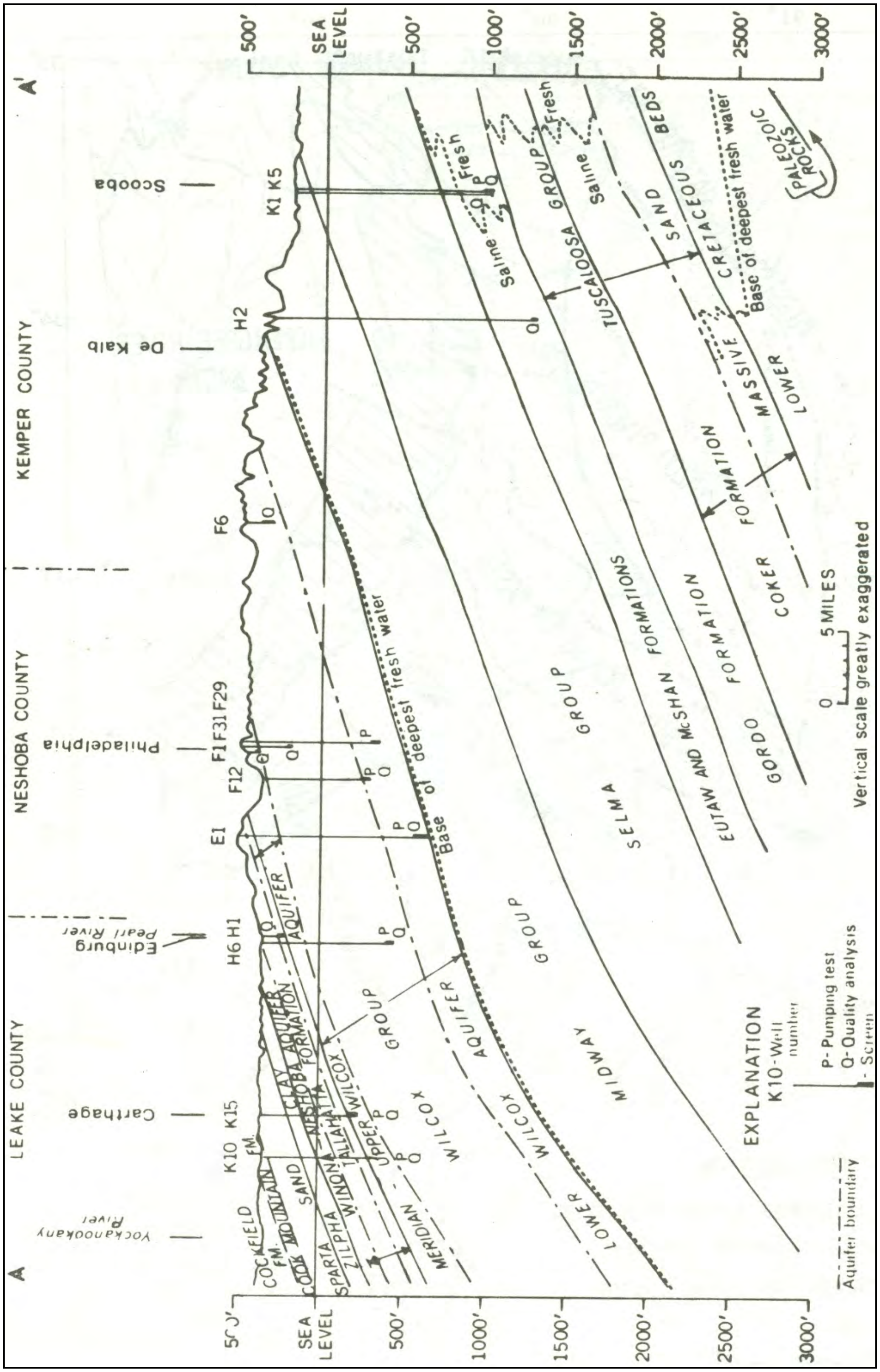


Figure 3.4-4. Regional Geologic Cross-Section

Source: Dalsin, 1979.

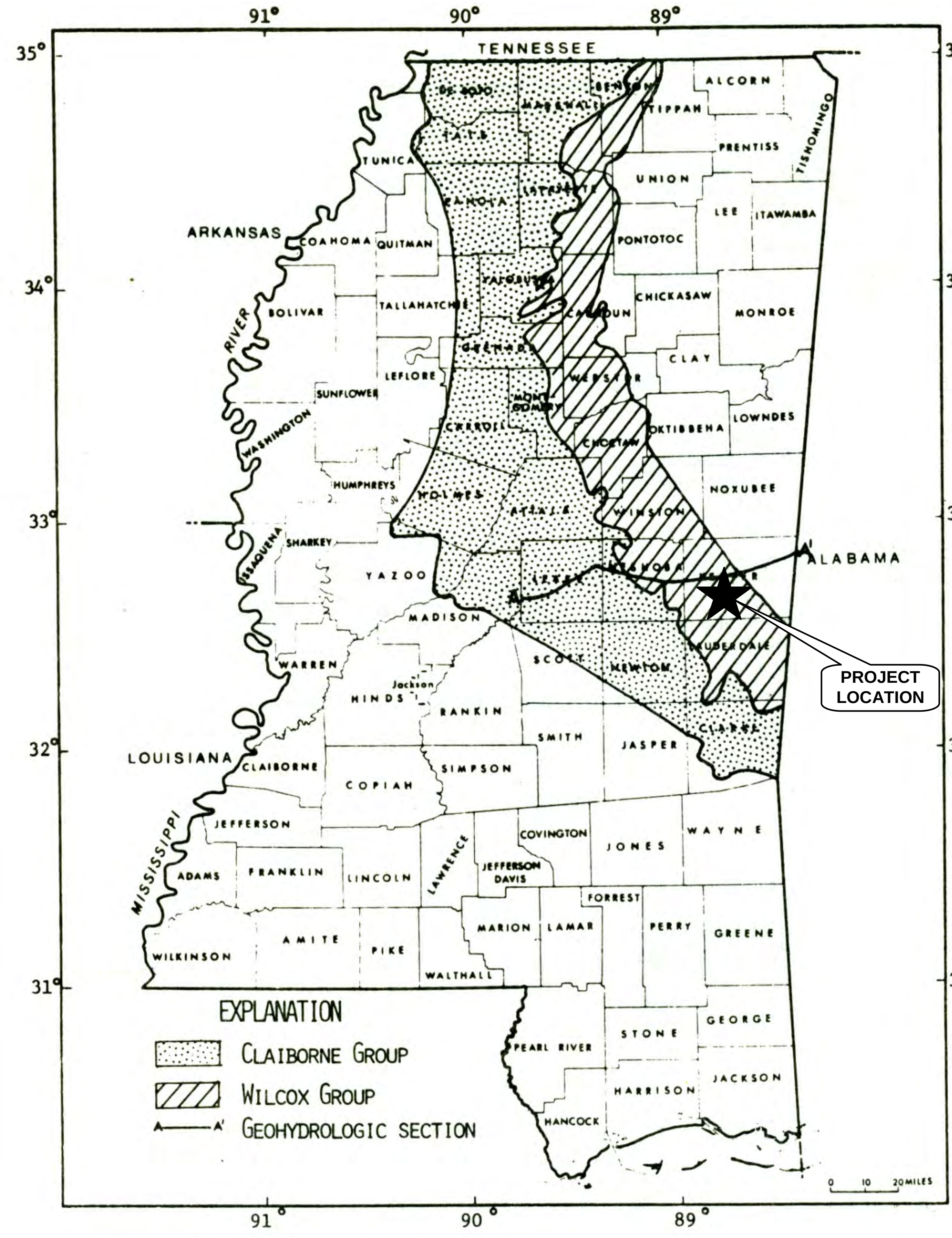


Figure 3.4-5. Location of Geologic Cross-Section A-A'

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.

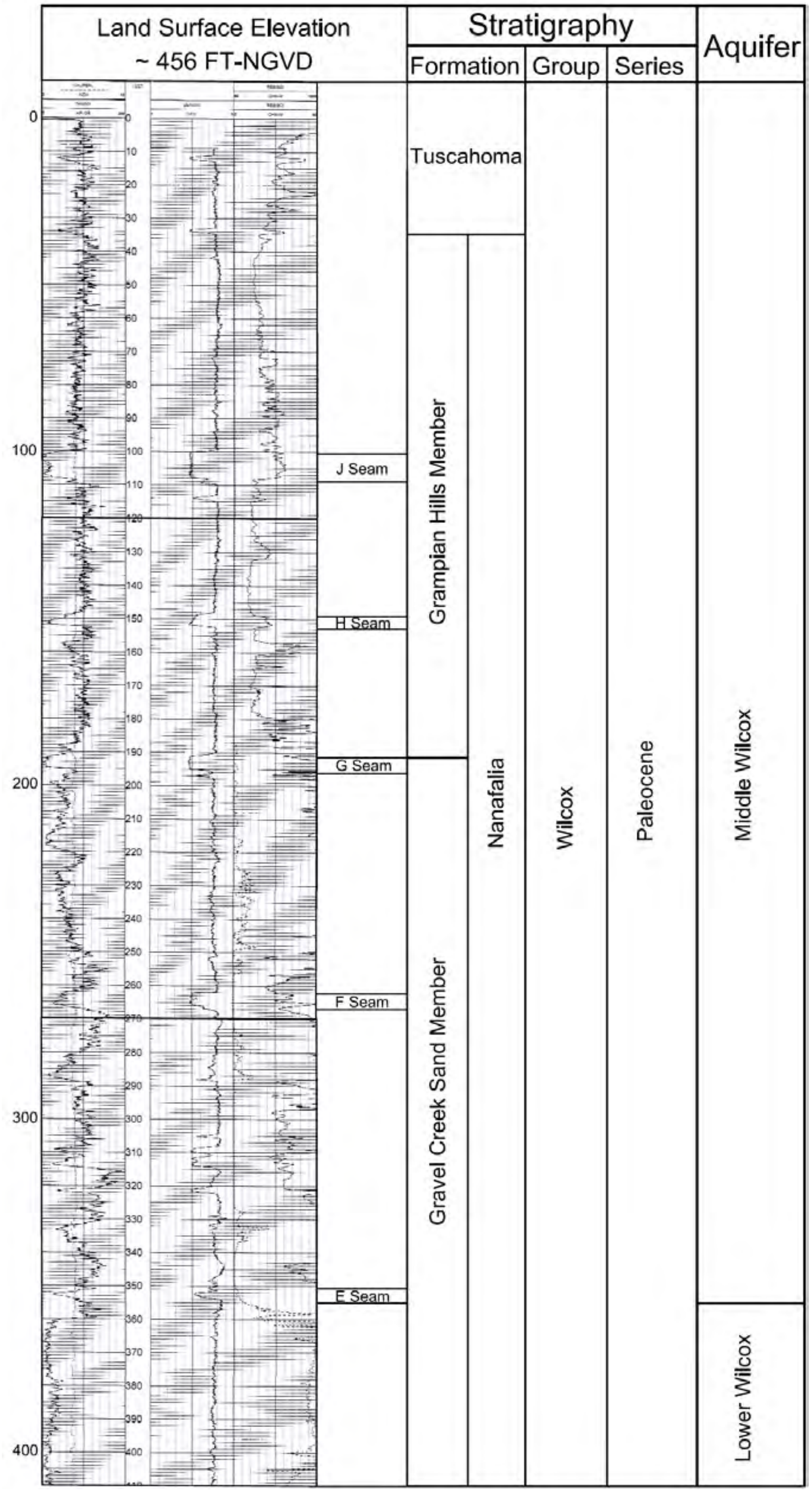


Figure 3.4-6. Shallow Stratigraphy in the Mine Study Area
Source: NACC, 2009.

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.

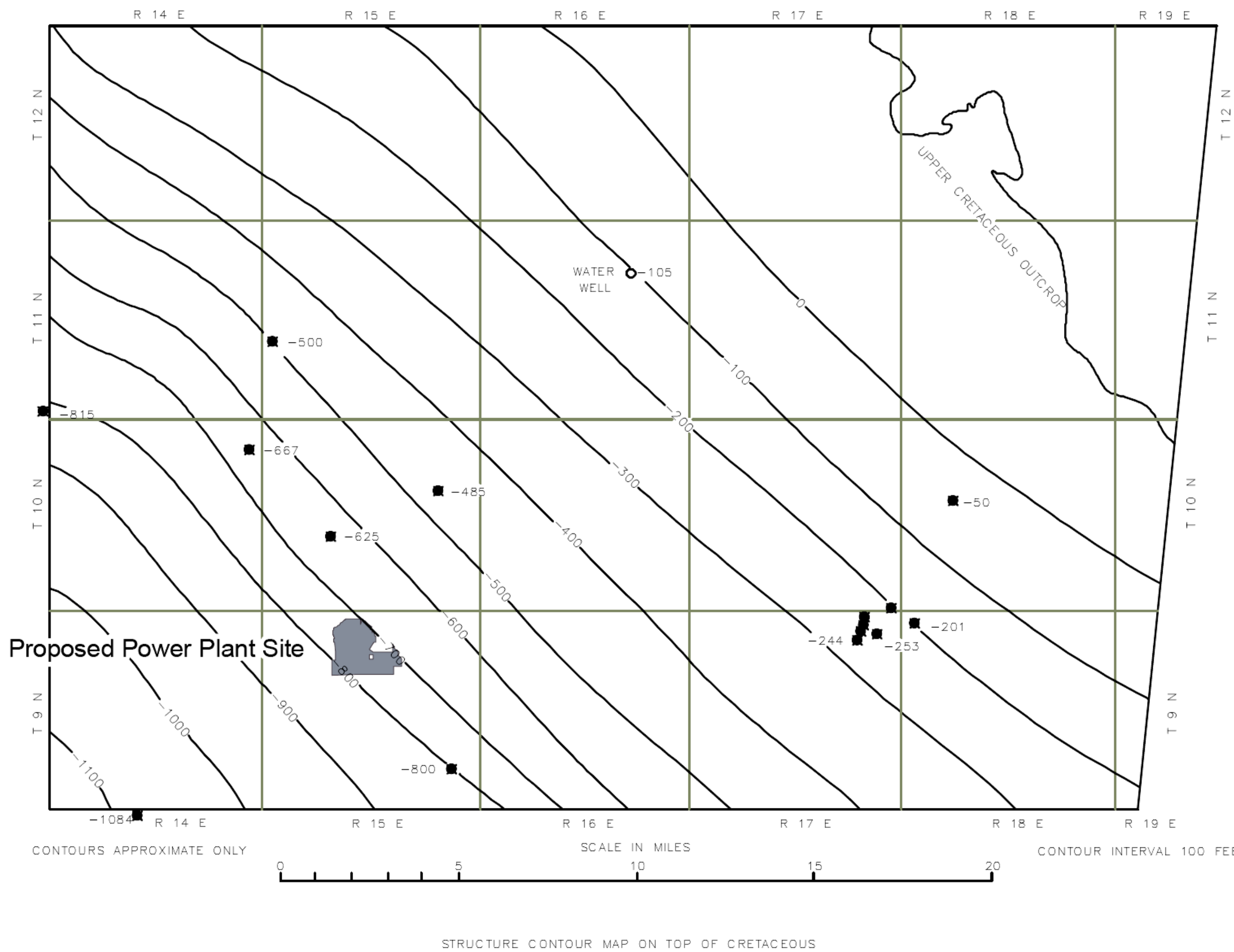


Figure 3.4-7. Structural Contour Map on Top of Cretaceous

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.

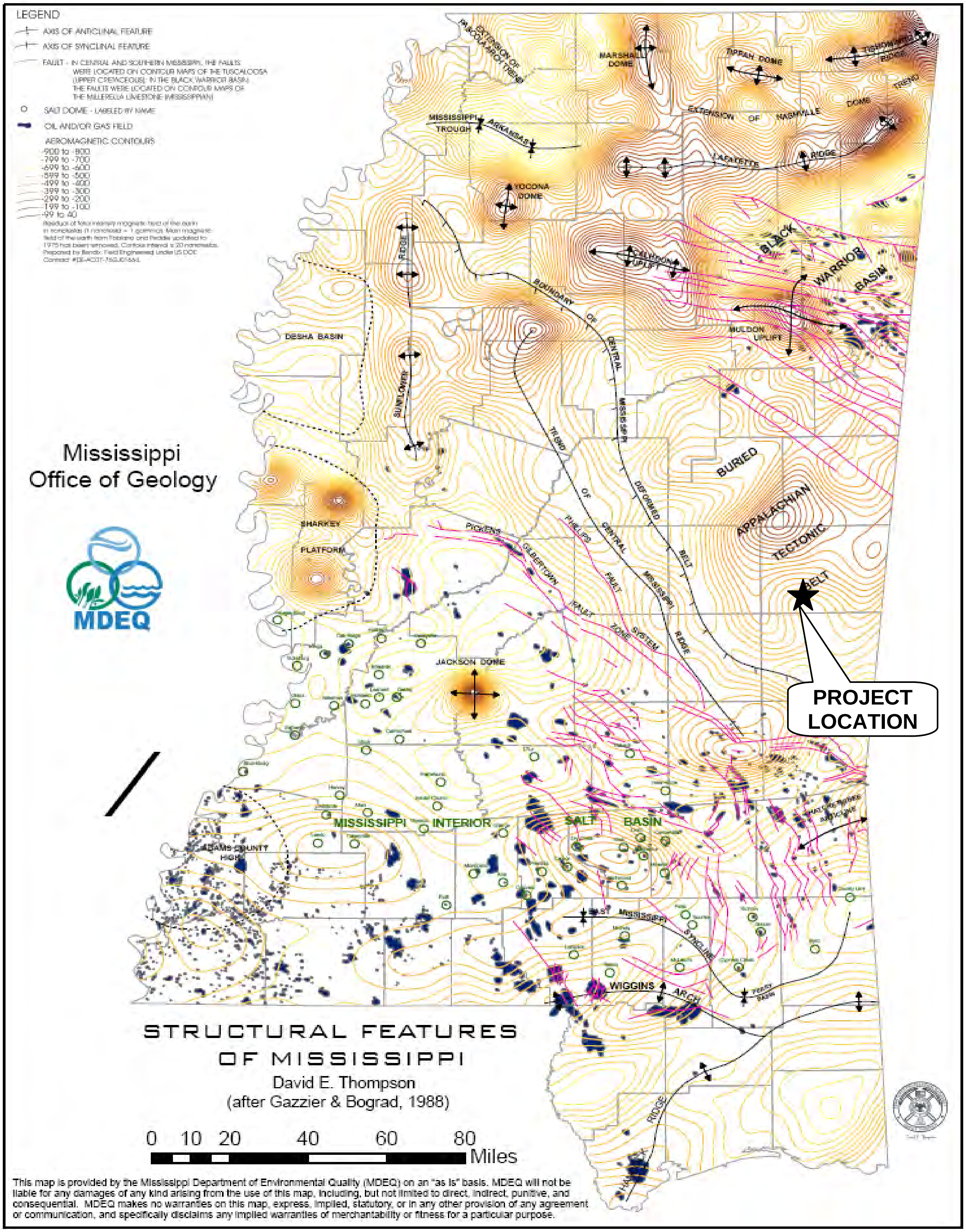


Figure 3.4-8. Structural Features of Mississippi
Source: MDEQ, 1988.

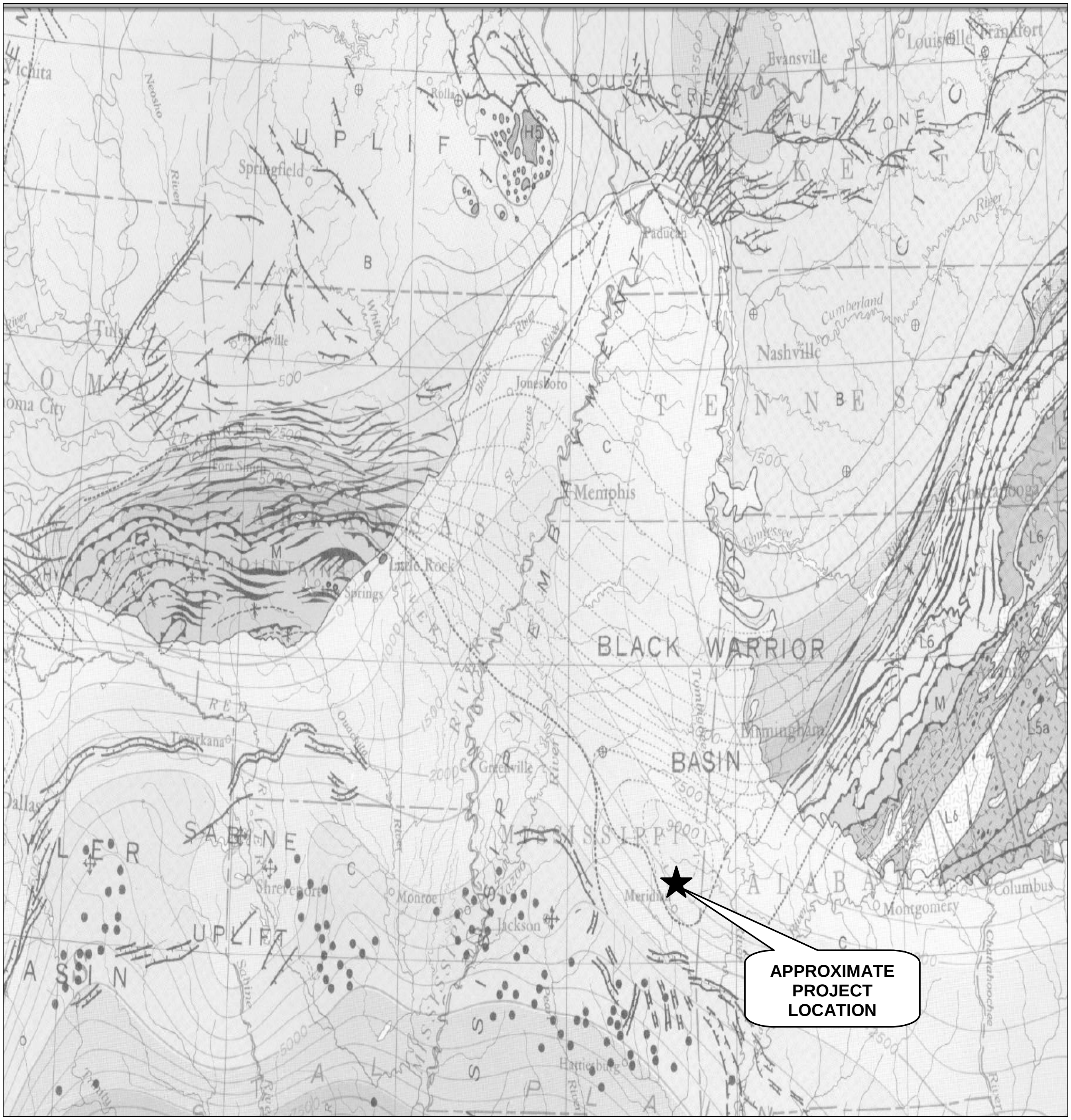


Figure 3.4-9. Tectonic Map near Project Area

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

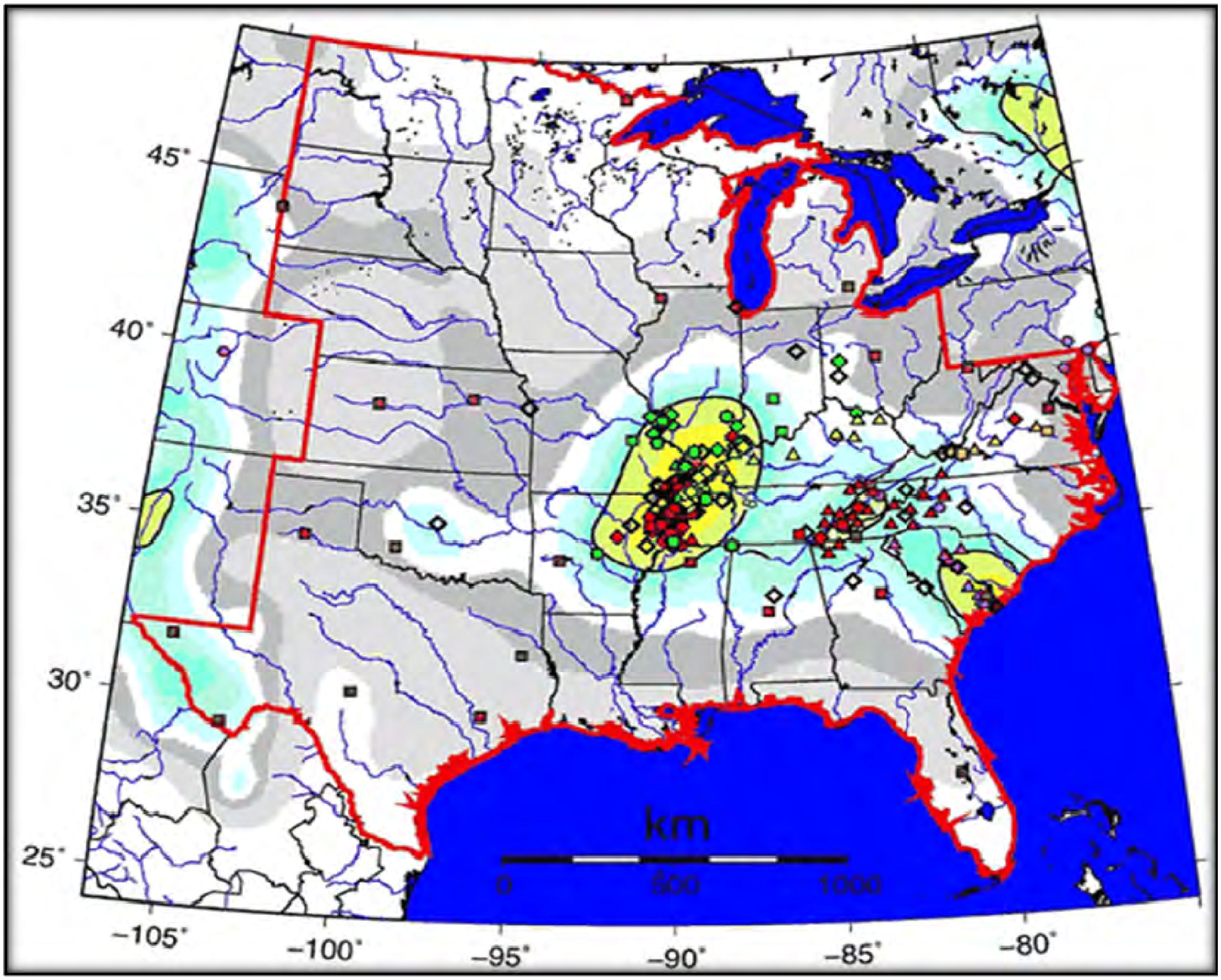
Source: NACC, 2009.

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 <u>Seismic Source Zone Influencing Proposed Project Area</u>

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**

Site Coefficients and Adjusted Acceleration Parameters:

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**
   $S_{MS} = S_s \times F_a = = 0.252g$

Design Acceleration Parameters:

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**

Design Response Spectrum:

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.

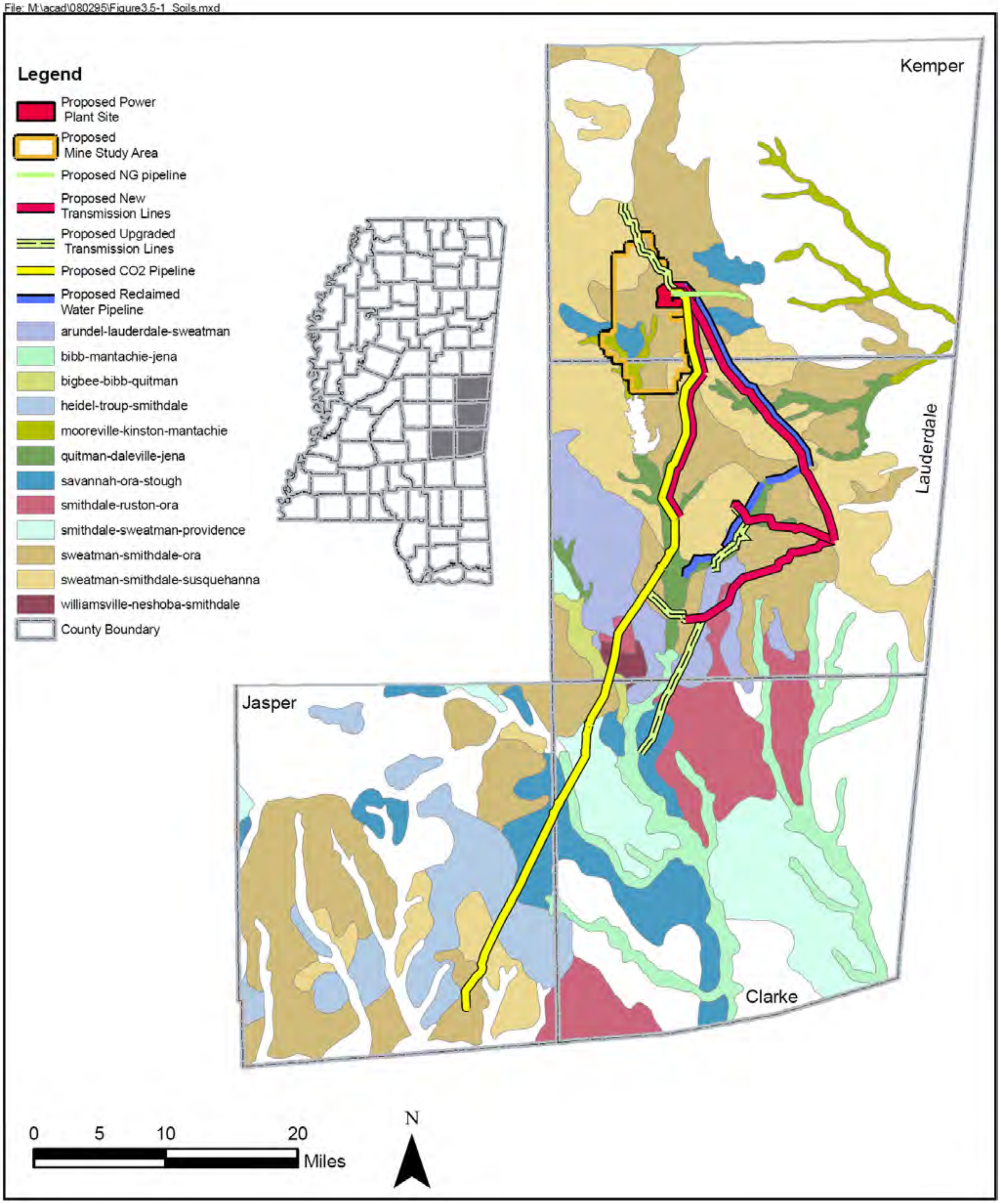


Figure 3.5-1. Soils Distribution for the Proposed Project Area
Sources: MARIS, 2008. ECT, 2009.

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.

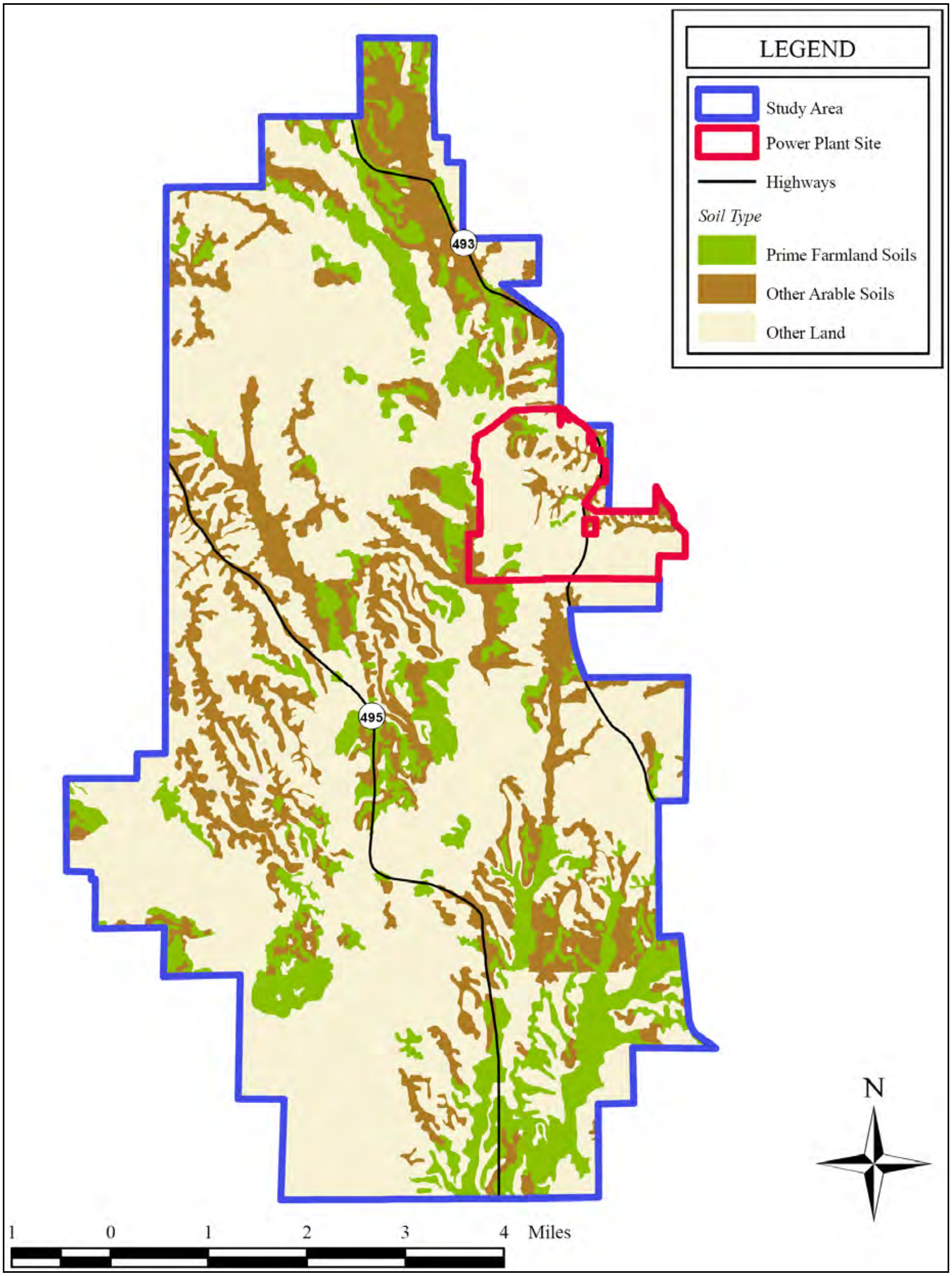


Figure 3.5-2. Geographic Locations of Soil Map Units
Source: NACC, 2009.

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

Soil Series	Ordination Symbol(s)	Management Concerns: Erosion Hazard	Equipment Limitation	Seedling Mortality	Plant Competition	Potential Productivity: 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.

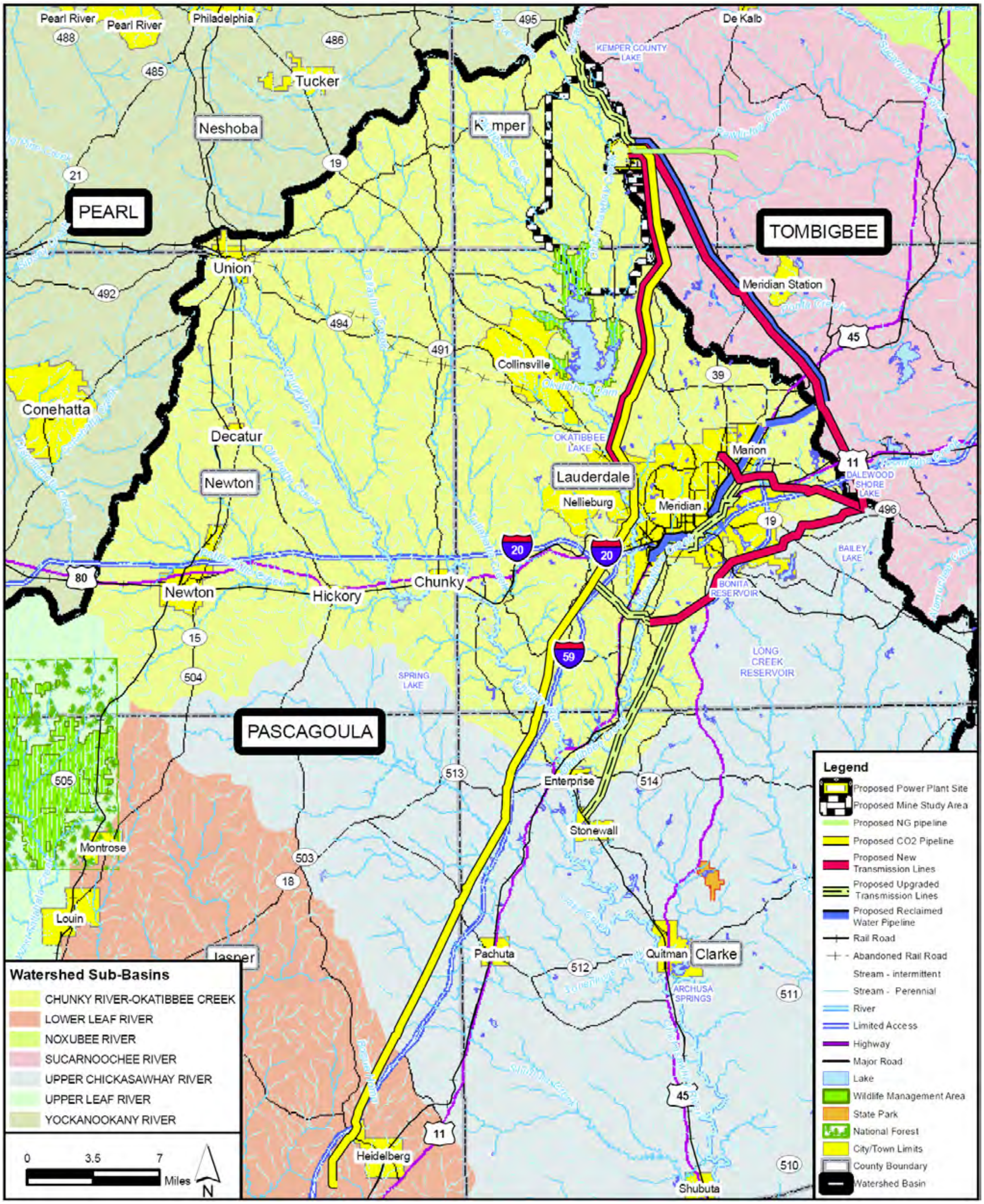


Figure 3.6-1. Watershed Basins and Sub-Basins in the Project Area

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 95^{th}-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.

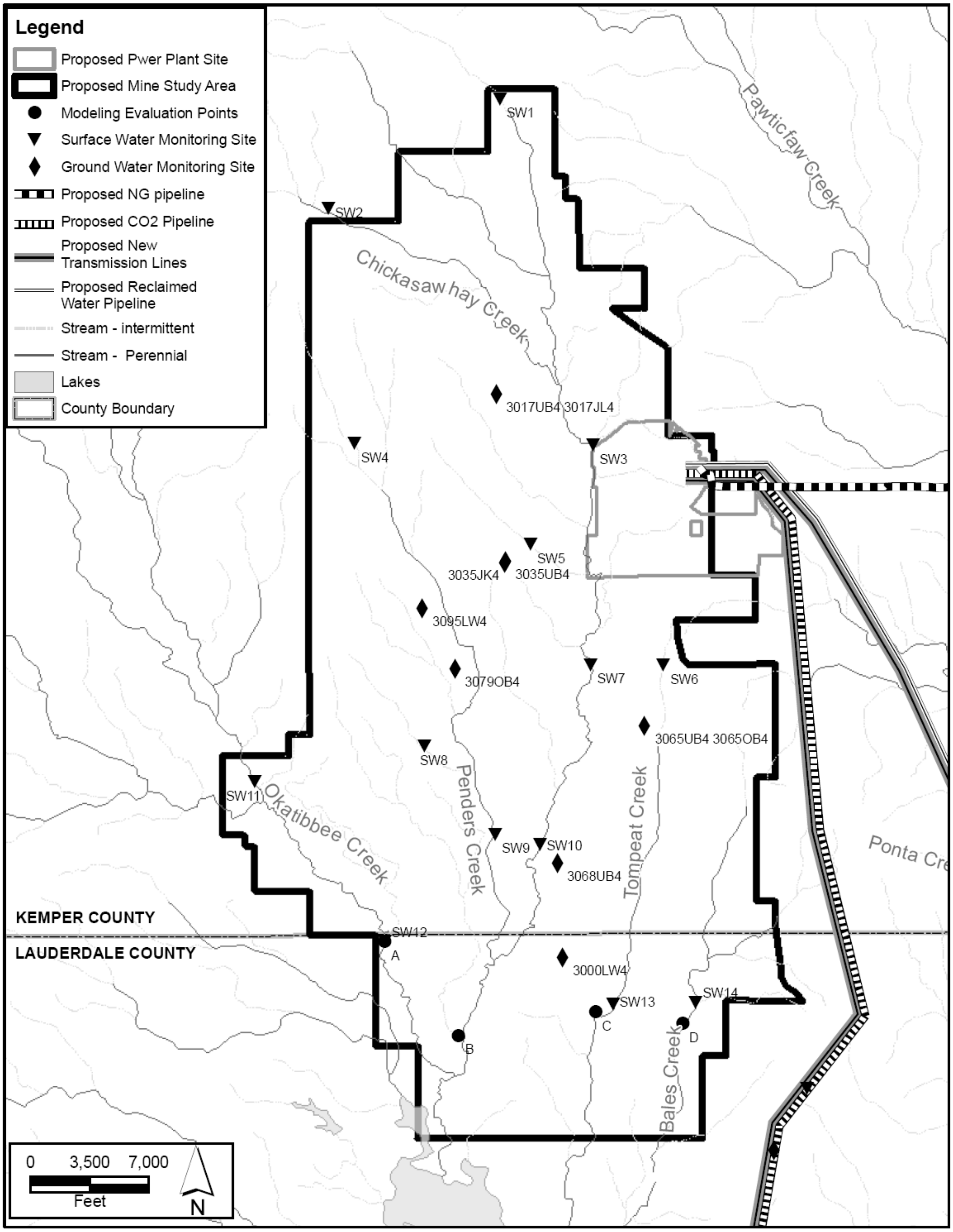


Figure 3.6-2. Surface Waters in the Vicinity of the Proposed Power Plant and Mine Study Area

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.

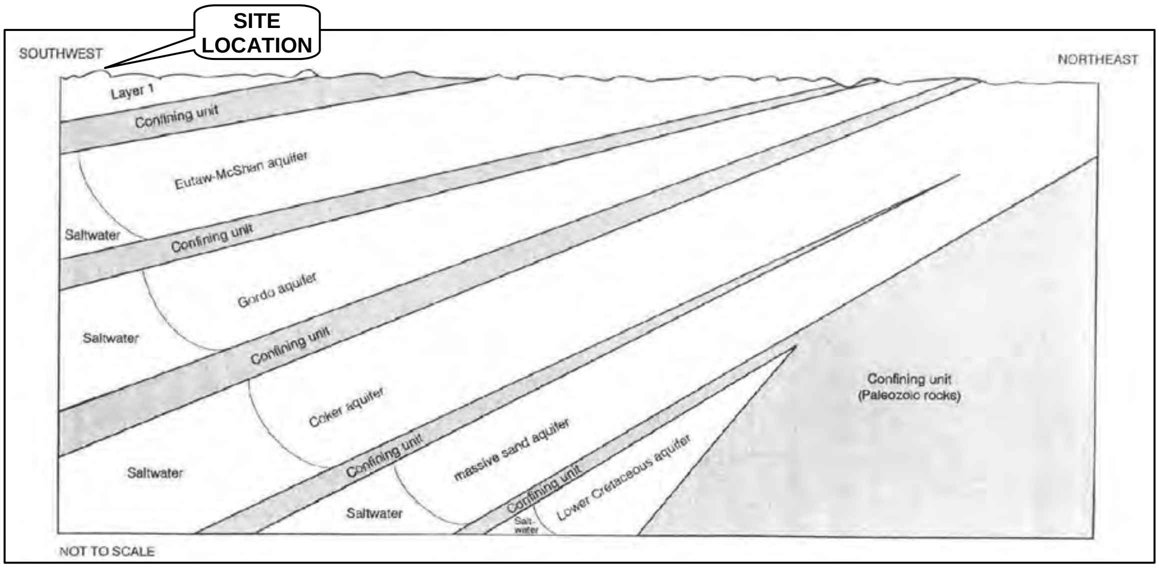


Figure 3.7-1. Hydrogeologic Cross-Section Schematic

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.

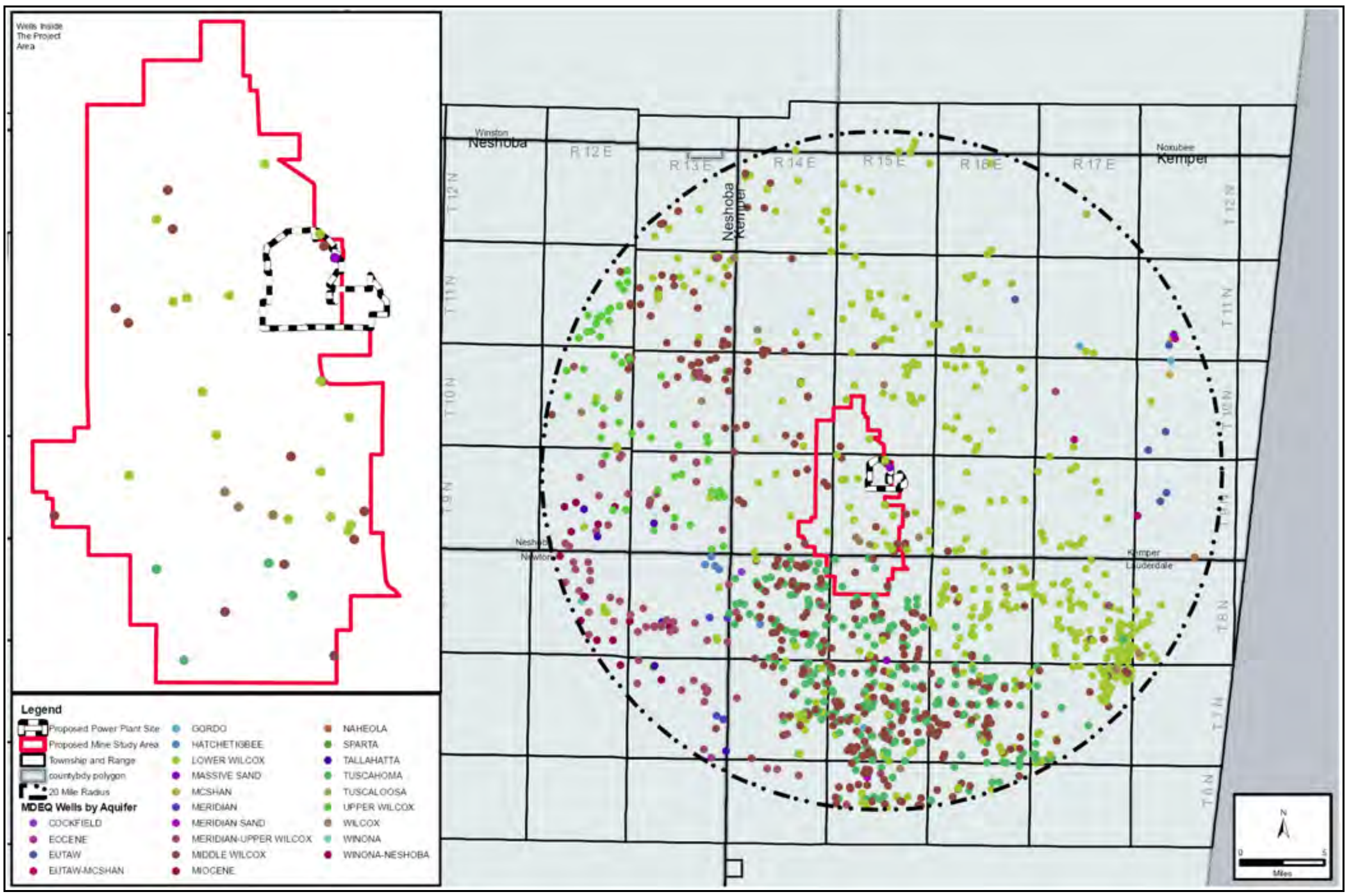


Figure 3.7-2. Water Well Location and the Aquifers Used for Water Supply
Sources: MDEQ, 2008. ECT, 2008.

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).

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.

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.

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.

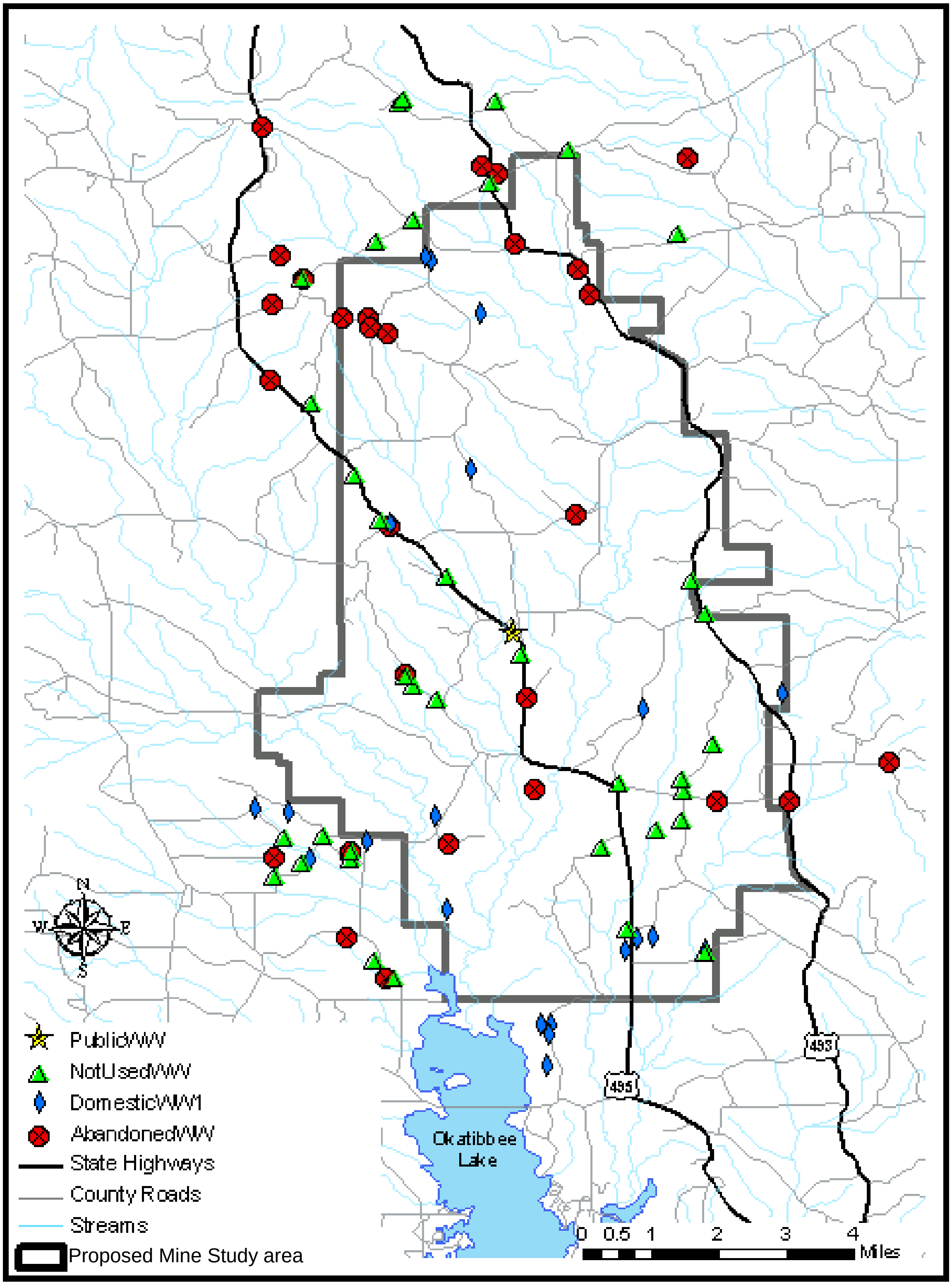


Figure 3.7-3. Locations of Water Wells in the Mine Study Area and Surroundings
Sources: MARIS, 2009. NACC, 2009.

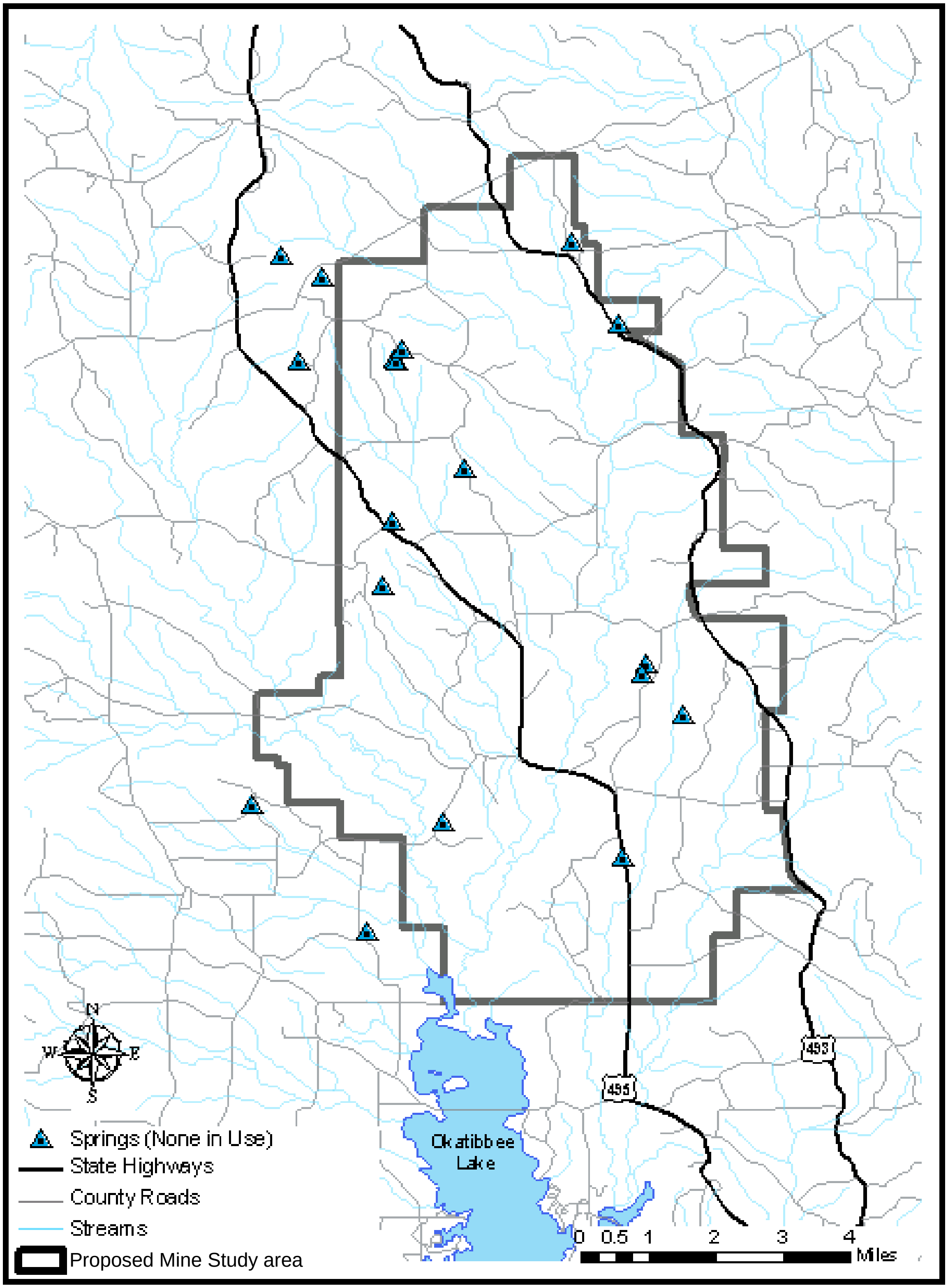


Figure 3.7-4. Locations of Springs in the Mine Study Area and Surroundings
Sources: MARIS, 2009. NACC, 2009.

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

Parameters	Units	Middle Wilcox			Lower Wilcox Aquifer			Middle Wilcox Springs			EPA	MCL Exceedences		
		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.

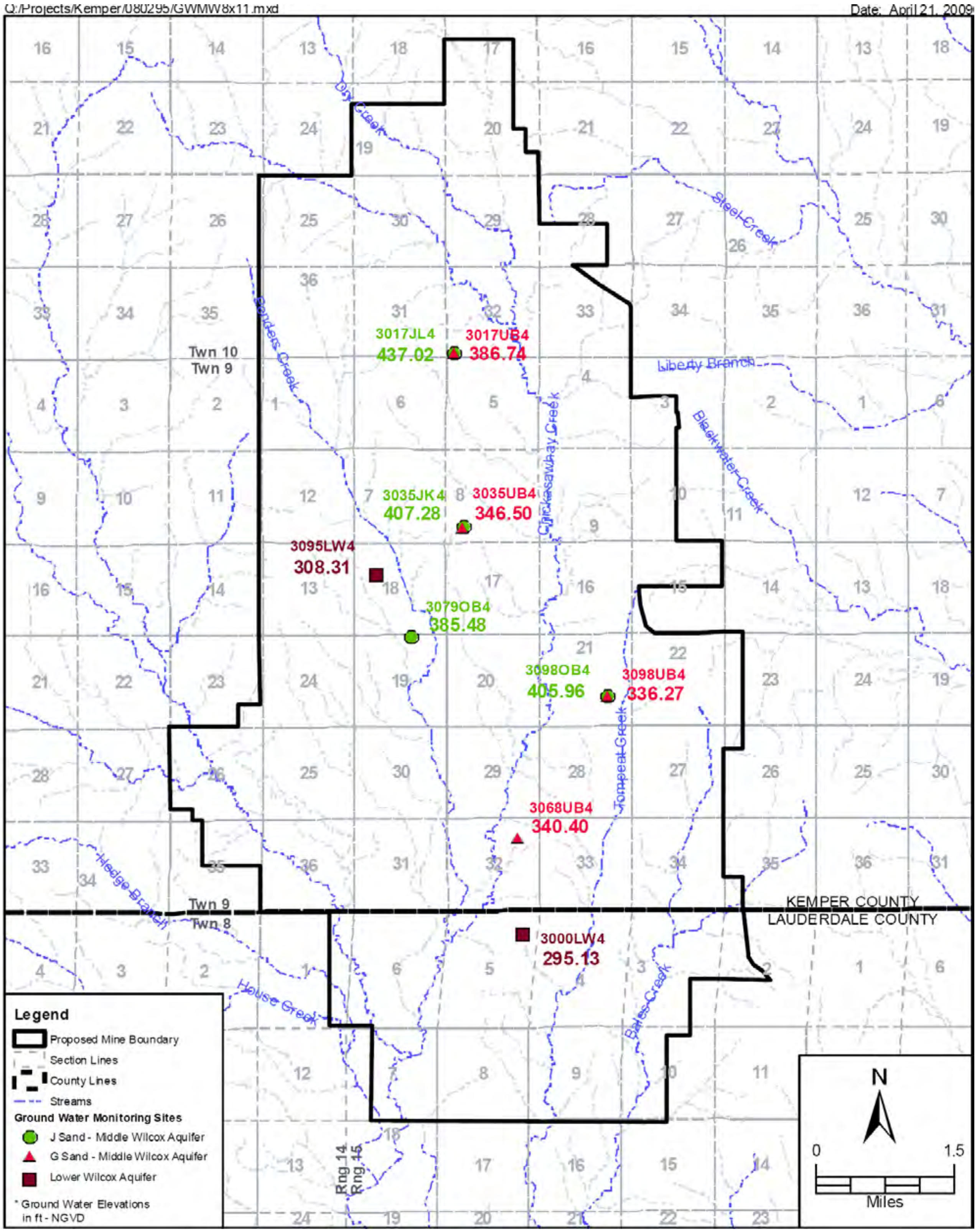


Figure 3.7-5. Water Level Elevations
Source: NACC, 2009.

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,

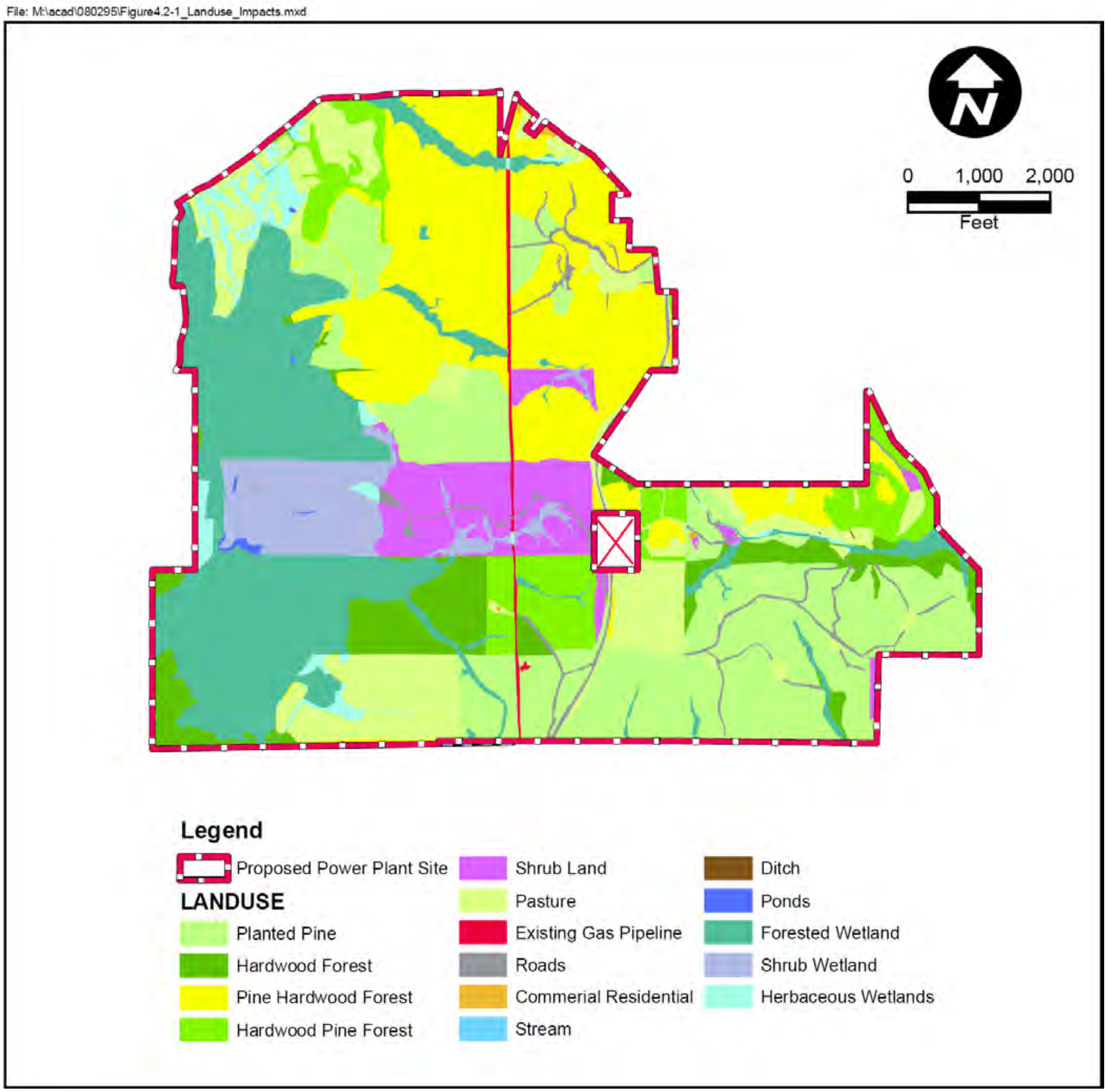


Figure 3.8-1. Vegetation/Land Use Types Identified Within the Power Plant Site
Sources: NACC, 2009. ECT 2009.

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 sororia	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
Vines	
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, black-gum, 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, sour-weed, 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, sour-weed, 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, sparkle-berry, 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,

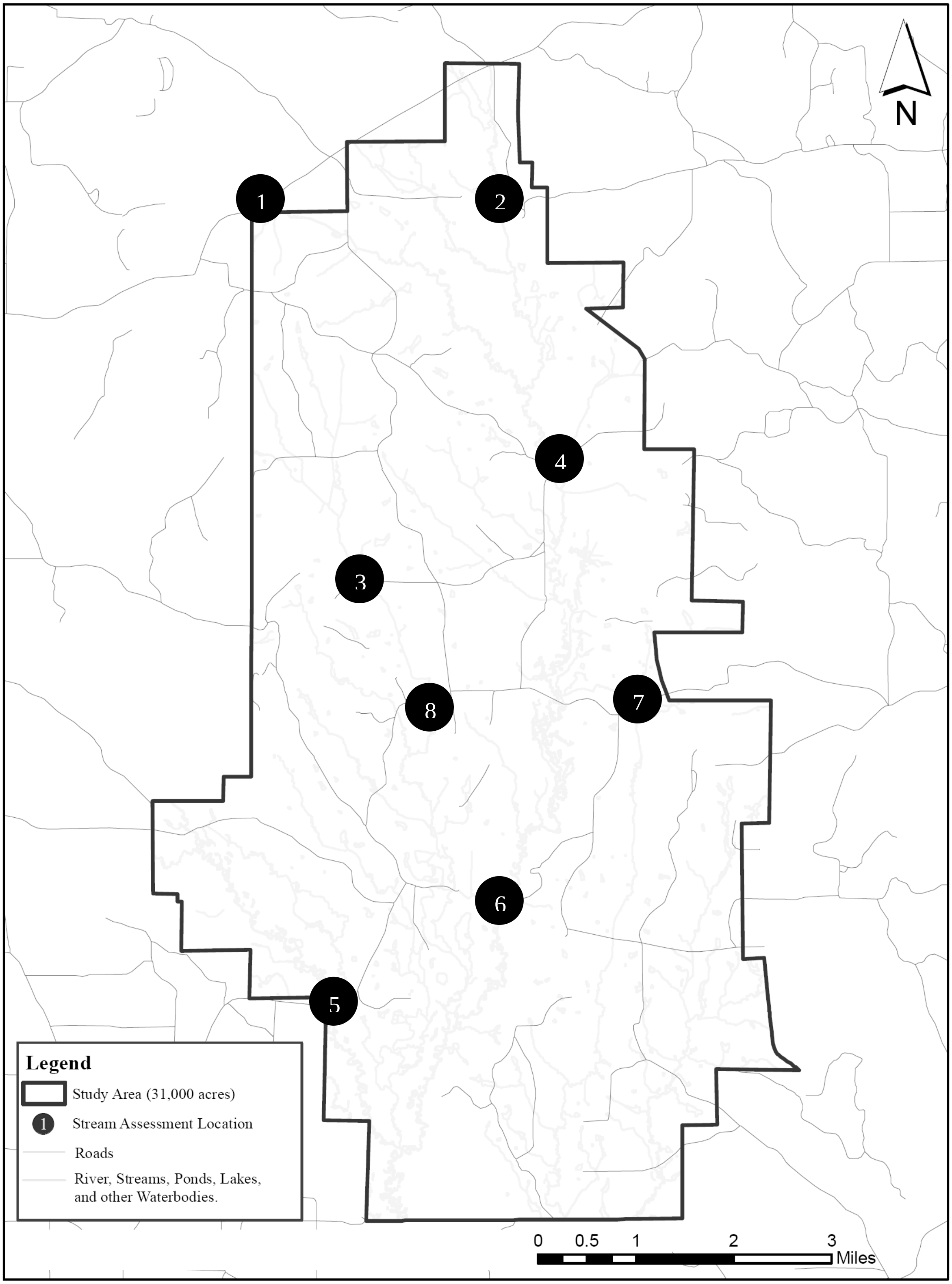


Figure 3.9-1. Stream Assessment Study Site Locations
Source: NACC, 2008.

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

Station	Station Description	Date Sampled	Station Location Latitude	Station Location Longitude	Stream Width (meter)	Average Stream Depth (meter)	Water Temperature (°C)	Conductivity (μmhos/cm)	pH	DO (mg/L)	DO (% Saturation)	Substrate Type*	HAS
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.

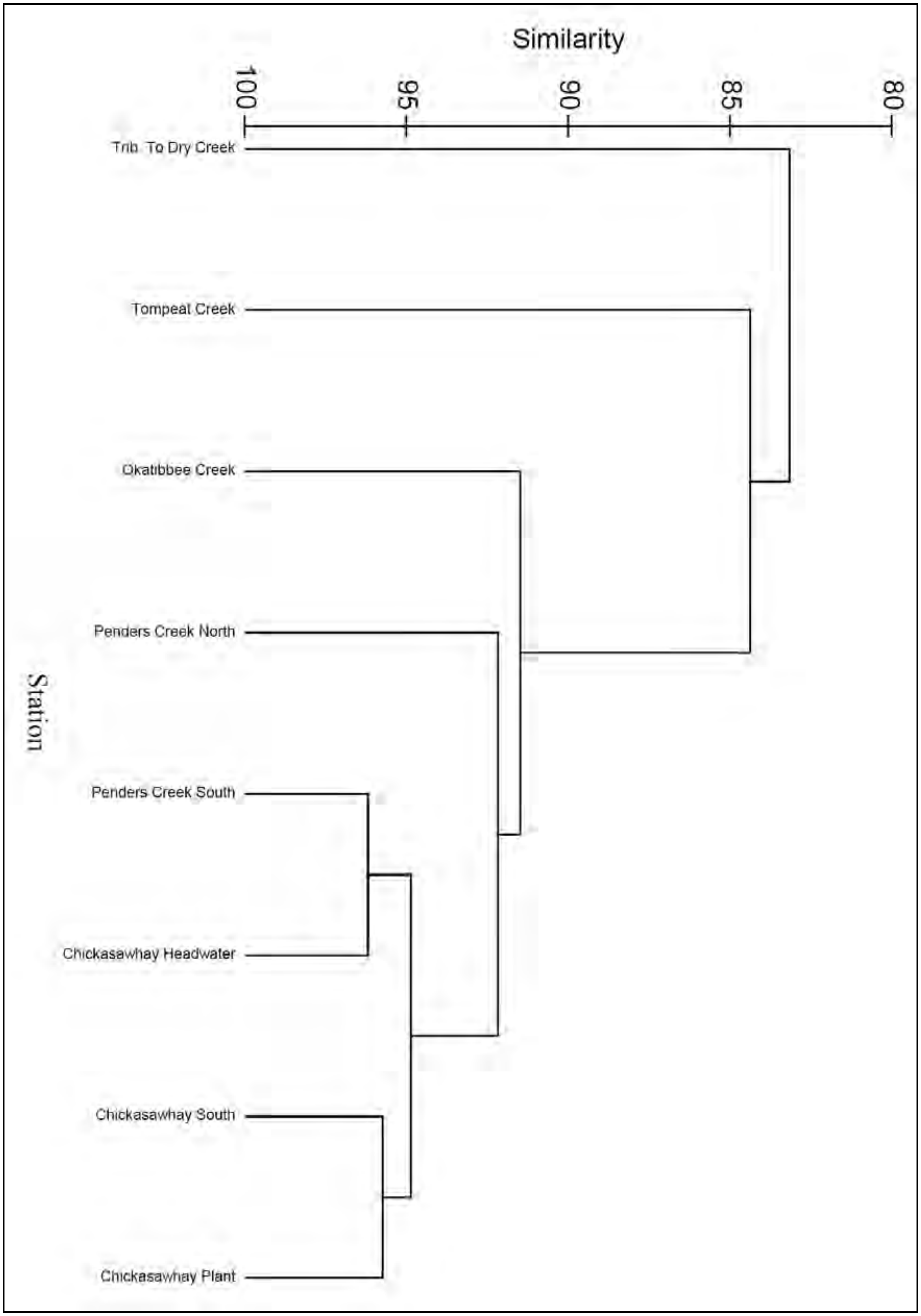


Figure 3.9-2. Cluster Analysis for Sampling Sites
Source: NACC, 2009.

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.

<u>Tompeat Creek</u>

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.

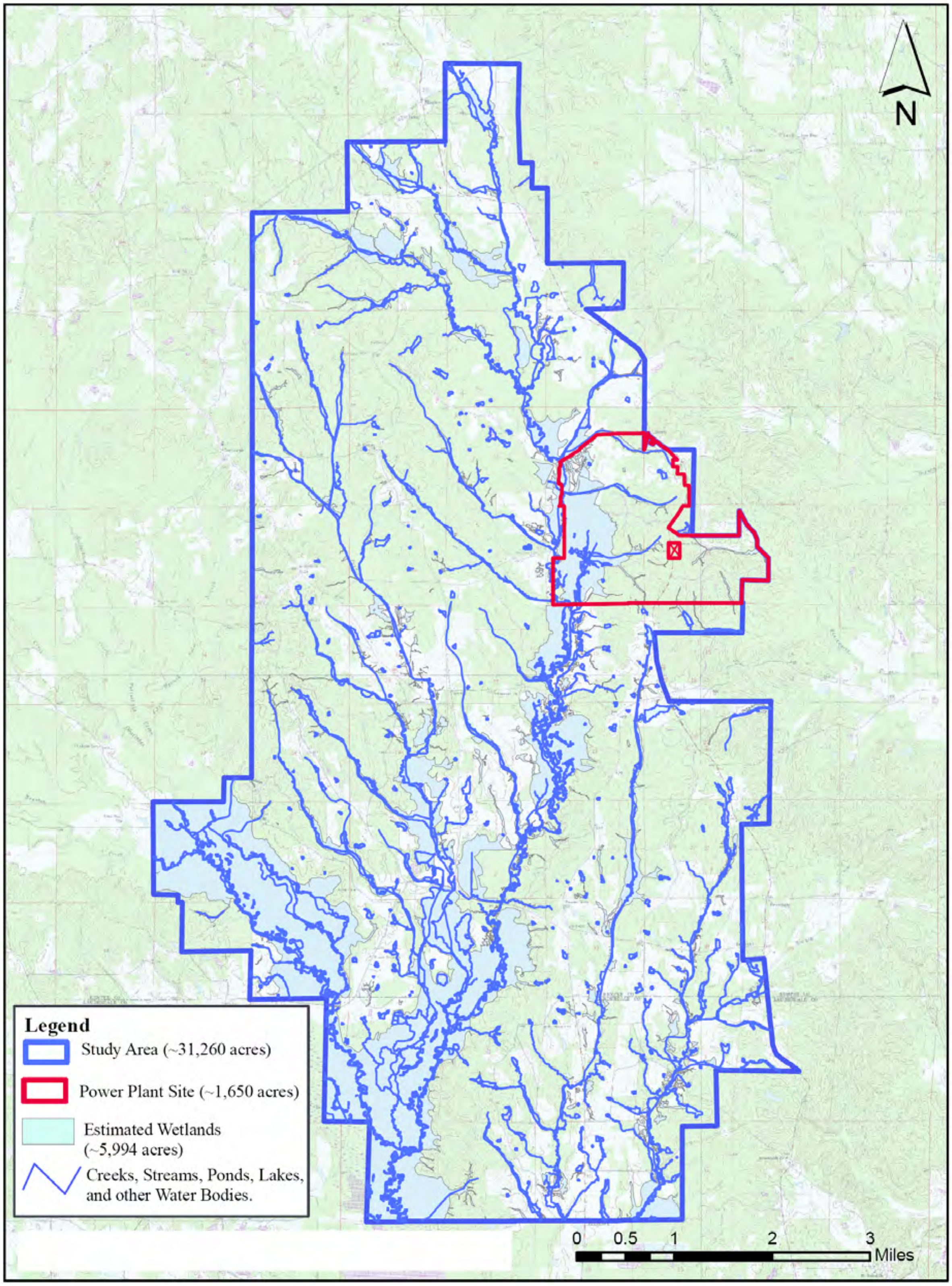


Figure 3.11-1. Spatial Distribution of Wetlands
Source: NACC, 2009.

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

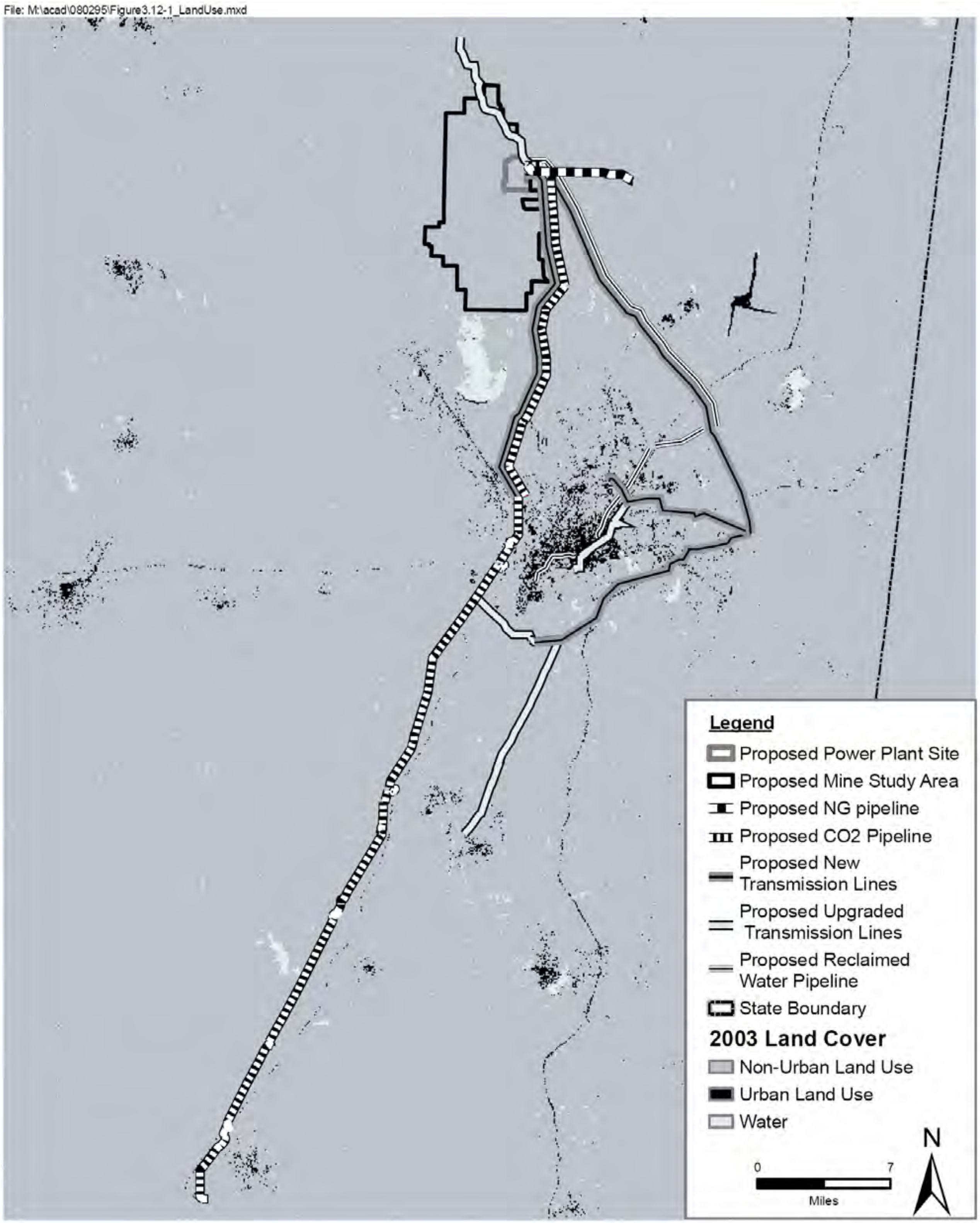


Figure 3.12-1. Land Use

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.

