2.0 Affected Environment

The site proposed by System Energy Resources, Inc. (SERI) for an early site permit (ESP) is located in Claiborne County, Mississippi, within the existing boundaries of the currently operating Grand Gulf Nuclear Station (GGNS) site. The site is on the east bank of the Mississippi River at River Mile 406, approximately 40 km (25 mi) south of Vicksburg, Mississippi and 60 km (37 mi) north-northeast of Natchez, Mississippi. The proposed Grand Gulf ESP facility location is described in Section 2.1, with the land, meteorology and air quality, geology, radiological environment, water, ecology, socioeconomics, historic and cultural resources, and environmental justice conditions of the site presented in Sections 2.2 through 2.10, respectively. Section 2.11 examines related Federal projects, and references are presented in Section 2.12.

To distinguish the areas discussed, "Grand Gulf site" refers to the entire 850-ha (2100-ac) property upon which GGNS Unit 1 and all existing facilities are located as well as the proposed Grand Gulf ESP facility. This environmental impact statement (EIS) refers to the "Grand Gulf site" for the entire property, "Grand Gulf Nuclear Station" for the existing facilities, and "Grand Gulf ESP facility/site" for the proposed facilities and area.

2.1 Site Location

SERI's proposed ESP site is within the Grand Gulf site. The Grand Gulf site is located in rural Claiborne County and is accessible by both river and road. Public transportation routes are limited within the site vicinity. The major highway in the vicinity of the Grand Gulf site is U.S. Highway 61, which passes by on the east-southeast. U.S. Highway 61 parallels the Mississippi River from New Orleans, Louisiana, to St. Louis, Missouri, and is approximately 7.2 km (4.5 mi) from the Grand Gulf site at the closest point. From Port Gibson, the highway goes north to Vicksburg, Mississippi, and south-southwest to Natchez, Mississippi. A section of the Natchez Trace Parkway passes approximately 10 km (6 mi) southeast of the Grand Gulf site running southwest toward Natchez and to the northeast to Jackson. State Highway 18 runs east from Port Gibson to Jackson. A number of county and rural roads are in the vicinity of the site. Figure 2-1 shows the area within a 10-km (6-mi) radius of the proposed Grand Gulf ESP facility.

Figure 1-1 shows the location of the Grand Gulf ESP site in relation to the counties and larger cities and towns in the region–the area within a radius of 80 km (50 mi) from the center of the proposed power block. The Grand Gulf ESP site consists primarily of woodlands and former farms as well as two lakes, Hamilton Lake and Gin Lake. These lakes were once in the channel of the Mississippi River and have an average depth of 2 to 3 m (8 to 10 ft). The land in the vicinity of the Grand Gulf site is mostly rural.

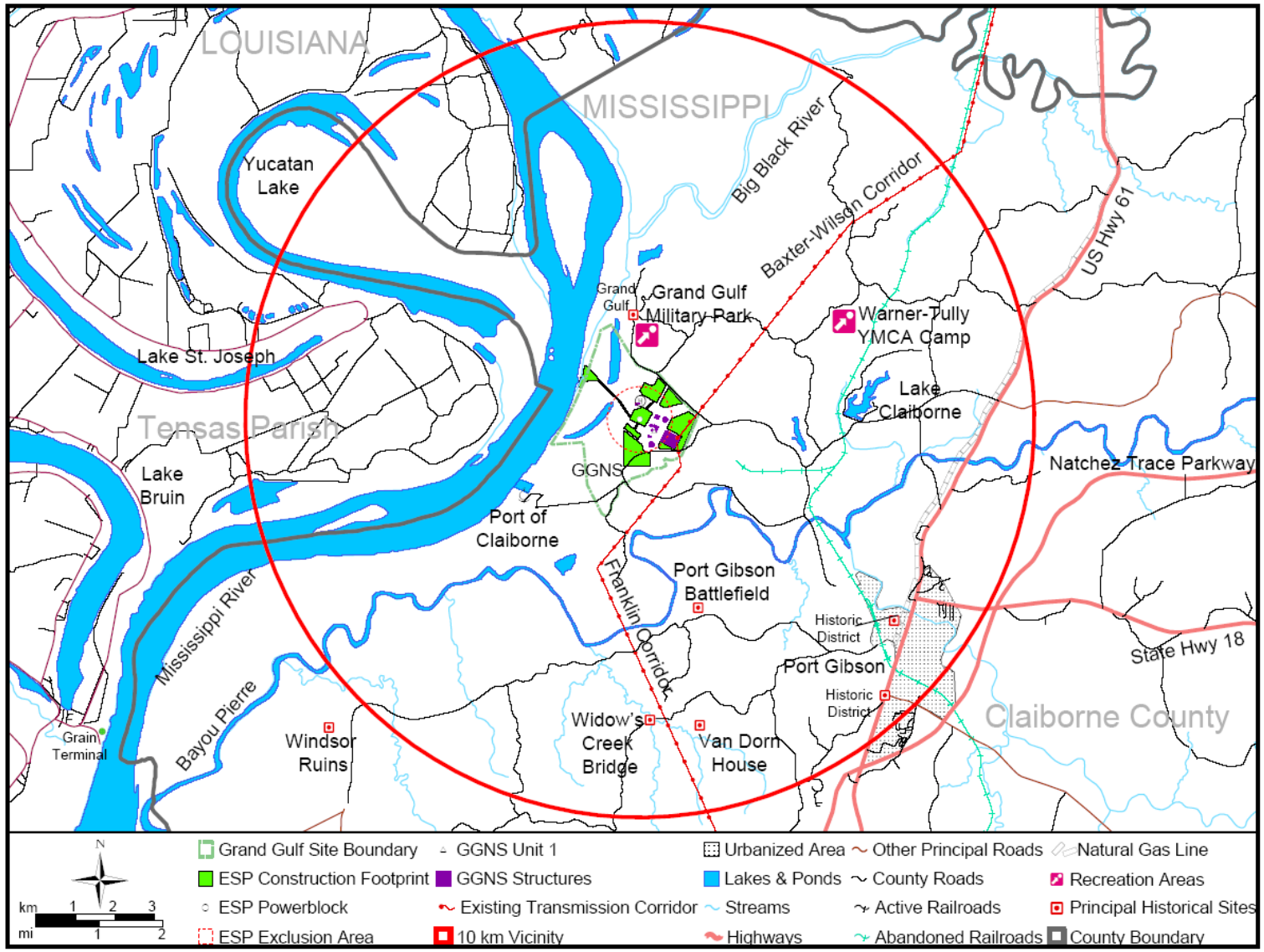

Figure 2-1. Map Showing Location and Vicinity within 10 Kilometers (6 Miles) of the Proposed Grand Gulf Early Site Permit Site

The western half of the site is the Mississippi Alluvial Valley, consisting of materials deposited by the Mississippi River and extending eastward from the river about 1.3 km (0.8 mi). The area is generally at elevations of 17 to 23 m (55 to 75 ft) above mean sea level (MSL). The eastern half of the site is rough and irregular with steep slopes and deeply cut stream valleys and drainage courses. Ground elevations in this portion of the Grand Gulf ESP site range from 24.4 m (80 ft) above MSL to more than 61 m (200 ft) above MSL inland. Elevations of about 122 m (400 ft) above MSL occur on the hilltops east and northeast of the site. Grade elevation for the existing GGNS facility structures is 40.4 m (132.5 ft) above MSL (SERI 2005).

2.2 Land

The Grand Gulf ESP site is 162 ha (400 ac) located on a portion of the Grand Gulf site within Claiborne County, Mississippi, approximately 10 km (6 mi) northwest of Port Gibson, the county seat. Claiborne County lies in southwestern Mississippi and is bordered on the west by the Mississippi River and Tensas Parish, Louisiana, on the north by Warren County, on the east by Hinds and Copiah counties, and on the south by Jefferson County. This section describes the land uses of the site, vicinity, and region affected by the Grand Gulf ESP facility.

2.2.1 Site and Vicinity

The Grand Gulf ESP facility would be located on the existing Grand Gulf site, slightly to the west and north of the GGNS power block. The Grand Gulf site encompasses approximately 850 ha (2100 ac) and lies within the property boundary shown in Figure 2-1. SERI, South Mississippi Electric Power Association, and Entergy Mississippi, Inc. are currently the primary owners of the Grand Gulf site. Entergy Operations, Inc. holds the operating license for the GGNS and maintains control of entrances and exits from the Grand Gulf site property. According to the SERI environmental report, approximately 162 ha (400 ac) of the 850 ha (2100 ac) would be directly affected by construction on the Grand Gulf ESP site (SERI 2005). Most of the area at the site that may be used for new construction was previously disturbed when GGNS was constructed in the early 1970s.

The vicinity of the Grand Gulf ESP site is defined by a circle drawn with a 10-km (6-mi) radius from the center of the proposed power block location (Figure 2-1). The vicinity includes a portion of Claiborne County in Mississippi and Tensas Parish in Louisiana. Table 2-1 provides the land cover classifications within the 10-km (6-mi) vicinity, in the 80-km (50-mi) region, and along the affected transmission line rights-of-way. The land use in the vicinity of the site includes primarily agricultural and undeveloped lands. The nearest incorporated community is the town of Port Gibson about 10 km (6 mi) southeast of the site. The small community of Grand Gulf lies about 2.6 km (1.6 mi) north of the Grand Gulf ESP site.

Table 2-1. Land Use in the Area of the Grand Gulf Early Site Permit Site

Land-Use Class	80-km (50-mi) Region Hectares (Acres)	Percent	10-km (6-mi) Vicinity Hectares (Acres)	Percent	Transmission Line Rights-of-Way Hectares (Acres)	Percent
Agricultural	557,511 (1,377,640)	27.7	3,552 (8,777)	11.3	100 (246)	14.7
Developed Nonresidential	4,100 (10,132)	0.2	140 (346)	0.4	1 (3)	0.2
Residential	30,313 (74,904)	1.5	504 (1,245)	1.6	11 (28)	1.7
Undeveloped	1,230,416 (3,040,423)	61.2	20,114 (49,703)	64.0	524 (1,296)	77.7
Water or Wetlands	189,089 (467,249)	9.4	7,118 (17,589)	22.6	39 (96)	5.8
Total Area	**2,011,428 (4,970,348)**		**31,428 (77,660)**		**675 (1,669)**	

Notes: U.S. Geological Survey land-cover classes have been aggregated for presentation purposes. Rounding may affect totals.
Source: Vogelmann et al. 2001

A number of recreational areas are in the vicinity of the Grand Gulf ESP site. The Grand Gulf Military Monument (162 ha (400 ac)) abuts the northern edge of the Grand Gulf site and has its main facilities about 3 km (2 mi) north of the Grand Gulf ESP site. The Grand Gulf Military Monument provides a year-round, 25-site campground and hosts many living history events and other activities for area visitors. The Warner-Tully YMCA Camp (44 ha (108 ac)) is a youth summer camp located approximately 5 km (3 mi) northeast of the site. Lake Claiborne is a private residential development with recreational facilities located on the lake about 5 km (3 mi) east of the Grand Gulf ESP site. Two oxbow lakes located on the Grand Gulf site (Hamilton and Gin lakes) provide limited small boating and fishing opportunities, and public access is permitted. Yucatan Lake in Louisiana also falls within the 10-km (6-mi) vicinity and offers boating and fishing opportunities.

About 18 km (11 mi) of the Mississippi River courses through the 10-km (6-mi) vicinity. The river provides a critical inland shipping route from the Gulf Coast to the interior of the South and Midwest. There is direct access to the Grand Gulf ESP site from the Mississippi River along the entire western edge of the Grand Gulf site. The Port of Claiborne has constructed a small shipping port on the river at River Mile 404.8 in Claiborne County. The mean depth of channel and berth at Port Claiborne is 4.3 m (14 ft). Services provided at this port include mooring assistance, stevedore, dryage, and deep-water berths. Port cargo includes forest products, pulpwood, feed grains, and agricultural products (see environmental report in SERI 2005).

SERI has acquired and will maintain surface ownership of all the land within the Grand Gulf site property boundary with the following exceptions (see Site Safety Analysis Report in SERI 2005, 2004e):

- South Mississippi Electric Power Association (SMEPA) has a 10-percent undivided interest in the GGNS Unit 1 power block area, a 38-ha (94-ac) tract containing the cooling towers, containment buildings, and other major structures. SMEPA also has a 10-percent undivided ownership interest in two very long and narrow strips of land (3 and 2 ha (7.5 and 5 ac)) on which the GGNS Unit 1 water supply and discharge piping are located.

- Entergy Mississippi, Inc. owns the 21-ha (52-ac) GGNS facility switchyard area on the site. However, under a 1999 agreement with Mississippi Power and Light (now Entergy Mississippi, Inc.), SERI has authority to exercise complete control and determine all activities on Entergy Mississippi, Inc. property and easements on the site, including exclusion of Entergy Mississippi, Inc. personnel and third parties. SERI has transferred such rights to Entergy Operations, Inc. Entergy Operations, Inc. has unrestricted access to the switchyard area.

- A 1-ha (2-ac) residential property, which is totally surrounded by the GGNS site property boundary in the southwest sector of the site, is privately owned.

SERI, SMEPA, and Entergy Operations, Inc. own or effectively control the mineral rights in the proposed power block and associated exclusion area.[(a)] Currently, mining, exploration, drilling, and other mineral-extraction activities are not being conducted at the Grand Gulf ESP site. Past unsuccessful exploration activities on or near the Grand Gulf ESP site and the geological character of the subsurface structure in the vicinity indicate that commercial mineral production appears unlikely in the foreseeable future. A geological appraisal dated January 1987 (see site safety analysis report in SERI 2005, 2004g) confirmed this conclusion.

Under Mississippi law, prospective mineral developers have no legal right to use physical force or to create a public disturbance to gain access to a property to explore for or to extract minerals. They would be prohibited from drilling any oil or gas well until a permit is issued by the Mississippi State Oil and Gas Board following a notice and public hearing. Since SERI and SMEPA own, and Entergy Operations, Inc. controls substantially all of the minerals on the Grand Gulf site, SERI and Entergy Operations, Inc. would participate in any hearings and would have the opportunity to object to the drilling and/or the location of any well. Therefore, although

(a) The term “exclusion area” is defined in 10 CFR 50.2

SERI and its affiliates do not legally own all of the subsurface rights on the Grand Gulf ESP site and the associated exclusion area, they effectively control the ability to exercise these rights and to preclude the exercising of these rights by others.

The Grand Gulf ESP site is accessible by both river and road. The major highways in the area lie mainly to the east, north, and south of the site, and a number of county roads serve the area (Figures 1-1 and 2-1). U.S. Highway 61 and State Highway 18 connect Port Gibson with Natchez, Vicksburg, and Jackson, Mississippi. There are no direct routes from the site into Louisiana, immediately west of the Mississippi River. U.S. Highway 61 parallels the east bank of the Mississippi River from New Orleans, Louisiana, to St. Louis, Missouri, and is approximately 7.2 km (4.5 mi) from the site at the closest point. From the town of Port Gibson, the highway runs north to Vicksburg and southwest to Natchez. A section of the Natchez Trace Parkway passes approximately 10 km (6 mi) southeast of the Grand Gulf ESP site running southwest toward Natchez, Mississippi, and northeast to Clinton, Mississippi. State Highway 18 runs east from Port Gibson to Jackson. A number of county and rural roads are in the 10-km (6-mi) site vicinity.

No active railroads or navigable waterways traverse the Grand Gulf ESP site. However, a currently abandoned spur of the Illinois Central Gulf railroad once served the area during construction of GGNS Unit 1. The remains of this spur extend 29.2 km (18.2 mi) to the north of the Grand Gulf ESP site where active service begins. One county-maintained road runs through the Grand Gulf ESP site (see Figure 2-1). Bald Hill Road cuts through the south-southeast, south, south-southwest, and southwest sectors of the Grand Gulf site. Another road (unpaved) traverses the GGNS site property in the north, north-northwest, northwest, west-northwest, and west sectors, providing access to the two lakes on the property. Two Entergy-Mississippi transmission lines traverse the eastern edge of the Grand Gulf site. No other industrial, commercial, institutional, or residential structures are on the Grand Gulf site other than a private hunting lodge on the extreme southwest corner. Entergy allows public access to parts of the Grand Gulf site property for recreational purposes (see environmental report in SERI 2005).

The nearest gas pipeline is 6 km (3.7 mi) east of the Grand Gulf site boundary (Figure 2-1). SERI and SMEPA own all the surface rights at the Grand Gulf ESP site except the switchyard, which is owned by Entergy Mississippi, Inc. A number of easements over the Grand Gulf ESP site are in effect (see environmental report in SERI 2005).

According to the environmental report, a review of the Claiborne County Soil Survey issued in 1963 and inquiry with the Claiborne County Natural Resources Conservation Service indicate the presence of soil types that may be considered “prime farmland” at the Grand Gulf site (SERI 2005). However, some exclusions apply. If land is frequently flooded during the growing

season or is already in or committed to urban development or water storage, it is not considered "prime farmland" (see environmental report in SERI 2005). No coastal zones or wild and scenic rivers were identified in or around the area that may be used for construction. Because of dense vegetation in the vicinity, the ESP site is not easily seen from nearby areas. The cooling tower and plume are visible from across the Mississippi River in Louisiana.

2.2.2 Transmission Line Rights-of-Way and Offsite Areas

SERI chose not to include a site redress plan in its ESP application and, therefore, would not be permitted to undertake site preparation activities, including work on transmission line rights-of-way, prior to obtaining a construction permit (CP) or combined license (COL). Consequently, because of regulatory constraints at the ESP stage, it is not possible to determine how or which specific transmission lines or rights-of-way may be affected by the addition of the Grand Gulf ESP facility. Once an ESP holder has chosen a specific facility design and has applied to the Federal Energy Regulatory Commission (FERC) for large-generator interconnection (most likely at the COL stage), a FERC transmission analysis would be required (18 CFR Part 35). This process would determine the optimal routing of any new transmission service by requiring studies of feasibility, impact, and facilities associated with the transmission request. See Section 3.3 for additional discussion. As a result, for analysis purposes, the staff assumed that the existing transmission lines leaving the GGNS switchyard would most likely be upgraded to handle the power generated by the proposed facility. The existing GGNS switchyard was built with provision for equipment installation and operation of a second unit. This portion of the switchyard would be used, with modifications as required, for a new facility's switching equipment and connection to existing transmission line(s).

Entergy Mississippi, Inc. owns the two FERC-regulated 500-kV transmission line rights-of-way that originate from the GGNS switchyard (Figure 2-1). The Baxter-Wilson transmission line right-of-way extends north 40.3 km (25.2 mi) from the switchyard to the Baxter-Wilson substation adjacent to the Baxter-Wilson combined-cycle power plant just south of Vicksburg, Mississippi. The Franklin transmission line right-of-way extends southeast 69.8 km (43.6 mi), traversing the Homochitto National Forest, to the Franklin substation near McCall Creek in northeastern Franklin County, Mississippi.

Land use within the transmission line right-of-way consists of agricultural and undeveloped lands. Table 2-1 provides a summary of land cover in the existing transmission line rights-of-way. The staff assumed that affected transmission line rights-of-way would have 61-m (200-ft) vegetation management buffers. The area covered by these buffers represents rights-of-way totaling 677 ha (1669 ac).

2.2.3 Region

The affected region for the purpose of analyzing environmental impacts is the area within 80 km (50 mi) from the center of the proposed power block location (Figure 1-1). That region encompasses significant portions of the following counties in Mississippi and parishes in Louisiana:

- Mississippi - Adams, Amite, Claiborne, Copiah, Franklin, Hinds, Issaquena, Jefferson, Lincoln, Rankin, Sharkey, Warren, and Yazoo

- Louisiana - Catahoula, Concordia, East Carroll, Franklin, Madison, Richland, Tensas, and West Carroll

Interstate 20 passes approximately 32 km (20 mi) north of the Grand Gulf ESP site connecting Vicksburg and Jackson, Mississippi, with towns to the east and west. Interstate 55 passes approximately 58 km (36 mi) east of the Grand Gulf ESP site, connecting Jackson, Mississippi, and New Orleans, Louisiana. U.S. Highway 65 runs north and south in Louisiana and lies approximately 18 km (11 mi) to the west of the Grand Gulf ESP site. U.S. Highway 84 runs east and west, connecting U.S. Highway 65 and Interstate 55, and passes within about 50 km (31 mi) to the south of the site. Figure 2-1 shows the locations of Federal highways and railroads in the site vicinity. The Mississippi River, which passes 1.6 km (1 mi) west of the Grand Gulf ESP site, provides another route for transportation. The nearest river port facility is Port Claiborne at River Mile 404.8. A larger river port facility, which is also a U.S. Customs port of entry, lies north of the site near River Mile 437 in Vicksburg.

The region consists mainly of forest and agricultural lands. Land cover information for Claiborne County and the adjoining counties is presented in Table 2-1. No known local or regional land use plans or other regional development plans affect the Grand Gulf ESP site. About 112 km (70 mi) of the Natchez Trace Parkway, designated as National Scenic Byway and All American Road, traverses the region.

Table 2-2 identifies agricultural land use by major crop in the affected region. Because of the topography of the region, agriculture thrives as an industry on the Louisiana side of the Mississippi River. The Louisiana side is typically a flat alluvial plain, while the Mississippi side is typically upland and rolling, forested hill country. On the Mississippi side, farms are generally smaller than on the Louisiana side (USDA 2004a, 2004b).