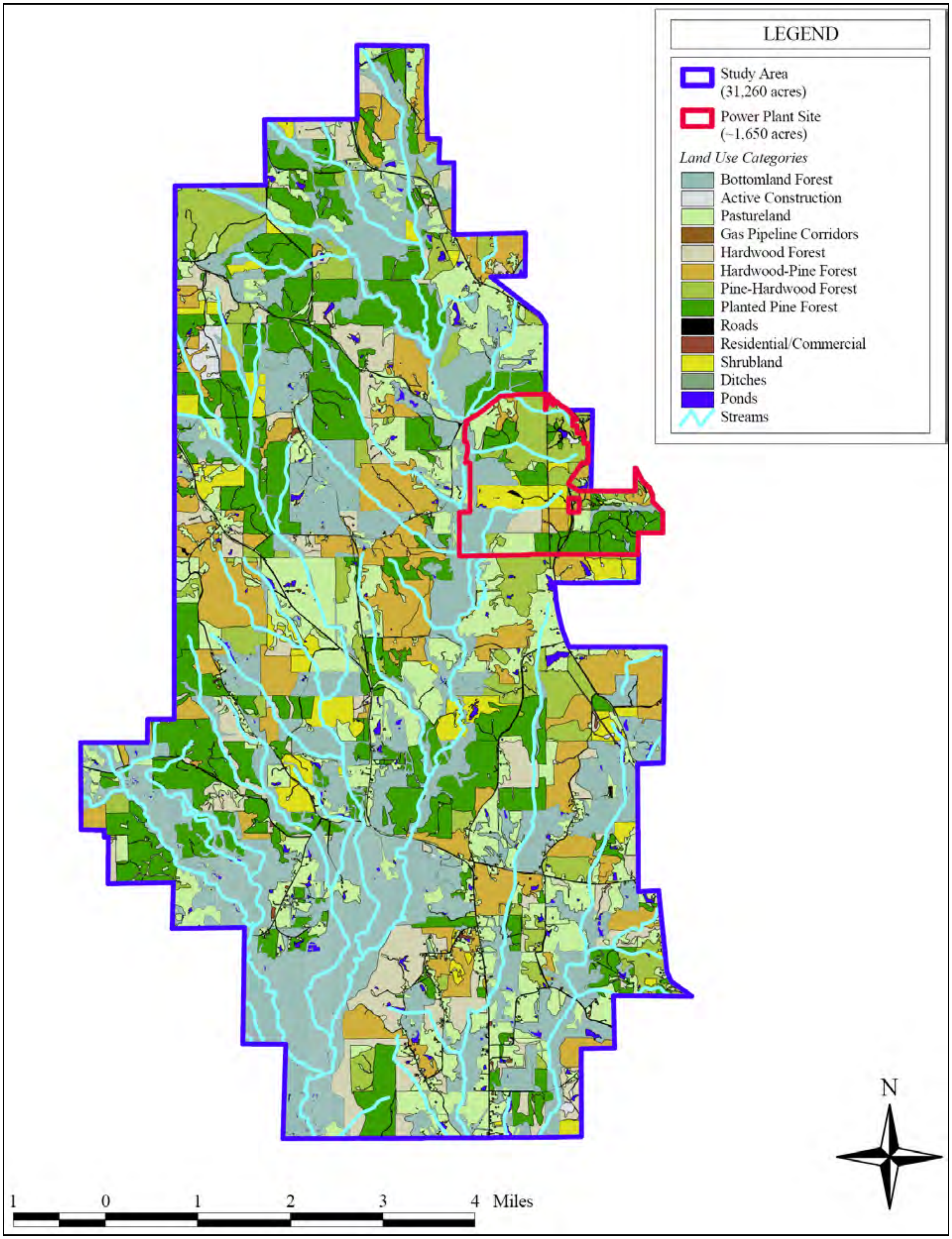


Figure 3.12-2. Land Use
Source: NACC, 2009.

- 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.

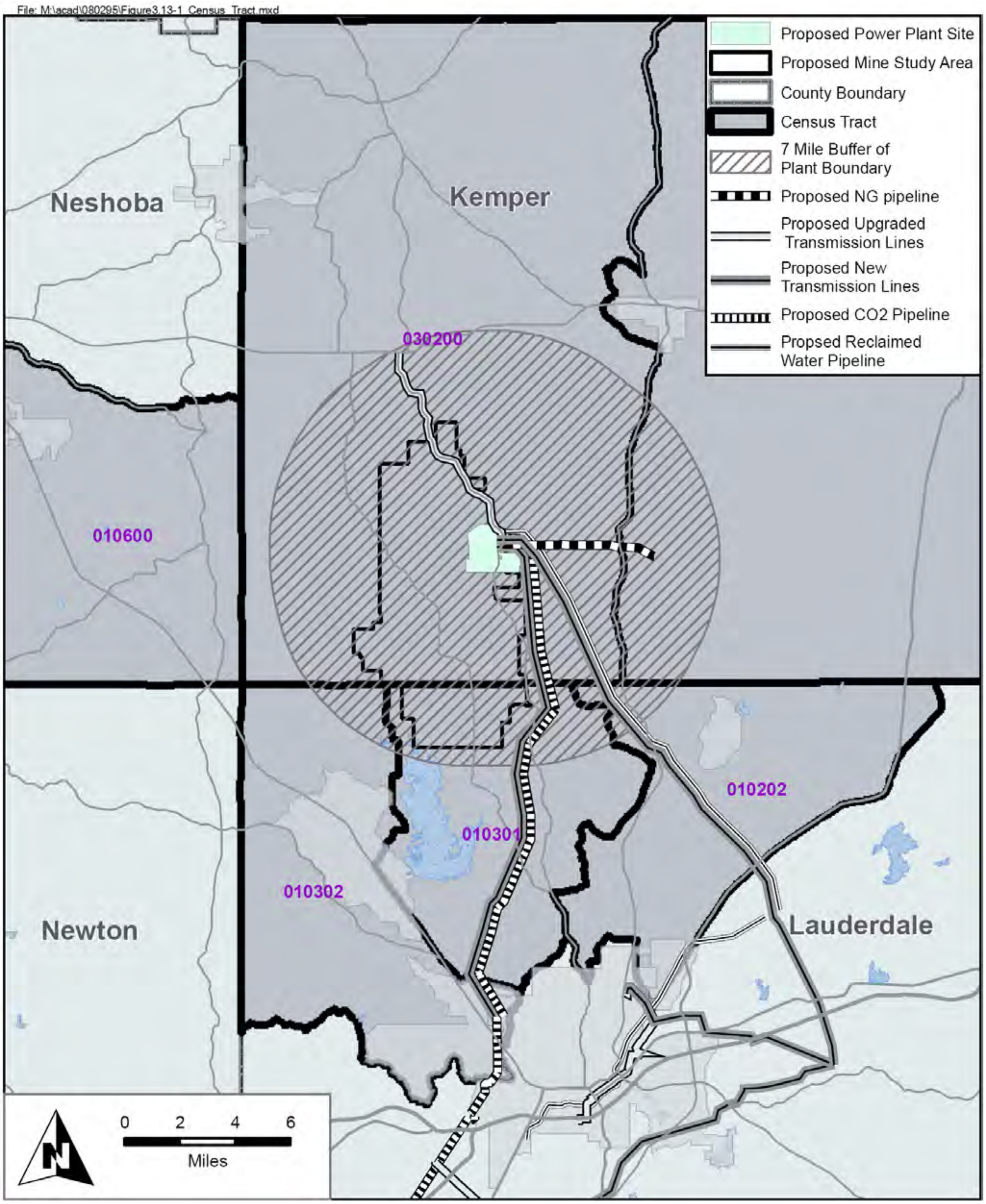


Figure 3.13-1. Census Tracts within a 7-Mile Radius of the Proposed Plant Site

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

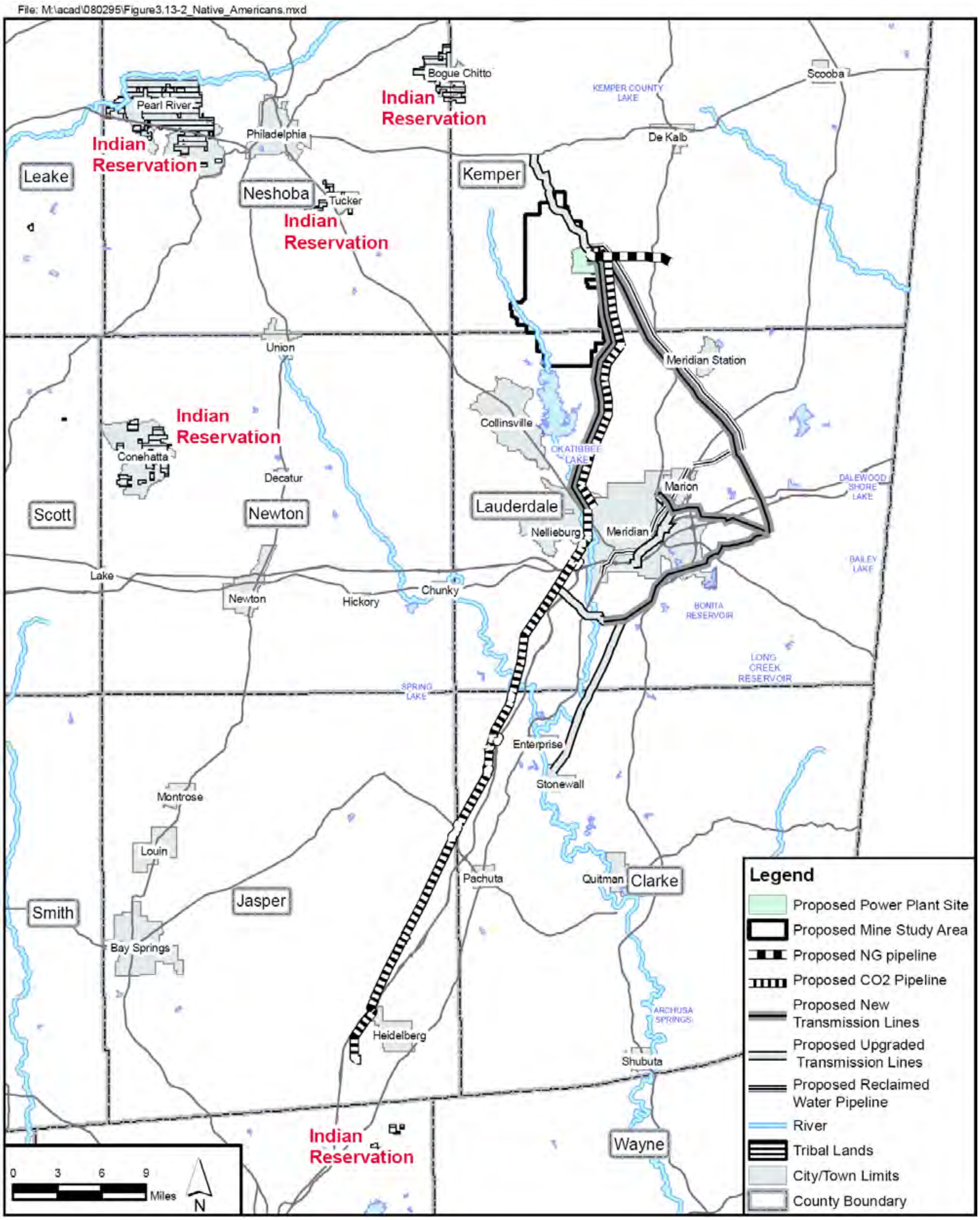


Figure 3.13-2. Native American Reservation Lands in the Vicinity of the Project Area

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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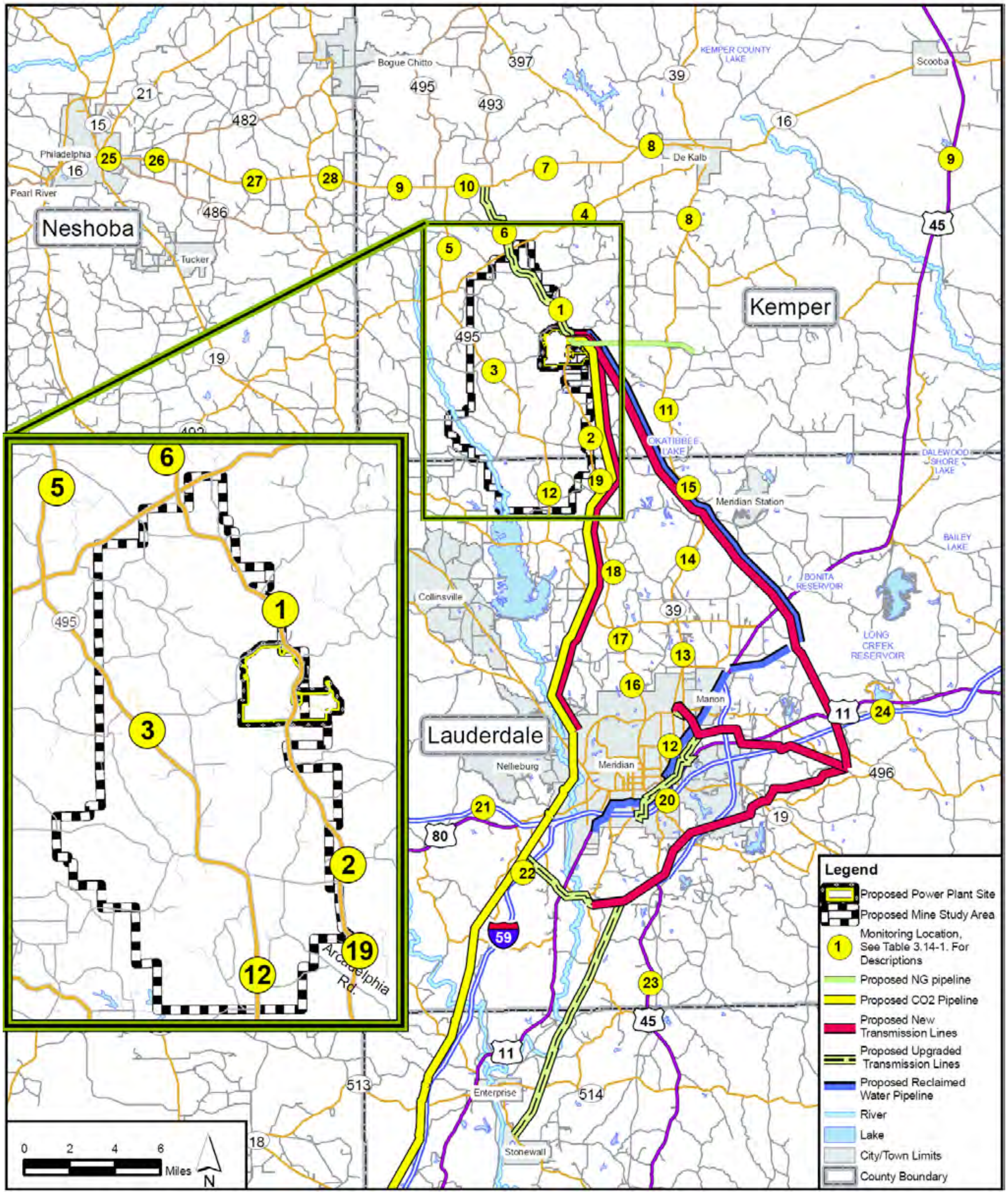


Figure 3.14-1. Road Map Showing Selected Traffic Volume Monitoring Locations

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.

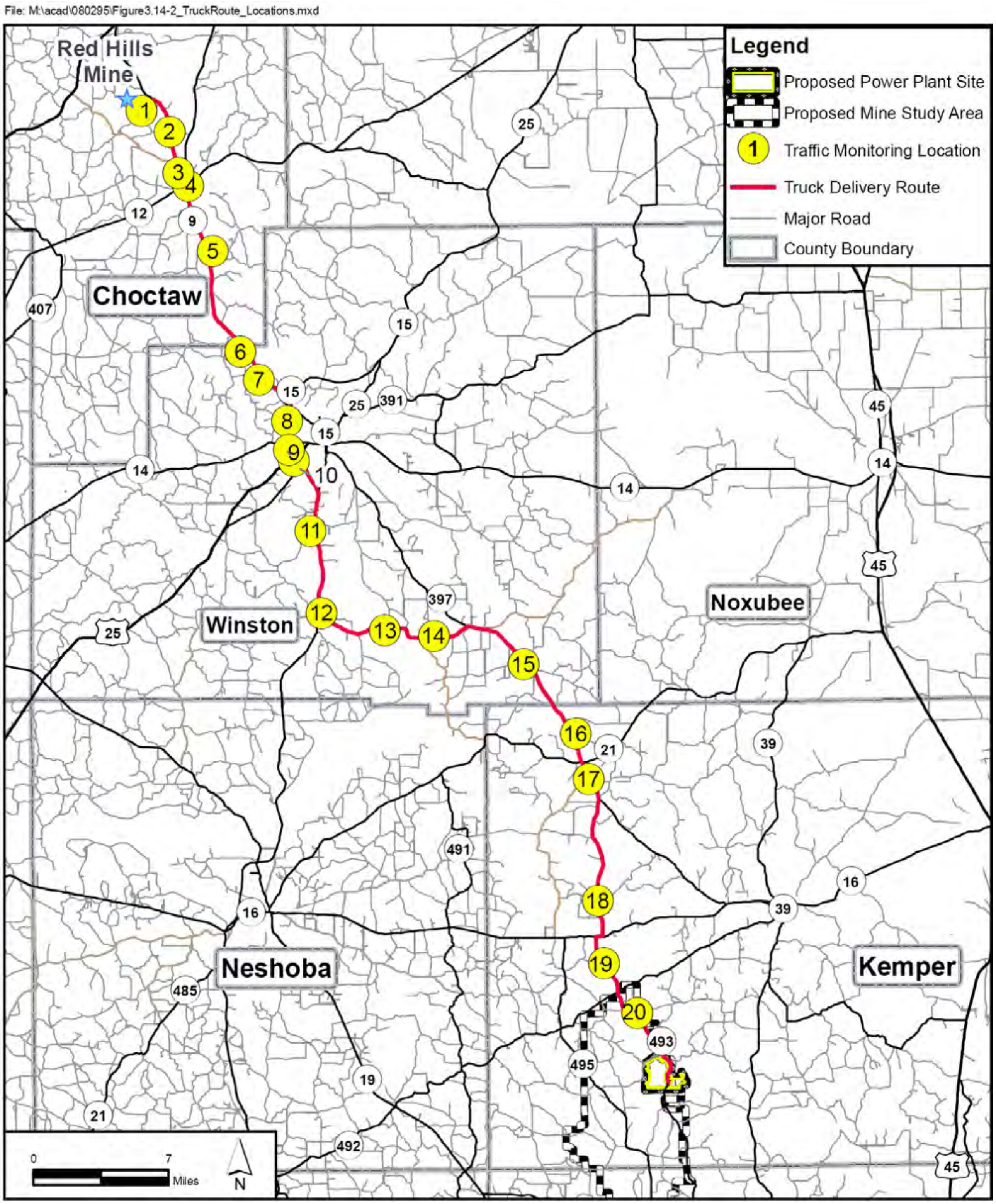


Figure 3.14-2. Selected Traffic Volume Monitoring Locations, Initial Lignite Coal Delivery Route

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

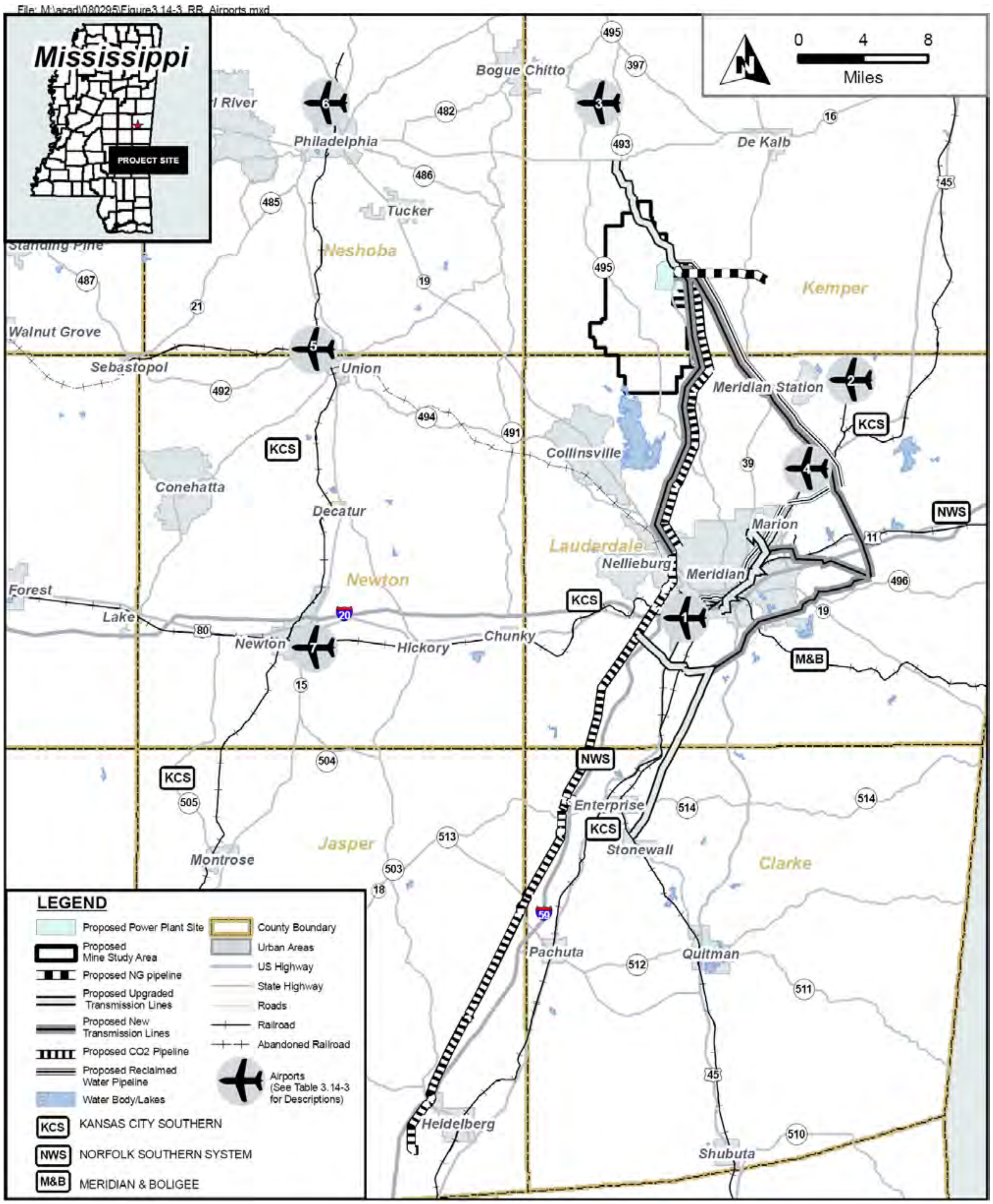


Figure 3.14-3. Airports and Railroads in the Vicinity of Proposed Kemper County IGCC Project Area

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.

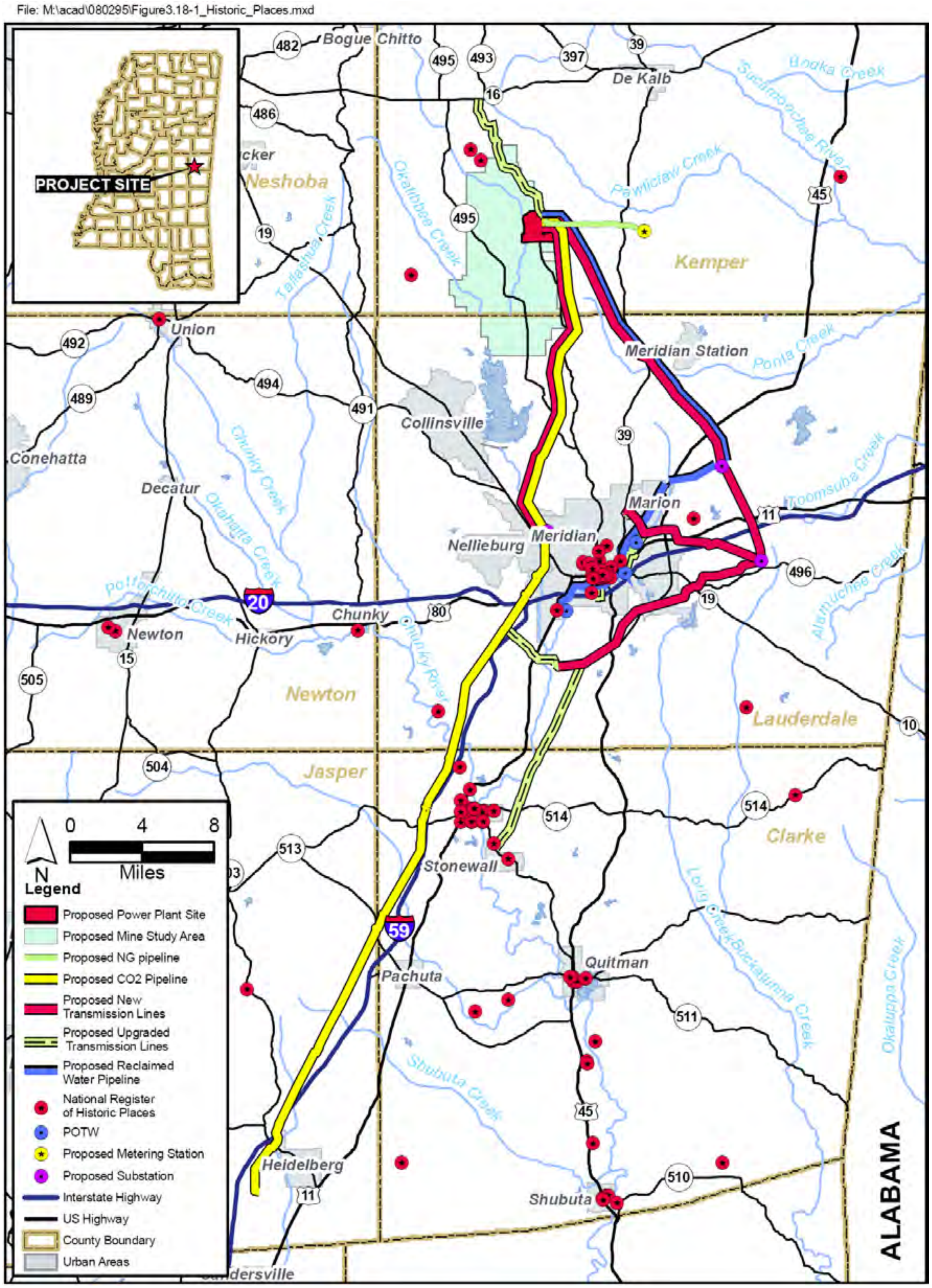


Figure 3.18-1. Listed Historic Places in the Project Counties

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.

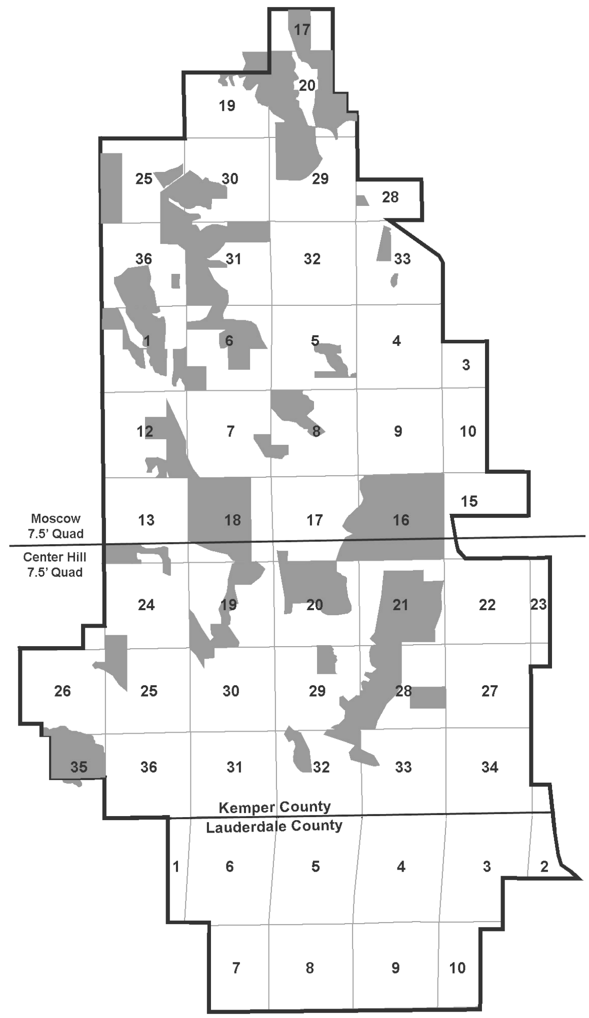


Figure 3.18-3. Potential Mining Area Boundary and Areas Surveyed

Source: Rafferty *et al.*, 2009.

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.

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.

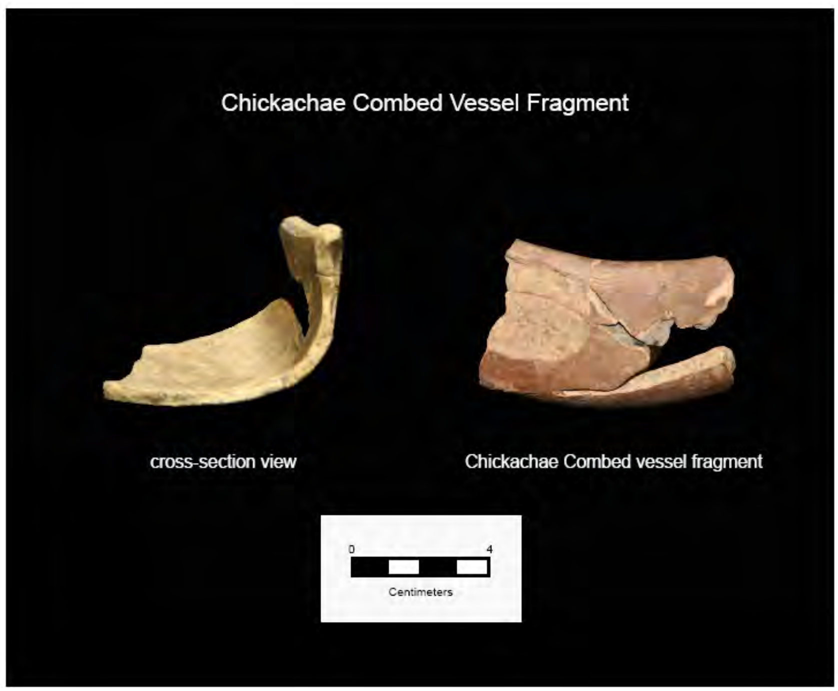


Figure 3.18-4. Chickachae Combed Vessel Fragment Recovered from Shovel Testing at Field Site Km002

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

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.

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.

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.

File: M:\acad\080295\Kemper_NoiseMonitoring.mxd

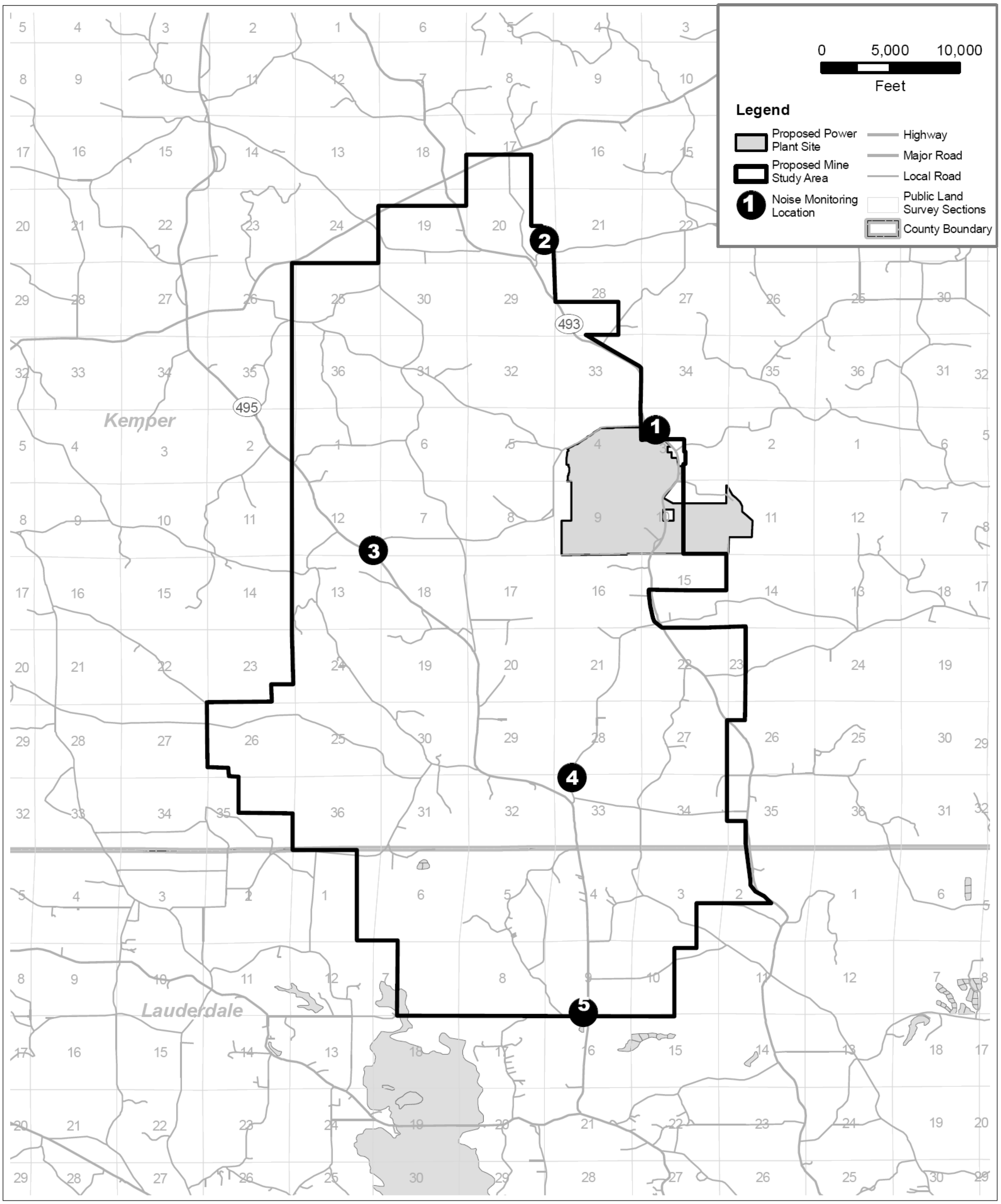


Figure 3.19-1. Ambient Sound Survey Locations

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.

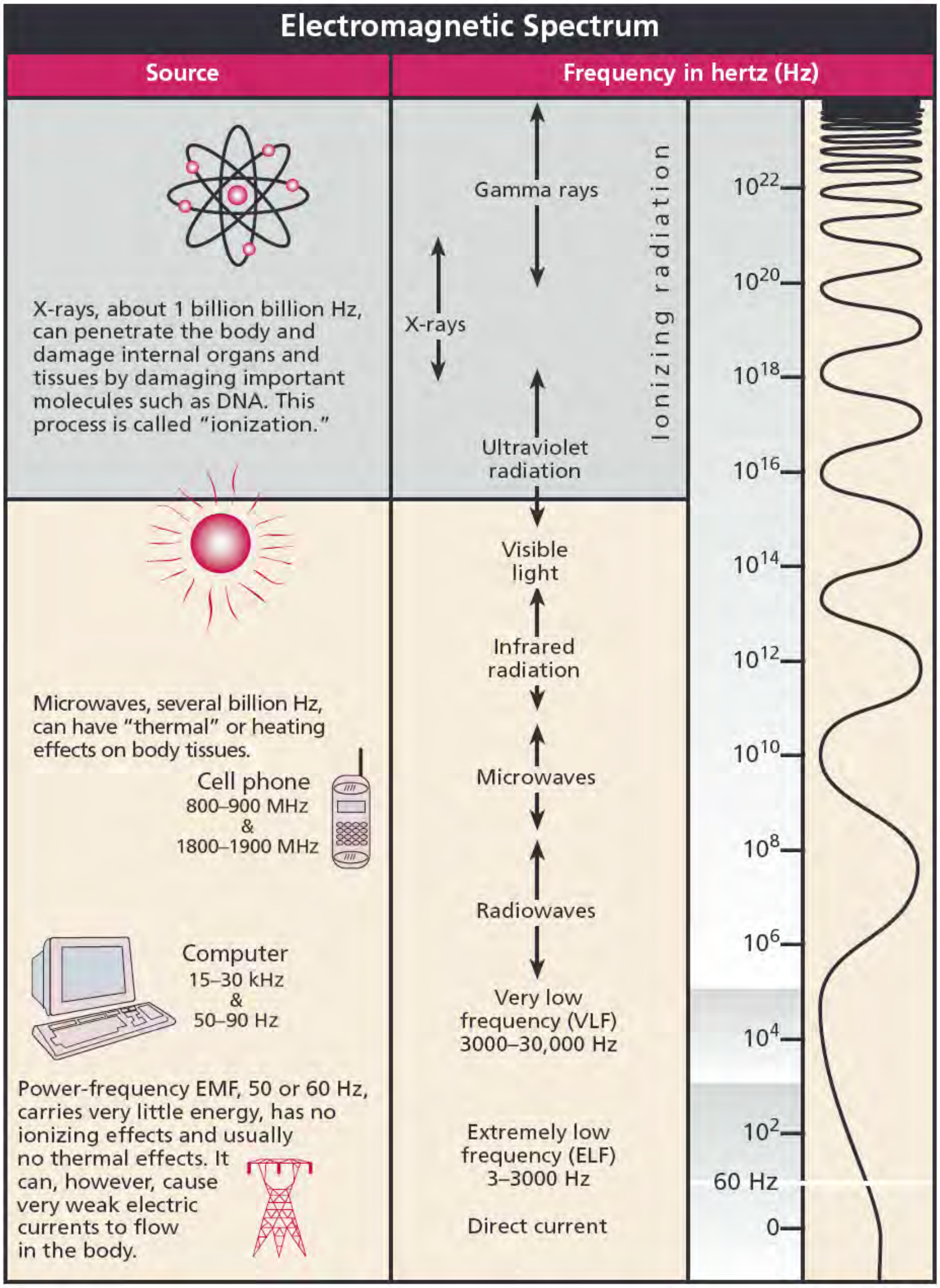
Air quality in Kemper County and the surrounding region of interest for the proposed project is described in Subsection 3.3.2. The AQI (discussed in Subsection 3.3.2) provides standardized means of communicating health information associated with daily ambient levels of ground-level air pollutants. As 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.

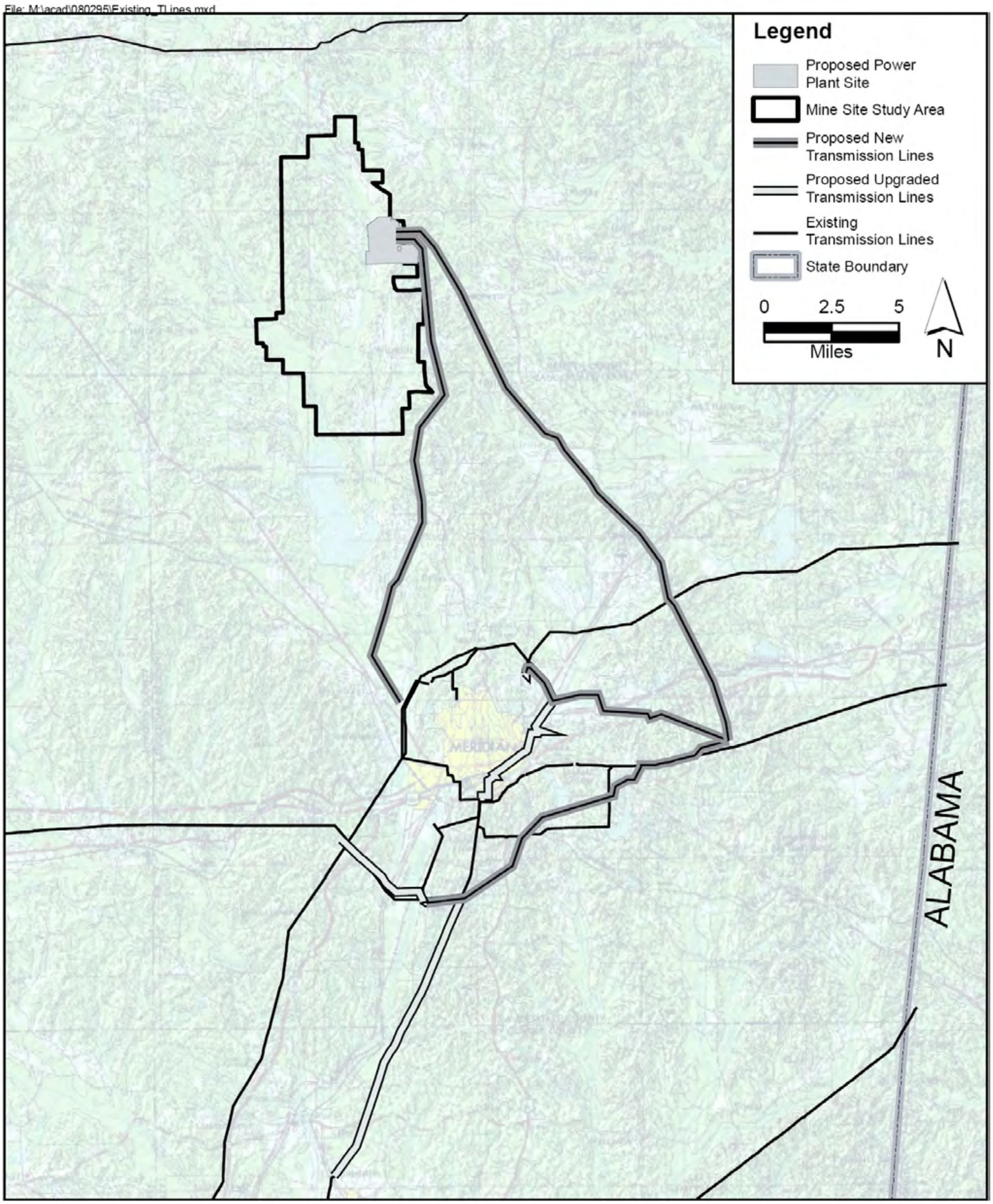


Figure 3.20-2. Existing Electrical Transmission Lines

Sources: MARIS, 2009. ESRI, 2009. ECT, 2009.

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4. ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter describes the environmental consequences that would likely result from the proposed action as described in Section 2.1. The principal alternatives are the proposed action as modified by conditions (e.g., mitigation) and the no-action alternative (see Section 2.7). Project design alternatives were also considered, and the potential impacts or effects of these alternatives were analyzed and are presented in this chapter. All of the potential impacts are analyzed in relation to the existing resources and environmental conditions described in Chapter 3, the baseline for assessing impacts. Section 4.2 addresses impacts of the proposed action, while Section 4.3 addresses the no-action alternative. Finally, Section 4.4 presents impacts of two project design alternatives. Chapter 5 describes measures to prevent pollution and mitigate impacts. Chapter 6 assesses cumulative impacts, where the impacts of the proposed action could, in conjunction with impacts of other reasonably foreseeable actions or activities, result in additive impacts on a particular resource; the impacts of climate change on a global, national, and regional scale are discussed in this chapter.

4.2 IMPACTS OF PROPOSED ACTION

Impacts of the proposed action, including the connected actions, are presented in the following subsections:

- 4.2.1—Atmospheric Resources and Air Quality.
- 4.2.2—Geology.
- 4.2.3—Soils.
- 4.2.4—Surface Water Resources.
- 4.2.5—Ground Water Resources.
- 4.2.6—Terrestrial Ecology.
- 4.2.7—Aquatic Ecology.
- 4.2.8—Floodplains.
- 4.2.9—Wetlands.
- 4.2.10—Land Use.
- 4.2.11—Social and Economic Resources.
- 4.2.12—Environmental Justice.
- 4.2.13—Transportation Infrastructure.
- 4.2.14—Waste Management Facilities.
- 4.2.15—Recreation Resources.
- 4.2.16—Aesthetic and Visual Resources.
- 4.2.17—Cultural and Historic Resources.
- 4.2.18—Noise.
- 4.2.19—Human Health and Safety.

4.2.1 ATMOSPHERIC RESOURCES AND AIR QUALITY

This section evaluates potential impacts to atmospheric resources that would result from construction and operation of the proposed Kemper County IGCC project power plant, lignite mine, and linear facilities. Subsection 4.2.1.1 discusses temporary effects of construction, including fugitive dust associated with earthwork and excavation. Subsection 4.2.1.2 discusses operational effects, including emissions of criteria pollutants and HAPs.

4.2.1.1 Construction

Power Plant

During construction of the proposed facilities, temporary and localized increases in atmospheric concentrations of NO_x, VOCs, CO, SO_2, and PM would result from exhaust emissions of workers' vehicles, heavy construction vehicles, diesel generators, and other machinery and tools. An average of approximately 45 vehicles would be used for construction activities on the site. Internal combustion engines would be used for activities such as excavation, concrete placement, and structural steel installation. Construction vehicles and machinery would be equipped with standard pollution control devices to minimize emissions.

During construction a variety of equipment including cranes, dump trucks, earth-moving equipment, and other internal combustion engine equipment would be operated for periods of up to 42 months; levels of various construction activities would vary widely during that time. For actual construction, the hours of operation, emission controls, vehicle maintenance, and forms of fuel are not known with certainty at this time. Nonetheless, worst-case annual construction emissions were conservatively estimated (i.e., tending to overestimate) for NO_x, VOCs, CO, SO_2, and PM_{10}, as 155, 8.6, 134, 0.03, and 19.2 tpy, respectively. These emissions represent an upper limit estimate for a year's emissions based on the expected construction activities. By comparison, the worst-case annual emissions from construction would be less than 11 percent of the anticipated annual emissions from normal plant operations (see Appendix C). Several of the conservative assumptions on which the estimated construction emissions were based include:

- The entire plant area (150 acres) and equipment laydown area (70 acres) would require 1.5 ft of fill material. This activity was assumed to occur over a 2-year period.
- The fill material would be transferred four times.
- Forty-five pieces of diesel engine driven equipment would operate for 10 hours per day, 5 days per week, and 52 weeks per year.
- Fifteen pieces of grading equipment would be operating at all times.
- All excavation/fill material would be transported on unpaved roads onsite.

HAP emissions from construction activities would be associated primarily with VOC emissions from diesel equipment. EPA has estimated the fractions of the predominant HAPs in VOC emissions from diesel exhaust as follows (EPA, 2004):

- Benzene 0.02
- Formaldehyde 0.118
- Acetaldehyde 0.053
- 1,3-Butadiene 0.002
- Acrolein 0.003

Using these fractions and the VOC emission estimate of 8.6 tpy, the annual emissions of air toxics in pounds per year (lb/yr) would be as follows:

- Benzene 344 lb/yr
- Formaldehyde 2,032 lb/yr
- Acetaldehyde 913 lb/yr
- 1,3-butadiene 34.4 lb/yr
- Acrolein 51.7 lb/yr

Based on conservative estimates, an upper limit to total annual HAP emissions from construction activities would be less than 2 tpy or approximately 20 percent of annual plant-wide HAP emissions during normal IGCC operations.

Fugitive dust would result from excavation, soil storage/handling, traffic over unpaved onsite roads, and earthwork. Most of this work would occur at the approximately 150-acre principal site of the proposed facilities located on the northeast portion of the property. The temporary impacts of fugitive dust from construction activities on offsite particulate concentrations would be localized because of the relatively rapid settling of larger size fugitive dust particles. To minimize fugitive dust emissions, water spray trucks would dampen exposed soil at the construction site with water as necessary, which is assumed to reduce fugitive dust by 50 percent (EPA, 1985a). Because construction of the facilities would be staggered, the maximum area undergoing heavy earthwork at any one time was assumed to be 5 percent of the total area to be developed (i.e., 7.5 of 150 acres) and the laydown area (3.5 of 70 acres), which would require some improvement prior to use.

Potential impacts of fugitive dust and other pollutants on local air quality were conservatively estimated using standard modeling techniques. The results presented herein represent a reasonable upper bound of possible impacts based on conservative assumptions. The construction activities were modeled using the EPA-approved American Meteorological Society (AMS)/EPA Regulatory Model (AERMOD) air dispersion model, and methods similar to the analyses conducted for plant operations described in the next section. Five years of meteorological data based on site-specific land use were used for modeling the construction activities. The construction activities were modeled as an area source encompassing the extent of the main IGCC facilities.

For the proposed construction activities, modeling results indicated that the greatest concentrations would occur at the proposed construction site, and concentrations would decrease steadily with distance from the site. Consequently, the maximum concentrations in the ambient air would occur at the nearest property boundary, northeast of the power block construction area. For comparison with the NAAQS, total concentrations were obtained by adding maximum modeled concentrations to their corresponding background concentrations as shown in Table 4.2-1.

The HAPs most associated with diesel emissions were assessed in a similar manner, and the results are shown in Table 4.2-2.

Table 4.2-1. Estimated Criteria Pollutant Air Quality Impacts from Power Plant Construction Emissions

Pollutant	Averaging Time	Impact from Construction (μg/m^3)	Background Air Quality* (μg/m^3)	Total Impact† (μg/m^3)	NAAQS‡ (μg/m^3)
NO_x	Annual	49	15	64	100
CO	1-hour	1,639	5,635	7,274	40,000
	8-hour	1,162	3,795	4,957	10,000
SO_2	3-hour	0.15	91	91	1,300
	24-hour	0.05	31	31	365
	Annual	0.01	8.0	8	80
PM_{10}	24-hour	39	40	79	150
	Annual	6.1	23	29	50
$PM_{2.5}$	24-hour	4.3	28.9	33.2	35
	Annual	0.7	12.8	13.5	15

*From Pascagoula Monitoring Station measurements from 2005 through 2007 for NO_x, SO_2, PM_{10}. CO from Jackson Station, 2003 through 2005. Short-term values are highest second-highest. Background $PM_{2.5}$ concentrations are conservative estimates from the urban and center city monitor in Merician using the most recent available data (2006 to 2008). The short-term values are the maximum 98th percentile value observed during the 3-year period.
†The sum of the modeled concentration and the ambient background concentration.
‡NAAQS are established in accordance with the CAA to protect public health and welfare with an adequate margin of safety.

Source: ECT, 2009.

Table 4.2-2. Estimated HAP Pollutant Air Quality Impacts from Power Plant Construction Emissions

Pollutant	Short-Term Impact (μg/m^3)	Screening Level Short-Term Concentration (μg/m^3)*	Long-Term Impact (μg/m^3)	Screening Level Long-Term Concentration (μg/m^3)†
Benzene	0.88	29	0.08	30
Formaldehyde	5.2	49	0.45	9.8
Acetaldehyde	2.3	81,000	0.20	9.0
1,3-Butadiene	0.09	440,000	0.01	2.0
Acrolein	0.13	0.19	0.01	0.02

*Minimum value from Table 2 of: Acute Dose-Response Values for Screening Risk Assessments (http://www.epa.gov/ttn/atw/toxsource/).
†From Prioritized Chronic (Noncarcinogenic) Dose-Response Values for Screening Risk Assessments (http://www.epa.gov/ttn/atw/toxsource/).

Source: ECT, 2009.

As shown in Tables 4.2-1 and 4.2-2, the results for the criteria and HAPs are below levels of concern, i.e., NAAQS or screening air toxic levels. Therefore, no adverse human health effects are expected to occur as a result of the plant construction activities. It should be recognized that the predicted impacts are likely an over-prediction resulting from conservative assumptions. Also, these activities would be temporary, and the activity level on average would be lower than assumed in the modeling.

Surface Lignite Mine

Construction of the mine facilities would occur on portions of the power plant site, as described in Subsection 2.2.1. Construction of facilities and structures would be accomplished using diesel-powered bulldozers, motor graders, trackhoes, and off-road trucks. Construction vehicles and machinery would be equipped with standard pollution-control devices to minimize emissions. Emissions similar to those described for the power plant would occur on a daily basis; however, the total emissions would be less because less construction would be required prior to commencing mining operations.

Construction activities would create short-term adverse effects from land disturbance by exposing soil to wind. However, MDEQ SMCRA regulations would require the mine operator to develop and implement a wind and water erosion control plan to minimize the impacts of soil erosion on undisturbed lands and offsite properties. Measures available to the mine operator to minimize soil erosion impacts include fabric filter fences, hay bales, and application of chemical soil stabilizers or water.

Construction activities would commence in 2011 and conclude in 2013. Exposed land surfaces would reach the maximum disturbance in 2012.

Linear Facilities

Linear facilities would include electrical transmission lines and reclaimed effluent, natural gas, and CO_2 pipelines. Construction of the transmission line facilities would involve clearing, grading, and excavation activities, followed by concrete placement and structure installation. Pipeline construction would involve similar site preparation work, followed by pipe installation, backfilling, and regrading (refer to Subsection 2.3.3). These activities would generate fugitive dust and engine exhaust emissions but would last for only a short period at any given location. In the case of the transmission lines that would be upgraded, the use of the existing rights-of-way would require less site preparation. Compared to the construction of the power plant, the activities would be temporary, more dispersed, and result in much less air emissions. Consequently, the air quality impacts resulting from the construction of the linear facilities would be negligible.

4.2.1.2 Operation

Power Plant

Permanent sources of air emissions from the proposed facilities would include the HRSG stacks, WSA system exhaust, AGR process vents, startup stacks, flares, material handling equipment, and mechanical draft cooling towers, of which the HRSG stacks would generate the most emissions. An auxiliary boiler and two fire-water pumps would also contribute to total emissions but would only be used occasionally.

Mississippi Power has submitted to MDEQ a revised air emissions source construction permit application (Mississippi Power, 2009a). This application is hereinafter referred to as the “revised PSD permit application,” as the relevant federal regulatory driver is the PSD program, as described in Chapter 7. The PSD permit application is too voluminous to append to this EIS, but it is available for public review. The application presents proposed project emissions in detail.

To ensure conservative estimates of air quality impacts, for air quality modeling purposes emissions were based on 100-percent load throughout the year (100-percent annual capacity factor) using the higher of estimated syngas or natural gas emission rates. On this basis, annual emissions from the proposed facilities of criteria pollutants with long-term averaging time NAAQS would include approximately 685 tons of SO_2, 2,214 tons of NO_x, 549 tons of PM, and less than 0.2 ton of lead. Annual emissions of VOCs, a precursor of the criteria pollutant ozone, would be 183 tons. The Kemper County IGCC Project would be a minor source of HAPs. Estimated potential HAP emissions of 4.1 tpy would result from the CT/HRSGs firing syngas exclusively. Exclusive firing of natural gas in the CT/HRSGs would result in up to 9.2 tpy of HAP emissions. Plant-wide emissions of mercury, primarily from the CT/HRSGs firing syngas, have been estimated to be approximately 0.03 tpy. Appendix C provides more detailed information on plant emissions.

Also, analyses of the potential air quality effects of criteria emissions from the proposed IGCC facility were performed for both the 50- and 67-percent CO_2 capture cases. The following discussions present the worst case of the two analyses.

Mobile emission sources would include plant vehicular traffic and personal commuter vehicles. Vehicles, ranging from passenger vehicles to tanker trucks, would be present during operations on the site. These vehicles would be equipped with standard pollution-control devices to minimize emissions. The relatively small amount of traffic would not contribute appreciably to ambient air pollutant concentrations in the area.

Additional PM would be generated from handling, transfer, and storage of coal, process wastes, and by-products. To reduce these particulate emissions, the number of handling and transfer points would be minimized, key drop points and crushers would be equipped with water sprays and/or foggers, much of the coal handling operation would be conducted in full to partial enclosures, and baghouses would be used at the milling and drying operations and crushed coal storage silos.

The potential impacts resulting from the facility emissions were evaluated using state-of-the-art air dispersion modeling techniques. The area surrounding the Kemper County IGCC Project site is designated a PSD Class II attainment area. Class II areas are deemed to be in compliance (attainment) with NAAQS and able to accommodate normal, well-managed industrial growth. Class I areas include national parks and wilderness areas where the air quality is more protected from the effects of industrial growth, i.e., a much smaller degree of air quality deterioration is allowed. Although the Sipsey Wilderness Area located in northern Alabama is more than 200 kilometers (km) from the Kemper County site, the possible impacts at this Class I area were included in the evaluation. Because of the distance of the Sipsey Wilderness Area from the site, the models and techniques were somewhat different from those used in the Class II area analysis. Therefore, the analyses for the Class I and II areas are discussed separately in the following subsections.

Class II Area Impact Analysis

As discussed in more detail in the air modeling sections of the revised PSD air permit application (Mississippi Power, 2009a) and supporting modeling protocol documents (ENSR, 2007a and b), the potential air quality impacts associated with operation of the proposed facilities were evaluated using refined air dispersion modeling techniques that include advanced treatment of atmospheric processes. Refined modeling requires detailed and precise input data, but also provides the best estimates of source impacts. The AERMOD modeling system (EPA 2004a and 2004b), together with 5 years of hourly meteorological data, was used in the refined ambient impact analysis. AERMOD was used to obtain refined impact predictions of concentrations for short-term (i.e., periods equal to or less than 24 hours) and long-term periods (i.e., annual averages). In the analyses, particulate emissions were conservatively assumed to be PM_{10} for comparison with the standards.

The AERMOD meteorological preprocessor AERMET (Version 06341) was used to process surface meteorological data collected at the Meridian Key Field Airport (MEI) (Weather Bureau, Air Force and Navy Station No. 13865) and upper air data from Jackson International Airport (AAB) (Station No. 13817). The surface and upper air data for the years 1991 to 1995 were obtained from the National Climatic Data Center (NCDC). The AERMET files for the years 1991 to 1995 were supplied to Mississippi Power by MDEQ. These data were processed by MDEQ using the land use characteristics of the surface weather station, i.e., Meridian Key Field. Additional AERMET files were produced based on the land use characteristics of the Kemper County IGCC Project site. The final modeling results were based on running both versions of the meteorological data.

Pollutant concentrations were predicted at ground-level locations (receptors) at the plant site boundary and beyond to distances of 20 km. Consistent with the Guideline on Air Quality Models (GAQM) and MDEQ recommendations, the ambient impact analysis was performed for the following model receptors:

- Fence line receptors—Receptors on the site fence line spaced 50 meters apart.
- Receptors beyond the fence line at 50-meter spacing, extending to 500 meters from the fence line.
- Receptors at 100-meter spacing, between 500 meters and 1 km from the fence line.
- Receptors at 500-meter spacing, between 1 and 5 km from the fence line.
- Receptors at 1,000-meter spacing, between 5 and 10 km from the fence line.
- Receptors at 2,000-meter spacing, between 10 and 20 km from the fence line.

Receptor terrain elevations derived from 7.5-minute digital elevation models were extracted using the latest version of AERMAP (Version 09040), the AERMOD terrain-processing program. The elevated terrain option in AERMOD was used to process the terrain data generated by AERMAP.

The effect of wakes produced from building downwash on plume dispersion were considered using EPA's Building Profile Input Program (BPIP) to determine the area of influence for each building. The building downwash analysis was performed using the most recent version of BPIP (Version 04274) with the plume rise model enhancements (PRIME) building downwash algorithms. The results were used as input to AERMOD.

The first step in the modeling process was to model the IGCC power plant sources alone and compare the results to the PSD Class II area significant impact levels (SILs). The SILs are set at levels far below the respective NAAQS (i.e., 1 to 10 percent of the NAAQS). According to EPA guidelines, a preliminary modeling analysis using SILs should include only the emissions associated with the proposed facilities to determine if the facilities would have a significant impact on ambient air quality. If the maximum predicted concentrations are less than the SILs, additional modeling including other sources and background concentrations is not required for regulatory purposes (EPA, 1990).

The proposed facilities would annually emit less than 0.2 ton of lead, which is less than the PSD significant emission rate of 0.6 tpy of lead (40 CFR 52.21). Lead ambient concentrations in recent years have been well below NAAQS, largely because of the decreased use of leaded gasoline in automobiles. Therefore, lead emissions from the proposed facilities were not evaluated further.

Ozone is not emitted directly from a source but is formed in the atmosphere from photochemical reactions involving emitted VOCs and NO_x. Because the reactions involved can take hours to complete, ozone can form far from the sources of its precursors (the VOCs and NO_x that initiate its formation). Therefore, the contribution of an individual source to ozone concentrations at any particular location cannot be readily quantified, and such an analysis is not required by MDEQ.

The full range of operating conditions (i.e., fuel type, load, supplemental duct burner firing, etc.) of the CT/HRSGs was considered. In addition, the full 5 years of meteorology were used in the modeling. A worst-case set of emission parameters was developed for each modeling case. These parameters consisted of the highest pollutant emission rate coupled with the lowest exhaust temperature and lowest exhaust flow rate to conservatively estimate ground level concentrations. The modeled results reported herein represent the highest values obtained for each pollutant and averaging time. As shown in Table 4.2-3, the results indicate that maximum concentrations were predicted to exceed the SILs for all pollutants except CO. Therefore, additional modeling, including other sources and background air quality, was required for SO_2, NO_x, and PM_{10}.

Table 4.2-3. Class II Area SIL Analysis

Averaging Period	μg/m³				
	SO_2	NO_2	PM_{10}	CO	SIL
1-hour	—	—	—	810.3	2,000
3-hour	43.3	—	—	—	25
8-hour	—	—	—	483.0	500
24-hour	13.6	—	21.4	—	5
Annual	1.9	1.8	3.2	—	1

Source: Mississippi Power, 2009a.

To determine whether or not emissions from the proposed IGCC power plant would cause or contribute to a violation of the NAAQS or any PSD increment, the cumulative impacts of the proposed new sources along with existing sources were estimated with further modeling. The significant impact area (SIA) of the proposed facility was determined for each pollutant and averaging time. The maximum distance at which a significant impact was predicted was used to determine each SIA. All emission sources within the SIA plus another 50 km were included in the inventories of other sources. (It is reasonably assumed that sources beyond this area would not contribute significantly within the SIA.) The information characterizing the other, offsite emission sources was supplied by MDEQ and ADEM.

Because of the large numbers of sources within the SIAs, a screening procedure was used to eliminate smaller sources located outside the SIA that would not be expected to contribute significantly to predicted concentrations within the SIA. The technique commonly referred to as the North Carolina 20D Rule was used to screen the sources in the inventories. The first step in this procedure is to multiply the distance of the source from the edge of the SIA in kilometers by 20 to obtain the value 20D. This defines the threshold value in tpy for each pollutant being studied. Facilities with emissions below 20D are assumed to not be able to contribute significantly within the SIA and are eliminated from the inventory. The complete lists of sources and the results of the screening procedure may be found in Appendix 3 of the revised PSD permit application.

The results of the NAAQS modeling are shown in Table 4.2-4. The modeled concentration is the cumulative impact from the IGCC power plant, the coal mining operations, and any existing sources that may possibly impact the SIA. The background air quality levels shown in Table 4.2-4 were obtained from the EPA AirData database available at http://www.epa.gov/air/data/index.html. The background air quality values are conservative, since they are based on values that are likely to be much higher than those found in the rural setting of the proposed IGCC plant. The total impact is the addition of the combined impacts of all sources and the background air quality. The highest change in total ambient concentrations for SO_2, NO_2, PM_{10}, and $PM_{2.5}$ are less than 13 percent of any of the respective standards (as indicated in the rightmost column). Consequently, cumulative air quality impacts from the sum of the proposed facilities along with existing sources and background air quality would not be expected to cause an exceedance of NAAQS.

Table 4.2-4. NAAQS Impact Analysis

Pollutant	Averaging Period	Standard* ($\mu g/m^3$)	Modeled Concentration† ($\mu g/m^3$)	Ambient Background Concentration‡ ($\mu g/m^3$)	Total Predicted Ambient Concentration§ ($\mu g/m^3$)	Change in Total Ambient Concentration as a Percentage of Standard
SO_2	3-hour	1,300	30.2	91	121	2.3
	24-hour	365	12.8	31.3	44	3.5
	Annual	80	2.0	8.0	10	2.5
NO_2	Annual	100	2.4	15.1	18	2.4
PM_{10}	24-hour	150	18.3	40	58	12.2
	Annual	50	3.2	23	26	6.4
$PM_{2.5}$**	24-hour	35	2.01	28.9	31	5.7
	Annual	15	0.35	12.8	13.2	2.3

*NAAQS are established in accordance with the CAA to protect public health and welfare with an adequate margin of safety.
†Maximum modeled concentration from the proposed facilities and other offsite sources. $PM_{2.5}$ modeled concentrations are estimated based on the 0.11-ratio of $PM_{2.5}$ to PM_{10}.
‡From Pascagoula monitoring station measurements from 2005 through 2007 (except $PM_{2.5}$). Short-term values are highest 2[nd] high.
§The sum of the modeled concentration and the ambient background concentration.
** Background $PM_{2.5}$ concentrations are conservative estimates from the urban and center city monitor in Meridian using the most recent available data (2006 to 2008). The short-term values are the maximum 98[th] percentile value observed during the 3-year period.

Sources: Mississippi Power, 2009a.

On May 8, 2008, EPA issued a rule that finalizes several New Source Review (NSR) program requirements for sources that emit $PM_{2.5}$; however, several other NSR program requirements were left unaddressed. The rule contains a transition policy that suggests State Implementation Plan (SIP)-approved states should continue to use PM_{10} as a surrogate for $PM_{2.5}$ to demonstrate compliance with PSD requirements. Mississippi is an SIP-approved state; therefore, MDEQ is allowed to use PM_{10} as a surrogate for $PM_{2.5}$.

Since 1997 it has been EPA's policy that compliance with NSR requirements for PM_{10} may be used as surrogate for compliance with requirements for $PM_{2.5}$ (1997 Memorandum from John S. Seitz: Interim Implementation for the New Source Review Requirements for $PM_{2.5}$ and 2005 Memorandum from Stephen D. Page: Implemetation of New Source Review Requirements in $PM_{2.5}$ Nonattainment Areas). Although this policy still remains in effect, and despite the lack of final rules regarding all of the requirements of NSR for $PM_{2.5}$, the universal use of this policy for all source types has recently been questioned. For the Kemper County IGCC Project, the analysis in this EIS uses PM_{10} as a surrogate for $PM_{2.5}$ because:

- For each source type, the emissions of $PM_{2.5}$ generally correlate with the PM_{10} emissions.
- The $PM_{2.5}/PM_{10}$ ratios with and without particulate control technology applied are reasonably similar.

The project's primary combustion sources would include the IGCC stacks, gasifier startup stacks, auxiliary boiler, and flare systems. Particulate emissions from combustion sources would be largely the result of incomplete fuel combustion. Although definitive particle size distribution data were unavailable for these sources, the particulate emissions are considered to be within the PM_{10} size range, with a high percentage falling in the $PM_{2.5}$ size range. In fact, for some combustion sources all of the particulate might be $PM_{2.5}$.

There are no additional postcombustion controls that would have been evaluated for $PM_{2.5}$ that were not evaluated for PM_{10}. Postcombustion controls for $PM_{10}/PM_{2.5}$ would not be economically feasible for the Kemper County IGCC Project combustion sources, mainly because of the low particulate concentration in the exhaust gas. In the case of the open flare systems, postcombustion controls would not be technically feasible. The BACT proposed for all of the combustion sources was good combustion practices (GCP) with clean fuels also listed for the IGCC units and the auxiliary boiler. The combustion products from the gasifier startup process would pass through the syngas particulate cleanup system providing control before being exhausted from the gasifier startup stacks. Also, the startup stacks would be expected to operate for less than 500 hours per year (hr/yr). Since the proposed BACT would limit the production of particulate products of combustion that comprise the $PM_{2.5}/PM_{10}$ emissions, and $PM_{2.5}$ represents most if not all of the particulate emissions, the efficiency of BACT for both size fractions is considered to be the same.

Regarding fugitive dust and material handling sources, in 2006 EPA updated the AP-42 emission factors for fugitive dust sources including paved and unpaved roads, material handling and storage piles, industrial wind erosion, material transfer operations, and construction and demolition. The uncontrolled $PM_{2.5}$ to PM_{10} ratios across all of these categories ranged from 0.10 to 0.15 (EPA, 1995a). BACT proposed for these sources would consist of BMPs, full and partial enclosures, wet suppression, fogging, covered storage piles, and wetting of material (salt and ash) prior to loading. Although the control efficiencies for some of these methods might be less for the $PM_{2.5}$ fraction than for the PM_{10} fraction (e.g., approximately 40 percent versus approximately 90 percent for wet suppression), they would represent the BACT for the Kemper County IGCC Project and would have been chosen if only $PM_{2.5}$ were considered. There is little information on the efficiencies of other control measures versus particle size fraction. For the material handling processes that would be vented to a baghouse (i.e., the storage silo, coal milling, and drying stacks), the BACT level of 0.005 grain per dry standard cubic foot (gr/dscf) was selected. Since the control efficiencies for baghouses are fairly flat across particle size ranges (e.g., approximately 99 percent for $PM_{2.5}$ and 99.5 percent for PM_{10}), the proposed BACT would be considered appropriate for $PM_{2.5}$ as well as PM_{10} (EPA, 1995b).

The emissions from the cooling towers would be limited to the particulate associated with dissolved solids in liquid droplets that become entrained in the air stream exiting the cooling tower. High efficiency drift eliminators (i.e., 0.0005-percent drift rate) would be BACT for these sources. Drift eliminators would be the only control technology available for wet cooling towers and would be appropriate for controlling both PM_{10} and $PM_{2.5}$. The particle size distribution is dependent on several factors, including the design of the cooling tower and drift eliminators, and the concentration of dissolved solids in the recirculating water (e.g., higher concentrations of dissolved solids may result in fewer particles below 2.5 microns aerodynamic diameter). There is limited information concerning the aerosol size distribution of droplets from cooling towers. However, based on the Reisman and Frisbie Method of “Calculating Realistic PM_{10} Emissions from Cooling Towers” (Reisman and Frisbie, 2002), $PM_{2.5}$ emissions would be a fraction of the PM_{10} emissions.

While the previous discussion suggests the surrogate approach is appropriate for this project, it is expected that EPA Region 4 would make the final determination as to whether it is or is not appropriate for purposes of the PSD permitting process. For this EIS, application of the surrogate policy was supplemented by use of a conservative approach, as described next, to estimate $PM_{2.5}$ impacts, adding to the confidence that all regulatory standards would be protected.

Current research and data indicate that multipliers in the range of 0.06 to 0.11 can be used to infer or scale $PM_{2.5}$ concentrations from PM_{10} data (EPA, 2005). The $PM_{2.5}$ modeled concentrations included in Table 4.2-4 were estimated by applying a multiplier of 0.11 to the PM_{10} modeled concentrations. When using a multiplier of 0.11 for relative $PM_{2.5}$ to PM_{10}, the resulting concentrations of 24-hour and annual $PM_{2.5}$ would not exceed their respective NAAQS standards.

The analyses to assess the possible impacts relative to allowable PSD increments were performed in a manner similar to the NAAQS analysis. The inventory of PSD consuming sources was different than existing sources, and background air quality was not used for the PSD increment analyses. As can be seen in Table 4.2-5, all modeled impacts were found to be less than their respective PSD increments. Except for the predicted 24-hour PM_{10} concentration, which is 71.3 percent of the allowable increment, all other impacts were found to be less than 20 percent of the PSD increments.

Table 4.2-5. Class II Area PSD Increment Impact Analysis

Pollutant	Averaging Period	Allowable PSD Increment ($\mu g/m^3$)	Modeled Concentration* ($\mu g/m^3$)	Impact as a Percentage of PSD Increment
SO_2	3-hour	512	42.1	8.2
	24-hour	91	13.6	14.9
	Annual	20	1.9	9.5
NO_2	Annual	25	2.1	8.4
PM_{10}	24-hour	30	21.4	71.3
	Annual	17	3.3	19.2

*Maximum modeled concentration from the proposed facilities and other PSD consuming sources.

Sources: Mississippi Power, 2009a.

Class I Area Impact Analysis

The nearest Class I area is the Sipsey Wilderness Area located in northern Alabama, approximately 225 km from the IGCC project site. Class I areas have more protective air quality increments than those established for Class II areas. Also, guidance for preparing impact assessments has been established by the Federal Land Managers (FLM), in the form of air quality-related values (AQRVs) (Federal Land Managers’ Air Quality-Related Values Workgroup [FLAG]), for the protection of Class I areas (FLAG, 2000). The AQRVs relevant to this analysis are air quality, visibility, and acidic deposition.

Since the Sipsey Wilderness Area is more than 50 km from the site, assessments of the impacts were performed using CALPUFF (Version 5.8, Level 070623), EPA’s recommended long-range transport model (Scire *et al.*, 2000). It was not necessary to consider building wake effects because of the distance to the Class I area (i.e., the effects would be negligible). The receptors were obtained from the NPS database of Class I receptors (www2.nature.nps.gov/air/maps/Receptors/index.htm). The CALPUFF model predicted impacts for the 247 closely spaced receptor points covering the Sipsey Wilderness Area for the AQRVs (i.e., air quality, visibility, and deposition).

The meteorological input files, consisting of wind field data, were provided by the Visibility Improvement State and Tribal Association of the Southeast (VISTAS) for the years 2001 to 2003. Wind field data from Version 5 of the Penn State/NCAR Mesoscale Model (MM5) were input to CALMET meteorological processor. The CALMET meteorological simulations used 12-km resolution MM5 data for 2001 and 2002. The 36-km resolution data for 2003 was used since it was the highest resolution available for that year.

Only sources with elevated stacks, i.e., the CT/HRSG stacks, the flares, and the WSA stacks, were included in the modeling since the impact of the other ancillary sources would be expected to have a negligible impact at the distance of the Class I area.

All predicted impacts were found to be well below the SILs for Class I areas (see Table 4.2-6). The impacts ranged from a few percent of the annual SILs to 37.8 percent of the 24-hour SIL for PM_{10}. Since the predicted impacts were below the SILs, no further air quality analysis was required, i.e., the new sources were shown to not contribute significantly at the Class I area and, therefore, could not contribute to an exceedance of the NAAQS or PSD increments.

Table 4.2-6. Maximum Predicted Ambient Air Pollutant Concentrations Due to Emissions from the Proposed Facilities Compared to Class I SILs

Pollutant	Averaging Period	Maximum Impact ($\mu g/m^3$)	SIL ($\mu g/m^3$)	Total Impact as Percent of SIL
PM_{10}	24-hour	0.121	0.32	37.8
	Annual	0.003	0.16	1.9
NO_2	Annual	0.004	0.10	4.0
SO_2	3-hour	0.169	1.00	16.9
	24-hour	0.049	0.20	24.5
	Annual	0.0027	0.10	2.7

Sources: Mississippi Power, 2009a.

Visibility, or background visual range, is defined as the maximum distance a large, black object can be observed on the horizon. The scenic quality of natural landscapes and their color, contrast, and texture, are improved by good visibility. Visibility, as a measure of atmospheric clarity, has been established as an important AQRV of national parks and wilderness areas that are designated as PSD Class I areas. The maximum predicted change in visibility extinction in the Class I area was 7.5 percent. This consisted of a single event (i.e., one daily period) greater than the target threshold value of 5 percent change in extinction predicted in the 2002 model year. The maximum predicted change in extinction for the other model years was 4.6 and 1.9 percent in 2001 and 2003, respectively. The U.S. Department of Agriculture, Forest Service, previously concurred that a single predicted occurrence greater than the target level represented an acceptable impact (Mississippi Power, 2007).

The estimated impacts of acidic deposition at the Class I area from sulfur and nitrogen compounds that would be emitted from the plant were predicted to be well below the deposition analysis threshold (DAT) of 0.01 kilogram per hectare per year (kg/ha/yr) for both sulfur and nitrogen deposition. The maximum predicted impacts were 55 and 50 percent of the sulfur and nitrogen DATs, respectively, at the Sipsey Wilderness Area.

Cooling Tower Fogging, Icing, and Salt Drift Deposition

Besides the emissions from the CT/HRSG units and other plant sources, emissions from the wet cooling towers that would be used were evaluated in terms of potential fogging, icing, and drift impacts. The results, which are presented in full in Appendix N (AECOM, 2009b, c, and d), showed that: (a) visibility for automobiles on nearby roads would not be affected by ground-level plumes, (b) there would be no likelihood for icing of nearby roadways on cold days, and (c) salt deposition resulting from cooling tower drift emissions would be below thresholds that could harm soils and vegetation in the vicinity. The latter topic is discussed further in Subsections 4.2.6 and 4.4.1.

Acid Rain

Acid rain, the name frequently given to describe the phenomenon of acidic deposition, occurs when SO_2 and NO_x are chemically transformed and transported in the atmosphere and deposited on the earth's surface in the form of wet (rain, snow, fog) or dry (particle, gas) deposition. SO_2 and NO_x are readily oxidized in the atmosphere to form sulfates and nitrates. Subsequently, the sulfates and nitrates may form H_2SO_4 and nitric acid when combined with water, unless neutralized by other chemicals present. Acidic deposition contributes to the acidification of lakes and damage to ecological resources. SO_2 and NO_x can be transported by the wind for hundreds of miles from one region to another. Therefore, air over any given area will contain some residual emissions from distant areas and infusions received from nearby areas. This continuing depletion and replenishment of emissions along the path of an air mass makes it extremely difficult to determine relationships between specific sources of emissions and acidic deposition at any particular location.

As a comparison to evaluate acidic deposition, estimated maximum annual SO_2 emissions from the proposed IGCC facility would be 685 tons, which would be approximately two and a half times those of Kemper and Lauderdale Counties' 2001 SO_2 emissions inventory of 277 tons. Annual NO_x emissions from the IGCC facility would be 2,213 tons, or approximately 36 percent of Kemper and Lauderdale Counties' 2001 NO_x emissions of 6,190 tons. The facility's combined SO_2 and NO_x emissions would be approximately 45 percent of the Kemper and Lauderdale County emissions. Even though the facility's emissions are significant in relation to those of the surrounding counties, total emissions of acid-producing pollutants would still be lower than most conventional coal-fired power plants.

The Kemper County IGCC Project would be required to obtain an Acid Rain Phase II permit under Title IV of the CAA. The Acid Rain Program (see Chapter 7) applies to electrical generating units greater than 25 MW. Consistent with this program, the facility would be operated in a manner to reduce acid rain precursors. The Clean Air Interstate Rule (CAIR), established under Section 110 of the CAA, expanded the Acid Rain Program by reducing the cap for SO_2 emissions. CAIR also established a cap-and-trade system for NO_x. The project would be subject to continuous emissions monitoring, recordkeeping, and reporting requirements under the Acid Rain and CAIR Programs. Although the Circuit Court of DC vacated the CAIR on July 11, 2009, and has since remanded the rule to EPA, the court decision did not affect individual states' obligations to eliminate significant contribution to downwind states, ozone, and fine particulate pollution. At the beginning of operation, the IGCC facility would need to hold SO_2 and NO_x emission allowances to cover actual emissions of those pollutants generated from the electrical generating units. Since the proposed facility would operate within its prescribed allowances, appreciable adverse impacts related to acid rain would be limited.

Odors

The proposed facilities would emit some odors that would be noticeable on the site. Sources for these odors would include diesel engine exhaust from trucks, maintenance equipment, and coal yard loaders; the coal handling equipment; H_2SO_4 storage and handling; and ammonia storage and handling. Any of these potential odors should be limited to the immediate site area and should not affect offsite areas.

Surface Lignite Mine

Consultants to Mississippi Power performed a supplemental analysis to evaluate the impact of the lignite mine and the IGCC plant in combination and to show compliance with the NAAQS and PSD increments. DOE has reviewed this information and agrees with the methodology and conclusions. The evaluation was confined to PM_{10} emissions, since PM emissions from earthmoving and mining operations would likely result in the most significant impacts. Also, the emissions were assumed to occur in the section of land that would likely be mined first, i.e., the area directly south of the IGCC plant site. Since this parcel is the one nearest to the proposed IGCC plant, modeling of it would be expected to result in the highest combined air quality impacts.

Conservative estimates of the mining activities and emissions were made based on similar operations at the existing Red Hills Mine in Choctaw County, Mississippi. The primary sources of emissions would be the lignite haul road from the pit to the IGCC plant, the exposed coal mine area (approximately 100-acre extent), and the active coal pit (approximately 16-acre extent). The haul road and grader activities were assumed to occur at least 10 hours per day and 287 days per year. The potential short-term PM_{10} emissions rates for the haul road, exposed mine study area, and coal pit were estimated to be 6.64, 0.52, and 2.50 lb/hr, respectively. Receptor spacing and modeling methodology was consistent with the PSD analysis. The highest predicted impacts are shown in Tables 4.2-7 and 4.2-8. Since the impacts were estimated to be less than the respective NAAQS and PSD increments, the air quality impacts of the IGCC plant in combination with the lignite mine would be in compliance with the standards.

Table 4.2-7. NAAQS Analysis of Lignite Mine Operations and IGCC Plant

Pollutant	Averaging Period	NAAQS ($\mu g/m^3$)	Maximum Model Concentration* ($\mu g/m^3$)	Ambient Background Concentration ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	Total Impact as Percent of NAAQS
PM_{10}	24-hour	150	22.68	40	62.68	41.8
	Annual	50	6.09	23	29.09	58.2

*Modeled concentration includes lignite mine and IGCC plant.

Source: Mississippi Power, 2009a.

Due to the construction schedule, lignite coal would need to be trucked from the Red Hills Mine located in Choctaw County during the first 6 months of operation of the IGCC power plant. It has been estimated that 50 to 60 trucks per day would be required for delivering lignite. The road distance from the Red Hills Mine to the Kemper County site is approximately 70 miles. Estimates of the air emissions resulting from the operation of the coal haul trucks were made for criteria pollutants and CO_2. Pre-2007 highway emission standards, along with conservative assumptions concerning fuel consumption and average speed, were used to estimate truck engine exhaust emissions of these pollutants. SO_2 emissions were based on the use of ultra-low sulfur diesel fuel (i.e., 0.0015 weight percent sulfur) that would be required in the year 2010. CO_2 emissions were based on an engineering estimate assuming 99-percent conversion of carbon in fuel to CO_2 and 87-percent weight carbon in diesel fuel. The resulting estimated annual emissions were 51 tpy of PM_{10}, 2,030 tpy of NOx, 7,860 tpy of CO, 660 tpy of VOC, 0.02 tpy of SO_2, and 264,500 tpy of CO_2. These emissions also assume an older fleet of trucks than might actually be used, adding to the conservative bias of the estimates.

Linear Facilities

Operation of the linear facilities should not result in any significant or routine air emissions. Only occasional vehicular traffic for service and inspection would be expected. Therefore, no significant air emissions or impacts on air quality would result from these facilities.

Table 4.2-8. PSD Increment Analysis of Lignite Mine Operations and IGCC Plant

Pollutant	Averaging Period	PSD Increment ($\mu g/m^3$)	Maximum Model Concentration* ($\mu g/m^3$)	Total Impact as Percent of Increment
PM_{10}	24-hour	30	25.83	86.1
	Annual	17	6.09	35.8

*Modeled concentration includes lignite mine and IGCC plant.

Source: Mississippi Power, 2009a.

4.2.2 GEOLOGY

4.2.2.1 Construction

Consideration must be given to construction activities associated with any feature of the proposed Kemper County IGCC Project that could impact geological resources. Furthermore, consideration must be given to risks associated with natural seismic activity that could damage or affect the project.

As outlined in Subsection 3.4.4, the only economically significant geological resources known to exist in the project areas (the power plant, mine, and various linear facilities) are sand, clay, and lignite. Construction activities associated with the proposed facilities would have no adverse impact on local geological mineral resources, other than to preclude the use of those geological resources in the immediate areas of the facilities. Sand, clay, and lignite deposits are present in relative abundance in this region of Mississippi, whereas the construction footprint of the power plant, mine, and linear facilities would be relatively small (see Subsection 2.5.1).

Subsection 3.4.5 provided a rigorous description and analysis of local seismic activity and seismic hazard analysis that included site-specific data. Considering site calculations and based on FEMA 450 provisions (BSSC, 2003), it was determined that the site designs would comply with the NEHRP provisions. The overall seismic hazard would be relatively small in the project areas. No impacts would be expected from seismicity with regard to construction of the proposed facilities. Conversely, construction would not be expected to trigger natural seismic events.

4.2.2.2 Operation

There would be some loss of sand and clay deposits as a result of the surface mining process, but these deposits are plentiful in the region. The approximately 12,275-acre area to be mined would represent only a small fraction of the total area where minable lignite is present in east-central Mississippi. Overburden removal would cause a change to current stratigraphy. Backfilling and grading to replace the overburden (associated with reclamation) would be contemporaneous with mining and would restore the land surface to its approximate original contour and elevation. Removal of the two deepest lignite seams (E and F; see Figure 3.4-6) is not currently planned due to economic considerations.

The potential for earthquake damage in the project area is low, as discussed in Subsection 3.4.5. Thus, it is unlikely that the long-term operation of the power plant and surface mine would be affected by earthquakes and natural seismic activity. No impacts related to local geology from O&M of the electrical transmission lines and various pipelines would be expected. The low potential for earthquake hazards and the application of appropriate design standards would result in a low potential for seismic activity to cause damage to the pipelines or other linear facilities.

The Kemper County IGCC Project plans to incorporate carbon capture technology into the plant design, with a goal of 67-percent capture. The captured CO_2 would be piped for eventual use in existing EOR operations, as discussed in Subsection 2.1.2.11. Other than the production of additional oil and gas, no adverse geologic effects would be expected to result from this incremental use of CO_2 for existing EOR operations.

4.2.3 SOILS

4.2.3.1 Construction

Power Plant

Up to approximately 1,100 acres of the total 1,650-acre site would ultimately be disturbed during project construction (including both power plant and mine-related facilities) (refer to Subsection 2.5.1). A portion of these acres would be disturbed only during the construction activities (e.g., equipment laydown) and would not be developed with permanent facilities. The balance of approximately 550 acres would remain undisturbed. Overall, the areas for construction would accommodate access roads; power block, gasification island, and associated cooling towers and flares; makeup water storage pond; byproduct storage areas; permanent mine and coal handling facilities; a portion of the initial mine block; mine-related sediment ponds; and construction parking and laydown areas.

Construction of all of these facilities would require clearing of vegetation and subsequent excavations that would temporarily expose soils to potential erosion by winds and stormwaters. Areas to be disturbed would first be cleared and grubbed removing vegetation, and then topsoil would be stripped and temporarily stockpiled. Silt fencing would encompass the stockpiles except for vehicle access points. Stockpiles would not be located in wetland areas or in areas that would be affected by other construction activities. Topsoil stripped from the construction areas would be stockpiled for reuse or incorporated into landscape features. Unsuitable fill material would be used for onsite landscaping features. Silt fencing (or other, similar measures) would encompass these areas, except for vehicle access points, until the establishment of final vegetation cover.

After site preparation and removal of unsuitable materials in all structural areas, foundations would be constructed. No adverse impacts would be anticipated relative to soil stability or bearing strength because concrete piles would support the power block foundation. Overall settling of the land area would be negligible. Further geotechnical studies would be conducted when designing the byproduct storage areas, as appropriate.

Most of the areas designated for construction of facilities and structures would require grading. The average graded site elevation would be 470 ft-msl, midway between the site's high and low elevations of 520 and 420 ft-msl, respectively.

Surface Lignite Mine

Construction of the mine support facilities (e.g., lignite handling facilities, office, etc.) and structures (e.g., sedimentation ponds) and premining activities to prepare mine block A for lignite extraction would affect the existing soils on approximately 455 acres. Subsection 4.2.3.2 explains NACC's proposal to use selected overburden materials as a substitute for native topsoil and subsoil in the postreclamation landscape. If approved by MDEQ, topsoil in these areas would be comingled with other overburden materials during the construction process.

Soil compaction would result beneath mine facilities and roads occupying approximately 320 acres, although reclamation following the completion of mining operations could reverse this effect. Existing soils within the four sedimentation ponds would be affected by construction; up to 94 acres could be affected by sedimentation pond construction. Construction of the 1-A diversion channel adjacent to Chickasawhay Creek would remove and redistribute the existing native soils from up to 41 acres along the 2.84-mile diversion channel.

Construction activities would create short-term adverse effects from land disturbance by accelerating soil erosion, especially on steeper slopes. However, MDEQ SMCRA regulations would require NACC to develop and implement a wind and water erosion control plan to minimize the impacts of soil erosion. During consultations with DOE, NACC committed to using BMPs to minimize soil erosion impacts, including installation of fabric filter silt fences, hay bales, application of water and/or chemical soil stabilizers, quickly germinating vegetation, and use of diversion structures and sedimentation ponds.

Linear Facilities

Construction of linear facilities (transmission lines and pipelines) would begin with clearing and grading, as described for the other project components. Information on construction methods was provided in Subsection 2.3.3. Construction of transmission lines would not require large excavations, and appropriate BMPs would be used to prevent erosion. Both the temporary and permanent rights-of-way would be revegetated following construction. Thus, impacts to soils would be minimized. During pipeline trenching, soil removed from the trench would be placed alongside and then used to fill the trench and restore natural grades and contours. BMPs for construction would minimize temporary impacts to soils. As shown in Subsection 2.3.3, the rights-of-way would be restored as closely as possible to original conditions.

4.2.3.2 Operation

Power Plant

Once constructed, the IGCC facility would have some potential to impact soils on the plant site and in the vicinity. First, as with any large industrial facility, stormwater runoff from impervious areas (e.g., parking lots) would potentially carry oil or grease onto soils. Spills of fuel, oil, and chemicals would also potentially impact soils if allowed to run off. However, in these cases, proper systems for stormwater management as well as containment or enclosure of fuel and chemical storage areas would minimize the potential to impact soils. In the event of spills, the facility would be required by regulation to implement measures spelled out in SPCC plans, the purpose of which would be to minimize impacts to surroundings, including soils.

Second, sulfur and nitrogen can be added to soil as a result of atmospheric deposition. Sulfur and nitrogen deposition in soil can have beneficial effects to vegetation if they are currently lacking these nutrients. At levels above requirements for specific plant species, gaseous emission impacts on soils can cause acidic conditions to develop. Acidic conditions in the soil can cause the leaching of basic cations essential for plant life and in extreme circumstances can transform aluminum to a more soluble form where toxicity can occur (Goldstein *et al.*, 1985).

Nitrogen deficiency is common in nonagricultural areas, and, therefore, much of the atmospherically deposited NO_x is biologically assimilated. There is a limited soil adsorption mechanism for nitrate, so unutilized nitrate will be leached through the soil (Johnson and Reuss, 1984). Both of these factors indicate that nitrate does not play a significant role in soil acidification and that sulfate is more of a concern. Atmospheric deposition of nitrogen can facilitate eutrophication of the soil and vegetative community. Critical loads of nitrogen, above which eutrophication caused a change in vegetative species present in calcareous forests was found to be 15 to 20 kg/ha/yr (Thimonier *et al.*, 1994).

Sulfur deposition can facilitate soil acidification. Sulfur exists in the soil predominantly in the form of sulfate. The maintenance of sulfate in soil solution facilitates the loss of cations. Therefore, the more sulfate that is adsorbed to soil particles, the more buffered the soils will be (Johnson and Reuss, 1984). The soil is a much larger sink for sulfate than vegetation (Johnson and Reuss, 1984). Sulfate can be adsorbed on the surface of reactive clays and iron/aluminum oxides within the soil, which often releases hydroxide, further buffering the soil (Johnson and Reuss, 1984). Soils found in the southeastern United States that have high adsorption rates for sulfates include ultisols and certain suborders of inceptisols and entisols (Psamments) (Johnson and Reuss, 1984). The high iron and aluminum content of the spodic (B_h) horizon of spodosols likely adsorbs the sulfate anion to a large extent, similar to the phosphate anion. The development of acidic conditions in the southeast is thought to be well buffered by the high rates of sulfate adsorption (USGS, 1999).

Dissolution of sulfate and nitrate can also facilitate the formation of nitric acid and H_2SO_4 in rainwater, which elevates hydrogen concentrations within the soil. Soils that are well buffered due to the addition of acidifying hydrogen ions have a high cation exchange capacity, often imparted by surface or subsurface clays and a high base saturation. Barton *et al.* (2002) found soils with a base saturation of 12 to 19 percent and reactive clays to be buffered to acidic inputs, whereas soils with a base saturation of 3 to 7 percent show the effects of soil acidification. In addition, organic horizons of wetland histosols buffer acidic inputs and retard the depletion of cations from the mineral horizons (Koptsik *et al.*, 1998).

As presented previously in Subsection 4.2.1.2, project emissions of sulfur and nitrogen compounds would result in worst-case impacts that would be well below NAAQS. Thus, it can be concluded that air pollutant-related impacts on plant site and area soils would be minimal.

Surface Lignite Mine

Lignite extraction is proposed to occur on up to 10,224 acres. Another 2,048 acres immediately adjacent to the extraction areas would be disturbed by mining operations. Therefore, the total mining-related disturbance would affect up to 12,272 acres through the end of the Kemper County IGCC Project, including the land disturbed during construction (see Table 2.4-2). Prime farmland soils occur on approximately 211 acres or 11 percent of this total disturbance.

At the Kemper County site, the mine operator is proposing to use selected overburden materials as a substitute for topsoil because the topsoil layer (i.e., the A horizon) is thin (see Subsection 3.5.2), a procedure specifically approvable by MDEQ SMCRA Regulations. In support of the proposed substitution, the mine operator has provided the following justification:

> *"Through three decades of experience on the parts of mine operators and regulatory agencies pursuant to the federal SMCRA and MSMRA, certain soil properties (both physical and chemical) have been identified as especially important for consideration during the processes of evaluating materials for use in the top 4 ft of reclaimed soils (premining) and monitoring reclamation success (postmining). For the purposes of this discussion, key soil properties are those soil properties that have been identified as important to consider in selecting 'best available materials' for reclamation of the postmining surface as required by SMCRA, MSMRA, and their implementing regulations. As discussed in Section 3.4, Geology, a total of 18 continuous (from the*

surface to a depth of 10 ft below the lowest mineable lignite seam) overburden cores were collected within the proposed project area for analyses by Energy Laboratories, Inc., College Station, Texas. To compare key properties of existing (native) soils to those of materials potentially available for use in the top 4 ft of reclaimed soils, data for each overburden core were depth-weighted to produce values for the topsoil, subsoil, oxidized overburden, and unoxidized overburden intervals, respectively defined as follows: zero (surface) to 1 ft, 1 to 4 ft, surface to base of oxidation, and base of oxidation to total depth. Table 4.2-9 summarizes maximum, minimum, and weighted mean values for key soil properties for each of these four intervals.

Weathering and leaching are among the important processes contributing to soil conditions measurable in terms of key soil properties. Logically, the effects or expression of these processes generally decrease with increasing depth below the surface. For the most part, increased expression of these processes equates to undesirable soil properties such as low (acid) soil reaction (pH) values, low base saturation, dense layers (pans) formed by accumulation of fine soil particles, and/or chemical compounds, etc. Briefly summarized, the data presented in Table 4.2-9 indicate that the effects of weathering and leaching are quite evident in the near-surface (topsoil and subsoil) materials, somewhat evident in the oxidized overburden, and not evident in the unoxidized overburden. Thus, the unoxidized overburden, with its near-neutral pH, high base saturation, and moderate textures, appears to be the 'best available material,' with the exception of one key property, pyritic sulfur content. When exposed to air and water (i.e., weathering), pyritic sulfur oxidizes, often creating acid drainage and/or acidic soils, both of which are undesirable conditions prohibited by both SMCRA and MSMRA. While not as desirable in terms of pH and base saturation, the oxidized overburden does not contain pyritic sulfur and is also superior to the unoxidized overburden in terms of texture. Compared to the topsoil and subsoil, the oxidized overburden is equivalent or superior in terms of all key soil properties. A detailed accounting of these comparisons will be the basis for a proposal (in the surface mining permit application) to use oxidized overburden as a topsoil and subsoil substitute, i.e., the top 4 ft of postmining (reclaimed) soils.

The proposed land reclamation procedure would involve placement and grading of select (oxidized) overburden to the final 4 ft of the reclaimed surface on the approximate original (i.e., premining) contour. Although soil compaction would be minimized through placement of the select overburden as the final step of truck/shovel topsoil substitute removal and placement operations, ripping and other tillage operations would be implemented as necessary. To verify the absence of acid-forming, toxic-forming, and combustible materials and identify any fertilizer and/or soil amendment needs, the reclaimed soils would be sampled and analyzed for the key properties listed in Table 4.2-9, as well as the major plant nutrients (i.e., nitrogen, phosphorus, and potassium). For most grass and legume species, the reclaimed soil layer (upper 6 inches) would be maintained above 6.0 pH. The rooting zone (upper 4 ft) would consist of a balanced mixture of particle sizes (sand, silt, and clay) to optimize important plant growth factors (e.g., cation exchange capacity and moisture movement, storage, and availability).

BMPs such as those described in Subsection 4.2.3.1 would minimize losses by erosion. For establishment of immediate cover, a properly prepared seedbed would be planted to warm-season grasses (e.g., common Bermuda grass) or cool-season grasses (e.g., tall fescue, ryegrass, wheat) depending on the season. As the vegetative cover becomes permanent, perennial legumes (e.g., clovers, lespedeza, and other locally adapted species) would be included to maintain and enhance long-term soil productivity, especially on areas proposed for agricultural postreclamation land uses. Based on the premining land use/and or landowner preferences, seedlings of loblolly pine or other tree species would be planted on reclaimed land designated for forestry, which is the predominant land use in both premining and postreclamation landscape (see Section 3.12 and 4.12)" (NACC, 2009).

Table 4.2-9. Minimum, Maximum, and Weighted Mean Values for Selected Parameters*: Topsoil†, Subsoil‡, Oxidized Overburden§, and Unoxidized Overburden**

		Topsoil	Subsoil	Oxidized Overburden	Unoxidized Overburden
pH (s.u.)	Minimum	4.3	4.3	4.3	5.7
	Maximum	6.6	5.2	5.8	7.1
	Weighted mean	4.8	4.6	4.9	6.5
Sand content (percent)	Minimum	17.0	10.3	11.3	27.3
	Maximum	57.0	63.0	76.9	59.0
	Weighted mean	34.1	34.2	42.7	39.8
Clay content (percent)	Minimum	15.0	13.7	8.2	10.9
	Maximum	53.0	56.0	40.5	24.7
	Weighted mean	30.1	31.3	24.8	19.0
Acid-base accounting††	Minimum	-4.0	-6.0	-4.7	-9.1
	Maximum	52.0	-0.3	10.4	9.3
	Weighted mean	1.4	-2.9	-0.8	1.0
Pyritic sulfur (percent)	Minimum	0.0	0.0	0.0	0.1
	Maximum	0.0	0.0	0.0	0.5
	Weighted mean	0.0	0.0	0.0	0.3
Base saturation (percent)	Minimum	31.0	20.7	38.2	74.3
	Maximum	100.0	89.0	86.3	99.8
	Weighted mean	60.3	43.0	64.6	93.0
Cadmium (ppm)	Minimum	0.0	0.0	0.0	0.0
	Maximum	0.2	0.5	0.2	0.4
	Weighted mean	0.1	0.1	0.1	0.2
Selenium (ppm)	Minimum	0.2	0.2	0.0	0.4
	Maximum	1.4	1.1	0.7	0.9
	Weighted mean	0.6	0.6	0.4	0.6

*Based on data from 18 continuous cores (surface to 10 ft below lowest mineable seam) collected throughout the mine study area and analyzed by Energy Laboratories, Inc., College Station, Texas.
†As represented by the 0- to 1-ft interval of 18 continuous cores collected throughout the mine study area.
‡As represented by weighted means of data from 1 to 4 ft for each of the 18 continuous cores collected throughout the mine study area.
§As represented by weighted means of data from the oxidized interval (surface to base of oxidation) for each of the 18 continuous cores collected throughout the mine study area.
**As represented by weighted means of data from the unoxidized interval (base of oxidation to total depth) for each of the 18 continuous cores collected throughout the mine study area.
††Tons of $CaCO_3$ per 1,000 tons.

Source: NACC, 2009.

Under this proposed soil substitution alternative, the existing topsoil and subsoil would be comingled with oxidized overburden during the overburden removal step in the lignite extraction process. It would become part of the topsoil and subsoil substitute proposed by NACC.

Within areas of upland soils to be mined, DOE concludes the proposed use of oxidized overburden would be a reasonably similar and practical substitute for the premining surface soils. The physical and chemical characteristics are comparable. The use of fertilizer, lime, and tillage; recontouring the land to optimally stabilize slopes; and revegetating the graded surfaces quickly are management procedures that would be needed to ensure successful reclamation.

Most of the prime farmland soils are moderately well drained soils on stream terraces. What makes these soils prime has more to do with the landscape position than any unique biological, chemical, or physical characteristics. DOE concludes the oxidized overburden, placed in a similar landscape configuration, would likely have soil-water conditions similar to the existing soils.

Although impacts to the morphology and composition of these prime farmland soils would be irreversible and permanent, their productivity could be fully replaced (and possibly exceeded) by a comparable acreage of reclaimed land. Historical cropland on prime farmland soils, as defined by MDEQ SMCRA Regulations, is nonexistent within the project area.

Following regulations and guidelines established by the FFPPA (USDA, 1984), a farmland conversion impact rating (Form AD-1006) was prepared for the soils in the project area (Figure 3.5-2 and Table 3.5-1) by a consultant to NACC. Based on the 4,710.2 acres of prime farmland soils in the 31,260-acre project area and local soil resource considerations, a rating of 19 (out of 100) was assigned by the Kemper County NRCS staff for land evaluation criteria, and a score of 77 (out of 160) was estimated for the site assessment, resulting in a total point score of 96 (out of 260) for potential prime farmland conversion impact, which is below the 160-point score USDA threshold requirement for additional project alternatives to be considered (NACC, 2009).

Upon completion of reclamation, soils in the mine study area would be comprised of up to 10,224 acres of oxidized overburden in areas where lignite extraction occurs and up to 2,047 acres of disturbed existing soils in areas occupied by mine support facilities or structures. Open water areas also could be present should NACC and landowners reach agreements to leave sedimentation ponds in place for private recreation and/or water supply purposes. Postreclamation wetland (hydric) soils are addressed in Subsection 4.2.9.

Linear Facilities

As discussed elsewhere, rights-of-way would be graded to natural (or close to natural) contours and would be revegetated. Impacts on soils resulting from operation of the linear facilities would, therefore, be minimal.

4.2.4 SURFACE WATER RESOURCES

Surface water resources would be impacted by project construction and operation directly (e.g., undermining of a surface water body) and indirectly (e.g., deposition of sediments and air pollutants). The characteristics of existing water bodies of particular interest were presented in Section 3.6.

4.2.4.1 Construction

There are three sources of impacts to surface waters that could potentially occur during construction of the various project components:

- Impacts resulting from construction and mining that displace existing surface waters.
- Impacts due to changes in stormwater quantities and/or qualities discharged offsite.
- Impacts due to disturbance of existing wetlands and/or waters of the United States.

The first two listed are addressed in this subsection. The latter are addressed in Subsection 4.2.9.1. All construction activities related to the proposed action would have the potential to deliver sediments from ground disturbances and airborne dust and petroleum products or other contaminants used during construction. These construction related impacts would be minimized or eliminated through implementation of BMPs, an SPCC plan, a stormwater pollution prevention plan (SWPPP), and NPDES discharge permit controls and monitoring.

Power Plant

As discussed previously, plans would be implemented to: (a) characterize and properly handle excavated soils and water from dewatering (if required), and (b) establish effective stormwater quantity and quality controls (SWPPP) as well as SPCC procedures. An SWPPP, including a detailed erosion and sediment control plan, would be prepared in accordance with and consistent with applicable regulatory requirements. The plan would form the basis for ensuring adequate protection of the surrounding surface waters during construction. Essentially, there would be three potential sources of impacts to surface waters during facility construction that would be addressed in the SWPPP:

- Impacts Due to Direct Disturbance of Existing Surface Waters—Some drainage features onsite would be filled or relocated, and stormwater management ponds would be built as part of the initial site work. Modification of drainage features would be done in accordance with stormwater management regulations to minimize adverse impacts to surface waters. The stormwater conveyance/management functions these existing features are providing would be maintained or enhanced by the new stormwater management system.
- Impacts Due to Significant Changes in Stormwater Quantities and/or Qualities Discharged Offsite—Stormwater ponds and sediment control facilities would be developed and installed to accommodate construction activities and achieve an acceptable transition from predevelopment conditions to the final facility stormwater management system. Key construction period controls would include:
  - Existing vegetation would be left in place wherever possible and disturbed soils compacted as necessary to prevent significant erosion.
  - Temporary and permanent swales, sediment control basins, and/or stormwater ponds would be installed as required prior to the initiation of construction (as stated in the general permit and regulations) to ensure adequate stormwater facilities are in place at all times. These facilities would be modified and/or expanded as needed during construction.

  - All temporary and permanent swales would be compacted as required and lined with grass, mulch, and/or staked straw bales to reduce water velocities and promote the settling of suspended sediments.

  The implementation of these plans in accordance with the approved stormwater systems and the application of BMPs would minimize potential impacts to any onsite or nearby offsite surface waters or wetlands during facility construction.

- Impacts Due to Accidental Spills of Onsite Chemicals, Lubricants, or Other Potential Contaminants—SPCC procedures would be developed and strictly followed. These procedures would be designed to minimize the opportunity for accidental spills and ensure that adequate systems were in place to contain any accidental spills.

The implementation of these procedures in accordance with the approved SWPPP and the application of BMPs would minimize potential impacts to any onsite or nearby offsite surface waters during facility construction. Impacts would also be minimized by the lack of surface water features and associated aquatic resources on the power plant site. The site is well drained by multiple ravines containing small ephemeral and intermittent streams that drain to Chickasawhay Creek. Control of construction stormwater runoff and delivery to drainage ravines would minimize impacts of sedimentation in downstream receiving water bodies.

Surface Lignite Mine

Construction required to be completed prior to commencement of mining operations would include assembly of the dragline, construction of the lignite handling plant and mine infrastructure facilities, and developing the water management system for initial mine block A. Construction associated with mine blocks B1 through G is addressed in Subsection 4.2.4.2.

The most prominent water management features would include construction of diversion channel 1A to reroute Chickasawhay Creek and sedimentation ponds SP-2, SP-3, SP-7, and SP-10. Other surface water control structures would include collection channels in active mining areas to route runoff from land disturbed by mining to sedimentation ponds. Minor structures such as berms, roadside ditches, and culverts also would be used within active mining areas to collect and route rainfall runoff into sedimentation ponds (NACC, 2009).

The 1A diversion channel would be designed and sized to safely convey the flows resulting from the 100-year storm event within the banks of the diversion channel to protect adjacent mining areas from flooding. Diversion channel 1A would originate in the southwest quarter of Section 9 and terminate in the northeast quarter of Section 29, both in Township 9 south, Range 14 west. Slopes and vegetative ground cover of diversion channel 1A would meet MDEQ SMCRA Regulations that require nonerosive velocities and adequate freeboard. Ground cover within the channel would include grass and hydrophytic trees that normally volunteer along the diversion channel banks. Trees would be planted to provide a protective canopy over the diversion channel. As explained in Subsection 2.3.2.4, the diversion channel would maintain water flows and quality in Chickasawhay Creek by routing the creek away from mining areas (NACC, 2009).

Design, sizing, and construction of diversion channel 1A as previously described would minimize impacts on the surface water resources downstream in Chickasawhay and Okatibbee Creeks and Okatibbee Lake. The subbasin drainage network within the mine study area and the associated water budget would not change due to the diversion channel. Potential water quality impacts in the form of increased turbidity, lower DO, and increased summer water temperature would be minimized by proper channel design, establishing grass cover in the channel bed and slopes (with sodding providing additional temporary benefits as compared to planting), and planting trees to provide shade over time, respectively.

Construction of the four sedimentation ponds would protect downstream water quality by reducing suspended solids and turbidity in rainfall runoff from mining and facilities areas located upstream of these structures through natural settling, augmented by flocculent additions when necessary. Runoff from active mining and facilities areas generated by storm events of less than 6.5 inches (i.e., the 10-year, 24-hour event) would be detained in accordance with MDEQ SMCRA Regulations. The retained runoff would be discharged from sedimentation ponds as soon as the NPDES permit effluent criteria for TSS are met, usually within a couple of days after the storm has passed. The maximum allowable discharge schedule is 10 days. Runoff from storm events in excess of 6.5 inches does not need to be contained and would pass through the spillways of the sedimentation ponds (NACC, 2009).

The effects attributable to construction of sedimentation ponds SP-2, SP-3, and SP-7 would be to control discharges from three intermittent streams: Tompeat Creek and two unnamed tributaries to Chickasawhay Creek. Approximately 1,350 acres of watershed on the mine study area would be controlled by these three structures, which equates to approximately 1.4 percent of the Okatibbee Lake watershed. No changes to the subbasin watershed acreages or boundaries would occur. Therefore, the principal effects would be changes in the flow patterns of the three streams during and after rainfall events to correspond with the MDEQ SMCRA-required 10-day maximum discharge release schedule. Runoff from storm events greater than 6.5 inches would pass over emergency spillways in the sedimentation ponds. The effects of constructing sedimentation pond SP-10 would be limited to the immediate area, because flow in Chickasawhay Creek would be routed through diversion channel 1A prior to construction of this structure.

In addition, the water budget in the SP-2 and SP-3 watersheds would change through the construction of approximately 300 acres of mine support facilities where lesser evapotranspiration would occur. These areas occupy less than 0.5 percent of the Okatibbee Lake watershed.

Water quality parameters that could be influenced by the surface water management system would include TSS, DO, and temperature, with TSS and DO controllable through pond and spillway designs. The likelihood of releases of pollutants due to spills (e.g., diesel fuel) during construction would be lessened by the MDEQ SMCRA requirement to prepare and implement an SPCC plan.

Separately, mine dewatering activities described subsequently in Subsection 4.2.5.1 would contribute flow to the surface water system. The average annual flow increase would be less than 2 cfs, or approximately 1 percent of the average flow into Okatibbee Lake.

Linear Facilities

As with the construction of the facilities on the power plant site, detailed erosion and sediment control plans, including SWPPP and BMPs, would be prepared to address stormwater and sediment control during construction of the transmission lines and pipelines. These plans would form the basis for ensuring adequate protection of the surface waters that would be intersected or nearby during construction.

Direct impacts to surface waters would be avoided or minimized by various measures. In the case of transmission lines, designs could allow for spanning intersected surface waters. In the case of the pipelines, construction methods could be used to install the pipes beneath streams, thereby avoiding construction in the streams themselves. Construction of the reclaimed effluent, natural gas, and CO_2 pipelines would potentially cause temporary direct impacts to streams that they cross. Impacts would vary depending on the construction method ultimately selected and approved. For most ephemeral and intermittent streams, the impacts would be short-termed and minimal. Open-cut trenching of ephemeral and intermittent streams would have the least impact if conducted during periods of low- or no-flow. Any time flow was present, sedimentation BMPs would be used to reduce transport of sediment downstream. For perennial streams, open-cut trenching might not be feasible, depending on the size of the stream. Open-cut trenching in perennial streams could cause extensive downstream sedimentation, which would be more difficult to control. Other crossing methods, such as jack-and-bore and directional drilling, would have less impact on perennial streams. Permit conditions should specify use of applicable construction BMPs and require restoration to preexisting conditions. Permit conditions could also require crossing methods other than open-cut trenching in perennial streams, or otherwise sensitive streams, to reduce impacts from linear facility construction.

Impacts associated with construction of electric transmission lines would result from clearing of vegetation, particularly shrubs and trees, from the riparian corridor and streambanks, and from physical crossings necessary to move equipment and materials along the corridors during construction. Heavy equipment operated in the riparian corridor could permanently alter the stream channel, riparian wetlands, topography, and flow paths. Such impacts would be detrimental to stream function and could be long-term. However, such impacts could be avoided or minimized by using proper crossing BMPs. Using temporary, stable crossings, properly constructed and removed, impacts would be temporary and minimal. Uncontrolled sedimentation resulting from excavation and grading in the riparian corridor could have long-term effects on habitat and biota downstream of the crossings. Appropriate soil erosion and sedimentation control BMPs would minimize impacts to surface waters during construction of the linear facilities.

Vegetation (especially trees and shrubs) removal within the riparian corridors of streams could potentially result in impacts on stream ecology. Tree and shrub removal would increase water temperature, decrease organic matter input, and increase sediment loading. Removal of trees and shrubs from streambanks could also lead to streambank erosion. The impacts of vegetation removal during construction on surface waters could be reduced by leaving some woody vegetation on streambanks.

4.2.4.2 Operation

The power plant and linear facilities should have minimal direct impacts on surface waters during operation. The surface lignite mine would have greater direct impacts on streams during operation due to active mining of the channels and associated channelization and diversion of flow. The degree of impacts would vary based on the active area of mining and number of diversions, total length of streams impacted, and length of channelization required at any given time.

Power Plant

The plant would be a zero-discharge facility with no cooling tower blowdown or other process wastewater discharges offsite. The only discharge from the power plant site would be stormwater runoff. Permitting and technology-based NPDES controls for stormwater discharges would be adequate to protect receiving waters. The facility would be operated under an NPDES general permit and an SWPPP in accordance with NPDES requirements.

Operation of the power plant would have other impacts to surface waters. These would include indirect impacts caused by deposition of air pollutants and impacts associated with the use of reclaimed effluent from the Meridian wastewater treatment system.

O&M of stormwater management facilities on the power plant site in accordance with the operational procedures and design elements would ensure that stormwater quality and quantities would be maintained within approved regulatory limits designed to minimize impacts to the site and surrounding waters during operations. All stormwater management facilities and operational characteristics would comply with applicable stormwater management regulations. The primary goals under these regulations would be to implement stormwater measures that would provide the recharge, water quality, and channel protection in accordance with the applicable design criteria. Additionally, storm drain conveyance systems would also be installed to safely and adequately convey the required design storm events through the property. The combination of these measures would be designed to minimize stream channel erosion, pollution, siltation, and sedimentation during plant operation. The potential sources of impacts to surface waters during facility operations would include:

- Potential Impacts Due to Direct Discharge of Process Effluents—Process effluents generated by facility operations would be managed onsite, as described in Subsection 2.6.2. Because there would be no direct discharge of process wastewater to any surrounding surface waters, there would be no surface water impacts associated with the direct discharge of any process waters during facility operations.
- Potential Impacts Due to Changes in Stormwater Quantities and/or Qualities Discharged Offsite—The facility would include stormwater management designed and installed to ensure that the water quality volume, ground water recharge, and channel protection volume would all be provided for in approved stormwater facilities, and that safe and adequate conveyance systems are provided for handling of larger storm events within approved limits. O&M procedures designed to ensure the continued effectiveness of this system would be established and strictly followed. Based on the installation of a sound stormwater management system and proper O&M of these facilities, impacts to any surrounding surface waters as a result of facility operations would be minimized.
- Potential Impacts Due to Accidental Spills of Onsite Chemicals, Lubricants, or Other Potential Contaminants—The facility would be designed to include spill containment and control features as developed under the overall SPCC plan. Properly followed, these procedures would be designed to minimize the opportunity for accidental spills and identify the appropriate procedures to be followed in case of an accidental spill.

As discussed in Subsection 4.2.1.2, some portion of the emissions of mercury from the IGCC stacks would deposit to the ground surface and could potentially make its way to surface waters. However, power plant mercury emissions would be minimized by control equipment. The maximum total deposition is predicted to be less than 12 percent of the total ambient deposition measured at a site in Florida (see Subsection 4.2.19.2). Also, the maximum wet deposition is predicted to be approximately 2 percent of the measured wet deposition at a site in Mississippi. Therefore, it is reasonable to conclude that the project would not contribute substantially to surface water mercury concentrations in the vicinity of the site.

The power plant would make use of reclaimed effluent from two Meridian POTWs to satisfy cooling and other plant water needs. Use of wastewater from the POTWs would reduce flows in Sowashee Creek, a tributary of Okatibbee Creek with its confluence located downstream of Okatibbee Lake. Sowashee Creek is impaired due to pathogens and biological impairments. It is currently on the 303(d) list for not meeting the Aquatic Life Support designated use, and is part of the Fecal Colifrom TMDL for Okatibbee Creek. Showashee Creek is impaired due to wastewater discharges and urban runoff. Removing a source of pollutants and stressors by routing a portion of the Meridian POTW effluent to the IGCC facility should improve the water quality of Sowashee Creek downstream of Meridian. It should also improve the water quality of Okatibbee Creek downstream of the Sowashee Creek confluence.

The mean effluent discharge rate for the period 1996 through 2008 was 10.67 cfs. Table 4.2-10 provides the historical effluent discharge rates for this same period by month and year (MDEQ, 2009). Sowashee Creek flows for roughly the same period (1998 to 2008) are provided for comparison in Table 4.2-11. Sowashee Creek flow data are provided by the USGS gauging station at Meridian (#02476500). USGS gage 02476500 is located upstream of the main Meridian POTW. Based on the averages in Table 4.2-11, the flow in Sowashee Creek upstream of the POTW is at times less than the discharge rate of the POTW effluent. For example, for September of 2006 the mean monthly average discharge was 2.77 cfs. At times, the POTW effluent discharge rate has exceeded the upstream discharge of Sowashee Creek. Therefore, the POTW effluent dominates the flow volume during low-flow conditions.

The existing 7Q10 flow for Sowashee Creek is 0.5 cfs (Telis, 1991). The 7Q10 flow is based on discharge data collected during the 1951 through 1986 climatic years (*ibid*). The data were obtained from USGS gauging station 02476500 upstream of the main Meridian POTW. The smaller East Meridian POTW was not yet in operation as of 1986. Therefore, the POTW effluent did not contribute to the 7Q10 flow. Given that the POTW increases the discharge of Sowashee Creek above background, reducing the effluent volume would not decrease the 7Q10 flow reported by Telis.

Table 4.2-10. Meridian WWTP Monthly Average Effluent Discharge (cfs)—1996 to 2008

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
2008	9.59	13.17	10.86	10.32	9.93	9.33	8.31	9.45	8.51	6.27	5.62	9.22	9.22
2007	11.82	11.05	8.96	8.88	9.05	8.73	10.20	8.80	8.77	8.06	6.81	7.07	9.02
2006	10.38	12.61	13.04	10.57	12.41	8.90	8.34	8.68	8.23	9.35	8.02	8.49	9.92
2005	10.38	11.84	16.56	17.04	11.40	12.38	15.89	10.83	13.69	9.35	8.02	8.49	12.16
2004	12.18	14.30	12.50	5.96	8.85	11.26	10.66	13.68	10.57	11.51	15.19	13.31	11.66
2003	10.99	13.63	14.58	14.48	14.89	14.90	15.67	13.48	11.22	10.58	10.40	10.66	12.96
2002	12.86	12.77	13.59	11.19	9.86	9.41	10.86	10.24	10.55	14.19	14.10	13.57	11.93
2001	11.54	12.15	15.60	13.91	10.86	13.37	10.23	10.80	15.58	10.69	9.50	12.70	12.24
2000	8.53	8.73	9.25	11.47	9.04	9.38	9.79	9.59	9.01	8.12	8.91	8.67	9.21
1999	10.68	11.88	12.49	10.97	9.07	10.04	10.04	9.69	8.67				10.39
1998	11.73	12.77	11.45	12.63	10.55	10.68	10.69	9.84	9.35	8.68	8.56	8.85	10.48
1997	9.59	10.75	10.86	9.64	9.62	10.26	10.44	9.92	8.19	8.00	9.02	9.33	9.64
1996	9.76	8.76	10.72	11.88	10.52	10.07	10.23	10.54	9.62	8.79	9.10	8.26	9.86

Source: MDEQ, 2009

Table 4.2-11. Sowashee Creek Mean Monthly Discharge Data for the Period 1998 through 2008 from USGS Gauging Station 02476500

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg
1998	350.9	131.3	115	77.2	13.5	28.6	25.7	8.69	3.53	3.61	12.6	16.4	66
1999	104	75.5	139.7	31.1	5.95	9.33	15.9	3.26	4.45	17.6	2.98	10	35
2000	19.3	11.1	26.2	64.7	6.39	4.88	0.965	2.07	1.73	1.25	11.4	15.2	14
2001	64.2	71.4	167.7	101.8	18.1	87.8	9.33	32.7	78.7	82.4	150	200.9	89
2002	177.1	124.3	144.4	50.5	12.2	9.58	17.5	2.52	90.1	131.3	73.5	221.5	88
2003	95.3	261.8	160.7	594.3	97.9	101.8	156.2	52.9	11.6	52.8	77.9	59.4	144
2004	93.5	308.8	98.5	25.1	61.9	87.3	108.5	29.5	30.9	61.2	270	152	111
2005	89.4	251.9	180.1	254	32.4	102.5	154.8	85	48.7	10.7	12.6	35.3	105
2006	97.5	215.6	164.1	35.5	116.1	7.78	3.25	2.57	2.77	10.1	8.83	34.8	58
2007	46.7	39	14.1	10.8	5.37	4.47	30	3.87	4.42	10.6	8.26	20.7	17
2008	44.4	224.2	64.7	45.3	67.9	48	26.2	150.6	26.6				
Avg	107	156	116	117	40	45	50	34	28	38	63	77	

Source: MDEQ, 2009.

Surface Lignite Mine

Operation of the lignite mine would remove and replace stream segments, change the overall water budget of the mine study area, change flow patterns in certain streams, and change onsite and downstream surface water quality. The following subsections describe these changes.

Stream Channel Removal and Replacement

The conceptual mine plan presented in Subsection 2.4.2 would result in the removal of 56.5 miles of existing stream channel, of which 24.25 miles is classified as perennial and 31.9 miles is classified as intermittent or ephemeral (NACC, 2009). Final determination of the stream channel segments and lengths to be removed, if any, would be made by USACE during its evaluation of NACC's CWA Section 404 permit evaluation and MDEQ during its mine permit application. Similarly, USACE and MDEQ would divide the type and amount of stream channel establishment in the reclaimed landscape necessary to mitigate for the removal of existing stream channels approved by either agency. Subsection 2.4.2.2 discusses these requirements. Subsections 4.2.7 through 4.2.9 address the effects of stream removal on the aquatic ecosystems, floodplains, and wetlands, respectively.

Hydrologically, stream channel removal creates the need for alternate routing of surface water flows across the mine study area. The conceptual mine plan proposes two methods: diversion channels and sedimentation ponds for collection, treatment, and discharge. Table 2.4-1 and Figures 2.4-2a through 2.4-2g identified and illustrated the locations of the proposed diversion channels, which would divert upstream flows in Chickasawhay, Penders, and unnamed creek channels. Tompeat and Bales Creeks, as well as flows in all intermittent and ephemeral channels, would be routed into sedimentation ponds for treatment and discharge using collection channels within active mining areas. Subsection 4.2.4.1 addresses the effects of diversion channels and the collection, treatment, and discharge flow routing methods.

Stream Flow Patterns

Stream flow patterns would change due to the presence of sedimentation ponds SP-7, SP-8, and SP-9. In addition, the collection of stormwater runoff and treatment in these and all other sedimentation ponds will affect stream flow rates during mining.

Modeling done by Tetra Tech, a consultant to NACC, provided estimated responses of the watersheds for the different periods of the mining operations depicted in Figures 2.4-2a through 2.4-2g. Rainfall runoff simulations were performed for 24-hour storm events with return periods of 2, 10, 25, 50, and 100 years. Simulations were performed using the USACE Hydrologic Engineering Center's HMS model (Version 3.3). Tables 4.2-12 through 4.2-18 present their results at evaluation points located on the named creeks at the downstream mine boundary, respectively. Figure 3.6-2 shows the location of the points where watershed modeling results are reported. The modeling is based on the conceptual mine plan presented in Subsection 2.4.2. Changes in the mine plan or in the postreclamation land uses or conditions would result in changes to the estimates provided.

Table 4.2-12. Storm Event Runoff Comparison—Mine Block A

Storm event (year)	2	10	25	50	100
Chickasawhay Creek					
Rainfall depth (inches)	4.4	6.5	7.3	8.1	8.9
Mining peak runoff (cfs)	4,366	8,985	11,958	14,163	15,972
Premining peak runoff (cfs)	4,755	10,020	12,146	14,328	16,503
Change (%)	-8.2	10.3	-1.5	-1.2	-3.2
Mining runoff volume (ac-ft)	3,711	7,088	9,073	10,551	12,057
Premining runoff volume (ac-ft)	3,554	7,059	8,477	9,933	11,420
Change (%)	+4.4	+0.4	+7.0	+1.7	+5.6
Tompeat Creek					
Rainfall depth (inches)	4.4	6.5	7.3	8.1	8.9
Mining peak runoff (cfs)	464	941	1,345	1,623	1,909
Premining peak runoff (cfs)	688	1,401	1,687	1,980	2,278
Change (%)	-32.6	-32.8	-20.3	-18.0	-16.2
Mining runoff volume (ac-ft)	240.2	479.9	831.7	973.6	1,118
Premining runoff volume (ac-ft)	353	695	834	976	1,121
Change (%)	-32.0	-30.9	-0.3	-0.2	-0.3

Source: NACC, 2009.

Table 4.2-13. Storm Event Runoff Comparison—Mine Blocks B and C

Storm event (year)	2	10	25	50	100
Chickasawhay Creek					
Mining peak runoff (cfs)	3,993	8,315	10,063	11,868	13,675
Premining peak runoff (cfs)	4,755	10,020	12,146	14,328	16,503
Change (%)	-16.0	-17.0	-17.1	-17.2	-17.1
Mining runoff volume (ac-ft)	3,085	6,122	7,435	8,887	10,379
Premining runoff volume (ac-ft)	3,554	7,059	8,477	9,933	11,420
Change (%)	-13.2	-13.3	-12.3	-10.5	-9.1
Tompeat Creek					
Mining peak runoff (cfs)	223	438	523	786	1,240
Premining peak runoff (cfs)	688	1,401	1,687	1,980	2,278
Change (%)	-67.6	-68.7	-69.0	-60.3	-45.6
Mining runoff volume (ac-ft)	34	112	278	436	574
Premining runoff volume (ac-ft)	353	695	834	976	1,121
Change (%)	-90.4	-82.4	-66.7	-55.3	-48.8
Bales Creek					
Mining peak runoff (cfs)	653	1,336	1,611	1,891	2,379
Premining peak runoff (cfs)	1,018	2,086	2,517	2,959	3,408
Change (%)	-35.9	-36.0	-36.0	-36.1	-30.2
Mining runoff volume (ac-ft)	321	689	917	1,149	1,384
Premining runoff volume (ac-ft)	544	1,076	1,292	1,513	1,739
Change (%)	-41.0	-36.0	-29.0	-24.1	-20.4

Source: NACC, 2009.

Table 4.2-14. Storm Event Runoff Comparison—Mine Blocks C and D

Storm event (year)	2	10	25	50	100
Chickasawhay Creek					
Mining peak runoff (cfs)	3,810	8,109	9,889	11,715	13,551
Premining peak runoff (cfs)	4,755	10,020	12,146	14,328	16,503
Change (%)	-19.9	-20.0	-18.6	-18.2	-17.9
Mining runoff volume (ac-ft)	3,080	6,117	7,347	8,655	10,118
Premining runoff volume (ac-ft)	3,554	7,089	8,477	9,933	11,420
Change (%)	-13.3	-13.7	-13.3	-12.9	-11.4
Tompeat Creek					
Mining peak runoff (cfs)	223	438	523	610	697
Premining peak runoff (cfs)	688	1,401	1,687	1,980	2,278
Change (%)	-67.6	-68.7	-69.0	-69.2	-69.4
Mining runoff volume (ac-ft)	34	65	77	224	376
Premining runoff volume (ac-ft)	353	695	834	976	1,121
Change (%)	-90.4	-90.6	-90.8	-77.0	-66.5
Bales Creek					
Mining peak runoff (cfs)	948	1,924	1,611	1,891	2,178
Premining peak runoff (cfs)	1,018	2,086	2,517	2,959	3,408
Change (%)	-6.9	-7.8	-36.0	-36.1	-36.1
Mining runoff volume (ac-ft)	382	750	798	1,025	1,256
Premining runoff volume (ac-ft)	544	1,076	1,292	1,513	1,739
Change (%)	-29.8	-30.3	-38.2	-32.3	-27.8

Source: NACC, 2009.

Table 4.2-15. Storm Event Runoff Comparison—Mine Blocks C, D, and E

Storm event (year)	2	10	25	50	100
Okatibbee Creek					
Mining peak runoff (cfs)	4,782	9,545	11,470	13,444	15,537
Premining peak runoff (cfs)	4,819	9,728	11,717	13,758	15,804
Change (%)	-0.8	-1.9	-2.1	-2.3	-1.7
Mining runoff volume (ac-ft)	5,064	9,948	11,898	13,941	16,069
Premining runoff volume (ac-ft)	5,119	10,136	12,163	14,242	16,362
Change (%)	-1.1	-1.9	-2.2	-2.1	-1.8
Chickasawhay Creek					
Mining peak runoff (cfs)	3,810	8,109	9,889	11,715	13,551
Premining peak runoff (cfs)	4,755	10,020	12,146	14,328	16,503
Change (%)	-19.9	-20.0	-18.6	-18.2	-17.9
Mining runoff volume (ac-ft)	3,080	6,117	7,347	8,664	10,118
Premining runoff volume (ac-ft)	3,554	7,059	8,477	9,933	11,420
Change (%)	-13.3	-13.7	-13.3	-12.9	-11.4
Tompeat Creek					
Mining peak runoff (cfs)	223	438	523	610	697
Premining peak runoff (cfs)	688	1,401	1,687	1,980	2,278
Change (%)	-67.6	-68.7	-69.0	-69.2	-69.4
Mining runoff volume (ac-ft)	34	65	77	224	376
Premining runoff volume (ac-ft)	353	695	834	976	1,121
Change (%)	-90.4	-90.6	-90.8	-77.0	66.5
Bales Creek					
Mining peak runoff (cfs)	653	1,336	1,611	1,891	2,178
Premining peak runoff (cfs)	1,018	2,086	2,517	2,959	3,408
Change (%)	-35.9	-36.0	-36.0	-36.1	-36.1
Mining runoff volume (ac-ft)	321	635	798	1,025	1,256
Premining runoff volume (ac-ft)	544	1,076	1,292	1,513	1,739
Change (%)	-41.0	-41.0	-38.2	-32.3	-27.8

Source: NACC, 2009.

Table 4.2-16. Storm Event Runoff Comparison—Mine Blocks D, E, and F

Storm event (year)	2	10	25	50	100
Okatibbee Creek					
Mining peak runoff (cfs)	4,782	9,545	11,794	13,812	15,868
Premining peak runoff (cfs)	4,819	9,728	11,717	13,758	15,840
Change (%)	-0.1	-1.8	-0.1	0	0
Mining runoff volume (ac-ft)	5,064	9,933	12,430	14,523	16,657
Premining runoff volume (ac-ft)	5,119	10,136	12,163	14,242	16,362
Change (%)	-1.1	-2.0	+2.2	+0.6	+1.8
Chickasawhay Creek					
Mining peak runoff (cfs)	4,386	9,149	12,110	14,279	16,452
Premining peak runoff (cfs)	4,755	10,020	12,146	14,328	16,503
Change (%)	-7.8	-8.7	-0.3	-0.3	-0.3
Mining runoff volume (ac-ft)	3,215	6,386	8,435	9,881	11,358
Premining runoff volume (ac-ft)	3,554	7,059	8,477	9,933	11,420
Change (%)	-9.5	-9.5	-0.5	-0.5	0.5
Tompeat Creek					
Mining peak runoff (cfs)	688	1,401	1,687	1,980	2,278
Premining peak runoff (cfs)	688	1,401	1,687	1,980	2,278
Change (%)	0	0	0	0	0
Mining runoff volume (ac-ft)	353	695	834	976	1,121
Premining runoff volume (ac-ft)	353	695	834	976	1,121
Change (%)	0	0	0	0	0
Bales Creek					
Mining peak runoff (cfs)	1,018	2,086	2,517	2,959	3,408
Premining peak runoff (cfs)	1,018	2,086	2,517	2,959	3,408
Change (%)	0	0	0	0	0
Mining runoff volume (ac-ft)	544	1,076	1,292	1,513	1,739
Premining runoff volume (ac-ft)	544	1,076	1,292	1,513	1,739
Change (%)	0	0	0	0	0

Source: NACC, 2009.

Table 4.2-17. Storm Event Runoff Comparison—Mine Block G

Storm event (year)	2	10	25	50	100
Okatibbee Creek					
Mining peak runoff (cfs)	4,819	9,625	11,834	13,863	15,931
Premining peak runoff (cfs)	4,819	9,728	11,717	13,758	15,840
Change (%)	0	-1.6	+1.0	+0.76	+0.6
Mining runoff volume (ac-ft)	5,066	9,961	12,414	14,509	16,644
Premining runoff volume (ac-ft)	5,119	10,136	12,163	14,242	16,362
Change (%)	-1.0	-1.7	+2.0	+1.9	+1.7
Chickasawhay Creek					
Mining peak runoff (cfs)	3,237	6,660	12,246	14,509	16,809
Premining peak runoff (cfs)	4,755	10,020	12,146	14,328	16,503
Change (%)	-31.9	-33.54	+0.8	+1.3	+1.9
Mining runoff volume (ac-ft)	2,693	5,372	8,695	10,152	11,638
Premining runoff volume (ac-ft)	3,554	7,059	8,477	9,933	11,420
Change (%)	-24.2	-23.9	+2.6	+2.2	+1.9
Tompeat Creek					
Mining peak runoff (cfs)	686	1,398	1,684	1,976	2,274
Premining peak runoff (cfs)	688	1,401	1,687	1,980	2,278
Change (%)	0	0	0	0	0
Mining runoff volume (ac-ft)	351	691	829	970	1,115
Premining runoff volume (ac-ft)	353	695	834	976	1,121
Change (%)	0	0	0	0	0
Bales Creek					
Mining peak runoff (cfs)	1,018	2,086	2,517	2,959	3,408
Premining peak runoff (cfs)	1,018	2,086	2,517	2,959	3,408
Change (%)	0	0	0	0	0
Mining runoff volume (ac-ft)	544	1,076	1,292	1,513	1,739
Premining runoff volume (ac-ft)	544	1,076	1,292	1,513	1,739
Change (%)	0	0	0	0	0

Source: NACC, 2009.

Table 4.2-18. Storm Event Runoff Comparison—After Mining

Storm event (year)	2	10	25	50	100
Okatibbee Creek					
After mining peak runoff (cfs)	4,819	9,778	11,717	13,758	15,840
Premining peak runoff (cfs)	4,819	9,728	11,717	13,758	15,840
Change (%)	0	0	0	0	0
After mining runoff volume (ac-ft)	5,119	10,136	12,163	14,242	16,362
Premining runoff volume (ac-ft)	5,119	10,136	12,163	14,242	16,362
Change (%)	+1.3	+0.9	+0.8	+0.7	+0.6
Chickasawhay Creek					
After mining peak runoff (cfs)	4,755	10,020	12,146	14,328	16,503
Premining peak runoff (cfs)	4,755	10,020	12,146	14,328	16,503
Change (%)	0	0	0	0	0
After mining runoff volume (ac-ft)	3,554	7,059	8,477	9,933	11,420
Premining runoff volume (ac-ft)	3,554	7,059	8,477	9,933	11,420
Change (%)	0	0	0	0	0
Tompeat Creek					
After mining peak runoff (cfs)	688	1,401	1,687	1,980	2,278
Premining peak runoff (cfs)	688	1,401	1,687	1,980	2,278
Change (%)	0	0	0	0	0
After mining runoff volume (ac-ft)	353	695	834	976	1,121
Premining runoff volume (ac-ft)	353	695	834	976	1,121
Change (%)	0	0	0	0	0
Bales Creek					
After mining peak runoff (cfs)	1,018	2,086	2,517	2,959	3,408
Premining peak runoff (cfs)	1,018	2,086	2,517	2,959	3,408
Change (%)	0	0	0	0	0
After mining runoff volume (ac-ft)	544	1,076	1,292	1,513	1,739
Premining runoff volume (ac-ft)	544	1,076	1,292	1,513	1,739
Change (%)	0	0	0	0	0

Source: NACC, 2009.

These estimates illustrate the mine operator's capability to use the flood storage capacity contained in the sedimentation ponds to reduce peak flood responses. Storms of less than 6.5 inches (i.e., the 10-year, 24-hour storm event) could be managed to significantly reduce peak flood flows, with storms of more than 6.5 inches attenuated to a lesser degree.

The postreclamation modeling results shown in Table 4.2-18 demonstrate existing stream flow responses to storm events could be replicated provided the land is specifications used as the model input parameters. These specifications provide the NACC reclamation design team with potential reclamation objectives going forward. Because a site-specific reclamation plan has not been developed, it is not possible to conclude at this time whether stream flow responses to storm events would mimic the conditions specified in the modeling.

Water Quality Changes

Potential surface water quality impacts attributable to the mining operation would include increased sediment loading, acid or toxic mine drainage, and increased concentrations and loadings of metals and dissolved solids in runoff from disturbed and reclaimed areas. MDEQ SMCRA and CWA regulations would require the mine operator to collect runoff from all active mining areas, route these volumes to sedimentation ponds, monitor water quality, and treat the water if necessary prior to discharge. All water discharged would be subject to the technology-based numerical effluent standards contained in 40 CFR 434, Subpart C, for TSS, total iron, total manganese, pH, and settleable solids, as well as aquatic life and water quality-based effluent limitations, pursuant to Section 402 of the federal CWA.

Tetra Tech prepared a mass balance analysis to project changes in water quality using TDS as an indicator parameter. The results of that analysis are presented in Table 4.2-19. Their discussion of these results follows. The use of TDS as the indicator parameter allows assessment of the general water quality effects due to changes in nontoxic pollutants, such as heavy metals that are assessed separately in the following.

Table 4.2-19. Mass Balance Analysis Results—TDS Concentration (mg/L)

Mass Balance Location	Acres of Total Drainage Area	Acres Disturbed by Mining*	Assumed Disturbed TDS†	Assumed Baseline TDS	Estimated Resulting TDS
Okatibbee Creek at SW-12†	40,262	828	500	50	59
Chickasawhay Creek at Penders Creek	21,529	7,553	500	50	207
Tompeat Creek at SW-13	2,464	1,791	500	50	378
Bales Creek at SW-14	3,840	1,020	500	50	169
Cumulative maximum impact	68,095	11,375	500	50	125

*Assuming all mine areas are in disturbed condition.
†Receiving stream segment standard for drinking water

Source: NACC, 2009.

"The TDS concentrations measured at the 14 surface water-monitoring stations from May to October of 2008 varied from 23 to 325 mg/L. For this worst-case assessment, a low value of 50 mg/L was chosen as an indicator of the natural water quality of the local streams. For the water released from sedimentation ponds, a concentration of 500 mg/L was assumed. This value is higher than those values normally observed in outflows from sedimentation ponds at the Red Hills Lignite Mine in Choctaw County, Mississippi, and at other lignite mines in the Gulf Coast Region. At the Red Hills Lignite Mine, concentrations of TDS at the sedimentation ponds has not reached 400 mg/L. The concentration of TDS in the receiving streams, under these scenarios, would increase from the assumed value of 50 mg/to 400 mg/L. Even with the worst-case scenario, the resulting TDS concentrations would fall below monthly average state water quality criteria for Mississippi.

When the total drainage area of the creeks affected by the active mining operations is used in assessing the impact of the mine, the resulting TDS concentration would result in an increase from 50 mg/to 125 mg/L. This increase falls within the normal variations observed under natural conditions. Any small increases in TDS concentration would be further reduced within short distances downstream from the sedimentation ponds due to normal dispersion and dilution processes. Concentrations would approach baseline levels well before the streamflow reached the upper reaches of Lake Okatibbee.

Actual results measured at surface water monitoring stations downstream of the Red Hills Lignite Mine indicate that the TDS concentration lies consistently within the range of 50 to 300 mg/L, although values below 120 mg/L are predominant. Discharge limitations for pH, TSS, total iron, and manganese required by the NPDES permit are within the range of the natural

> *conditions of the local streams. Therefore, compliance with the applicable effluent limitations of the NPDES permit, coupled with the small proportional contribution of actively disturbed mine areas to the cumulative streamflow of the watersheds feeding Lake Okatibbee, would preclude any adverse impacts on the downstream water quality of the streams and of Lake Okatibbee. Monitoring data from the Red Hills Lignite Mine in Choctaw County, Mississippi, indicate that actual TDS concentrations should be much less than those estimated by the worst-case scenario"* (NACC, 2009).

The data presented in Table 4.2-19 project a cumulative maximum impact of drainage from 68,095 acres containing 125 mg/L TDS. The total drainage area addressed in the analysis represents approximately 69 percent of the Okatibbee Lake watershed. Given that MDEQ reported Okatibbee Lake TDS concentrations of 14 to 42 mg/L, the level of TDS in Okatibbee Lake would increase over time. However, Okatibbee Lake TDS levels would remain well below the MDEQ potable water standard of 250 mg/L and the MDEQ aquatic life support standard of 750 mg/L.

With respect to acid-forming or toxic-forming materials (AFM and TFM), Subsection 3.4.3 presents site-specific geochemical analyses that substantiate a low probability of encountering significant acid mine drainage (AMD) or toxic material drainage (TMD). The analyzed overburden materials did not contain AFM or TFM. Further, even if AFM or TFM should be encountered, the MDEQ SMCRA Regulations include specific provisions for preventing and controlling AMD and TMD.

Similarly, Tables 3.4-3, 4.2-9, 4.2-17, and 4.2-23 present site-specific analyses of metals, including lignite leachate test results, and overburden analyses that demonstrate a low probability of elevated heavy metals concentrations or loadings resulting from the mine discharges. Manganese, iron, and aluminum are present in Okatibbee Lake at elevated levels due to erosion and leaching of the natural clay soils upstream; the federal CWA water quality-based effluent limitations would limit concentrations (and loadings) resulting from mine discharges. Monitoring of these parameters in mine effluent and at downstream locations is recommended to confirm these conclusions.

Design and operation of the sedimentation ponds would control the level of settleable solids, TSS, pH, and DO in the mine water discharges. The use of flocculants and pH modifiers (e.g., lime) could be required to meet the technology-based effluent limitations. Spillway and outfall channels would be capable of oxygenating mine discharges.

Nutrient concentrations and loadings in surface water runoff from reclaimed lands would increase during efforts to revegetate mined lands. Use of BMPs, such as soil testing to determine fertilizer requirements, would minimize these effects. Subsection 3.10.2 documents that there are currently limited areas in the mine study area where fertilizers are used. Phosphorus would be the nutrient of concern because monitoring by consultants to the mine operator did not, on average, detect phosphate in existing streams monitored at 14 stations. In contrast, organic and inorganic nitrogen was detected at all 14 locations, in some events at elevated levels. Thus, phosphorus is the nutrient limiting algal production.

Effects on Okatibbee Lake

In summary, flow volumes into Okatibbee Lake would increase during mining due to reduced evapotranspirative losses, mine dewatering, and depressurization (see Subsection 4.2.5.2). Peak flow rates would decrease due to the detention of mine water runoff in the sedimentation ponds. In the postreclamation condition the reclaimed land uses would be the principal determinant of changes in the flows to the lake. Because mining would disturb less than 2 percent of the lake contributing watershed at any given time and the total mine disturbance would be less than 12 percent of the watershed, flow volume changes would be small.

Water quality effects would be limited to TSS, turbidity, and TDS based on the available data. The TDS analysis presented previously indicates an increasing level of TDS in the lake would be measurable but would not cause the lake water to exceed drinking water or aquatic life support criteria. With respect to TSS and turbidity, water currently flowing into the lake from the mine study area is turbid, ranging from 25 to 143 nephelometric turbidity unit (NTU) on average. The numerical TSS effluent limitation imposed by 40 CFR 34, Subpart C, would help to control TSS levels in the lake.

Linear Facilities

Once constructed, the only types of impacts to surface waters that could potentially result from operations of transmission lines and pipeline facilities would be potential impacts from maintenance activities and changes in stormwater quantities and/or qualities discharged offsite.

Operational activities along the linear facility corridors would include equipment maintenance and repairs and vegetation management. Application of BMPs would reduce impacts to streams intersected by the linear corridors. Permanent crossings would be designed and constructed according to regulatory requirements and in a manner that would not prevent fish passage or alter channel hydraulics. Permit conditions could be used to ensure that impacts associated with permitted permanent crossings were minimized.

Continual periodic vegetation maintenance along the corridors would result in permanent impacts to the riparian habitat of streams, resulting in increased water temperatures, decrease in organic matter input, and increased sediment loading. Minimizing the cleared corridor width would reduce impacts, particularly water temperature increases. Maintaining shrubby vegetation on streambanks would reduce the risk of erosion. The project’s linear facilities’ permanent, new ground-level features would be limited (e.g., foundations supporting the new or replacement transmission line structures, minimal aboveground facilities associated with the pipelines). The total horizontal surface area of these foundations and other facilities would be minimal.

4.2.5 GROUND WATER RESOURCES

4.2.5.1 Construction

Power plant and surface lignite mine construction activities potentially affecting ground water resources would include impacts to shallow perched aquifers from site excavation and grading and construction ground water use. Shallow perched aquifers, where present, could be permanently removed or disturbed due to site grading, excavation, and compaction. It is also possible that short-term dewatering activities might be necessary at some locations. Impacts from dewatering would be relatively localized and would not cause long-term impacts to the local ground water resources or to other users of ground water.

Construction of the mining facilities would require intermittent use of ground water from a single well completed in the Lower Wilcox aquifer located near the mine office and shop facilities. The average withdrawal rate during the construction period would be approximately 0.01 MGD (7 gpm), with peak short-term pumping rates of up to 100 gpm. Predicted drawdowns at a distance of 0.5 mile from the supply well would be less than 1 ft for both peak short-term and average long-term use. Similarly, construction of the power plant facilities would also require intermittent use of ground water from a well completed in the Lower Wilcox aquifer to facilitate drilling of deep production wells into the Massive Sand aquifer and for other construction activities. Total pumpage would be expected to average approximately 0.02 MGD (14 gpm), with peak short-term pumping rates of up to 100 gpm. Again, predicted drawdowns at distance of 0.5 mile from the supply well would be less than 1 ft for both peak short-term and average long-term use. The effect of construction ground water use would be limited to insignificant declines in the local potentiometric surface in the Lower Wilcox aquifer. None of the private water supply wells in the project locality would be adversely affected from construction activities.

Construction activities for the various linear facilities (e.g., clearing, grading, shallow excavation, shallow horizontal drilling, potential localized dewatering of trenches, etc.) would not be expected to adversely impact ground water resources or any ground water users. Any effects would be highly localized and short-termed.

4.2.5.2 Operation

Power Plant

Operation of the IGCC power plant could potentially impact ground water resources as a result of direct ground water use, onsite management of solid wastes, and spills.

Ground Water Use

Ground water from the shallower Lower Wilcox aquifer using two or more onsite wells would be the water source for potable uses. The potable water demands (an estimated 3,000 gpd) would be low, such that no impacts would occur to the aquifer or other ground water users.

Reclaimed effluent from two Meridian POTWs would constitute the main supply of water for cooling and other process uses at the generating facility (see Subsection 2.5.2). Use of reclaimed water would minimize the withdrawal and consumption of Massive Sand aquifer ground water. However, in the event that sufficient quantities of reclaimed water were not available, up to 1 MGD of ground water would be pumped from an onsite well field to supply cooling water. The well field would consist of two wells screened in the Massive Sand aquifer of the Tuscaloosa Group. At the power plant site, the Massive Sand is approximately 290 ft thick at a depth of approximately 3,360 ft bls, as further described in Subsection 3.7.3.

Ground water flow modeling was performed to facilitate evaluation of potential impacts from the withdrawal of 1 MGD of ground water from the Massive Sand aquifer. The quasi three-dimensional Modular Three-Dimensional Finite Difference Ground Water Flow Model (MODFLOW), developed at USGS by McDonald and Harbaugh (1988, 1996), was applied for this ground water modeling exercise; the model was created using Groundwater Vistas software. The model was based on a 34,960-mi^2 area in northeastern Mississippi that was previously modeled by Eric W. Strom of USGS (Strom, 1998), as described in the USGS WRIR 98-4171 (i.e., the Strom Model).

ECT obtained a copy of the original Strom Model MODFLOW files, which were used as the base for an *expanded* model. The Strom Model is constructed with six layers, each layer representing a regional aquifer, as follows: layer 1 is the Coffee Sand aquifer; layer 2 is the Eutaw-McShan aquifer; layer 3 is the Gordo aquifer; layer 4 is the Coker aquifer; layer 5 is the Massive Sand aquifer; and layer 6 is the Lower Cretaceous aquifer. In the extreme northeastern corner of Mississippi, layers 4 and 5 of the Strom Model represent the Iowa aquifer and the Devonian aquifer, respectively; the Coker and Massive Sand aquifers do not extend to that area.

The boundaries for each aquifer/model layer are defined by both the depositional extent of the aquifer and by the location of the freshwater-saltwater interface in the aquifer, which is defined by Strom as a TDS concentration of 10,000 mg/L (see Subsection 3.7.1). The freshwater-saltwater interface represents no-flow lateral boundaries in the Strom Model for all of the aquifers/layers; all model cells located beyond the no-flow boundaries are inactive. However, the proposed well field for the power plant would be located approximately 4 miles south of (beyond) the published freshwater-saltwater interface for the Massive Sand aquifer (layer 5) and, thus, would be situated in an inactive portion of layer 5 in the Strom Model. Therefore, for the expanded model boundaries, it was necessary to modify the Strom Model by extending layer 5 (the Massive Sand aquifer) further to the southwest, as shown in Figure 4.2-1. No other changes were made to model boundaries or cell input parameters relative to the Strom Model.

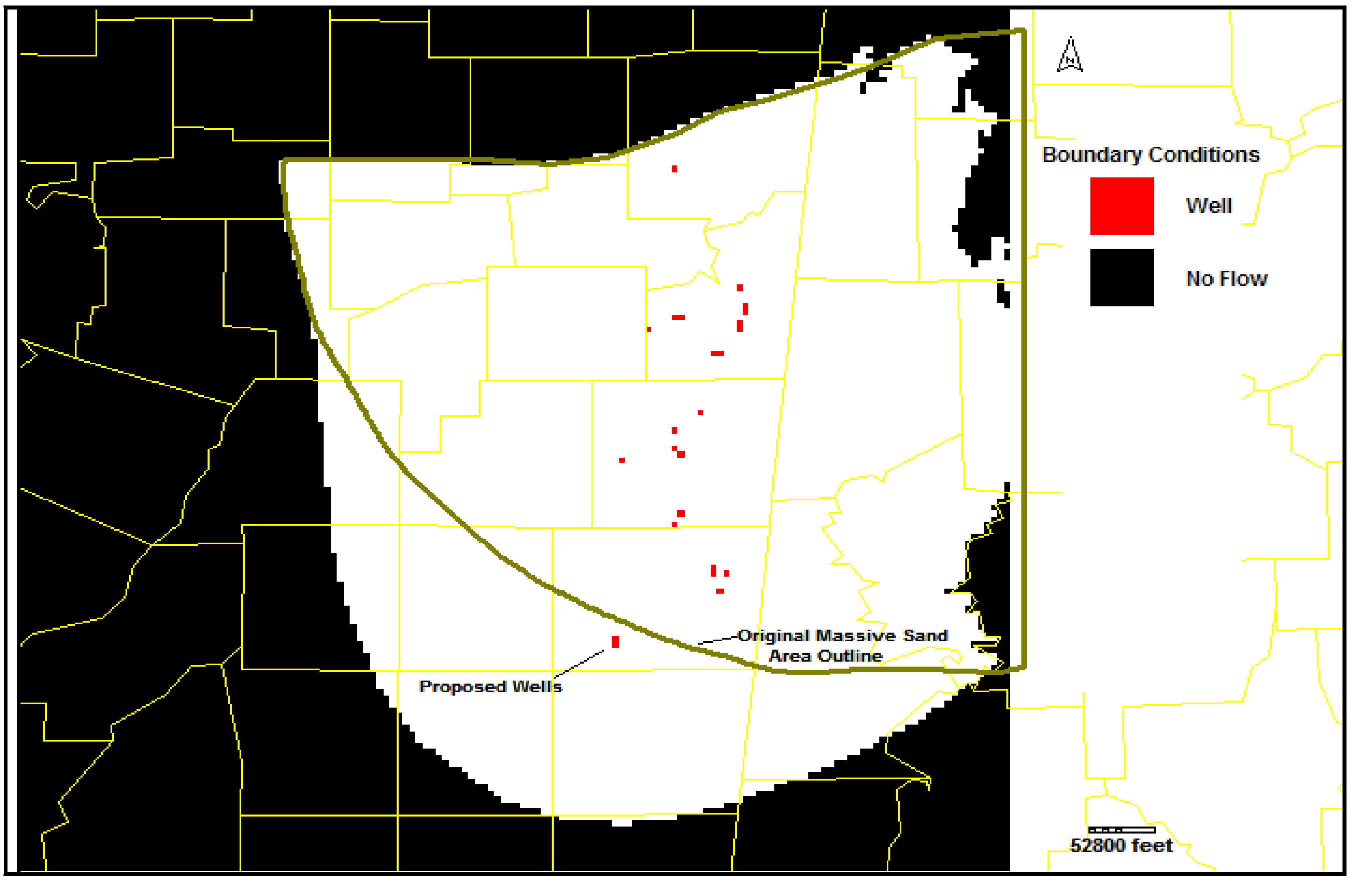

Figure 4.2-1. Massive Sand (Layer 5) Active Cell Extension toward the Southwest over the Site Proposed Wells Located Southwest of the Saltwater-Freshwater Interface

Sources: Strom USGS, 1998. ECT, 2009 Strom_transexp_V5b2.gvw.

Strom's calibrated transient model includes pumping stresses for numerous wells through 1995, which is the last year modeled by Strom. The expanded model continued the 1995 pumping stresses forward in time (1996 through 2010) and then added a constant 1-MGD ground water withdrawal from the Massive Sand aquifer at the power plant site for a 40-year period. As such, the expanded model was used to simulate the effects of the proposed 1-MGD ground water withdrawal over the projected 40-year life of the facility. A more detailed description of the expanded ground water model is provided in Appendix O.

Figure 4.2-2 depicts the potentiometric surface drawdown estimated in the Massive Sand aquifer after 40 years of constantly pumping at the 1-MGD rate. The estimated drawdowns are widespread, yet of a low magnitude. The expanded model estimated approximately 6 ft of drawdown at the nearest existing user of the Massive Sand aquifer, which is located approximately 9.5 miles northeast of the proposed power plant in the town of De Kalb. The MDEQ water well database (MDEQ, 2008a) suggests that several wells using the Massive Sand aquifer exist near the towns of Electric Mills and Scooba. Three of those wells are owned by the town of Scooba, and two are owned by the Potterville Water Association, which suggests that all five of these Massive Sand wells are used for public supply. Those wells are located approximately 21 to 22 miles east-northeast of the power plant site. Less than 5 ft of drawdown is predicted in the Massive Sand (layer 5) at those well locations. These estimated drawdowns (6 ft or less) would not be expected to cause any adverse impact to the existing users of the Massive Sand aquifer, as this small change in static head in deep wells would result in no measurable change in pump performance or power requirements.

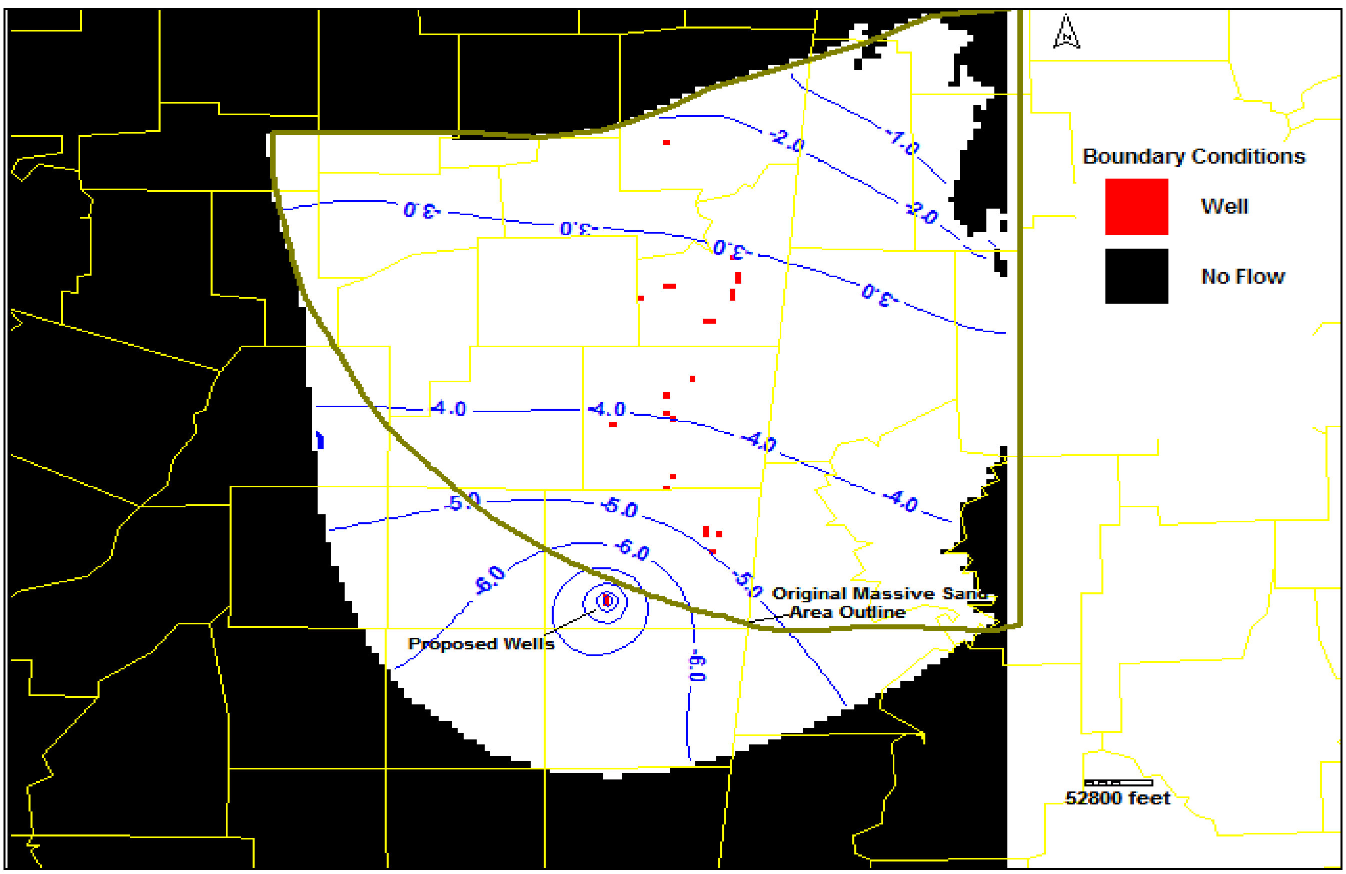

Figure 4.2-2. Predicted Drawdown in the Massive Sand (Layer 5) at the End of 40 Years of Pumping Based on 1.0 MGD Total Withdrawal from the Massive Sand

Sources: Strom USGS, 1998. ECT, 2009 Strom_Transexp_V5b2.gvw.

Smaller drawdowns would occur in the underlying and overlying aquifers; the expanded model estimates for maximum drawdowns were 3.5 ft or less in the underlying Lower Cretaceous aquifer (layer 6), 3 ft or less in the overlying Coker aquifer (layer 4), and 1.5 ft or less in the shallower Gordo and Eutaw-McShan aquifers (layers 3 and 2, respectively). The MDEQ water well database (MDEQ, 2008a) suggests that, within 20 miles of the power plant site, no existing users of the water are present in the overlying Coker aquifer or the underlying Lower Cretaceous aquifer. The withdrawal of 1 MGD of ground water from the Massive Sand aquifer would not cause any adverse impact to existing users of the water from the various underlying and overlying aquifers.

The shallower Lower Wilcox aquifer is not included in the Strom Model or the expanded model. The base of the Lower Wilcox aquifer is separated from the top of the Eutaw-McShan aquifer by more than 1,400 ft of sediments that form an effective confining unit (see Table 3.7-8). No measurable drawdown would occur in the Lower Wilcox aquifer from the proposed withdrawal of 1 MGD of ground water from the Massive Sand. Accordingly, there is no potential for any impact to the even shallower surface features (e.g., wetlands, streams, etc.) from the proposed withdrawal of 1 MGD of ground water from the Massive Sand aquifer. Similarly, that withdrawal would not be expected to have any measurable influence on land surface subsidence.

As more fully described in Appendix O, the Strom Model and the expanded model boundary conditions and other factors tend to result in somewhat overestimated drawdowns. Actual drawdowns would probably be somewhat less than those described here, which adds conservatism to this analysis of potential impacts.

Consideration was also given to the potential effects of the proposed withdrawal of 1 MGD on ground water quality. The Massive Sand aquifer at the site is known to be saline, as described in Subsection 3.7.2.2 (e.g., the TDS concentration is 23,000 mg/L). As such, the site is situated on the saltwater side of the freshwater-saltwater interface, defined by 10,000 mg/L TDS. The estimated drawdowns do not suggest the likelihood of inducing any measurable saltwater migration into freshwater portions of any aquifer.

Onsite Solid Waste Management

Gasification ash and other byproducts and solid wastes generated by the IGCC facility would be marketed for beneficial use or managed onsite (see Subsection 2.6.3). Any ash material managed onsite would be placed in designated ash management units constructed in accordance with MDEQ solid waste disposal regulations to ensure ground water protection.

Spills or Releases of Potentially Harmful Chemicals

As described in Chapter 2 (e.g., Subsection 2.5.3), fuels and other potentially harmful chemicals would be stored in properly designed and constructed tanks and enclosures. In the unlikely event of a fuel spill or release of other potentially harmful chemicals, assessment and recovery of the spill or release would be conducted in accordance with MDEQ requirements. This would minimize the potential for impacts to ground water resources resulting from a spill.

Surface Lignite Mine

Pit Water Control

Mine pit water control would include dewatering operations and depressurization operations. The overburden material of the middle Wilcox Group consists mainly of interbedded clay, sand, and shale. In general, most of the overburden sediments have low permeability, making advanced dewatering (using wells) impractical and unnecessary. However, one overburden sand interval (the JS) was identified as having sufficient thickness and permeability to warrant advance dewatering. In addition, one underburden sand interval (the GS) would likely require depressurization. Potential impacts from these operations are described herein.

Dewatering Operations—As described in Subsection 3.7.3, the JS sand overlies the J lignite seam, has a representative maximum thickness of approximately 50 ft, and has an average thickness of 20 to 25 ft where the sand is present. Although the transmissivity of the sand is variable, current indications are that advanced dewatering would assist in maintaining highwall stability and minimizing the volume of water that would need to be handled in the pit. Because pit lengths, sand dimensions, and hydraulic properties would vary, an estimated maximum pit inflow rate and pumping rate from wells was calculated for the longest pit with the thickest sands. Therefore, the ground water impacts described herein represent the maximum impact from mine dewatering operations.

Using proprietary ground water modeling software designed specifically for mining applications and based on the Theis (1935) equation, pumping of dewatering wells was simulated to achieve a dewatering goal of 5 ft of saturated thickness (in the well bore) for the longest pit with the thickest interval of sand. Forty-three wells having a spacing of 300 ft and an initial pumping rate of 10.3 to 11 gpm were simulated parallel to a 12,700-ft pit having a saturated sand thickness of 50 ft. A transmissivity value of 590 gallons per day per foot (gpd/ft) (79 ft^2/day) and a storativity value of 0.15 were applied in this simulation (Table 4.2-20). Based on the model output, a maximum combined pumping rate of approximately 450 gpm would be necessary to achieve the dewatering goals. As the sand dewatered during the year or so it would take to achieve the dewatering goals, dewatering well yields would decline to 1 gpm or less per well.

Table 4.2-20. Worst-Case of JS Dewatering Model Input Parameters

Transmissivity	Storativity	Specific Yield	Saturated Thickness	Well Radius	Well Efficiency
590 gpd/ft (79 ft^2/day)	0.15	0.15	50 ft	1 ft	80%
Output parameters					
Drawdown (ft)	20	15	10	5	2
Distance from wellfield (ft)	660	776	893	1,050	1,159

Source: ECT, 2009.