Table 2-3 provides information on the region's livestock production. According to the environmental report, information from the Claiborne County Agricultural Extension office

Table 2-2. 2002 Major Agricultural Crops and Land in Production within 80 Kilometers (50 Miles) of the Grand Gulf Early Site Permit Site, hectares (acres)

County/Parish	Land Area	Harvested Area of Major Crops							Major Crop Land Harvested	Total Land in Crop Production
		Corn	Cotton	Rice	Sorghum	Soybeans	Wheat	Hay		
Catahoula, LA	182,245	7080	13,568	3,064	11,192	13,624	1339	2174	52,041	71,947
	(450,335)	(17,495)	(33,526)	(7,571)[a]	(27,657)	(33,666)	(3309)	(5373)	(128,597)	(177,785)
Concordia, LA	180,240	15,543	9,508	4,955	3,386	20,775	2,164	562	56,894	70,842
	(445,382)	(38,407)	(23,494)	(12,245)	(8,368)	(51,337)	(5,347)	(1,389)	(140,587)	(175,054)
East Carroll, LA	109,153	21,109	12,245	6,880	1,070	28,976	2,294	352	72,926	77,120
	(269,722)	(52,162)	(30,259)	(17,000)	(2,644)	(71,600)	(5,669)	(870)	(180,204)	(190,566)
Franklin, LA	161,516	16,308	22,054	263	923	8,466	11,826	3361	63,203	79,729
	(399,112)	(40,299)	(54,497)	(651)[a]	(2,282)	(20,921)	(29,223)	(8,304)	(156,177)	(197,014)
Madison, LA	161,638	29,204	20,237	1,940	2,315	15,273	2,295	453	71,718	85,332
	(399,415)	(72,164)	(50,007)	(4,795)	(5,721)	(37,741)	(5,671)	(1,120)	(177,219)	(210,858)
Richland, LA	144,640	12,150	13,801	3,313	1,195	7,997	4,890	3,085	46,431	66,326
	(357,411)	(30,023)	(34,103)	(8,187)	(2,952)	(19,762)	(12,084)	(7,622)	(114,733)	(163,894)
Tensas, LA	156,043	21,921	28,917	268	3,153	8,065	3,357	228	65,910	71,085
	(385,589)	(54,168)	(71,456)	(663)	(7,792)	(19,928)	(8,296)	(563)	(162,866)	(175,653)
West Carroll, LA	93,084	6,024	6,450	3,337	2,159	6,046	6,033	3,576	33,625	52,279
	(230,015)	(14,885)	(15,937)	(8,245)	(5,336)	(14,941)	(14,909)	(8,837)	(83,090)	(129,184)
Adams, MS	119,208	1,797				2,558		1,422	5,778	16,376
	(294,567)	(4,440)	D	0	0	(6322)	D	(3,515)	(14,277)	(40,466)
Amite, MS	188,966	142						5,319	5,461	16,633
	(466,944)	(350)	0	0	0	0	0	(13,144)	(13,494)	(41,101)
Claiborne, MS	126,073	1,687	1,396			947	484	2,038	6,552	13,092
	(311,531)	(4,169)	(3,450)	0	D	(2,339)	(1,196)	(5,037)	(16,191)	(32,351)
Copiah, MS	201,140	188						4,044	4,232	18,075
	(497,025)	(464)	D	0	0	0	D	(9,994)	(10,458)	(44,664)

Table 2-2. (contd)

County/Parish	Land Area	Harvested Area of Major Crops							Major Crop Land Harvested	Total Land in Crop Production
		Corn	Cotton	Rice	Sorghum	Soybeans	Wheat	Hay		
Franklin, MS	146,230	490						1,399	1,889	5,536
	(361,341)	(1,212)	0	0	0	0	0	(3,457)	(4,669)	(13,679)
Hinds, MS	225,119	4,459	4,911			870	27	6,282	16,549	44,001
	(556,278)	(11,019)	(12,135)	0	0	(2,150)	(067)	(15,522)	(40,893)	(108,728)
Issaquena, MS	106,983	9,967	7,015	1,253		12,014	2,491	301	33,041	35,868
	(264,360)	(24,629)	(17,335)	(3,097)	0	(29,687)	(6,155)	(744)	(81,647)	(88,632)
Jefferson, MS	134,521	238	1,819			1,352		1,594	5,003	12,583
	(332,408)	(589)	(4,494)	0	0	(3,341)	0	(3,938)	(12,362)	(31,092)
Lincoln, MS	151,697	206						4,306	4,512	13,303
	(374,851)	(509)	0	0	0	0	D	(10,641)	(11,150)	(32,873)
Rankin, MS	200,599	1,091	2,592			458		4,186	8,327	17,157
	(495,690)	(2,695)	(6,405)	0	D	(1,132)	D	(10,344)	(20,576)	(42,395)
Sharkey, MS	110,777	13,708	18,388	1,363	382	22,166	739	32	56,779	59,986
	(273,735)	(33,874)	(45,437)	(3,369)	(945)	(54,774)	(1,825)	(80)	(140,304)	(148,229)
Warren, MS	151,932	4,174	3,100			7,043	445	982	15,744	21,638
	(375,431)	(10,315)	(7,659)	0	D	(17,404)	(1,099)	(2,427)	(38,904)	(53,468)
Yazoo, MS	238,146	11,807	47,177		974	5,823	2,970	3,364	72,115	87,608
	(588,468)	(29,177)	(116,577)	D	(2,407)	(14,388)	(7,339)	(8,313)	(178,201)	(216,483)
Region Total[(b)]	3,289,950	179,294	213,178	26,638	26,751	162,454	41,354	49,062	698,730	936,515
	(8,129,610)	(443,045)	(526,771)	(65,823)	(66,104)	(401,433)	(102,189)	(121,234)	(1,726,599)	(2,314,169)

(a) Values from LSU 2003
(b) Totals affected by rounding
D = values not disclosed by U.S. Department of Agriculture
Sources: USDA 2004a, 2004b

Table 2-3. 2002 Livestock Production and Farm Value within 80 Kilometers (50 Miles) of the Grand Gulf Early Site Permit Site

	Livestock Inventory				Farm Inventory		
County/Parish	Beef Cows (Head)	Milk Cows (Head)	Hogs and Pigs (Head)	Chickens Sold (Number)	Farms	Average Value per Farm ($)	Average Value Per Acre ($)
Catahoula, LA	4,902		346	30	432	577,352	1,164
Concordia, LA	2,042		(a)		331	690,690	1,127
East Carroll, LA	744		1,553		238	1,101,056	1,194
Franklin, LA	11,200		76		856	334,280	1,191
Madison, LA	1,888		15		275	928,926	1,105
Richland, LA	(a)	(a)	102	(a)	538	494,785	1,045
Tensas, LA	497		30		230	1,047,322	1,055
West Carroll, LA	7,384		84		703	384,114	1,781
Adams, MS	3,844		159		269	336,308	1,004
Amite, MS	9,918	2,896	16	12,930,000	639	348,222	1,572
Claiborne, MS	6,654		(a)	1,000	297	380,948	1,203
Copiah, MS	10,679	870	1,270	9,900,000	690	350,023	1,646
Franklin, MS	(a)	(a)	5	(a)	210	392,149	1,644
Hinds, MS	18,167	1,690	497	20	1,246	343,373	1,348
Issaquena, MS	(a)		100		91	1,529,891	1,169
Jefferson, MS	6,199	9	86	3,900,000	315	419,870	1,467
Lincoln, MS	11,647	2,160	(a)	9,900,000	641	446,949	2,255
Rankin, MS	(a)	(a)	(a)	30,040,000	804	351,427	1,485
Sharkey, MS					100	1,727,477	1,064
Warren, MS	(a)	(a)	(a)		282	471,906	1,095
Yazoo, MS	(a)	(a)	655		564	729,113	1,102
Total Region	95,765	7,625	4,994	66,680,000	9,751	491,662	1,273

(a) Not disclosed by the U.S. Department of Agriculture (USDA), not included in totals.
Sources: USDA 2004a, 2004b

indicated that there are approximately 300 to 400 head of cattle, and no commercial dairy milk cows reported within a 10-km (6-mi) radius of the Grand Gulf ESP site, and most of the cattle are located southwest of the site (SERI 2005).

2.3 Meteorology and Air Quality

Climatological information presented in this section was obtained from the Jackson, Mississippi, first-order National Weather Service station (NCC 1980; NCDC 2004a), which is about 80 km (50 mi) northeast of the proposed Grand Gulf ESP site. This station provides a good indication of the general climate at the Grand Gulf ESP site because of its proximity and long period of record. Recent climatological data for Jackson are available from the National Climatic Data Center in Asheville, North Carolina (NCDC 2004a). This section also contains information from Revision 2 of the environmental report of the SERI application, which provides site-specific data

for the Grand Gulf ESP site and data for Vicksburg, Mississippi. Vicksburg is on the Mississippi River about 40 km (25 mi) north of the proposed Grand Gulf ESP site (SERI 2005).

2.3.1 Climate

The Grand Gulf ESP site is within the Grand Gulf site on the east bank of the Mississippi River in southwestern Mississippi about 240 km (150 mi) from the coast of the Gulf of Mexico. The dominant air mass in the region during most of the year is a maritime tropical air mass originating in the Gulf of Mexico. As a result, the climate of the region is humid most of the year. The winters are relatively short and mild with occasional brief cold periods associated with outbreaks of continental polar air. These cold periods rarely last more than three or four days. Summers are long and warm; however, temperatures above 38°C (100°F) are infrequent and long periods of very hot weather are rare. During these summer months, the weather at the site is dominated by the western edge of the Bermuda High.

Mississippi is south of the general track of winter cyclones. This location, in combination with the dominant influence of the Bermuda High in the summer, results in a limited wind resource in the area. Wind energy resource maps prepared for the U.S. Department of Energy (DOE) indicate that Mississippi wind resources fall into Wind Power Class 1, the lowest of seven classes used to rate the resource (DOE 2004c). DOE does not list commercial wind power projects in Mississippi (DOE 2004a).

On average, about 60 percent of the sky at Jackson, Mississippi, is covered by clouds. However, cloudiness varies seasonally and diurnally. Daytime cloudiness at Jackson covers more than 50 percent of the sky during the winter, with maximum sky cover of about 80 percent in December and January. The rest of the year, the average daytime sky cover is 50 percent or less, with minimum sky cover of about 30 percent during September (NCDC 2004a). The DOE estimates the annual average solar resource in the vicinity of the Grand Gulf ESP site to be 4.5 to 5.0 kWh/m^2 per day for flat-panel collectors, and 4.0 to 4.5 kWh/m^2 per day for concentrating collectors (DOE 2004b). The DOE lists two photovoltaic energy projects with a total installed capacity of 44.2 kW in Mississippi (DOE 2004a).

2.3.1.1 Wind

Recent wind data from the GGNS meteorological system presented in the SERI environmental report indicate that the winds at the Grand Gulf ESP site are relatively light (SERI 2005). The average wind speed for the Grand Gulf site during the period from 2001 through 2003 is 1.9 m/s (4.2 mph). This speed is significantly lower than average wind speeds at Vicksburg (SERI 2005) and Jackson (NCDC 2004a), Mississippi. More than 99 percent of the time, the wind speed at the Grand Gulf ESP site is less than 5.8 m/s (13 mph) (SERI 2005). The most prevalent wind direction is from the northeast. Winds from the northeast and southeast

quadrants are far more frequent than winds from the southwest and northwest quadrants. The highest wind speeds tend to have a southerly component.

Wind direction persistence is an important consideration in evaluation of the consequences of accidents. Tables 2.7-88 through 2.7-95 of the SERI environmental report (SERI 2005) describe wind direction persistence at GGNS, Vicksburg, and Jackson, Mississippi. Considering the period of record at each site (3 years at GGNS, 5 years at Vicksburg, and 10 years at Jackson), it appears that the GGNS has a somewhat greater persistence than the other two sites. The maximum persistence of wind direction within the 22.5° sectors at GGNS was 32 hours for winds from the northeast. The maximum persistence in 9 of the 16 sectors exceeded 12 hours. The maximum persistence for wind direction within three adjacent sectors at GGNS was 102 hours for winds from the north, north-northeast, and northeast. Persistence exceeded 24 hours for all sets of three winds direction sectors except those sets centered on east and west-southwest. For five adjacent wind direction sectors, the maximum persistence was 122 hours for the five sectors centered on north-northeast. The maximum wind persistence in all sets of sectors exceeded 36 hours.

2.3.1.2 Atmospheric Stability

Atmospheric stability is a measure of the tendency of the atmosphere to dilute material. It can be estimated from the magnitude of change in the ambient temperature with height. Seven atmospheric stability classes based on the temperature difference between two levels are defined in Safety Guide 23 (also referred to as Regulatory Guide 1.23) (AEC 1972). SERI's meteorological monitoring system, which is described in Section 2.3.3, is designed to measure temperature difference for use in estimating atmospheric stability.

When the temperature decreases rapidly with height, the atmospheric stability is described as extremely unstable, and when it increases rapidly with height, the atmospheric stability is described as extremely stable. Extremely unstable atmospheric conditions generally occur on summer afternoons when the wind speed is light. These conditions are associated with good dilution of material. Extremely stable atmospheric conditions generally occur on clear nights, and are associated with very limited dilution. When it is cloudy and windy, atmospheric stability is generally neutral.

Data for 2002 and 2003 from the GGNS meteorological system indicate that on average the atmospheric stability is neutral about 35 percent of the time. About 47 percent of the time, the atmospheric stability is slightly to extremely stable, and the remaining 18 percent of the time, the atmospheric stability is slightly to extremely unstable.

2.3.1.3 Temperature

The long-term (95-yr) annual average temperature in Jackson is 18.4°C (65.2°F), with monthly average temperatures ranging from 8.4°C (47.2°F) in January to 27.7°C (81.9°F) in July. During the year, the normal (based on data for 1971 through 2000) number of days with minimum temperatures of 0°C (32°F) and below is 46, while the normal number of days with maximum temperatures of 0°C (32°F) and below is less than 2. The lowest temperature at the current and comparable measurement locations, based on a 63-yr period of record, is -17°C (2°F). Temperatures below -18°C (0°F) have been observed in the area. In contrast, the normal number of days with maximum temperatures of 32°C (90°F) and above is 84, and the highest temperature on record is 42°C (107°F).

The monthly mean temperatures for 2000 and 2001 are consistent with monthly mean temperatures for a 5-year period at Vicksburg and a 40-year period at Jackson (SERI 2005; NCDC 2004a).

2.3.1.4 Atmospheric Moisture

Precipitation averages about 142 cm (56 in.) per year and is uniformly distributed throughout the year. The months of January, March, April, November, and December average more than 13 cm (5 in.) of precipitation, while the months of June, August, September, and October average less than 10 cm (4 in.). The maximum precipitation in a 24-hour period was 22 cm (8.5 in.) in April 2003. On average, about one third of the days each month experience measurable precipitation. Typically, snow falls almost every year, but only about 4 years in 10 have measurable snowfall. The maximum snowfall in a 24-hour period, 15 cm (6 in.), occurred in January 1982. On occasion, the 24-hour snowfall in the vicinity of Jackson has exceeded 15 cm (6 in.). In January 1940, 27 cm (10.6 in.) was recorded, and in February 1960, 23 cm (9.1 in.) was recorded (NCC 1980).

The 30-year normal relative humidity at Jackson, Mississippi has an annual average of about 75 percent with a diurnal variation in the annual average value from about 91 percent at 6:00 a.m. to about 58 percent at noon (NCDC 2004a). Seasonal variation of relative humidity is small. The 6:00 a.m. monthly average relative humidities range from a minimum of 87 percent in March to a maximum of 95 percent in August. The noon monthly average humidities range from a minimum of 53 percent in April to a maximum of 65 percent in January. Relative humidities for Vicksburg, Mississippi, reported in the environmental report (SERI 2005) are consistent with those for Jackson, Mississippi.

When the relative humidity is near 100 percent, small water droplets (fog) form in the atmosphere and reduce visibility. Records for Jackson indicate that heavy fog, which reduces the visibility to 400 m (0.25 mi) or less can occur in any month. On average, heavy fog occurs on more than 22 days per year with 3 days in December and January, and less than 1 day in

June (NCDC 2004a). The environmental report (SERI 2005) indicates that Vicksburg, Mississippi averages approximately 92 hours per year of fog, with fog defined as reduction of visibility to less than 1 km (5/8 mi).

The combination of wet- and dry-bulb temperatures are used to evaluate the performance of cooling towers. Tables 2.3-16, 2.3-17, and 2.3-18 in the site safety analysis report (SERI 2005) list wet-bulb temperatures and associated dry-bulb temperatures for the 1-, 5-, and 30-day periods with least cooling capacity in a 36-year period of record. For the worst day, the average wet-bulb temperature was 27.2°C (81.0°F) with an average dry-bulb temperature of 30°C (86°F).

2.3.1.5 Severe Weather

The Grand Gulf ESP site can experience severe weather in the form of thunderstorms, snow, ice, tornadoes, and hurricanes. Other significant weather can be associated with these events. For example, lightning, hail, and high winds frequently occur with thunderstorms, and tornadoes can occur with both thunderstorms and hurricanes.

Meteorological records for Jackson, Mississippi, indicate that thunderstorms can be expected on about 68 days per year (NCDC 2004a). Thunderstorms are most frequent in summer. The months of June, July, and August average 9 or more thunderstorm days per year. Months from October through February average fewer than 3 thunderstorm days per year. National Climatic Data Center Storm Data lists 23 hail events with hail 1.9 cm (0.75 in.) or greater in diameter in Claiborne County since 1971 (NCDC 2004b). This number is incomplete because no events were listed from 1972 through 1982.

On average, hurricanes strike the Gulf Coast along the Louisiana and Mississippi coastlines several times a decade. The Grand Gulf ESP site is sufficiently far inland that the strength of storms generally diminishe to less than hurricane strength by the time they reach the vicinity of the site. For example, the remnants of Hurricane Ivan passed near the site in September 2004, and the remnants of Hurricanes Katrina and Rita passed near the site in August and September 2005. In each instance, the sustained winds in the storms were barely at or below hurricane force when the storm passed the site.

The NRC staff has conducted an independent assessment of tornadoes in the vicinity of the Grand Gulf ESP site using National Climatic Data Center data for 1950 through August 2003 (Ramsdell 2004). For this time period, there were 592 tornado events within the two-degree box centered on the Grand Gulf ESP site. Given the distribution of areas associated with the events, it is estimated that the expected probability of a tornado striking the site is

approximately 7.4 x 10^{-4} yr^{-1} with 95 percent confidence that the strike probability is less than 9.4 x 10^{-4} yr^{-1}. A tornado struck the Grand Gulf site on April 17, 1978. Detailed reports of this event are included in the GGNS *Updated Final Safety Analysis Report* (Entergy 2003c).

2.3.2 Air Quality

The Grand Gulf ESP site is in Claiborne County, Mississippi, which is on the western edge of the Mobile, Alabama-Pensacola, Florida-Panama City, Florida-Southern Mississippi Interstate air quality control region. The area across the Mississippi River from the site is in the Monroe, Louisiana-El Dorado, Arkansas Interstate air quality control region. None of the counties in these air quality control regions have been designated as in nonattainment of the National Ambient Air Quality Standards (40 CFR 81.325; 40 CFR 81.319). There are no mandatory Class 1 Federal Areas where visibility is an important value within 160 km (100 mi) of the proposed Grand Gulf ESP site.

The Mississippi Department of Environmental Quality (MDEQ) conducts air quality monitoring throughout the State. However, no monitoring is conducted in Claiborne County. The closest monitoring site is in Vicksburg, where the State monitors ozone and particulate matter smaller than 2.5 micrometers. Monitoring results for Vicksburg, Mississippi, for 2001, 2002, and 2003 demonstrate that concentrations of these pollutants are well below National and Mississippi Ambient Air Quality Standards (MDEQ 2002a, 2003, 2004a). More extensive monitoring is conducted in Jackson, Mississippi, with similar results.

The Air Quality Index (AQI) is a national standard method for reporting air pollution levels for the general public. The AQI is based on comparison of the concentrations of six pollutants with National Ambient Air Quality Standards. The six pollutants are ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, particulate matter smaller than 10 micrometers, and particulate matter smaller than 2.5 micrometers. The air pollution level for each day is placed in one of six categories based on the AQI. In order of decreasing air quality, the categories are Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, Very Unhealthy, and Hazardous.

Jackson is the only location in Mississippi for which AQIs are summarized by MDEQ. According to the MDEQ, the air quality in Jackson was classified Good or Moderate for all of 2001 and 2003 (MDEQ 2002a, 2003, 2004a). In 2002, the average air quality was Good or Moderate for all months, but the air quality did decrease to Unhealthy for Sensitive Groups at least one day in September.

All of the areas, for which monitoring data and AQIs exist, are more densely populated than Claiborne County and the area around the Grand Gulf ESP site. Consequently, air quality at the Grand Gulf ESP site should be better than indicated by the monitoring data and AQIs.