Table 4.2-20 shows the model output results in terms of water level drawdown in the JS as a function of distance from the dewatering well field. A potentiometric surface decline (drawdown) of 5 ft would likely extend a maximum of 1,000 ft from the dewatering well field (where the JS sand is present). This 5 ft of drawdown would not be expected to extend beyond the mine study area. Due to the small number of actively used water wells within the mine study area, it is unlikely that these dewatering operations would adversely impact ground water supplies. However, if an existing supply became unusable due to mining operations, NACC would have to provide at its expense alternative water supplies as required by MDEQ SMCRA Regulations. Alternative sources would include the Lower Wilcox aquifer; connection to a local water supply corporation; and, possibly, tapping deeper or other sand intervals within the middle Wilcox aquifer.

The remaining water in the JS sand interval would passively drain into the mine pit. The rate of mine pit inflows from passive dewatering was estimated based on models and methods described in the U.S. Departments of Army, Navy, and Air Force Dewatering and Ground Water Control Report TM 5-818-5 (Departments of the Army, the Navy, and the Air Force, 1983). Because pit lengths, sand dimensions, and hydraulic properties would be highly variable, an estimated maximum pit inflow rate was calculated for the longest pit and greatest sand thickness. Based on these calculations, the maximum pit inflow rate would be approximately 200 gpm (Table 4.2-21). Typical pit inflow rates from the overburden in most mine pits would be less than 100 gpm.

Table 4.2-21. Input Parameters of JS Dewatering System Based on U.S. Army and Navy Model

Permeability	Saturated Thickness	Length of Pit	Seepage Face	Height of Water Above Aquifer Bottom	Height of Water at Well Bore
33 gpd/ft^2 (4.4 ft/day)	33 ft	14,533 ft	5.5 ft	50 ft	33 ft
Output parameters					
Artesian inflow	Artesian water level inflow	Pit inflow			
1,338,118 gpd	1,021,953 gpd	316,165 gpd			
		219 gpm			

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

Source: ECT, 2009.

Depressurization Operations—The GS sand interval underlies the G lignite seam throughout approximately half of the proposed mine study area. Because the clays separating the G lignite seam from the GS sand interval are thin and the artesian pressure exerts an upward force on the confining clay that is greater than the clay's weight, depressurization of the GS sand would be necessary to conduct safe mining operations.

An analytical ground water model based on the Theis (1935) equation was used to estimate the pumping rate and artesian pressure decline needed to depressurize the GS sand. The goal of this depressurization is to bring artesian water levels down below the bottom of the G seam to prevent upward artesian pressure from causing the pit floor to heave. Actual water levels in the depressurization well bores would be below the top of the GS sand, while a minor amount of upward artesian pressure would be present between wells. The GS sand averages approximately 14 ft in thickness and has a maximum thickness of 50 ft where it is present in the proposed mine area. While GS sands up to 50 ft thick exist in isolated areas within the study area, that thickness is not persistent across the study area. Therefore, a more representative maximum thickness of 25 ft was used in these simulations. As with the dewatering calculations (see Subsection 4.2.5.2), the longest pit in the area of greatest representative sand thickness (25 ft) was used to estimate the maximum potentiometric surface declines (drawdowns).

Table 4.2-22. Worst-Case GS Depressurization Model Input Parameters

Transmissivity	Storativity	Sand Thickness	Available Drawdown	Well Radius	Well Efficiency
930 gpd/ft (124 ft^2/day)	0.00055	25 ft	100 ft	1 ft	75%
Output parameters					
Drawdown (ft)	20	15	10	5	2
Maximum distance beyond mine property boundary (ft)	2,500	4,000	5,400	10,000	14,000

Source: ECT, 2009.

The model was run using 51 simulated wells at a spacing of 250 to 300 ft. Storage and transmissivity values (Table 4.2-22) were based on the results of aquifer testing, as described in Subsection 3.7.3. To achieve the depressurization goals, the wells would need to be pumped for approximately 180 days prior to mining in the area. The initial pumping rate for each well was estimated to be from 4 to 14 gpm, with an average of approximately 6 gpm for each well, totaling approximately 315 gpm. As depressurization progressed, well yields would decline to approximately 1 gpm per well.

Table 4.2-22 shows the model output results in terms of water level drawdown in the GS as a function of distance from the mine study area boundary. A potentiometric surface decline (drawdown) of 5 ft was estimated to extend a maximum of 10,000 ft beyond the mine boundaries, and 15 ft of drawdown was estimated to extend a maximum of 4,000 ft beyond the mine boundaries. The actual extent of drawdown in the GS would obviously be limited to the actual physical extent and thickness of the GS sand interval; the GS might not be laterally continuous in some areas.

Actively used ground water wells do exist within the mine study area and in the immediately surrounding areas, as described in Subsection 3.7.2.1. Therefore, some nearby wells in the Middle Wilcox aquifer would experience drawdown from the GS depressurization pumpage. Actual impacts to a ground water user's well would be relative not only to the amount of drawdown experienced, but also to the specific circumstances of a given well (e.g., well depth, pump setting, etc.). The amount of drawdown at a given well could cause adverse impacts to that water user via diminution of supply. At other wells, the drawdown effects could be insignificant.

If an existing supply became unusable, alternative supplies would be available, as described previously. Any impacts to other water users from mining activities would be mitigated by NACC, the mine operator, as required by the SMCRA Regulations.

Long-Term Effects of Mining on Ground Water Availability

Following mine reclamation, ground water movement and levels in replaced spoil would be dependent upon the final topographic configuration, recharge, and hydraulic characteristics of the reclaimed spoil materials. Postmining ground water movement patterns would likely approximate premining conditions since postmining and premining topography would be similar. However, the structure of the replaced overburden deposits would be substantially different than that of the natural overburden sediments. The natural layering of the undisturbed overburden sediments would not exist in the replaced overburden. Consequently, the perched aquifers and water tables observed in the natural overburden would probably be less common in the mixed mine spoil deposits. It would be unlikely that existing springs and seeps associated with these perched zones would develop in their current locations, although spring and seeps might occur at new locations during the postmining period where subsurface conditions were favorable.

During reclamation backfilling, the redistribution of sediments could result in increases in porosity, and changes in storage characteristics, horizontal and vertical hydraulic conductivities, and recharge capacity of overburden materials. Removal and redeposition would probably result in mixing of soils and material from the deeper excavated strata and stratigraphic changes, which would likely increase vertical hydraulic conductivity and porosity. As a consequence, local recharge characteristics in spoil materials could be slightly enhanced relative to premining conditions. However, the regional effect on recharge to aquifers would be negligible, as the disturbed areas of the mine would represent a small fraction of the total outcrop recharge area of the Middle Wilcox aquifer in Kemper and Lauderdale Counties.

Changes in the hydraulic characteristics of the replaced overburden could affect future use of replaced overburden as a source of ground water supply. However, currently, the undisturbed overburden Wilcox in the proposed mine study area is limited as water-supply source, supplying only small well yields and spring flows (i.e., 12 wells and no springs currently being used within the mine study area). With abundant alternative ground water supplies available from the Lower Wilcox aquifer and from local public water supply corporations, the impact of changes in hydraulic properties of the overburden in the mine study area would likely be insignificant.

Ground Water Use for Mining

Ground water would be used for nondrinking water requirements of the mine office and shop facilities, including fire suppression and makeup water for the truck wash bay. The long-term average withdrawal rate during the mining period would be approximately 0.01 MGD, with peak short-term pumpage of up to 100 gpm. The effect of pumpage would be limited to declines in the local potentiometric levels in the Lower Wilcox aquifer. Predicted drawdowns beyond a distance of 0.5 mile from the supply well would be on the order of 1 ft or less for both peak short-term usage and long-term average pumpage. None of the private water supply wells in the project locality would be adversely affected.

Mining Effects on Ground Water Quality

Mining operations would be conducted to minimize potential impacts to local ground water quality in laterally adjacent overburden sediments outside the mine study area. As discussed in Subsection 3.4.3, approximately 20 percent of the unoxidized overburden core samples showed pyritic sulfur contents in excess of 0.5 percent. All of the pyritic sulfur observed in the core samples was associated with unoxidized sediments. The oxidized overburden materials containing no acid-forming pyritic sulfur would be handled by truck/shovel operations and used in reconstruction of postmining soils. Special handling techniques would be applied to unoxidized overburden known to contain AFM or TFM to prevent acid or toxic drainage. These techniques would include special placement of AFM or TFM spoils at depths that would preclude seepage, acid neutralization by mixing with a source of alkalinity, or other approved methods. Application of these techniques would reduce potential geochemical problems.

Ground water quality in the Lower Wilcox aquifer, the principal water supply aquifer in Kemper and Lauderdale Counties, would not be expected to be adversely impacted by mining operations. The Lower Wilcox aquifer is separated from the deepest lignite seam to be mined (the G seam) by approximately 100 to 180 ft of sediments primarily composed of clay, silty clay, sandy clay, interbedded sands, and lignite. Although interbedded sands exist, most of the sediments in this interval have relatively low permeabilities and act as aquitards that minimize vertical flow. This is also evident by ground water elevation data (Figure 3.7-5), which show appreciably higher levels in the GS sand than in the Lower Wilcox aquifer. If the sediments between the GS and the Lower Wilcox were relatively permeable, then their ground water elevations would be similar, reflecting good hydrologic connection; that is not the case. The combined effects of multiple low-permeability layers between the GS sand and the Lower Wilcox would likely limit downward migration of any potentially degraded ground water from the overlying reclaimed spoil areas.

Postmining ground water quality in the reclaimed mine study area cannot be predicted with certainty but, based on past histories of other similar mines, would likely have higher TDS than premining ground water. Therefore, development of shallow freshwater wells in mine spoil deposits might not be feasible in the foreseeable future. However, sufficient fresh water would be available from the Lower Wilcox aquifer and public water systems during and after mining.

Water Quality Effects from Lignite Storage

Life-of-mine lignite storage would be located near the mine facilities. The lignite storage would be necessary for the supply of lignite during inclement weather where lignite delivery from the pit was not possible. Lignite contained in the storage area could also be used for blending to meet power plant fuel specifications.

Leachate would be occasionally produced from precipitation infiltrating through the lignite pile. The leachate would eventually seep at the base of the pile, and some would infiltrate into the underlying sediments. Any surface flow would be routed to a mine sedimentation pond for treatment before being discharged in accordance with the facility NPDES permit. Results of EPA Method 1312 synthetic precipitation leaching procedure (SPLP) tests performed on three lignite samples are presented in Table 4.2-23. Trace element concentrations of the leachate samples are either below EPA drinking water MCLs or below the laboratory detection limit for EPA Method 1312. Considering the relatively benign characteristics of the lignite leachate, no adverse impacts to ground water or surface water quality would be expected.

Table 4.2-23. SPLP Test Results for Three Lignite Leachate Samples

Parameter	Laboratory Detection Limit	SPLP No. 1	SPLP No. 2	SPLP No. 3	EPA MCL
Arsenic (mg/L)	0.05	ND	ND	ND	0.01
Barium (mg/L)	0.01	0.15	0.26	0.14	2.0
Cadmium (mg/L)	0.02	ND	ND	ND	0.005
Chromium (mg/L)	0.05	ND	ND	ND	0.10
Lead (mg/L)	0.05	ND	ND	ND	0.015
Mercury (mg/L)	0.0002	ND	ND	ND	0.002
Selenium (mg/L)	0.05	ND	ND	ND	0.05
Silver (mg/L)*	0.005	ND	ND	ND	0.10
Boron (mg/L)†	0.01	0.28	0.51	0.35	—
Copper (mg/L)	0.010	ND	ND	ND	1.3
Molybdenum (mg/L)†	0.05	ND	ND	ND	—
Nickel (mg/L)†	0.02	ND	ND	ND	—
Vanadium (mg/L)†	0.02	ND	0.08	ND	—
Zinc (mg/L)*	0.025	0.031	0.051	0.021	5.0
pH (s.u.)*	—	7.39	7.27	7.32	6.5 - 8.5

*Secondary drinking water standard.
†No EPA drinking water standard established.

Source: NACC, 2009.

Linear Facilities

Operation and maintenance of the various linear facilities would not be expected to adversely impact the ground water resources of the area. As described in Subsection 4.2.6, vegetative growth would be managed by a variety of methods, including targeted use of EPA-approved growth regulators and herbicides. Judicious selection and proper application of such growth regulators and herbicides would reduce any potential for impacts to ground water quality. In the unlikely event of a fuel spill or other release of potentially harmful chemicals, assessment and recovery of the spill or release would be conducted in accordance with MDEQ requirements.

4.2.6 TERRESTRIAL ECOLOGY

This section addresses potential impacts to terrestrial ecological resources located on the power plant site, surface lignite mine study area, and the linear facilities associated with the preferred alternative for the project. The assessment of impacts associated with the construction and operation of linear facilities focuses on the approximately 156 miles of corridors that were fully defined and field-surveyed.

4.2.6.1 Construction

Clearing of vegetation would be performed as necessary to construct the mine facilities, power plant, and rights-of-way for linear features (typically right-of-way vegetation removal is accomplished by shearing at the surface and leaving root structures and soils as undisturbed as possible for new construction and existing line upgrades), including access roads and three electrical substations.

Impacts to remaining terrestrial ecological resources associated with the project construction would depend primarily on the location and extent of surface disturbance and, to a lesser degree, clearing and construction techniques. Fugitive dust from clearing operations could affect otherwise undisturbed vegetation in the vicinity of the project site. Dust particles can accumulate on leaf surfaces, thereby reducing evapotranspiration and photosynthesis and potentially causing decline in vigor of some plants in extreme situations. However, it is not likely that dust accumulation associated with clearing and/or construction would have adverse impacts on adjacent vegetation resources due to its temporary nature, the fact that periodic rainfall would wash the dust off the leaves, and implementation of BMPs including watering of dirt access roads in active construction areas. Potential erosion and sediment transport on exposed ground at construction sites would be controlled by a variety of temporary and permanent measures, as discussed in Subsection 4.2.3.1. These erosion and sediment control methods would be implemented during and after construction and include seeding and/or mulching along newly exposed areas; silt screens and hay bales along the sloped edges of surface water features and wetlands; and redirection of stormwater runoff by the construction of swales, basins, and berms. An evaluation of potential and expected impacts on vegetation and wildlife components resulting from construction is presented in the following paragraphs.

Power Plant

Vegetation

The power plant and associated onsite facilities, construction laydown areas, sedimentation ponds, and byproduct storage area would occupy approximately 739 acres of land (approximately 45 percent of the total power plant area). To the extent practicable, the plant and associated facilities would be situated near to each other to reduce impacts to the natural terrestrial ecosystems remaining on the approximately 1,646-acre site. The lignite mine facilities and structures would occupy 342.5 acres or 21 percent of the power plant site. The remaining 564 acres of the power plant site (34 percent of the total power plant area) would not be impacted by construction. Table 4.2-24 lists specific displacements of terrestrial ecological resources by construction of the power plant and the lignite mine portion that is located on the power plant site. Figure 4.2-3 illustrates the location of the vegetation/land use impacts for the power plant and the lignite mine. Wetland and aquatic resources exist on 445 acres or approximately 27 percent of the site. Wetlands include forested wetlands (palustrine forested), shrub wetlands (scrub shrub), and herbaceous wetlands (palustrine emergent). Aquatic resources include intermittent streams (riverine), manmade ponds, and ditches. Of this total of 445 acres of regulated wetland/aquatic resources on the site,

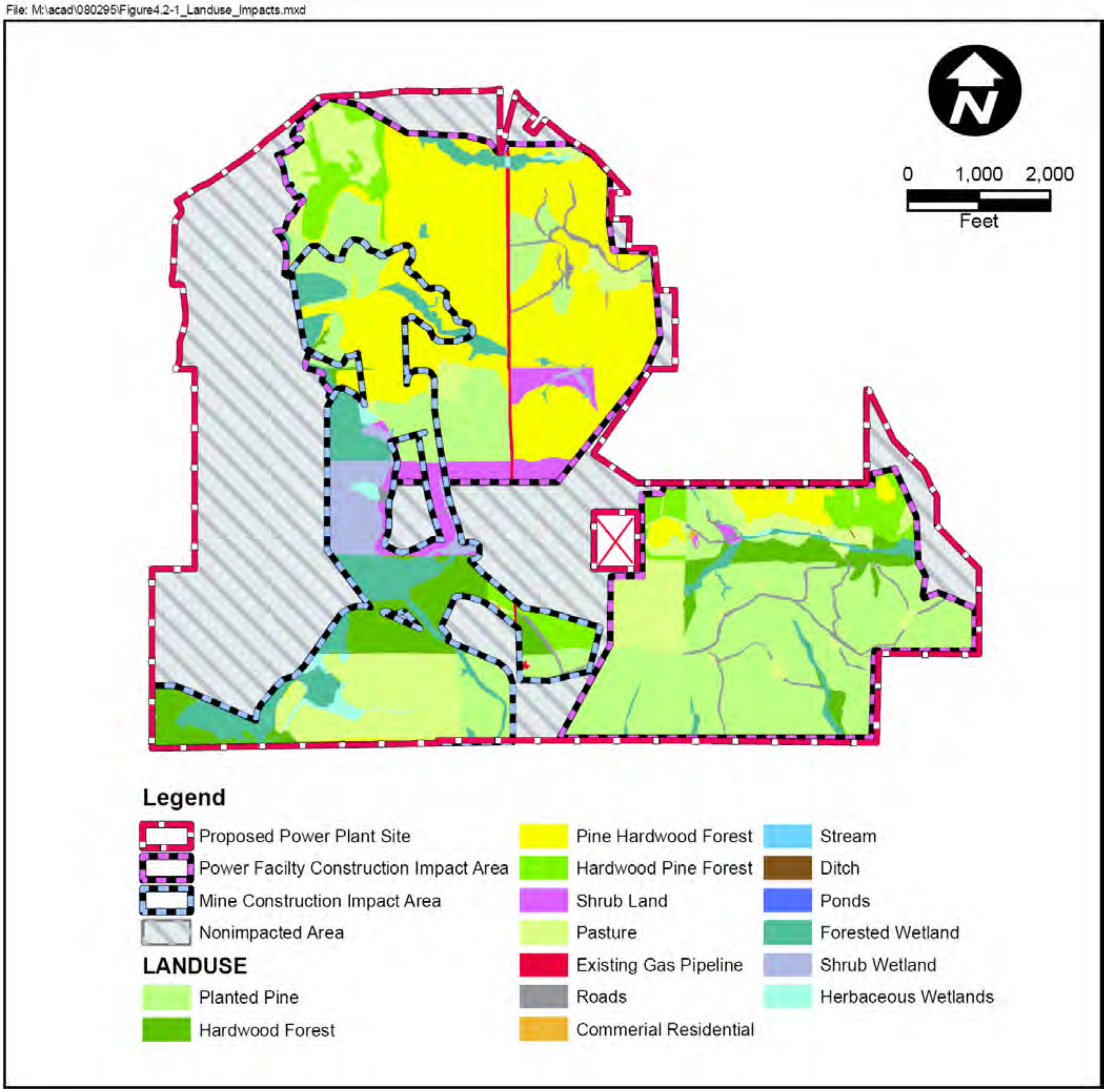

Figure 4.2-3. Vegetation/Land Use Impacts on the IGCC Power Plant Site
Source: ECT, 2009.

29.5 acres or 0.07 percent of regulated wetland/aquatic resources would be impacted by construction of the power generating station; the lignite mine-related facilities (including the onsite portion of the initial mine block) would impact approximately 103 acres or 23 percent of onsite wetland/aquatic resources. Approximately 312 acres or 70 percent of wetland/aquatic resources would not be impacted by construction associated with either the power plant or mine. The upland communities that would be impacted are primarily forested; much of the forest is planted pine or pine and hardwood mixed communities that have been logged in the past.

Table 4.2-24. Vegetation/Land Use Impacts for the Power Plant Site

Vegetation/ Land Use Type	Total Area (Acres)	Impact Area Due to Power Generating Facility Construction (Acres)	Impact Area Due to Lignite Mine Construction (Acres)	Unimpacted Area (Acres)
Shrub wetland	76.13	1.23	26.38	48.52
Herbaceous wetland	35.54	3.66	8.11	23.76
Forested wetland	330.67	24.51	68.85	237.31
Ditches	0.08	0.05	0.00	0.03
Existing gas pipeline	8.48	5.15	0.53	2.81
Hardwood forest	104.01	23.40	52.26	28.35
Hardwood pine forest	101.41	44.91	11.17	45.32
Pasture/hay fields	177.99	83.51	57.50	36.98
Pine hardwood forest	336.71	247.35	48.42	40.94
Planted pines	351.76	266.11	54.34	31.31
Ponds	2.10	0.00	0.00	2.10
Residential/commercial	1.91	0.56	0.09	1.25
Roads	27.08	14.34	2.17	10.57
Shrubland	91.78	24.58	12.61	54.59
Streams	0.28	0.00	0.03	0.25
Total	1,646	739.40	342.50	564.10

Source: ECT, 2009.

Wildlife

Site preparation and construction activities would result in the removal or alteration of up to approximately 1,100 acres of wildlife habitat out of the total Kemper County site acreage of approximately 1,650 acres. Much of this area is comprised of pasture and second-growth forest/pine plantations. Clearing and construction would generally result in a permanent loss of native habitats within the power plant area. The loss of this low-quality and fairly common habitat would not be important from a regional perspective. Site surveys by Vittor and ECT revealed the site’s habitats do not serve as critical breeding, nesting, staging, or roosting habitats for migratory birds protected by the Migratory Bird Treaty Act. Therefore, adverse impacts to these species are expected to be minimal.

Most wildlife located within the proposed construction area would be mobile and would relocate to suitable onsite or adjacent offsite habitats. Small, less mobile, or fossorial individuals of a species might be lost. However, the construction area of the power plant site does not represent unique wildlife habitat for this region of Mississippi, nor does it harbor rare or unique wildlife species.

Indirect effects to wildlife might result from increased human presence, traffic, and noise during construction. This might cause some wildlife species to relocate farther onsite or to offsite habitats. This would be a temporary impact to wildlife during construction (approximately 3.5 years). An increase in mortality to some wildlife species would occur during this period due to increased traffic on surrounding roadways.

The construction of the power plant would result, however, in the suspension of hunting leases on the property and increased access restrictions. This would, in effect, provide a refugium for wildlife, especially game animals. Deer and wild turkey, both heavily hunted onsite, would be afforded additional protection during hunting season because of restricted access during power plant construction and operation.

Listed Species

No federal- or state-listed plant species were found on the power plant site, nor are any known to occur based on records maintained by MNHP (administered by MDWFP). In addition, no federally listed wildlife species were found on the power plant site, nor are any known to occur there. One state-listed species of concern (the sharp-shinned hawk) was observed on the east side of the property in an area potentially needed for power plant development (primarily byproduct storage). This bird is listed because of rarity of the breeding population in the state. The field surveys failed to identify any nesting pairs of this bird on the site, and, due to its mobility and the abundance of suitable habitat in the area, no adverse impacts to this species would be expected.

Surface Lignite Mine

Vegetation

Site preparation and construction activities would result in vegetation removal from most of the mine facility construction areas. These areas include the access roads, water control structures, lignite transport roads, and mine support facilities, such as shop and warehouse building, offices, parking areas, fuel tank farm, vehicle wash area, and dragline erection site. Approximately 455 acres would be affected during the construction phase, and suitable habitat for wildlife in the immediate vicinity of the construction site would be impacted. Vegetative cover removed during site preparation and facility construction would generally not become reestablished in the mine area. Plant communities that would be affected include mainly pine/hardwood forest, planted pine, and pasture land. Most of these areas have been altered by past timber management or farming activities.

Wildlife

Terrestrial impacts would result in the migration of mobile species out of the construction area during the initial construction phase. Loss of habitat would continue for the life of the project within the footprint of building structure, access roads, parking lots, and other mining-related structures. Once the initial construction phase is completed, return of some mobile species within the construction area would be expected. The species likely to be displaced by facility construction include deer, turkey, rabbit, grey squirrel, other small mammals, several species of birds, and various reptiles and amphibians. Some wildlife species such as mice, rats, squirrels, and various birds would become reestablished in the vicinity of mine buildings and infrastructure where revegetation occurs. Landscaping and regrowth of native plant species would provide some habitat for wildlife species.

Listed Species

Mine facilities site preparation and construction would not be expected to have any impact on threatened or endangered plant or animal species. No species listed by USFWS as threatened or endangered were found in the mine study area, although Prince’s potato bean has been recorded in Kemper County. Soils suitable for this species do not occur in the mine study area, and it is unlikely that it would become established along mine roadways or woodland edges.

Two state-listed bird species were observed in the mine study area and could be affected by construction activities. The barred owl is classified as S-5 (secure) and the sharp-shinned hawk is S-1 (critically imperiled). The barred owl is a permanent resident of Kemper County and could be displaced by clearing of nest sites and forage areas. The sharp-shinned hawk is a nonbreeding, temporary resident and would be less likely to be adversely affected by construction. No other state-listed plant or animal species would be affected by mine construction.

Linear Facilities

The study corridors in which the final rights-of-way for the linear facilities are proposed to be constructed are 200 ft wide for new facilities and 75 ft wide (the existing rights-of-way) for transmission lines that would be upgraded. As discussed in Subsection 2.3.3, most or all of the width of the corridors would potentially be needed for construction where transmission lines and pipelines would be collocated. In other situations (natural gas pipeline and southern portion of CO_2 pipeline), the 200-ft width study corridors are wider than the linear projects' rights-of-way for construction and maintenance. In those cases, the additional space provides design engineers with flexibility in siting the final rights-of-way and facilities within the study corridor. This slight flexibility might provide opportunities to avoid significant natural resources that exist within the 200-ft-wide study corridor. Nonetheless, for purposes of assessing potential impacts, the complete 200-ft-wide corridor has been assumed to be impacted during construction. For the existing transmission line rights-of-way, the full 75-ft width was assumed to be impacted. These assumptions likely overestimate overall impacts by a wide margin. Future engineering efforts on the placement and design of the linear facilities would aim to minimize environmental impacts.

As noted in Subsection 3.8.4 (also see Subsection 2.2.3), information to fully characterize several linear facility corridors was incomplete or unavailable for this EIS. Approximately 13.5 miles of the reclaimed effluent pipeline corridor in the immediate vicinity of Meridian were not surveyed, nor has the approximately 9.5-mile stretch of existing electrical distribution line right-of-way along MS 493 from MS 16 to the site. And the estimated 9- to 10-mile-long TVA transmission line interconnection corridor between MS 16 and the mine site has not been demarcated. The approximately 32 to 33 miles of unsurveyed corridors represent less than 18 percent of the project's estimated 189 total miles of linear corridors.

Impacts due to construction of these 32 to 33 miles of the connected linear facilities would likely be similar to those described in the subsequent paragraphs given the similar physiographic locations and features of the unsurveyed corridors. Terrestrial ecological characteristics of the unsurveyed portions would also likely be similar to those of the surveyed areas. Furthermore, the distribution line upgrades would occur within an existing right-of-way. These upgrades would likely be constructed by EMEPA, which would follow its own procedures to minimize environmental impacts. Similarly, TVA would follow its environmental review procedures when selecting the route for their power transmission line connecting to the mine site.

Thus, while impacts could not be assessed within 18 percent of the project's linear facility corridors, DOE does not believe the missing and incomplete information is essential to its evaluation of overall project impacts.

Vegetation

The major primary impact from linear facility construction or upgrade would result from vegetation clearing; smaller, temporary impacts would be due to trenching for laying of pipelines. Table 4.2-25 lists the worst-case acreages of potential impacts associated with constructing linear facilities.

Pipelines—Dirt from the pipeline trenches would be side cast and used to refill the trenches after laying each pipeline. Only that vegetation lying within the actual construction width and interfering with actual trenching and laying of the pipe would be cleared. Various clearing methods would be employed and would depend on the size of woody vegetation, contour of the land, and ability of the ground to support clearing equipment. Cleared brush would be shredded and distributed on the cleared right-of-way to stabilize the soil surface. Again, the acreages shown in Table 4.2-25 are conservative upper limits that assume the entire width of the study corridors would be impacted. In the cases of the natural gas pipeline and the southern 40-mile stretch of the CO_2 pipeline corridor, only a 75-ft-wide construction right-of-way would be required. The final right-of-way and trench location would be selected based, in part, on minimizing environmental impacts.

Table 4.2-25. Potential Vegetation/Land Use Impacts Associated with Construction of Linear Facilities

Land Use	Total Impacted Acreage Within Linear Facilities Corridors	Impacted Acreage Along Natural Gas Pipeline*	Impacted Acreage Along CO_2 Pipeline Only*	Existing Transmission Lines To Be Reconductored†	Impacted Acreage Along New Transmission Lines*
Active construction†	17.31		6.27		11.04
Pastures, hay fields, deer plots‡	132.25	0.80	35.57	4.08	91.80
Existing gas pipeline corridors‡	7.64		5.50	0.58	1.55
Hardwood forest	319.90	15.48	2.50	3.82	298.10
Hardwood pine forest	313.15	3.45	178.70	3.61	127.39
Pine hardwood forest	486.84	20.65	148.36	3.54	314.29
Planted pine	787.82	86.27	219.08	2.60	479.87
Roads‡	76.49	5.98	25.04	8.16	37.31
Residential or commercial development‡	48.35		10.58	34.73	3.04
Shrubland	13.15		2.25	0.49	10.40
Existing transmission line corridors‡	382.21	0.70	163.64	182.06	35.81
Forested wetland (palustrine forested)	246.81	6.06	145.48	1.29	93.98
Herbaceous wetland (palustrine emergent)	99.89	0.23	45.65	30.49	23.52
Shrub wetland (scrub-shrub)	46.95	0.26	18.22	4.55	23.92
Ditches	3.94	0.05		1.62	2.26
Ponds	12.56		4.61	0.90	7.05
Natural drainages seasonal, intermittent, and perennial streams (riverine)	41.40	0.32	3.21	9.14	28.73
Totals	3,036.67	140.25	1,014.67	291.67	1,590.07

*Impact acreage calculations are based on complete clearing of the 200-ft-wide study corridors. Actual terrestrial ecology impacts will be calculated for necessary clearing of a 150-ft right-of-way for transmission line construction and 75-ft rights-of-way for the natural gas, reclaimed effluent, and CO_2 pipelines after final engineering design. Formerly forested areas would be maintained as shrub and/or herb communities; the only permanent impacts would be due to pad construction/pole placement for transmission line structures and any necessary access road construction. Trenching for pipeline placement would be a temporary impact, and revegetation would occur through seeding of native herbs or natural recruitment.

†For those portions of the transmission line to be reconductored, 75 ft would be cleared adjacent to the existing cleared and maintained transmission line.

‡Roads, pastures, existing corridors, etc., crossed by proposed new linear facilities are already cleared; no additional impact would occur.

Source: ECT, 2009.

Transmission Lines—All impacts associated with construction of the new transmission lines would be associated with clearing for construction activities required for pole placement and any necessary access roads. In certain areas, the distance between structures would vary, for example, to minimize impacts on wetlands or other significant ecological or cultural resources, provide proper clearance over roads or other existing obstructions, or reduce the height of structures where shorter structures would be required.

Construction phases would consist of right-of-way clearing, access road construction (where necessary), line construction, and right-of-way restoration (where necessary). Construction phases generally would be performed sequentially along the right-of-way such that activities in any one area would be short-termed. Where available, mainly in the case of existing transmission lines to be upgraded, existing roads would be used for access and construction activities to the greatest extent practicable. Improvements might be made to these roads depending on their existing conditions. However, where roads are not available for access, new access roads might be constructed. Structure pads for placement of new pole locations might also be constructed at structure locations perpendicular to existing or proposed road crossings.

In areas of the corridor where collocation opportunities occur with existing transmission lines or hunting roads, forested communities have already been impacted. Limited additional clearing of danger trees directly adjacent to the existing rights-of-way would be required, and these areas of the rights-of-way would subsequently be maintained in a low-growing, early successional state with vegetation not exceeding heights necessary to ensure safe and reliable operation. Adjoining tracts of woodlands would remain intact and provide habitat for forest species. In addition, adjacent communities should not be affected by structure pad and road construction since erosion control measures and proper culverting would be used wherever necessary. Clearing would be required for construction of the new transmission line structures, pads, and roads. The forested portions of the right-of-way would generally be cleared across the entire permanent right-of-way width. Upland areas that are not heavily vegetated (herb- and/or shrub-dominated areas) would be mowed or brush-hogged. Depending on the density of trees to be cut and the restrictions on clearing in wetlands and sensitive areas, the machinery required for clearing would include bulldozers, shearing machinery, and chain saws for hand removal of woody vegetation in sensitive areas such as wetlands.

Due to necessary maintenance practices in the right-of-way, a decrease in structural diversity would occur in formerly forested areas (i.e., permanent loss of a tree canopy layer). However, this would be offset by an increase in species diversity as additional shrubs and herbs colonize the right-of-way in response to increased sunlight and decreased competition for light due to canopy removal.

Access roads would be needed to provide efficient, safe, and cost-effective ingress and egress to the structures. Access roads would be used for initial construction, routine maintenance, and to repair any damage to the transmission facilities that might occur on rare occasions. Where available, existing access roads (i.e., hunting roads/trails, public roadways, or roads within existing transmission line corridors to be upgraded) would be used. In some cases, these existing access roads might need to be improved to accommodate the necessary construction and/or maintenance equipment.

Proper construction of the access roads and pads for the new transmission line structures would result in minimal impacts to terrestrial (upland and wetland) and water resources. Means to minimize impacts would include the use of turbidity screens and erosion control devices, where there is a potential for erosion, to minimize construction impacts to wetlands and water bodies. Wetlands could be avoided wherever practicable by routing necessary access roads around them; unavoidable wetland impacts could be minimized by constructing access roads as narrow as possible and using corduroy roads or geotextiles. Unavoidable stream crossing impacts could be minimized by restricting access road width to the minimum necessary and culvert placement to allow uninhibited flow and wildlife/fish/macroinvertebrate movement through the culverts. In summary, necessary wetland/waterway crossings could be constructed to allow continued functioning of wetland/riparian areas.

Finally, the installation of transmission line structure foundations would require structural fill. Other than any necessary access roads, structure placement would be the only permanent impact to terrestrial ecological resources. In upland areas, access would be at-grade earthen or gravel roads. As previously mentioned, structure placement could be manipulated to avoid or minimize the impacts to significant ecological resources.

Wildlife

The proposed transmission lines, reclaimed effluent pipeline, natural gas pipeline, and CO_2 pipeline would cross many potential wildlife habitats found throughout this part of Mississippi. Although these rights-of-way would be relatively narrow, they would be cleared of most forested and shrubby vegetation communities. The estimated acreage to be cleared would be approximately 1,700 acres. Subsection 3.8.4.1 describes these communities in more detail.

These habitats would be altered along the various rights-of-way by removal of trees and most shrubby vegetation. This would represent a permanent loss of some forested habitat and shrub community habitats within the right-of-way boundaries. Most wildlife encountered during field surveys would be mobile enough to relocate to offsite habitats during clearing and construction activities. Some individuals of less mobile species might be lost, however.

It is anticipated that, where possible, wetlands would be avoided or spanned by the new or upgraded transmission lines. Some wetland impacts would be unavoidable from the pipeline construction. Generally these impacts would consist of clearing and trenching/backfilling of wetland areas, as discussed previously. Some larger wetland areas could potentially be directionally drilled; in which case, the wetland itself might not be affected, but the adjacent vegetation on each side might be removed for the drilling setup and operation. In these areas, this type of construction would represent a temporary impact on wildlife that use wetland systems. Some minor degradation of water quality might occur because of construction in wetlands and thereby affect fish and aquatic/wetland-dependent wildlife, such as reptiles and amphibians. The use of BMPs, including silt screens, would minimize potential impacts to such wildlife species.

No threatened or endangered species' habitats would be affected along the proposed corridors. No parks, preserves, or wildlife refuges would be crossed by the linear facilities other than the proposed Vimville-Sweatt transmission line, which would cross the southern portion of the Bonita Lakes Park, owned by Meridian.

Listed Species

Construction of the linear facilities would not be expected to adversely affect any endangered or threatened plant and wildlife populations. Evidence of only one listed species was observed along the approximately 156 miles of new and existing linear facility corridors that were surveyed: one inactive burrow of a gopher tortoise. No other listed species were observed, although the potential exists for some to use portions of the proposed corridors, as described in Subsection 3.8.4.3.

The one inactive gopher tortoise burrow might be affected by construction, depending on final right-of-way location in that vicinity. If the burrow was deemed active at that time and could be affected by construction activities, Mississippi Power could relocate the tortoise to suitable adjacent habitat or capture and hold the animal until completing construction in that area and then release it back to the same area.

Price's potato bean is federally listed as threatened by USFWS and has been recorded in Kemper County. Where known, it is most often found in open woods and along woodland edges in limestone areas, typically where bluffs are adjacent to creek or river bottoms and on roadsides or transmission line rights-of-ways. Though Price's potato bean was not observed within the project area during the ecological field surveys, appropriate habitat is present. Some wooded habitat and bluffs that are adjacent to creeks or river bottoms could be impacted. Again, there is some flexibility due to the widths of the study corridor and the subsequent ability to avoid or minimize impacts to sensitive ecological features such as bluffs by avoidance through structure/trench placement and access road location flexibility. It is possible that construction of the linear facilities might produce habitats suitable for Price's potato bean's growth, since it is known to occur on roadsides and linear facilities rights-of-ways elsewhere in its range. DOE has initiated informal consultation with USFWS regarding potential effects to this species (see Appendix A).

4.2.6.2 Operation

Potential impacts to terrestrial ecological resources associated with the project operation could result from air emissions from the power plant (the stacks and cooling towers) and the noise levels originating from operation of the power plant site and surface mine (wildlife resources only). The audible noise associated with a transmission line is expected to be less than the ambient outdoor noise levels and would not result in any impact to wildlife. An evaluation of potential and expected impacts on vegetation and wildlife components resulting from air emissions is presented in the following paragraphs.

Power Plant

Since the IGCC facility would be a new stationary source, it requires additional impact analysis to evaluate the impacts of the proposed emissions on soils, vegetation, and wildlife, etc., via the PSD permitting process. Although state-of-the-art equipment and emissions controls would be employed, there is the potential for impacts to vegetation and wildlife resources of the project site resulting from the proposed plant operation. Emissions of air pollutants could have an impact on local flora and fauna; the secondary NAAQS are designed to protect public welfare, including protection against damage to animals, crops, and vegetation (see Table 3.3-2). Modeled impact levels for criteria pollutants are below these standards (refer to Subsection 4.2.1). The following discussion provides additional information regarding potential impacts to ecological resources.

Vegetation

Vegetation damage due to power plant emissions is principally foliar damage. Less apparent vegetation injury is described as a reduction in growth and/or productivity without visible damage, as well as changes in secondary metabolites such as tannins and phenolic compounds (Booker *et al.*, 1996). Vegetation damage most often results from acute exposure to pollution (i.e., relatively high doses over relatively short time periods). Injury is also associated with prolonged exposures of vegetation to relatively low doses of pollutants (chronic exposure). Acute damages, which have both functional and visible consequences, are usually manifested by internal physical damage to foliar tissues. Chronic injuries are typically more associated with changes in physiological processes.

The following discussion summarizes descriptions from the literature of the potential effects on vegetation in the project region that have been associated with the relevant pollutants. To evaluate the potential for impacts, levels known to cause damage to the most sensitive vegetation are discussed.

Nitrogen Oxides—During combustion, atmospheric and fuel-bound nitrogen are oxidized to nitrogen oxide (NO) and small amounts of NO_2 (Taylor *et al*., 1975). Impacts to vegetation from NO_2 result from high concentrations occurring during short time periods (Taylor and MacLean, 1970). Acute exposures of this sort will cause necrotic lesions in leaf tissue and excessive defoliation (MacLean *et al*., 1968). Short-term (acute) exposures to NO_2 of less than 1,880 µg/m³ for 1 hour have caused no adverse effects to vascular plants (Taylor *et al*., 1975). Common sunflower exhibits an injury threshold of 375 µg/m³ for chronic exposure. For perennial ryegrass, the injury threshold for chronic exposure is 125 µg/m³. Nonvascular bryophytes are very sensitive to NO_x exhibiting reductions in nitrate reductase activity at concentrations of 65 µg/m³ with exposure duration of 24 hours (WHO, 2000). The possibility of vegetation injury to vascular or nonvascular plants due to NO_x emissions from the power plant would be remote, since emissions from the plant are predicted to result in an average annual ambient concentration of only 1.43 µg/m³; this level is below the level known to cause damage to the most sensitive plants, bryophytes and far below the chronic exposure thresholds know to cause injury to sunflower and ryegrass, which are common in the area.

Sulfur Dioxide—Natural (ambient) background concentrations of SO_2 range between 0.28 and 2.8 µg/m³ on a mean annual basis (Prinz and Brandt, 1985). The most common source of atmospheric SO_2 is the combustion of fossil fuels (Mudd and Kozlowski, 1975). At low concentrations, SO_2 byproducts are effectively detoxified by the plant and can become a sulfur source to the plant, while elevated concentrations can be toxic (Zeiger, 2002). Adverse effects on plants from SO_2 are primarily due to impacts to photosynthetic processes. SO_2 can react with chlorophyll by bleaching or phaeophytinization. This latter process constitutes a photosynthetic deactivation of the chlorophyll molecule. Acute damage due to SO_2 appears as marginal or intercostal areas of dead tissue that at first cause leaves to appear water-soaked (Barett and Benedict, 1970). Chronic injuries are less apparent; the leaves remain turgid and continue to function at a reduced level. In more severe cases of chronic SO_2 exposure, there is some bleaching of the chlorophyll that appears as a mild chlorosis or yellowing of the leaf and/or a silvering or bronzing of the undersurface. Species that are categorized as sensitive to SO_2 emissions are those that show damage to at least 5 percent of the leaf area upon being exposed to 131 to 1,310 µg/m³ SO_2 for a period of 8 hours (Jones *et al*., 1974).

Researchers have conducted numerous studies to determine the effects of SO_2 exposure to a wide variety of selected plant species. A review of the literature demonstrates that the most sensitive vascular plants (e.g., white ash, sumacs, tulip poplar, goldenrods, legumes, bracken fern, blackberry, black oak, and ragweeds) exhibit visible injury to short-term (3 hours) exposure to SO_2 concentrations ranging from 790 to 1,570 µg/m³. All these plants are present on the plant site or vicinity.

Due to their rather diminutive and inconspicuous nature, lichens and bryophytes are often not considered as important biological components of the ecosystem. However, these nonvascular plants do play a valid role in the environment by functioning as habitat for invertebrates, containing blue-green bacteria that fix nitrogen, participating in mineral cycling, and providing a food source for various fauna, among others. These plants are especially important as bioindicators due to well-documented air pollution sensitivity. Because of relatively low chlorophyll content and the absence of the protective covering of a cuticle (common in the leaves of higher plants), nonvascular plants are more sensitive to SO_2 injury. Tolerant lichens can resist SO_2 concentrations in the range of 79 to 157 µg/m^3; higher concentrations are deleterious to most nonvascular flora (LeBlanc and Rao, 1975). A mean annual concentration of 30 µg/m^3 of SO_2 may injure sensitive individuals of some lichen species such as *Usnea*, *Lobaria*, *Ramalina*, and *Cladonia* (Treshow and Anderson, 1989). One lichen species, *Ramalina americana*, is known to be absent where SO_2 concentration mean annual values range from 13 to 26 µg/m^3 (LeBlanc, *et al.*, 1972; Wetmore, 1983). The maximum predicted impact resulting from emissions of SO_2 from this project are 1.91 µg/m^3 annual average and 33.86 µg/m^3 for a 3-hour exposure period, below levels known to cause injury to vascular or nonvascular plants in the region.

<u>Particulate Matter</u>—In addition to gaseous emissions, small amounts of PM would be emitted from the power plant and mining facilities. Typically, the density of PM limits impacts such that only vegetation in proximity to the source may be affected. Because the power plant must operate within permit limits for PM, adverse impacts are not expected to occur from plant operations.

Included among the PM may be low concentrations of mercury, beryllium, arsenic, and lead, to the extent present at low levels in coal. The mercury may occur as both mercury vapors and particulates. The mechanism of mercury phytotoxicity is currently under investigation. Past investigations indicate that mercury vapors will cause chlorosis, abscission of older leaves, growth reduction, and poor development. Most investigations have been restricted to greenhouse crops where air quality monitoring was not conducted. One investigation indicates that vegetation exposed to 50 µg/m^3 mercury for 7 days experienced leaf abscission (Siegel *et al*., 1984). Plants found in the region showing injury at this concentration and period of exposure to mercury are willow and red maple.

No impacts to ecological resources are anticipated due to PM emissions since estimated impacts (21.4 µg/m^3 for 24-hour and 3.2 µg/m^3 annual average) are predicted to be less than those that could affect plants and animals in the project region.

<u>Carbon Monoxide</u>—CO is not considered harmful to plants and is not known to be effectively taken up by plants (Bennett and Hill, 1975). Microorganisms within the soil appear to be a major sink for CO. Therefore, no adverse impacts to plant and animal resources in the project area would be expected to occur due to CO emissions from the proposed generating plant.

<u>Salt Drift</u>—Based on the plan to use reclaimed effluent as the primary IGCC plant water source, deposition of salt from cooling tower drift would have little potential to harm terrestrial ecological resources (see also Appendix N and Subsection 4.4.1).

Wildlife

Operational impacts would consist of human presence, routine vehicular traffic, noise, vibrations, air pollutant emissions, and artificial lighting. These impacts might cause certain wildlife species to relocate farther from the power block area. However, most wildlife species would soon become acclimated to the presence of the power plant and would reestablish in suitable adjacent habitats.

Air emissions have the potential to impact wildlife due to direct uptake of pollutants through ingestion or via the skin and indirectly as a result of air pollution-induced changes to wildlife habitat and food source. Studies have shown direct air pollution-induced injury and death in wildlife as a result of fluoride, cadmium, SO_2, particulates, NO_x, arsenic, mercury, and oxidants like ozone (Newman 1980; Newman and Schreiber 1985). These impacts are mostly the result of extreme incidences due to acute toxicity. This acute toxicity occurs most severely in circumstances where air pollutants were likely elevated far above the NAAQS, or where significantly elevated concentrations of pollutants occurred on vegetation that was subsequently consumed.

Studies have shown damage to the tracheal epithelium of bird species at extreme concentrations of NO_x and SO_2 of 2,500 µg/m³ and 1,221 µg/m³, respectively (Llacuna *et al.*, 1993). These values are far elevated above concentrations that would be expected from IGCC facility emissions.

In summary, air pollutant concentrations in the project vicinity would be expected to remain below NAAQS and minimum injury threshold concentrations, below which no wildlife acute toxicity would be expected to occur. Most effects on wildlife are indirect, predominantly as a result of decreased habitat quality.

Listed Species

No listed plant species were observed on the project site, nor are any expected to inhabit the site. Furthermore, air pollutant concentrations are projected to be lower than those known to affect the most sensitive vegetation. For listed wildlife, other than the aforementioned sharp-shinned hawk, no other listed wildlife species are known to occur on the power plant site. Given the low air pollutant impacts predicted, the air emissions from operation of this facility should have no effect on this bird or any other listed species. As previously mentioned, DOE has initiated informal consultation with USFWS regarding potential project impacts on federally listed species.

Surface Lignite Mine

Vegetation

Operation of the mine would remove all vegetation on up to 11,816 acres proposed to be mined or disturbed during the 40-year operating period. Depending on vegetative cover type, tracts of land would be cleared and grubbed just prior to mining, except in the case of some commercial timberlands. The rate of clearing would range from 195 to 375 acres per year and would average 275 acres each year, in advance of lignite removal.

Table 4.2-26 provides the average of selected land covers/vegetative communities that would be affected by the surface lignite mine. As shown, the 31,260-acre mine study area contains 20,822 acres of the vegetative communities listed, of which 7,005 acres (or 34 percent) are prepared to be mined or disturbed. The remainder of the mine study area is comprised of bottomland forests (i.e., wetlands/floodplains) and land historically converted into other uses (e.g., roads).

The total maximum proposed mining disturbance is 12,272 acres within the 31,260-acre mine study area, or 39 percent (see Table 2.4-2). The total maximum proposed disturbance of 7,005 acres shown in Table 4.2-26 is 34 percent of the land covers listed. Hardwood pine forest communities and pastures/hayfields would be cleared at percentages above the sitewide average, whereas hardwood forest and scrubland communities, as well as pine plantations, would be cleared at percentages below the sitewide average.

In terms of timing of the proposed clearing on the native communities listed in Table 4.2-26, mine blocks C (2023 to 2032) and G (2043 to 2053) would represent 86 percent of the hardwood forests and 64 percent of the hardwood pine forests to be cleared; mine blocks A (2012 to 2018), B (2018 to 2022), and C (2023 to 2032) would represent 85 percent of the pine hardwood forests; and mine blocks A (2012 to 2018), D (2033 to 2037), and F (2040 to 2042) would represent 96 percent of the scrubland. Clearing of wetlands is addressed in Subsection 4.2.9, and clearing of floodplain is addressed in Subsection 4.2.8.

Table 4.2-26. Summary of Vegetative Cover Cleared in Advance of Mining

Cover Type	Current Acreage	Percent of Current Total	Acreage Cleared in Mine Blocks							Cleared Total	Percent of Total Disturbance	Percent of Current Total
			A	B	C	D	E	F	G			
Hardwood forest	2,176	10	3	12	227	26	34	4	240	546	8	25
Hardwood pine forest	3,689	18	115	116	442	300	34	0	561	1,568	22	43
Pasture/hayfields	5,909	28	487	57	667	503	86	100	331	2,231	32	38
Pine/hardwood forest	2,233	11	254	172	194	77	3	0	34	734	10	33
Planted pine	5,746	28	149	366	291	229	242	84	375	1,652	24	29
Scrubland	1,069	5	121	0	12	69	0	72	0	274	4	26
Total*	20,822	100	1,129	723	1,833	1,204	399	260	1,542	7,005	100	34
Total mine study area	31,260	—	—	—	—	—	—	—	—	12,272	—	39

*Excluding bottomland wetlands forests and converted uplands (e.g., residential).

Source: ECT, 2009.

Following lignite removal, the mine pit would be backfilled and regraded to approximate original contour. Once the final contour was achieved, revegetation activities would begin. Much of the original soil seed bank would be eliminated, and the revegetated community during the early years of reclamation would be largely determined by the replanting process. The plant species diversity of the reclaimed lands would initially be lower than premining conditions, and premining plant communities would be eliminated in the immediate disturbance area.

The type of plant cover restored during reclamation would be determined by NACC, the MDEQ SMCRA Regulations, and the discretion of the surface landowner. It is likely that most landowners would request pine plantations, which would be interspersed with fish and wildlife features and grasslands. Plant succession in areas reclaimed as pine plantations would likely follow trends in commercial pine plantations following clear cutting and site preparation. Grasses and forbs would be expected to dominate during the first 5 to 10 years until the pines become large enough to shade out the understory, which could cause plant species diversity to decrease.

Wildlife

Operation of the mine would impact wildlife populations. Existing wildlife habitats would be cleared by mining operations at an average rate of 275 acres per year. Local wildlife species using mature hardwood and hardwood-pine forests would likely be temporarily lost from the site.

Mobile species of wildlife, such as deer, would disperse ahead of mining activities into adjacent areas including the Okatibbee Lake WMA in northern Lauderdale County managed by USACE. This dispersal could cause an increase in the number of deer and other mobile species in these areas; however, these increases would be considered temporary because wildlife would return to reclaimed areas as the mining progressed; furthermore, the area from which such species would be displaced at any one time would be less than 1,897 acres. Experience at the Red Hills Mine indicates that return of various wildlife species including deer and turkey onto reclaimed land happens relatively quickly.

Wildlife populations in the pine plantations would likely reach their highest levels of diversity and abundance during the first decade after reclamation and would resemble populations currently found in commercial pine plantations located within the project boundary (Atkeson and Johnson, 1977; Dickson and Segelquist, 1979; Dickson et al., 1995). Current reclamation practices include development of wildlife areas within pine plantations to provide long-term habitat for returning wildlife.

Mining operations could benefit many wildlife species using early succession grassland and shrub habitats by providing increased acreages of these habitats on reclaimed land. Species that would benefit include eastern cottontail, several small mammals, northern harrier, American kestrel, northern bobwhite, eastern bluebird, eastern phoebe, and loggerhead shrike. Early successional grasslands would also provide over-wintering habitats for several species such as the savannah sparrow, LeConte’s sparrow, song sparrow, and yellow-rumped warbler.

Sedimentation ponds would provide additional wetland and open water habitats for mammals such as the muskrat and raccoon, wading birds, waterfowl, and several species of reptiles and amphibians. Impacts to some wildlife species could be mitigated through specific reclamation practices such as establishment of wildlife food plots and planting groves of mast- and fruit-bearing trees and shrubs. Hard-mast producing riparian corridors could be planted along reclaimed stream banks.

Listed Species

The lignite mining operation would not be expected to adversely affect any federally listed species. No threatened or endangered species were observed during surveys, nor will any designated critical habitat for any species be disturbed. Price’s potato bean was not observed within the project area during the ecological field surveys. However, this federally threatened species has been recorded in Kemper County. Where known, it is most often found in open woods and along woodland edges in limestone areas, typically where bluffs are adjacent to creek or river bottoms and on roadsides or transmission line rights-of-ways. Appropriate habitat for Price’s potato bean is present within the proposed mine blocks, and it is possible that some of that habitat would be affected by construction. DOE has initiated informal consultation with USFWS regarding potential effects to this species.

Natureserve (2008) indicates a previous element occurrence of gopher tortoise from Lauderdale County, Mississippi. The species is not included on USFWS’ list of protected species occurring in Lauderdale County, and the species is assumed to have been extirpated and is no longer occurring there. There are no element occurrences of gopher tortoise in Kemper County, and they are not expected to be found within the mine operation area.

Two state-listed avian species were observed within the mine area. One barred owl was observed dead on a road, and it should be noted that the species is a permanent resident in Kemper and Lauderdale Counties, Mississippi. The barred owl is listed as an S-5 (secure) species in the state of Mississippi. Habitat for this species may be adversely affected by mining operations. One sharp-shinned hawk was observed within the proposed mine blocks. The sharp-shinned hawk is listed as an S-1 (critically imperiled) species in Mississippi and is considered to be a nonbreeding resident. Habitat for this species may also be adversely affected by mining operations.

Linear Facilities

Vegetation

The only impact due to operations of the linear facilities would result from periodic maintenance of the rights-of-way. Safe and reliable operation of all linear facilities would be maintained through regular inspection of the pipelines, structures, conductors, insulators, access areas, and vegetation in the rights-of-way. To ensure safe and reliable linear facility operation, vegetation in the right-of-way would be managed by a variety of methods, including trimming, mowing, and the use of EPA-approved growth regulators and herbicides, targeting species that are incompatible with the safe access, operation, and maintenance of the linear facilities.

The exact manner in which maintenance would be performed would depend on the location, type of terrain, and surrounding environment. Vegetation removal would be minimized consistent with safe and reliable operation of the transmission and pipelines. For example, fast-growing vegetation species and other vegetation whose mature height could interfere with the safe operation of the linear facilities would normally be cut or removed. Other species would generally be allowed to remain, resulting in a shrubby and herbaceous cover within the right-of-way. This would encourage a broad diversity of vegetation growth to remain on the right-of-way, which would enhance wildlife use potential.

Growth regulators and herbicides would typically be selectively used for vegetation control. Due to the selective nature of vegetation cutting, the prescriptive use of growth regulators and herbicides, and the infrequent occurrence of maintenance activities, the potential effects on wildlife and water quality should be negligible.

Wildlife

As previously mentioned, construction of the linear facilities would result in clearing of most trees and shrubs. Taller growing plant species would not be allowed under the transmission lines or within a certain distance of the conductors. Also, plants (such as trees and shrubs) with extensive root systems would not be allowed within the right-of-way for the pipelines. This means that maintenance practices would be developed to preserve the rights-of-way as early successional habitats—herbaceous and small shrubby communities.

Perpetuation of these community types would not adversely affect regional wildlife populations. None of the communities crossed by the linear facilities are considered rare or unique.

These maintained rights-of-way would create a diverse habitat edge through forested communities. This edge would provide foraging habitat to certain forest species, but it would reduce the amount of forest habitat for forest-nesting/breeding species. In turn, the open herbaceous communities created would increase this habitat type for open land or grassland-nesting/breeding species. The rights-of-way might also open previously inaccessible areas to unauthorized four-wheel-drive vehicles and hunters. Mississippi Power could work with landowners to ensure access was limited to the landowner’s desires.

Operation of the linear facilities would not be expected to negatively affect wildlife. The pipelines would be buried, so they would not affect wildlife usage of the right-of-way. The overhead transmission lines could be located so as to not cross any major wetlands or water bodies, which are used by large flocks of waterfowl or water birds. Therefore, potential for bird collisions with the wires could be minimized. In situations where there were bird collisions or probable collisions, bird diversion devices on the conductors could be installed. Other than the occasional maintenance and patrols by utility personnel, human disturbances to wildlife would remain similar to current conditions.

Listed Species

O&M of the linear facilities would have no effect on listed species that may occur along the routes. The gopher tortoise, if present, might actually benefit from the low-growing herbaceous habitat that would be maintained on the right-of-way. DOE has initiated informal consultation with USFWS regarding potential effects to this species.

4.2.7 AQUATIC ECOLOGY

Potential impacts on aquatic systems and ecology associated with power plant, mine, and linear facilities construction activities and operations would relate directly to impacts on surface waters, as previously discussed in Subsection 4.2.4. Potential impacts would be controlled by the same means and methods described previously.

4.2.7.1 Construction

Power Plant

Construction activities would include clearing and grading, which would potentially increase runoff from the construction site during rain events. Construction of the power plant would have minimal likelihood to impact aquatic ecology. The power plant site is well drained by multiple drainageways containing small ephemeral and intermittent streams that drain to Chickasawhay Creek. Control of construction stormwater runoff and delivery to drainageways would minimize impacts of sedimentation in downstream receiving water bodies and would, therefore, minimize impacts on the aquatic systems.

Surface Lignite Mine

Construction activities associated with the proposed mine facilities would include clearing and grading for haul roads, shop/maintenance areas, etc. These activities would potentially increase runoff from the construction site during rain events. All surface water runoff from all construction projects would flow to stormwater sediment ponds where it would be retained to meet effluent standards. The construction of a sediment pond would be the first disturbance to a watershed area. During the construction of the sedimentation ponds, planned surface water runoff and sediment transport controls, provided for in the SWPPP, such as fabric filter fences, hay bale dikes, and use of BMPs, would be expected to reduce the impacts of construction of the ponds. Once the sedimentation ponds were constructed, construction-related runoff within that watershed would flow to the sediment pond.

Clearing of terrestrial vegetation in areas to be mined, construction of surface water control structures, and erection of administrative and service buildings would also occur as part of initial mine construction. Some of the roads would cross area streams, as would embankments constructed for diversion channels and sedimentation ponds. Each of these activities could adversely impact aquatic biota resulting from: (1) disruption of existing stream channels (e.g., stream realignment); (2) changes in nutrient and chemical inputs; (3) reduction in the shade and organic materials provided by riparian vegetation; and (4) alteration of existing flows.

The immediate increase in leaching of soil nutrients commonly associated with the clearing of vegetation could temporarily enrich streams in the project area. If this were accompanied by the clearance of riparian vegetation, etc., the increased nutrient and light levels could cause algal blooms in pool areas, when suspended solids concentrations are sufficiently low. Nutrient release rates from cleared areas would decrease following the initial pulse; therefore, nutrient enrichment of project streams is not anticipated to be a long-term effect.

Construction of sedimentation ponds SP-2 and SP-3 would remove less than 4,000 linear feet (lf) of intermittent tributary stream channels currently connected to Chickasawhay Creek. Construction of sedimentation pond SP-7 would remove approximately 3,000 lf of the Tompeat Creek channel. Upstream of the SP-7 dam, Tompeat Creek is classified intermittent. Construction of all three ponds would require authorization by USACE through issuance of a 404 Permit, including measures to minimize and mitigate these potential effects.

Construction of temporary diversion channel 1A would disconnect approximately 3.6 miles of Chickasawhay Creek channel, which is classified perennial. These losses of connected habitat would be offset, in part by aquatic habitat created in the diversion channels, as more fully discussed in Subsection 4.2.7.2. Construction of the diversion channel would require authorization by USACE through issuance of a 404 Permit, including measures to minimize and mitigate these potential effects.

Linear Facilities

Construction of the linear facilities would not be expected to have any permanent impacts on streams crossed. Activities would include soil disturbance (i.e. tracking, grading, and excavation), trenching, stockpiling of excavated soils during construction, clearing of vegetation, and installation of temporary crossings. These activities could deliver excess sediment to streams and increase turbidity during wet weather if adequate soil erosion and sedimentation control measures were not used. During construction of overhead transmission lines, installation of temporary crossings, removal of vegetation, and tracking could disturb soils within the stream corridors. Installation of the pipelines via trenching within streambeds would increase turbidity in the stream if construction was completed in the presence of flow. Likewise, trenching and excavation adjacent to the streams could deliver sediment to the stream during wet weather.

Excess sedimentation and turbidity caused by linear facility construction activities could directly impact habitat and organisms through smothering. Turbidity could damage fish gills. However, short-term increases in turbidity would not usually harm biological organisms, particularly when the turbidity was within the natural range for the crossed streams.

Sedimentation and turbidity could be effectively controlled by using applicable soil erosion and sedimentation control BMPs to minimize soil erosion and transport to the stream, as discussed previously. When trenching in streambeds with water flow, sediment traps could be used or flow could be dammed and pumped around the trenching site. When appropriate, on larger streams with perennial flow, other means such as jack-and-bore and directional drilling might be feasible for installation of the pipelines. These construction methods would reduce the impacts associated with open trenching in the presence of flow.

4.2.7.2 Operation

The power plant and linear facilities should have minimal impacts on streams and aquatic resources during operation. The surface lignite mine would have greater direct impacts on aquatic resources during operation due to mining of stream channels and associated diversion of flow. Other potential indirect impacts on aquatic systems associated with operation of the surface lignite mine would include sedimentation and downstream alteration of hydrology.

Power Plant

The power plant would be a zero-discharge operation with no cooling tower blowdown or other process discharges. The only discharge from the power plant site would be stormwater runoff. Permitting and technology-based NPDES controls for stormwater discharges are adequate to protect receiving waters. Operation of the power plant would have other potential impacts on aquatic resources. These would include indirect impacts caused by deposition of air pollutants to surface waters and impacts associated with the use of reclaimed effluent from the Meridian wastewater treatment system.

The power plant would make use of reclaimed effluent from two Meridian POTWs to satisfy cooling and other plant water needs, as discussed elsewhere. Use of POTW effluent would reduce flows in Sowashee Creek, a tributary of Okatibbee Creek with its confluence located downstream of Okatibbee Lake. Sowashee Creek is impaired due to pathogens and biological impairments. It is currently on the 303(d) list for not meeting the Aquatic Life Support designated use and is part of the fecal coliform TMDL for Okatibbee Creek. Due to wastewater discharges and urban runoff, the biological communities of Sowashee Creek have been degraded. There are special or unique aquatic animals or communities associated with Sowashee Creek downstream of the main Meridian POTW. Removing a source of pollutants and stressors by routing a portion of the Meridian effluent for use at the proposed power plant should have long-term benefits for the biological communities of Sowashee Creek downstream of Meridian. It would also benefit Okatibbee Creek downstream of the Sowashee Creek confluence.

Surface Lignite Mine

Disturbance of downstream aquatic habitats during mine operation could result from increased suspended solids loads entering the creeks; however, all of the runoff and other discharges along and within each mine block would be regulated by sedimentation ponds and diversions. Sedimentation ponds would provide detention of surface runoff from subbasins affected by the mining operation, as well as the detention of pit inflows from mine pit water control operations. Discharges from sedimentation ponds would be subject to the MDEQ SMCRA and CWA permits and effluent limitation requirements discussed in Subsection 4.2.4.2.

Potential constituents of runoff from roads and service areas could include oil and grease deposited during operation of vehicles. Runoff from service areas and road surfaces would be controlled by sedimentation ponds or other BMPs. An SPCC plan would be in place to address oil and grease spillage. Releases of this type would be subject to the permit and effluent limitation requirements discussed in Subsection 4.2.4.2.

Lignite extraction during the operation period would remove up to 31.9 miles of stream channel classified as perennial (NACC, 2009). In addition, lignite extraction would remove up to 24.26 miles of intermittent tributaries. Lignite extraction in aquatic habitat would require approval by USACE through issuance of a 404 permit, including measures to minimize and mitigate effects of aquatic resources.

Use of temporary stream diversions would result in the loss of habitats and the aquatic life in the existing stream channels. Although rapid colonization of the new channels would likely occur, the new channels would not likely initially provide the habitat diversity of the natural channels.

Extensive removal of riparian vegetation from the streams of the mine study area would result in the loss of stream ecosystems that are presently dominated by detrital food chains dependent on leaf litter fall from the surrounding woodlands. In situ production by algae and macrophytes is, at present, largely confined to areas that have been cleared, such as road crossings. While extensive alterations in the abundance and composition of the algal and macrophyte flora could be initially expected, the potential effects on other components of the aquatic community are less clear but are discussed further.

Zooplankton and littoral macroinvertebrate densities would probably rise due to increases in phytoplankton food availability and the additional cover provided by more extensive stands of aquatic vegetation. The factors affecting potential changes in the macroinvertebrate community are more complex. Although in situ production would, to a large degree, supplement terrestrial organic material at the base of the food chain, it must be pointed out that the largest proportion of aquatic macrophyte production also enters the food web as detrital material rather than being cropped when living. Detritus-feeding organisms (e.g., most oligochaetes) may be largely unaffected, as the source of organic material in the sediments appears to be unimportant relative to the amount available. Some changes might occur in the composition of the detritus-feeding fauna as the source of detritus changes from mainly terrestrial plant leaves to aquatic vegetation, but little is known about the dependence (or lack thereof) of these species upon specific detrital sources. Two groups of macroinvertebrates, the scrapers/algal grazers and filter feeders, could be expected to increase in abundance and diversity in response to these changes. Additionally, the increased habitat diversity provided by macrophyte stands could be expected to result in some increase in macroinvertebrate abundance and diversity. Fish species feeding on macroinvertebrates (e.g., sunfishes, catfish) would be affected by changes in invertebrate species composition and distribution only to the extent that the availability, or catchability, of prey items changed. For instance, the greater abundance and variety of invertebrates generally associated with aquatic vegetation could result in some increases in sunfish and top minnow populations. Other factors attendant to the change from woodland to open stream habitat that could affect the fish community would include increases in the ranges of variation in temperature and water level, and increased availability of cover in stands of vegetation.

Sedimentation ponds controlling runoff from disturbed areas would not be expected to concentrate a variety of discharge constituents such as metals for two reasons. Firstly, although these ponds are designed to treat mine discharge and other runoff by settling and would be able to retain the water and associated solids during a 10-year, 24-hour storm, MDEQ SMCRA Regulations require all captured runoff be routed through sedimentation ponds for removal of TSS. Secondly, the data obtained from the overburden cores suggest that concentrations of runoff materials such as arsenic, cadmium, chromium, copper, lead, nickel, manganese, selenium, and zinc from disturbed and undisturbed areas would be insignificant.

No attempt would be made to artificially restock stream sections because of their ephemeral or intermittent nature. Natural restocking of plankton and invertebrate species would occur, and fish would move principally from downstream areas to occupy the postreclamation habitat. Following completion of mining, stocking of individual landowner's reclamation ponds and lakes could be employed to maintain or enhance their fishery value. Although fish stocking depends on landowner goals and management philosophy, the most commonly stocked fish in Mississippi farm ponds are channel catfish, largemouth bass, bluegill, and redear sunfish. Ponds and lakes stocked with these species, and properly managed, would provide a stable fishery resource.

A study of existing streams and diverted streams at NACC's Red Hills Mine showed that habitat quality, water quality, and biological communities were similar in natural and diverted streams (Vittor, 2008). RBAs were performed at four sites: one upstream of the mine study area in the natural headwater stream (R1 Headwaters), one downstream of the mine study area in the natural stream (Little Bywy), and two within portions of the diverted stream (Diversion 1 and 2). Water quality met minimum state standards at all but the Diversion 1 site, where DO was measured at 2.75 mg/L. Habitat scores ranged from 98 at Diversion 2 to 128 at Little Bywy. The habitat score at Diversion 1 and R1 Headwaters were the same (113). The habitat scores for streams on the Kemper County mine study area ranged from 56 to 115. Bioassessment scores at Red Hills ranged from 13 to 25. R1 Headwaters and Diversion 1 scores were 13, while the Diversion 2 and Little Bywy scores were 25 and 23, respectively. Bioassesssment scores at the Kemper County mine study area ranged from 17 to 27. These study results suggest that stream diversions proposed for the Kemper County mine study area (Liberty Fuels Mine) could maintain biological conditions similar to existing conditions during mine operation if the diversions are constructed and maintained in a fashion similar to that of the Red Hills Mine.

Impacts to the aquatic ecosystem within the mine study area would be limited to those authorized by the USACE 404 Permit. Mitigation for the authorized impacts would be required to result in no net loss of stream functional values provided by the existing dendritic intermittent and perennial stream system, including accounting for temporal losses. The USACE Mobile District Compensatory Stream Mitigation Standard Operating Procedures and Guidelines (USACE, 2009) would determine the type and magnitude of mitigation required, including creation of intermittent and perennial stream channels.

Linear Facilities

Operation of the linear facilities would not result in any permanent impacts on aquatic ecology.

4.2.8 FLOODPLAINS

Floodplains mapped by FEMA are limited to Okatibbee Creek in Kemper County. In Lauderdale County, mapping includes Chickasawhay, Tompeat, and Bales Creek floodplains as well. The FEMA Lauderdale County maps of 100-year floodplains generally correspond with the areal extent of the bottomland forest type wetlands mapped and described in Chapter 3. Qualitatively, these comparisons indicate Penders and Chickasawhay Creek riparian wetlands provide sizeable flood storage capacities in unmapped Kemper County, whereas Tompeat Creek, Bales Creek, and the intermittent tributary streams do not. The discussion of floodplain impacts in this section, combined with the descriptions of the proposed action in Chapter 2, the affected environment in Chapter 3, and alternatives to the proposed action in Section 2.7, satisfies the requirements regarding preparation of a floodplain assessment (see Subsection 7.1.6).

4.2.8.1 Construction

Power Plant

The portion of the power plant site that would be used for permanent facilities is wholly located outside of floodplains. Construction of the power plant would have no direct or indirect impacts on floodplains.

Surface Lignite Mine

All permanent facilities associated with the mine would be constructed at locations with elevations above the 100-year flood level. Several of the water management structures, however, would be located within mapped and estimated floodplain areas. There would be no critical action in the critical action floodplain as defined in 10 CFR 1022.4.

Construction of diversion channels 1A and 1B would disconnect the existing floodplain of Chickasawhay Creek. To mine through Chickasawhay Creek, the creek would be relocated into a channel that bypasses the existing valley and floodplain. The diversion channel would be constructed to contain the 100-year flood flow. Therefore, the floodplain of the Chickasawhay Creek would be completely contained within the diversion channel banks once its construction is completed.

The principal hydrologic effect attributable to the construction of diversion channel 1A would be removal of an unestimated volume of flood storage capacity in the Chickasawhay Creek basin. Because the diversion channel would be sized to convey the 100-year flood flow within its banks, floodwaters historically stored in bottomland forested riparian wetlands along Chickasawhay Creek within the mine study area would be conveyed downstream by the diversion channel into Okatibbee Lake. As discussed in Section 3.10, no flood studies of Chickasawhay Creek have been conducted; therefore, the volume of flood storage capacity reduction cannot be quantified at this time. Once mining operations commence, the control of drainage in mine block A and the attenuation capacity of sedimentation pond SP-10 would partially offset the reduction by reducing flood flows.

Linear Facilities

Construction of the linear facilities would not have any permanent impacts on floodplains of streams crossed. Temporary impacts would be limited to short-term stockpiling of excavated soils during construction, clearing of vegetation, and temporary crossings. All disturbed portions of floodplains would be returned to preconstruction grades and revegetated to prevent permanent or long-term impacts to crossed floodplains.

4.2.8.2 Operation

Power Plant

The operation of the power plant would have no impact on floodplains.

Surface Lignite Mine

During active mining of mine block A, the Chickasawhay Creek floodplain would be removed over the length of mine block A. Up to 450 acres of floodplain would be removed. The volume of flood storage provided by the existing floodplain has not been quantified. The 100-year flood flow of Chickasawhay Creek would be completely contained within the 41-acre diversion channel along the west edge of mine block A.

To prevent floodwaters from entering active mine block E during mining and reclamation, NACC's current conceptual plans include construction of a levee within the Okatibbee Creek floodplain. Construction of a levee at this location would require approval by USACE in a CWA Section 404 permit and MDEQ in a mine operation permit. During permit application review, USCAE or MDEQ could require relocation or redesign to avoid or minimize impacts. In addition, NACC might at some future date revise, alter, or amend the location and design based on further engineering studies. The following assessment of effects is based on the initial location proposed by NACC.

Figure 4.2-4 illustrates the initial location proposed by NACC. At this location, the proposed levee would reduce the floodplain width from approximately 3,000 ft to approximately 200 ft. The estimated cross-sectional area within the floodplain would decrease from 21,000 to 2,700 ft^2. The areal extent of the floodplain would decrease from approximately 1,509 to 885 acres.

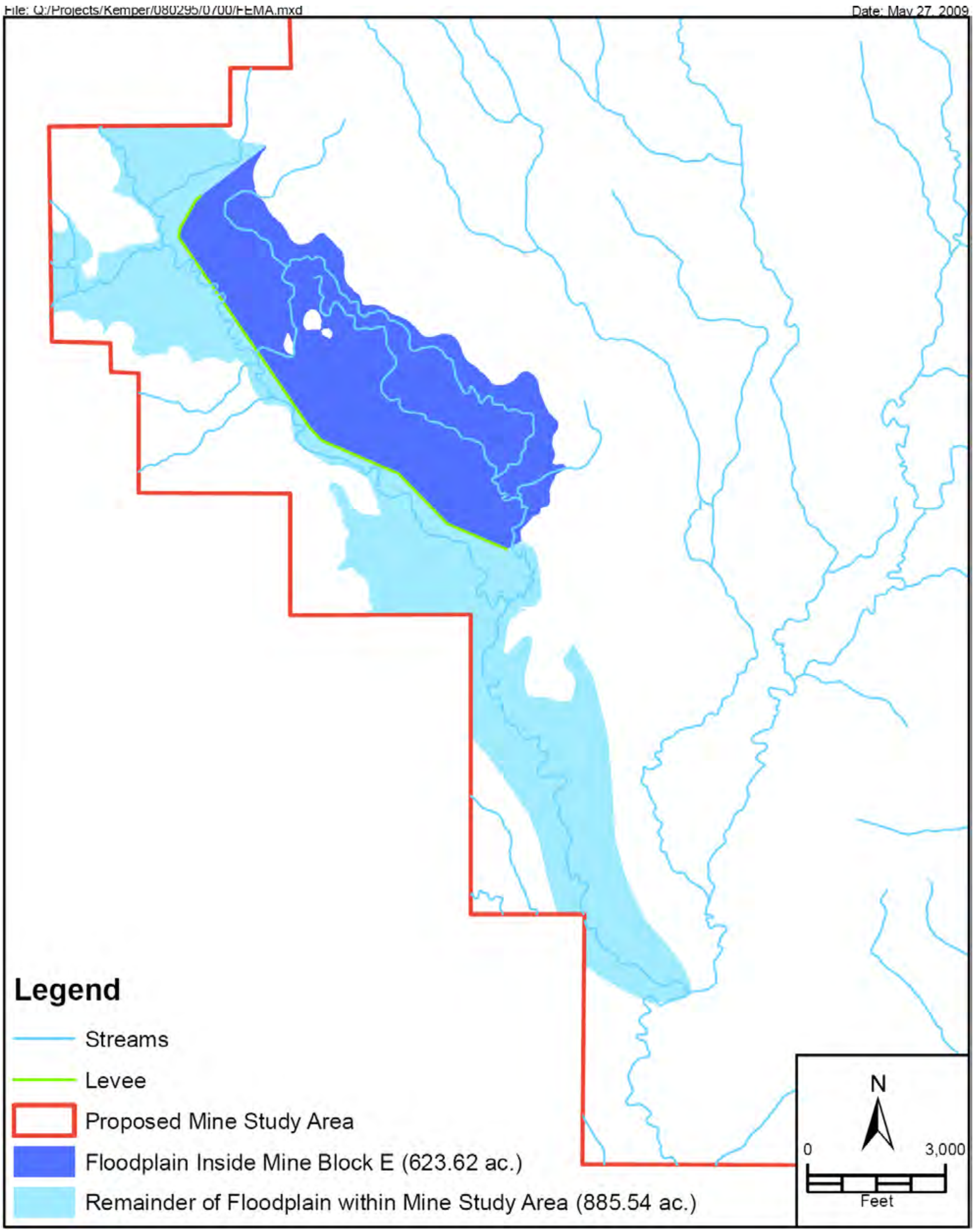

Figure 4.2-4. Impact of Mining Block E on Okatibbee Floodplain
Source: ECT, 2009.

Tetra Tech, a consultant to NACC, evaluated the effects of constructing a levee at this location using USACE's HEC RAS flood routing model. Tetra Tech reports flood elevations adjacent to and upstream of the proposed levee would rise approximately 1.5 ft in response to the 50-year or 100-year rain event. Flood flow velocities in Okatibbee Creek within the mine study area would increase by 0.5 ft per second.

Linear Facilities

Operations of transmission lines and pipelines would have no impacts on floodplains.

4.2.9 WETLANDS

This section addresses potential impacts to wetland resources located on the power plant site, surface lignite mine, and linear facilities (approximately 156 miles of surveyed corridors) associated with the project. Subsection 4.2.6.1 presented information on impacts to terrestrial ecology, including wetlands. The following focuses more specifically on wetland impacts. The discussion of wetlands impacts in this section, combined with the descriptions of the proposed action in Chapter 2, the affected environment in Chapter 3, and alternatives to the proposed action in Section 2.7, satisfies the requirements regarding preparation of a wetlands assessment (see Subsection 7.1.6).

4.2.9.1 Construction

Clearing of wetland vegetation and subsequent excavations associated with construction would expose soils to erosion by winds and stormwater. Increased stormwater runoff, erosion, and sedimentation into downstream wetlands and surface waters have the potential to accelerate eutrophication. Eutrophic waters exhibit an increase in turbidity, nutrient and bacterial levels, and oxygen demands, producing an environment that favors plant over animal life. Fugitive dust from clearing operations could affect wetland vegetation in the vicinity of the project site. Potential impacts resulting from fugitive dust and prevention techniques to control and limit potential erosion, sediment transport, and fugitive dust from the site are previously discussed in Subsection 4.2.6.1.

Power Plant

The power plant and associated onsite facilities' construction activities with the potential to impact wetlands include clearing and grading for the various power plant and mining facilities built on the plant site. The portion of the 1,646-acre site potentially impacted is shown in Figure 2.5-1. Construction activities associated with the power generating facilities as well as a portion of the lignite mine that would be located on the power plant site would impact approximately 133 acres of wetlands (30 percent of the total wetland acreage on the power plant site). Forested wetlands are second-growth wetlands, and all of the wetlands on the site have been impacted to varying degrees by historical uses of the property, primarily pine plantation and other agricultural activities. The remaining 312 acres (70 percent) of wetlands on the power plant site would not be impacted by construction. Table 4.2-27 lists specific wetland impacts.

Table 4.2-27. Specific Wetland Impacts—Power Plant Site

Wetland/Aquatic Resource Type	Total Wetland Acreage	Wetland Impact Acreage
Forested wetland (palustrine forested)	330.7	93.4
Herbaceous wetland (palustrine emergent)	35.5	11.8
Shrub wetland (scrub shrub)	76.1	27.6
Ditches	0.08	0.05
Ponds	2.1	0
Streams	0.28	0.03
Total	**444.7**	**132.9**

Source: ECT, 2009.

Construction of the project would avoid wetland impacts to the extent ble, and unavoidable impacts to wetlands would be minimized to the extent possible. Any unavoidable wetland impacts that could not be acceptably minimized would be mitigated per CWA Section 404 requirements. DOE may also consider additional mitigation as a condition of the record of decision (ROD). Details would be established as part of the Section 404 permitting process. Appendix P provides a preliminary wetland and stream mitigation plan that outlines possible mitigation concepts and options. Both DOE and USACE have conducted an initial review of this plan; however, neither agency has granted final approval, pending final review and response to comments.

Surface Lignite Mine

Assembly of the dragline and construction of the mine facilities would remove fewer than 25 acres of wetlands. Construction of sedimentation ponds SP-2, SP-3, SP-7, and SP-10 would impact up to 92 acres of wetlands.

Construction of the 1A diversion channel would indirectly impact up to 476 acres of wetlands through hydroperiod alteration. Removal of the Chickasawhay Creek inflow would eliminate periodic flooding and result in periodic dehydration.

As previously stated, wetlands would be avoided where practicable and mitigated where impacts are unavoidable. Only then would mitigation to offset impacts to wetlands be considered. During the application review process, USACE would review the proposed mine plan, as well as alternative mine plans, to ensure all appropriate and practicable steps have been taken to minimize potential adverse impacts on the aquatic ecosystem.