2.3.3 Meteorological Monitoring

Entergy Operations, Inc. and its predecessors have had a meteorological monitoring program at the Grand Gulf site since March 1972. In August 1972, meteorological instrumentation was installed on a permanent tower approximately 1500 m (5000 ft) north-northwest of Unit 1 to provide onsite meteorological information required for licensing of the GGNS. This instrumentation is described in the GGNS Final Environmental Statement (AEC 1973) and in SERI's environmental report (SERI 2005). In December 2000, the tower and instrumentation were replaced by a new tower and state-of-the-art instrumentation. The new tower is located approximately 1.6 km (1 mi) northwest of the control building. The new instrumentation and data collection system are described in detail in the environmental report (SERI 2005) and summarized below.

The meteorological monitoring system consists of a 50-m (162-ft) tower, meteorological instrumentation at the 10-m (33-ft) and 50-m (162-ft) levels of the tower, surface meteorological instrumentation, and data collection and processing equipment. Instrumentation at the 10-m (33-ft) level of the tower measures wind direction, wind speed, temperature, and relative humidity. Instrumentation at the 50-m (162-ft) level measures wind direction, wind speed, and temperature. The temperature difference between the two levels is also determined. A tipping-bucket rain gage is located near the base of the tower. A 10-m (33-ft) backup meteorological tower measures wind direction, wind speed, and temperature at the 10-m (33-ft) level.

Signals from the instruments are sent to the facility's data computer at about 10-second intervals. They are also recorded in data storage modules in a small building near the base of the tower. Each datum is checked to determine whether it is within instrument limits. Fifteen-minute and hourly averages are calculated for each parameter. In addition, 15-minute and 1-hour average values of sigma theta (standard deviation of the wind direction fluctuations) are calculated from the wind direction data. These data (observations and averages) are available to the control room and facility personnel.

The meteorological instrumentation is inspected routinely to ensure that no damage has occurred to the tower or instrumentation and that the instruments are operating properly. These routine inspections are supplemented by semiannual calibration of instruments on the primary tower, check of the tension of tower cables, and visual inspections of wiring. Overall data recovery rates for the meteorological instrumentation for 2001, 2002, and 2003 were 98 percent, 99 percent, and 96 percent, respectively (SERI 2005).

The staff viewed the meteorological site and instrumentation, reviewed the available information on the meteorological measurement program, and evaluated data collection under the Entergy Operations, Inc. program. Based on this information, the staff concludes that the program provides data that represent the onsite meteorological characteristics as required by

10 CFR 100.20(c). The data also provide an acceptable basis for making estimates of atmospheric dispersion for the evaluation of the consequences of routine and accidental releases required by 10 CFR 50.34(a)(1) and 10 CFR Part 50, Appendix I. If continued, the Entergy Operations, Inc. meteorological monitoring program for the GGNS is suitable for preoperational and operational monitoring as outlined in the *Environmental Standard Review Plan 6.4* (NRC 2000).

2.4 Geology

A description of the geological, seismological, and geotechnical conditions at the Grand Gulf ESP site is provided in Section 2.5 of SERI's site safety analysis report (SERI 2005). Subsurface investigations performed in 2002 as part of the ESP application provided additional information. These involved engineering, geologic, and geotechnical site investigations performed for the proposed location of the new facility to characterize site conditions.

The Grand Gulf ESP site lies within the Mississippi Alluvial Plain Section of the Coastal Plain Physiographic Province. Several important aquifer systems are in the vicinity of the Grand Gulf ESP site including: Mississippi River Valley Alluvial Aquifer system, Coastal Lowlands Aquifer system, and the Mississippi Embayment Aquifer system. The site is south of the southern extent of the Mississippi River Valley Alluvial Aquifer system. However, the site is within the very northern extent of the Coastal Lowlands Aquifer system and in the center of the Mississippi Embayment Aquifer system.

The Coastal Lowlands Aquifer System consists of a gulfward-thickening, heterogeneous, unconsolidated to poorly consolidated wedge of discontinuous beds of sand, silt, and clay that range in age from Oligocene to Holocene. Beneath the Coastal Lowlands Aquifer System is the Mississippi Embayment Aquifer System. At the site, the Mississippi Embayment Aquifer System consists of several aquifers that range from late Cretaceous to middle Eocene in age with a combined thickness of over 1500 m (5000 ft).

During the subsurface investigation completed for the existing Grand Gulf Unit 1, 275 borings were drilled within the site area to a maximum depth of 136 m (447 ft). An additional 3 borings were performed as part of SERI's ESP site characterization activities. These borings provide the basis of the description of the stratigraphy at the Grand Gulf ESP site.

The bluffs at the site delineate a change in the upper stratigraphy. The upland plain, east of the bluffs, is a Pleistocene terrace rising to an elevation of about 46 m (150 ft) above MSL. The surface of the upper plain is about 23 m (75 ft) of loess overlaying about 12 m (40 ft) coarse-grained alluvial sand and gravel deposits of the Upland Complex. The lowland, west of the bluffs, at an elevation of about 21 m (70 ft) above MSL consists of a layer of Holocene alluvium over 30 m (100 ft) in thickness including backswamp areas and meander belts of the

Mississippi River. The Catahoula formation underlies both the terrace deposits in the uplands and the alluvium in the lowlands. The ESP facility would be located in the uplands portion of the site.

At this time, a plant design has not been selected, and the exact footprint and embedment depth of the plant have not been determined. After a plant design has been selected, additional site exploration, laboratory testing, and geotechnical analyses would be performed to develop final plant design criteria for the CP and COL phase of the project.

No activity involving exploration, drilling, or otherwise extracting minerals occurs at the Grand Gulf site. Past unsuccessful exploratory activities on or near the Grand Gulf site and the geological character of the subsurface structure in the vicinity of the Grand Gulf site indicate that commercial mineral production appears unlikely in the foreseeable future (see environmental report in SERI 2005).

2.5 Radiological Environment

A radiological environmental monitoring program (REMP) has been conducted around the Grand Gulf site since 1978. The preoperational program established information on background radiation in the environment (AEC 1973). After GGNS Unit 1 began operation in 1985, Entergy Operations, Inc. and its predecessors monitored the following: air, water, sediment, fish and food products, and direct radiation. Milk is also sampled when there is commercial milk production within 8 km (5 mi) of the site. The REMP has indicator and control locations within a 29-km (18-mi) radius of the site. Sample results from the indicator locations are compared to the control locations and preoperational data to determine (1) pathways for radionuclides released into the environment, (2) potential buildup of long-lived radionuclides, and (3) potential exposure to plants and animals. The results of this monitoring are documented in an annual environmental operating report for GGNS. The staff reviewed historical data from the REMP reports for the past 3 years and found that environmental measurements of this time period were similar to those during the preoperational monitoring phase (Entergy 2002b, 2003b, 2004b).

Each year, Entergy issues a report titled “Annual Radioactive Effluent Release Report,” which documents gaseous and liquid releases and potential doses from GGNS. The staff reviewed annual radioactive effluent release reports for calendar years 2001, 2002, and 2003 (Entergy 2002a, 2003a, 2004a). Maximum doses to a member of the public were calculated using effluent concentration and historical annual average meteorological data for the site. For the 3 years of data reviewed, the maximum annual dose to a member of the public was estimated to be 0.017 mSv (1.7 mrem). The data showed that doses to the maximally exposed individuals around GGNS were a small fraction of the limits specified in Federal environmental radiation standards (10 CFR Part 20; 10 CFR Part 50, Appendix I; 40 CFR Part 190). In

addition to the environmental monitoring program conducted by GGNS, information on Mississippi's environmental monitoring program was reviewed.

2.6 Water

This section describes the hydrological processes and physical site features that define the movement, distribution, and quality of surface water and groundwater at the Grand Gulf ESP site. Additionally, this section describes the current and likely future uses of water at the site to meet the various water needs of the population in the vicinity. The existing GGNS plant has significantly altered the local hydrological environment and is included as a key feature of the affected environment. Hydrological, thermal, and chemical monitoring programs for the existing GGNS provide an important source of information for understanding the current environmental baseline and the likely incremental impacts of the Grand Gulf ESP facility on the water resources in the vicinity.

2.6.1 Hydrology

This section describes the site-specific and regional hydrological features of the existing environment that could be altered by the construction, operation, or decommissioning of the proposed new facility. A description of the site's hydrological features was presented in Section 2.3.1 of the environmental report (SERI 2005). The hydrological features of the site related to site safety (e.g., probable maximum flood) are described by SERI in the site safety analysis report portion (Part 2) of the application (SERI 2005).

The site has three primary hydrological areas. The first is the Mississippi River, the dominant hydrological feature of the vicinity. The second is the lowlands between the bluffs and the Mississippi River. The third is the uplands area east of the bluffs. These three areas can be seen in Figure 2.2. In the following sections, the surface and subsurface hydrology are discussed for each of the three areas. Additionally, surface and subsurface hydrological monitoring programs are discussed.

2.6.1.1 Surface Water Hydrology

Mississippi River

With an average discharge of 16,800 m^3/s (593,000 cfs) draining 2,980,000 km^2 (1,150,000 mi^2), the Mississippi River is the largest river in the United States. The western boundary of the Grand Gulf site is defined by the Mississippi River's eastern bank. At the site, the Mississippi River is about 0.8 km (0.5 mi) wide at low flow and about 2.3 km (1.4 mi) during a typical annual high flow period. The depth of the thalweg of the Mississippi River at the site is