Once the minimization review is complete, the mitigation requirements would be established by USACE, both in terms of type and magnitude. If issued, the CWA 404 permit would require that all wetland functional losses, including temporal losses, be offset through the mitigation in accordance with USACE and EPA regulations. Mitigation type would be established by USACE, and magnitude would be established using the quantitative WRAP method (see Appendix P).

Linear Facilities

Construction practices in wetlands would retain the vegetative root mat in the rights-of-way in areas not filled for road or structure pad construction or pipeline trench excavation, thereby minimizing impacts to wetlands. Impacts to wetlands would vary depending on the wetland system through which the transmission line or the pipeline was routed. The shift in wetland composition would vary with the type of original overstory and soil alterations resulting from construction activities. Outside areas where filling might be necessary for roads or structure pads or laying of the pipeline, small freshwater marsh/wet prairie systems intersected by the transmission lines and pipelines could potentially be avoided as a matter of design choices. If so, clearing would be required in those areas, and proper culverting would maintain the existing hydroperiod. In forested wetland areas, restrictive clearing processes could be used. Restrictive clearing would require that all cutting be done by hand, usually with chain saws, or by low ground-pressure shearing machines to reduce disturbance to the ground cover. Table 4.2-28 lists worst-case potential wetland impacts and acreage associated with linear facilities. Wetlands are identified in Table 4.2-28 as forested wetland (palustrine forested), herbaceous wetland (palustrine emergent), and shrub wetland (scrub-shrub). Similar to the power plant site, wetlands intersected by the linear facility corridors have been impacted to varying degrees by past uses, primarily pine plantation. Jurisdictional *other waters* resources are identified as ditches, ponds, and natural drains: seasonal, intermittent, and perennial streams (riverine). As discussed previously in Subsection 4.2.6.1, the acreages of wetland impacts have been conservatively estimated to provide an upper bound. Actual impacts to wetlands would likely be less. Possible means to reduce impacts are discussed in the next subsections.

Table 4.2-28. Specific Wetland Impacts—Linear Facilities

Land Use	Total Impacted Acreage of All Linear Features	Impacted Acreage Along New Transmission Lines*	Impacted Acreage Along CO_2 Pipeline*	Impacted Acreage Along Natural Gas Pipeline Only*	Existing Transmission Lines to be Reconductored
Forested wetland (palustrine forested)	246.81	93.98	145.48	6.06	1.29
Herbaceous wetland (palustrine emergent)	99.89	23.52	45.65	0.23	30.49
Shrub wetland (scrub-shrub)	46.95	23.92	18.22	0.26	4.55
Ditches	3.94	2.26	0	0.05	1.62
Ponds	12.56	7.05	4.61	0	0.90
Natural drainages (riverine)-seasonal, intermittent, and perennial streams	41.40	28.73	3.21	0.32	9.14
Totals	**451.55**	**179.46**	**217.17**	**6.92**	**47.99**

*Maximum predicted impacts due to the necessity of clearing vegetation within a 100-ft-wide right-of-way for transmission lines and 50-ft rights-of-way for the natural gas and CO_2 pipelines. This would result in conversion of forested uplands and wetlands to shrub- or herb-dominated communities. The only permanent impact would be due to any structures or necessary access road construction through or in wetlands or over streams in the transmission line right-of-way.

Source: ECT, 2009.

Pipelines—In wetlands or sensitive areas within the right-of-way, the top soil would be stockpiled and replaced after the pipe is entrenched. Storing that side cast material for short periods would minimize impacts to the soils. BMPs would be employed during construction, including the use of hay bales and/or silt screens, to prevent or control and contain possible sedimentation and erosion. If necessary, clearing within wetlands and buffers could be accomplished using only chain saws or brush axes.

At the crossings of highways and major streams, pipe could be laid by bore and jack. The effluent from dewatering of jacking and receiving pits could be pumped to a dewatering basin or portable sediment tanks. At stream crossings and other flooded areas, two types of sandbag/stone flow diversions could be used to isolate the work areas from streams and wetland areas. Sediment-laden water could then be pumped from the construction site into a dewatering basin to allow for filtration before re-entering the waterway. The excavated material could then be stockpiled inside of the sandbag area. Silt fences could also be used as required to prevent any discharge of sediment into the stream or adjacent wetlands.

When construction activities would take place within a stream channel, such as culvert construction or replacement, a flow diversion pipe could be installed. The water within the sandbag/stone diversion area could be pumped instead of providing a diversion pipe. However, pumping would only be acceptable if the diversion was only in place for a single workday or the pump was supervised during off-work hours.

Some steams crossings would require the installation of an in-stream stone dike to be used as a sediment-filtering device for streams that generally carry wet weather flow. Alternatively, a temporary swale might be constructed to divert and filter runoff from disturbed areas.

The sandbag/stone diversions proposed to isolate work areas from streams could be used unless the site conditions require other measures, such as coffer dams, sheeting, or manufactured dams. No standard construction specifications exist for the referenced dams since these devices are extremely variable in design and could be specifically manufactured based on site-specific conditions. Straw bale dikes could be used along the edges of some wetland areas located close to construction areas to prevent erosion or sedimentation damage.

<u>Transmission Lines</u>—Impacts to wetlands could be minimized where the transmission line could be designed to span sensitive areas by locating structure pads outside of wetlands. Where wetlands cannot be avoided, the construction of the transmission lines could involve installation of culverts and placement of fill resulting in temporary increases in turbidity and silt deposition. Such impacts would be local. Appropriate control measures such as staked hay bales and silt curtains would minimize sedimentation. Construction of transmission lines and access roads (where necessary) in wetland areas would use methods such as proper culverting and erosion control as necessary to minimize any significant disruption to the aquatic ecosystem.

The proposed transmission line corridors cross the following streams: Wild Horse, Baker, Lost Horse, Ponta, Toomsuba, Blackwater, Rogers, Okatibbee, Nanabe, Hognose, Sawashee, Coats, and Graham Mill Creeks and White, McLeemore, and Curtis Branches. No transmission structures would likely be placed within these water bodies, because all are narrow enough to be spanned by the proposed transmission lines. New transmission lines would also cross some wetland areas. Some of these wetlands have been previously impacted by existing transmission lines, gas pipelines, and agriculture (particularly pine cultivation). Impacts to these wetlands could be minimized to the extent practicable by locating construction activities in areas of existing cleared right-of-way, using existing access roads where available, or by locating new right-of-way immediately adjacent to existing clearing so only supplemental clearing is needed. Where available, existing roads and access ways could be used to limit the need for construction of new roads. For example, some structure pads could potentially be located and constructed to allow access to the structure from an existing road, thus minimizing the need for new and additional roadway impacts.

Water quality along and adjacent to the construction site would be preserved by the implementation of BMPs to control the quantity and quality of runoff from the construction site. Prior to construction near or in wetlands/surface waters, silt fences and/or hay bales would be placed landward of the wetland or stream boundary. Hand removal of trees in wetlands or on stream banks would decrease the potential for erosion/siltation that could result from machinery. Where use of machinery is required, low ground pressure equipment could be employed. This would minimize substrate disturbance and reduce the potential for sedimentation/erosion into wetlands or streams.

To the extent possible, native wetland vegetation would be left in place to reduce erosion. However, some vegetation would be disturbed by the construction of the transmission lines. The impacts of land clearing could be reduced in forested wetlands by leaving the root mat of most trees in place. Upon completion of construction, disturbed areas of steep slopes would be seeded and mulched to control erosion. Native vegetation would gradually recolonize the disturbed areas.

The construction of the transmission lines would not require ground water withdrawal, dewatering, or relocation of any water bodies.

4.2.9.2 Operation

Impacts to wetland ecological resources associated with the project operation would result from potential air impacts on vegetation and wildlife and the noise levels originating from operation of the power plant site and surface mine. The audible noise associated with transmission lines would be expected to be less than the ambient outdoor noise levels. An evaluation of potential and expected impacts on wetland vegetation and wildlife components resulting from operation of the project is presented in the following paragraphs.

Power Plant

Operational impacts on wetland vegetation would be similar to those discussed in Subsection 4.2.6.2.

Surface Lignite Mine

A total of 5,994 acres of wetlands were identified within the 31,260-acre mine study area; of this total, approximately 2,374 acres are within the approximately 13,000-acre area proposed to be disturbed by mining and mining-related activities (including buffer zones around the immediate mining perimeter, ponds, and diversions) (Table 4.2-29).

Table 4.2-29. Proposed Wetlands Impacts—Surface Lignite Mine

Combined Category	Vegetation/Land Use Categories Included	Proposed Acreage Impacts	Percent of Existing
Forested wetlands	BF, H, HP, PH, PP	1,856	39
Shrub wetlands	S	181	62
Herbaceous wetlands	C, F, G, R, R/C	237	41
Total Wetlands		**2,374**	**41**

Source: NACC, 2009.

Impacts to wetlands due to mining would be limited to those authorized by the USACE 404 Permit. Avoidance, minimization, and mitigation requirements and procedures to be implemented by USACE during review of the CWA 404 permit application would be identical to those described in Subsection 4.2.9.1. See Appendix P, which provides a preliminary wetland and stream mitigation plan outlining possible mitigation concepts and options.

Linear Facilities

Wetland vegetation in the rights-of-way would be managed by a variety of methods, including trimming of all vegetation to the height that is compatible with the safe access, operation, and maintenance of the linear facilities. The exact manner in which maintenance would be performed would depend on the location, type of terrain, and surrounding environment. Wetland vegetation removal would be minimized consistent with safe and reliable operation of the transmission lines and pipelines. For example, fast-growing vegetation species and other vegetation whose mature height could interfere with the safe operation of the linear facilities would be cut or removed. Other species would generally be allowed to remain, resulting in shrub and herbaceous wetlands within the right-of-way. This would encourage a broad diversity of vegetation growth to remain on the right-of-way, which would enhance wildlife use potential.

Growth regulators and herbicides would be selectively used for vegetation control. Due to the selective nature of vegetation cutting, the prescriptive use of growth regulators and herbicides, and the infrequent occurrence of maintenance activities, the potential effects on wetlands should be reduced.

4.2.10 LAND USE

The current land uses of the power plant, surface lignite mine, linear facilities, and substations were described in Section 3.12. The majority of the properties are nonurban and forested. Existing development is limited to residences, churches, and commercial uses located on the proposed mine study area.

4.2.10.1 Construction

The proposed project would involve the construction and operation of an electrical generation facility, a surface lignite mine, transmission lines, pipelines, and three substations. Construction of the power plant would result in permanent land use change. Mining activities would result in both permanent and temporary land use changes based on the reclamation approved by the landowners and applicable regulatory agencies. The impacts from constructing new transmission lines and burying of the pipelines would be primarily temporary, although the conversion of permanent rights-of-way would be long-term. There would be permanent land use changes associated with development of the substations and access roads associated with the transmission lines.

Power Plant

Construction activities of the power plant would not displace any residences or businesses. The principal land use conversion would be from forests (approximately two-thirds of the site) to power plant and associated facilities. The impacted portions of the site would be converted to electrical power generating and related uses (including the mining-related facilities onsite), precluding other uses of the site for the life of the facilities, with the rest to remain in existing vegetation, providing screening and buffering. Even if all the upland forested portions of the power plant site were harvested and converted to power plant uses, the sale of the timber would have a negligible effect on the local timber supply and the timber market.

Surface Lignite Mine

All mining activities would be subject to reclamation. A landowner would have the option to sell or lease their property or opt not to be part of the mine. The landowner might or might not opt to rebuild after reclamation was complete. NACC, the landowner, and MDEQ and USACE regulations would determine the vegetative cover that would be present after mining and reclamation were complete.

Construction of mine support facilities (see Subsection 2.2.1 and Figure 2.1-5, for example), including a shop and warehouse building, an office and change house building, parking areas, bucket shed, fuel storage area, vehicle ready line, wash pad, and dragline erection site, would disturb approximately 320 acres. These facilities would be located on the 1,650-acre power plant site. Change to industrial land use for construction of these buildings and facilities could be long-term (i.e., in excess of 50 years), thereby precluding any use for other purposes.

The construction impacts of the mine are identified as the mine support facilities to be built on the power plant site and premining construction of various sedimentation ponds. The actual mining of the lignite is analyzed as an operational impact.

Linear Facilities

Clearing activities would be conducted during construction of the linear facilities. After construction, there would be no trees within the transmission corridors and within an approximately 50-ft-wide area over and adjacent to the buried pipelines. Except for any access roads beneath the transmission lines and at the pad locations, the linear facilities would be vegetated with naturally recruited ground cover and shrubs.

The three substation sites (or at least portions thereof) would be converted from the existing land uses. There might be some landscaping vegetation provided.

4.2.10.2 Operation

Power Plant

It is anticipated that the direct impacts related to construction would continue through the life of the power plant. The laydown area could continue to be used for overflow parking during planned outages. Some of the forested vegetation, including planted pines, would remain in place to maintain a screening and buffering function.

It is not anticipated that commercial or industrial development would occur in the project vicinity. Nearby development has not occurred in the vicinity of the RHPP or the TVA Kemper plant. Similarly, it is anticipated that any permanent relocations to the area would occur in established municipalities such as Meridian, Philadelphia, or DeKalb.

Surface Lignite Mine

Proposed mining activities would eventually affect land use on up to approximately 12,275 acres (Figure 2.2-3). This includes up to 11,250 acres that would be disturbed over a 40-year period by the excavation and removal of lignite.

Various water control structures (i.e., sedimentation ponds) would be constructed over the life of the proposed mine. As discussed in Chapter 2 (e.g., Subsection 2.4.2), some of these ponds would be constructed within the area to be mined prior to mining and would be removed with advancing mining and reclamation activities, while other ponds would be constructed outside the area to be mined. Although all ponds would be designed as *temporary* (i.e., to be removed as part of the reclamation process), some might be left in place, depending on the owner(s) of the surface rights.

At an approximate rate of 195 to 375 acres per year (see Table 2.4-2), the existing land would be converted to reclaimed land forms that would be revegetated and redeveloped in accordance with agreements with each landowner and MDEQ and USACE regulations and permits. Areas being mined would be precluded from any other land use from the initiation of land clearing activities until the reclamation activities were deemed complete and the land was released (typically 8 to 9 years). At that time, the individual properties could be returned to the control of the landowner.

The predominant land use within the area to be mined is forestry, with approximately 1,073 acres of recent clear-cuts. Actual operation of the mine would change current land uses within the up to 10,285 acres from which lignite would be removed. For each individual land tract, the postmining land use would be determined by the premining land use(s), surface owner wishes, and MDEQ and USACE regulations and permits. Based on a survey of landowners within the area proposed to be impacted by mining activities during the first 5 years of operation, most of the project area is anticipated to be reclaimed to forest, which in most cases corresponds to the premining use.

Linear Facilities

The transmission line corridors and at least a portion of the buried pipeline corridors would be maintained in low vegetation. The construction and operation of the linear facilities (156 miles) would result in the permanent loss of approximately 1,900 acres of upland forests, of which 790 acres are planted pine. The loss of the planted pine acreage is only approximately 0.2 percent of the total acreage of commercial forest acreage in Kemper County. There would be a permanent loss of vegetation beneath the access roads associated with the transmission corridors and the pads for the poles.

The construction impacts from development of the substations would continue through the operational life of the substations. It is anticipated that the substation sites would be mostly impervious.

4.2.11 SOCIAL AND ECONOMIC RESOURCES

4.2.11.1 Construction

Construction impacts to social and economic resources are discussed for the power plant and for the surface lignite mine. Employment for the construction of the transmission corridors/lines, pipelines, and substations would be minor in comparison.

Power Plant Employment

Employment during construction of the generation facility is estimated to average 500 workers, with an estimated peak of 1,150 workers. The peak employment would be expected to be maintained for 3 months of the approximately 42-month construction schedule (see Figure 2.3-1). Mississippi Power project managers would expect that approximately 15 percent of the workers would commute from their current residences in the local area. Except for certain specialized needs, all of the construction workers could be recruited from the east Mississippi/west Alabama area within an approximate 65-mile radius of Meridian.

As of 2006, 2,308 employees of Kemper County's entire employed labor force worked outside Kemper County, and these employees had an average commute time of 31.1 minutes (MDA, 2008). The corresponding numbers in Lauderdale County are 2,583 employees of the entire employed labor force of 31,670, with an average commute time of 17.9 minutes, and in Neshoba County are 2,901 (2000 count), with an average commute time of 20 minutes. The combined unemployment in 2006 of Kemper, Neshoba, and Lauderdale Counties was 3,364. According to a labor availability report prepared by the Pathfinders (January 2008), there are 12,700 unemployed persons actively seeking work within a 65-mile radius of Meridian. Given a 42-month construction period with varying numbers and types of workers required, it is reasonable to assume that potential workers would increase and, in fewer cases decrease, commute times to maintain their existing housing. A housing profile conducted by Alpha Resources (December 17, 2007) reviewed housing opportunities in the east-central Mississippi area and concluded that a large percentage of the estimated number of average workers could be accommodated in the area, particularly in Philadelphia and Meridian. The housing profile identified rental units, recreational vehicle (RV) parks, and hotel rooms in the area. The housing profile noted that workers do not generally gravitate to a residence camp environment.

The supposition that commute times to maintain existing housing or to seek housing in nearby metropolitan areas is borne out by the experience during construction of the RHPP. As with the proposed project and construction projects in general, workers with expenses such as temporary housing would be allowed a per diem. Per diem is a primary tool used to attract and maintain workers. Per diem is an allowance provided to craft workers from outside the local area and can be used to offset travel and living expenses. The per diem amount for each project is based on market conditions at the time of the project. On past projects located in rural areas of the southeast where per diem has been used, workers have been successful in locating temporary housing, and local people have also been successful in meeting temporary housing needs to earn extra money. On some projects, added incentives such as completion incentives or safety incentives might be offered to maintain craft workers at the project. The need for these added incentives are evaluated on a project-by-project basis.

Surface Lignite Mine Employment

During mine construction and development, average monthly employment is estimated to be 88 workers over an approximate 31-month period. Peak employment is estimated to be 155 workers for approximately 5 months. The impacts of these workers would depend on the timing of peak employment relative to the peak employment of the generation facility construction. The following subsection addresses the combined impacts of construction of the power plant and the mine development.

Combined Impacts of Power Plant and Lignite Mine

Employment and Employment-Related Economic Impacts

The greatest potential for impacts would be the result of the peak employment for the construction of the generation facility overlapping with that of development of the mine for a total construction work force of 1,305 for 3 months. For comparison purposes, the estimated peak employment at the Red Hills power plant and mine was estimated to be 1,700 workers for a 3-month period. Because of the temporary nature of construction employment, the normal commuting range for construction workers is often considerably larger than that for permanent positions. As previously noted, an area with a radius of 65 miles centered around Meridian has 12,700 unemployed persons actively seeking work. As happened at the Red Hills project, up to one-half of the workers could move within commuting range of the project to available temporary housing opportunities. The other workers would already be located in the local area encompassing all of the adjacent counties. In the specific instance, that would be expected to occur in the area to the west (Philadelphia area) and to the south (Meridian area).

Total payroll during construction would be expected to be $130 million for the generation facility and $15 million for development of the mine. Total construction expenditures for the generation plant are estimated to be $1.6 billion with $225 million to be spent in the local area. The corresponding amounts for the mine are total estimated construction expenditures of $54 million with most of the monies to be spent in the local area.

The U.S. Bureau of Economic Analysis developed the Regional Industrial Multiplier System (RIMS) for estimating regional input-output multipliers. RIMS II is the most recent model used to estimate the regional impacts on the initial changes in output, earnings, or employment associated with a specific project for any industry or group of industries. To incorporate the Red Hills project, a region encompassing Choctaw, Winston, Kemper, Lauderdale, Clarke, and Jasper Counties was created to determine the specific multipliers for the utilities and mining industries. The utilities industry includes power generation and mining excludes oil and gas extraction. Table 4.2-30 provides the direct-effect multipliers for the power plant construction and development of the surface lignite mine.

Table 4.2-30. Direct-Effect Multipliers—Construction

Construction Employment	Average	Direct-Effect Multiplier	Total Employment	Earnings (Payroll, $ Millions)	Direct-Effect Multiplier	Total Earnings ($ Millions)
Power plant	500	1.3191	659	$130	1.5503	$201.54
Surface lignite mine	88	1.3	114	$26.25	1.3961	$36.65

Source: U.S. Bureau of Economic Analysis, RIMS II Multiplier, 2006.

The construction employment and direct-effect multipliers would temporarily increase local government revenues through sales tax proceeds associated with worker spending, sales tax proceeds associated with equipment and materials procurement locally, and ad valorem taxes for workers purchasing residential property. RIMS II estimated that the impact to the region from construction of the power plant would be an additional $71.54 million and 159 jobs. The corresponding numbers for the development of the surface lignite mine would be an additional $10.4 million and 26 jobs.

Population and Housing

The previous section provided estimates of the number of workers for construction of the generation facility and development of the mine. It is estimated that up to 10 percent of the average construction employment could be supervisors and managers. Most of these employees would likely be relocations to the area. In addition, up to 50 of the mine construction workers would remain during the operational phase of the mine. Again, based on the experience of similar projects, the majority of the remaining employees would commute up to 1 hour from the project site and would use existing temporary housing opportunities. Based on both the availability of unemployed and underemployed workers in the surrounding area and accommodations in the area, a significant influx of new residents would not be expected. For purposes of impact assessment, it is estimated that 85 percent of the average combined work force would move to the area. Supervisors and managers and approximately 50 of the mine workers would bring families. Given these assumptions and the average of the Kemper, Lauderdale, and Neshoba Counties' persons-per-household count of 2.54, Kemper County and the adjacent counties would experience a relocated population increase of 1,310 at peak employment, or approximately 1.1 percent of the combined 2006 population of Kemper, Lauderdale, and Neshoba Counties. Table 4.2-31 summarizes the estimate of population increase. All of the children have been assumed to be of school age.

Table 4.2-31. Construction Worker Population Increase

Construction Area	Average Construction Employment	Average From Outside Area	Peak Construction Employment	Peak From Outside Area	Percent Supervisors or Managers	Additional Household Population	Total Relocated Population Average Construction Employment	Total Relocated Population Peak Construction Employment
Power plant	500	425	1,150	978	10*	77	502	1,055
Surface lignite mine	88	75	155	132	10*	90†	165	255
Total	588	500	1,305	1,110		167	667	1,310

*Percent of average number of employment.
†Includes supervisors, managers, and 50 employees transitioning to operational phase.

Source: ECT, 2009.

The largest increase would be expected in Lauderdale County (Meridian area), with the next largest increase expected in Neshoba County (Philadelphia area). According to the 2000 U.S. Census, there were 3,428 vacant housing units; 228 seasonal, recreational, or occasional use units; and a rental vacancy rate of 10.2 percent in Lauderdale County. The corresponding numbers for Neshoba County are 1,286 vacant housing units; 198 seasonal, recreational, or occasional use units; and a rental vacancy rate of 9.1 percent. In addition, the housing profile study conducted by Alpha Resources identified more than 1,700 hotel rooms in a 40-mile radius of DeKalb and more than 176 RV spaces in six RV parks in DeKalb or Philadelphia. Given the availability of vacant housing units, units available for occasional use, rental housing availability, hotel rooms, and RV parks, any shortfall in housing availability should be minor and can be mitigated through a proactive and aggressive housing identification program.

Schools

The estimated increase in the number of school-aged children during the 42-month construction/development schedule is 167. The majority of the increase in school-age population would be expected to occur in Lauderdale County, where there are nine schools, with the next largest increase to occur in Neshoba County, with six schools. Comparison of this estimated increase with the available capacity in the surrounding area indicates that the existing schools would have the capacity to absorb the projected increases.

Health Facilities

Between the four hospitals identified in Subsection 3.13.5.5, there are 697 licensed beds and four emergency treatment centers. Three of the hospitals with a total of 615 licensed beds are located in Meridian, and the fourth nearby hospital is located in Philadelphia (82 licensed beds). Expected population-based impacts on medical facilities and services from construction/development activities would be minimal since the estimated increase in population would only be 1.1 percent of the existing population. Both the mine and power plant would place priority on worker safety and training programs. It is anticipated that the four nearby emergency room-equipped hospitals would be capable of meeting the emergency medical service needs that might arise during construction/development. In the event of a catastrophic event, communication between emergency service personnel and first responders would direct patients to available treatment facilities, where, if necessary, additional beds, gurneys, and/or staff could be added.

Law Enforcement

The estimated increase in population from construction of the power plant and development of the mine would likely increase the demand for law enforcement. It is expected that the increased demand would be greatest in Meridian/Lauderdale County and Philadelphia/Neshoba County. Since the estimated population increase would represent only 1.1 percent of the existing population, there would be no *boomtown* impact where the increase in population overwhelmed the existing population. It is not expected that there would be any measurable change in the incidence of crime.

Linear Facilities

As previously mentioned, construction of the pipelines and transmission lines would not be expected to result in an increase in employment. These activities are generally conducted by subcontractors already working in the general area. These employees would not be expected to relocate to the project area.

4.2.11.2 Operation

Operation impacts to social and economic resources are discussed for the power plant and for the surface lignite mine.

Power Plant and Surface Lignite Mine Employment

Employment during operation of the power plant would be 105 fulltime employees during commissioning and demonstration (initial 6 years) and approximately 90 employees through the remaining life of the plant. It is anticipated that most of the employees would be hired from the local area (i.e., a 65-mile radius of Meridian). It is also anticipated that relocations would occur within or near the existing municipalities in Lauderdale, Neshoba, and Kemper Counties.

Employment during operation of the mine would total an estimated 189 to 213 employees, some of whom might be part-time. This employment level would continue throughout the life of the mine. As with the power plant, the employees would be hired from a 65-mile radius area around Meridian, and the permanent relocations would likely be in or around the existing municipalities.

Combined Impacts of Power Plant and Surface Lignite Mine

Employment and Employment-Related Economic Impacts

The combined employment of the power plant and surface lignite mine would be 318 (using the upper estimate for mine employment) for the first 6 years and 303 thereafter. The operational employees would likely be hired from or would relocate to municipalities located in Kemper, Lauderdale, and Neshoba Counties. Total operational payroll for the power plant would be an estimated $10 million per year for the first 6 years, decreasing to approximately $7.75 million (2009 dollars) per year for the remainder of the plant life. The operational payroll for the surface lignite mine would be an estimated $15 million per year.

Using the RIMS II input-output multipliers as described in Subsection 4.2.11.1, Table 4.2-32 provides the direct-effect multipliers for the operation of the power plant broken down into the commissioning and demonstration stage and thereafter and for the surface lignite mine.

Table 4.2-32. Direct-Effect Multipliers—Operation

Operation Area	Operational Employment	Direct-Effect Multiplier	Total Employment	Earnings (Payroll, $ Millions)	Direct-Effect Multiplier	Total Earnings ($ Millions)
Power plant first 6 years	105	1.3191	139	$10	1.5503	$15.5
Power plant after first 6 years	90	1.3191	119	$7.75	1.5503	$12.01
Surface lignite mine	213	1.3	276	$15	1.3961	$20.94

Source: U.S. Bureau of Economic Analysis, RIMS II Multiplier, 2006.

The employment and payroll direct-effect multipliers would increase local government revenues through property taxes for the improvements and increased value of the power plant and surface lignite mine properties, sales tax proceeds associated with plant and mine purchases of equipment and materials locally, and sales tax proceeds associated with worker spending. RIMS II estimates that the impact to the region from operation of the power plant for the first 6 years would be an additional $5.5 million and 34 jobs and for the remainder of the life of the power plant to be an additional $4.26 million and 29 jobs. The corresponding numbers for operation of the surface lignite mine would be an additional $5.94 million and 63 jobs.

Population and Housing

It is anticipated that the majority of the workforce would be provided from the local labor pool encompassing east-central Mississippi. The maximum operational employment of 318 workers would represent only 0.3 percent of the combined 2006 populations of Kemper, Lauderdale, and Neshoba Counties. Even if 50 percent of the operational employment, which is much higher than would be expected, relocated to the project area and established households, the increase in population, using 2.54 persons per household (average of the three counties), would result in a population increase of 404 persons, or only 0.4 percent of the combined populations. The 159 new households could be more than accommodated by the 6,305 (year 2000) vacant homes in the three-county area and/or available rental housing.

Schools

Using the relocation scenario of 50 percent of the highest operational employment (159 employees) and the averaged person-per-household multiplier and assuming that all children are of school age, there would be 245 additional students. The anticipated distribution would be 171 students in Lauderdale County, 61 students in Neshoba County, and 13 students in Kemper County. The increase in the number of students would represent an increase in school population of 2.6, 1.5, and 0.9 percent for Lauderdale, Neshoba, and Kemper Counties, respectively. These small potential increases in school population should be easily accommodated through the existing school facilities within each of the three counties.

Health Facilities

The maximum population increase through relocations to the project area would represent an increase of only 0.4 percent to the existing population of Lauderdale, Neshoba, and Kemper Counties. As during construction, both the power plant and mine would place priority on worker safety and training programs. The four area hospitals with 697 licensed beds and four emergency treatment centers would be more than adequate to meet the medical and health-related needs of the operational workforce and new residents.

Law Enforcement

The operational employment (within the first 6 years) with permanent relocations and the establishment of up to 162 new households would be far less of an impact to law enforcement personnel than impacts associated with construction. It is not expected that operation of the power plant and mine would require an increase in law enforcement positions. This expectation is further strengthened by the anticipation that the vast majority of relocations would be to the established municipalities as opposed to the rural areas.

Water Supplies

The discussion in Subsection 3.13.5.2 indicated that the city of Meridian has excess water treatment capacity of approximately 7 MGD. The certified utility providing service to the power plant site and mine study area has excess capacity of more than 4 MGD. The city of Philadelphia has excess capacity of approximately 1.8 MGD. Table 4.2-33 provides an estimate of the potable water needs from the area utilities.

There would be sufficient water treatment capacity to provide potable water to the power plant site and mine study area, if needed, and to the maximum projected population increase in the area.

Table 4.2-33. Potable Water Demand

Area Utilities	Employees/ Population	Per Capita Demand (gpd)	Potable Water Demand (gpd)	Excess Capacity (MGD)
Power plant and mine	323/411	100	32,300/41,100	4
Meridian	226/288	200	45,200/57,600	7
Northwest Kemper	16/20	200	3,200/4,000	4
Philadelphia	81/103	200	16,200/20,600	1.8

Source: ECT, 2009.

Wastewater Treatment

The information presented in Subsection 3.13.5.2 indicates there are no municipal wastewater treatment plants in Kemper County. It is anticipated that septic tank systems would be used to dispose and treat wastewater generated by the power plant. The mine operation would employ a package waste treatment plant. The total domestic wastewater generation, based on a per capita rate of 15 gpd, would be 4,770 gpd during the first 6 years, decreasing to approximately 4,545 gpd for the remainder of the life of the power plant and mine.

The city of Meridian has an estimated wastewater treatment excess capacity of 3.8 MGD (on average) at its wastewater treatment plant. The WWTP operated by the city of Philadelphia has an estimated

Table 4.2-34. Wastewater Generation

Area Utilities	Employees/ Population	Per Capita Generation (gpd)	Wastewater Generation (gpd)	Excess Capacity (MGD)
Power plant and mine	323/411	15	4,845/6,165	*
Meridian	226/288	250	56,500/72,000	3.8
Northwest Kemper	16/20	250	4,000/5,000	*
Philadelphia	81/103	250	20,250/25,750	0.85

*No municipal wastewater treatment facilities.

Source: ECT, 2009.

excess capacity of 0.85 MGD. Table 4.2-34 provides an estimate of wastewater generation. There would be cient capacity in the cities of Meridian and Philadelphia to accommodate the maximum projected population increase in these cities.

Linear Facilities

There would be only a minor increase in employment, if any, for maintenance of the transmission lines, pipelines, and substations.

4.2.11.3 Forestry Resources

The economic impact of the project on forestry resources was determined by assigning a value of $1,800 per acre for southern pine and $1,900 per acre for hardwoods.

Construction

Construction impacts with regard to forestry resources means the permanent loss of these resources. The land clearing for the power plant and its associated facilities on the power plant site, construction of the transmission lines and pipelines, and development of the substations would result in the permanent conversion of any marketable timber. The only construction impacts attributable to the mine are the mining facilities to be built on the power plant site. All other mining activities are intended to be temporary and would be reclaimed.

Power Plant

The estimated maximum value of the loss of timber on the power plant site is $121,295. This value is derived from the loss of all of the upland forest. The actual construction is intended to leave a perimeter buffer of trees.

Linear Facilities

As previously noted, approximately 1,900 acres of upland forests would be removed to develop the linear corridors. The estimated current value of the timber is $3,539,315.

Operation

Operational impacts to forestry resources would occur only as a result of mining and mining activities. To determine the economic impact of mining operations on forestry resources, the net present value of timber resources in the area to be impacted by mining activities was determined over the next 40 years on both with and without mine bases. The 40-year life-of-mine time frame forest economic models were based on a 25-year harvest rotation for southern pine and 40-year rotation for marketable hardwood species. Simulated forest growth and harvest economics associated with mining activities over a 40-year planning horizon employed the following assumptions/criteria:

- The study area would coincide with the 31,000-acre project area; timberlands outside the study area were assumed to be unaffected by the mine.
- Only those areas currently in timber, including cut-over land, would be reclaimed to forest after mining. Areas not in timber were assumed to be reclaimed to other (nonforestry) uses.

- In analyses both with and without the mine, timber stands were harvested as mature stands on an annual basis.
- All land reclaimed to forest would be planted with southern pine or marketable hardwood species.
- In accordance with mine reclamation timetables, annual tree planting activities would lag 3 years following mining operations.
- Postmining soil productivity (i.e., forestry site index) would be the same as the premining (original) productivity.
- Timber prices based on the current (2008) market were applied to the analysis. Timber prices and inflation were assumed to remain stable.

Using these assumptions, a simulation was performed to determine the economic effect of the mine operation with respect to onsite timber resources. The model accounted for annual timber harvests according to the mine plan. Growth on reclaimed land was simulated for 25-year rotations for southern pine and 40 years for marketable hardwood stands to calculate net present value. All income from timber sales was expressed in 2008 dollars.

Timber currently on the proposed pond sites is estimated to be worth approximately $1,100,000 (based on 243 acres at $1,800 per acre for southern pine, and 365 acres at $1,900 per acre for hardwoods). Assuming ponds would be reclaimed, timber value within the former pond sites would appreciate slightly to approximately $1,300,000 (based on 243 acres at $2,100 per acre for southern pine and 365 acres at $2,100 per acre for hardwoods) upon reaching maturity.

Based on the forestry growth and harvest simulation, the current value of timber in the study area is estimated to be $1,800 per acre for southern pine, and $1,900 per acre for hardwoods. Without the mine (that is, if the mine were not in place), the net value of timber would be $7,100,000 for southern pine and $11,300,000 for marketable hardwoods.

With the mine, the simulation predicted that the net present value of timber for southern pine would be approximately $1,800 per acre for timber stands not planted or managed as a result of mine reclamation. Following mining, timber would be intensively managed to maximize profit margins, with a predicted timber value of $2,100 per acre for mine-managed southern pine stands. These increases are due primarily to the maximization of resources associated with reclamation, i.e., establishment and intensive management of loblolly pine to produce high-quality wood products. Due to a 3-year lag in reclamation following mining operations, intensively managed timber would not reach maturity (25 years) until year 29 of the mining operation. Therefore, increased revenue would only be realized during years 29 through 40 of the mining operation. Furthermore, clearing for mining would continue to necessitate approximately 100 acres per year of timber harvest in front of the mining operations. With the mine, the net value of timber would be $9,600,000 for southern pine resulting from both the harvest of mine-managed timber and timber harvested in front of mining. Thus, implementation of the project would result in an increase ($2,500,000) in the net present value of southern pine resources during the 40-year life-of-mine. In addition, increased southern pine values would be realized for 15 years postmining, as many of the stands intensively managed under the mine scenario would not reach maturity until after the 40-year project term.

With the mine, the simulation predicted that the net present value of timber for marketable hardwoods would be approximately $1,900 per acre. Due to the 40-year rotation of marketable hardwoods, no change to net present value of timber resources would be realized during the 40-year life-of-mine. At maturity, postmining net present value of marketable hardwoods would be approximately $2,100 per acre. As a result of maturation periods related to the 40-year life-of-mine, increased timber value for marketable hardwoods would be realized for 40 or more years following the completion of the mine operation.

4.2.12 ENVIRONMENTAL JUSTICE

Specific populations identified under Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (Volume 59, Issue 7629, FR), were investigated in Subsection 3.13.6. Kemper County has a higher percentage of minorities and a higher percentage population below the poverty level than in the United States and in Mississippi. In this section, the potential effects of the power plant and the surface lignite mine on these populations are investigated for construction and operation. Environmental justice specifically refers to the potential disproportionately high and adverse human health or environmental effects on minority and low-income populations.

DOE defines environmental justice as "[t]he fair treatment and meaningful involvement of all people—regardless of race, ethnicity, and income or education level—in environmental decision-making. Environmental justice programs promote the protection of human health and the environment, empowerment via public participation, and the dissemination of relevant information to inform and educate affected communities. DOE environmental justice programs are designed to build and sustain community capacity for meaningful participation for all stakeholders in DOE host communities" (DOE, 2006).

Mississippi Power has met monthly with local leaders, including the Kemper County Economic Development Board and the Kemper County Board of Supervisors, beginning in 2007 to continually brief local leadership on the project, including environmental, social, economic development, and governmental issues. In 2009, Mississippi Power completed and adopted the Kemper County Community Plan (Mississippi Power, 2009), which addresses education, leadership development, communications, and other community impact issues. This plan was developed with input from the minority community leadership, local elected officials, and the Kemper Economic Development Board. The plan continues the ongoing community interface with Kemper County citizens and leaders addressing Kemper County IGCC project impacts to local citizens, including environmental justice, employment, supplier diversity, and many other social issues of importance to the local community.

Since 2007, Mississippi Power, in cooperation with its project partners, has involved citizens and provided Kemper County IGCC Project orientations including bus tours of the NACC operations at Red Hills Mine in Choctaw County, Mississippi, and the Southern Company Power Systems Development Facility's coal gasification research facility in Wilsonville, Alabama. These project orientations included presentations and onsite tours of similar lignite mining facilities and a pilot-scale gasification facility. Citizens and local leaders from Kemper and adjacent counties have been invited to participate. These orientation tours will continue as part of the plan. Mississippi Power will also continue to participate in local community activities, including the Boys and Girls Club, Relay for Life, Kemper senior citizens center, community events, and related Chamber of Commerce activities (Mississippi Power, 2009).

In addition to the baseline data presented in Subsection 3.13.6, the following information is presented to provide background as to the existing health of the residents of Kemper County and to the existing risk of exposure to pollutants.

Figure 4.2-5 depicts the estimated number of emergency department visits per county for asthma as the initial diagnosis. Kemper and Neshoba Counties are depicted with the lowest rates of visits per 10,000 population. No data are available for Lauderdale County.

Table 4.2-35 provides data for cancer rates per 100,000 population for 2003 through 2006. Kemper County ranked 44th (out of 82 counties) for incidences of invasive cancer, 47th for all cancer, and 76th for cancer mortality. The National Cancer Institute state cancer profile identified Kemper County as having a death rate trend for lung and bronchus cancers through 2005 as stable and similar to the overall national rate. Lauderdale County has a rising trend above the national rate, Mississippi has a stable trend above the national rate, and Neshoba County has a trend and national rate the same as Kemper County (NCI, 2009).

Table 4.2-35. Regional Cancer Rates for 2003 through 2006

Location	Invasive Cancer Incidences	All Cancer Incidences	Cancer Mortality
State	461.65	486.32	209.02
Kemper	464.36	476.51	167.75
Lauderdale	492.22	513.03	246.76
Neshoba	410.05	428.65	174.17

Source: www.cancer-rates.info/ms, 2009.

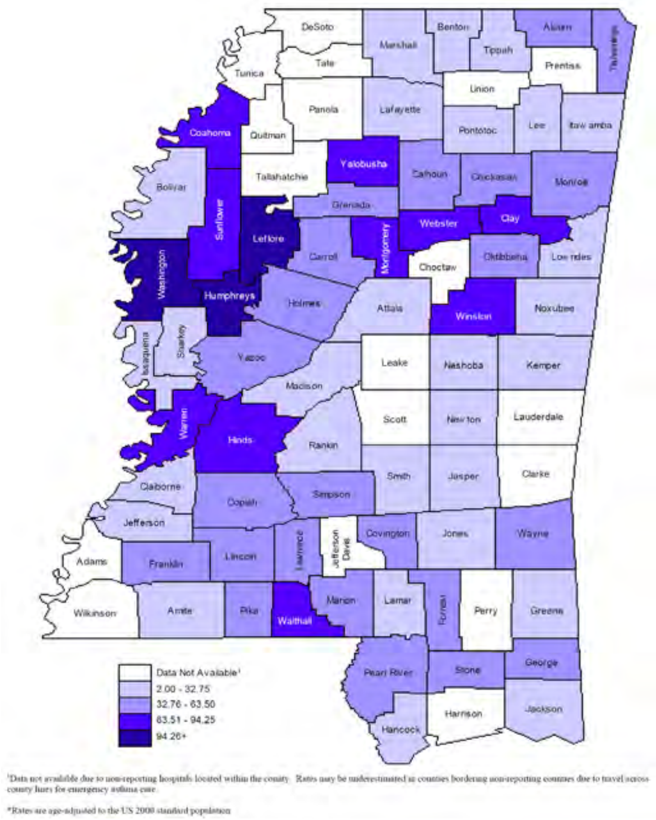

Figure 4.2-5. Estimated Number of Emergency Department Visits with Asthma as First Diagnosis per 10,000 Population—Mississippi 2003 to 2005

Source: Mississippi State Department of Health, http://www.msdh.state.ms.us/msdhsite/_static/resources/2922.pdf, 2009.

Table 4.2-36 lists mortality rates for 2007. The mortality rate in Kemper County in 2007 did not significantly vary from that of the state as a whole. Table 4.2-37 provides information for the rate of heart disease per 100,000. The Web site did not indicate which year the data represented. Table 4.2-38 provides the same information for chronic lung disease. Kemper County ranged 65th (out of 82 counties) for incidences of heart disease and 75th for chronic lung disease.

Table 4.2-36. Regional Mortality Rates for 2007*

Location	Total	White	African-American
State	9.6	10.6	8.1
Kemper	9.6	11.3	8.6
Lauderdale	11.6	13.7	8.8
Neshoba	10.2	10.6	9.6

*Rates per 100,000 population.

Source: www.msdh.state.ms.us/msdhsite/_static/resources/3010.pdf, 2009.

Table 4.2-37. Regional Heart Disease Rates*

Location	Total
State	293.25
Kemper	277.0
Lauderdale	289.4
Neshoba	328.2

*Rates per 100,000 population.

Source: www.worldlife expectancy.com, 2009.

Table 4.2-38. Regional Chronic Lung Disease Rates*

Location	Total
State	50.76
Kemper	30.3
Lauderdale	60.6
Neshoba	31.9

*Rates per 100,000 population.

Source: www.worldlife expectancy.com, 2009.

The Web site www.scorecard.org provides an environmental justice analysis of Kemper County based on health risks, exposures, and emissions. Based on information provided at this Web site, Kemper County ranks as follows:

- Does not rank among the top 25 counties in Mississippi for VOC emissions.
- Does not rank among the top 18 counties with the worst air quality indices.
- Does not rank among the top 6 counties with the highest number of person-days in exceedance of NAAQS.
- Is in the 20th to 30th percentile of CO emissions.
- Is in the 20th to 30th percentile of NO_x emissions.
- Is in the 10th to 20th percentile of $PM_{2.5}$ emissions.
- Is in the 10th to 20th percentile of PM_{10} emissions.
- Is in the 0 to 10th percentile of SO_2 emissions.
- Is in the 10th to 20th percentile of VOC emissions.

The environmental justice analysis indicates that there are no National Priority List facilities in the county and only one facility releasing toxic release inventory chemicals to land. The release is identified as 44 lb of polycyclic aromatic compounds.

The existing health data indicates that residents of Kemper County have average to better than average health when compared to the state as a whole. The environmental justice analysis provided by www.scorecard.org indicates that Kemper County is well below the national average for air pollutant emissions and has almost no record of environmental degradation from industry.

As noted in Subsection 3.3.2, all areas of Mississippi are designated as better than national standards for unclassifiable/attainment for NAAQS. In addition, the AQI for Lauderdale County is characterized as good to moderate. The AQI for Kemper County would be expected to be lower (better air quality) than that for Lauderdale County due to fewer emission sources (see Subsection 3.3.3). Approximately 84 percent of the total emissions of six criteria pollutants in Kemper and Lauderdale Counties are attributable to sources in Lauderdale County because of the greater population, resulting in more vehicle-miles traveled (VMT). Although manufacturing provides approximately 23.5 percent of the employment in Kemper County, there are not a substantial number of employers with only five companies providing approximately one-third of the total manufacturing employment. Manufacturing in Kemper County is not identified as a major point-source for pollutant emissions.

The EPA document, Ensuring Risk Reduction in Communities with Multiple Stressors: Environmental Justice and Cumulative Risks/Impacts (EPA, 2004d), discusses multiple stressors, which include physical, chemical, biological, or other entity that can cause an adverse response in a human. The effects of these or other stressors are compounded by the vulnerability of the affected population. The document describes the following aspects of vulnerability:

- Susceptibility/Sensitivity—A subpopulation may be susceptible or sensitive to a stressor if it faces an increased likelihood of sustaining an adverse effect due to a life state (young, old), impaired immune system, or preexisting condition such as asthma.
- Differential Exposure—A subpopulation can be more vulnerable because it is living or working near a source of pollution and is, therefore, exposed to a higher level of the pollutant than the general population.
- Differential Preparedness—Refers to subpopulations that are less able to withstand an environmental impact, such as those with poor access to preventative health care.
- Differential Ability to Recover—Some subpopulations are more able to recover from an impact or stressor because they have more information about environmental risks, health, and disease.

As to susceptibility/sensitivity, medical information described previously indicated that the existing health characteristics of the residents of Kemper County are generally better than those of the state as a whole.

Table 4.2-39 provides the age distribution of Kemper, Lauderdale, and Neshoba Counties and the state of Mississippi. The median age of Kemper County in 2006 was 35.1; Lauderdale County was 36.1 in 2006; Neshoba County was 34.6 in 2006; and the state as a whole was 35.4 in 2008. The age distribution of Kemper County indicates a slightly lower percentage of children and a slightly higher older population. The 7.29 percent of the population older than74 years was a total of 744 individuals in 2006.

Table 4.2-39. Regional Age Distribution

Location	Age (Percent)				
	<17	18 to 34	35 to 54	55 to 74	> 74
Kemper (2006)	23	26.92	25.52	17.27	7.29
Lauderdale (2006)	25.6	22.94	27.11	17.23	7.12
Neshoba (2006)	27.19	23.36	25.99	16.75	
Mississippi (2008)	25.74	23.69	26.94	17.68	5.95

Source: Mississippi Development Authority, 2009.

The previous discussion of emission sources and pollutant sources existing in Kemper County indicated that there are no significant environmental stressors at present. The AQI is good to moderate, and air pollutants meet all NAAQS.

Residents of Kemper County currently have access to the following health care agencies/facilities located within the county:

- Women, Infants, and Children (WIC) Program (Board of Health).
- Kemper County Health Department.
- Scooba Medical Clinic.
- Kemper Family Medical Clinic.
- Mississippi Care Center of DeKalb.
- Weems Community Health Care Center.

The nearest hospitals are located in Philadelphia and Meridian, as noted in Subsection 3.13.5.5. The residents of Kemper County have access to medical treatment and are likely to experience only a slight diminution of preparedness because of the distance of the nearest hospitals providing more advanced care. The same statement applies to the differential ability to recover.

The referenced EPA document discusses disadvantaged, underserved, and environmentally burdened communities. The information provided in this section and Subsection 3.13.6 clearly demonstrates a disproportionate population of minorities and low-income persons in Kemper County. However, the information demonstrates that these populations are not currently subject to disproportionately high and adverse impacts, and have access to adequate health care. The impacts of the project, when combined with other past, present, or reasonably foreseeable actions and impacts, are not expected to result in cumulative impacts.

4.2.12.1 Construction

Construction impacts with regard to environmental justice are discussed for the power plant and the surface lignite mine. Impacts associated with the linear facilities and the substations would be substantially less in comparison.

The impacts associated with construction would primarily be deforestation and clearing activities, fugitive dust, and traffic. As has been noted in the sections relating to socioeconomics, transportation, and air quality, the overall loss of vegetation and timber forest would be minimal compared to the county as a whole. The vast majority of the vegetation and forests to be cleared will be reclaimed postmining. The only permanent loss of forestry resources would be on the power plant site.

The transportation impact analysis has indicated that only roadway segments near the power plant entrance would experience heavy traffic. Local populations would be most affected, and the potential for a disproportionate impact to minority and low-income populations would be the same as for the local population, as a whole. Mitigation measures such as shuttles and park-and-ride facilities could mitigate this localized impact.

Fugitive dust would be a consequence of the major earthmoving activities to be undertaken during construction of the power plant and the mine facilities. Local populations would be most affected, but impacts are not expected to be disproportionately high and adverse. Mitigation measures would employ BMPs, including silt fences/hay bales and frequent watering of exposed areas.

Surface water flows would be altered during the construction and operation stages of the mining activities. Individual streams would have reduced flow and/or would be temporarily removed for recovery of the lignite. The downstream impact to the Okatibbee WMA would result in a different pattern of flow volumes with a reduction in peak flows. There will be an increase in TDS concentrations. In the case of Sowashee Creek, the diminution of stream flows would remove a source of pollutants. Impacted streams would be restored during the reclamation process. It is not anticipated that impacts to surface water quantity and quality would result in high and adverse impacts to the existing recreational opportunities.

The development of the surface lignite mine would displace willing landowners, i.e., landowners that successfully concluded negotiations with the mine owner for use of their land. The procurement of land to be mined would not be subject to eminent domain. To secure land for coal extraction, the mining company must approach the landowner and successfully negotiate for use of the land. The mining company might purchase the land, in which case any existing improvements such as houses, barns, fences, etc., would not be replaced after reclamation. Alternatively, the land might be leased, or lands might be swapped. If leased, the mining company would pay for all surface improvements and would disclose the length of the lease and the plan for reclamation. The landowner would have the option of rebuilding any or all of the former improvements. Landowners would be compensated for accepting temporary housing or other housing until reclamation and rebuilding activities are complete. These displaced homeowners could compete for available housing, apartments, and other rental opportunities in the area.

Landowners/residents whose property lies within the mine study area who choose not to allow their property to be mined would be affected to a greater extent than surrounding landowners by:

- Roadway congestion on local roads.
- Fugitive dust.
- Noise.
- Dewatering activities.
- Visual impacts.

Subsections 3.13.3 and 4.2.11.2 indicated that there would be sufficient housing opportunities to accommodate construction and operational employees. There would be sufficient vacant housing and rental opportunities to accommodate landowners willing to be compensated for temporary displacement. Traffic impacts and fugitive dust have been addressed previously. Noise impacts would be localized and limited in duration to the period of time required for mining and reclamation activities in any given area (i.e., mine block).

Dewatering effects during mining could disrupt private well use in the local area due to diminution of supply. There would be alternative potable well sources made available to affected landowners by the mine owner. The deforestation activities would result in change in the appearance of the mine study area. Given that reclamation would likely include replanting of pines and hardwoods and the current periodic clear-cutting activities associated with the silvicultural activities in the area, these land use changes would not be unusual. The increased health and safety risks during construction would be primarily traffic-related.

4.2.12.2 Operation

Operational impacts with regard to environmental justice are discussed for the power plant and the surface lignite mine. Impacts associated with the linear facilities and the substations would be insignificant in comparison.

The impacts associated with operation would primarily be ongoing deforestation and clearing activities for the mine and fugitive dust, traffic, and air quality impacts for the power plant. The discussion for construction impacts and for potential mitigation measures applies to the operational impacts with the clarification that the traffic would be reduced and that clearing for the power plant site would have been completed during construction.

Potential air quality impacts were described in detail in Subsection 4.2.1. Conservatively high estimates of increases in total air quality concentrations from project operations were predicted to range from as low as 2 percent of an individual NAAQS to up to 12 percent. Long-term air quality in the vicinity of the project site would remain within the limits set to safeguard public health and welfare. Therefore, minority and low-income populations would not bear a disproportionate share of high and adverse environmental impacts from the proposed project.

Many of the construction impacts attributable to the mine would be present during the operation of the mine (i.e., deforestation, surface and dewatering impacts, noise, and increased health and safety risks). The completion of the power plant construction would permanently change the views in that area. The taller structures and transmission lines would be visible in the proximate area and to the traveling public. There would be increased lighting associated with both the power plant and surface lignite mine. Impacts resulting from ongoing operations (e.gl, visual, noise, and lighting effects) on low-income and minority populations in the area near the power plant and the mine would not exceed those on the general population.

The construction and operation of the power plant and the surface lignite mine would create a substantial number of new jobs. The following is a discussion of the hiring practices of Mississippi Power and NACC.

Table 4.2-40 provides demographic information for Mississippi Power ongoing operations employment. Mississippi Power will continue to hire qualified women and minorities by:

- Building a job bank pre- and postconstruction for consideration of contractors and Mississippi Power and contractors (preconstruction) and Mississippi Power (postconstruction).
- Holding job fairs for minorities in the area.
- Meeting its equal opportunity employer regulatory requirements through an affirmative action plan.
- Providing vocational technology scholarships.
- Donating to area higher education schools and universities.
- Establishing training programs.
- Participating in military transition programs, local job fairs, posting available positions on university Web sites, etc.

Table 4.2-40. Mississippi Power Demographics

	March 2009	Mississippi Power 2008	Mississippi Power 2007	Mississippi Power 2006	Mississippi Power 2005	Mississippi Power 2004
Mississippi Power Demographics—2004 to 2009						
Total company staffing	1,304	1,308	1,288	1,262	1,242	1,255
Women	369 (28%)	368 (28%)	355 (28%)	336 (27%)	322 (26%)	324 (26%)
Minorities	224 (17%)	229 (18%)	228 (18%)	218 (17%)	196 (16%)	193 (15%)
Mississippi Power Generation Demographics—2004 to 2009						
Total company staffing	451	456	451	452	447	445
Women	65 (14%)	65 (14%)	60 (13%)	60 (13%)	59 (13%)	53 (12%)
Minorities	85 (19%)	85 (19%)	85 (19%)	83 (18%)	75 (17%)	75 (17%)

	Number Hired in Temporary Program	Number Hired Fulltime
Total company staffing	19	15
Women	7 (37%)	5 (33%)
Minorities	4 (21%)	2 (13%)

Source: Mississippi Power, 2009.

Mississippi Power is committed to affirmative action hiring practices, supplier diversity, and economic development by building and attracting businesses to the community.

NACC is an Equal Opportunity Employer adhering to U.S. Equal Employment Opportunity Commission (EEOC) requirements by:

- Recruiting, training, and promoting persons without regard to race, religion, color, sex, age, national origin, status as a disabled veteran or Vietnam-era veteran, or disability except where a disability is a bona fide occupational disqualification.
- Basing decisions on employment so as to further the principle of equal opportunity.
- Ensuring promotion decisions are in accordance with equal employment opportunity by imposing only valid requirements for promotional opportunities.
- Ensuring that all other personnel actions, such as compensation, benefits, transfers, layoffs, return from layoff, company-sponsored training, education, tuition assistance, and social and recreational programs will be administered without regard to race, religion, color, sex, age, national origin, status as a disabled veteran or Vietnam-era veteran, or disability except where a disability is a bona fide occupational disqualification.
- Protecting all employees and applicants for employment from coercion, intimidation, interference, or discrimination for filing or assisting in an equal opportunity complaint.

As of December 31, 2008, the Red Hills Mine employed 176 employees. Of these 176 employees, 15 (8.5 percent) were women and 28 (16 percent) were minorities. NACC attempts to hire new employees locally by first placing job advertisements in local newspapers. If no qualified candidates are found in the local area, the company begins extending the search area (NACC, 2009).

Given the current levels of employment of minorities by both Mississippi Power and NACC, the commitment of both firms to equal opportunity employment and processes in place to foster such hirings, it is anticipated that minorities would be well represented in the construction and operation workforces. In addition, the construction and operation of the power plant and the development and operation of the mine would likely have indirect impacts to minority hiring through vendor and subcontractor selection. Where the additional employment would reduce unemployment, increase gainful employment (part-time to full-time, underemployed to fully employed), and/or reduce commute times, the quality of life of employees and employees' families would improve.

4.2.13 TRANSPORTATION INFRASTRUCTURE

The construction and operation of the power plant and surface lignite mine have the potential to impact rail, airports, and highways. Any impact to rail would primarily occur during construction activities and then only on existing rail lines and rail yards as there is no planned construction of a rail spur to the project area. Air travel would be only minimally impacted since permanent relocations to the area are expected to be limited and due to the presence of several airports in the area. An impact of short duration to area roadways would be heavy-haul highway/roadway trips to move heavy equipment to the project area. Turbines, generators, building materials, and the dragline would be brought to the project site over highways such as I-20, I-59, and U.S. 45 before finalizing the trips over local roads. Heavy-haul trips would be limited in number and temporary in nature. Another short-term impact would be initial lignite deliveries from the Red Hills Mine to the project site. It is anticipated that the route (described in Subsection 2.4.1) would be used for approximately 6 months during the startup and initial operations of the power plant.

The primary impact of the project would be construction commuters. The roadway segments presented previously in Table 3.14-1 provide the anticipated routes from the surrounding municipalities anticipated to house workers to the power plant and the mine. Commuter trips have been assigned to the roadway network based on the availability of housing and related amenities; the existing distribution of population in the nearby municipalities and Neshoba, Lauderdale, and Kemper Counties; and roadway characteristics (speed limits, number of lanes, estimated travel times, etc.). Even though a significant percentage of the employees would come from the east-central Mississippi area, almost all of the construction and operation traffic would be new trips to the project area, as there are no employment generators in the area currently.

Active mining might result in the temporary relocation of portions of MS 495 and MS 493, as well as local roads internal to the mine study area. Maintenance of traffic would be required for both local trips and for through traffic along the north-south MS 495 and MS 493 routes. Trips generated by construction and operation employees assigned to these two north-south routes would use either the existing roadways or those sections of these roadways provided to maintain traffic.

4.2.13.1 Construction

As noted in Subsection 4.2.11.1, the peak construction employment would be an estimated 1,305 employees for a period of 3 months. Because it is anticipated that workers would be successful in saving per diem allowances, 1.5 passengers per vehicle have been assigned for each of the two daily trips (to and from the project site). The following capacity analysis has been based on LOS D vehicles per hour. The most recent annual average daily traffic (AADT) count (2007) was converted to vehicles per hour using a K factor (the proportion of AADT occurring in the analysis period) in rural areas of 0.1 and suburban/urban areas of 0.09. The LOS D AADT was derived from a default value for either a rural highway or a suburban arterial, as appropriate, from the Highway Capacity Manual (Transportation Research Board, 2000). The 2007 background traffic plus the one-way commuter traffic are considered to provide an estimate of the traffic on the roadways as a result of construction of the power plant and development of the mine.

In addition to the capacity analysis, the existing LOS was determined for the roadway segments that comprise the available routes to and from the power plant site. LOS A describes the highest quality of traffic service, when motorists are able to travel at their desired speed. LOS B characterizes further increases in flow with speeds of 50 mph or slightly higher on level terrain highways. LOS C describes further increases in flow resulting in noticeable platoon formation, platoon size, and passing impediments. The average speed exceeds 45 mph on level terrain highways. Unstable traffic flow describes LOS D. On two-laned roads, passing demand is high, but passing capacity is near zero. LOS E defines the capacity of the highway. Operating conditions at capacity are unstable.

It can be expected that there would be significant peak-hour traffic at the start and end of the construction day, with minimal construction activities occurring at night. It is likely that the peak hours of construction traffic would occur before and after the peak-hour traffic of other commuters because of the length of the workday.

Traffic generated by construction of the transmission lines and pipelines would be insignificant compared to that generated from the construction of the power plant and the mine. In addition, these construction activities would occur away from the municipalities and the main driving routes.

In addition to the commuter traffic, there would be truck deliveries. An estimated 50 one-way truck deliveries and a total of 100 daily truck trips would be added to the roadway. Ninety percent of the trucks would be expected to arrive and depart the project site from the south by the MS 39-Blackwater Road-MS 493 route. The remaining 10 percent would leave and depart from the west by the MS 16-MS 495 or MS 16-MS 493 routes. Trucks used for heavy hauls and heavier or wider loads will enter the project site from the north. Most of these trips will originate at Scooba or Columbus along U.S. 45. This truck traffic will proceed south to MS 16, then south on MS 493 to the project entrance. Because these trips will be relatively few in number, infrequent, and can be scheduled for nonpeak-hour deliveries, they have not been added into the daily trip capacity analysis.

Combined Impacts of Power Plant and Surface Lignite Mine

Figure 4.2-6 depicts the distribution of traffic on the main roads from the south, west, and east to the power plant site and mine study area. Workers would be anticipated to locate within the nearby city (incorporated) boundaries or within the nearby, adjoining suburbs. The majority of the traffic of workers located to the south would be likely to travel to and from the project area by MS 39 to Blackwater Road to MS 493. The primary reason for this is that MS 39 is four-laned from downtown Meridian to and from John C. Stennis Drive, allowing for higher driving speeds. Blackwater Road is paved and allows for the shortest travel time to and from MS 493 and the power plant entrance. For workers living in the northern suburbs of Meridian, MS 493 would provide a more direct route to and from the power plant. The development of the mine and the first 6 years of mining would occur in the vicinity of MS 493. As a worst-case scenario, all construction traffic to the power plant and the mine facilities during construction originating from the northern suburbs of Meridian have been assigned to MS 493.

For workers located to the west, MS 16 would be the commuter route to and from either MS 495 or MS 493. There would likely be a split in the use of these two roadways as workers would seek less congested and quicker routes to the employee parking areas for the power plant and the mine. Only 5 percent of the construction workforce has been assigned, for evaluation purposes, to the area surrounding DeKalb. Commutes from this area to the project site would be split between Old Jackson Road to and from MS 493 and MS 16 to and from MS 493, with the majority using Old Jackson Road since it would be closer to the power plant entrance.

Table 4.2-41 identifies the significant roadway segments with directional information indicative of the morning commute. The information depicted on Figure 4.2-6 (project traffic) has been added to the 2007 AADT volume (derived from MDOT) multiplied by a K factor (peak hour) of 0.1 (this may overestimate the background traffic in suburban/urban areas but is a conservative figure). Table 4.2-41 presents the existing LOS and the LOS with project traffic. A review of the table indicates that the traffic generated by the project would degrade the LOS D at the following roadway segments:

- MS 493 from Bailey-Topton/Dogwood Lake Road/Briarwood School Road Northeast to Center Hill Road.
- MS 493 from Blackwater Road to project entrance.
- MS 493 from MS 16 to Old Jackson Road.
- MS 493 from Old Jackson Road to the project entrance.

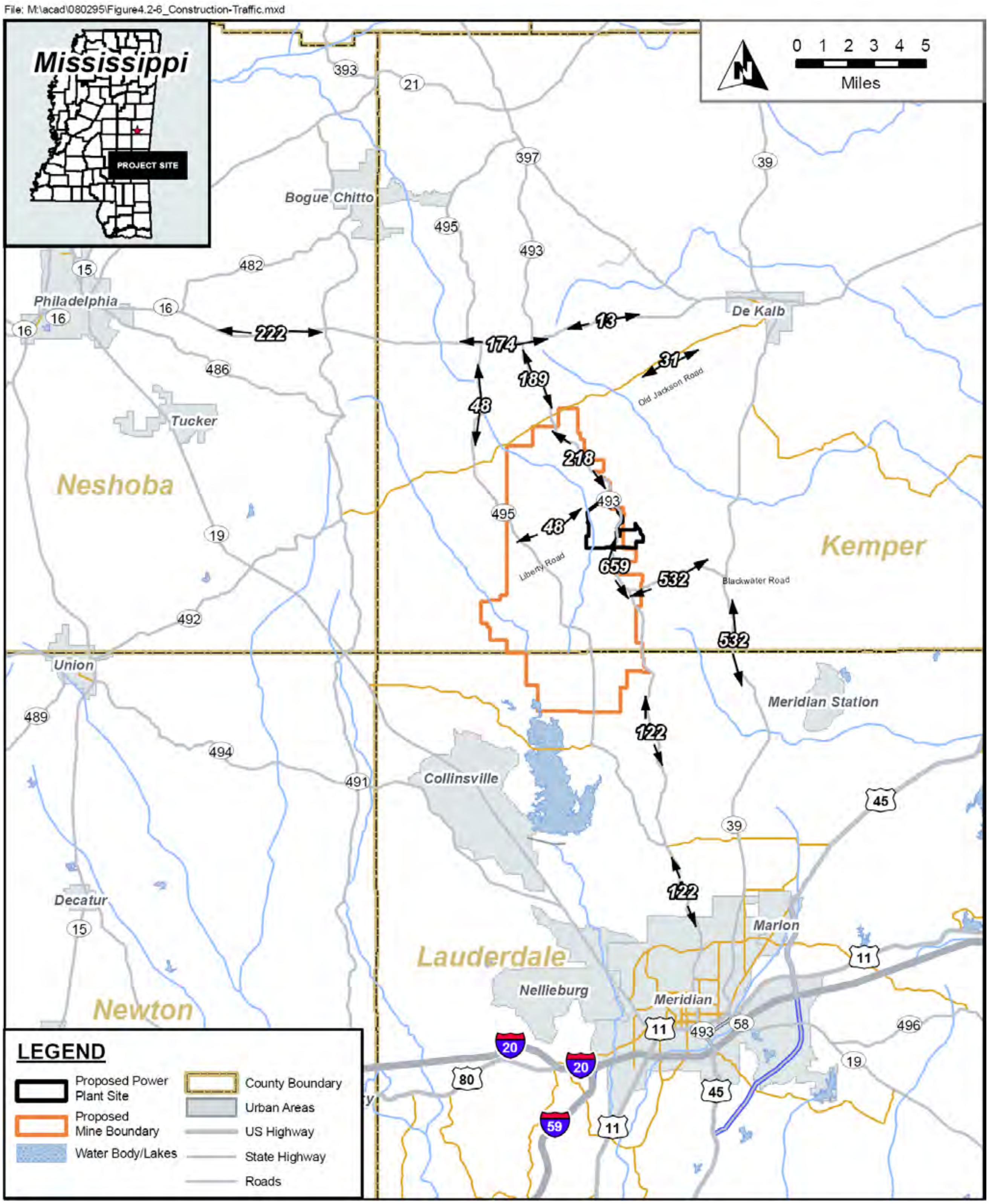

Figure 4.2-6. Distribution of Traffic—Construction (a.m. Shift)

Sources: U.S. Census, 2000. MARIS, 2008. ECT, 2009.

Table 4.2-41. Capacity Analysis—Construction

Segments	Description	Number of Lanes	2007 AADT	LOS D AADT	LOS D Vehicles per Hour	LOS D Vehicles per Hour with Project	LOS Existing	LOS with Project Traffic*
Lauderdale County								
MS 39	From U.S. 45 north of 52nd Street	4	5,900	34,000	3,060	1,122	A	B
MS 39	From 52nd Street north to Bailey-Topton/ Dogwood Lake Road/Briarwood School Road Northeast	4	9,400	34,000	3,060	1,472	A	C
MS 39	From Bailey-Topton/Dogwood Lake Road/Briarwood School Road Northeast north to John C. Stennis Drive	4	4,500	34,000	3,400	482	A	B
MS 39	From John C. Stennis Drive north to county line	2	2,500	7,900	790	782	D	E
MS 493	From North Hills Street north to Windsor Road	2	4,100	7,900	790	532	D	D
MS 493	From Windsor Road north to Bailey-Topton/Dogwood Lake Road/Briarwood School Road Northeast	2	3,100	7,900	790	432	D	D
MS 493	From Bailey-Topton/Dogwood Lake Road/Briarwood School Road Northeast north to Center Hill Road	2	2,400	1,700	170	362	D	E
MS 493	From Center Hill Road north to county line	2	470	1,700	170	169	C	D
Kemper County								
MS 39	From county line north to Blackwater Road	2	1,900	7,900	790	722	D	D
MS 493	From county line north to Blackwater Road	2	460	1,700	170	168	C	D
MS 493	From Blackwater Road north to project entrance	2	350	1,700	170	689	C	E
MS 493	From MS 16 south to Old Jackson Road	2	420	1,700	170	229	C	E
MS 493	From Old Jackson Road south to project entrance	2	350	1,700	170	253	C	E
MS 495	From MS 16 south to Old Jackson Road	2	550	1,700	170	103	C	C
MS 495	From Old Jackson Road south to county line	2	520	1,700	170	100	C	C
MS 16	From Neshoba County line east to MS 495	2	2,400	13,900	1,390	462		C
MS 16	From MS 495 east to MS 493	2	2,300	13,900	1,390	404	B	C
MS 16	From MS 493 east to MS 397	2	2,700	13,900	1,390	283	B	B
MS 16	From MS 397 east to DeKalb	2	3,100	13,900	1,390	323	B	B
Old Jackson Road	From DeKalb west to MS 493	2	690	1,700	170	100	C	C
Neshoba County								
MS 16	From west of MS 19 west to MS 486	4	17,000	34,000	3,400	1,922	C	C
MS 16	From MS 486 to MS 482	2	6,700	13,900	1,390	892	C	D
MS 16	From MS 482 east to MS 491	2	3,300	13,900	1,390	552	C	C
MS 16	From MS 491 east to county line	2	2,700	13,900	1,390	492	B	C

Note: LOS D capacity derived from Highway Capacity Manual.
2007 AADT information from MDOT.

Source: ECT, 2009.

In all of these listed instances, the resulting LOS would not fall below the LOS E roadway capacity. Most of the LOS impacts would occur in the vicinity of the project area. This is not unanticipated as the roadways in this area are two-laned rural facilities with limited peak-hour capacity.

The LOS impacts noted could be mitigated by establishing a shuttle service from convenient park-and-ride locations within or near the city limits of Meridian and Philadelphia. Another mitigation factor could involve restricting truck deliveries to nonpeak-hour times. It is noted that during the nonpeak construction months, only three roadway segments would experience an LOS degradation. One segment, MS 493 from Bailey-Topton/Dogwood Lake Road/Briarwood School Road Northeast to and from Center Hill Road, is already above the LOS D peak-hour volume without project traffic. The second and third segments, MS 493 from Blackwater Road and MS 493 to the project site entrance, would experience heavy project traffic during the entire construction schedule. Since the intersection of MS 493 and Blackwater Road actually occurs within the project boundary, a large parking area could be developed with shuttle buses distributing workers to the mine and power plant construction areas.

Linear Facilities

Construction of the linear facilities would not be expected to have a significant impact on the area roadways since the crews would be using different roadways throughout the construction schedule, and far fewer trips would be involved in the construction of these facilities. In addition, construction activities at any one location would be of shorter duration.

4.2.13.2 Operation

The initial power plant employment would be 105 for the first 6 years, decreasing to 90 for the remainder of the plant life. The mine operational employment would be a maximum 213 employees. Both the power plant and surface lignite mine would work in two shifts.

The start and end of the two shifts would likely be either 6 a.m. to 6 p.m. or 7 a.m. to 7 p.m. After the first 6 months or so of power plant operation, the expected number of visitor and delivery trips would be 45 per day, to occur primarily during the day shift. Ninety percent of the deliveries would be expected to leave from the south, with the remaining 10 percent to transit from the west. Although up to 100 trucks per day would be expected to deliver coal from the mine to the power plant, these trips would be internal to the project site. During the initial 6 months of power plant operation, up to 80 truck trips per day would deliver lignite from the Red Hills Mine by the route described in Subsection 2.4.1 and characterized in Section 3.14.

Combined Impacts of Power Plant and Surface Lignite Mine

Given the employment numbers, Figure 4.2-7 depicts the estimated trips during either the a.m. or p.m. peak hour for first 6 years of operation. Given the hours of the shifts, either the a.m. or the p.m. peak-hour traffic currently on the area roadways would not be significantly impacted by the project. Trip generation would be an estimated two per employee, and the vehicle occupancy ratio assumed to be one. After the first 6 years of operation, the impacts would be reduced.

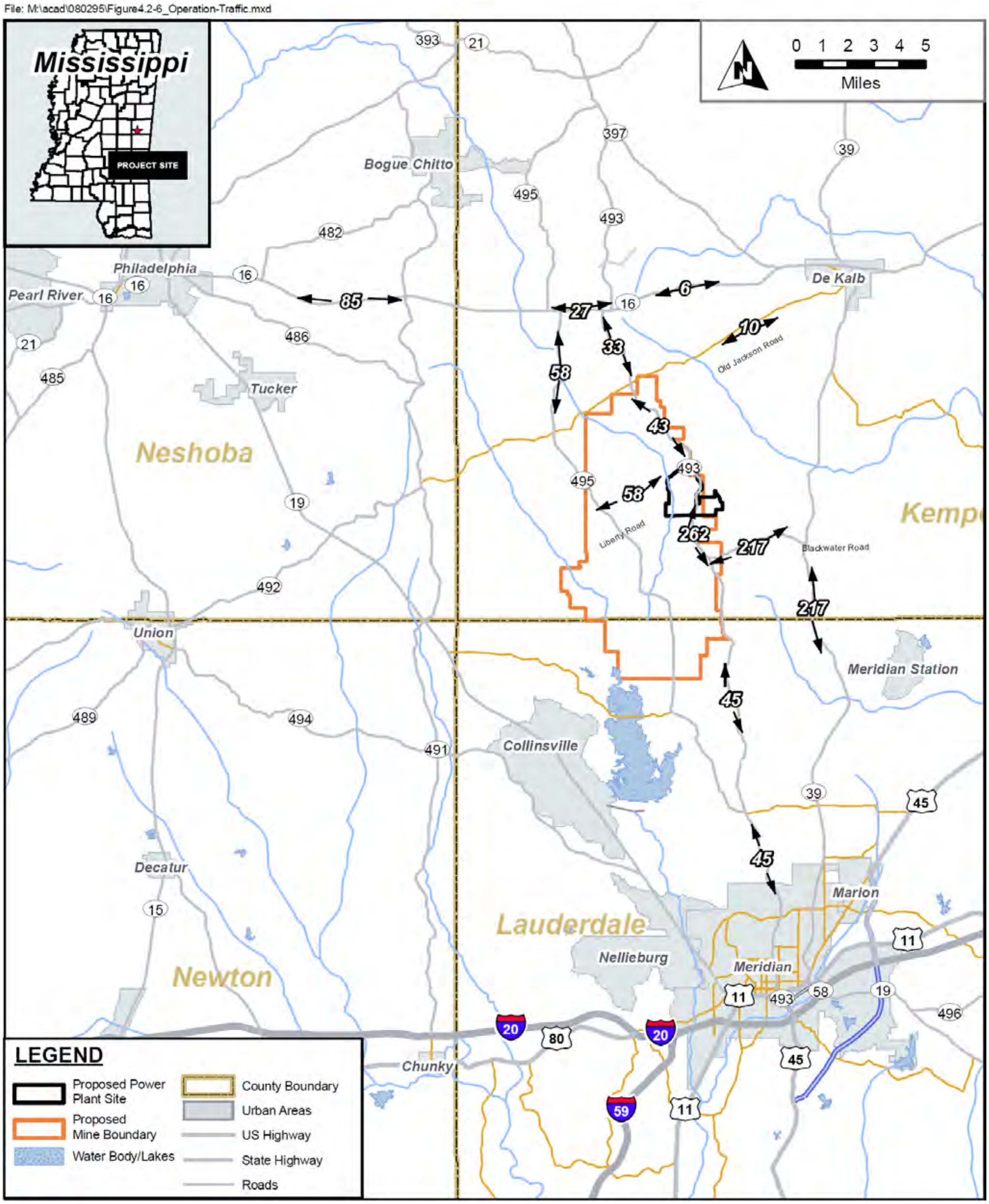

Figure 4.2-7. Distribution of Traffic—Operation (a.m. or p.m. Peak Hour)

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

Table 4.2-42 presents only those roadway segments that would be impacted by the much greater trip generation expected during the peak of construction. As with the construction traffic impacts, the resulting LOS would not fall below the LOS E roadway capacity. The capacity analysis indicates that only two segments would experience a degradation in the LOS. The two segments are two of the same as would be impacted by the average number of expected construction workers:

- MS 493 from Bailey-Topton/Dogwood Lake Road/Briarwood School Road Northeast to Center Hill Road.
- MS 493 from Blackwater Road to the project entrance.

Table 4.2-42. Capacity Analysis—Operation

Segments	Description	Number of Lanes	2007 AADT	LOS D AADT	LOS D Vehicles per Hour	LOS D Vehicles per Hour with Project (a.m. Shift)
Lauderdale County						
MS 39	From John C. Stennis Drive north to county line	2	2,500	7,900	790	467
MS 493	From Bailey-Topton/Dogwood Lake Road/Briarwood School Road Northeast north to Center Hill Road	2	2,400	1,700	170	285
MS 493	From Center Hill Road north to county line	2	470	1,700	170	92
Kemper County						
MS 39	From county line north to Blackwater Road	2	1,900	7,900	790	407
MS 493	From county line north to Blackwater Road	2	460	1,700	170	91
MS 493	From Blackwater Road to project entrance	2	350	1,700	170	297
MS 493	From MS 16 south to Old Jackson Road	2	400	1,700	170	73
MS 493	From Old Jackson Road south to project entrance	2	350	1,700	170	78

Note: LOS D capacity derived from Highway Capacity Manual.
2007 AADT information from MDOT.

Source: ECT, 2009.

As noted previously, the first segment is already operating above the LOS D capacity, and the second segment would experience heavy traffic throughout operation of the plant and the mine. Similar mitigation methods as described in Subsection 4.2.13.1 could be employed during operation of the plant and mine such as park-and-ride lots with shuttles.

Initial Lignite Coal Delivery Route

Figure 4.2-8 depicts the initial delivery route of coal from the Red Hills Mine to the power plant entrance of MS 493. It is anticipated that up to 80 truckloads per day would be delivered over a 16-hour period for a period of approximately 6 months. Table 4.2-43 provides a capacity analysis of the roadway segments that comprise the route from the Red Hills Mine to MS 16. For a worst-case scenario, all 80 truckloads are analyzed as arriving during the a.m. peak hour. In actuality, the truckloads and truck trips would be evenly spaced over the 16-hour delivery schedule resulting in only five peak-hour trips on the delivery route. Only the LOS of two roadway segments (MS 397 from MS 490 to the Winston/Kemper County line and MS 397 from MS 21 to MS 493) would be

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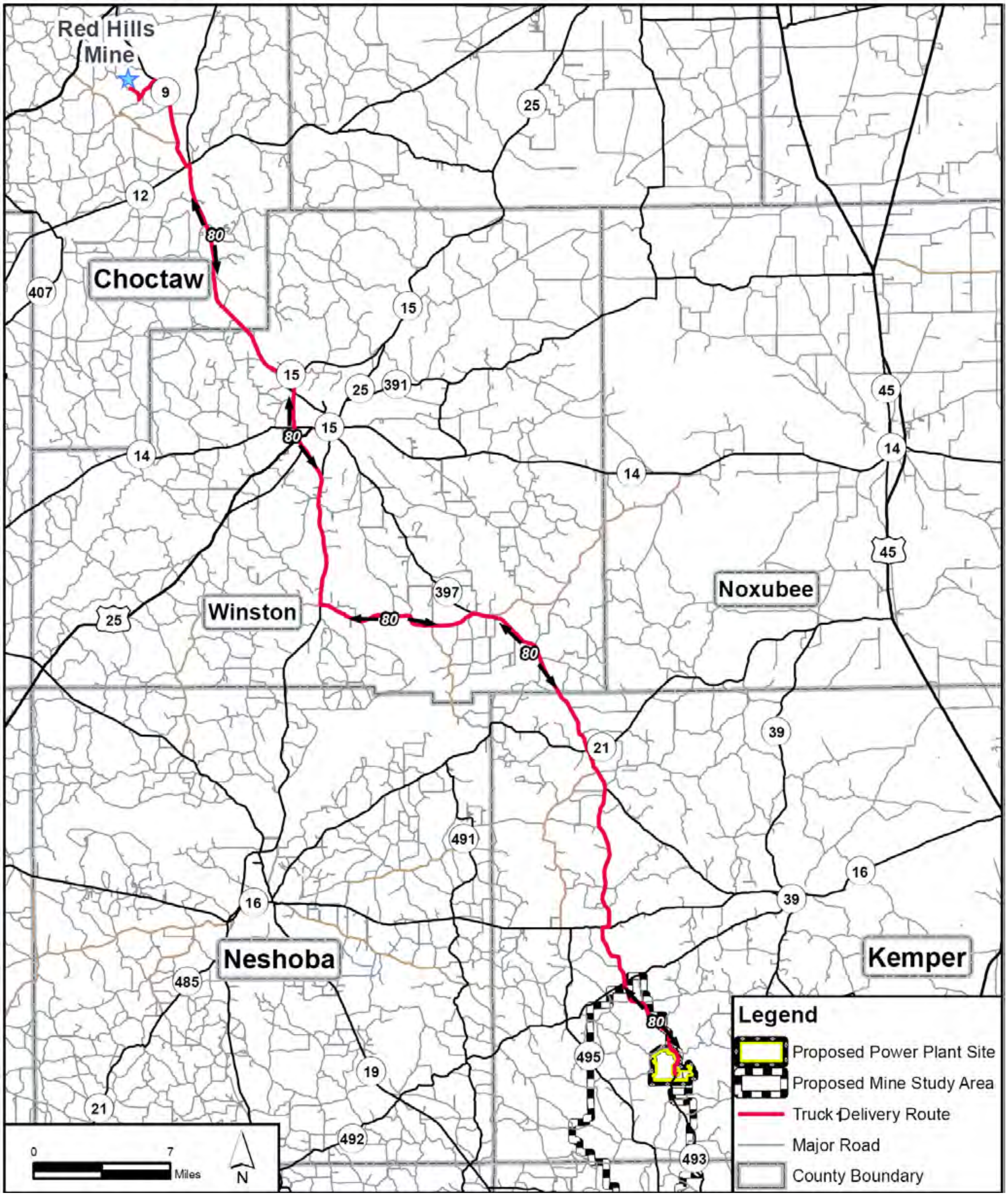

Figure 4.2-8. Initial Lignite Coal Delivery Route Distribution of Traffic

Sources: MARIS, 2008. ECT, 2009.

impacted, and then only if at least 70 trucks traveled the peak hour through the first segment and at least 30 trucks were delivering during the peak hour through the second segment.