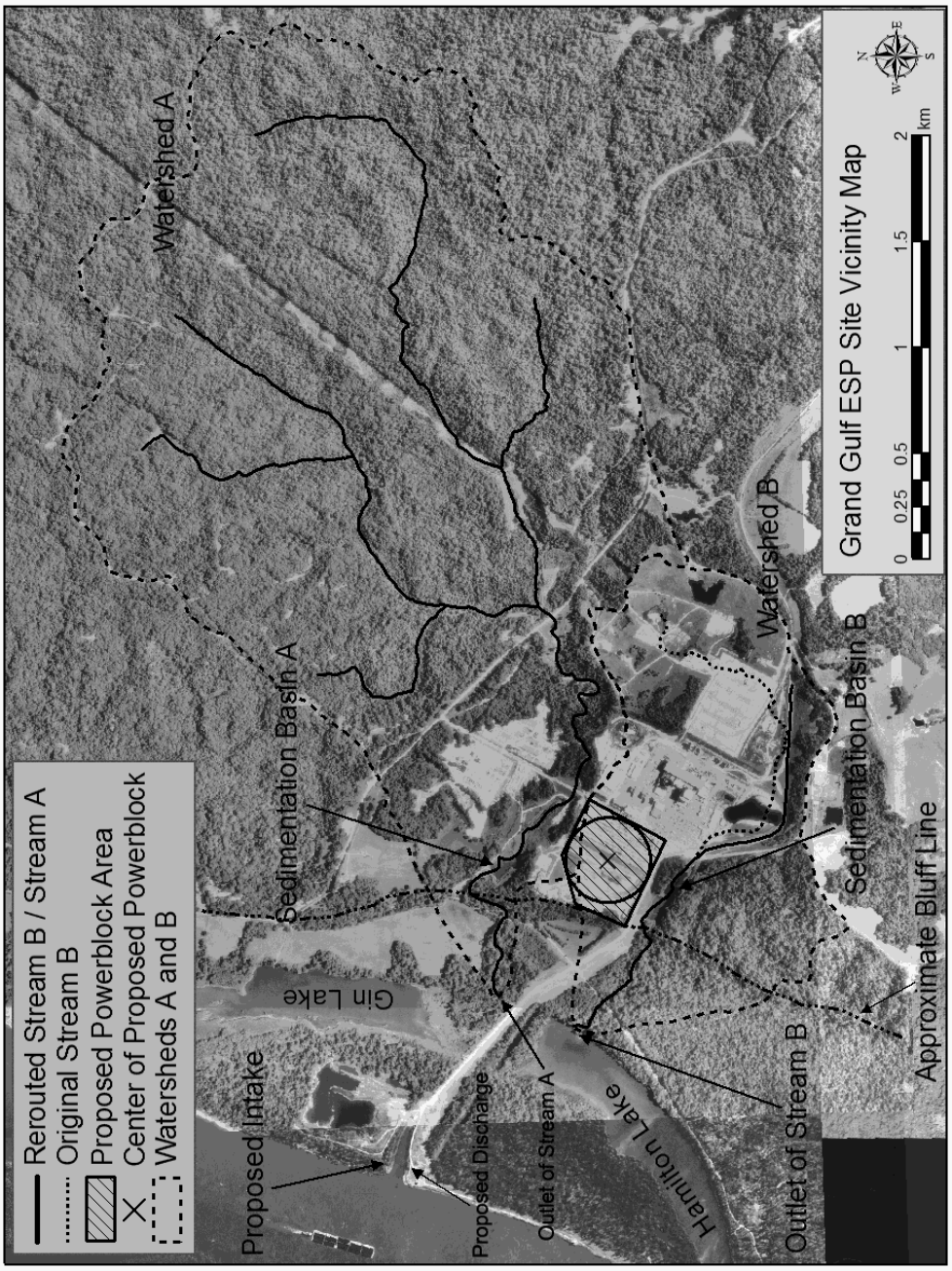

Figure 2-2. Surface Drainage Plan for the Grand Gulf Early Site Permit Site

about 4.9 m (16 ft) below MSL. Historically, the Mississippi River near the site has been very active with frequent changes in the channel alignment and thalweg (Schumm et al. 1994).

However, the Mississippi River is now subject to the management and control of the U.S. Army Corps of Engineers (ACE). Through an aggressive and ongoing program of dredging, installation of river bank revetments and armor, levee construction and maintenance, and upstream reservoir regulation, the ACE has stabilized the historical movement of the river into a relatively stable channel alignment. The bluffs at the Grand Gulf site represent a natural levee and have confined the river, even during pre-channelization times, to stay to the west of the Grand Gulf ESP site.

The Mississippi River flow varies considerably throughout the year and between years. Based on streamflow data from Vicksburg, Mississippi, from 1929 through 1983, the 7-day, 10-year low flow and 100-year flood have been estimated at 3400 m^3/s (120,000 cfs) and 62,380 m^3/s (2,203,000 cfs), respectively (van der Leeden et al. 1990). February, March, April, and May are the months with the highest mean monthly discharges and as such are the periods that the river would most likely rise over its normal banks inundating the adjacent lowland floodplain.

Lowland Plain

The lowland plain of the Grand Gulf ESP site is the area between the Mississippi River and the bluffs. With an elevation of about 20 m (70 ft) above MSL, the lacustrine or palustrine wetlands of the lowlands are subject to nearly annual inundation by the Mississippi River. In periods when the Mississippi is not inundating the lowlands, movement of water through the lowlands is primarily associated with the streamflow of small tributaries that drain the uplands into Hamilton Lake before joining the Mississippi River. Both Gin Lake and Hamilton Lake, within the lowlands, show the characteristics of shallow oxbow lakes formed by the historic migration of the Mississippi River. Construction of a haul road from the GGNS site to the Mississippi River divided the lowlands. A buried pipeline follows the path of the haul road and discharges GGNS's cooling tower blowdown to a small embayment along the Mississippi River. The GGNS intake and discharge pipelines follow the haul road.

Uplands

Based on digital topographic data, the staff delineated the two upland watersheds and their associated stream channels as shown in Figure 2-2. These watersheds correspond closely to those presented by SERI in the environmental report (SERI 2005). Following the naming convention used by SERI, the two watersheds are called "A" and "B." Watershed A lies to the north of Watershed B. The staff estimated the areas of Watershed A and Watershed B as 7.61 km^2 (2.94 mi^2) and 1.76 km^2 (0.68 mi^2), respectively.

The watersheds are very distinct in nature. Whereas Watershed A is mostly covered with a dense canopy of trees and brush, the majority of Watershed B has been cleared of vegetation for the GGNS site. The stream channel in Watershed A follows its natural course, whereas the course of the stream channel in Watershed B has been altered, and the channel lined to provide drainage for the GGNS site. The alterations to Watershed B have resulted in it behaving more like urban watershed with flashy responses to rainfall with little or no baseflow, whereas Watershed B responds like a forested watershed with a more attenuated response to rainfall and continuous baseflow.

Sedimentation basins were constructed on both stream channels downstream from the existing site. However, because of the greater flow and higher sediment load, the sediment basin on Stream A has been filled with sediment and now represents more of a constructed wetland than a basin to trap sediment. Because of the lower flow and lower sediment yield, the sediment basin in Watershed B remains a viable trap for sediment.

The local precipitation is relatively uniform throughout the year. With an average annual precipitation of 130 cm (53 in.), eight months have average monthly precipitation of 10 to 15 cm (4 to 6 in.) and four months have average monthly precipitation of 5 to 10 cm (2 to 4 in.). March and October are the months with both the highest and lowest monthly average precipitation and runoff, respectively. Because of the relatively warm winters, the region experiences little precipitation as snow.

2.6.1.2 Groundwater Hydrology

Several important aquifer systems are in the vicinity of the proposed site including: Mississippi River Valley Alluvial Aquifer system, Coastal Lowlands Aquifer system, and the Mississippi Embayment Aquifer system. The site is within the very northern extent of the Coastal Lowlands Aquifer system and in the center of the Mississippi Embayment Aquifer system.

During the subsurface investigation completed for the existing Grand Gulf Unit 1, 275 borings were drilled within the site area to maximum depth of 136 m (447 ft). An additional 3 borings were performed as part of SERI's ESP site characterization activities. These borings provide the basis of the description of the stratigraphy at the Grand Gulf ESP site.

At this time, a plant design for the ESP site has not been selected, and the specific footprint and embedment depth of the plant have not been determined. After a plant design has been selected, additional site exploration, laboratory testing, and geotechnical analyses would be performed to develop final plant design criteria for the CP or COL phase of the project (SERI 2005).

Mississippi River

The morphology of the Mississippi River has defined much of the alluvial aquifer system near the site. The Holocene alluvium near the river has been affected by deposition and erosion. Faster-moving sections of the river are able to scour and cut down to the Catahoula formation, whereas slower-moving sections of the river provide an opportunity for the sediment in the river to deposit.

Beneath and adjacent to the river, the alluvium is in close hydraulic connection with the river. The fluctuation of the Mississippi River causes fluctuation in the alluvial aquifers. Generally, at the site the alluvium discharges to the river. However, during floods the direction of flow in the alluvial aquifers can reverse.

The GGNS cooling system uses radial (Ranney) wells reaching out beneath the Mississippi River stream bed to induce river water to migrate through the alluvium to the collectors. The connection between the alluvium and the river means that the existing plant is essentially using river water and not groundwater. The radial well system lets the existing plant use the alluvial aquifer to filter out the sediment in the river water without resulting in significant impacts to the local groundwater resources.

Lowland Plain

The bluffs at the site delineate a change in the upper stratigraphy. The upland plain, east of the bluffs, is a Pleistocene terrace rising to an elevation of about 46 m (150 ft) above MSL. The lowland, west of the bluffs, at an elevation of about 20 m (70 ft) above MSL, consists of a layer of Holocene alluvium more than 30 m (100 ft) thick, including backswamp areas and meander belts of the Mississippi River. The Miocene Catahoula formation underlies the alluvium in the lowlands.

In addition to the effect of the Mississippi River, infiltration from local precipitation and shallow surface water bodies, such as Gin Lake and Hamilton Lake, can recharge the lowland alluvial aquifer. The unconfined water surface in the alluvial aquifer in the lowlands is at most a few feet beneath the ground surface. The aquifers in the deeper Catahoula formation are more likely to be recharged via lateral flow from outcrops a distance from the site.

Upland

The surface of the upper plain is about 23 m (75 ft) of loess overlaying about 10 m (40 ft) coarse-grained alluvial sand and gravel deposits of the Upland Complex. The unconfined aquifer in the loess and alluvium is recharged from local precipitation and lateral movement. The water table elevation is not significantly influenced by the fluctuations in the Mississippi River. The Catahoula formation underlies the terrace deposits in the upland.

2.6.1.3 Hydrological Monitoring

Preoperational and ongoing operational monitoring of the GGNS facility provide a limited hydrological baseline of the affected environment within and near the Grand Gulf ESP site. Many of the construction impacts of an ESP facility at the site are likely to be similar to the impacts that occurred during construction of the existing plant. For instance, groundwater drawdowns caused by dewatering wells are likely to have similar impacts to the impacts experienced and monitored during the construction of the GGNS facility. These impacts were temporary and localized to the GGNS site.

The flow and water surface elevation of the Mississippi River are continuously monitored by the ACE. The ACE operates a station at Vicksburg (Station #15145) and a station downstream from the site at Natchez, Mississippi (Station #15155). The ACE also publishes a hydrographic survey, including the maps of the riverbed elevations of the Mississippi River adjacent to the site.

As part of the GGNS National Pollutant Discharge Elimination System (NPDES) permit, streamflows are monitored on Stream A and Stream B downstream of Sedimentation Basin A and Sedimentation Basin B, respectively. For Stream A, SERI reported annual average flows of 0.00954 m^3/s (0.337 cfs) for 1999 and 0.0934 m^3/s (3.30 cfs) for 2001. For Stream B, SERI reported annual average flows of 0.00832 m^3/s (0.294 cfs) for 1999 and 0.0138 m^3/s (0.487 cfs) for 2000 (SERI 2005). Additionally, flows are recorded for each of the outfalls from the GGNS facility discharging into Sedimentation Basin A, Sedimentation Basin B, and directly into the Mississippi River.

Total annual water withdrawals from radial wells adjacent to the Mississippi River, dewatering wells, and wells in the Catahoula formation for potable water supplies are reported to the MDEQ. The staff reviewed annual water use reports obtained from MDEQ for 2000 and 2002 and found that the radial wells and potable wells were operating well below their rated capacities and the dewatering wells were not being used at all during these two years.