Table 4.2-43. Capacity Analysis—Initial Lignite Coal Deliveries

Segments	Description	Number of Lanes	2007 AADT	LOS D AADT	LOS D Vehicles per Hour	LOS D Vehicles per Hour with Project
Choctaw County						
Pensacola Road	From Red Hills Mine northeast to MS 9	2	260	1,700	170	106
MS 9	From Pensacola Road south to MS 415	2	1,900	7,900	790	270
MS 9	From MS 415 south to MS 12	2	3,300	7,900	790	410
MS 12	From MS 9 northeast to MS 15	2	4,100	7,900	790	490
MS 15	From MS 12 south to county line	2	2,600	7,900	790	340
Winston County						
MS 15	From county line south to McMillan	2	3,300	7,900	790	410
MS 15	From McMillan south to South Ackerman Road	2 to 4	2,600	7,900	790	340
MS 15	From South Ackerman Road south to MS 14	4	7,300	34,000	3,400	810
MS 15	From MS 14 south to Old Robinson Road	4	4,800	34,000	3,400	560
MS 15	From Old Robinson Road south to South Church Avenue	2 to 4	4,400	7,900	790	520
MS 15	From South Church Avenue south to MS 490	2	4,500	7,900	790	530
MS 490	From MS 15 east to Union Ridge Road	2	1,900	7,900	790	270
MS 490	From Union Ridge Road east to Enon Road	2	870	7,900	790	167
MS 490	From Enon Road east to MS 397	2	77	7,900	790	157
MS 397	From MS 490 south to county line	2	1,000	1,700	170	180
Kemper County						
MS 397	From county line south to MS 21	2	750	1,700	170	155
MS 397	From MS 21 south to MS 16	2	1,400	1,700	170	220
MS 493	From MS 16 south to the plant site	2	200	1,700	170	100

Note: LOS D capacity derived from Highway Capacity Manual.
2007 AADT information from MDOT.

Source: ECT, 2009.

The addition of five trucks along the following project vicinity roadway segments would not degrade the LOS D roadway capacity:

	Existing Traffic* Peak Hour	Existing Traffic with Project (a.m. Shift)	Existing Traffic with Project and Initial Route Deliveries (a.m. Shift)	LOS D Vehicles per Hour Capacity
MS 16 from MS 493 to MS 493	270	276	281	1,390
MS 493 from MS 16 to Old Jackson Road	42	76	81	170
MS 493 from Old Jackson Road to project entrance	35	79	84	170

*Based on MDOT 2007 AADT.

Linear Facilities

There would be no permanent employment associated with the linear facilities and, therefore, no trips to assign to the road network. Maintenance activities would be sporadic and of short duration.

4.2.14 WASTE MANAGEMENT FACILITIES

There is one permitted landfill in Kemper County as described in Section 3.15. The landfill is undergoing an expansion from 8.17 to 22.37 acres within the total property area of 102 acres. (This expansion is unrelated to the proposed IGCC project.)

4.2.14.1 Construction

Power Plant

It is anticipated that any economically valuable timber would be harvested prior to the start of construction. Unusable wood and other vegetation remaining after clearing and grubbing would be burned onsite in accordance with applicable regulations. Any concrete or other nonburnable debris found during clearing activities could be accepted at the Kemper County Solid Waste Landfill. During actual construction activities, solid waste would consist of scrap lumber, scrap metal, and packing materials. Materials that cannot be recycled could be disposed locally in the county landfill. The current expansion is intended to meet the county's needs at current landfilling rates for the foreseeable future (Kemper County Solid Waste Landfill, LLC, 2008).

The largest quantities of hazardous wastes generated during construction of the power plant would be associated with maintenance of the equipment. Waste oil, spent solvents, and other used oils and coolants would be drummed and periodically removed and disposed at regulated facilities such as the Chemical Waste Management, Inc., facility located in Emelle, Alabama.

Surface Lignite Mine

As with the power plant site, all economically valuable timber would likely be harvested prior to development of the mine. Vegetative waste would be burned onsite. The disposition of homes and other structures would be arranged with each landowner and would be disposed of properly. Wastes capable of being disposed in mined-out pits include demolition debris such as wood, metal, sheetrock, wiring, farm building, sheds, scrap piles of wood, glass, appliances, furniture, brick, concrete, stone, asphalt, fences, power poles, pipes, cables, and similar material. Asbestos-containing building materials, refrigerants, air conditioners, empty or full containers, or any hazardous materials would be disposed offsite in approved, licensed locations. As with the power plant, hazardous wastes generated during development of the mine would most likely be associated with spent equipment fluids.

Linear Facilities

To the extent practicable, economically valuable timber within the linear facilities corridors would be harvested. Other vegetative waste would be burned in accordance with applicable regulations. It is anticipated that excess materials such as wood, metal, and cable would be amassed onsite or offsite at contractor's facilities before being disposed appropriately at area landfills. The amount of debris associated with development of the linear facilities would be insignificant compared to construction of the power plant and development of the mine. It is not anticipated that any hazardous waste would be generated onsite within the linear facility corridors.

4.2.14.2 Operation

Solid and hazardous wastes would be generated by the power plant and surface lignite mine during operation. Ongoing development of the mine, expected to comprise approximately 275 acres per year, would be considered an operation-related impact relative to solid waste generation. The maintenance facilities, offices, warehouses, and other buildings serving the mine would be located close to the power plant facilities. There would not likely be any significant amount of solid waste or hazardous waste generation associated with the linear facilities.

Combined Impacts of Power Plant and Surface Lignite Mine

The solid waste generation per employee per year, based on a generation rate of 0.8 tpy, would be an estimated 274.4 tpy for the initial 6 years and 238.4 tpy through the life of the plant and the mine. This generation rate could easily be accommodated at the existing landfill or at appropriately licensed disposal facilities.

Based on an 85-percent capacity factor, approximately 560,000 tons of ash would be produced annually. Both gasifier and filter ash would be transported by truck to the ash management unit located in the northern portion of the plant site along Liberty Road (see Figure 2.1-5). Although likely exempt from regulation under RCRA as a Bevill amendment material, the ash would be classified as industrial/special waste in the state of Mississippi, and the ash management unit would be subject to the permit requirements and regulations of MDEQ. To reduce long-term ash storage needs, Mississippi Power would try to market ash for beneficial use in industrial processes such as building roads, soil amendment, or for other uses as approved by MDEQ. Limited quantities of hazardous wastes would be generated primarily from maintenance activities. Management of hazardous wastes would begin by limiting the amount of hazardous materials used and through reuse and recycling to reduce the generation of waste. Wherever possible, nonhazardous materials would be used instead of hazardous chemicals. Hazardous material use and hazardous waste generation programs would be supported by appropriate and adequate training. Hazardous wastes would be managed in accordance with applicable federal regulations.

Spent equipment fluids such as waste oil, waste coolant, and used hydraulic oil would be properly managed onsite prior to removal offsite to a recycler for processing. Spent batteries would also be temporarily stored onsite before being removed offsite for disposal at a properly licensed facility. Periodic outages would result in the temporary accumulation of a larger amount of wastes. Arrangements would be made with outside contractors to dispose of spent materials in an appropriate manner.

Linear Facilities

The only solid waste generated as a result of the presence of the linear facilities would be during sporadic maintenance activities. Waste disposal would be the responsibility of the maintenance crews and would be at the nearest landfill. There would be no continuous source of solid waste generation associated with operation of the linear facilities.

4.2.15 RECREATION RESOURCES

No public recreation resources exist or are proposed on the power plant site or mine study area. Hunting activities associated with leases could continue outside of actively mined areas. The closest publicly available recreational facilities, described in Section 3.16, are Okatibbee Lake and WMA located approximately 4.7 miles to the south and Kemper County Lake located approximately 6.5 miles to the north. Limited impacts associated with the construction or operation of the linear facilities would be anticipated as discussed in the following.

4.2.15.1 Construction

Increased use of public recreational use facilities could be anticipated during construction of the power plant and development of the mine study area.

Combined Impacts of Power Plant and Surface Lignite Mine

Even at the peak construction employment resulting in the relocation of 1,330 people to the three-county area, the increase would be only 1.1 percent of the area's population in 2006. The nearby recreational facilities would be able to accommodate the increased utilization potential from this small increase in population. It is likely that some hunting club leases might be terminated as a result of the project. Deer and turkey hunting are popular activities in Kemper County and the surrounding area. The displaced hunters should be easily accommodated through other hunt clubs or leases.

Construction of the proposed power plant and surface lignite mine would not cause measurable adverse effects on Okatibbee Lake and the associated recreation resources. Subsection 4.2.4.1 documents that changes in water flows into the lake and water quality in the lake would be *de minimis*. Based on that analysis, no decrease in recreation values would occur during the time of construction.

Linear Facilities

There would not likely be any impact to recreational resources associated with the construction of the linear facilities and the substations, with the exception of traversing Lake Bonita Park. This park is owned by the city of Meridian, is 3,300 acres in size, and includes Long Creek Reservoir, Lakeview Golf Course, and primitive park features, including nature trails, jogging and walking track, horseback riding, picnic facilities, paddle boats, boat ramps, and fishing. The transmission line does not intersect any improvements other than trails. The siting of the transmission line through the park will remove a swath of uninterrupted forest that will have to be maintained as lower level vegetation.

4.2.15.2 Operation

For the first 6 years of operation, the plant and mine employment would be an expected 323 employees, with approximately 411 people relocating to the area.

Combined Impacts of Power Plant and Surface Lignite Mine

The expected population increase due to employment and relocations to the area would be only 0.4 percent of the 2006 combined population of Lauderdale, Kemper, and Neshoba Counties. The impact to the surrounding recreational facilities, such as Okatibbee Lake and WMA and Kemper County Lake, would be easily accommodated by the existing amenities/facilities. There would likely be a permanent loss of some hunting lands at the power plant site. Reclamation activities could, over time, replace forested areas and restore land that could be leased for hunting within the mine study area. An opportunity would exist to enhance fishing and wildlife activities if sedimentation ponds constructed during mining activities were left as permanent impoundments and made available for public use. Public recreation opportunities would be dependent upon postmining ownership of the ponds, accessibility of the ponds to the public, access to public roads, and the size and quality of the ponds.

Subsection 4.2.4.2 documents water quality changes that would occur in Okatibbee Lake due to operation of the proposed surface mine. During mining and following reclamation, surface water inflows would increase in response to rainfall events. TDS levels would increase; however, the changes would not be noticeable to humans, induce changes in fish species present in the lake, or exceed MDEQ water quality standards. Turbidity and suspended solids levels would not change measurably. Thus, the recreation values of the lake would not diminish.

Linear Facilities

There would be no permanent employment associated with the linear facilities or the substations and, therefore, no potential impacts to recreational facilities.

4.2.16 AESTHETIC AND VISUAL RESOURCES

There are no unique landforms or visual or scenic features associated with the power plant site, mine study area, or linear facilities. A majority of Kemper County is forested, which restricts long-range views at ground and road levels.

4.2.16.1 Construction

Power Plant

Construction activities would involve substantial clearing of trees and a permanent conversion of land use from primarily forested land to an industrial use. Except at roadway entrances from MS 493, linear facility crossings of the property boundaries, and the interconnection of the power plant with the mining facilities and activities, it is anticipated that a perimeter of trees would be retained to provide screening and buffering. The traveling public along MS 493 and local drivers in the project area would have views of the clearing, grading, berming, earthmoving, and structural building activities. In the initial stages of construction, the vegetative clearing, berming, and earthmoving activities would predominate. Exhaust and dust would likely be associated with heavy machinery and equipment use. As the permanent structures commence construction, more of the surrounding area would be affected by changing views. Taller structures/equipment would include cranes, the stack, cooling towers, and transmission towers. As the taller structures reached completion toward the end of the 42-month construction schedule, they would be seen from greater distances along MS 495 and possibly MS 39. It is not anticipated that there would be views of the construction activities from Okatibbee Lake and WMA or from Kemper County Lake.

Surface Lignite Mine

The initial development of the mine would involve tree harvesting, vegetative clearing, burning, and earthmoving activities. Water control structures and the excavation and preparation of sedimentation ponds would occur early in the development of the mine. Stream and road relocations, overburden stockpiles, dragline construction, and construction of the buildings would also be occurring. Mine development would be the most extensive impact since more area of the entire mine study area would be involved. These activities would be visible to the traveling public from MS 495 and MS 493 and from many of the local roads. The widespread activities would be temporary as the mine infrastructure is completed during the approximately 30-month construction period. Views should be limited to the traveling public and nearby surface landowners. Existing roadside vegetation would screen some views.

Linear Facilities

The construction activities would involve removing the forested vegetation within the transmission line corridors, vegetation in the areas of any access roads, and vegetation in the pipeline corridors. It is anticipated that most of the vegetative debris would be burned. Completion of the pads, erection of the poles, and construction of any access roads would occur in the transmission corridors. The amount of time spent in any one place within either the transmission or pipeline corridors would be limited. The views of the construction activities would also be limited as the surrounding vegetation is primarily forested. Where there are openings in the tree cover and at road crossings, the construction activities would be visible. Construction of the substations would result in removal of the existing vegetation. Construction of the substations would have a limited visual impact restricted to the traveling public in the area and a few local residents.

4.2.16.2 Operation

Power Plant

At completion of power plant construction, the land use would be converted from primarily forested land in silvicultural use to an electrical power generation facility, the second one in Kemper County. The proposed power plant would be the only built environment of its kind in the surrounding area. The other power plant located in the county is located approximately 14.5 miles northeast of the proposed site. Taller structures would include the stacks, baghouses, cooling towers, and onsite transmission towers. Despite the incongruous appearance of the proposed plant, existing forested vegetation would screen all but the tallest structures from the few nearby residences and from the traveling public along MS 493. The taller structures would be visible to the traveling public along MS 493, from local roads, and possibly at limited intervals along MS 495 and MS 39. Views of the majority of the site and facilities would be obscured by perimeter vegetation. Landowners in the area would have views of the taller structures. It is possible that the tallest structures could be seen from Okatibbee Lake and WMA and Kemper County Lake. The lighting required at night would be visible for many miles where views are unobstructed by foreground vegetation. Mitigative measures to be used would be shielded fixtures and a dual lighting system in accordance with FAA Circular AC 70/7460_15 (January 1, 1996). The dual lighting system uses medium-intensity strobes during the day and steady red lights at night. The flame produced by the occasional operation of the derrick flares to combust syngas during IGCC plant upsets would also be visible. However, it is not expected that such events would be frequent. These events would also likely have short durations.

Surface Lignite Mine

Once development of the mine is complete, operation of the mine would be expected to proceed at approximately 275 acres per year. As active mining progressed, reclamation activities would follow to reestablish landforms and vegetation. The mining activities would be visible along MS 495 and MS 493 and the local roads in the project area at times. Surface landowners in the area would be visually impacted by the active mining operations. The traveling public might be able to see the top of the dragline and might occasionally see the piles of overburden. The coal handling equipment would be collocated with the power plant. Only a limited area of the overall mine would be actively excavated and reclaimed each year.

Long-term visual impacts attributable to the mine study area would likely be few. Depending upon landowner preferences, the current number of residences in the mine study area could remain approximately the same or decrease. Similarly, the types of vegetation after mining could vary from current conditions, although the amount of forested land postreclamation would be expected to be similar for both economic and recreational considerations. There would likely be more ponds in the postmining landscape. The visual impact of the reclaimed mine study area might be minimal, depending on landowner preferences. Given the intervening vegetation that would not be disturbed, active mining activities would not be visible from Okatibbee Lake and WMA or Kemper County Lake.

Linear Facilities

Only the electrical transmission line corridors would have tall structures. The majority of the corridors traverse forested lands. The transmission towers would be visible throughout the postconstruction landscape where views were available. It can be anticipated that views would be limited to road crossings and a few residences. In general, the views would be limited (e.g., to the tops of structures) except at road crossings because of the presence of intervening trees and vegetation. The transmission lines would be visible where silvicultural activities result in clear-cutting. The pipelines would be buried, and the only indications of their presence would be signage and maintained, lower vegetation above and adjacent to the pipelines. The operational substations would only be visible to the traveling public in the immediate vicinity and to local landowners.

4.2.17 CULTURAL AND HISTORIC RESOURCES

Cultural and historic resources that might be affected by construction or operation of the various components of the project were described in Section 3.18. Of primary concern would be impacts to resources that have been determined to, or could potentially, be eligible for listing on the NRHP.

4.2.17.1 Construction

Power Plant

The approved cultural resources study of the plant site yielded no sites potentially eligible for listing other than one architectural resource, the Goldman House. In correspondence with Mississippi Power and NACC, MDAH determined that this house was potentially eligible for listing on the NRHP and that its demolition would be an adverse effect. MDAH stated that mitigation in the form of Historic American Building Survey (HABS)-quality documentation (drawings and photographs) would be required if the house were to be demolished. The current site arrangement might allow for the house to remain in place and undisturbed. If the house cannot be avoided, however, Mississippi Power and NACC would then not disturb this house prior to completion of the required HABS documentation. After completing the documentation process, the house could be relocated or demolished.

It is unlikely but conceivable that, during construction of the power plant, additional archaeological resources might be encountered. In such situations, adverse impacts to such resources would be avoided, minimized, or mitigated pursuant to an approved emergency discovery plan.

As was shown in Figure 3.18-1, there are no NRHP-listed sites near the power plant site. The two closest listed sites are the Perkins House and the Oliver House, both approximately 5 miles northwest of the power plant site.

Surface Lignite Mine

All potential cultural resources sites would be identified prior to any mine or mine-related activity disturbance. Cultural resources include archaeological sites, standing structures, cultural landscapes, and traditional cultural properties. Once sites were identified and determined to be significant, and, based on the proposed mine plan and associated facility disturbance, it would be necessary to identify which archaeological sites, cultural landscapes, and structures would be impacted and mitigated. Potentially eligible NRHP sites that could be adversely impacted would require Phase II work to determine eligibility.

Prior to any vegetation clearing, the qualifying archaeological site would be completely mitigated, and all documentation of the site would be approved by affected parties as identified in a programmatic agreement to be developed specifically for this project. Once approved, the construction activity would commence. The only difference between the impacts of mine construction and mine operation on archaeological sites would be the time at which impacts occurred.

Linear Facilities

A number of cultural resources deemed eligible and potentially eligible for listing on the NRHP were discovered during the extensive field surveys of the proposed linear facility corridors (156 miles surveyed). Impacts to those resources would depend on whether: (a) the potentially eligible resources were determined to be, based on Phase II evaluation, eligible for listing; and/or (b) avoidance would be possible through transmission line structure location or pipeline trench alignment. Given that detailed engineering of the transmission lines and pipelines would not occur for some time, definitive assessments of potential impacts are not possible at present. Construction activities and facility designs could be carried out to avoid the resources. However, some sites were determined in the field to cover most or all of the 200-ft width of the study corridor. Transmission line construction could potentially avoid impacts by spanning particular sites. Pipeline construction, however, would not, in these few instances, be able to avoid some sites without rerouting. In these cases, Phase III data recovery would be the likely recourse. Tribal representatives have expressed their particular interest in any sites that might be investigated and artifacts that might be recovered, to the extent those sites/artifacts would relate to historical Native American habitation or presence.

Figure 3.18-1 illustrated a number of previously listed places in proximity to planned linear facility study corridors. Numerous places are shown in Meridian near one of the transmission line segments that would be upgraded. However, as this line and right-of-way already exist, it can be concluded that no significant new impacts would result from the line upgrade. Two listed places are near the proposed CO_2 pipeline corridor in the vicinity of its crossing of the Lauderdale-Clarke County line. Stuckey's Bridge over the Chunky River is located more than 1 mile west of the corridor, while the Ward House in northern Clarke County is somewhat closer but separated from the corridor by I-59. Construction of the pipeline would impact neither of these places, given the separation of each from the corridor.

4.2.17.2 Operation

Power Plant

Once constructed, the operations of the IGCC power plant and related onsite facilities would have no potential to affect cultural or historical resources beyond those impacts that would occur during construction.

Surface Lignite Mine

All potential cultural resources sites would be identified prior to any mine or mine-related activity disturbance. Cultural resources include archaeological sites, standing structures, cultural landscapes, and traditional cultural properties. Once sites were identified and determined to be significant, based on the proposed mine plan and associated facility disturbance, it would be necessary to identify which archaeological sites, cultural landscapes, and structures would be impacted and mitigated. Potential NRHP sites that could be adversely impacted would require Phase II work to determine eligibility.

Impacts to archaeological sites come primarily from the removal of the overburden soil in order to access the lignite coal. Impacts to standing structures additionally might include viewshed alterations and activities that affect the integrity of the structure's setting.

The survey conducted for the EIS represents part of a Phase I effort. A 100-percent survey will be completed prior to application for the Mississippi Surface Mining and Reclamation Permit with the MDEQ. Once the 100-percent Phase I survey is complete, significance of the sites will be determined. Significance would be linked to NRHP eligibility statements, as required under Section 106 of the National Historic Preservation Act (NHPA).

Prior to any vegetation clearing for mining, the qualifying archaeological site would be completely mitigated, and all documentation of the site would be approved by affected parties as identified in a project-specific programmatic agreement. Once approved, the mining activity would commence. The only difference between the impacts of mine construction and mine operation on archaeological sites would be the time at which impacts occurred.

It is important to note that construction and mine disturbances associated with a surface mine do not all occur at the initiation of the project. The disturbances would be over time as the mining advances from one block to the next, as described in Chapter 2. All of these disturbance activities associated with the construction or the mining at the surface mine project area would be preceded by a complete survey and sign-off of the site by appropriate state and federal authorities in accordance with Section 106 of the NHPA.

Linear Facilities

The operations of the linear facilities would have essentially no potential to impact cultural or historical resources beyond those impacts that would occur during construction.

4.2.18 NOISE

Noise would result from both the construction and operation of the proposed facilities. A contractor to ECT (Tech Environmental) conducted a noise study (2009) that evaluated the potential impacts of power plant and lignite mine construction and operation. Their full report is included in Appendix Q. Impacts associated with the linear facilities would be minor and are discussed briefly.

4.2.18.1 Construction

Power Plant and Surface Lignite Mine

The construction of the Kemper County IGCC Project power plant and connected lignite mine would require the use of equipment that might be audible from offsite locations. Facility construction would consist of site clearance, excavation, foundation work, steel erection and installation of facility equipment, and finishing work. Some of these activities would overlap. During construction of the proposed facilities, noise would be generated by construction equipment including bulldozers, trucks, backhoes, graders, scrapers, compactors, cranes, pile drivers, pumps, pneumatic tools, air compressors, and front-end loaders. Noise levels during construction on the site would be typical of any major industrial plant construction. Noise from construction-related truck traffic passing residences on MS 493 and other local roads would constitute another form of noise impact.

The noise levels resulting from construction activities would vary greatly depending on factors such as the type of equipment, the specific equipment model, the operations being performed, and the overall condition of the equipment. Variations in the energy expended by the equipment and changes in construction phases and equipment mix make the prediction of potential noise impacts even more challenging.

Table 4.2-44. Estimated Sound Levels at the Closest Residential Receptor by Construction Phase

Construction Phase	50 ft from Source (L_{eq})	At Closest Residential Receptor (L_{eq})
Site clearance	90	64
Excavation	89	63
Pile driving	95	68
Foundations	78	53
Erection	85	60
Finishing	89	63

Source: Tech Environmental, 2009.

EPA (1971) published data on the average sound levels for typical construction phases of industrial facilities. These average levels were projected from the edge of the power plant footprint to the closest residential receiver, located at a distance of approximately 900 ft. This calculation conservatively assumed all equipment operating concurrently onsite for the specified construction phase. The results of these calculations are presented in Table 4.2-44, which shows that estimated construction sound levels at the nearest residence would be between 53 and 64 dBA for all activities except pile driving, which, if necessary, would produce a sound level of approximately 68 dBA at the nearest residence. If pile driving were required for the project's foundations, that activity would most likely be limited to daytime hours. The construction sound at more distant locations would be less since sound level decreases with distance from the sound source. Construction noise impacts would be temporary, and the highest levels experienced by residents would be no louder than maximum levels from passing vehicular traffic on MS 493.

The estimated noise levels conservatively (i.e., as an upper bound) do not account for any additional sound attenuation that might result from structures or vegetation. The predicted noise levels apply to receptors outdoors; persons indoors would experience a reduced level of noise.

Reasonable effort would be made to minimize the impact of noise resulting from construction activities. The mitigation measures outlined herein would be incorporated into the construction management guidelines:

- Construction activities that produce significant noise would generally be limited to daytime hours.
- Properly designed engine enclosures and intake silencers would be required.

- Regular equipment maintenance and lubrication would be required.
- All exhaust systems would be in good working order.

One other construction activity that would occur toward the latter part of power plant construction is steam blowdown. Steam blowdown is a procedure using pressurized steam to clear specific equipment of debris. For the HRSGs and steam turbine, the activity would consist of five blows over a period of 6 days lasting approximately 18 to 24 hours each. For the gasifier steam lines, four additional blows of approximately 18 to 24 hours each over a 5-day period would be required. For all of these steam blows, the peak sound pressure level at a distance of 50 ft from the source would be approximately 102 dBA. The noise would attenuate to a level of approximately 77 dBA at the nearest residence (outdoors). Relative to the human response to typical sounds levels presented in Table 3.19-2, the noise produced during the temporary steam blows would approach the level of annoyance. Persons indoors would experience a reduced level of noise.

Linear Facilities

The construction of the new and upgraded transmission lines and substations and reclaimed effluent, natural gas, and CO_2 pipelines would require the use of equipment that might temporarily be audible from locations outside the facility corridors. Project linear facilities construction would consist of site clearing, excavation, foundation work, trenching, pipe laying, structure erection and installation, transmission wire installation, and finishing work. Work on some of these phases would overlap. Excavations for transmission structure foundations would be relatively modest in size to meet the design requirements. Excavations for pipeline trenches would run the length of each corridor but would otherwise be modest in width and depth. Rock blasting would likely not be required to construct the project facilities and structures. At this time, pile driving is also not anticipated to be required.

The sound levels resulting from linear facility construction activities would vary greatly depending on such factors as the operations being performed and the type of equipment being employed. Most of the time, noise generated by these construction activities would be screened by trees and vegetation and/or masked by noise from other manmade activities. At locations more distant from the construction activities, the noticeable sound would be less since sound levels decrease with distance from the source. At any given location, linear facilities construction activities (other than at the electrical substations) would occur during only a brief time (days or several weeks, at most).

4.2.18.2 Operation

Power Plant

Maximum sound levels at nearby sensitive receivers (residences and Liberty Church) were calculated using the Cadna-A acoustic model assuming simultaneous operation of all IGCC plant equipment at maximum operating conditions. Appendix Q contains all Cadna-A model outputs. Figure 4.2-9 shows the location of noise-sensitive receivers in relation to the project site and its property boundaries. Cadna-A is a sophisticated three-dimensional model for sound propagation and attenuation based on International Standards Organization (ISO) 9613-2. Atmospheric absorption is the process by which sound energy is absorbed by the air and was calculated using American National Standards Institute (ANSI) S.1.26-1995 (ANSI, 1995). Air absorption of sound assumed standard day conditions and is significant at large distances and high frequencies. ISO 9613-2 was used to calculate propagation and attenuation of sound energy by hemispherical divergence with distance, surface and building reflection, and shielding effects by barriers, buildings, and ground topography. The predicted maximum sound levels are conservative because: (1) the acoustic model assumes a ground-based temperature inversion, such as may occur on a calm, clear night when sound propagation is most favorable; (2) the model was instructed to ignore foliage sound absorption; and (3) no ground absorption (i.e., 100-percent sound wave reflection) was assumed for the plant equipment area.

The potential future sources of sound at the site would be the coal gasification process equipment, including process air compressors (PAC) and PAC intercoolers, CTs and generators, a steam turbine and generator, CT air inlets, HRSGs, HRSG exhaust stacks, cooling towers, transformers, and auxiliary equipment. The modeling effort assumed standard silencers on the HRSG air inlet and exhaust and standard acoustical enclosures for the CTs and steam turbine. Modeling also assumed noise mitigation from barrier walls around the PAC and PAC intercoolers on the north, east, and south sides. These sound sources would have the highest sound power at the facility, and some form of sound reduction would be necessary to limit offsite noise impacts. Barrier walls were assumed, but other forms of mitigation could be implemented during detailed design to achieve similar results.

Table 4.2-45 summarizes predicted L_{eq} at the sensitive receiver locations . These are maximum sound levels that assume all facility equipment would be in operation, and atmospheric conditions

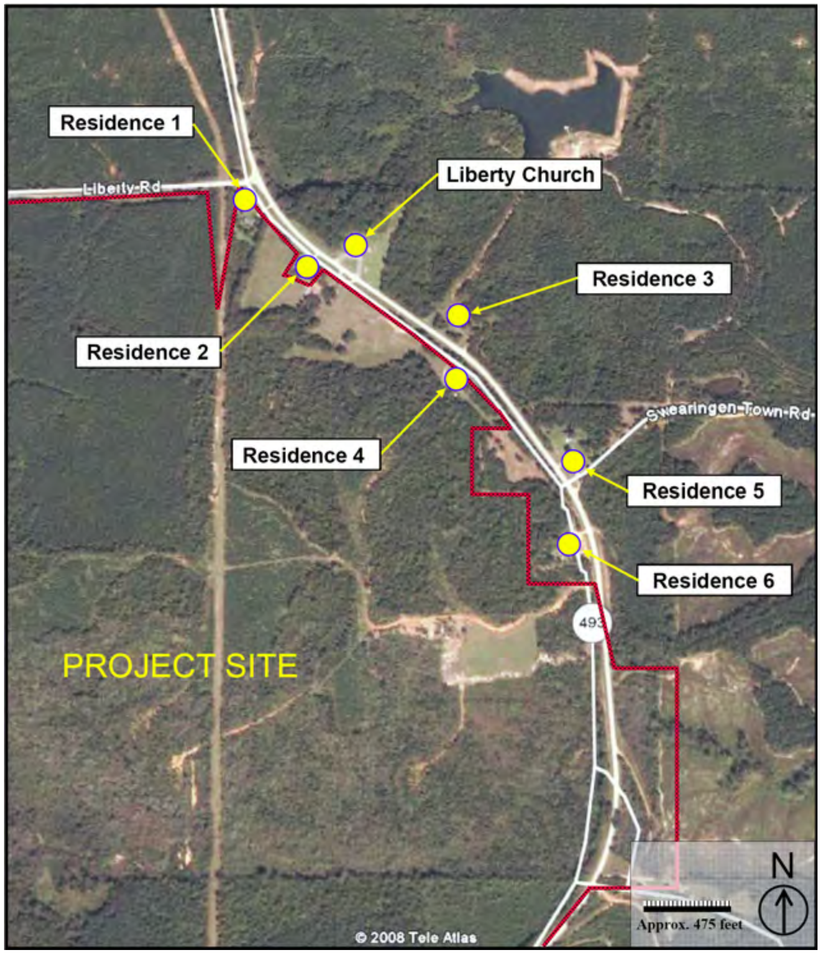

Figure 4.2-9. Sensitive Receiver Locations near Kemper County IGCC Plant

Source: Tech Environmental, 2009.

Table 4.2-45. Maximum Sound Levels from the Kemper County IGCC Plant (dBA)

Receiver Location	L_{eq}	L_{dn}
Residence 1	46.2	52.6
Residence 2	47.4	53.8
Liberty Church	43.4	49.8
Residence 3	44.7	51.1
Residence 4	47.9	54.3
Residence 5	45.6	52.0
Residence 6	50.9	57.3

Source: Tech Environmental, 2009.

produce minimum sound attenuation. Predicted maximum facility sound levels are 43 to 51 dBA at the nearest receivers. Figure 4.2-10 presents a color contour plot of the facility sound levels and predicted levels at the sensitive receivers.

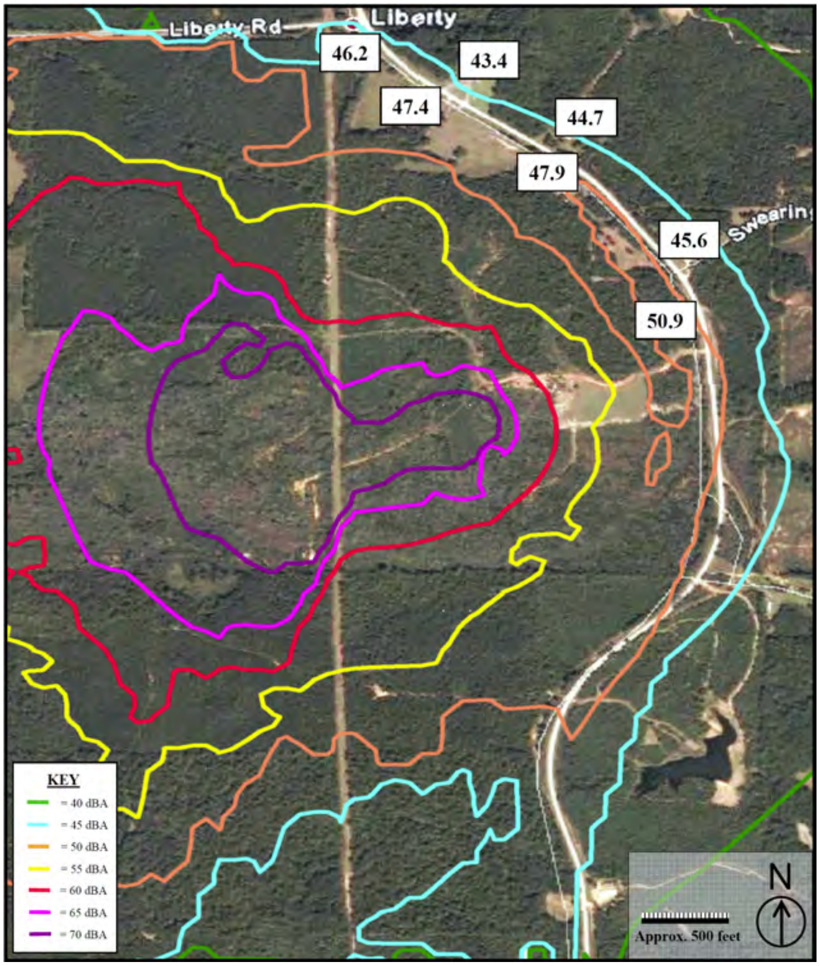

Figure 4.2-10. Maximum Sound Levels (dBA) at the Kemper County IGCC Plant (L_{eq})

Source: Tech Environmental, 2009.

Table 4.2-40 also provides the L_{dn} computed for noise from the IGCC power plant. Whereas the facility would operate 24 hours per day, the L_{dn} level is equal to the predicted L_{eq} level plus 6.4 dBA. These results show that the L_{dn} operational sound levels at Liberty Church and at all but one of the nearest residences would comply with the EPA residential noise guideline of 55 dBA L_{dn}. The predicted level at Residence 6 would be slightly above the EPA guideline but below the HUD residential guideline of 65 dBA L_{dn}.

It is expected that the sound from the IGCC power plant would be more audible at night when there would be less roadway traffic or human activity. Much of the time, depending upon weather conditions, actual sound levels would be less than predicted here, because this analysis does not include additional attenuation from wind gradients and atmospheric turbulence, effects that, at times, can reduce sound levels 10 to 20 dBA.

Combined Power Plant and Surface Lignite Mine Impacts

This subsection presents the potential sound impacts from lignite coal mining operations and the potential sound impact of coal mining and the power plant operations occurring simultaneously. Both operations would normally occur 24 hours per day and 7 days per week. The mining operation would consist of three major activities: removal of overburden, surface mining of coal, and reclamation of the open pit.

Surface mining would first consist of removing the overburden and then the exposed lignite seam with excavating equipment. This sequence would be repeated for each seam to be mined. The removal of the overburden for the first 5- to 20-ft depths would be conducted using a hydraulic-powered shovel to excavate the overburden and load into large dump trucks, which would then remove the overburden from the area. At depths below 20 ft, the electric-powered dragline would be used to remove overburden material. The dragline would operate from a bench within the pit mine. Once the overburden is removed from the pit, surface mining operations would occur.

Equipment used during surface mining activities would consist of electric-powered dragline, cable tractor, loaders, large dump trucks, dozers, graders, and backhoes. Surface mining would commence in the northeast corner of the life-of-mine area closest to the IGCC power plant. Each mining pit would be approximately 150 ft wide and 7,000 ft long and would be constructed from north to south, with mining operations occurring from east to west or west to east within each pit.

As required by federal and state surface mining regulations, reclamation of mined areas would occur concurrently with other mining operations. Following removal of the final coal seam from a mine pit, the pit would be backfilled with the overburden material from the adjacent active mine pit. The same equipment used to remove the overburden would be used during reclamation activities. If necessary, top soil would be salvaged, and large dozers would be used to spread the final cover. The final cover would be mulched, seeded, and planted to reduce runoff and dust impacts.

NACC provided a list of equipment anticipated to be in operation during coal mining. Noise emissions from mining operations were based on sound level measurements taken by NACC of some of the louder pieces of equipment and from Federal Highway Administration (FHWA) documentation (U.S. Department of Transportation [DOT], 2006). Table 4.2-46 presents the equipment and sound power levels used to represent surface coal-mining operations. Usage factors were applied to the sound power levels for each piece of equipment. A usage factor is the percentage of time during a 1-hour period that the equipment is actually being used at its maximum power and not shut down or idling. For example, during mining operations, the dragline would have a high usage factor of 90 percent, whereas a large dozer would have usage factor of 40 percent (DOT, 2006).

Table 4.2-46. Coal-Mining Equipment Sound Power Levels

Equipment	Sound Power Level (L_w) (dBA)
P&H 757 dragline*	119
Cable tractor	113
Cat 966 front-end loader	108
Cat 345 backhoe	108
Cat 365 backhoe	108
Cat 789C end dump truck*	112
Cat 785C end dump truck	111
Cat 844 wheel dozer	110
Cat 994F wheel loader	112
Cat D11R track dozer	109
Cat D10R track dozer	110
Cat D10R D.L. dozer	116
Cat D6LGP/D8LPG track dozer	110
Cat 24H* and 16 H graders	115
Cat D400 dump truck	110
O&K hydraulic shovel	116
O&K RH120C backhoe	108
Cat 436 backhoe/loader	114
Cat 825C compactor	109
Cat water truck	107

*NACC provided sound data for these pieces of equipment.

Sources: NACC, 2008; Tech Environmental, 2009.

The Cadna-A model was used to model the surface mining operations. The overburden removal phase would generate the highest sound levels during mining operations because much of the equipment would be working at the shallowest depth of the mining activities compared to those inside the pit, which would provide shielding for the dragline and other mining equipment. These highest sound levels were used to assess potential noise impacts at the seven noise-sensitive receivers. Sound modeling was conducted for two worst-case scenarios: (1) mining operations at its closest point to the noise-sensitive receivers, and (2) mining and IGCC power plant operating simultaneously. Because the coal mining operation would be approximately 2 miles away from the nearest noise-sensitive receivers impacted by the IGCC power plant, the sound level contribution from mining operations would not add to the plant's impacts at those same receivers. The cumulative modeling results showed that the IGCC power plant and mine operating simultaneously would not generate sound levels higher than those presented in Table 4.2-45 for IGCC power plant operating by itself. Figure 4.2-11 shows the maximum sound level contours for coal mining and IGCC power plant operating simultaneously. Appendix Q presents other graphical presentations of results as well as the Cadna-A model outputs.

The magnitude and areal extent of noise impacts beyond each subsequent active mining area would not likely vary to any significant degree. However, the noise generated by mining activities would shift with shifts in mine block locations, and new areas would be impacted. Mining of portions of blocks B1, C, E, and F would likely result in some temporary noise impacts within the northern areas of the WMA (see Figure 2.2-3).

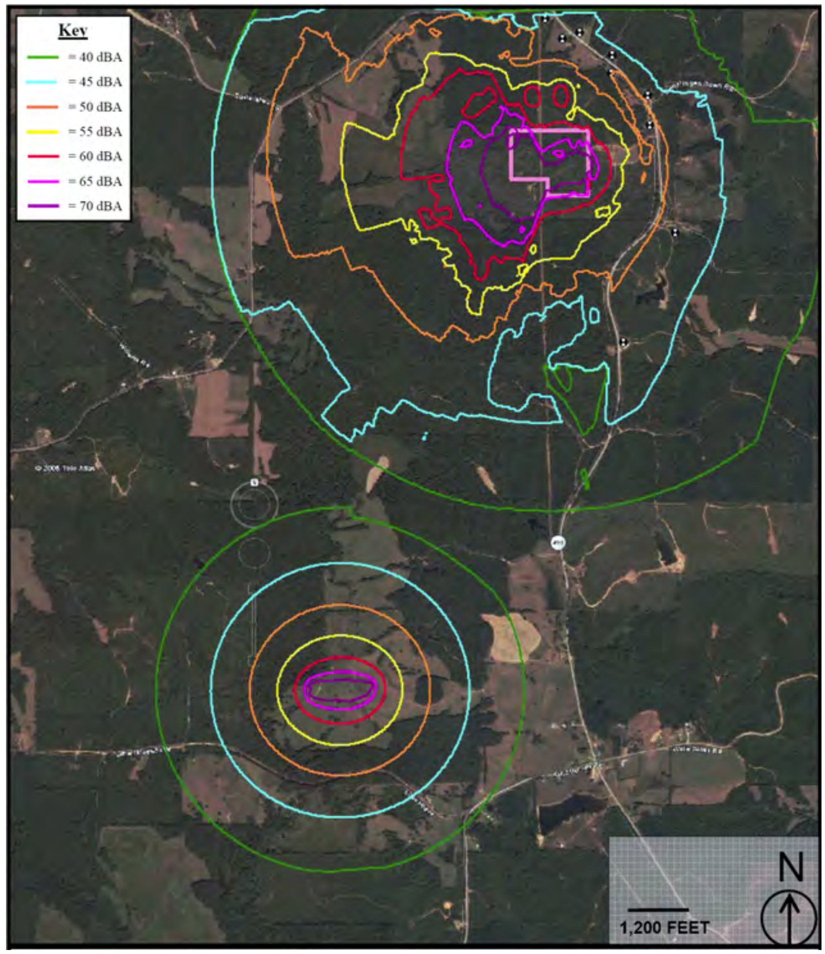

Figure 4.2-11. Maximum Sound Levels from Surface Mining Operations and IGCC Power Plant Noise (dBA)

Source: Tech Environmental, 2009.

Linear Facilities

Both the natural gas pipeline and CO_2 pipeline would be underground. Normal operation of these facilities would produce no noise.

Turning to electrical transmission line operation, the *corona effect* could produce some limited audible noise and radio interference. The audible noise associated with a transmission line is generated by either corona from the conductors or from gap-type discharges. Corona is a phenomenon that occurs when there is an irregularity on the surface of the conductor, such as buildup from fog, water droplets, significant PM, etc. Corona activity at the surface of the conductors produces a low-level audible noise that is a slight humming sound. Under wet conditions, higher noise levels are experienced than would occur under dry conditions. However, the background noise from various sources (inclement weather, traffic, etc.) has the effect of masking transmission line noise. For a small portion of time, when the conductors are wet from rainfall or heavy fog, the transmission line noise would increase.

For the new and reconductored transmission lines, maximum audible noise levels at the edges of the rights-of-way should be less than levels that might potentially result in any interference of activity, including at the nearest residential areas.

Corona, which can occur on high-voltage transmission lines, produces electromagnetic noise. When this noise is sufficiently strong, it can cause interference with radio and television signals. Since corona is enhanced by water droplets or water vapor, the magnitude of this noise is greater during wet or rainy periods than during dry or fair weather periods. The amplitude-modulated (AM) broadcast radio band and two television bands (very high frequency [VHF] and ultra high frequency [UHF] bands) are susceptible to this potential interference. No interference is typically expected for frequency-modulated (FM) radio, cable or satellite television systems, cellular telephones, home cordless telephones, or wireless networking. In general, the electromagnetic noise levels from a transmission line decrease with increasing distance from the right-of-way and with increasing noise frequency. Thus, interference effects are greatest immediately adjacent to the right-of-way and at the lower broadcast frequencies for radio and television.

Actual radio and television interference from transmission line corona would depend on numerous factors, including the weather, terrain, broadcast signal strength, and frequency. In general, corona effects from transmission lines at 230-kV or lower are not a significant issue. Due to the normal 230-kV operating voltages and the mostly rural, isolated locations of the proposed rights-of-way, the overall impacts to radio or television would likely be minimal, with the main potential for impact being the lower frequency AM radio band.

4.2.19 HUMAN HEALTH AND SAFETY

Both construction and operation of the Kemper County IGCC Project facilities would potentially impact human health and safety. Local community residents as well as project workers and employees could be impacted. Potential impacts due to releases of toxic or hazardous materials, whether due to accidents or intentional acts of terrorism, are described in this section.

4.2.19.1 Construction

Construction of all of the project facilities and components would involve the operation of heavy equipment and other job site hazards. U.S. Department of Labor Bureau of Labor Statistics (BLS) data for the United States construction industry were extracted from the BLS Web site (U.S. Department of Labor, 2009). Data were obtained on incidence rates of: (a) nonfatal occupational injuries and illnesses, and (b) fatal occupational injuries. The incidence of nonfatal injuries and illnesses averaged 230.5 per 10,000 full-time workers over the 5-year period from 2003 through 2007. The data show that injuries occur at a higher rate in the construction industry than in all United States industries on average (although the trend over the 5 years of data for construction was distinctly downward). The number of fatal injuries in the United States' construction industry during the same 5-year period averaged 1,246 per year. By comparison, there were 5,657 total fatalities in United States' industry in 2007. As reported elsewhere by BLS (Department of Labor, 1999) for the period 1995 through 1999, the construction industry had an average fatality rate of 14.3 per 100,000 full-time workers.

As discussed in Section 2.3, an average of approximately 500 construction workers would be onsite during the estimated 3.5-year construction period. Assuming an added 50 workers associated with mine construction over the same period and applying the industry incidence rates, an average of approximately 13 injuries per year might be anticipated. No fatalities would be expected in a given year (applying the incidence rate yields less than 0.1).

The proposed power plant and some of the mine facilities would be subject to several OSHA standards during construction (e.g., OSHA General Industry Standards [29 CFR 1910] and the OSHA Construction Industry Standards [29 CFR 1926]). A majority of the mine facilities would be solely subject to MSHA standards (30 CFR) during construction. During construction, risks would be minimized by the proposed facilities' adherence to procedures and policies required by OSHA and/or MSHA. These standards establish practices, chemical and physical exposure limits, and equipment specifications to preserve employee health and safety. Construction permits and safety inspections would be employed to minimize the frequency of accidents and further ensure worker safety. Construction equipment would be required to meet all applicable safety design and inspection requirements, and personal protective equipment would be used when needed to meet regulatory and consensus standards.

Subsection 4.2.13, previously, discussed potential impacts on transportation infrastructure. As presented therein, construction traffic would impact local highways and roads. The increases in traffic would have the potential to increase local area traffic-related accidents, injuries, and deaths.

During the construction phase, workers and suppliers would arrive and leave the site by cars and trucks. DOT has developed statistics for fatalities based on 1 million VMT. For 2008, the fatality rate was 1.37 per 100 million VMT (National Highway Traffic Safety Administration [NHTSA], 2009). Assuming an average of 629 workers per month over a 42-month construction period and 50 truck deliveries per day and that each worker and trucker would make two trips per day (one arriving, one leaving) over 6 days a week provides a conservative upper-bound estimate of roadway accidents. It was further assumed that all workers would individually make daily vehicle trips of 25 miles per day on roadways, even though it is likely that some construction workers would reside closer to the project area and that many workers would carpool often with other workers. If each trip is assumed to be 25 miles in length, then, collectively, over the 42-month period, the total number of miles driven by all workers would be approximately 42,206,250 miles. Based on a fatal accident rate of 1.37 fatalities per 100 million VMT (*ibid*.), 1 fatality might be predicted due to the construction of the project (the application of the fatal accident rate yields approximately 0.6).

4.2.19.2 <u>Operation</u>

<u>Power Plant</u>

General Considerations of Operation, Including Traffic

As discussed under construction, BLS statistics were obtained for incidences of worker injuries and fatalities under the category “electrical power generation.” The incidence of nonfatal injuries and illnesses averaged 83.4 per 10,000 full-time workers over the 5-year period from 2003 through 2007. The data show that injuries occur at a lower rate in the power generation industry than in all United States’ industries on average. The number of fatal injuries in the United States’ power generation industry during the same 5-year period averaged 13 per year. As reported by BLS (Department of Labor, 1999) for the period 1995 through 1999, transportation and public utilities had an average fatality rate of 12.7 per 100,000 full-time workers. Closer examination of the underlying data show that most of these deaths were in the transportation sector (e.g., trucking), not in the utility sector.

As presented in Section 2.4, a maximum of approximately 105 employees would staff the IGCC power plant. Applying the industry incidence rates, an average of approximately one injury per year might be anticipated. No fatalities would be expected.

During operations, an upper limit on traffic fatalities could be estimated by assuming that approximately 318 maximum employees would be employed by the power plant and the mine, and an estimated 45 deliveries would occur daily. Assuming every employee traveled an average of 50 miles per day (25 miles both to and from work), this would collectively total approximately 37,686,250 miles traveled over the first 5 years of operation and 301,500,000 miles traveled over a 40-year period of operations. Based on a fatal accident rate of

1.37 fatalities per 100 million VMT (NHTSA, 2009), these estimates of travel would suggest potentially one fatal accident during the first 5-year period (calculation yields 0.52), and approximately four (calculation yields 4.1) fatalities could occur during the 40-year life of the power plant and the mine.

During operation of the proposed facilities, as with their construction, risks would be minimized by the proposed facilities' adherence to procedures and policies required by OSHA. These standards establish practices, chemical and physical exposure limits, and equipment specifications to preserve employee health and safety.

The proposed facilities would also likely develop supplemental detailed procedures for inclusion in their Occupational Safety and Health Program to assure compliance with OSHA and EPA regulations and serve as a guide for providing a safe and healthy environment for employees, contractors, visitors, and the community. These procedures would include job procedures describing proper and safe manners of working within the facilities (e.g., handling and storage of ammonia would comply with 29 CFR 1910.111), appropriate personal protective equipment (complying with 29 CFR 1910.132), and appropriate hearing conservation protection devices. The manual would be used as a reference and training source and would include accident reporting and investigation procedures, emergency response procedures, toxic gas rescue-plan procedures, hazard communication program provisions, material safety data sheet accessibility, medical program requirements, and initial and refresher training requirements. In addition, supplemental provisions would be added to the proposed facilities' emergency action, risk management, and process safety management plans.

HAPs Impact Analyses

HAPs would be emitted from the IGCC facility, most notably from the CT/HRSGs, auxiliary boiler, AGR process, and flares. The facility would not be a major source of HAPs (i.e., it would have total emissions that are less than 25 tpy of total HAPs and less than 10 tpy of any single HAP). The total HAP emissions from the power plant would be a maximum of 18.5 tpy of total HAPs.

An analysis of the potential effects of HAP emissions from the proposed IGCC facility CT/HRSG stacks was performed for the 50- and 67-percent CO_2 capture cases (AECOM, 2009a and e). These analyses are included in separate reports in Appendix R. The following discussions present the worst case of the two analyses. The HAPs were ranked in terms of potential impacts on health by comparing the maximum emissions of individual HAPs to their associated toxicological values for cancer risk and chronic exposure. The results indicated that arsenic and cadmium emissions would contribute to nearly 75 percent of the inhalation cancer risk and nearly 50 percent of the chronic noncancer inhalation risk. Since the combined impacts from these two substances were shown to be well below the levels of concern (i.e., more than two orders of magnitude below the reference air concentration and less than 20 percent of the one-in-a-million cancer risk target), it was concluded that all of the HAPs in combination would not pose an unacceptable health risk. Mercury is not classified as a carcinogen, and although mercury was not expected to contribute much to the chronic inhalation noncancer health risk, mercury was also evaluated because of the general concern over this substance. Mercury is an environmentally persistent bioaccumulative toxic element. In particular, the deposition of air mercury emissions onto watersheds can lead to increased human health risks from ingestion of fish with elevated mercury levels.

Only syngas firing was considered in the analysis, since that fuel would be the source of the HAPs resulting in the highest risks (i.e., arsenic and cadmium), as well as the primary source of the mercury emissions. Also, emissions were based on the CTs operating continuously at peak power. The modeling methodology was consistent with that of the Class II PSD analysis. However, only the meteorological data based on the surface characteristics of the National Weather Service site at the Meridian Airport were used, since they were found to result in the highest modeled concentrations. Although the risk analyses contained in Appendix R were limited to the three substances mentioned previously (arsenic, cadmium, and mercury), the evaluation for this discussion was expanded to include estimates of concentrations and risks for the complete list of HAPs emitted from the CT/HRSGs while firing syngas.

Cancer and Noncancer Risks—Cancer risk was determined by multiplying the modeled concentrations by the chemical specific unit risk estimate (URE) developed by EPA. The URE has units that are the inverse of concentration, such that the chronic predicted concentration multiplied by the URE produces the probability that a person breathing the pollutant at that concentration for a lifetime will have of developing cancer. A one-in-a-million risk is generally considered to be an acceptable level.

Noncancer risk was assessed by comparing the chronic predicted concentration to an inhalation reference concentration (RfC). The RfC is an estimate of a continuous inhalation exposure of a chemical to the human population, including sensitive subpopulations, that is likely to be without risk of deleterious noncancer effects during a lifetime. The RfCs are generally higher for shorter averaging times. If the hazard quotient, defined as the predicted concentration divided by the RfC, is below 1, then the noncancer risk is considered to be acceptable.

The chronic cancer and noncancer risks were assessed in two ways. First, the maximum risk was based on the maximum impact from the IGCC plant predicted to occur anywhere. Second, the average risks for the project were estimated. The latter were developed by averaging the predicted impacts for a model receptor grid of 1,000-meter spacing covering the entire county. In addition, the average predicted concentrations were added to chemical-specific values predicted for the project in the 1999 National Air Toxics Assessment (EPA, 2008). The results for the IGCC plant maximum impacts and Kemper County-wide average impacts are shown in Tables 4.2-47 and 4.2-48.

The maximum risks estimated from the Kemper County IGCC Project are shown in Table 4.2-47. As can be seen, the hazard quotients were predicted to be much less than 1, and the total individual cancer risk were estimated to be well below the target value of one in a million (i.e., less than 1.0E-06).

The average project chronic cancer risk estimates were driven by the background estimates from the NATA study. Although the total cancer risk was greater than one in a million (i.e., 4.1E-06), the project's contribution to the total would be less than 1 percent of the total (see Table 4.2-48). The risk is attributed to the high background estimates for acetaldehyde and benzene, which accounts for approximately 88 percent of the total estimated cancer risk.

Also in Table 4.2-48, the average project chronic hazard quotient was greater than the target level of 1 (i,e,. 1.3). Again, the Kemper County IGCC Project would contribute an insignificant amount (i.e., 0.05 percent) to the noncancer risk estimate. The high-risk estimate was primarily due to a high background level of acrolein and, to a lesser extent, by the estimated background levels of acetaldehyde and formaldehyde. Acrolein background accounts for more than 90 percent of the risk, and the background concentration of the three substances together account for 99.8 percent of the estimated risk.

Acute inhalation risk was also assessed for these HAPs. The acute dose response values are levels below which no adverse health effects should result for exposure times up to 1 hour. As shown in Table 4.2-49, the maximum predicted concentrations were found to be well below the acute dose response values.

Table 4.2-47. Maximum Chronic Inhalation Risk Estimates from Kemper County IGCC Project

HAP	Maximum Short-Term Emissions (lb/hr)	Maximum Chronic Impact (µg/m^3)	Cancer Unit Risk Estimate (µg/m^3)$^{-1}$	Maximum Cancer Risk	Reference Air Concentration (µg/m^3)	Chronic Hazard Quotient
VOCs						
Acetaldehyde	1.79E-02	8.7E-05	2.2E-06	1.9E-10	9	9.7E-06
Acrolein	1.58E-03	7.7E-06	NA		0.02	3.8E-04
Benzene	1.91E-02	9.3E-05	7.8E-06	7.2E-10	30	3.1E-06
Ethylbenzene	6.43E-03	3.1E-05	NA		1000	3.1E-08
Formaldehyde	8.61E-02	4.2E-04	5.5E-09	2.3E-12	9.8	4.3E-05
Toluene	1.92E-02	9.3E-05	NA		5,000	1.9E-08
Xylene	1.83E-02	8.9E-05	NA		100	8.9E-07
POM*						
PAH†	1.33E-04	6.5E-07	1.1E-03	7.1E-10	200	3.2E-09
2-Mythlnapthalene	1.14E-03	5.5E-06	NA		NA	
Acenapthylene	8.25E-05	4.0E-07	NA		NA	
Benzo(a) anthracene	7.30E-06	3.5E-08	1.1E-04	3.9E-12	NA	
Benzo(e)pyrene	1.75E-05	8.5E-08	NA		NA	
Benzo(g,h,i)perylene	3.02E-05	1.5E-07	NA		NA	
Napthalene	1.45E-03	7.0E-06	3.4E-05	2.4E-10	3	2.3E-06
Metals						
Antimony	1.24E-02	6.0E-05	NA		NA	
Arsenic	9.52E-03	4.6E-05	4.3E-03	2.0E-07	0.03	1.5E-03
Beryllium	2.92E-03	1.4E-05	2.4E-03	3.4E-08	0.02	7.1E-04
Cadmium	1.33E-02	6.5E-05	1.8E-03	1.2E-07	0.02	3.2E-03
Chromium VI	1.45E-03	7.0E-06	1.2E-02	8.5E-08	0.1	7.0E-05
Cobalt	2.57E-03	1.2E-05	NA		0.1	1.2E-04
Lead	1.27E-02	6.2E-05	NA		1.5	4.1E-05
Managanese	1.36E-02	6.6E-05	NA		0.05	1.3E-03
Mercury (total)	3.67E-03	1.8E-05	NA		0.3	5.9E-05
Elemental mercury	3.31E-03	1.6E-05	NA		NA	
RGM	3.67E-04	1.8E-06	NA		NA	
Hg_p	Trace	NA	NA		NA	
Nickel	1.78E-02	8.7E-05	NA		0.09	9.6E-04
Phosphorous	1.08E-02	5.2E-05	NA		0.07	7.5E-04
Selenium	1.36E-02	6.6E-05	NA		20	3.3E-06
Inorganic Compounds						
Carbon disulfide	1.43E-01	6.9E-04	NA		700	
Total				**4.4E-07**		**9.3E-03**

*Polycyclic organic matter.
†Polynuclear aromatic hydrocarbons.

Note: The hourly emissions shown are for a single CT/HRSG and based on full load with duct burner firing.
The unit risk factors (URF) and reference air concentrations from prioritized chronic dose-response values: http://www.epa.gov/ttn/atw/toxsource/table1.pdf.

Sources: AECOM, 2009a and e.
ECT, 2009.

Table 4.2-48. Average Kemper Countywide Chronic Inhalation Risk Estimates from Kemper County IGCC Project

HAP	Maximum Short-Term Emissions (lb/hr)	Maximum Chronic Impact (μg/m^3)	NATA Kemper County Chronic Concentration (μg/m^3)	Total Kemper County Chronic Concentration (μg/m^3)	Cancer Unit Risk Estimate (μg/m^3)$^{-1}$	Maximum Cancer Risk	Reference Air Concentration (μg/m^3)	Chronic Hazard Quotient
VOCs								
Acetaldehyde	1.79E-02	6.1E-06	6.10E-01	6.1E-01	2.2E-06	1.3E-06	9	6.8E-02
Acrolein	1.58E-03	5.4E-07	2.40E-02	2.4E-02	NA		0.02	1.2E+00
Benzene	1.91E-02	6.5E-06	2.90E-01	2.9E-01	7.8E-06	2.3E-06	30	9.7E-03
Ethylbenzene	6.43E-03	2.2E-06		2.2E-06	NA		1,000	2.2E-09
Formaldehyde	8.61E-02	2.9E-05	2.60E-01	2.6E-01	5.5E-09	1.4E-09	9.8	2.7E-02
Toluene	1.92E-02	6.5E-06	3.29E-01	3.3E-01	NA		5,000	6.6E-05
Xylene	1.83E-02	6.2E-06	3.21E-01	3.2E-01	NA		100	3.2E-03
POM			2.99E-03	3.0E-03				
PAH	1.33E-04	4.5E-08		4.5E-08	1.1E-03	5.0E-11	200	2.3E-10
2-Mythlnapthalene	1.14E-03	3.9E-07			NA		NA	
Acenapthylene	8.25E-05	2.8E-08			NA		NA	
Benzo(a) anthracene	7.30E-06	2.5E-09		2.5E-09	1.1E-04	2.7E-13	NA	
Benzo(e)pyrene	1.75E-05	6.0E-09			NA		NA	
Benzo(g,h,i)perylene	3.02E-05	1.0E-08			NA		NA	
Napthalene	1.45E-03	4.9E-07	2.96E-03	3.0E-03	3.4E-05	1.0E-07	3	9.9E-04
Metals								
Antimony	1.24E-02	4.2E-06	8.98E-05	9.4E-05	NA		NA	
Arsenic	9.52E-03	3.2E-06	7.83E-07	4.0E-06	4.3E-03	1.7E-08	0.03	1.3E-04
Beryllium	2.92E-03	9.9E-07	2.48E-07	1.2E-06	2.4E-03	3.0E-09	0.02	6.2E-05
Cadmium	1.33E-02	4.5E-06	7.22E-07	5.3E-06	1.8E-03	9.5E-09	0.02	2.6E-04
Chromium VI	1.45E-03	4.9E-07	3.40E-05	3.4E-05	1.2E-02	4.1E-07	0.1	3.4E-04
Cobalt	2.57E-03	8.7E-07	2.73E-05	2.8E-05	NA		0.1	2.8E-04
Lead	1.27E-02	4.3E-06	8.31E-05	8.7E-05	NA		1.5	5.8E-05
Managanese	1.36E-02	4.6E-06	8.39E-05	8.9E-05	NA		0.05	1.8E-03
Mercury (total)	3.67E-03	1.2E-06	8.90E-07	2.1E-06	NA		0.3	7.1E-06
Elemental mercury	3.31E-03	1.1E-06			NA		NA	
RGM	3.67E-04	1.2E-07			NA		NA	
Hg_p	Trace	NA			NA		NA	
Nickel	1.78E-02	6.1E-06	1.68E-04	1.7E-04	NA		0.09	1.9E-03
Phosphorous	1.08E-02	3.7E-06		3.7E-06	NA		0.07	5.2E-05
Selenium	1.36E-02	4.6E-06		4.6E-06	NA		20	2.3E-07
Inorganic Compounds								
Carbon disulfide	1.43E-01	4.9E-05		4.9E-05	NA		700	6.9E-08
Total						**4.1E-06**		**1.3E+00**

Note: The hourly emissions shown are for a single CT/HRSG and based on full load with duct burner firing.
The URF and reference air concentrations from prioritized chronic dose-response values: http://www.epa.gov/ttn/atw/toxsource/ table1.pdf

Sources: AECOM, 2009a and e.
ECT, 2009.

Table 4.2-49. Maximum Acute Inhalation Risk Estimates from Kemper County IGCC Project

HAP	Maximum Short-Term Emissions (lb/hr)	Maximum Acute Impact (µg/m^3)	Acute Reference Air Concentration (µg/m^3)	Acute Hazard Quotient
VOCs				
Acetaldehyde	1.79E-02	2.0E-03	81,000	2.5E-08
Acrolein	1.58E-03	1.8E-04	0.19	9.2E-04
Benzene	1.91E-02	2.1E-03	29	7.3E-05
Ethylbenzene	6.43E-03	7.1E-04	350,000	2.0E-09
Formaldehyde	8.61E-02	9.6E-03	49	2.0E-04
Toluene	1.92E-02	2.1E-03	3,800	5.6E-07
Xylene	1.83E-02	2.0E-03	8,700	2.3E-07
POM				
PAH	1.33E-04	1.5E-05		
2-Mythlnapthalene	1.14E-03	1.3E-04	6,000	2.1E-08
Acenapthylene	8.25E-05	9.2E-06	NA	
Benzo(a) anthracene	7.30E-06	8.1E-07	100	8.1E-09
Benzo(e)pyrene	1.75E-05	1.9E-06	NA	
Benzo(g,h,i)perylene	3.02E-05	3.4E-06	10,000	3.4E-10
Napthalene	1.45E-03	1.6E-04	130,000	1.2E-09
Metals				
Antimony	1.24E-02	1.4E-03	5,000	2.8E-07
Arsenic	9.52E-03	1.1E-03	0.19	5.6E-03
Beryllium	2.92E-03	3.2E-04	25	1.3E-05
Cadmium	1.33E-02	1.5E-03	900	1.6E-06
Chromium VI	1.45E-03	1.6E-04	1,500	1.1E-07
Cobalt	2.57E-03	2.9E-04	2,000	1.4E-07
Lead	1.27E-02	1.4E-03	10,000	1.4E-07
Managanese	1.36E-02	1.5E-03	50,000	3.0E-08
Mercury (total)	3.67E-03	4.6E-04	1.8	2.5E-04
Elemental mercury	3.31E-03	4.1E-04	1.8	2.3E-04
RGM	3.67E-04	4.6E-05		
Hg_p	Trace			
Nickel	1.78E-02	2.0E-03	6	3.3E-04
Phosphorous	1.08E-02	1.2E-03	20	6.0E-05
Selenium	1.36E-02	1.5E-03	100	1.5E-05
Inorganic Compounds				
Carbon disulfide	1.43E-01	1.6E-02	6,200	2.6E-06
Total				**7.7E-03**

Note: The hourly emissions shown are for a single CT/HRSG and based on full load with duct burner firing.
The URF and reference air concentrations from prioritized chronic dose-response values: http://www.epa.gov/ttn/atw/toxsource/table1.pdf.

Sources: AECOM, 2009a and e.
ECT, 2009.

It can be concluded from the results of this screening assessment that the HAPs emitted from the Kemper County IGCC Project would not result in or contribute significantly to an inhalation human health risk.

Mercury Deposition—An assessment of mercury deposition that could result from potential mercury emissions from the HRSG stacks was conducted. The combustion of fossil fuels containing mercury might result in emissions of elemental mercury, reactive gaseous divalent mercury (Hg^{2+}) (RGM), and/or particle-bound mercury (Hg_p). Hg_p is emitted in particulate form, while both elemental mercury and RGM are released in the gaseous state. The deposition characteristics of each of these three mercury species differ. Elemental mercury has a long residence time in the atmosphere and travels long distances (i.e., greater than 30 miles) before it is ultimately deposited on the earth's surface. The other two forms of mercury, RGM and Hg_p, deposit locally (i.e., within approximately 30 miles) and regionally (i.e., from 30 to several thousand miles). The dispersion of elemental mercury is evaluated on regional and global scales and, therefore, was not considered for this analysis of local mercury deposition. The analysis focused on local deposition (i.e., within approximately 30 miles) and, because RGM is the form of mercury emissions (as opposed to elemental or particulate mercury) to dominate deposition at that scale, the analysis estimated the total deposition caused by potential RGM emissions from the proposed facilities. Dry, wet, and total RGM depositions were estimated using wet and dry algorithms contained in the current version of EPA's AERMOD dispersion model.

The proposed IGCC syngas treatment process would include an alumina-based metal sulfide system for mercury removal. Due to the nature of the IGCC process, emissions of Hg_p would be lower than conventional coal-fired power plants firing the same fuels. Combustion of the treated syngas would result in an estimated potential IGCC total mercury emission rate of 32.18 lb/yr per CT/HRSG stack. Of this total, 90 percent (i.e., 28.96 lb/yr) would be emitted as elemental mercury, 10 percent (i.e., 3.22 lb/yr) as RGM, and only trace amounts as Hg_p. The mercury emission rates and the IGCC HRSG stack parameters for each analysis case are summarized in Tables 2 and 3 of the respective report located in Appendix R.

The application of AERMOD for a deposition analysis requires additional parameters associated with the surrounding surface characteristics, transport characteristics of the pollutant, and meteorological data. The selection of each of these model input parameters is discussed in the following.

Dry gas deposition measures the mass of pollutant transferred to the ground in the absence of precipitation. Because vegetation removes RGM from the atmosphere, information concerning the surface characteristics surrounding the Kemper County site was required. Since the area surrounding the site is forested in all directions, source category 4 (forest) was selected for input to the model. In addition, the reactivity factor of RGM is required. An RGM reactivity factor of 1.0 was used in accordance with EPA guidance (EPA, 2004a). The transport and mobility of a pollutant are determined by the physical properties of the specific pollutant. For deposition modeling, AERMOD requires the following pollutant-specific parameters: (1) diffusivity in air; (2) diffusivity in water; (3) leaf cuticular resistance to lipid uptake; and (4) the Henry's Law constant. The values of these parameters selected to represent RGM are shown in Table 4.2-50.

Table 4.2-50. Physical Characteristics of RGM

Parameter	Value
Diffusivity in air (cm^2/s)	6.0 E-02
Diffusivity in water (cm^2/s)	5.25 E-06
Cuticular resistance (s/m)	1.0 E 7
Henry's law constant (pa-m^3/mol)	6.0 E-06

Source: AECOM, 2009a.

As shown in Figure 6 of each report located in Appendix R, the maximum dry deposition was found to occur along the southeast line of the power block portion of the facility site, and the maximum wet and total RGM depositions occurred along and just past the northeast fence line of the power block. The predicted deposition values are compared to deposition measured at the National Atmospheric Deposition Program (NADP) Oak Grove site in Mississippi, and the outlying landing field (OLF) site near Pensacola, Florida, as shown in the Table 4.2-51.

As can be seen, predicted wet deposition was estimated to be well below the measured values, while dry deposition was found to be within the range of the values measured at the OLF site. The maximum total deposition predicted from the IGCC project emission sources was estimated to be less than 12 percent of the total ambient deposition measured at the OLF site.

Table 4.2-51. Comparison of Modeled Mercury from Kemper IGCC Stacks with Measured Deposition ($g/m^2/yr$)

Pollutant	Maximum Annual Modeled Impact	NADP Mercury Deposition Network	OLF 2005 to 2008 Average Low/High Estimates
Mercury, wet deposition	3.44 E-07	1.68 E-05	1.47 E-05
Mercury, dry deposition	2.24 E-06	NA	1.22E-06/2.45E-06
Mercury, total deposition	2.46 E-06	NA	15.9E-06/17.2E-06

Note: $g/m^2/yr$ = gram per square meter per year.

Source: AECOM, 2009a.

Hazards Associated with Accidental Releases of Ammonia

Two substances that would be generated onsite were evaluated because of their potential for adverse impacts on the public if an accidental release were to occur. Ammonia and CO_2 would be captured from the syngas process. To assess the hazards associated with an inadvertent release of these substances, screening modeling was performed for two scenarios: a catastrophic release and a lesser release scenario. Since ammonia would be transported offsite in tanker trucks, a truck accident involving an almost instantaneous release of ammonia was also evaluated. Accidental releases of CO_2 are addressed subsequently under Linear Facilities.

As just mentioned, ammonia would be recovered from the syngas production process. A portion of the ammonia would be used onsite in the SCR NO_x postcombustion control system of the CT/HRSGs. More ammonia would be created than used in the SCR systems (which would only be required when firing natural gas); the excess would be sold as a useful byproduct. Approximately 70 tpd of ammonia would be produced. The ammonia would be stored in a pressurized aboveground tank of approximately 400-ton (approximately 160,000-gallon) capacity. Tanker trucks of approximately 18-ton capacity (approximately 7,200-gallon) would also be loaded from the tank.

Ammonia Acute Toxicity Levels—Levels of concern for toxic gas releases have been developed by the Emergency Response Planning Committee of the American Industrial Hygiene Association. The values are referred to as Emergency Response Planning Guidelines (ERPGs), and have the following meanings:

- ERPG 1—The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving clearly defined odor.

- ERPG 2—The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.
- ERPG 3—The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects, even though effects could be severe.

The ERPGs are not designed to be protective of extremely sensitive individuals, nor do they have safety factors that are normally built into many exposure guidelines. However, the ERPGs are considered to be appropriate for evaluating accidental releases, and are also used in the EPA risk management program analyses required under the CAA. Following are the EPRGs for ammonia:

- EPRG 1 = 25 ppm.
- EPRG 2 = 150 ppm.
- EPRG 3 = 750 ppm.

The routine emissions of ammonia from the CT/HRSG stacks, and very small amounts of fugitive emissions, would be expected to result in offsite impacts that would be much less than the ERPG 1 level of 25 ppm.

Model Selection for Ammonia Accidental Releases—The Areal Locations of Hazardous Atmospheres (ALOHA) model was selected for this analysis (EPA, 2007). This model was developed jointly by EPA and NOAA for use by people responding to chemical releases and for emergency planning and training. ALOHA is designed to simulate toxic gas dispersions, fires, and explosions. The relevant information concerning the physical properties and toxicity of the chemical are contained in the model. In addition to the dispersion of toxic gas, the model can simulate the effects of fires (i.e., heat exposure), and the blast force from a vapor cloud explosion.

Ammonia Accidental Release Scenarios—Three release scenarios were assessed:

- A catastrophic release where the entire contents of the tank were released in a relatively short time frame (e.g., less than 1 hour).
- A more likely release where a break in piping resulted in a much smaller release.
- A truck accident where the entire contents were released nearly instantaneously.

The simulated catastrophic release would involve a rupture of a storage tank and the release of the entire contents. The ammonia in the tank would be stored as a liquid under pressure at approximately 300 psia and at ambient temperature. A breach in the tank would result in a two-phase jet release, (i.e., ammonia gaseous and liquid aerosol). A 12.6-square-inch breach in the tank would result in the entire contents being emptied in 38 minutes at a rate of approximately 19,600 pounds per minute (lb/min). Since the exact location of the storage tank on the IGCC plant site has not yet been determined, a location in the vicinity of the main CT/HRSG stacks was assumed.

The tank puncture would result in a much lower rate of release (1,230 lb/min). It was assumed that this type of release could be stopped within several hours.

A typical tanker truck would be expected to carry up to 18 tons of ammonia (approximately 7,200 gallons). The truck release could occur anywhere from the plant site to its final destination. Since routes and destinations are unknown at this time, no attempt was made to estimate the population that could potentially be exposed to such an event. The release of the contents of the truck was assumed to occur within 5 minutes.

Ammonia Accidental Release Model Results—The three release scenarios were input to the ALOHA model, and the maximum distance at which ambient concentrations would exceed the short-term health based levels (i.e., ERPGs) were computed. The ammonia storage tank was assumed to be located at a point near the planned location of the CTs. The LandView[R] 6 population estimation program was used to determine the population within the area defined by a circle with the radius equal to the distance to the toxic endpoint. The estimation of affected population was only performed for the storage tank scenarios, since the possible routes taken by the tanker trucks are not known at this time. The maximum distances to each of these endpoints for the accidental release scenarios and the maximum residential population that could be affected are as shown in Table 4.2-52.

Table 4.2-52. Results for Ammonia Accidental Release Scenarios

Release Scenario	Toxic Endpoint (ppm)	Distance to Toxic Endpoint (miles)	Population Within Radius of Distance
Tank rupture	750 (ERPG 3)	1.7	35
	150 (ERPG 2)	5.0	1,007
	25 (ERPG 1)	>6.0	1,703
Tank puncture	750 (ERPG 3)	0.45	0
	150 (ERPG 2)	1.2	31
	25 (ERPG 1)	>6.0	1,703
Tank truck release	750 (ERPG 3)	1.2	NA
	150 (ERPG 2)	2.8	NA
	25 (ERPG 1)	>6.0	NA

Source: ECT, 2009.

As can be seen in this table, the maximum distance that concentrations would exceed the ERPG 1 was predicted to be more than 6 miles for all scenarios. Also, the distance to the ERPG 1 and 2 levels was predicted to exceed 1 mile for those scenarios. The tank rupture was shown to possibly affect the greatest population. However, the population that could actually be affected, even for these worst-case release scenarios, would likely be less than shown, since the plume from an accidental release would only affect a small downwind sector.

Surface Lignite Mine

For the coal mining industry (which includes both underground and surface mining) the incidence of nonfatal injuries and illnesses averaged 335.6 per 10,000 full-time workers over the 5-year period from 2003 through 2007 (U.S. Department of Labor, 2009). The data show that injuries occur at a higher rate in the mining industry than in all United States' industries on average, but the trend over the 5 years of data for construction was downward. The number of fatal injuries in the United States' mining industry during the same 5-year period averaged 30 per year. As reported elsewhere by BLS (Department of Labor, 1999) for the period 1995 through 1999, the mining industry had an average fatality rate of 24.5 per 100,000 full-time workers.

A maximum of approximately 213 employees would operate the proposed Liberty Fuels Mine. Applying the industry incidence rates, an average of approximately seven injuries per year might be anticipated. No fatalities would be expected.

The Federal Mining Safety and Health Act (MSHA) regulates surface miner training under 30 CFR 48, Subpart B and §77.107. The regulations require that all new miners receive a minimum of 8 hours of training, including an introduction to the mining environment, hazard recognition, and task-specific health and safety issues, prior to assignment to work duties. All new miners must complete a minimum of 24 hours of new miner training before working without the supervision of an experienced miner. MSHA regulations also require all experienced miners to complete an annual refresher course that meets the standards outlined in 30 CFR 48.28.

The NACC Red Hills Mine operation in Ackerman, Mississippi, has worked more than 2 million man-hours since initiating commercial coal production activities in 2000. No fatal injuries have occurred at the Red Hills Mine, and the nonfatal injury incidence rates at Red Hills have been consistently below the national average (MSHA, 2008). MSHA has inspected the Red Hills Mine facility on 24 occasions. The U.S. Department of Labor has recognized the Red Hills Mine with three Sentinels of Safety Awards since 1999.

Linear Facilities

General Considerations of Operation

BLS statistics for the electric power transmission, control, and distribution category report the incidence of nonfatal injuries and illnesses averaged 143.5 per 10,000 full-time workers over the 5-year period from 2003 through 2007. The data show that injuries occur at a slightly higher rate than in all United States' industries on average. The number of fatal injuries in the United States' electric power transmission industry during the same 5-year period averaged 19.4 per year. No information on additional project-related employment associated with operations of the electric transmission lines and pipelines with which to estimate injuries is available.

A number of mandated protections would be built into the natural gas and CO_2 pipelines to make them safe to operate and to assure that people and properties would be protected throughout the life of the pipelines. The manner and method of pipeline design, construction, and operation are regulated by DOT in 49 CFR 192 (natural gas) and 195 (CO_2). These regulations address designing and constructing the pipeline to meet or exceed the government safety requirements, including using equipment and material that meet or exceed industry practices, coating the steel pipe with special protective compounds to minimize rust or corrosion, and conducting X-ray inspections of every weld joining each section of pipe. The regulations also address burying pipelines to a minimum ground cover, using low-voltage electricity on all surfaces to further protect against corrosion (cathodic protection), testing the pipe using water, and inspecting each stage of construction by qualified inspectors. After completion and being placed in service, the pipelines would be monitored and maintained on a regular basis to maintain their integrity. Leak surveys would also be conducted periodically.

Electromagnetic Fields (EMF)

As discussed in Subsection 3.20.3, there are many sources of power-level frequency EMF, including internal household and building wiring, electrical appliances, and electric power transmission and distribution lines. And there have been numerous scientific studies about the potential health effects of EMF. Yet after many years of research, the scientific community has not established that exposures to EMF cause any health hazards. Accordingly, state and federal public health regulatory agencies have not identified a direct link between exposure to EMF and human health effects and have determined that setting health-based numeric exposure limits is not appropriate.

The public could potentially be exposed to EMF effects as a result of the installation and operation of the new and upgraded electrical transmission lines. Most of the new and upgraded lines would be in rural areas and removed from the most populated areas. Mississippi does not have EMF rules (few states do).

The addition of new 230-kV transmission lines and the reconductoring of existing transmission lines would potentially increase EMF exposure within and near the rights-of-way. These field strengths would vary depending on conductor design, load conditions, and other factors, but would be similar to those of existing transmission lines of comparable size within the Mississippi Power transmission grid and of other utilities around the country. Based on the current scientific understanding of potential health effects of EMF, little or no EMF-related impacts would be expected from the addition/modification of transmission facilities.