According to the safety analysis report, groundwater levels were initially measured in 1972 with 15 piezometer and 36 observation well locations (SERI 2005). The number of locations in the Catahoula formation, terrace deposits, and alluvium was 10, 33, and 8, respectively. These data reported by SERI for 1972 through 1976 provide a baseline for the pre-GGNS groundwater elevations. The data show both inter-annual and intra-annual variation in the three strata of as much as 12 m (40 ft). While the magnitude of water surface changes vary considerably between wells, generally the direction of water surface change is consistent (i.e., all wells and strata increase and decrease together), suggesting that the three strata have some degree of hydraulic connection.

Water levels in one piezometer, nine observation wells, seven monitoring wells and eight dewatering wells in the Catahoula formation, terrace deposits, and alluvium are measured monthly. The number of locations in the Catahoula formation, terrace deposits, alluvium, and perched aquifers in the fill around the GGNS reactor block are 2, 5, 2, and 15, respectively. The environmental report (SERI 2005) contains recent groundwater sampling data from published sources and from results of ongoing monitoring programs at the GGNS site.

The NRC staff found the hydraulic conductivity information from various permeability tests reported by SERI for the Catahoula formation is currently inadequate to provide a reliable basis to estimate the groundwater drawdowns associated with withdrawals from this formation. However, other than this exception, the staff found that continuation of the existing monitoring program would provide an adequate hydrological monitoring program.

2.6.2 Water Use

Water in the vicinity satisfies a variety of purposes including domestic, industrial, and agricultural uses with groundwater withdrawn from the various aquifers and surface water withdrawn from the Mississippi River. SERI presented estimated water use data for 1995 in Claiborne County (SERI 2005). The NRC staff used 2000 data from the USGS (USGS 2004). The staff found that total estimated water use in Claiborne County was 130,000 m^3/d (34.3 MGD). Groundwater comprises all of that total except 1600 m^3/d (0.4 MGD) of surface water.

2.6.2.1 Surface Water Use

Although surface water is not directly used at the existing GGNS, the facility withdraws groundwater that is hydraulically connected to the river, as further described below. Total surface water withdrawals in Claiborne County are predominantly for agricultural use, with no surface water usage reported for public supply, domestic self-supplied systems, mining, hydroelectric power, thermoelectric power, industrial or commercial uses (see environmental report in SERI 2005).

The nearest downstream user of Mississippi River water is Southeast Wood Fiber located at the Claiborne County Port facility, 1.3 km (0.8 mi) downstream of the Grand Gulf ESP site. The maximum intake requirement for this facility is less than 3400 m^3/d (0.9 MGD) for industrial purposes; however, none of this intake is used as potable water (MDEQ 2004b). According to the environmental report, there are only three public water supply systems in the state of Mississippi that use surface water as a source, and none of these are located within 80 km (50 mi) of the Grand Gulf ESP site (SERI 2005). There are no downstream or upstream intakes in Mississippi within 160 km (100 mi) of the Grand Gulf ESP site that use the Mississippi River as a potable water supply (MDEQ 2002b).

The ACE maintains a depth of 3 m (9 ft) at low water on the Mississippi River for navigational uses.

2.6.2.2 Groundwater Use

Service water for the existing GGNS is supplied from radial (Ranney) collector wells located beneath and adjacent to the Mississippi River. The collector wells pump water from the Mississippi alluvial aquifer via induced infiltration from the Mississippi River (Entergy 2003c).

Total groundwater withdrawal in Claiborne County for 2000 was 128,000 m^3/d (33.9 MGD), with the majority used for cooling at GGNS.

Entergy Operations, Inc. is required to submit an Annual Water Use Survey to the MDEQ. According to data for the 2003 calendar year, the GGNS has seven active wells with a total of 0.116 million L/d (30.8 MGD) pumped in 2003. All of this water was pumped from the four radial collector wells, except 0.302 million L/d (0.08 MGD) pumped from three wells in the Catahoula formation used for general site purposes, including potable, sanitary, air conditioning, and landscape maintenance.

Public water supply wells in Claiborne County, excluding GGNS, are supplied from the Catahoula formation. Nine active public water supply systems were located in Claiborne County as of July 2004 (EPA 2004). The closest area of concentrated groundwater withdrawal is the Port Gibson municipal water system about 8 km (5 mi) southeast of the site. It pumps from five wells completed in the Catahoula formation and is the largest system in the county, serving a population of 4845. Within 3.2 km (2 mi) of the Grand Gulf ESP site, essentially all groundwater is used for domestic purposes.

SERI estimated future groundwater demands in the vicinity of the site on the basis of projected population growth. According to the population projections (see the environmental report in SERI 2005), the population within a 3.2-km (2-mi) radius of the Grand Gulf ESP site will increase by 14 percent to 58 persons by the year 2070 (excluding Grand Gulf plant personnel). Current water use in this area is primarily for domestic consumption (SERI 2005). Conservatively assuming the entire projected population used groundwater as a source, and each person used 382 L/d (101 GPD) (Carr et al. 1990), the estimated groundwater withdrawal within a 3.2-km (2-mi) radius of the Grand Gulf ESP site by the year 2070 will be 22,200 L/d (5860 GPD). Much of that groundwater consumption would likely return to the surficial aquifer via septic drainfields. A listing of water wells within a 6.4-km (4-mi) radius of the Grand Gulf ESP site can be found in the environmental report (SERI 2005).

2.6.3 Water Quality

Surface water and groundwater quality in the vicinity of the ESP site are adequate for a variety of uses. The water quality of the Mississippi River and the two small onsite drainages, Stream A and Stream B, has been slightly altered by the construction and operation of the GGNS facility. The induced infiltration from the operation of the GGNS radial wells has ensured that the quality of the groundwater in the vicinity of the radial wells is nearly identical to the water quality of the Mississippi River, except for suspended sediment. The water quality of the groundwater in the Catahoula formation does not appear to have been influenced by the construction or operation of the GGNS facility.

2.6.3.1 Surface Water Quality

The Mississippi River integrates the qualities of all its multitude of inflows throughout its course to the Grand Gulf site. The massive nature of the Mississippi River makes the discharges from the GGNS facility undetectable within the overall flow regime, and any changes in the quality are small and localized compared to the overall width of the river. The water quality of the Mississippi is monitored by the ACE at Vicksburg, Mississippi upstream of the Grand Gulf ESP site. Temperatures in the Mississippi River vary seasonally with maximum and minimum temperatures reported as 32°C (90°F) and 1.5°C (35°F), respectively. The Mississippi River water is generally hard to very hard and therefore requires softening to avoid scale formation when heated.

At the Grand Gulf site, water quality of Streams A and B (see Figure 2.2) is affected by the GGNS facility. Stream A is generally unaffected by the GGNS facility until it reaches Sedimentation Basin A. At this location, discharges include: storm water runoff, standby service water leakage, treated sanitary waste water, and miscellaneous waste water from the GGNS Energy Services Center, including water softener backwash and air-conditioning cooling tower blowdown. These sources contribute nutrients, chlorine, and sediment to the sedimentation basin. In compliance with its NPDES permit, Entergy Operations, Inc. is required to monitor these. The maximum monthly average nutrient concentration of the sanitary waste treatment system reported by SERI, expressed in terms of biological oxygen demand, for 2000 and 2001 was 25 mg/L. The maximum total suspended solids from the combined outflow from Sediment Basin A reported by SERI for 1999, 2000, and 2001 was 97 ppm.

The watershed and channel for Stream B were nearly entirely modified as a result of the construction of the GGNS facility. The water quality of Stream B has been altered by the loss of the vegetation and soil cover. The normal nutrient and sediment load from a forested watershed have been reduced by the loss of the canopy and changes of the surface runoff conditions. Sedimentation Basin B also receives standby service water leakage, intermittent circulating water basin overflows, storm water runoff, and water from a variety of building

drains. Entergy Operations, Inc. is required by its NPDES permit to monitor these sources. The maximum amount of total suspended solids in the combined outflow from Sedimentation Basin B reported by SERI for 1999, 2000, and 2001 was 26 ppm.

2.6.3.2 Groundwater Quality

The GGNS facility uses radial wells adjacent to and with laterals extending beneath the Mississippi River to provide cooling water. The high rate of water induced to infiltrate from the Mississippi River into the Holocene alluvium has ensured that the dissolved solids concentrations of the groundwater in the vicinity of the radial wells are nearly identical to the water quality of the Mississippi River. Suspended sediment in the river water is trapped in the stream bed, thereby reducing the suspended solids in the cooling water. The water quality of the groundwater in the Catahoula formation does not appear to have been influenced by the construction or operation of the GGNS facility.

The GGNS uses wells in the Catahoula formation as the source of water for several purposes, including potable water needs. The water is sampled for the Mississippi Health Department pursuant to the Safe Drinking Water Act. The water quality of the groundwater from the Catahoula formation, although very hard, is suitable for potable uses. Water quality generally decreases as wells go deeper below the Catahoula formation.

2.6.3.3 Thermal Monitoring

Pre-application, pre-operational, and ongoing operational monitoring of the GGNS facility provide a limited baseline of the temperatures in the Mississippi River. The operational impact of the additional thermal load in the cooling tower blowdown from the Grand Gulf ESP facility would be additive to the thermal impact of the GGNS facility. It is expected that the discharge volume would increase, but discharge temperature would not change. Therefore, the existing thermal plume would increase in area, but would not have a higher maximum temperature. Adequate temperature baseline data can be developed from the existing plant's discharge to calibrate and validate thermal plume models such as CORMIX. (See Section 5.3.2 for a discussion of the thermal analysis performed by the NRC staff using the CORMIX model.)

The NRC staff found the thermal plume data for the existing GGNS discharge are currently inadequate to calibrate the CORMIX model. Pursuant to Section 316(a) of the Clean Water Act, an applicant for a CP or COL may be required by MDEQ to collect sufficient temperature data to calibrate the CORMIX model. Other than this exception, the staff found that continuation of the existing operational monitoring program would provide an adequate thermal monitoring program for a new power generation facility at the Grand Gulf ESP site.

2.6.3.4 Chemical Monitoring

Pre-application, pre-operational, and ongoing operational monitoring of the GGNS facility provide a limited water quality baseline of the affected environment within and near the proposed Grand Gulf ESP site. Many of the operational impacts of an ESP facility at the site are likely to be similar to the impacts that are occurring as a result of the existing plant. For instance, nutrient loads to Sedimentation Basin A from the sanitary treatment system are likely to increase proportionally to the increase in staff for both facilities. The current water quality baseline data can be used to calibrate and validate mixing models such as CORMIX. (See Section 5.3.2 for a discussion of the chemical mixing analysis performed by the staff using the CORMIX model.)