Hazards Associated with Accidental Releases of CO_2

CO_2 would be captured from the gasification process and transported offsite for beneficial use. The gas would be compressed and dehydrated before being introduced into the pipeline. The pipeline would connect to an existing CO_2 pipeline system, which would continue to transport the gas to locations where it could be injected into deep geologic formations to aid in oil recovery (CO_2 EOR). This assessment only addresses the length of new pipeline that would be constructed to support the Kemper County IGCC Project, i.e., leaks related to the injection process at the wellhead and postsequestration leaks are not evaluated. Although not considered particularly toxic, in high concentrations, CO_2 can have adverse health effects. The CO_2 produced by the IGCC plant would also contain trace amounts of H_2S (at concentrations of less than 10 ppm). Since the concentration of H_2S in the pipeline, and in the ambient air following a release, would be at or below levels believed to result in adverse human health effects, the potential impacts of the H_2S in the accidental release are not assessed further.

COS would also be present in the pipeline gas at a concentration of 4.7 ppmv or less. Since this concentration would already be below the EPA acute exposure guideline level (AEGL), or any DOE protection action criteria (PAC) levels, for this substance, no adverse impacts would be expected from an accidental release from the pipeline. CO would also be present in the pipeline gas (0.08 to 0.16 percent). Air concentrations of CO could exceed the lowest PAC (i.e., PAC-1 equal to 83 ppm) in the event of a catastrophic pipeline rupture. However, the distance to this endpoint (i.e., less than 25 ft) would be much less than the distance to the toxic endpoint for CO_2. Therefore, releases of CO were not assessed.

The primary risk to the general population from the CO_2 would be a break in the pipeline. Therefore, the compression and dehydration of the gas onsite were not assessed. The new CO_2 pipeline would be 61 miles in length. As can be seen in Figure 2.2-1, the pipeline would proceed south from the plant site to the west side of the city of Meridian and then south-southwest to the west and southwest of the city of Heidelberg before connecting with the existing pipeline. After crossing I-20 west of Meridian, the pipeline would generally run parallel to and west of I-59 before it crossed I-59 northwest of Heidelberg. Generally, the route is sparsely populated with an absence of schools and hospitals in the near vicinity.

The pipeline would have an inside diameter of approximately 12 or 14 inches, corresponding to capture of 50 percent or 65 percent of the CO_2, respectively. The maximum distance between safety valves would be 20 miles. At water crossings, a safety valve would be located on each side or the stream or water body. The pipeline would be buried, which would provide insulation and safety from most types of accidents. The maximum amount of CO_2 that could be released, based on a break in a 20-mile section of pipe, would range from approximately 1,900 to 2,600 metric tons.

The CO_2 in the pipeline would be at 98-percent concentration and maintained at a pressure of 2,100 psi and 95°F (35°C). At this temperature and pressure, the gas would be in a supercritical fluid state and have characteristics of a substance between a gas and a liquid with of density of approximately 800 kilograms per cubic meter (kg/m^3).

Acute Toxicity Levels—For assessing accidental releases of CO_2, DOE's PAC levels (i.e., PAC-1 and 2 equal to 30,000 ppm and the PAC-3 level equal to 40,000 ppm) were used. These PAC levels have the following definitions:

- PAC-1 is the maximum concentration in air below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing more than mild transient adverse health effects or perceiving a clearly defined objectionable odor.
- PAC-2 is the maximum concentration in air below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.
- PAC-3 is the maximum concentration in air below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

As recommended, the PAC levels were evaluated as peak 15-minute time-weighted average concentrations. The PAC levels for CO_2 are similar to the National Institute for Occupational Safety and Health (NIOSH) immediately dangerous to life or health (IDLH) value of 40,000 ppm over a 30-minute period, and the short-term reference exposure level of 30,000 ppm for a 15-minute exposure to CO_2. The IDLH is the airborne concentration from which a worker could escape without irreversible health effects. The short-term exposure limit (STEL) is a 15-minute exposure that should not be exceeded at any time during a workday.

The following NIOSH-based exposure limits were considered for H_2S: the 30-minute IDLH of 100 ppm, the 15-minute STEL of 15 ppm, and the 10-minute ceiling of 10 ppm. The ceiling value should not be exceeded at anytime. Although the PAC levels are lower (i.e., PAC-1 is 0.51 ppm, PAC-2 is 27 ppm, and PAC-3 is 50 ppm), only PAC-1 is significantly lower than the initial levels of H_2S in the pipeline. Since it was determined that levels in the ambient air would be much less than the PAC-1 level (i.e., less than 1 millionth of the PAC-1 level after 15 minutes) immediately following a catastrophic release, no further evaluation is necessary.

Model Selection for CO_2 Accidental Releases—The SLAB model was selected to simulate accidental releases from the CO_2 pipeline (Ermak, 1990). SLAB was designed to simulate denser-than-air gas releases, which include the jet releases that would be associated with a pipeline accident. SLAB simulates the gravity spread and dispersion of a heavy gas cloud. Information on the source chemicals, release parameters, assumed meteorological conditions, site characteristics, and desired concentration averaging times are input to the model. The output consists of concentrations at various downwind distances, and various heights and distances from the plume centerline giving a three-dimensional view of the plume. SLAB is generally accepted as a state-of-the-art model for simulating heavy gas releases.

CO_2 Pipeline Release Scenarios—At the pipeline temperature and pressure, CO_2 would exist in a supercritical fluid state. With a rupture or break, the gas would be released at a high velocity in a choked flow condition. In a choked flow release, the speed of the gas is determined by the speed of sound for the gas at the initial pressure and temperature conditions. As a worst-case, the volume of gas released is determined by the density of the gas in the pipeline and the volume of pipeline between safety valves. For this simulation, the maximum volume based on 20 miles between safety valves and an inside pipe diameters of 12 and 14 inches were assumed. The time of release was estimated based on the initial velocity of the released gas, even though the speed of release would decrease as the gas was depleted from the pipeline. As the gas was released to the atmosphere, it would rapidly expand, and the temperature of the gas would decrease. This decrease in temperature would cause some of the CO_2 to solidify and deposit as dry ice snow. This material would slowly evaporate, and would not significantly add to the concentration in the gas cloud. It has been estimated that 26 percent of the volume of gas released would be in the solid phase (DOE, 2007b). Therefore, the volume released was adjusted in this scenario to account for this phenomenon.

The accidental releases that were assessed were a complete pipe rupture and a pipe puncture resulting in a 3-square-inch hole. The amount of material released was determined by the volume of the pipeline between safety valves and the density of the CO_2. The CO_2 in a 20-mile section of pipeline would take 10.8 minutes to be released if the pipe were ruptured near a safety valve. For the pipe puncture scenario, it would take the gas 407 minutes to be released. These release times are intended for worst-case scenarios and do not account for the reduction in pressure and release rate as the gas was depleted from the pipeline. Also, to simulate a worst-case release, a horizontal jet release was assumed, along with meteorological conditions that would result in the least dispersion (i.e., low wind speed and stable conditions). Flat terrain was assumed, and the potential for possible accumulation of CO_2 in low areas along the pipeline route was not assessed.

Table 4.2-53. Results for CO_2 Pipeline Accidental Release Scenarios

Release Scenario	Toxic Endpoint* (ppm)	Distance to Toxic Endpoint (miles)	Population Within Radius of Distance
12-Inch pipeline rupture	30,000	0.62	146
	40,000	0.25	146
12-Inch pipeline puncture	30,000	0.065	0
	40,000	0.05	0
14-Inch pipeline rupture	30,000	0.63	150
	40,000	0.73	192

*30,000 ppm is PAC-1 and PAC-2 level; 40,000 ppm is PAC-3 level.

Source: ECT, 2009.

CO_2 Accidental Release Model Results—The SLAB model was run for the two release scenarios, and the maximum distances at which ambient concentrations would exceed the short-term limits (i.e., PAC levels) were estimated. The point along the pipeline where the maximum population density was believed to occur was selected for assessing potential population exposure. This point was located where the pipeline would cross MS 19 west of the city of Meridian. The LandView[R] 6 population estimation program was used to determine the population within the area defined by a circle with the radius equal to the distance to the toxic endpoint (U. S. Census Bureau, 2003). The maximum distances to each of these endpoints for the accidental release scenarios and the maximum residential population that could be affected are shown in Table 4.2-53.

As Table 4.2-53 shows, the maximum distance that levels would exceed a toxic endpoint was relatively short, even for the worst-case pipeline rupture scenario. The population affected would likely be less than shown, since the plume from an accidental release would only affect a small area (i.e., small wind sector). In addition, the predominate wind directions are north and south for this region of Mississippi, so it is probable that the plume from an accidental release would not be transported toward the population centers along the route of the pipeline.

4.2.19.3 Intentional Destructive Acts

Although concerns have been raised about the vulnerability of nuclear power plants to terrorist attack, the potential for such attacks on coal-based power plants has not been identified as a threat of comparable magnitude. However, as with any United States energy infrastructure, the proposed power plant could potentially be the target of terrorist attacks or sabotage. In light of two recent decisions by the U.S. Ninth District Court of Appeals (San Luis Obispo Mothers v. NRC, Ninth District Court of Appeals, June 2, 2006; Tri Valley Cares v. DOE, No. 04-17232, DC No. CV-03-03926-SBA, October 16, 2006), DOE has examined the potential environmental impacts from acts of terrorism or sabotage against the facilities proposed for the Kemper County IGCC Project.

Although risks of sabotage or terrorism cannot be quantified, because the probability of an attack is not known, the potential environmental effects of an attack can be estimated. Such effects may include localized impacts from releases of toxic substances at the proposed power plant and associated facilities, which may be similar to what would occur under an accident or natural disaster. Hazardous events considered for the proposed power plant caused by intentional destructive acts included gas releases and exposure to toxic gas clouds. A particular concern associated with the release of a gas is exposure to a toxic component within the dispersing gas cloud. The potential impacts of sabotage or terrorism would be expected to be similar to the impacts of releases of ammonia and/or CO_2 as described in Subsection 4.19.2.

4.3 IMPACTS OF NO ACTION

Under the no-action alternative, DOE would not provide continued funding under the cooperative agreement or provide a loan guarantee for the project. In the absence of DOE funding, Mississippi Power could reasonably pursue two options. First, the gasifiers, syngas cleanup systems, and CT/HRSGs and supporting infrastructure could be built as proposed without DOE funding; therefore, this option would be essentially the same as the proposed action. The connected actions would remain unchanged. The environmental and other impacts of the project would occur as described in this chapter.

Second, Mississippi Power could choose not to pursue the IGCC project. None of the connected actions would likely be built. This option would not contribute to the goal of the CCPI program, which is to accelerate commercial deployment of advanced coal technologies that provide the United States with clean, reliable, and affordable energy. Similarly, the no-action alternative would not contribute to the federal loan guarantee program goals to make loan guarantees for energy projects that "avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases" and "employ new or significantly improved technologies."

Following the second no-action option, none of the environmental and other impacts—positive as well as negative—caused by the project would occur. The existing environmental and socioeconomic conditions described in Chapter 3 would remain.

Air pollutants resulting from power plant and mine operations would not be emitted under the no-action alternative, and the resulting impacts that have been estimated would be avoided. CO_2 that would be captured and used for EOR would not be available for that use. Noise from operations and resulting impacts on the surrounding area would not occur.

Reclaimed effluent from Meridian's wastewater treatment facilities would not be required. The opportunity for benefits arising from recycling the reclaimed effluent (e.g., improvements to water quality downstream of the WWTPs) would be missed.

Under the second option to the no-action alternative, wildlife and their habitats would likely remain as they have for decades in this rural area of Mississippi. Logging and agricultural conversion represent the current impacts to wildlife. Hunting through various leases would continue. Therefore, additional impacts could occur only if the properties were used for some other development, which could result in greater impacts than the current proposed project. However, such development plans are unknown at this time.

Under the no-action alternative, listed wildlife species and their habitats would likely continue as they currently exist. The linear facility corridors would not be cleared as described herein. However, other disturbances such as logging, agricultural conversion, or other developments could occur on these properties and might have impacts similar to or greater than the proposed project. Wetlands that would be impacted by power plant, mine, and linear facility construction would not be impacted under the no-action alternative.

In the absence of the proposed action, the local area would not experience the various predicted land use alterations (conversion of the power plant site from rural to industrial use, conversion of mine blocks during active mining and reclamation, use of largely rural corridors for transmission lines and pipelines). The no-action alternative would avoid the impacts to local roads that would result from power plant and mine construction worker traffic.

Under the no-action alternative, the significant, positive economic impacts to the local area and east-Mississippi area would not be felt. Construction jobs and opportunities for permanent employment at the power plant and mine would be lost, as would all of the positive secondary economic benefits. These jobs would add to the limited industrial base of Kemper County where many residents travel out of the county for employment. These jobs would also be relatively high-paying. The increase to the existing ad valorem tax base and other tax benefits of the plant and mine would not accrue to the county for upgrading public infrastructure.

Without the proposed action, important archaeological resources that might be recovered would be left in place where their fate would be uncertain.

In all, under the second option to the no-action alternative, where the proposed action would not be constructed, both negative and positive environmental and socioeconomic impacts would not occur.

4.4 COMPARATIVE IMPACTS OF PROJECT DEVELOPMENT ALTERNATIVES UNDER CONSIDERATION

Subsection 2.7.2 identified three alternatives for project development under consideration. These addressed water supply, linear facility routing, and levels of CO_2 capture. The comparative impacts of these alternatives are discussed here.

4.4.1 ALTERNATIVE SOURCES OF WATER SUPPLY

Mississippi Power plans to obtain water for plant uses primarily from two city of Meridian POTWs. Up to 1 MGD of ground water withdrawn from deep onsite wells might also be used on an as-needed basis. Potential impacts resulting from this plan were presented in Subsection 4.2.5.2.

As an alternative, the use of ground water to fully supply the water requirements for the generation facility was also considered. In this case, the well field would consist of several wells capable of withdrawing 6.5 MGD of ground water from the Massive Sand aquifer of the Tuscaloosa Group (instead of the 1-MGD withdrawal proposed for the backup well field). Ground water flow modeling using MODFLOW, as described in Subsection 4.2.5.2, was again used to evaluate the potential impacts associated with the greater, 6.5-MGD withdrawal.

ECT used the original Strom Model (Strom, 1998) MODFLOW files as the basis for an expanded model. In the case of the alternative analyses, the expanded model described in Subsection 4.2.5.2 was modified to include the withdrawal of 6.5 MGD divided equally between two ground water supply wells (instead of 1 MGD from one well). The resulting model was then used to simulate the drawdown impact associated with a constant ground water withdrawal of 6.5 MGD over the projected 40-year life of the facility on all area aquifers (see Section 3.7). Appendix O provides a more detailed description of the expanded model. As described therein, the model boundary conditions and other factors tended to result in overestimated drawdowns. Actual drawdowns would probably be somewhat less than those described here, which adds conservatism to this analysis of potential impacts.

Figure 4.4-1 depicts the potentiometric surface drawdown predicted in the Massive Sand aquifer (layer 5) after 40 years of constant pumping at the 6.5-MGD rate. The resulting estimated drawdowns are widespread and of a relatively high magnitude. Estimated drawdowns in the Massive Sand aquifer were predicted to range from 28 to 70 ft in Kemper County. The 6.5-MGD model predicted approximately 40 ft of drawdown at the nearest existing user of the Massive Sand aquifer, which is the town of De Kalb located approximately 9.5 miles northeast of the proposed power plant site. In addition, the 6.5-MGD simulation estimated 31 ft or less of drawdown at the wells located in the towns of Electric Mills and Scooba, located approximately 21 to 22 miles east-northeast of the power plant site. These estimated drawdowns would have the potential to cause adverse impacts to those existing users of the water from the Massive Sand aquifer (layer 5). Such impacts could likely be mitigated by retrofitting and/or upgrading the well pump assembly at impacted wells.

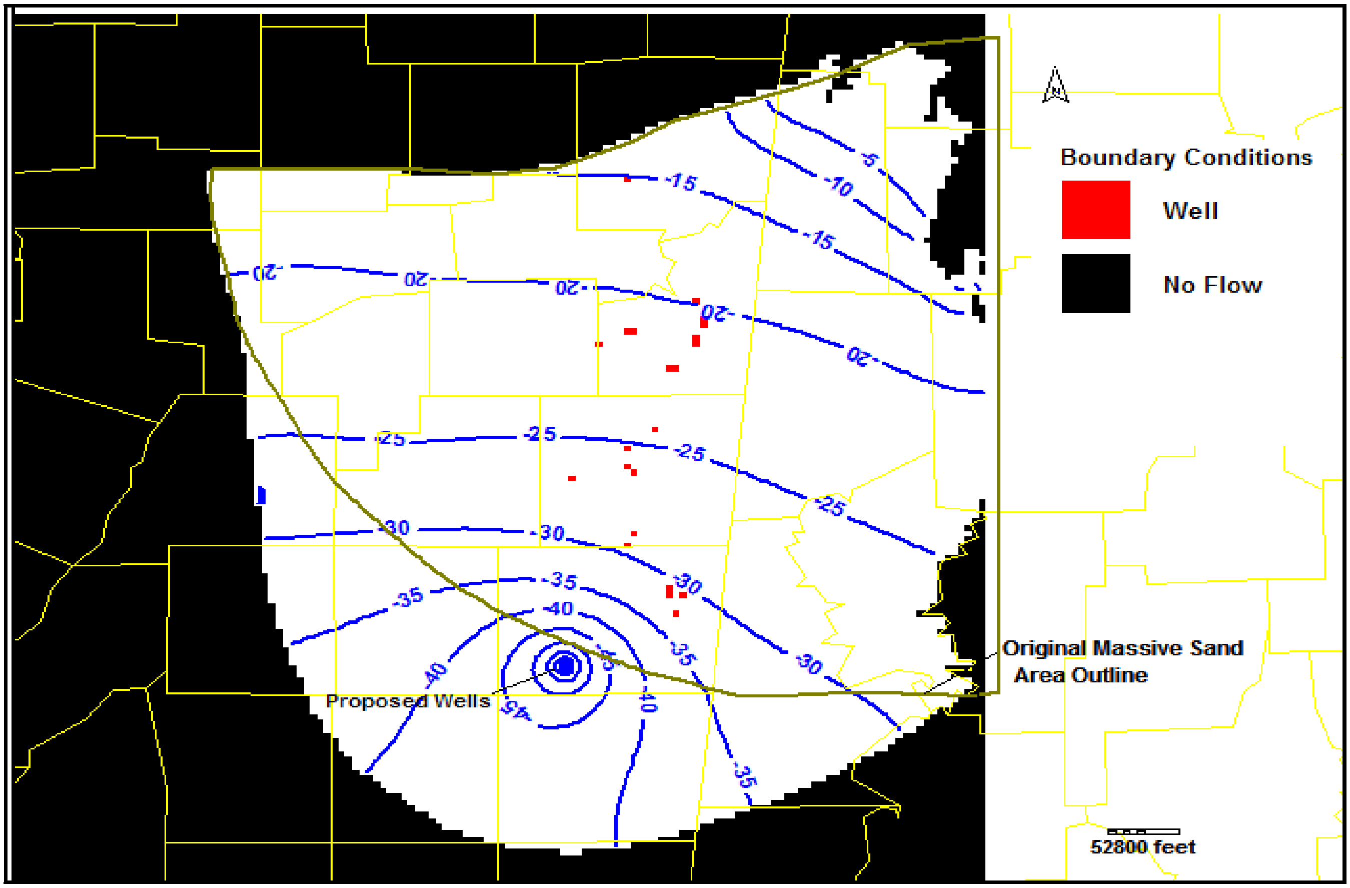

Figure 4.4-1. Predicted Drawdown in the Massive Sand (Layer 5) at the End of 40 Years of Pumping Based on 6.5-MGD Total Withdrawal from the Massive Sand

Sources: Strom, USGS, 1998. ECT, 2009 Strom_transexp_V5a2.gvw.

The 6.5-MGD model also estimated widespread and moderate to low amounts of drawdown in the underlying and overlying aquifers. The 6.5-MGD model estimated approximately 20 to 23 ft of drawdown in the underlying Lower Cretaceous aquifer (layer 6); however, currently there are no water wells screened in that aquifer in this region, according to the MDEQ database. Approximately 18 to 20 ft of drawdown was estimated in the overlying Coker aquifer (layer 4) throughout Kemper County. Currently, there are no water wells screened in the Coker aquifer within at least 20 miles of the power plant site, according to the MDEQ database; the closest well appears to exist approximately 30 miles to the north in Noxubbe County. The model estimated approximately 16 ft of drawdown at that Coker aquifer well location. Maximum drawdown estimates in the shallower Gordo aquifer (layer 3) were 11 ft or less, maximum drawdown estimates in the Eutaw-McShan aquifer (layer 2) were 10 ft or less, and maximum drawdown estimates in the Coffee Sand aquifer (layer 1) were 5 ft or less.

Based on these modeling results, the withdrawal of 6.5 MGD of ground water from the Massive Sand aquifer would have some potential to cause minor adverse impact to existing users of ground water from the Coker aquifer, and possibly the Gordo aquifer. No significant impacts would be expected relative to existing uses of ground water from the Eutaw-McShan aquifer or the Coffee Sand aquifer. Actual impacts to a water user's well are relative not only to the amount of drawdown experienced but also to the specific circumstances of a given well (e.g., well depth, pump setting, etc.). It is quite possible that a given amount of drawdown could cause adverse impacts at a given well via diminution of supply, whereas at other wells constructed differently that same given amount of drawdown might have insignificant effects.

As noted previously, the shallower Lower Wilcox aquifer is not included in the Strom Model or the expanded model used for this EIS. The base of the Lower Wilcox aquifer is separated from the top of the Eutaw-McShan (layer 2) aquifer by more than 1,400 ft of sediments that form an effective confining unit (see Table 3.7-8). No measurable drawdown would be expected to occur in the Lower Wilcox aquifer from a proposed withdrawal of 6.5 MGD of ground water from the Massive Sand aquifer (layer 5).

Accordingly, there is no significant potential for any impact to the even shallower surface features (e.g., wetlands, streams, etc.) from the proposed withdrawal of 6.5 MGD of ground water from the Massive Sand aquifer. Similarly, that withdrawal would not be expected to have a significant influence on land surface subsidence.

Consideration was also given to the potential effects of the proposed withdrawal of 6.5 MGD on ground water quality. The Massive Sand aquifer at the site is known to be saline, as described in Subsection 3.7.2.2 (e.g., the TDS concentration is 23,000 mg/L); as such, the site is situated on the saltwater side of the freshwater-saltwater interface, as defined by 10,000 mg/L TDS. The magnitude of the estimated drawdowns suggests a potential for inducing some amount of saltwater migration into freshwater potions of the underlying and overlying aquifers. Further analysis of the potential ground water flow gradients induced by the withdrawal might be necessary if this alternative were pursued. However, based on modeling performed for the Red Hills FEIS (TVA, 1998) under similar circumstances of pumping, position relative to the freshwater-saltwater interface, and hydrogeologic conditions (compare Tables 3.7-1 and 3.7-8), it is likely that such migration would be limited to a maximum of a few hundred feet in the underlying and overlying aquifers. Such migration would probably be insignificant.

In the Massive Sand aquifer, extrapolation of the Red Hills FEIS modeling results suggests that the position of the freshwater-saltwater interface might migrate approximately 1,000 to 2,000 ft toward the southwest in the region of the power plant site. This would slightly expand the freshwater portion of the Massive Sand aquifer locally and would not likely cause adverse impacts.

In conclusion, the alternative of using 6.5 MGD of ground water from the Massive Sand aquifer could adversely impact some users of water from that same aquifer, yet such impacts could be mitigated. In addition, the position of the freshwater-saltwater interface in some aquifers could be induced to migrate slightly, but probably not to such an extent as to constitute a significant adverse impact on the aquifer. The alternative of using 6.5 MGD of ground water from the Massive Sand aquifer might have some undesirable effects but would probably be feasible.

In addition to the potential impacts on ground water resources resulting from the alternative water supply plan, impacts to terrestrial ecological and other resources might also result. The use of the saline ground water in the IGCC facility's two cooling towers would concentrate the dissolved salts to an even higher level, approximately 85,000 ppm, in the circulating water. A small amount of this highly saline water would be introduced into the surroundings as drift from the cooling towers (i.e., escaping water droplets).

The amount of salt potentially deposited in the surrounding area was assessed on this basis, and the study is included in Appendix N. These results were compared with information on the responses of sensitive vegetation to salt deposition. Literature indicates that salt deposition in the range of 4.5 to 9 gram per square meter per year ($g/m^2/yr$) could be an issue for sensitive species. This range translates to approximately 40 to 80 lb/ac per year. So, deposition averaging between 3.3 and 6.7 lb/ac per month could damage sensitive plants. Davis (1979), for example, gives salt thresholds for dogwood of 517 kilograms per square kilometer per month (kg/km^2/month) and 6.2 g/m^2/yr. These equate to 4.6 lb/ac per month and 55.3 lb/ac per year. White ash is another species with a low tolerance for salt. Tobacco and corn are reportedly as sensitive as dogwood to salt deposition. The modeling results presented in the appended report would seem to indicate that the potential for damage to sensitive species would exist, at least on the power plant site, itself. The model also indicated deposition in that range in some limited, nearby, offsite areas.

4.4.2 ALTERNATIVE LINEAR FACILITY ROUTES

Subsection 2.7.2.2 described the methodology Mississippi Power used to select routes for the proposed pipelines and new electrical transmission lines. Mississippi Power might revise or amend the precise final route for one or more of its linear facilities, although the analysis of impacts provided herein should cover any impacts resulting from modest revisions to those routes. It is not expected that any such route changes would result in any material differences in the analysis of impacts discussed in this document.

4.4.3 ALTERNATIVE LEVELS OF CO_2 CAPTURE

As discussed in Subsection 2.7.2.3, Mississippi Power has considered a range of alternative levels of CO_2 capture. Comparative impacts for two alternative levels of CO_2 capture—50 percent and 67 percent (natural gas equivalence)—are described in this subsection.

As shown in Table 2.5-1 and described in Subsection 2.7.2.3, there would be some increase in lignite coal consumption associated with the higher capture rate due to the increased parasitic load (i.e., more coal would be needed to achieve the same net output). The greater fuel consumption would result in correspondingly higher emission rates, also indicated in Table 2.5-1. And, corresponding to the differences in emissions, there would be differences in air quality impacts for these two levels of CO_2 capture. While the emission rates for criteria pollutants would not change appreciably for the two levels of CO_2 capture considered, the dispersion of the plume would be slightly different and result in modest differences in predicted ground-level concentrations. The air quality impacts were described previously in Subsections 4.2.1 (criteria pollutants) and 4.2.19 (HAPs). The differences vary by pollutant species and averaging times for the two CO_2 alternative capture levels. However, for each pollutant and averaging time, the higher impacts of the two capture cases were presented. See Appendix R for detailed results of the HAPs impacts assessments for the two cases.

In addition to differences in air quality impacts, the differences in CO_2 capture would result in differences in risks associated with transport via pipeline. As presented in Subsection 4.2.19, somewhat greater pipeline-related risks would attach to the higher capture rate, because the flow rate of CO_2 in the pipeline would be higher for the higher capture level.

Finally, the two capture cases would have small variations in outputs of byproducts. The higher rate of fuel consumption associated with the higher rate of CO_2 capture would result in slightly greater generation of ammonia, ash, and sulfuric acid.

Overall, the differences in operating characteristics and impacts would not alter the conclusions regarding the ability to permit the facility or the levels of potential impacts.

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5. POLLUTION PREVENTION AND MITIGATION MEASURES

Pollution prevention, minimization, and mitigation measures have been incorporated by Mississippi Power and NACC as part of the conceptual designs of the proposed project facilities. For example, regulated air pollutant emissions would be reduced through the use of advanced technologies and emission controls. In addition, the IGCC power plant would be designed to capture approximately 67 percent of the CO_2 that would have otherwise been emitted. Power plant facilities would be located to avoid impacts to wetlands to the extent practicable. Similarly, the mining plan would avoid some of the most sensitive areas, and linear facility corridors were selected giving consideration to avoiding environmentally sensitive areas. Unavoidable impacts to wetlands would require compensatory mitigation. Additional measures would be incorporated at subsequent stages of design and engineering. For example, exact placements of pipeline trenches and transmission line structures would be adjusted where practicable to avoid impacts to wetlands or other sensitive areas (such as cultural resources).

The mitigation of potential adverse impacts from project activities would be achieved through implementation of BMPs and compliance with requirements contained in facility permits and other applicable federal, state, or municipal regulations and ordinances. Table 5.0-1 outlines specific pollution prevention and mitigation measures, including those required under federal, state, or local regulations and permitting requirements that would be implemented for each resource area. Permits yet to be obtained by Mississippi Power and NACC would also impose a variety of measures to prevent or minimize pollution and mitigate environmental impacts through the imposition of specific permit conditions. DOE may also consider additional mitigation as a condition of the ROD.

The proposed IGCC power plant would reduce SO_2, NO_x, mercury, and particulate emissions by removing constituents from the syngas. The removal of nearly 100 percent of the fuel-bound nitrogen from the syngas prior to combustion in the gas turbine would result in appreciably lower NO_x emissions compared to existing, conventional coal-fired power plants. The project is expected to remove more than 99 percent of the sulfur and more than 92 percent of the mercury. More than 99.9 percent of particulate emissions would be removed using high-temperature, high-pressure filtration (rigid, barrier-type filter elements).

Approximately 60 percent less CO_2 would be permitted per unit of power generated compared to typical emissions rates at existing, conventional coal-fired power plants. However, there would still be some emissions of CO_2, and these emissions would contribute to a net increase in global atmospheric concentrations of CO_2. This mitigation of CO_2 emissions would be achieved through beneficial use for EOR and geologic storage. The design would incorporate systems to capture approximately 67 percent of the CO_2, which would be delivered via pipeline for use in existing EOR operations in Mississippi. DOE has been studying the use of EOR for sequestration and believes it is “a promising technology to safely store CO_2 underground” (DOE, 2008).

Use of reclaimed municipal effluent and reuse of other water reclaimed from within the power plant and mine for cooling water makeup would greatly reduce the potential withdrawal and consumption of ground water from the Massive Sand aquifer, thereby reducing impacts on ground water resources. The proposed generation facilities would discharge no process liquid effluent from the site. Ash generated by the gasifiers would be made available for beneficial use, managed onsite, or trucked to a permitted landfill. Commercial-grade anhydrous ammonia and H_2SO_4 would be recovered as byproducts and marketed.

Avoidance and minimization of impacts on wetlands and other Waters of the United States to the extent practicable would be USACE’s focus during review of CWA Section 404 permit applications submitted in the future by Mississippi Power and NACC. If issued, USACE's permits would require impacts to wetlands to be mitigated to offset functional losses to Waters of the United States, including jurisdictional wetlands and streams. The required amounts and types of mitigation would be determined by the USACE district engineer based on practicability, degrees of impacts (e.g., temporary versus permanent), and the appropriate level of compensation given the aquatic resource functions that would be lost as a result of the permitted activity.

As stated elsewhere, the linear facility study corridor widths would allow some flexibility to avoid and minimize wetland impacts. In addition, some impacts associated with pipeline construction would be temporary, not permanent. Estimates of potential impacts to wetlands and Waters of the United States are expected to be conservative; impacts would likely be much less than the upper limits presented in Chapter 4. It would, nonetheless, be necessary to provide compensatory mitigation to offset losses of wetland functions relative to Waters of the United States, as described previously.

Table 5.0-1 lists the pollution prevention, minimization, and mitigation measures for the proposed facilities.

Table 5.0-1. Pollution Prevention and Mitigation Measures Developed for the Proposed Kemper County IGCC Project Facilities

Environmental Issue	Pollution Prevention or Mitigation Measure
Atmospheric resources and air quality	During construction, use of modern, well-maintained machinery and vehicles meeting applicable emission performance standards would minimize emissions. Use of dust abatement techniques such as wetting soils, covering storage piles, and limiting operations during windy periods on unpaved, unvegetated surfaces would reduce airborne dust and resulting impacts. The distances of most construction-related activities from the nearest property boundary and residences would mitigate most potential impacts. During operation, a number of means would be employed to prevent or reduce emissions of air pollutants, including: • Application of best available control technology (BACT), as required by PSD permit. • Partial enclosure of coal unloading, transfer and conveying equipment, plus application of water sprays, as needed, and use of baghouses. • Use of high-temperature, high-pressure filters within the gasification process to collect more than 99.9 percent of PM from the syngas. • Use of sulfur removal technology to reduce sulfur concentrations in the syngas by more than 99 percent. • Nearly 100 percent removal of the fuel-bound nitrogen from the syngas, resulting in appreciably lower NO_x emissions. • Use of a reactor containing alumina-based metal sulfide to remove more than 92 percent of mercury from the syngas. • High-efficiency drift eliminators would reduce water droplet emissions from the cooling towers. Monitoring to ensure compliance with emission limits would be carried out during operation. It is expected that the proposed facilities would be subject to any future CAIR, applicable New Source Performance Standards, and 40 CFR 75 (Acid Rain Program). Continuous monitoring and recording of SO_2, NO_x, and CO emissions would be performed. Monitoring would be subject to stringent quality assurance/quality control (QA/QC) requirements to ensure that the monitored emissions data are accurate and complete. Initial and periodic compliance testing of pollutants emitted by the proposed facilities would be conducted pursuant to MDEQ requirements. This stack testing, using EPA reference methods, would be expected to address the principal air pollutants emitted by the proposed facilities, including NO_x, CO, SO_2, VOCs, and PM_{10}. An extensive network of area gas detectors would continually sample for H_2S and other compounds. Detection would trigger actions to eliminate equipment leaks. Mississippi Power would design the IGCC facility to capture approximately 67 percent of CO_2 that would otherwise be emitted to the atmosphere. The captured CO_2 would be sent by pipeline for use in EOR.

Table 5.0-1. Pollution Prevention and Mitigation Measures Developed for the Proposed Kemper County IGCC Project Facilities (Continued, Page 2 of 5)

Environmental Issue	Pollution Prevention or Mitigation Measure
Geological and hydrogeological resources, including soils	Fuel and chemical storage areas would be enclosed to minimize the potential to impact soils in the event of spills. In the unlikely event of a fuel spill or other release, assessment and recovery of the spill or release would be conducted in accordance with MDEQ requirements. Use of reclaimed effluent and other reclaimed water for cooling water makeup would minimize the withdrawal and consumption of ground water from the Massive Sand aquifer, thereby minimizing impacts on ground water resources. Soils removed during construction would be stockpiled for reuse where possible. In the event mine dewatering operations would adversely impact local shallow ground water wells, alternative water supplies would be available. These would include the Lower Wilcox aquifer; connection to a local water supply corporation; and, possibly, tapping deeper or other sand intervals within the Middle Wilcox aquifer. Any impacts to ground water users from mining activities would be mitigated as required by the SMCRA Regulations (e.g., Water Rights and Replacement, etc.). If acidic seeps result from handling of acid-forming materials during mining, impacts would be mitigated by implementing measures such as addition of buffering agents. If topsoil substitution were determined to be the best available plant growth material, existing topsoil and subsoil in mined areas would be comingled with overburden during the overburden removal step in the lignite extraction process; it would become fill material for returning the land surface to approximate premining elevations. Within upland soils to be mined, the use of oxidized overburden (having less potential for generating acidic leachates than unoxidized overburden) would be a reasonably similar and practical substitute for the premining surface soils. The use of fertilizer, lime, and tillage; recontouring the land to optimally stabilize slopes; and revegetating the graded surfaces quickly are management procedures that would help ensure successful reclamation. Continual monitoring and lime applications to maintain soil pH levels would be an appropriate management step to further minimize impacts. In the event hydric soils were proposed to be replaced with oxidized overburden to support wetlands created as mitigation for impacts authorized by the CWA 404 Permit, adverse impacts associated with the elimination of the original soil seed bank would dissipate through natural succession processes, assuming proper hydrologic support to sustain the wetlands had been achieved by the reclamation design. Dispersal of native seeds by wind, water, and fauna would cause plant species composition to trend toward premining conditions.

Table 5.0-1. Pollution Prevention and Mitigation Measures Developed for the Proposed Kemper County IGCC Project Facilities (Continued, Page 3 of 5)

Environmental Issue	Pollution Prevention or Mitigation Measure
Surface water resources	SWPPPs would be developed and implemented for all project construction programs and facility operations. To reduce the deposition of sediments beyond the construction areas, site-specific BMPs would be selected, potentially including silt fences, hay bales, vegetative covers, and diversions, to reduce impacts to surface water. SPCC plans would be followed to minimize the opportunity for accidental spills and identify the appropriate procedures to be followed in case of an accidental spill. Cooling tower blowdown, process effluents, and runoff generated by/from proposed operations would be discharged to wastewater management and reuse systems. No process wastewater would be discharged to any surface waters. The proposed mine plan would protect the project area hydrologic balance and minimize impacts to streams to the extent practicable. Surface water management structures within mining areas, including stream diversion channels, internal runoff capture and diversion channels, and sedimentation ponds, would maintain the hydrologic balance and surface water quality within required limits. Following mining, stream mitigation of the appropriate type and magnitude would be conducted as determined by USACE and required by permit. Mitigation measures would include reconstruction incorporating gentle slopes, meanders, and drops, and slope stabilization through vegetative planting and use of rock or rip-rap (see Appendix P).
Ecological resources	Impacts to terrestrial resources would be minimized by implementing the measures described for air quality, geology and soils, and surface water resources (immediately preceding table subject entries). Reclamation of mined areas would restore terrestrial resources following completion of mining. Impacts on wildlife during mining would be temporary in a given area and would be mitigated by the ability of mobile species to move to other areas. Wildlife would return upon completing reclamation. For any listed (including rare, threatened, or endangered) species potentially impacted by construction or operation of project facilities, prevention or mitigation could incorporate a wide variety of options ranging from passive measures (such as construction timing outside of critical breeding periods), permanent protection of known habitats elsewhere that contain the resource to be affected, or more aggressive measures such as complete avoidance of impact. Potential impacts to aquatic resources would be minimized through the USACE CWA Section 404 permit evaluation process. Linear facility final design and engineering would minimize impacts through placement of rights-of-way and structure locations. Restoration of rights-of-way would limit permanent impacts following completion of construction activities. Where possible, use of existing roads for right-of-way access would minimize impacts associated with construction of new access roads.
Floodplains and wetlands	The power plant, mine, and linear facilities would all require coverage under permits issued by USACE under the CWA before impacts to wetlands could occur. USACE and EPA have adopted minimum numerical compensatory mitigation rules designed to completely offset any wetland functional losses. Mitigation for wetland impacts could potentially be accomplished through purchase of credits from an approved mitigation bank or participation in an *in-lieu* fee fund program (see Appendix P). In addition, impacts from the mine would be governed by permits issued in accordance with the federal SMCRA. The proposed mine plan would also reduce impacts through selection of mine blocks to avoid wetlands and floodplains to the extent practicable. Linear facility final design and engineering would minimize impacts through final alignments of rights-of-way and final locations of structures/pipelines.

Table 5.0-1. Pollution Prevention and Mitigation Measures Developed for the Proposed Kemper County IGCC Project Facilities (Continued, Page 4 of 5)

Environmental Issue	Pollution Prevention or Mitigation Measure
Land use and recreation	The project area is largely rural and sparsely populated. Land use incompatibility (e.g., proximity to high-density residential developments) where mitigation might be needed would not be an issue. The construction and operation of the surface mine would temporarily convert the existing, primarily silvicultural use. Original uses might be reestablished after mining and reclamation was complete; however, this would be a matter of choices of the holders of surface rights. Gasification ash would, as the preferred options, be evaluated for beneficial use at the adjacent mine or managed onsite, thereby eliminating or reducing landfill requirements. Corridors for linear facilities would minimize land use impacts by approximating the shortest distances between end points, avoiding developed areas to the extent possible, paralleling existing linear rights-of-way where possible, and co-locating two project linear facilities where possible.
Socioeconomics	As a result of the employment of construction and operational workers, there would be substantial direct and indirect benefits to Kemper County and the surrounding area as a result of the creation of additional jobs and the use of local qualified vendors. Housing impacts would be manageable through the use of per diem, which would tend to increase the sharing of living arrangements during the construction period and mitigate impacts on housing availability. There would be relatively fewer transfers to the area resulting in permanent residents compared to the total numbers of employees during construction.
Environmental justice	DOE has concluded that an environmental justice population exists, and consideration must be given to the potential for "disproportionately high and adverse" health or environmental effects, consistent with Executive Order 12898. Based on an analysis of these potential effects, DOE has determined that construction and operation of the proposed facilities would not place high and adverse impacts and burdens on an environmental justice community, while exporting all of the benefits (e.g., jobs, direct and indirect economic benefits, etc.). Construction and operation of the proposed facilities could have positive economic effects for the environmental justice population by creating employment and direct and indirect income in the area. Minority hiring practices and training programs already used by Mississippi Power and NACC would potentially enhance these positive effects.
Transportation	Construction traffic would have the greatest impact on the local road network in the vicinity of the power plant site. Peak hour trips would increase and would exceed the LOS D on roads closest to the proposed plant site. There would be no degradation of the existing LOS below LOS E. Carpooling would be encouraged to reduce the number of trips and mitigate impacts. Truck deliveries would be encouraged to avoid the a.m. and p.m. peak hours. Potential impacts to bridges and roads resulting from hauling of heavy equipment would be minimized by selection of suitable haul routes. Local authorities would be consulted about ways to prevent unnecessary traffic congestion and increased road hazards and to coordinate and implement transportation measures, especially during the movement of oversized loads, construction equipment, and materials. Where traffic disruptions would be necessary, coordination with local authorities would occur to implement detour plans, warning signs, and traffic diversion equipment to improve traffic flow and road safety. Operational traffic would be well below that experienced during construction. Only the LOS of several local roads would be degraded below LOS D and none below LOS E. Carpooling would be encouraged, and off-peak truck deliveries would also be encouraged. Impacts associated with temporary deliveries of lignite from the Red Hills Mine would be minimized by limiting hauling to daytime hours to the extent possible.

Table 5.0-1. Pollution Prevention and Mitigation Measures Developed for the Proposed Kemper County IGCC Project Facilities (Continued, Page 5 of 5)

Environmental Issue	Pollution Prevention or Mitigation Measure
Aesthetics	There are no unique landforms or visual or scenic features in the area of the proposed power plant and surface lignite mine or the associated facilities. Location of power block and IGCC equipment in the site interior would mitigate aesthetic impacts. Perimeter trees would provide screening to mitigate the potential for visual impacts. Only the taller structures associated with the power plant would be visible from the area and the area roadways. The mine activities would temporarily cover several hundred acres and would be visible from local roads. When complete, reclamation activities would likely result in a landscape similar to that existing premining. Existing roadside vegetation would screen some views of mining. Transmission lines and towers would be visible to the traveling public where roadways intersect the lines and to some local landowners, but would mostly be screened by existing vegetation in the largely rural areas proposed for the new lines.
Cultural resources	Construction of all proposed project facilities and operation of the surface mine would potentially affect some archaeological and historic resources. To the extent possible, mitigation would result from design and layout of facilities to avoid impacts. Where avoidance through design and layout would not be possible, Phase II characterization of affected resources and Phase III recovery consistent with an approved Programmatic Agreement executed by DOE, USACE, and relevant state and tribal agencies and private participants would take place.
Noise	During construction, some activities would result in noticeable noise at the closest receptors. The impacts of these temporary activities would be mitigated by properly maintaining construction equipment and limiting the noisiest of the activities (e.g., pile driving) to daylight hours. Steam blows would potentially cause noise approaching levels of annoyance (at least out-of-doors); the impacts of this necessary activity would be mitigated by the limited duration. Mississippi Power would notify affected receptors in advance of steam blowing events. Sound generated by the operation of the IGCC power plant would result in noise impacts on the closest receptors. The maximum predicted level at one nearby residence would be slightly above the EPA guideline but below the HUD residential guideline. An appropriate level of sound control (baffling, silencers) would be designed into facility equipment to limit operational noise levels. In addition, noise from several of the loudest pieces of equipment would be controlled to mitigate impacts, either through construction of barrier walls or other means to achieve similar levels of reduction.
Human health and safety	As required by law, Mississippi Power and NACC would implement project-specific health and safety-related plans, which would include appropriate training and supervision of employees and enforcement of workplace safety policies in accordance with regulatory standards. All processes and equipment would be designed and constructed for safe operation. An extensive network of area monitors would detect leaks of potentially hazardous chemicals. Mississippi Power would develop and implement a process safety management program to identify hazards associated with each applicable chemical. This program would establish emergency response measures as well as specify training protocols. Commercial-grade ammonia and H_2SO_4 generated at the proposed facilities would be handled and transported in accordance with the DOT's hazardous materials regulations. Design of the CO_2 pipeline with automatic emergency shutoff valves, burial of pipeline to minimize accidental damage, and frequent monitoring and inspections of the pipeline and related equipment are some of the safety measures that would be taken to minimize the chance of an accidental release.

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6. CUMULATIVE EFFECTS

This chapter discusses potential impacts resulting from other facilities, operations, and activities that, in combination with potential impacts from the proposed project, might contribute to cumulative impacts. Cumulative impacts are impacts on the environment that result from the incremental impact of the proposed project when added to other past, present, and reasonably foreseeable future actions, regardless of the agency (federal or non-federal) or person that undertakes such other actions (40 CFR 1508.7). An inherent part of the cumulative effects analysis is the uncertainty surrounding actions that have not yet been fully developed. CEQ regulations provide for the inclusion of uncertainties in the EIS analysis, and state that "(w)hen an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an EIS and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking" (40 CFR 1502.22). Consequently, the analysis contained in this chapter includes what could be reasonably anticipated to occur given the uncertainty created by the lack of detailed investigations to support all cause and effect linkages that may be associated with the proposed project and the indirect effects related to construction and long-term operation of the facilities.

Because cumulative impacts accumulate as to a specific resource area, the analysis of impacts must focus on particular resources or impact areas as opposed to merely aggregating all of the actions occurring in and around the proposed facilities and attempting to form some conclusions regarding the effects of the many unrelated impacts. Narrowing the scope of the analysis to resources where there is a likelihood of reasonably foreseeable cumulative impacts supports the goal of the NEPA process: "to reduce paperwork and the accumulation of extraneous background data" and "emphasize real environmental issues and alternatives" (40 CFR 1500.2[b]). The resources and impact areas that were identified with a likelihood of cumulative impacts include: (1) atmospheric resources, including CO_2 emissions contributing to global climate change; (2) surface water resources; (3) ground water resources and related withdrawal issues; (4) social and economic resources and related traffic congestion issues; (5) environmental justice issues; and (6) other issues. The lack of significant impacts to some other resources by the proposed project combined with the absence of any other known or anticipated events or effect linkages precludes the need to address other resources in this cumulative effects analysis.

Each resource analyzed has an individual spatial (geographic) boundary, although the temporal boundary (time frame) can generally be assumed to equal the 40-year life expectancy of the proposed facilities.

6.1 ATMOSPHERIC RESOURCES

6.1.1 AIR QUALITY

For air quality, the dispersion modeling analysis in Subsection 4.2.1.2 indicates that maximum predicted concentrations would be greater than the SILs for all criteria pollutants except CO. For CO the SILs could be used as thresholds for determining the potential for cumulative impacts under NEPA. For SO_2, NO_2, and PM_{10}, additional modeling, including other sources and background air quality concentrations, was performed. These detailed analyses addressed other emissions sources well beyond the predicted areas of impact for the proposed project and also added background concentrations to address other sources not otherwise accounted for. These analyses demonstrated that no air quality standards or PSD air quality increments would be exceeded (see Tables 4.2-4 and 4.2-5). The highest total impacts, including other sources and background air quality, for SO_2, NO_2, and PM_{10}, were equal to 12.5, 18.0, and 52.0 percent of their respective NAAQS, respectively. (Total impacts relative to $PM_{2.5}$ NAAQS were also estimated but were due almost entirely to ambient levels and not predicted impacts due to project facilities.) In addition, no other future projects that would constitute new major sources of air emissions are known to be in development (MDEQ, 2009e). Consequently, adverse cumulative air quality impacts from the proposed Kemper County IGCC Project facilities, existing sources, and other sources that might be constructed in the foreseeable future, would not be expected.

6.1.2 CLIMATE CHANGE

Background—A worldwide environmental issue is the likelihood of changes in the global climate as a consequence of global warming produced by increasing atmospheric concentrations of GHGs (International Panel on Climate Change [IPCC], 2007a). The atmosphere allows a large percentage of incoming solar radiation to pass through to the earth’s surface, where it is converted to heat energy (infrared radiation) that is more readily absorbed by GHGs such as CO_2 and water vapor than incoming solar radiation. The heat energy absorbed near the earth’s surface increases the temperature of air, soil, and water.

GHGs include water vapor, CO_2, methane, nitrous oxide, ozone, and several chlorofluorocarbons. The GHGs constitute a small percentage of the earth’s atmosphere. Water vapor, a natural component of the atmosphere, is the most abundant GHG. The second-most abundant GHG is CO_2, which remains in the atmosphere for long periods of time. Due to man’s activities, atmospheric CO_2 concentrations have increased approximately 35 percent over preindustrial levels. Fossil fuel burning, specifically from power production and transportation, is the primary contributor to increasing concentrations of CO_2 (IPCC, 2007a). In the United States, stationary CO_2 emission sources include energy facilities and industrial plants. Industrial processes that emit these gases include cement manufacture, limestone and dolomite calcination, soda ash manufacture and consumption, CO_2 manufacture, and aluminum production (EIA, 2009a).

In the preindustrial era (before 1750 A.D.), the concentration of CO_2 in the atmosphere appears to have been in the range of 275 to 285 ppm (IPCC, 2007a). In 1958, C.D. Keeling and others began measuring the concentration of atmospheric CO_2 at Mauna Loa in Hawaii (Keeling *et al.*, 1976). The data collected by Keeling’s team and others since then indicate that the amount of CO_2 in the atmosphere has been steadily increasing from approximately 316 ppm in 1959 to 386 ppm in 2008 (NOAA, 2009). This secular increase in atmospheric CO_2 is attributed almost entirely to the anthropogenic activities noted previously. In addition, industrial and agricultural activities release GHGs other than CO_2—notably methane, NO_x, ozone, and chlorofluorocarbons—to the atmosphere, where they can remain for long periods of time.

Kemper County IGCC Project Emissions of GHGs—The Kemper County IGCC Project, operating at an 85-percent capacity factor (i.e., at full capacity), would emit approximately 1.8 to 2.6 million tpy of CO_2 while burning lignite coal and firing natural gas in the duct burners, assuming CO_2 capture of 67 and 50 percent, respectively (see Table 2.5-1). It would also emit small amounts (approximately 91,000 tpy of CO_2 equivalents) of other GHGs (e.g., nitrous oxide from the CTs)[1].

Based on a study of life cycle GHG emissions from IGCC power systems (Reuther *et al.*, 2004), DOE estimates that plant operations support, maintenance, and lignite mining could increase annual GHG emissions at-

[1] These other GHGs would be released by combustion of syngas to generate electricity; combustion of fuels (diesel and gasoline) for transportation and coal mining activities; and the combustion of fuels to produce energy needed for operations and maintenance.

tributable to the operation of the generating station by approximately 130,000 tons (for a total of approximately 2.0 to 2.8 million tons annually). Total emissions of GHGs from construction activities would be approximately 430,000 tons of CO_2 equivalents (approximately 15 to 22 percent of 1 year's operating emissions).

GHG emissions from the coal-mining operations would primarily result from the combustion of diesel fuel in mining equipment and off-road vehicles. The mining equipment would include loaders, large dump trucks, dozers, backhoes, graders, and hydraulic shovels. Emissions were conservatively estimated based on a 7-day-per-week, 24-hour-per-day operating schedule, and a best guess as to the number of pieces of equipment and the percent of time that they would be used. For comparative purposes, the annual emissions of CO_2 from mining operations were estimated at approximately 45,000 tons. These emissions would represent less than 2 percent of the annual Kemper County IGCC Project emissions.

Annual emissions of GHGs from construction activities were estimated to be approximately 27,000 tons of CO_2 (i.e., approximately 1 percent of 1 year's operating emissions of the IGCC facility).

Operating at full capacity with beneficial use of CO_2 for EOR and geologic storage, the facility would constitute one of the larger point sources of CO_2 emissions in Mississippi. Neither federal law nor Mississippi law place limits on CO_2 emissions on sources such as the Kemper County IGCC Project, and generally there are few economic incentives or regulatory requirements for utilities to reduce emissions of GHGs from their power plants at this time. However, the federal government is considering several approaches to addressing global warming by limiting emissions of GHGs, including regulating them under the CAA.

The GHGs emitted by the Kemper County IGCC Project would add a relatively small increment to emissions of these gases in the United States and the world. Overall GHG emissions in the United States during 2007 totaled approximately 7,881.6 million tons (7,150.1 million metric tonnes) of CO_2-equivalents, including approximately 6,727.8 million tons (6,103.4 million metric tonnes) of CO_2. These emissions resulted primarily from fossil fuel combustion and industrial processes. Approximately 42 percent of CO_2 emissions came from the generation of electrical power (EPA, 2009). By way of comparison, annual operational emissions of GHGs from the proposed generating station would equal approximately 0.04 percent of the United States' total 2007 emissions.

The release of anthropogenic GHGs and their potential contribution to global warming are inherently cumulative phenomena. That is, emissions of GHGs from the proposed power plant by themselves would not have a direct impact on the global, regional, or local environment. Similarly, current scientific methods do not allow one to correlate emissions from a specific source with a particular change in either local or global climates.

Impacts of GHGs on Climate—Climate is usually defined as the average weather of a region, or more rigorously as the statistical description of a region's weather in terms of the means and variability of relevant parameters over time periods ranging from months to thousands of years. The relevant parameters include temperature, precipitation, wind, and dates of meteorological events such as first and last frosts, beginning and end of rainy seasons, and appearance and disappearance of pack ice. Because GHGs in the atmosphere absorb energy that would otherwise radiate into space, the possibility that anthropogenic releases of these gases could result in warming that might eventually alter climate was recognized soon after the data from Mauna Loa and elsewhere confirmed that the atmosphere's content of CO_2 was steadily increasing (IPCC, 2007a).

Changes in climate are difficult to detect because of the natural and complex variability in meteorological patterns over long periods of time and across broad geographical regions[2]. There is much uncertainty regarding the extent of global warming caused by anthropogenic GHGs, the climate changes this warming has or will produce, and the appropriate strategies for stabilizing the concentrations of GHGs in the atmosphere. The World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) established IPCC to provide an objective source of information about global warming and climate change, and IPCC's reports are generally considered to be an authoritative source of information on these issues.

According to the IPCC fourth assessment report, "[w]arming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level" (IPCC, 2007b). The IPCC report finds that the global average surface temperature has increased by approximately 0.74°C in the last 100 years; global average sea level has risen approximately 150 millimeters over the same period; and cold days, cold nights, and frosts over most land areas have become less frequent during the past 50 years. The report concludes that most of the temperature increase since the middle of the twentieth century "is very likely due to the observed increase in anthropogenic [GHG] concentrations."

The 2007 report estimates that, at present, CO_2 accounts for approximately 77 percent of the global warming potential attributable to anthropogenic releases of GHGs, with the vast majority (74 percent) of this CO_2 coming from the combustion of fossil fuels. Although the report considers a wide range of future scenarios regarding GHG emissions, CO_2 would continue to contribute more than 70 percent of the total warming potential under all of the scenarios. IPCC therefore believes that further warming is inevitable, but that this warming and its effects on climate could be mitigated by stabilizing the atmosphere's concentration of CO_2 through the use of: (1) "low-carbon technologies" for power production and industrial processes, (2) more efficient use of energy, and (3) management of terrestrial ecosystems to capture atmospheric CO_2 (IPCC, 2007b).

Environmental Impacts of Climate Change—IPCC and the U.S. Climate Change Science Program (CCSP) have examined the potential environmental impacts of climate change at global, national, and regional scales. The IPCC report states that, in addition to increases in global surface temperatures, the impacts of climate change on the global environment may include:

- More frequent heat waves, droughts, and fires.
- Rising sea levels and coastal flooding; melting glaciers, ice caps, and polar ice sheets.
- More severe hurricane activity and increases in frequency and intensity of severe precipitation.
- Spread of infectious diseases to new regions.
- Loss of wildlife habitats.
- Heart and respiratory ailments from higher concentrations of ground-level ozone (IPCC, 2007b).

On a national scale, average surface temperatures in the United States have increased, with the last decade being the warmest in more than a century of direct observations (CCSP, 2008). Impacts on the environment attributed to climate change that have been observed in North America include:

[2] Detection of these types of changes was also difficult because of the limited tools that were available for collecting data and for modeling climate systems. However, scientific advances over the last 20 years have vastly improved the tools available for climatological research.

- Extended periods of high fire risk and large increases in burned area.
- Increased intensity, duration, and frequency of heat waves.
- Decreased snow pack, increased winter and early spring flooding potentials, and reduced summer stream flows in the western mountains.
- Increased stress on biological communities and habitat in coastal areas (IPCC, 2007b).

On a regional scale, there is greater natural variability in climate parameters that makes it difficult to attribute particular environmental impacts to climate change (IPCC, 2007b). However, based on observational evidence, there is likely to be an increasing degree of impacts such as coral reef bleaching, loss of specific wildlife habitats, reductions in the area of certain ecosystems, and smaller yields of major cereal crops in the tropics (*ibid.*). For the northern hemisphere, regional climate change could affect physical and biological systems, agriculture, forests, and amounts of allergenic pollens (*ibid.*)[3].

In the region where the Kemper County IGCC Project would be located, the average temperature over the last century has decreased slightly at a rate of 0.5 to 1°F per century (1901 to 2006), and precipitation in some areas of Mississippi has increased at a rate of 0 to 7 percent per century (EPA, 2008). During the next century, Mississippi's climate may change even more—IPCC predicts that the largest increases in future temperatures are likely to occur in the northern latitudes (IPCC, 2007b).

Addressing Climate Change—Because climate change is a cumulative phenomenon produced by releases of GHGs from industry, agriculture, and land use changes around the world, it is generally accepted that any successful strategy to address it must rest on a global approach to controlling these emissions. In other words, imposing controls on one industry or in one country is unlikely to be an effective strategy. And because GHGs remain in the atmosphere for a long time and industrial societies will continue to use fossil fuels for at least 25 to 50 years, climate change cannot be avoided. As IPCC report states, "[s]ocieties can respond to climate change by adapting to its impacts and by reducing [GHG] emissions (mitigation), thereby reducing the rate and magnitude of change" (IPCC, 2007b).

According to the IPCC, there is a wide array of adaptation options. While adaptation will be an important aspect of reducing societies' vulnerability to the impacts of climate change over the next two to three decades, "adaptation alone is not expected to cope with all the projected effects of climate change, especially not over the long term as most impacts increase in magnitude" (IPCC, 2007). Therefore, it will also be necessary to mitigate climate change by stabilizing the concentrations of GHGs in the atmosphere. Because these gases remain in the atmosphere for long periods of time, stabilizing their atmospheric concentrations will require societies to reduce their annual emissions. The stabilization concentration of a particular GHG is determined by the date that annual emissions of the gas start to decrease, the rate of decrease, and the persistence of the gas in the atmosphere. The IPCC report predicts the magnitude of climate change impacts for a range of scenarios based on different stabilization levels of GHGs. "Responding to climate change involves an iterative risk management process that includes both mitigation and adaptation, taking into account actual and avoided climate change damages, co-benefits, sustainability, equity, and attitudes to risk" (IPCC, 2007b).

[3] The IPCC report provides more detailed information on the current and potential environmental impacts of climate change and on how climate may change in the future under various scenarios of GHG emissions.

Climate Change, GHGs, and the Kemper County IGCC Project—DOE estimates that annual emissions of GHGs from the Kemper County IGCC Project would range from approximately 2.0 to 2.8 million tpy of CO_2-equivalents. Over the 40-year commercial life of the project, total emissions would be up to approximately 80 to 112 million tons. The estimates of emissions from the Kemper County IGCC Project account for CO_2 removal that would occur as a result of the carbon capture and sequestration systems. As mentioned earlier, the plant would be designed to capture and sequester approximately 50 to 67 percent of the CO_2 created in the syngas production process. The annual emissions of GHGs from the Kemper County IGCC Project would add to the approximately 2.64 billion tons (2.40 billion metric tonnes) of energy-related CO_2 emissions released annually by the electric power sector in the United States (EPA, 2009). Coal-fired power plants account for 2.17 billion tons (1.97 billion metric tonnes) of that amount (EPA, 2009). Globally, 54 billion tons (49 billion metric tonnes) of CO_2-equivalent anthropogenic GHGs are emitted annually, with fossil fuel combustion contributing approximately 32 billion tons (29 billion metric tonnes). However, it cannot be assumed that, if the Kemper County IGCC Project were not built, these additional emissions would be avoided—other less efficient and/or more CO_2-emitting fossil fuel power plants might be constructed in its stead, or existing plants might produce more power, thereby increasing their CO_2 emissions.

As noted earlier, emissions of GHGs from the proposed power plant by themselves would not have a direct impact on the environment in the proposed plant's vicinity; neither would these emissions by themselves cause appreciable global warming that would lead to climate changes. However, these emissions would increase the atmosphere's concentration of GHGs, and, in combination with past and future emissions from all other sources, contribute incrementally to the global warming that produces the adverse effects of climate change described previously. At present there is no methodology that would allow DOE to estimate the specific impacts (if any) this increment of warming would produce in the vicinity of the plant or elsewhere.

Climate Change, Greenhouse Gases, and the CCPI— As described in more detail in Subsection 1.2, CCPI provides funding to the private sector for projects intended to demonstrate the commercial potential of advanced technologies that could improve the performance of coal-fired power plants as to energy efficiency, pollution control, and cost of operation.

Increased efficiencies can result in small but cumulatively significant reductions in CO_2 emissions from power stations because less fuel is burned in producing each kilowatt-hour of electricity. Producing power with IGCC units can facilitate carbon capture because the volume of the gas stream from which the CO_2 would be removed is much smaller; it is a precombustion stream and at a higher pressure than the exhaust gas of a pulverized coal unit.

Demonstrations of technologies that increase efficiency, facilitate carbon capture, and sequester CO_2 are important steps in developing strategies for stabilizing atmospheric concentrations of GHGs. The IPCC report states that there is high agreement that atmospheric concentrations can be stabilized by "deployment of a portfolio of technologies that are either currently available or expected to be commercialized in coming decades assuming that appropriate and effective incentives are in place for their development." It identifies carbon capture and storage for coal-fired power plants as one of the key mitigation technologies for development before 2030 (IPCC, 2007b). It notes that energy efficiency will also play a key role in stabilizing atmospheric concentrations. DOE believes that the objectives of CCPI embody these recommendations of the IPCC, and that by providing funding to the Kemper County IGCC Project and other CCPI projects, DOE is providing appropriate incentives for developing technologies that can address global warming and the adverse environmental impacts of climate change.

6.2 SURFACE WATER RESOURCES

Surface water resources could be affected by two separate actions under consideration by DOE: (1) the Kemper County IGCC Project evaluated in this EIS, and (2) construction and operation of a strategic petroleum reserve (SPR) facility downstream at Richton in Perry County, Mississippi. Figure 6.2-1 illustrates the locations of these two projects. In addition, USACE's Civil Works program actions could affect surface water resources in two ways: regulatory approvals of 404 Permit applications and reasonably foreseeable navigation, hydraulics, and habitat projects.

The areal extent of these cumulative effects would be the Pascagoula River basin, including the saltwater/freshwater interface in the estuary at the river's mouth. Current conditions in the river reflect past and present actions. The analysis that follows focuses on future reasonably foreseeable actions by DOE and USACE.

6.2.1 DOE ACTIONS

The Energy Policy Act of 2005 (EPACT) (P.L. 109-58) required DOE to expand the SPR from its current 727-million-barrel capacity to 1 billion barrels. To fulfill its NEPA requirements, DOE prepared an EIS regarding site selection. The preferred alternative that evolved from the EIS site section process was the location of a new SPR facility near Richton, Mississippi, due to the presence of a large, undeveloped salt dome, enhanced oil distribution capabilities, and an inland location less vulnerable to hurricanes.

The principal effects on water resources attributable to the SPR expansion would be: (1) the need to withdraw up to 50 MGD (i.e., approximately 77 cfs) continuously during the construction period and during petroleum withdrawals (i.e., to replace the volume of petroleum withdrawn with water to maintain the integrity of the dome); and (2) the need to discharge brine generated by dissolution of the salt to form the petroleum storage cavity, as well as when brine is pumped out of the cavity to make room for petroleum additions. The volume of brine discharge would correspond to the volume of raw water makeup.

DOE is considering locating the raw water intake immediately downstream of the confluence of the Leaf and Chickasawhay Rivers in the Pascagoula River near the USGS Merrill gauging station. The brine discharge would occur offshore in the Gulf of Mexico. The Kemper County IGCC Project site is inland and located in a different watershed than the proposed SPR brine discharge facility. Therefore, no cumulative effects would be associated with the contemplated brine discharges.

DOE is conducting two modeling efforts to predict the effects of the water withdrawals required by the SPR Richton site on the Pascagoula River: (1) a Pascagoula River Habitat Study: IFIM (available at http://fossil.energy.gov/programs/reserves/spr/expansion_reports_and_studies.html); and (2) a Pascagoula River Salt Water Wedge Study (estimated availability later in 2009). The habitat study resulted in DOE proposing the following limits to withdrawals to maintain the minimum instream flow necessary to support the federally protected species in the river. The proposed withdrawal limits would be:

- No withdrawals would occur during flows of less than 1,000 cfs.
- Withdrawals of up to 39 cfs would occur at flows of 1,000 to 1,100 cfs (3.5 to 3.9 percent of flow).

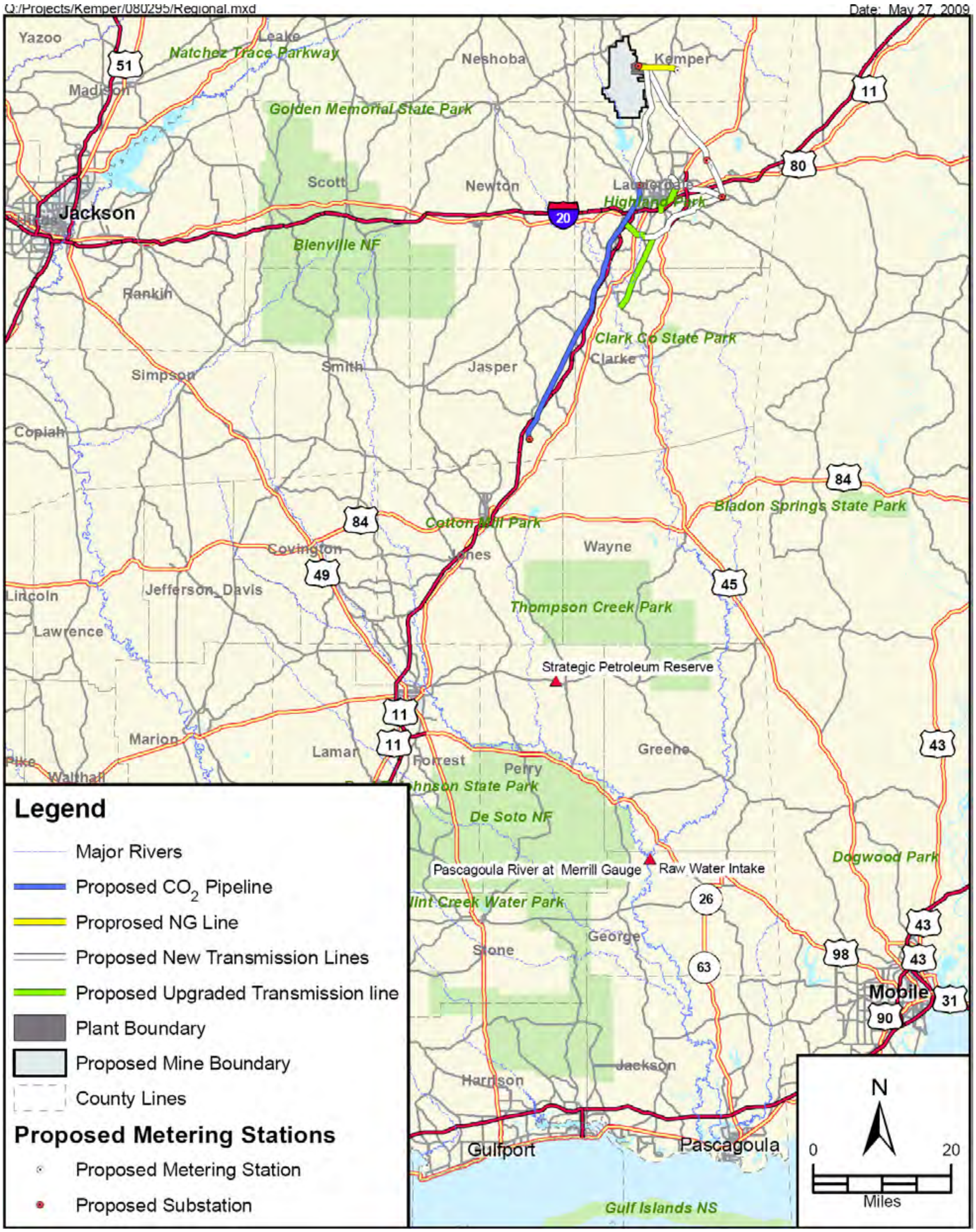

Figure 6.2-1. DOE Actions in Eastern Mississippi

Source: ECT, 2009.

- Withdrawals of up to 78 cfs would occur at flows of more than 1,100 cfs (up to 7.1 percent of flow).

Because yearly low flows predictably occur in October, DOE would also schedule system maintenance to occur at that time, thereby reducing the need to operate the diversion during annual low flows (DOE, 2009).

Across the 78-year period of record for the USGS flow gauge at Merrill, the average daily flow is 1,120 cfs. The drainage area at the Merrill gauge is 6,590 mi^2; the 31,000-acre Kemper County IGCC Project study area represents 0.74 percent of the Merrill gauge drainage area. MDEQ has set the 7Q10 flow at the Merrill gauge at 917 cfs. These flow measurements include historic releases from Okatibbee Lake according to the schedule shown in Table 6.2-1. The proposed DOE SPR withdrawal schedule does not require or request USACE to adjust the Okatibbee Lake release schedule to augment low-flow conditions to facilitate development of the SPR.

The hydrologic analyses conducted in this Kemper County IGCC Project EIS are presented in Subsection 4.2.4. Those analyses included incremental water budget analyses and modeling of responses to various storm event responses. The storm event models predicted changes in high-flow conditions, which are not at issue in the SPR evaluations. The water budget of Okatibbee Lake is as follows:

- Rainfall = 57.04 inches.
- Runoff = 17.00 inches.
- Onsite consumption = 40.04 inches.

Table 6.2-1. Okatibbee Dam Minimum Discharges

Month	Minimum Discharge (cfs)
January	10
February	10
March	10
April	50
May	50
June	70/50/30*
July	70/50/30*
August	70/50/30*
September	30
October	30
November	10
December	10

*Pulse and minimum releases subject to lake level.

Onsite consumption would consist of deep recharge, net ground water outflow, evaporation, and transpiration. Deep recharge is negligible due to the presence of dense clay beneath the mineable lignite seams. Thus, the predominant onsite consumption factors are evaporation and transpiration.

Onsite consumption during mining would decrease, as up to 3 mi^2 of mined land would consist of disturbed, unreclaimed overburden. These areas could increase the average annual flow into Okatibbee Lake by approximately 2 cfs, or 1 percent of the annual average flow across the dam. Such changes would represent less than 0.02 percent of the average flow at the Merrill gauge site.

Onsite consumption in the postreclamation condition would be controlled by the percentage of open water, wetlands, forested uplands, and grasslands in the landscape. Onsite consumption would increase if more acres of open water and wetlands exist when compared to the current condition. However, because the total disturbed areas would represent less than 0.3 percent of the Merrill gauge drainage area where the SPR withdrawals would occur, the cumulative effect of the two DOE projects would be insignificant.

In conclusion, the two DOE actions under consideration would not synergize into cumulative effects. Because SPR withdrawals would be controlled by flow volumes at the Merrill gauge, any changes to low flow volumes attributable to the Kemper County IGCC Project would influence when SPR withdrawals could occur but would not combine into cumulative flow reductions downstream beyond those caused by the SPR withdrawals.

6.2.2 USACE ACTIONS

USACE is subject to the same cumulative impact assessment standards and criteria that apply to DOE. Both USACE's (a) regulatory permit programs under Section 404 of the CWA and Section 10 of the Rivers and Harbors Act and (b) Civil Works program are subject to these requirements. Accordingly, as USACE evaluates permit applications under its regulatory programs or considers civil works projects, the cumulative effects of those proposed activities or projects are evaluated and considered prior to permit issuance or Civil Works project authorization. Under these regulations and procedures, for example, USACE would evaluate the potential cumulative effects of the proposed Kemper County IGCC Project during their review of applications submitted by Mississippi Power and NACC as one element of their decision-making concerning whether to issue the requested permits.

6.3 GEOLOGIC AND GROUND WATER RESOURCES

The direct and indirect geologic impacts of the action alternative, and the resultant construction and operation of the generation facility, surface lignite mine, and associated linear facilities, were described in Subsection 4.2.2. Adoption of the action alternative would not result in significant cumulative impacts to geological resources such as the potential for seismic activity or the future recovery of minerals in the area.

Potential impacts on ground water resources resulting from the construction and operation of the generation facility, surface lignite mine, and associated linear facilities, were described in Subsection 4.2.5. The cumulative impacts would primarily affect ground water availability in the shallow Middle Wilcox aquifer and the deep Massive Sand aquifer. Current uses of these aquifers were described in Subsection 3.7.2, and the estimated water level drawdowns and impacts were described in Subsection 4.2.5.2. The drawdown in the GS sand interval of the Middle Wilcox aquifer could approach 15 ft only to the extent of approximately 0.5 to 1 mile beyond the active mining area, and those drawdowns would not be permanent at any given location. Modeling estimated approximately 6 ft of drawdown at the nearest existing user of the Massive Sand aquifer. This small change in static head in deep wells would result in no measurable change in pump performance or power requirements.

No changes to ground water quality would be expected in any aquifer, with one possible exception. Ground water in the mine spoil deposits in the reclaimed mine areas would likely have higher TDS concentrations than premining ground water, which could preclude development of shallow freshwater wells in the mined portions of the Middle Wilcox aquifer. Fresh ground water would remain available from the underlying Lower Wilcox aquifer, and perhaps from lower sand intervals within the Middle Wilcox aquifer.

6.4 SOCIAL AND ECONOMIC RESOURCES, INCLUDING TRAFFIC CONGESTION ISSUES

Construction and operation of the proposed power plant and the surface lignite mine would be unlikely to combine with any other development activity in the immediate project area to result in cumulative impacts. The area is rural and has not supported significant commercial or industrial development in the past and is not likely to in the foreseeable future. The anticipated economic impact of the direct-effect multiplier would be likely to occur in and around the established municipalities in the area. Similarly, while there would be traffic congestion and a potential for limited housing opportunities, particularly during construction, in the project area, there would likely not be a combined effect with other projects.

There are no known or planned projects in the surrounding area where the local roadways or local housing market would experience traffic/population influx in addition to that generated by the proposed power plant and surface lignite mine construction and operation. The business development manager for the area economic development corporation informed that net employment resulting from known business expansions and contractions would be negative (i.e., net job loss) (Scaggs, 2009). In addition, a recent study of the area's employment (The Pathfinders, 2008) found that: (a) there are "approximately 12,700 unemployed persons actively seeking work," (b) there is "significant underemployment (employment below skill level)," and (c) the "area has approximately 29,400 available workers for new or expanding businesses." Mississippi Power (2009) inquiries also turned up no plans for major project or development activity in the area during the foreseeable future.

Without the proposed project, the population of Kemper County in 2011 is estimated to decrease from that in 2000. Thus, no cumulative effects on demands for labor and socioeconomic resources would be anticipated as a result of the development of the Kemper County IGCC Project.

6.5 ENVIRONMENTAL JUSTICE

Subsection 4.2.12 discussed environmental justice issues. While an environmental justice population exists, "disproportionately high and adverse" impacts to minority and low-income population would not be expected to result, and no additional current or future stressors were identified. Economic direct and indirect multiplier impacts would most likely accrue to the larger municipal areas in the adjacent counties. There might be additional support development occurring in the DeKalb and Scooba areas where there is infrastructure to support such development. The immediate project area is anticipated to remain rural with only limited commercial development likely to occur.

6.6 OTHER ISSUES

The proposed project would have some impacts to other resources, such as noise and ecological resources. The noise impacts of the IGCC power plant and surface lignite mine would not be cumulative, as shown in Subsection 4.2.18.2. In addition, there are no other known or anticipated developments that could add to the noise environment.

Similarly, the project would impact ecological resources, including wetlands. All wetlands impacted by project activities would be subject to permitting and mitigation. There are no other known or anticipated developments that could result in cumulative impacts on wetlands and other ecological resources.

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7. PERMITTING AND LICENSING REQUIREMENTS

Per 40 CFR 1502.25(b), this chapter lists and discusses federal permits and licenses that must (or might need to) be obtained to implement the proposed action. This chapter also identifies the key state regulatory permit requirements that apply (or might apply) to the proposed facilities. In some cases federal permitting responsibilities have been delegated to the state. Note that the permitting and licensing requirements presented in this chapter would apply independent of NEPA.

7.1 FEDERAL REQUIREMENTS

Table 7.1-1 lists the federal permits and licenses that would or might be required for the Kemper County IGCC Project and the connected facilities. The most applicable among these are discussed in greater detail, as follows. This section also discusses several other important regulatory programs that do not require specific permits but are implemented through other permits.

7.1.1 CLEAN AIR ACT

- Enacted by Public Law 90-148, Air Quality Act of 1967 (42 USC 7401 *et seq.*).
- Amended by Public Law 101-549, Clean Air Act Amendments of 1990.
- Comprised of Titles I through VI.
- Applicable titles:
    - Title I—Air Pollution Prevention and Control. This title is the basis for air quality standards and emission limitations, PSD permitting program, SIPs, New Source Performance Standards (NSPS), and National Emissions Standards for Hazardous Air Pollutants (NESHAP).
    - Title IV—Acid Deposition Control. This title establishes limitations on SO_2 and NO_x emissions, permitting requirements, monitoring programs, reporting and record keeping requirements, and compliance plans for emission sources. This title requires that emissions of SO_2 from utility sources be limited to the amounts of allowances held by the sources.
    - Title V—Permitting. This title provides the basis for the operating permit program and establishes permit conditions, including monitoring and analysis, inspections, certification, and reporting. Authority for implementation of the permitting program is delegated to authorized states, including Mississippi.

- On March 10, 2005, the EPA issued the final CAIR, also referred to as the Rule to Reduce the Interstate Transport of Fine Particulate Matter and Ozone (40 CFR 51, 72, 73, 77, 78, and 96). This rule was remanded without vacatur by the United States Court of Appeals for the District of Columbia on December 23, 2008. EPA will modify CAIR consistent with the Court’s July 11, 2008, opinion. The objective of CAIR is to assist states with $PM_{2.5}$ and 8-hour ozone nonattainment areas to achieve attainment by reducing precursor emissions at sources located in 28 states (including Mississippi) situated upwind of these nonattainment areas. Based on regional dispersion modeling, EPA determined that these 28 upwind states significantly contribute to $PM_{2.5}$ and 8-hour ozone

Table 7.1-1. Summary of Federal Permits and Licenses Required for the Kemper County IGCC Project, Lignite Surface Mine, or Linear Facilities

Permit/License/Approval	Principal Regulatory Citation(s)	Lead Agency	When Required	Required for: Construction	Required for: Operation	Applicable/ Potentially Appl.: IGCC Power Plant	Applicable/ Potentially Appl.: Lignite Surface Mine	Applicable/ Potentially Appl.: Pipelines/Electric Transmission Line	Comments
Clean Air Act									
PSD Permit	40 CFR 52.21; MCEQ APC-S-5	MDEQ	Construction of a new major source of air pollutant emissions.	✓		✓			
Title IV Acid Rain Permit	40 CFR 72; MCEQ APC-S-7	MDEQ	Applicable to new generation units greater than 25 MW.		✓	✓			Application required to be submitted 2 years prior to start of operations.
Title V Operating Permit	40 CFR 70; MCEQ APC-S-6	MDEQ	Applicable to operation of emission sources.		✓	✓			Application required to be submitted within 180 days after start of operations. Would also cover CAIR requirements.
Clean Water Act									
NPDES Industrial Wastewater Discharge Permit	40 CFR 122, 434; MCEQ WPC-1	MDEQ	Discharges into surface waters of the state or to an area where surface waters may be affected.		✓		✓		Power plant would not discharge any process wastewaters offsite.
NPDES General Permit NOI for construction sites	40 CFR 122; MCEQ WPC-1	MDEQ	Discharges of stormwater from construction sites greater than 5 acres in size. Must include pollution prevention plan.	✓		✓	✓	✓	
NPDES Stormwater Permit NOI associated with industrial activity	40 CFR 122; MCEQ WPC-1	MDEQ	Discharges of stormwater associated with industrial activity. Must include pollution prevention plan.		✓	✓	✓		
CWA Section 404 Dredge-and-Fill Permit	33 CFR 320	USACE	Impacts of construction on wetlands and/or navigable waters.	✓		✓	✓	✓	
CWA Section 10 Permit	33 CFR 322	USACE	Construction of structures in navigable waters.	✓			✓	✓	A Section 10 permit would be required for the lignite mine. A permit might be required for one or more of the linear facilities.

Table 7.1-1. Summary of Federal Permits and Licenses Required for the Kemper County IGCC Project, Lignite Surface Mine, or Linear Facilities (Continued, Page 2 of 2)

Permit/License/Approval	Principal Regulatory Citation(s)	Lead Agency	When Required	Required for: Construction	Required for: Operation	Applicable/ Potentially Appl.: IGCC Power Plant	Applicable/ Potentially Appl.: Lignite Surface Mine	Applicable/ Potentially Appl.: Pipelines/Electric Transmission Line	Comments
Section 401 water quality certification		MDEQ	State certification that water quality standards will be met is required when obtaining a dredge-and-fill (Section 404) permit.	✓			✓	✓	
Oil Pollution Prevention Plan	40 CFR 112	EPA	SPCC plan needed when aboveground oil storage has potential for discharge to state waters.		✓	✓	✓		
Other									
RCRA	40 CFR 261	EPA/MDEQ	Waste generation	✓	✓	✓	✓		
Notice of Proposed Construction or Alteration	14 CFR 77	Federal Aviation Administration (FAA)	Construction of tall structures, including exhaust stacks.	✓		✓	✓		IGCC stacks and structures would require FAA clearance. Dragline booms associated with mining might also require notice.
SMCRA	30 CFR 700	MDEQ	Prior to the commencement of any surface mining activity or disturbance.	✓	✓		✓		
Ground Control Plan	30 CFR 77.1000	MSHA	Before beginning mining operations		✓		✓		
Mine ID Registration	30 CFR 41	MSHA		✓	✓		✓		

Sources: SCS, 2009.
NACC, 2009.
ECT, 2009.

nonattainment in downwind areas. To achieve these goals, CAIR provides for reductions in precursor emissions of SO_2 and NO_x. EPA has approved Mississippi's SIP incorporating the CAIR regulations, and the SIP became effective on November 2, 2007.

- Under the CAA, EPA must regulate large or *major* industrial facilities that emit one or more of 188 listed HAPs. EPA has developed standards for listed industrial categories of major sources (those that have the potential to emit 10 tpy or more of a listed pollutant or 25 tpy or more of a combination of pollutants). These standards require application of maximum achievable control technology (MACT). The Kemper County IGCC Project's HAP emissions including mercury are below major HAP thresholds. Therefore, the facility is not subject to a 112(g) case-by-case MACT determination.
- The risk management program (40 CFR 68) requirements apply to owners and operators of stationary sources that have more than a threshold quantity of a regulated substance contained in a process. A risk management plan (RMP): (1) describes the planned regulated substance management systems for the new facilities, (2) presents the results of a hazard assessment/offsite consequences analysis, (3) describes the process safety management program, and (4) describes emergency response plans.
- Regulations implementing the CAA are found in 40 CFR 50 to 95.

CAA standards and permitting requirements would apply to the IGCC facility. The key construction permit would be the PSD permit, through which emission controls and limitations would be determined, and compliance with NAAQS evaluated and enforced. In December 2007 Mississippi Power applied to MDEQ, which operates in accordance with an approved SIP, for a PSD permit to construct the facility. The final permit (Air Pollution Control Permit No. 1380-00017) was issued in October 2008 by MDEQ. In September 2009 Mississippi Power revised its PSD permit application to reflect changes in the plant's equipment and design (Mississippi Power, 2009a). MDEQ is reviewing the revised application. Air permitting required for the mine operation or lignite handling associated with the mining operation would be addressed through the mine's overall state permitting process through MDEQ.

7.1.2 CLEAN WATER ACT

- Enacted by Public Law 92-500, Federal Water Pollution Control Act Amendments of 1972 (33 USC 1251 *et seq.*).
- Amended by Public Law 95-217, CWA, and Public Law 100-4, Water Quality Act of 1987.
- Comprised of Titles I through IV.
- Applicable titles:
    - Title III—Standards and Enforcement:
        - Section 301, Effluent Limitations, is the basis for establishing a set of technology-based effluent standards for specific industries.
        - Section 302, Water Quality Related Effluent Limitations, addresses the development and application of effluent standards based on water quality goals for the waters receiving the effluent.

- o <u>Title IV</u>—Permits and Licenses:
  - ▪ Section 402, NPDES, regulates the discharge of pollutants to surface waters. Regulations implementing the NPDES program are found in 40 CFR 122. Authority for implementation of the NPDES permit program is delegated to authorized states, including Mississippi.
  - ▪ Section 404, Permits for Dredged or Fill Material, regulates the discharge of dredged or fill material in the jurisdictional wetlands and waters of the United States. USACE has been delegated the responsibility for authorizing these actions.

- Regulations implementing the CWA are found in 40 CFR 104 through 140. Regulations that affect the permitting of this project include:
  - o <u>40 CFR 112</u>—Oil Pollution Prevention. This regulation requires the preparation of an SPCC.
  - o <u>40 CFR 122</u>—NPDES. This regulation requires the permitting and monitoring of any discharges to waters of the United States.

A number of permits under the CWA would be required, as shown in Table 7.1-1. Construction of the proposed facilities would require NPDES permits associated with stormwater management, for example. One of the most significant CWA-related permits for the proposed project would be those required to impact wetlands and navigable waters (Section 404). USACE also is responsible for discharging its responsibilities under Executive Orders 11998 and 11990 when implementing its dredge-and-fill regulatory program under Section 404 of the federal CWA. In addition, EPA has adopted guidelines for the specifications of disposal sites for dredged or fill material regulated by Section 404 permits. The proposed IGCC facility and the connected actions (i.e., the linear facilities and the lignite mine), are subject to these regulations. USACE is a cooperating agency in the Kemper County IGCC Project EIS, in part for the purpose of fulfilling its regulatory responsibilities under Section 404 of the CWA.

USACE and EPA have executed a Memorandum of Agreement (MOA) under Section 404(q) of the CWA to implement these Executive Orders. The MOA specifies how Section 404 permit applications will be evaluated and establishes a sequence of avoidance, minimization, and mitigation evaluations that must be conducted before a permit to impact Waters of the United States can be issued. In April 2008, EPA and USACE issued regulations defining their procedures for determining the type and level of mitigation appropriate and practicable for Section 404 permits. The other significant CWA-based permit would be for the mine discharges to waters of the United States from the various sediment ponds throughout the life of mine area.

7.1.3 RESOURCE CONSERVATION AND RECOVERY ACT OF 1976

- Enacted by Public Law 94-580, RCRA (42 USC 6901 *et seq.*).
- Amended by legislation including Public Law 98-616, Hazardous and Solid Waste Amendments of 1984, Public Law 99-499, Superfund Amendments and Reauthorization Act of 1986, and Public Law 104-119, Land Disposal Flexibility Act of 1996.
- Applicable title is Title II—Solid Waste Disposal (known as the Solid Waste Disposal Act). This title regulates the disposal of solid wastes. Title II, Subtitle C—Hazardous Waste Management,

provides for a regulatory system to ensure the environmentally sound management of hazardous wastes from the point of origin to the point of final disposal. The state of Mississippi has the authority to administer the RCRA Subtitle C program within the state through MDEQ's Office of Pollution Control. Title II, Subtitle D—State or Regional Solid Waste Plans, allows states to plan for managing and permitting the disposal of solid wastes and requires each state to develop and implement a regulatory program to ensure that municipal solid waste landfills and other facilities that receive household hazardous waste or conditionally exempt small-quantity generator hazardous waste meet federal minimum standards (40 CFR 258) for the location, design, operation, closure, and postclosure care of municipal solid waste landfills.

Project participants would be required to identify any residues that require management as hazardous waste under RCRA (40 CFR 261). For some waste streams, this includes testing waste samples using the toxic characteristic leaching procedure or other procedures that measure hazardous waste characteristics.

7.1.4 FEDERAL AVIATION ACT OF 1958

- Enacted by Public Law 85-726, Federal Aviation Act of 1958 (49 USC 1101 *et seq.*, as amended).
- Regulations implementing this Act are found in 14 CFR 77 and are enforced by DOT, Federal Aviation Administration (FAA).
- These regulations require submittal of a notice identifying any structures that, because of construction or alteration, may be a hazard to air transportation. A project located within 3.8 miles of a public airport and/or which contains elements with an elevation of 200 ft above the ground level must receive a clearance from FAA.

Because the IGCC plant's HRSG stacks would be 325 ft tall, a Notice of Proposed Construction or Alteration would be filed with FAA. Because of the stack heights, lighting would be required. Similarly, due to the height of the dragline boom at the proposed mine, FAA approval might be required.

7.1.5 SURFACE MINING CONTROL AND RECLAMATION ACT OF 1977

SMCRA (30 CFR 700, *et seq.*) provides for the federal regulation of surface coal mining operations and the acquisition and reclamation of abandoned mines. Title IV of SMCRA is designed to help reclaim and restore abandoned coal mine areas throughout the country. Title V of SMCRA controls the environmental impacts of surface coal mining. MDEQ is authorized to administer the requirements of the act and has regulations promulgated under the Mississippi Code Annotated §53-9-11.

The SMCRA regulations promulgated by MDEQ require 5-year mining permit renewals. Each mine permit must provide the following details:

- Identification of interests including applicant information and owners of property to be mined.
- Compliance information including any current or previous violations.
- Right of entry and operation information including written consent of surface owner, documents of conveyance, or documentation of legal authority.
- Relationship to areas designated unsuitable for mining.

- Permit term information including timing and number of acres to be affected.
- Certificates of liability insurance.
- Identification of other licenses and permits required by local, state, and federal agencies.
- General environmental resources information including archeological, historical, and cultural resources; identification of sites eligible for the NRHP; and results of field investigations.
- Description of hydrology and geology including details of methodology, hydrology, water quality, calculations, drafts, charts, models, cross-sections, chemical analyses, etc.
- Ground water information including quality, quantity, well locations, ownership, well specifications, and geologic logs.
- Surface water information including baseline surface water flow data, surface impoundment baseline data, histograms, and chemical analyses.
- Baseline cumulative impact area information including probable cumulative hydrologic impacts.
- Modeling including watershed data, hydrologic modeling flow runoff data, and baseline sediment yield calculations.
- Alternative water source information.
- Probable hydrologic consequence determination including baseline information, adverse impacts, contamination potential, specific impacts, sediment yield, water quality parameters, flooding or streamflow alteration, water availability, etc.
- Cumulative hydrologic impact assessment.
- Climatological information including precipitation, wind direction, wind velocity, temperature data, etc.
- Vegetation information including a description of plant communities and vegetation types and a fish and wildlife habitat evaluation.
- Soil resources information including soil surveys and topsoil evaluations.
- Land use information including historic uses of the land as well as land capability and productivity.
- Cross-sections, maps, and plans.
- Prime farmland investigation.
- Operation plan including mining procedures, facilities, dams, embankments, impoundments, non-coal storage areas, coal handling, waste handling, etc.
- Air pollution control plan.
- Fish and wildlife plan.
- Detailed reclamation plan including compliance standards, permit area information, reclamation timetable, reclamation cost estimate, plans to achieve final surface configuration, topsoil removal, revegetation schedule, species and planting rates, planting and seeding methods, irrigation and pest control, soil testing plan, etc.
- Ground water monitoring plan.
- Surface water monitoring plan.
- Postmining land use plan detailing proposed land uses.
- Construction and reclamation plans for siltation structures, impoundments, and embankments.

- Road systems plan including maps, cross-sections, design drawings for roads, bridges, low water crossings, etc.

7.1.6 DOE FLOODPLAIN AND WETLAND ENVIRONMENTAL REVIEW REQUIREMENTS

Executive Order 11988, Floodplain Management, directs federal agencies to establish procedures to ensure that they consider potential effects of flood hazards and floodplain management for any action undertaken. Agencies are to avoid impacts to floodplains to the extent practical. Executive Order 11990, Protection of Wetlands, requires federal agencies to avoid short- and long-term impacts to wetlands if a practicable alternative exists. DOE regulation 10 CFR 1022 establishes procedures for compliance with these Executive Orders. DOE is required to prepare a floodplain and wetlands assessment discussing the effects on the floodplain and wetlands, and consideration of alternatives. In addition, these regulations require DOE to design or modify its actions to minimize potential damage in floodplains or harm to wetlands. DOE is also required to provide opportunity for public review of any plans or proposals for actions in floodplains and new construction in wetlands. DOE’s compliance with the regulations may be accommodated through its NEPA procedures More specifically, its regulations require DOE to:

- Prepare floodplains and/or wetland assessments that describe the project elements located in wetlands and/or floodplains.
- Assess positive and negative, direct and indirect, and the long-term and short-term effects on floodplains and/or wetlands.
- Evaluate alternatives that avoid actions in floodplains and/or wetlands, including alternate sites, alternate actions, and no action.
- Evaluate measures that mitigate the adverse effects of actions in a floodplain and/or wetland including, but not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecologically sensitive areas.

The three components of a floodplain and/or wetland assessment, as listed in 10 CFR 1022, are as follows: (1) project description, including a map showing location with respect to the floodplain and /or wetland; (2) floodplain or wetland impacts; and (3) alternatives, including alternate sites, alternate actions, and no action. A description of the proposed action is provided in Section 2.1 of this EIS; descriptions of the connected actions are provided in Section 2.2; and descriptions of the floodplains and wetlands affected are provided in Section 3.10 and 3.11, respectively. Impacts to floodplains and wetlands are described in Subsections 4.2.8 and 4.2.9, respectively. Alternatives to the proposed action are described in Section 2.7, and a mitigation plan developed by the project proponents is provided in Appendix P. Both DOE and USACE have conducted an initial review of this plan; however, DOE may consider additional mitigation in the final EIS and Record of Decision (ROD).

As stated in 10 CFR 1022.14, if DOE finds that no practicable alternative to conducting the action in the floodplain or wetland is available, then before taking action DOE shall modify its action to minimize potential harm to or within the floodplain or wetland. For the floodplain action, DOE may incorporate the floodplain statement of findings into the final EIS, as appropriate, or issue such statement separately.

7.1.7 ENDANGERED SPECIES ACT OF 1973

Enacted by Public Law 93-205, the ESA (16 USC 1531, *et seq.*). Section 7, Interagency Cooperation, requires any federal agency authorizing, funding, or carrying out any action to ensure that the action is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat of such species. Consequently, USFWS will conduct a consultation, in compliance with Subsection (a)(2) of Section 7 of the ESA, with regard to the impacts of the proposed project on threatened and endangered species listed by USFWS and any critical habitat of such species in the vicinity of the proposed facilities.

In accordance with Section 7 of the ESA, DOE has initiated informal consultation with USFWS. During the scoping period, DOE met with USFWS and provided a tour of the project site and mine study area. Surveys were conducted, consistent with MDEQ and USFWS guidance (see Appendices A and F), to address the presence or potential presence of threatened or endangered species (see Sections 3.8 and 3.9) and impacts to these species (see Section 4.2, specifically Subsection 4.2.6). Based on the available information, DOE has made a preliminary determination that the project “may affect, but would not likely adversely affect, threatened or endangered species.” Informal consultation will continue until DOE makes a final determination and USFWS concurs with a determination of “may affect, but would not likely adversely affect” or DOE makes a determination that the project “may adversely affect threatened or endangered species,” initiates formal consultation, and requests a biological opinion from USFWS.

7.1.8 NATIONAL HISTORIC PRESERVATION ACT OF 1966

- Enacted by Public Law 89-665, National Historic Preservation Act of 1966 (amended in 2006) (16 USC 470, *et seq.*).
- Under Section 106, the head of any federal agency having direct or indirect jurisdiction over a proposed federal or federally assisted undertaking in any state and the head of any federal department or independent agency having authority to license any undertaking shall, prior to the approval of the expenditure of any federal funds on the undertaking or prior to the issuance of any license, as the case may be, take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the NRHP. The head of any such federal agency shall afford the Advisory Council on Historic Preservation established under Title II of the NHPA a reasonable opportunity to comment with regard to such undertaking.

DOE has given historic and cultural resources very detailed consideration (see Section 3.18 and Subsection 4.2.17). Under Section 106 of the NHPA, DOE has consulted with Mississippi’s State Historic Preservation Officer, as well as made contact with the tribal chief or primary contact with 26 federally recognized regional tribes for the purpose of informing and determining interest in this project. As a result of this contact, two Tribal Historic Preservation Officers, one for the Oklahoma Band of Choctaw and one for the Mississippi Band of Choctaw have expressed an interest and are currently part of the consultation process for the 106 activities (Appendix L).

7.1.9 OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

- OSHA General Industry Standards (29 CFR 1910). Authority: Sections 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order Numbers 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), 1-90 (55 FR 9033), and 6-96 (62 FR 111), as applicable.
- OSHA Construction Industry Standards (29 CFR 1926). Authority: 44 FR 8577, February 9, 1979; 44 FR 20940, April 6, 1979.

OSHA standards would apply to both construction and operation of the various project components.

7.1.10 MINING SAFETY AND HEALTH ADMINISTRATION

- MSHA guidelines and standards (30 CFR 1 through 199) address the safety standards at all mining facilities, including surface coal mines. The MSHA standards apply to both the construction and operation of all activities within an active mine boundary.
- An MSHA mine identification number would be applied for at the District II office in Birmingham, Alabama. This application would identify the location, type of mine facility, and the operator of that facility. This would also trigger the training requirements and safety measures required of the operator as well as the inspections conducted by MSHA. In addition to the mine identification number, the mine must file a ground control plan (30 CFR 77.1000), which evaluates the geotechnical stability of the pit, highwall, spoil banks, and general work area for operation constraints and additional safety measures when constructing the pit and operating in and around the pit.
- All mine-related pond dams meeting the criteria of impounding water or sediment to an elevation of 5 ft or more above the upstream toe of the structure and have a storage volume of 20 ac-ft or more (30 CFR 77.216) shall obtain MSHA approval for the design, construction, and maintenance of said structure(s).

7.1.11 PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION

The Pipeline and Hazardous Materials Safety Administration (PHMSA), a division of DOT, regulates interstate pipelines under 49 CFR 191, 192, and 195. The Gas Pipeline Safety Division of the Mississippi PSC regulates intrastate pipelines. Under the Mississippi PSC's Rule 57.1, the applicant must give notice (either written or verbal) to the Mississippi PSC prior to beginning construction of a gas system (which would include the relocation of the existing, onsite line).

7.2 STATE REQUIREMENTS

In addition to permits required as a result of federal regulations, the state of Mississippi would require a number of permits, licenses, and approvals for construction and operation of the Kemper County IGCC Project and the connected facilities. The following summarizes the most significant of these state requirements:

- Mississippi Power is a public utility as defined in Section 77-3-3(d)(i) of the Mississippi Code of 1972, as amended, and is engaged in the business of providing electric service to and for the public in twenty-three (23) counties of southeastern Mississippi. The Mississippi Public Utility Act (Section 77-3-11 of Mississippi Code of 1972) requires that a utility must first obtain a Certificate of Public Convenience and Necessity (CPCN) from the Mississippi PSC before commencing construction of a new electric generating facility. On or about January 16, 2009, the Mississippi Power filed with the PSC a petition for a CPCN requesting the authority to acquire, construct, maintain, and operate the proposed Kemper County IGCC Project in Kemper County, Mississippi. The Mississippi PSC is expected to utilize a process that provides for interested parties' intervention, allows appropriate periods for discovery and submittal of both interveners' direct testimony and Mississippi Power's rebuttal testimony, and concludes with public hearings at the PSC to determine the merits of the petition. Upon completion of this process, the Mississippi PSC will issue a ruling on Mississippi Power's request for a CPCN.

- MDEQ requires that new power generating facilities use the lowest quality water source that is economically, environmentally, and technologically feasible; high-quality ground water may be used only for potable purposes. The state places no permitting requirements on the reuse of treated municipal sanitary wastewater, use of which would also not be considered a beneficial use of surface water and, therefore, would not require a surface water withdrawal permit. The only authorization required would be from the city of Meridian. A legislative statute is in place that would allow the Mayor and City Council of Meridian to sign long-term contracts obligating the rights of use for the subject wastewater in anticipation of Mississippi Power using this water supply. Pumping rates would be monitored to determine the amount of water being reclaimed for use by the proposed IGCC project. A sampling and monitoring program would also be initiated to document the quality of reclaimed water being released from the city of Meridian.
- MDEQ would require a ground water withdrawal permit and an NOI for individual wastewater treatment system certification.
- Hydrostatic testing conducted on each of the pipelines would require a hydrostatic test general permit for the discharge of test water and stormwater associated with construction activities as well as a surface water withdrawal permit to utilize available surface waters for the test.
- Solid waste generated by construction or operation of the proposed facilities would need to be managed in accordance with the Nonhazardous Solid Waste Management Regulations. Statutory authority for these regulations includes Sections 17-17-27, 17-17-213, 17-17-229, 17-17-231, 21-27-207, and 49-17-17, Mississippi Code Annotated. Any landfills used for disposal of such waste would require an appropriate permit issued in accordance with those regulations by MDEQ. Proposals for beneficial use of gasification ash or other solid wastes from the proposed facilities would require case-by-case review by MDEQ to verify that the proposed use of these wastes would not pose an unacceptable human health risk or cause ground water or surface water contamination in concentrations above MDEQ standards or criteria.
- MDEQ would issue a solid waste management permit and a beneficial use determination for nonhazardous solid waste transmission for the CO_2 pipeline.
- For the mine, NACC would potentially be required to obtain the following permits/licenses:
  - State of Mississippi surface mining and reclamation permit from MDEQ.

- State coal exploration license from MDEQ.
- Mine identification number from U.S Department of Labor, MSHA.
- State of Mississippi water pollution control permit from MDEQ.
- Section 404 permit from USACE.
- Section 21 nationwide permit from USACE.
- Section 401 state water quality certification from MDEQ.
- Exclusion for rubbish disposal activities from MDEQ.
- Mississippi conditionally exempt small-quantity generator from MDEQ.
- SPCC plan submitted to EPA Region 4.
- Dragline boom height determination from DOT.
- Road closures, relocation and operations within 100 ft of outside right-of-ways from Kemper County Board of Supervisors, Lauderdale County Board of Supervisors, and Mississippi Department of Transportation.
- Water withdrawal permit for beneficial uses for public water of the state of Mississippi from MDEQ.
- Dam construction authorization for sediment pond from MDEQ and U.S. Department of Labor, MSHA.
- Beneficial use determination for ash from MDEQ.

8. IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

For the construction and operation of the proposed Kemper County IGCC Project and connected facilities, some of the resource commitments would be irreversible and irretrievable; that is:

- Irreversible when primary or secondary impacts from use would limit future use options. Irreversible commitment applies primarily to nonrenewable resources, such as minerals or cultural resources, and to those resources that are renewable only over long time spans, such as soil productivity.
- Irretrievable when use or consumption would be neither renewable nor recoverable for use by future generations. Irretrievable commitment applies to the loss of production, harvest, or natural resources.

Resources that would be irreversibly or irretrievably used during construction of the power plant, lignite mine, and linear facilities (pipelines and electric transmission lines) would include land and raw materials. The land areas needed for the power plant and linear facilities corridors would be cleared, graded, and filled as needed to suit the facilities' construction. Although arguably the land areas and corridors and their associated resources could potentially be reclaimed at some point in the future, it is unlikely that they would be restored to original conditions and functionality. Therefore, these land commitments would be considered irreversible. Land impacted by surface lignite mining would be reclaimed after completing the mining, and, thus, would not be considered an irreversible commitment of resources, although the loss of productive use for other purposes (e.g., silviculture) during mining operations would be irretrievable. Raw materials needed for construction would include crushed stone, sand, concrete, lumber, water, diesel fuel, gasoline, and steel, for example. Construction would consume these materials, which would constitute an irretrievable commitment.

Resources that would be irreversibly or irretrievably used or lost during the demonstration would include lignite, water, natural gas (used during startup and fired in the CTs and duct burners during periods when the gasifiers were not operating), process chemicals, paints, degreasers, and lubricants. Based on full-load operations (see Table 2.5-1), the IGCC power plant would consume an estimated 19 million tons of lignite during the 4.5-year demonstration period (172 million tons over a 40-year project life, assuming successful demonstration). The lignite in deeper seams left in place (not mined due to economic considerations) would likely never be recovered and would, therefore, be considered irretrievably lost. Approximately 10 to 11 billion gallons of water (mostly reclaimed effluent) would be required for plant operations during demonstration (90 to 100 billion gallons over 40-year life). None of these resources is in short supply relative to the size and location of the proposed facilities. The large quantities of water used to operate the IGCC power plant would almost all be evaporated rather than discharged back to surface or ground water and, thus, would be considered irretrievably consumed on a local basis.

The construction and operation of the proposed facilities would require the irreversible commitments of human resources that would not be available for other activities during the period of their commitment, but these commitments would not be irretrievable.

Finally, the implementation of the proposed action would require the commitment of financial resources by Mississippi Power, NACC, their investors and lenders, and DOE for the construction, demonstration, and operation of the Kemper County IGCC Project. However, these commitments are consistent with the purposes of and needs for the proposed action as described in Chapter 1.

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9. THE RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

The proposed Kemper County IGCC Project's power plant and the connected lignite mine and linear facilities would occupy large amounts of land (although the mined lands would be reclaimed). The facilities would consume resources including lignite, natural gas, water, process chemicals, paints, degreasers, and lubricants (see Chapters 2 and 8). The proposed facilities would generate electricity, commercial-grade ammonia and H_2SO_4, CO_2 for EOR, along with air emissions, liquid effluents, and solid wastes. No process wastewater streams would be released off the power plant site; however, the mine facilities would discharge water from impoundment structures and effluent from a sanitary treatment plant. The impacts of constructing and operating the project facilities would meet all applicable regulatory requirements (see Chapter 4). Gasification ash would be used beneficially to the extent possible and would be landfilled only if no beneficial use were found. Anhydrous ammonia and H_2SO_4 byproducts would be recovered and marketed.

Longer term, the proposed action would support the DOE objective of demonstrating and promoting innovative coal power technologies that can provide the United States with clean, reliable, and affordable energy using abundant domestic sources of coal. The long-term benefit of the proposed project would be to demonstrate advanced power generation systems using IGCC technology at a sufficiently large scale to allow industries and utilities to assess the project's potential for commercial application. The proposed project would minimize SO_2, NO_x, mercury, CO_2, and PM emissions. The project would be expected to remove more than 99 percent of the SO_2 produced in the gasification process using lignite containing an average of 1-percent sulfur. The removal of nearly all of the fuel-bound nitrogen from the syngas prior to combustion in the CTs would result in appreciably lower NO_x emissions compared to conventional coal-fired power plants. More than 92 percent of the mercury in the lignite fuel would be removed in the gasification process. More than 99.9 percent of particulate emissions would be captured using rigid, barrier-type filter elements. The IGCC power plant would be designed to remove approximately 67 percent of the carbon in the feedstock lignite from the syngas.

The successful demonstration of low-emissions electricity production from lignite, an abundant worldwide energy source, could foster similar power plants. These technological advancements would further the goal of reducing anthropogenic emissions of CO_2. Were the project to be successful, the use or consumption of land, materials, water, energy, and labor to construct and operate the project would have long-term positive impacts, both in the United States and abroad, on reducing CO_2 emissions per unit of electricity generated.

The ability to show prospective domestic and overseas customers an operating facility rather than a conceptual or engineering prototype would provide a persuasive inducement to purchase advanced coal utilization technology. The design size for the proposed project was selected to convince potential customers that the IGCC technology, once demonstrated at this scale, could be commercialized without further scale-up to verify operational or economic performance. Successful demonstration would enhance prospects of exporting the technology to other nations and might provide the United States a very important advantage in the global competition for new markets.

The proposed action would also support Mississippi Power's objectives to provide a source of electric power for the state of Mississippi and the national electric grid, as well as provide revitalization for an economically depressed part of Mississippi.

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11. LIST OF PREPARERS

U.S. Department of Energy

Richard A. Hargis, Jr., NEPA Document Manager
Office of Project Facilitation and Compliance, National Energy Technology Laboratory

Mark L. McKoy, Geologist and Environmental Manager
Office of Project Facilitation and Compliance, National Energy Technology Laboratory

U.S. Army Corps of Engineers (Cooperating Agency)

Environmental Consulting & Technology, Inc.[1]

Jeffrey L. Meling, P.E., Senior Vice President
Principal in Charge, overall ECT Project Manager
M.S., 1979, Environmental Engineering, University of Illinois
B.S., 1977, Civil Engineering, University of Illinois
29 years of environmental impacts assessment experience, with emphasis on management of multi-disciplinary studies of power generation and transmission facilities

Gary P. Uebelhoer, Senior Vice President
Assistant Project Manager
M.B.A., 1976, Purdue University
B.S., 1975, Environmental Engineering, Purdue University
30 years of experience preparing multi-disciplinary environmental impact assessments of mining projects, including coal, copper/nickel, phosphate, potash, gold, and aggregates

Martin J. Boote, Staff Scientist
Lead scientist, surface water resources and aquatic ecology
B.S., 1992, Biology-Fisheries, Central Michigan University
17 years of environmental consulting focusing on the biology and ecology of surface water resources, including biological surveys, environmental assessments, environmental impact statements, habitat assessment, limnological surveys, and geomorphological studies

James E. Poppleton, Principal Scientist
Lead terrestrial ecologist
M.A., 1976, Botany, University of South Florida
B.S., 1972, Biology, University of Central Florida
32 years of ecological consulting experience focusing on wetland delineation and permitting, listed plant species evaluations, vegetation description and mapping, and evaluation of the effects of air pollution on vegetation

[1] Appendix S contains the Letter of Understanding and Disclosure Statement pertaining to ECT's assistance to DOE in the preparation of this EIS.

Maya R. Scohier, Associate Scientist
Terrestrial ecologist, field team leader
B.A., 2002, Environmental Science, University of Florida
7 years of environmental experience, with emphasis on in wetland delineation and permitting, land use/cover mapping, and mitigation monitoring

John E. Shrock, Senior Scientist
Lead air quality scientist
M.S., 1976, Environmental Science, Indiana University
B.A., 1974, Physics and Psychology, Indiana University
Over 30 years of experience in the field of air quality, with emphasis on permitting and modeling of industrial sources

Philip W. Simpson, Vice President, Principal Scientist
Lead wildlife biologist
M.S., 1976, Wildlife Management, University of Michigan
B.S., 1973, Wildlife Science, Purdue University
32 years of environmental impact assessment experience, with focus on ecological impacts of energy development, particularly power plants and electric transmission lines

Richard J. Stebnisky, P.G., Principal Scientist
Lead geologist/hydrogeologist
M.S., 1997, Hydrogeology, University of South Florida (Tampa)
B.S., 1983, Geology, Edinboro University of Pennsylvania
24 years of environmental impacts assessment experience, with emphasis on hydrogeologic evaluations and groundwater quality and quantity studies related to power generation and other industrial facilities

Darren L. Stowe, AICP, Principal Scientist
Lead land use planner
1990, Graduate Study, Urban and Regional Planning, Florida State University
B.S., 1975, Biology, Cornell University
24 years of land use and socioeconomic impacts assessment experience, with emphasis on mining, electrical power plants, electric transmission systems, and other large-scale developments

Domenick M. Tufariello, P.E., Senior Engineer
Surface water resources engineer
1997 – 2001, Graduate Studies, Water Resources, University of South Florida
B.S., 1996, Civil Engineering, University of South Florida
13 years of regional stormwater management planning, watershed hydrology, design of stormwater facilities, wetland rehydration, site development, hydrologic and hydraulic modeling, and permitting

Jill Van Dyke, CPG, CUSTP, CHMM
Hydrogeologist, groundwater modeler
M.S., 1994, Hydrogeology-Geology, Western Michigan University
M.S., 1979, Geophysics, University of Minnesota
B.A., 1976, Geophysics, Hope College
30 years of experience in complex hydrogeological, geological and geophysical technical investigations, groundwater availability and contaminant fate and transport computer modeling

12. LIST OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS SENT COPIES OF EIS

Federal Elected Officials

Honorable Joe Barton, Ranking Member
Committee on Energy and Commerce
United States House of Representatives

Honorable Robert Bennett, Ranking Member
Subcommittee on Energy and Water Development
Committee on Appropriations
United States Senate

Honorable Jeff Bingaman, Chairman
Committee on Energy and Natural Resources
United States Senate

Honorable Barbara Boxer, Chairman
Committee on Environment and Public Works
United States Senate

Honorable Travis Childers
United States House of Representatives

Honorable Thad Cochran
United States Senate

Honorable Byron Dorgan, Chairman
Subcommittee on Energy and Water Development
Committee on Appropriations
United States Senate

Honorable Rodney P. Frelinghuysen, Ranking Member
Subcommittee on Energy and Water Development, and Related Agencies
Committee on Appropriations
United States House of Representatives

Honorable Bart Gordon, Chairman
Committee on Science and Technology
United States House of Representatives

Honorable Ralph Hall, Ranking Member
Committee on Science and Technology
United States House of Representatives

Honorable Gregg Harper
United States House of Representatives

Honorable James M. Inhofe, Ranking Member
Committee on Environment and Public Works
United States Senate

Honorable Lisa Murkowski, Ranking Member
Committee on Energy and Natural Resources
United States Senate

Honorable Gene Taylor
United States House of Representatives

Honorable Bennie Thompson
United States House of Representatives

Honorable Peter J. Visclosky, Chairman
Subcommittee on Energy and Water Development, and Related Agencies
Committee on Appropriations
United States House of Representatives

Honorable Henry A. Waxman, Chairman
Committee on Energy and Commerce
United States House of Representatives

Honorable Roger Wicker
United States Senate

Native American Tribal Leaders

Mr. Beasley Denson
Chief
Mississippi Band of Choctaw Indians

Ms. Jennie Lillard
Town King/Mekko
Kialegee Tribal Town Creek Nation of Oklahoma

Ms. Christine M. Norris
Chief
Jena Band of Choctaw Indians

Mr. Gregory E. Pyle
Chief
Choctaw Nation of Oklahoma

State Elected Officials

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Governor Haley Barbour

Commissioner Leonard Bentz
Mississippi Public Service Commission

Senator Nickey Browning

Lieutenant Governor Phil Bryant

Senator Terry Burton

Representative Tad Campbell

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Insurance Commissioner Mike Chaney

Senator Debbie Dawkins

Representative Reecy Dickson

Representative Mark DuVall

Representative Bo Eaton

Representative Tyrone Ellis

Senator Tommy Gollott

Transportation Commissioner Dick Hall

Senator Billy Hewes

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Representative Steve Horne

Secretary of State Delbert Hosemann

Senator Sampson Jackson

Senator Tom King

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Representative Billy McCoy

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State Auditor Stacey Pickering

Commissioner Lynn Posey
Mississippi Public Service Commission

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Mississippi Public Service Commission

State Treasurer Tate Reeves

Representative Ray Rogers

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Representative Greg Snowden

Commissioner of Agriculture Lester Spell

Representative Johnny Stringer

Senator Giles Ward

Federal Agencies

Ms. Caroline Blanco
Assistant General Councel
National Science Foundation

Ms. Susan Bromm
Director
Office of Federal Activities
U.S. Environmental Protection Agency

Mr. Joe Carbone
Ecosystem Management Coordinator
Forest Service
U. S. Department of Agriculture

Mr. Thomas A. Egeland
Director
Environmental Planning and Conservation Policy
Office of the Assistant Secretary of the Navy (I&E)

Mr. John (Matthew) Harrington
National Environmental Coordinator
U. S. Department of Agriculture
Natural Resources Conservation Service

Ms. Cherie Hutchinson
Office of Standards, Regulations, and Variances
Mine Safety and Health Administration
U. S. Department of Labor

Mr. Steve Kokkinakis
NOAA Program Planning and Integration
U.S. Department of Commerce

Mr. Mark Matusiak
Civil Works Policy and Policy Compliance Division
Office of Water Project Review
U.S. Army Corps of Engineers

Ms. Camille Mittelholtz
Environmental Team Leader
Office of Transportation Policy (P-32)
U.S. Department of Transportation

Frank Monteferrante, Ph.D. Economic Development Administration
U.S. Department of Commerce

Mr. Reid Nelson
Director
Office of Federal Agency Programs
Advisory Council on Historic Preservation

Dr. Charles P. Nicholson
NEPA Policy Program Manager
Environmental Stewardship and Policy
Tennessee Valley Authority

Mr. Ed Pfister
Environmental Program Manager
Office of the Secretary
U.S. Department of Health and Human Services

Mr. Mark Plank
Rural Utilities Service
U.S. Department of Agriculture

Mr. David Reese
USM/OCAO/Occupational Safety and Environmental Programs
Department of Homeland Security

Ms. Marthea Rountree
Staff Level Contact
Office of Federal Activities
U.S. Environmental Protection Agency

Raja Veeramachaneni, Director
Office of Project Development & Environmental Review
Federal Highway Administration

Mr. Willie R. Taylor
Director
Office of Environmental Policy and Compliance
U.S. Department of the Interior

Mr. Jeff C. Wright
Director
Office of Energy Projects
Federal Energy Regulatory Commission

Federal Agencies—Regional Officials

Mr. Ray Aycock
Field Supervisor
U. S. Fish & Wildlife Service

Mr. Jeff Gillespie
Office of Surface Mining
Birmingham Field Office
U. S. Department of Interior

Mr. Gregory L. Hogue
Regional Environmental Officer
Office of Environmental Policy and Compliance
U.S. Department of the Interior

Ms. Cindy J. House-Pearson
Field Office Manager
U. S. Army Corps of Engineers

Mr. Dwight Jackson
U. S. Department of Agriculture, Natural Resources Conservation Service
and Landowner

Mr. Howard Ladner
Biologist
Planning and Environmental Division, Mobile District
U.S. Army Corps of Engineers

Ms. Kathy Lunceford
Biologist
U. S. Fish & Wildlife Services

Mr. Heinz Mueller
Chief of NEPA Program Office
U. S. Environmental Protection Agency, Region 4

Mr. Larry Simpson
Gulf States Marine Fisheries Commission

Dr. William R. Straw
Regional Environmental Officer
Department of Human Services/Federal Emergency Management Agency Region IV

Mr. Homer L. Wilkes
State Conservationist
U. S. Department of Agriculture
Natural Resources Conservation Service

Ms. Sherry Wilson
Director, Birmingham Field Office
Office of Surface Mining

Damon M. Young
Project Manager, Coastal Branch
Regulatory Division, Mobile District
U.S. Army Corps of Engineers

State Agencies

Mr. Bryan Collins
Branch Chief
Mississippi Department of Education

Ms. Trudy Fisher
Executive Director
Mississippi Department of Environmental Quality

Mr. Ron Garavelli
Mississippi Department of Wildlife, Fisheries & Parks

Mr. Paul Hurst
Chief of Staff
Governor's Office
State of Mississippi

Mr. Andrew Ketchings
Governor's Office
State of Mississippi

Mr. William Pennington
Pat Harrison Waterway District

Dr. Sam Polles
Mississippi Department of Wildlife, Fisheries & Parks

Mr. Dennis Riecke
Mississippi Department of Wildlife, Fisheries & Parks

Ms. Krystal Rudolph
Environmental Permits Division
Mississippi Department of Environmental Quality

Mr. Gray Swoope
Mississippi Development Authority

Mr. Patrick Sullivan
Governor's Office
State of Mississippi

Mr. Stan Thieling
Mississippi Department of Environmental Quality

Mr. Bobby Waites
Executive Director
Mississippi Public Utilities Staff

Dr. Bill Walker
Director
Mississippi Department of Marine Resources

Mr. Andrew Whitehurst
Mississippi Museum of Natural Science

Regional and Local Officials and Agencies

Mr. Keith Barnes
Chairman
Kemper County Economic Development Authority

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Mayor of Heidelberg

Mayor Cheri Barry
Mayor of Meridian

Mayor Allen Beaty
Mayor of Scooba

Supervisor Ray Boswell
Supervisor of Lauderdale County

Supervisor Chris Cole
Supervisor of Kemper County

Mayor David Carr
Mayor of Newton

Alderman Theotis Cole
Alderman of Kemper County

Mayor J. D. Davis
Mayor of Chunky

Supervisor John Darnell
Supervisor of Kemper County

Ms. Juanice Evans
President
Kemper County Chamber of Commerce

Supervisor Hank Florey
Supervisor of Lauderdale County

Mayor Eddie Fulton
Mayor of Quitman

Mr. Willie Gillespie
Kemper County Economic Development Authority

Supervisor James Granger
Supervisor of Kemper County

Mayor Homer Hall
Mayor of Dekalb

Mr. John Harris
Meridian City Council

Ms. Dorothy B. Henderson
Burton Water Corporation

Ms. Barbara Henson
Meridian City Council

Mr. Brian Henson
Director
Kemper County Economic Development Authority

Mr. Wayne Henson
General Manager
East Mississippi Electric Power Association

Supervisor Craig Hitt
Supervisor of Lauderdale County

Mayor Elvis Hudson
Mayor of Marion

Mr. Bernard Hulin
Kemper County Economic Development Authority

Mr. Wade Jones
Executive Director
East Mississippi Business Development Corporation

Mr. Kenneth Kingery
Economic Development Authority

Mayor Alton Lightsey
Mayor of Pachuta

Supervisor Mike Luke
Supervisor of Kemper County

Mayor Carl Matthews
Mayor of Montrose

Mayor Jackie McHenry
Mayor of Stonewall

Mr. Rusty McMillan
Mid-Mississippi Development District

Mayor Larry Murray
Mayor of Enterprise

Supervisor Wayman Newell
Supervisor of Lauderdale County

Mayor Tommy Nichols
Mayor of Hickory

Supervisor Joe Norwood
Supervisor of Lauderdale County

Mr. Jesse Palmer
Meridian City Council

Ms. Mary Perry
Meridian City Council

Ms. Jackie Pollock
Kemper County School Board

Mayor Randy Rushing
Mayor of Decatur

Ms. Ann Salter
Kemper County School Board

Mr. John Stewart
Vice Chairman
Kemper County Economic Development Authority

Mr. Ken Storms
Chief Administrative Officer
City of Meridian

Mr. George Thomas
Meridian City Council

Ms. Anita Thompson
Kemper County Economic Development Authority

Mayor James Young
Mayor of Philadelphia

Mayor J. Rodney White
Mayor of Louin

Supervisor Johnny Whitsett
Supervisor of Kemper County

Mayor Charles Williams
Mayor of Shubuta

Ms. Margaret Womble
Kemper County Economic Development Authority

Mr. Jim Woodrick
Review and Compliance Officer
Historic Preservation Division

Native American Tribal Organizations

Mr. Ken Carleton
Tribal Historic Preservation Officer
Mississippi Band of Choctaw Indians

Mr. Bryant Celestine
Historical Officer
Alabama Coushatta Tribe of Texas

Mr. Terry Cole
Tribal Historic Preservation Officer
Choctaw Nation of Oklahoma

Mr. Charles Coleman
Warrior, Tribal Historic Preservation Officer
Thiopthiocco Tribal Town

Dr. Linda Langley
Section 106 Contact
Coushatta Tribe of Louisiana

Mr. Brandt Petrasek
Executive Committee
State and Tribal Government Working

Mr. Willard Steele
Tribal Historic Preservation Officer
Seminole Tribe of Florida

Mr. Robert Thrower
Tribal Historic Preservation Officer
Poarch Band of Creek Indians

Ms. Rovena Yarqee
Historical Officer
Alabama Quassarte Tribal Town of the Creek Nation of Oklahoma

National Nongovernmental Organizations

Mr. Thomas H. Adams
Executive Director
American Coal Ash Association

Mr. David Alberswerth
Senior Energy Policy Advisor
Policy Department
The Wilderness Society

Ms. Anna Aurilio
Director, Washington DC Office
Environmental America

Mr. Robert A. Beck
Executive Vice President
National Coal Council

Ms. Karen Bennett
Vice President, Environmental Affairs
National Mining Association

Mr. Thomas Cassidy
Director of Federal Programs
The Nature Conservancy

Ms. Joy Ditto
Director of Legislative Affairs
American Public Power Association

Ms. Libby Fayad
Counsel
National Parks Conservation Association

Ms. Eileen Fretz
American Rivers

Mr. David Goldstein
Energy Program Director
Natural Resources Defense Council

Mr. David Hawkins
Director, Climate Center
Natural Resources Defense Council

Dr. Allen Hershkowitz
Senior Scientist
New York Urban Program
Natural Resources Defense Council

Mr. Ed Hopkins
Sierra Club

Ms. Rachel Jacobson
Director of Special Funds
National Fish and Wildlife Foundation

Ms. Julie James
Earthjustice

Mr. Fred Krupp
President
National Headquarters
Environmental Defense Fund

Ms. Pamela Lacey
Senior Managing Counsel
American Gas Association

Mr. Jim Lyon
Senior Vice President
National Wildlife Federation

Mr. Richard M. Loughery
Director, Environmental Activities
Edison Electric Institute

Mr. Harry Ng
General Counsel
American Petroleum Institute

Mr. Erich Pica
Director of Economic Programs
Friends of the Earth

Mr. Jim Price
Senior Regional Staff Director
Sierra Club

Mr. Randy Rawson
President
American Boiler Manufacturers Association

Mr. Guy Ray
Ducks Unlimited

Mr. Paul Schwartz
National Policy Coordinator
Clean Water Action

Mr. Frank M. Stewart, President
American Association of Blacks in Energy

Ms. Barbara Bauman Tyran
Director, Washington Relations
Electric Power Research Institute

Mr. Barry K. Worthington
Executive Director
United States Energy Association

Dr. Scott Yaich
Director of Conservation Program
Ducks Unlimited

Mr. Louis Zeller
Blue Ridge Environmental Defense

Regional Nongovernmental Organizations and Governmental Associations

Mr. Will Callaway
Legislative Director
Physicians for Social Responsibility

Mr. Andrew Covington
Chunky Okatibbee Watershed Group

Mr. Rome Emmons
Mississippi Chapter
Coastal Conservation Association

Ms. Ronda Gooden
American Association of Retired Persons
Mississippi State Office

Mr. Mikel Gusa
Mississippi Gulf Fishing Banks

Dr. Mark LaSalle
Pascagoula River Audubon Center
Mississippi Audubon Society

Mr. George Lewis
Mississippi Municipal League

Mr. Louie Miller
Mississippi Sierra Club

Mr. Jay Moon
Mississippi Manufacturers Association

Mr. Jim Murrian
The Nature Conservancy of Mississippi

Mr. Kenneth Nemeth
Executive Director
Southern States Energy Board

Ms. Melissa Pringle
East Mississippi Foothills Land Trust

Dr. Cathy Schropshire
Mississippi Wildlife Federation

Mr. Louis Skrmetta
Gulf Islands Conservancy

Ms. Judy Steckler
Executive Director
Land Trust of the Mississippi Coastal Plain

Mr. Roger Still
Interim Executive Director
Mississippi State Office
National Audubon Society

Mr. Derrick Surrette
Mississippi Supervisors Association

Mr. Blake Wilson
Mississippi Economic Council

Mr. Joel Yelverton
MS Supervisors Association

Libraries

Bay Springs Municipal Library
Jasper County

DeKalb Public Library
Kemper County

Meridian-Lauderdale County Public Library
Lauderdale County

Quitman Public Library
Clarke County

Interested Parties

Mr. Wade Allen
Mr. Jeff Anderson
Mr. Austin Bishop
Mr. Raymond C. Caldwell
Mr. Dan Clay
Mr. Kipp Coddington
Loran & Ann Collins
Mr. Jim Copeland
Naval Air Station Meridian
Mr. Michael D. Correro
Ms. Barbara J. Correro
Mr. Ricky Cox
Mr. John W. Dow
Ms. Connie Eldridge
Ms. Chyrel Vick Francis
Ms. Bernice B. Garrett
Ms. Michelle Graham
Mr. Patrick B. Harper
Mr. Donald B. Harper
Mr. Rod Henderson
Mr. Michael Herrington
Bill & Jeannie Hover
Ms. Mary E. Hudnell
Mr. J. K. Joyner
Mr. James Key
Mr. John R. Kynerd
Ms. Mia Lutchenkov
Environmental Scientist
Analytical Services, Inc.
Mr. Bobbie May
Dr. Mildred McClain
Ms. Sandra Measels
Mr. William Munn
Ms. Susan Myers
Mr. Ed Nave
Ms. Carol Overland
LEGALECTRIC Energy Consulting
Mr. Henry Palmer
Mr. Doug Rowell
Henry & Darlene Rush
Mr. Terry L. Shirley
Mr. Bobby Ray Smith
Mr. Alan G. Smith
Ms. Laura C. Stewart
Mr. Ben Stone
Mr. Queshaun Sudbury
Mr. Samuel W. Talbert
Mr. Earline VW Taylor
Mr. Wallace R. Terry Jr.
Ms. Apphia G. Terry
Mr. James E. Thompson
Mr. Jimmy Todd Thrash
Mr. Mose L. Vick
Mr. Elwood D. Vick
Mr. Joe Waggoner
Mississippi Engineering Group, Inc.
Mr. Ronnie Walton
Mr. Thomas L. Webb
Mr. Doug Wilkerson
Mr. John Williams
Mr. Glover Wingfield, Jr.
Mr. Dale Winstead
Ms. Lisa Winstead

GLOSSARY

100-year floodplain	Land that becomes or will become submerged by a flood that has a chance to occur every 100 years.
7Q10	Seven-day low flow average with a 10-year recurrence interval.
acre-foot	The volume that would cover one acre to a depth of one foot.
aerodynamic diameter	A term used to describe particles with common aerodynamic properties, which avoids the complications associated with varying particle sizes, shapes, and densities. For example, PM_{10} is defined in 40 CFR Part 50 as consisting of particles 10 micrometers or less in aerodynamic diameter, meaning particles that behave aerodynamically like spherical particles of unit density (1 gram per cubic centimeter) having diameters of 10 micrometers or less.
aerosol	A suspension of fine solid or liquid particles in a gas.
aesthetics	The perception of appearance of features in relation to one's sense of beauty.
air dispersion model	A computer program that incorporates a series of mathematical equations used to predict downwind concentrations in the ambient air resulting from emissions of a pollutant. Inputs to a dispersion model include the emission rate; characteristics of the emission release such as stack height, exhaust temperature, and flow rate; and atmospheric dispersion parameters such as wind speed and direction, air temperature, atmospheric stability, and height of the mixed layer.
air quality	The cleanliness of the air as measured by the levels of pollutants relative to standards or guideline levels established to protect human health and welfare. Air quality is often expressed in terms of the pollutant for which concentrations are the highest percentage of a standard (e.g., air quality may be unacceptable if the level of one pollutant is 150% of its standard, even if levels of other pollutants are well below their respective standards).
alluvial	Relating to clay, silt, sand, gravel, or similar detrital material deposited by running water.
alternative	One of two or more things, courses, or propositions to be chosen.
ambient	The surrounding environment or atmosphere.
ambient noise	Background noise associated with a given environment. Ambient noise is typically formed as a composite of sounds from many near and far sources, with no particular dominant sound.
ancillary	Subsidiary or supplementary.
anion	A negatively charged ion.
anticline	A geologic fold that is arch-like in form, with rock layers dipping outward from both sides of the axis, and older rocks in the core. The opposite of syncline.

approximate original contours	Surface configuration achieved by backfilling and grading of the mined area, such that the reclaimed area closely resembles the general surface configuration of the land prior to mining and blends into and complements the drainage pattern of the surrounding terrain.
aquatic	Characteristics of or pertaining to water.
aquifer	A subsurface saturated rock unit (formation, group of formations, or part of a formation) of sufficient permeability to transmit groundwater and yield usable quantities of water to wells and springs.
aquitard	Low permeability units that can restrict the flow of groundwater from one aquifer to another.
archaeological resources	Material remains of past activity.
area of potential effect (APE)	The geographic region that may be impacted as a result of the construction and operation of the Proposed Action or alternatives.
arterial highway	Highway generally characterized by its ability to quickly move a relatively large volume of traffic, but often with restricted capacities to serve abutting properties. The arterial system typically provides for high travel. The rural and urban arterial highway systems are connected to provide continuous through movements.
artesian	Groundwater conditions in which water in wells rises above its level in the aquifer, including conditions in which groundwater rises to the ground surface or above.
ash	The mineral content of a product remaining after complete combustion.
ash management unit	Area designated within the generation facility boundary for the management of ash for beneficial use or storage.
attainment	Those areas of the U. S. that meet National Ambient Air Quality Standards as determined by measurements of air pollutant levels.
attenuate	To lessen the amount of force, magnitude, or value of something.
A-weighted scale	Assigns a weight to sound frequencies that is related to how sensitive the human ear is to each sound frequency. Frequencies that are less sensitive to the human ear are weighted less than those for which the ear is more sensitive. A-weighted measurements indicate the potential damage a noise might cause to hearing.
baghouse	An air pollution control device that filters particulate emissions, consisting of a bank of bags that function like a vacuum cleaner bag to intercept particles that are mostly larger than 10 micrometers in aerodynamic diameter.
baseline	Existing conditions of the environment.
bedrock	The rock of Earth’s crust that is below the soil and largely unweathered.
bench	A leveled area near the pit that provides a safe location for the equipment to operate.
beneficiation	The process of washing or otherwise cleaning coal to increase the energy content by reducing the ash content.

benthic invertebrates	An animal lacking a spinal column and living on lake and stream bottoms.
berm	A mound or wall of earth.
best management practice (BMP)	A practice, or combination of practices, that is determined to be the most effective, practical means of preventing or reducing non-point source pollution to a level compatible with maintaining water quality.
biocide	A substance (e.g., chlorine) that is toxic or lethal to many organisms and is used to treat water.
biomass	The amount of living matter, as in a unit area or volume of habitat.
blasting	Use of explosives to loosen consolidated overburden materials or lignite.
blowdown	Portion of circulating cooling tower water (or steam or water removed from a boiler) removed to maintain the amount of dissolved solids and other impurities at an acceptable level.
boiler	A pressurized system in which water is vaporized to steam, the desired end product, by heat transferred from a source of higher temperature, usually the products of combustion from burning fuels.
brackish	Water that has high concentrations of salts, but that may still be suitable for some uses.
brine	Water saturated with salt.
building downwash	The downward movement of an elevated plume toward the area of low pressure created on the lee side of a structure in the wake around which the air flows.
capacity factor	The percentage of energy output during a period of time, compared to the energy that would have been produced if the equipment operated at its maximum power throughout the period.
carbon dioxide (CO_2)	A colorless, odorless, nonpoisonous gas that results from fossil fuel combustion and is normally a part of the ambient air.
carbon monoxide (CO)	A colorless, odorless, poisonous gas produced by incomplete fossil fuel combustion.
carcinogenic	Capable of producing or inducing cancer.
cation	A positively charged ion.
census tract	A small, relatively permanent statistical subdivision of a county. Census tracts, which average about 4,000 inhabitants, are designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions.
Class I area	Under the Clean Air Act, a Class I area is one in which visibility is protected more stringently than under the national ambient air quality standards, with only a small increase in pollution allowed. Class I areas include national parks, wilderness areas, monuments, and other areas of special national and cultural significance. Only very slight deterioration of air quality is allowed in Class I areas.

Class II area	Most of the country not designated as Class I is designated as Class II. Class II areas are generally cleaner than air quality standards, and moderate increases in new pollution are allowed after a regulatory mandated impacts review.
Clean Water Act	Primary federal law governing water pollution. The Clean Water Act's (CWA's) goals include eliminating toxic substance releases to water, eliminating additional water pollution, and ensuring that surface waters meet standards necessary for human sports and recreation (see National Pollutant Discharge Elimination System).
coal gasification	A process that converts coal into a gaseous product, which involves crushing coal into a powder and heating the powder in the presence of steam and oxygen in a reducing or sub-stoichimetric atmosphere. After impurities (e.g., sulfur) are removed, the gas can be used as a fuel or further processed and concentrated into a chemical or liquid fuel.
Combined-cycle electric power plant	A power plant that uses both a steam turbine generator and a combustion turbine generator at one location to produce electricity.
combustion turbine (CT)	A gas turbine that burns natural gas, fuel oil, or other similar fuels and drives a turbine and generator to produce electricity, and is typically used as the primary generator of electricity in a combined cycle installation.
combustor	Equipment in which coal or other fuel is burned at high temperatures.
conductivity	The ability to carry an electrical charge in ions. The conductivity of aqueous solutions is increased by dissolved salts, and thus is a measure of the amount of ionized salts in solution.
confined aquifer	An aquifer that is bounded by two confining units, and in which the water level in wells usually rises above the top of the aquifer.
confining unit	A geologic formation or bed that has lower permeability than layers above and below it, and therefore restricts vertical water movement. (Confining units are also called aquitards.)
conservative	As applied to calculations or estimates, assumptions that would tend to over-estimate the calculated or estimated impact or cause the impact to be at the high end of the plausible range.
contaminant	A substance that contaminates (pollutes) air, soil, or water. It may also be a hazardous substance that does not occur naturally or that occurs at levels greater than those that occur naturally in the surrounding environment.
contamination	The intrusion of undesirable elements (unwanted physical, chemical, biological, or radiological substances; or matter that has an adverse effect) to air, water, or land.
contiguous	Adjacent or touching.
continuous equivalent sound level	Steady-state decibel level which would produce the same A-weighted sound energy over a stated period of time as an equivalent sound over time.
conveyor system	Method used to transport material in a continuous fashion, consisting of a drive, belt, pulleys, and conveyor stands. Material is placed on the belt and is moved by rotating the belt over pulleys.

cooling tower	A structure that cools heated condenser water by circulating the water along a series of louvers and baffles through which cool, outside air convects naturally or is forced by large fans.
cooling tower drift	The dispersion and deposition of wet or dry aerosols emitted from natural or mechanical draft cooling towers.
cooling water	Water that is heated as a result of being used to cool steam and condense it to water.
corona noise	Noise caused by partial discharges on insulators and in air surrounding electrical conductors of overhead power lines. Corona noise level is dependent on weather conditions.
criteria	Standards on which a judgment or decision may be based.
croplands	Lands used for growing agricultural crops such as soybeans and corn.
cultural resources	Archaeological sites, historical sites (e.g., standing structures), Native-American resources, and paleontological resources.
cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.
day-night	A-weighted equivalent decibel level for a 24-hour period with an additional 10-dB.
decibel (dB)	A unit for expressing the relative intensity of sounds on a logarithmic scale from zero for the average least perceptible sound to about 130 for the average level at which sound causes pain to humans.
deciduous	Shedding leaves at a certain season.
demand-side management	Activities which influence electricity use on the customer’s side of the meter.
density	Ratio of a substance's weight relative to its volume.
dissolution	Process of dissolving a substance into a liquid.
disturbed area	Any area where vegetation, topsoil, or overburden is removed or upon which spoil is placed.
diversions	The amount of water taken from a stream, spring, or well by channel, embankment, or other man-made structure constructed for the purpose of diverting water from one area to another.
dragline	An electric-powered excavating machine used for digging or removal of overburden with a large capacity bucket that is lowered and raised by dragging in, paying out, hoisting, and lowering the wire rope attached to the bucket.
drawdown	The process by which the water table adjacent to a well is drawn down after active pumping from an aquifer.

dredged material	Material that is dredged or excavated from waters of the United States, including wetlands.
duct firing	Supplemental firing of fuel in burners within a heat recovery steam generator (HRSG) as a means of increasing steam production or temperature and, correspondingly, power generated by a steam turbine.
ecosystem	A community and its environment treated together as a functional system of complementary relationships involving the transfer and circulation of energy and matter.
effects	The consequences or results of an action; synonymous with impacts. Includes direct effects caused by an action that occur at the same time and place, and indirect effects caused by an action that are later in time or further removed in distance but still reasonably foreseeable. Potential effects can be adverse, beneficial, cumulative, irretrievable, irreversible, long-term, or short-term.
effluent	Waste stream flowing into the atmosphere, surface water, groundwater, or soil.
electric and magnetic fields (EMF)	Two types of energy fields which are emitted from any device that generates, transmits, or uses electricity.
emergent	Erect, rooted herbaceous plants, such as cattails and bulrush, which dominate wetlands.
emission	A material discharged into the atmosphere from a source operation or activity.
endangered species	Any species in danger of extinction throughout all or a significant portion of its range or territory.
environmental justice	The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, state, local, and tribal programs and policies. Executive Order 12898 directs Federal agencies to make achieving environmental justice part of their missions by identifying and addressing disproportionately high and adverse effects of agency programs, policies, and activities on minority and low-income populations.
epicenter	Area on the earth’s surface directly above the focus of an earthquake.
equivalent sound (L_{eq})	Weighting imposed on the equivalent sound levels occurring during nighttime.
erosion	The process by which particles of soils or other material are removed and transported by water, wind, and/or gravity to some other area.
evaporation	A physical process by which a liquid is transformed into a gaseous state.
evapotranspiration	The amount of water removed from a land area by the combination of direct evaporation and plant transpiration.
fault	A fracture or fracture zone in rock along which the sides have been displaced vertically or horizontally relative to one another.

fecal coliforms	A large and varied group of bacteria flourishing in the intestines and feces of warm-blooded animals, including man. Large amounts of fecal bacteria in water indicate sewage, feedlot, or other animal waste pollution.
fill material	Material used for the primary purpose of replacing an aquatic or wetland area with dry land, or changing the bottom elevation of a waterway.
floodplain	Flat or nearly flat land adjacent to a stream or river that experiences occasional or periodic flooding.
flue gas	Residual gases after combustion that are vented to the atmosphere through a flue or chimney.
fluvial	Relating to, or produced by, stream or river action.
fly ash	The small ash particles that are carried out of a combustor with the flue gas.
formation	The primary unit associated with formal geological mapping of an area. Formations possess distinctive geological features and can be combined into “groups” or subdivided into “members.”
fossil fuel	Coal, including lignite, oil, or natural gas, formed from vegetation and animals under high pressure and temperatures during a past geological age.
fragipan horizon	A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard and has a higher bulk density than the horizon or horizons above.
frequency	The number of cycles of completed occurrences per unit of time of a sound wave, most often measured in Hertz.
fresh water	Water with a low concentration of salts (typically less than 1,000 parts per million of dissolved solids).
fugitive dust	Particulate matter composed of soil; can include emissions from haul roads, wind erosion of exposed surfaces, and other activities in which soil is removed and redistributed.
fugitive emissions	Air pollutant emissions that cannot be traced to a particular point source.
gasification	Conversion process of fuel to gas or a gas-like phase.
Gaussian	Concentrations of pollutants downwind of a source are assumed to form a normal distribution (i.e., bell-shaped curve) from the centerline of the plume in the vertical and lateral directions.
generation facility	Electrical power generating station.
geographic	Belonging to or characteristic of a particular region.
geologic sequestration	CO_2 capture and storage in deep underground geologic formations.

global warming	The theory that certain gases such as carbon dioxide, methane, and chlorofluorocarbon in the earth's atmosphere effectively restrict radiation cooling, thus elevating the earth's ambient temperatures or creating a greenhouse effect.
greenhouse gas (GHG)	Gas that contributes to the greenhouse effect by absorbing infrared radiation and ultimately warming the atmosphere. GHGs include water vapor, nitrous oxide (NO_x), methane, CO_2, ozone (O_3), halogenated fluorocarbons, hydrofluorocarbons, and perfluorinated carbons.
groundwater	Water within a geologic stratum that supplies wells and springs.
habitat	The environment occupied by individuals of a particular species, population, or community.
hazardous air pollutant (HAP)	Air pollutants that are not covered by ambient air quality standards but that present, or may present, a threat of adverse health or environmental effects. These include an initial list of 189 chemicals designated by Congress that is subject to revision by the EPA.
hazardous waste	A by-product of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appears on special Environmental Protection Agency lists.
haze	Atmospheric moisture, dust, smoke, and vapor suspended to form a partly opaque condition.
heat rate	Amount of heat required (usually in Btu) to produce an amount of electricity (usually in kW-hr).
heavy metals	Natural trace elements such as lead, mercury, cadmium, and nickel, that are leachable and potentially toxic.
herbicide	Any substance or mixture of substances intended to prevent the growth of or destroy unwanted plants or vegetation.
heterogeneity	The quality or state of consisting of dissimilar ingredients or constituents.
highwall	The face of exposed overburden and lignite in an open cut of a surface mine.
historic property	Prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places.
historic site	A site that is more than 50 years old.
hydrology	A science dealing with the properties, distribution, and circulation of water on the surface of the land, in the soil and the underlying rocks, and in the atmosphere.
impacts	The consequences or results of an action; synonymous with effects.
impoundment	A body of water confined by a dam, dike, floodgate, or other barrier.

industrial and/or process waste	Any liquid, solid, semisolid, or gaseous waste generated when manufacturing a product or performing a service. Examples include cutting oils; paint sludges; equipment cleanings; metallic dust sweepings; used solvents from parts cleaners; and off-specification, contaminated, or recalled wholesale or retail products. The following wastes are not industrial process wastes: uncontaminated packaging materials, uncontaminated machinery components, general household waste, landscape waste, and construction or demolition debris.
infiltration	The process of water entering the soil at the ground surface and the ensuing movement downward. Infiltration becomes percolation when water has moved below the depth at which it can return to the atmosphere by evaporation or evapotranspiration.
infrastructure	The underlying foundation of basic framework, as in a system or organization.
integrated gasification combined-cycle (IGCC)	A process that uses synthesis gas derived from coal to drive a gas combustion turbine and exhaust gas from the gas turbine to generate steam from water to drive a steam turbine.
integrated resource planning	A utility planning process that evaluates supply-side resources and demand-side resources on a level field to reliably meet the future energy needs of customers.
irretrievable commitments	Those that are lost for a period of time.
irreversible commitments	Those that cannot be reversed, except perhaps in the extreme long term.
issue	An expressed concern regarding the scope and analyses included in an EIS.
landfill	Waste disposal method where waste material is stockpiled until the landfill is full, at which time the material is buried and reclaimed in accordance with the applicable regulations for that type of landfill.
laydown area	Material and equipment storage area during the construction phase of a project.
leachate	Solution or product obtained by leaching, in which a substance is dissolved by the action of a percolating liquid.
level of service (LOS)	Measure of traffic operation effectiveness on a particular roadway facility type.
lignite	A brownish-black coal in which the alteration of vegetal matter has proceeded farther than peat, but not so far as sub-bituminous coal.
lignite seam	A distinct layer of lignite with the potential to be mined
lithic scatters	Concentrations of waste flakes resulting from the manufacture of stone tools.
lithological	Pertaining to the study of rocks and rock formations.
loam	A soil composed of a mixture of clay, silt, sand, and organic matter.
long-term	Occurring over or involving a relatively long period time.

low income population	A community that has a proportion of low-income population greater than the respective average. Low income populations in an affected area should be identified with the annual statistical poverty thresholds from Bureau of the Census Current Population Reports, Series P-60, Income and Poverty.
magnitude (of an earthquake)	A quantity that is characteristic of the total energy released by an earthquake. Magnitude is determined by taking the common logarithm of the largest ground motion recorded on a seismograph during the arrival of a seismic wave type and applying a standard correction factor for distance to the epicenter. A one-unit increase in magnitude (e.g., from magnitude 6 to magnitude 7) represents a 30-fold increase in the amount of energy released.
makeup pond	Pond used to store makeup for cooling water.
Maximum contaminant level goal (MCLG)	The maximum concentration of a substance in drinking water at which there is no known or anticipated adverse effect on human health, and which allows an adequate margin of safety, as determined by the U.S. Environmental Protection Agency.
mean sea level	Average ocean surface height at a particular location for all stages of the tide over a specified time interval (generally 19 years).
Megawatt (MW)	Unit of power equal to one million watts or 1,000 kilowatts (kW). A power plant with 1 MW of capacity operating continuously for a year could supply electricity to approximately 750 households.
metamorphic rocks	Rocks that have undergone chemical or structural changes produced by an increase in heat and temperature or by replacement of elements by hot, chemically active fluids.
meteorology	The science dealing with weather and weather conditions.
minority	Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.
minority population	Identified where either the affected area's minority population exceeds 50 percent or the affected area's minority population percentage is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.
mitigation	Efforts to lessen the severity or to reduce adverse impacts: including avoiding the impact altogether by not taking a certain action or parts of an action; minimizing impacts by limiting the degree or magnitude of the action; repairing, rehabilitating or restoring the affected environment; reducing or eliminating the impact over time by preservation; and compensating for the impact by replacing or providing substitute resources or environments.
mixing height	The height in the lower atmosphere within which relatively vigorous mixing of pollutant emissions occurs.
monitoring	Periodic or continuous determination of the amount of substances present in the environment.

National Ambient Air Quality Standards (NAAQS)	Uniform, national air quality standards established by the Environmental Protection Agency that restrict ambient levels of certain pollutants to protect public health (primary standards) or public welfare (secondary standards). Standards have been set for ozone, carbon monoxide, particulates, sulfur dioxide, nitrogen dioxide, and lead.
National Energy Policy	The National Energy Policy (NEP), developed by the National Energy Policy Development Group in 2001 with members of the President's cabinet, is based on three principles: provide a long-term, comprehensive energy strategy; advance new, environmentally-friendly technologies to increase energy supplies and encourage cleaner, more efficient energy use; and seek to raise the living standards of the American people, recognizing that to do so our country must fully integrate its energy, environmental, and economic policies.
National Environmental Policy Act	Signed into law on January 1, 1970, the National Environmental Policy Act (NEPA) declared a national policy to protect the environment and created the Council on Environmental Quality (CEQ) in the Executive Office of the President. To implement the national policy, NEPA requires that environmental factors be considered when federal agencies make decisions, and that a detailed statement of environmental impacts be prepared for all major federal actions significantly affecting the human environment.
National Oceanic and Atmospheric Administration	Department of Commerce agency focused on the condition of the oceans and atmosphere. NOAA divisions include the National Weather Service, the National Hurricane Center, and the National Marine Fisheries Service.
National Pollutant Discharge Elimination System	Provision of the Clean Water Act that prohibits discharge of pollutants into U.S. waters unless a special permit is issued by EPA, a state, or where delegated, a tribal government on a Native American reservation, abbreviated NPDES.
native species	Species normally indigenous to an area; not introduced by man.
new source performance standards (NSPS)	Regulation under Section 111 of the Clean Air Act enforcing stringent emission standards for power plants constructed on or after January 30, 2004.
nitrogen oxides (NO_x)	A product of combustion by mobile and stationary sources and a major contributor to the formation of ozone in the troposphere.
noise	Any sound that is undesirable because it interferes with speech and hearing; if intense enough, it can damage hearing.
nonattainment	An area that does not meet air quality standards set by the Clean Air Act for specified localities and time periods. Locations where pollutant concentrations are greater than the NAAQS.
nonpoint sources	Pollution sources that are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet. The pollutants are generally carried off the land by stormwater runoff.
notice of intent (NOI)	Notice that an environmental impact statement will be prepared and considered, and is published in the Federal Register as soon as practicable as an agency knows that an EIS is required for a proposed action.

overburden	Material that lies above the area of economic or scientific interest, such as the rock, soil, and ecosystem that lies above the coal seam.
oxidized overburden	Overburden which has been exposed to oxygen, resulting in the oxidation (loss of electrons) of many minerals.
ozone (O_3)	A form of oxygen found naturally in the stratosphere and that provides a protective layer for shielding the Earth from ultraviolet radiation.
palustrine	Living or thriving in a marshy environment.
particulate matter (PM)	Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog, found in air or emissions.
particulates	Small particles of solid or liquid materials that, when suspended in the atmosphere, constitute an atmospheric pollutant.
peak demand	The maximum rate of electricity use, expressed in kW.
peaking capacity	Capacity that is available for use and used to meet peak load, but usually designed to operate for relatively short periods of time.
pedogenic	Having to do with soil horizons.
permeability	Rate at which fluids flow through the subsurface and reflects the degree to which pore space is connected.
pH	A measure of the relative acidity or alkalinity of a solution, expressed on a scale from 0 to 14, with the neutral point at 7. Acid solutions have pH values lower than 7, and basic (i.e., alkaline) solutions have pH values higher than 7.
piezometer	An instrument for measuring pressure or compressibility of a material subjected to hydrostatic pressure.
Plume	A flowing, often somewhat conical, trail of emissions from a continuous point source.
point sources	A stationary location or fixed facility from which pollutants are discharged or emitted. Also, any single identifiable source of pollution, for example, a pipe, ditch, or stack.
postmining land use	The land use that is selected by the landowner for use after the mining and reclamation process has been completed.
potable water	Water that is safe and satisfactory for drinking and cooking.
potentiometric surface	Imaginary surface defined by the elevations to which the groundwater in an aquifer would rise in wells completed in the aquifer.
Prevention of Significant Deterioration (PSD)	An Environmental Protection Agency program in which federal or state permits are required that are intended to restrict emissions for new or modified sources in places where air quality is already better than required to meet primary and secondary ambient air quality standards.

prime farmland	Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion.
proposed action	The activity proposed to accomplish a Federal agency's purpose and need. An EIS analyzes the environmental impacts of the Proposed Action. A proposed action includes the project and its related support activities (preconstruction, construction, and operation, along with post-operational requirements).
pulverized coal	Crushed coal used to fuel a coal power plant. Currently the principal electric generation technology in the US
qualitative	Analysis based on professional judgment of quality, generally lacking hard data.
quantitative	Analysis based on hard data or numbers that can generally be repeated.
recharge	The movement of water from an unsaturated zone to a saturated zone.
reclaimed effluent	Treated effluent, typically from a municipal wastewater treatment plant, that is beneficially reused. Examples of reuses include agricultural irrigation, dust control, watering of golf courses, cooling tower makeup, and other industrial uses.
reclamation	Restoration of land, water bodies, or other affected environmental resources to the original use, or equal to or better alternate use.
reconstructed soil	Overburden material that consists of suitable materials, based on physical and chemical parameters analyzed during a comparison of the native soils and the oxidized portion of the overburden material, selected to replace the native soils as a topsoil-substitute material.
record of decision (ROD)	The concluding document of the NEPA process, as based on the conclusions of the EIS process, which states the agency's decision for the preferred alternative, along with its rationale for its selection, including the major environmental reasons.
recycled	The process of reusing or reprocessing a material after its initial use.
reference concentrations	Estimates of continuous inhalation exposure to human populations (including sensitive subgroups) that are likely to be without an appreciable risk of deleterious effects during a lifetime.
region of influence (ROI)	The physical area that bounds the environmental, sociologic, economic, or cultural features of interest for the purpose of analysis.
revegetation	The process of establishing new vegetative cover.
Richter scale	A measure of earthquake magnitude developed by Charles Richter.
riparian	Pertaining to, situated, or dwelling on the bank of a river or other body of water.
ruderal area	Heavily disturbed land, such as along roadsides, where vegetation is typically weedy.
runoff	The portion of precipitation falling on the land that flows over the surface, rather than soaking into the surface.

saline	Describes water with high concentrations of salts (typically more than 10,000 parts per million dissolved solids), making it unsuitable for use.
scoping meeting	An early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action.
scrubber	A device that removes noxious gases from flue gases (such as sulfur dioxide) by using absorbents suspended in liquid solution.
scrub-shrub	Woody vegetation less than 20 ft tall. Species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions.
secondary drinking water standards	Non-enforceable Federal guidelines regarding cosmetic effects (e.g., tooth or skin discoloration) or aesthetic effects (e.g., taste, odor, or color) of drinking water.
sediment	Material that has been eroded, transported, and deposited by erosional processes, typically wind, water, and/or glaciers.
sediment control	The planning and construction of facilities for prevention of excessive damage by water in flood stages.
sedimentary rocks	Rocks formed by the accumulation of sediment in water or from air. Sandstone, chert, limestone, dolomite, shale, siltstone, and mudstone are types of sedimentary rocks identified in the EIS. They are differentiated by chemistry and texture.
sedimentation	The process or action of depositing sediment.
seedling	A young plant developing from a seed. In a commercial forestry context, a live tree less than 1.0 inch in diameter.
seismic	Pertaining to, characteristic of, or produced by earthquakes or earth vibrations.
seismicity	A seismic event or activity such as an earthquake or earth tremor; seismic action.
selective catalytic reduction (SCR)	A system to reduce NO_x emissions by injecting a reagent, such as ammonia, into exhaust gas to convert NO_x emissions to nitrogen gas and water via a chemical reduction reaction.
sensitive receptor	As used in this EIS, any specific resource (i.e., population or facility) that would be more susceptible to the effects of the impact of implementing the proposed action than would otherwise be.
sequestration	As used in this EIS, the process of injecting CO_2, which has been compressed into a liquid state, into the deep subsurface, potentially isolating CO_2 from the atmosphere for centuries. While the technologies currently exist to directly inject CO_2 into the deep ocean, the knowledge base is inadequate to determine what biological, physical, or chemical impacts might occur from interactions with the marine ecosystem.
short-term	Occurring over or involving a short period of time.
significant	As used in an EIS, a measure of the severity of an impact, based on the setting, timing, and intensity of the impact.

sludge	A semi-solid residue containing a mixture of solid waste material and water from air or water treatment processes.
slurry	A watery mixture or suspension of fine solids, not thick enough to consolidate as a sludge.
soil	A dynamic natural medium composed of mineral and organic materials in which plants grow.
soil amendments	Fertilizers and other materials added to soil to make it suitable for prescribed uses.
solubility	Ability or tendency of one substance to dissolve into another at a given temperature and pressure.
sound pressure	The physical force from a sound wave that affects the human ear, typically discussed in terms of decibels (dB).
sour water	Water with dissolved sulfur compounds and other contaminants condensed from synthesis gas (syngas).
spill prevention control and countermeasure (SPCC) plan	A plan that is implemented to protect navigable waters of the US from harmful quantities of petroleum discharges.
spoil	Overburden material from the mined—out pit, which would be utilized to backfill an open pit, or otherwise be used to achieve original topography.
spring	A location on the land surface or the bed of a surface water body where groundwater emerges from rock or soil without artificial assistance.
stratification	The seasonal layering of water within a reservoir due to differences in temperature or chemical characteristics of the layers.
streams	A continually, frequently, or infrequently flowing body of water that follows a defined course. The three classes of streams are: ephemeral: a channel that carries water only during and immediately following rainstorms, intermittent: a watercourse that flows in a well-defined channel during the wet seasons of the year, but not the entire year. perennial: a watercourse that flows throughout the year or nearly 90 percent of the time in a well-defined channel.
sub-bituminous	A type of coal, which is used primarily as fuel for electrical power generation, whose properties range between those of lignite and those of bituminous coal. At the lower end of the range it may be dull, dark brown to black, soft, and crumbly. At the higher end of the range it may be bright, jet black, hard, and relatively strong. Sub-bituminous coal contains 20 to 30% moisture by weight. Heating value varies from 7,000 Btu/lb to slightly over 9,000 Btu/lb.
subsidence	A sinking of a part of the surface topography.
substation	An assemblage of equipment for the purposes of switching and/or changing or regulating the voltage of electricity.

substrates	The base or material to which a plant is attached and from which it receives nutrients.
sulfur dioxide (SO_2)	A heavy, pungent, colorless, gaseous air pollutant formed primarily by the combustion of fossil-fuel plants.
supercritical CO_2	CO_2 usually behaves as a gas in air or as a solid in dry ice. If the temperature and pressure are both increased (above its supercritical temperature of 88°F [31.1°C] and 73 Atmosphere [1073 psi]), it can adopt properties midway between a gas and a liquid, such that it expands to fill its container like a gas, but has a density like that of a liquid.
surface water	Streams, rivers, ponds, lakes, and man-made reservoirs.
syngas	Synthesis gas. Gas mixture containing varying amounts of carbon monoxide (CO) and hydrogen (H_2) generated by the gasification of a carbon-containing fuel.
threatened species	A species that is likely to become an endangered species within the foreseeable future throughout all or a significant part of its range.
topography	The configuration of a surface including its relief and position of the natural and manmade features.
topsoil	The upper native soil layer, usually consisting of the A and E horizons.
transmission corridor	Area used to provide separation between the transmission lines and the general public and to provide access to the transmission lines for construction and maintenance.
transmissivity	The quality of transmitting groundwater through a geologic stratum or formation.
turbidity	Defined as capacity of material suspended in water to scatter light. Highly turbid water is often called muddy; although all manner of suspended particles contribute to turbidity.
turbine	A machine for directly converting the kinetic energy and/or thermal energy of a flowing fluid (air, hot gas, steam, or water) into useful rotational energy.
understory	Saplings, shrubs, forbs, and other low-growing vegetation present in a forest.
upconing	Vertical upward intrusion from lower water into a shallower groundwater zone caused by pressure reductions in the shallower groundwater zone; usually applies when water in the deeper zone is denser.
upland	The higher parts of a region, not closely associated with streams or lakes.
upset or upset condition	An unplanned or unpredictable failure of process components or subsystems that leads to an overall malfunction or temporary shutdown of the power plant or subsystem while an issue with a component is corrected.
vibration	Force that oscillates about a specified reference point. Vibration is commonly expressed in terms of frequency such as cycles per second (cps), Hertz (Hz), cycles per minute (cpm), and strokes per minute (spm).
viewshed	A non-managed area with aesthetic value.

volatile organic compounds (VOCs)	Any organic compound that participates in atmospheric photochemical reactions except for those designated by the EPA as having negligible reactivity.
wastewater	A combination of liquid and water-carried wastes from residences, commercial buildings, and/or industrial facilities.
water table	(1) The upper limit of the saturated zone (the portion of the ground wholly saturated with water). (2) The upper surface of a zone of saturation above which the majority of pore spaces and fractures are less than 100 percent saturated with water most of the time (unsaturated zone) and below which the opposite is true (saturated zone).
watershed	A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.
wetlands	Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Indicators of wetland include types of plants, soil characteristics, and hydrology of the area. Wetlands generally include swamps, marshes, bogs and similar areas.
wind rose	Circular diagram that illustrates the relative frequency of wind speeds for each compass direction based on a time interval.
worst-case	A situation in which the combination of factors that would produce the worst potential impact on the environment.
zero liquid discharge system	Process separates solids and dissolved constituents from the plant wastewater and allows the treated water to be recycled or reused in the industrial process, resulting in no discharge of industrial process wastewater to the environment.

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