As no specific design has been selected for the ESP facility, water treatment and waste water designs are currently unknown. Water treatment is likely to be required to improve the quality of water withdrawn from the Mississippi River that is proposed to be used in the closed-cycle cooling system. Other than the sanitary effluents, there currently is no basis to evaluate the suitability of the current monitoring program to fit the needs of the liquid effluents from a new ESP facility. Prior to operation, the applicant for a CP or COL at the Grand Gulf ESP site would be required to define the effluents and obtain an NPDES permit from MDEQ.

2.7 Ecology

The vast majority of the Grand Gulf site has been left undisturbed since construction of GGNS Unit 1. The site is roughly bisected by a north-south line of bluffs located parallel to and east of the Mississippi River. The Grand Gulf site consists of seasonally inundated bottomland west of the bluffs along the river and uplands atop the bluffs. About one-half of the site is bottomland, including forested, shrub, and emergent marsh wetlands. The other half of the site supports upland habitat, including forests, fields, and small wetlands, in areas that were not cleared during construction of GGNS Unit 1. The Grand Gulf ESP site consists primarily of upland hardwood forest and bottomland forested wetlands. Generally, wildlife species found on the Grand Gulf site are representative of those commonly found in central Mississippi and northern Louisiana along the Mississippi River.

Sections 2.7.1 and 2.7.2 provide general descriptions of terrestrial and aquatic environments on and in the near vicinity of the Grand Gulf site. Detailed descriptions are provided where needed to support the analysis of potential environmental impacts from construction, operation, and decommissioning of new nuclear power generating facilities. The descriptions are provided to support mitigation activities identified during the assessment to avoid, reduce, minimize, rectify, or compensate for potential impacts. Descriptions are also provided to help compare the alternative sites to the Grand Gulf site. Also included are descriptions of monitoring programs for terrestrial and aquatic environments.

2.7.1 Terrestrial Ecology

The Grand Gulf ESP site overlaps the Mississippi Valley Alluvial Plain and Mississippi Valley Loess Plains ecoregions as described by Omernik (1987). The Mississippi Valley Alluvial Plain ecoregion consists of a broad, flat alluvial plain with river terraces, swales, and levees providing the main elements of relief. Soils are typically finer-textured and more poorly drained than the upland soils of the adjacent Mississippi Valley Loess Plains ecoregion. Bottomland deciduous forest vegetation covers the Mississippi Valley Alluvial Plain ecoregion where it has not been cleared for cultivation. The Mississippi Valley Loess Plains ecoregion consists primarily of irregular plains, some gently rolling hills, and bluffs near the Mississippi River. Thick loess is one of the distinguishing characteristics. Oak-hickory and oak-hickory-pine forest was the natural vegetation in this ecoregion. In the Mississippi portion of this ecoregion there is a mosaic of forest and cropland (Omernik 1987).

Reconnaissance visits to the Grand Gulf site were made by Enercon Services, Inc. (Enercon), on behalf of SERI, during August 19 to 24 and October 29 to November 1, 2002 (SERI 2005). The purpose of these visits was to identify jurisdictional waters of the United States including wetlands, and qualitatively assess existing ecological resources (including vegetation and wildlife) for comparison with descriptions provided in Mississippi Power and Light's (MP&L's) Final Environmental Report (1973). Information provided in the MP&L Final Environmental Report was based on field surveys conducted from June 1972 to August 1973 prior to construction of GGNS Unit 1 (see environmental report in SERI 2005).

Figure 2-3 is an aerial photograph of the Grand Gulf area taken in 1971, prior to construction of GGNS Unit 1. Figure 2-4 is an aerial photograph taken in 2001 depicting GGNS Unit 1 and proposed construction areas for the Grand Gulf ESP facility. A comparison of Figures 2-3 and 2-4 shows the vast majority of the Grand Gulf site has been left undisturbed since construction of GGNS Unit 1. It is noteworthy, however, that the main channel of the Mississippi River north of the barge slip (Figure 2-4) has moved to the east in the intervening 30 years, as evidenced by the property line extending into the river. This represents a loss of about 34 ha (85 ac) of terrestrial habitat. According to the environmental report, the ACE has stabilized the banks of the river by constructing revetments; therefore, further erosion of the eastern bank is not anticipated (SERI 2005).

The conclusion drawn from the Enercon reconnaissance visits and comparison of Figures 2-3 and 2-4 is that the ecological descriptions in the final environmental report (MP&L 1973) adequately describe current conditions at the Grand Gulf site (see environmental report in SERI 2005). Consequently, the final environmental report descriptions (updated with information to indicate where biological conditions at the Grand Gulf site differ from those in

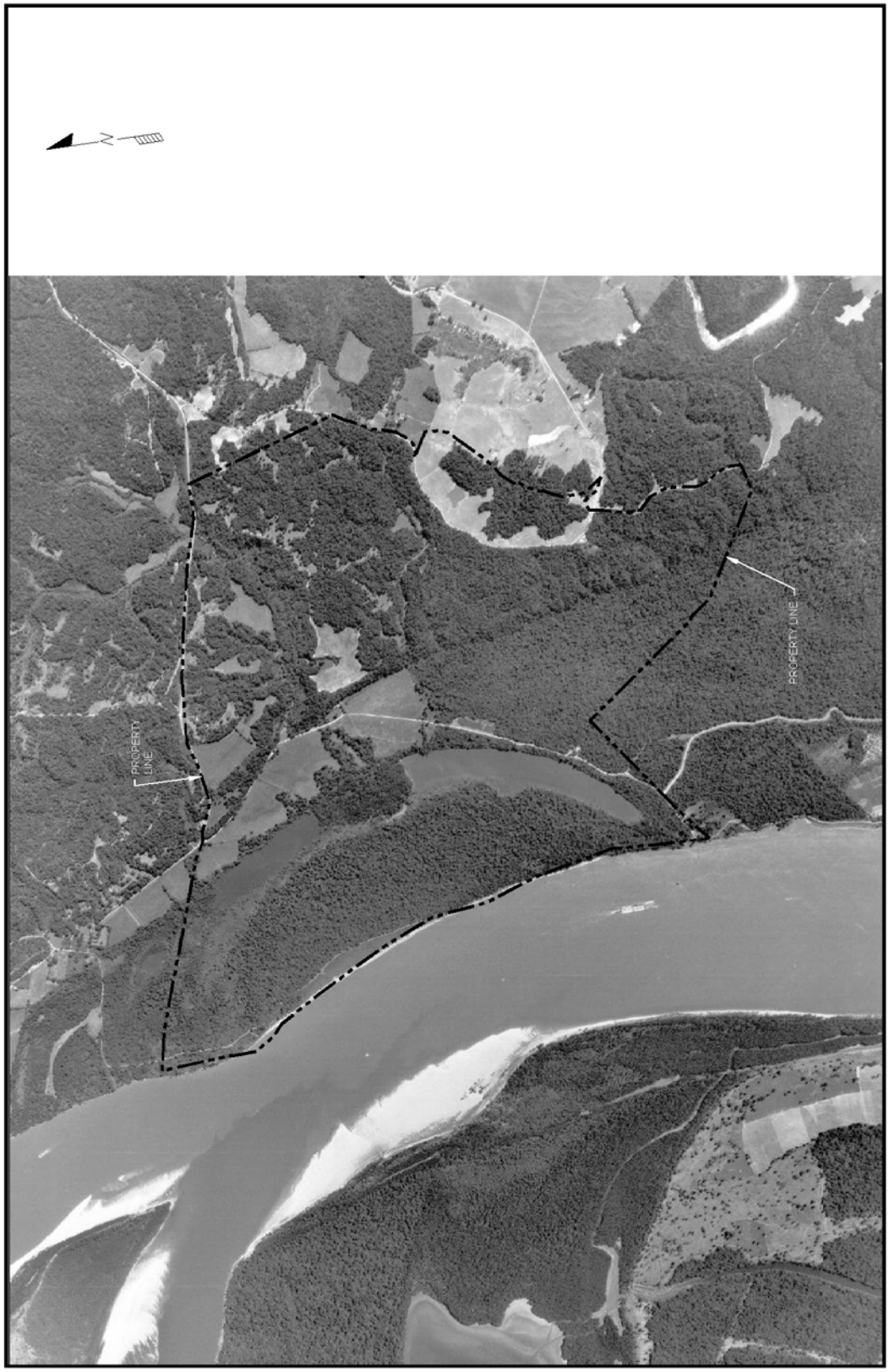

Figure 2-3. Aerial Photograph of the Grand Gulf Area (October 11, 1971) Prior to Construction of Grand Gulf Nuclear Station Unit 1 Facility (SERI 2005, Figure 2.4-1)

Figure 2-4. Aerial Photograph Depicting Grand Gulf Nuclear Station Unit 1 (November 21, 2001) and Construction Areas (Cross-Hatched Areas) for the Proposed Grand Gulf Early Site Permit Facility (SERI 2005, Figure 2.4-2)

existence prior to construction of GGNS Unit 1) were incorporated into the environmental report for the Grand Gulf ESP (SERI 2005) and are extensively used for the following descriptions of terrestrial ecological resources.

2.7.1.1 Biological Communities

Vegetation on the Grand Gulf Site

About one-half of the Grand Gulf site is bottomland, including forested, shrub, and emergent marsh wetlands. According to the environmental report, the other half of the site supports upland habitat types, including forests, fields, and small wetlands, in areas that were not cleared during construction of GGNS Unit 1 (SERI 2005).

During 1972 and 1973, before the construction of GGNS Unit 1, at least 420 species of vascular plants representing 285 genera and 105 families were observed on the site (MP&L 1973; SERI 2005). The environmental report states that of the 64 tree species, all but three are deciduous (SERI 2005). The composition of understory vegetation varied by location and season, with the largest number of plant taxa occurring in the uplands during the summer, and the smallest number of taxa in the bottomland during winter (SERI 2005). The uplands are more diverse than the bottomland primarily because of the lack of Mississippi River inundation and its scouring effects on understory vegetation. Common plant taxa that were found in upland and bottomland forests are listed in Table 2-4.

Terrestrial habitats at the Grand Gulf site can now, as in the 1970s, generally be classified as upland and bottomland forest, upland and bottomland clearings (since planted with loblolly pine [*Pinus taeda*] and American sycamore [*Platanus occidentalis*], respectively), and upland and bottomland wetlands. The distribution of these habitats, including areas currently developed for GGNS Unit 1 infrastructure and those proposed for construction of the Grand Gulf ESP facility, are shown in Figure 2-5. According to the environmental report, most of the currently developed area is located in the uplands (SERI 2005). The terrestrial habitats on the Grand Gulf site are described in the following paragraphs.

Bottomland Forest

Bottomland hardwood forests may be characterized as palustrine, seasonally flooded wetlands. This habitat covers approximately 358 ha (885 ac), most of the bottomland between the Mississippi River and the bluff line (Figure 2-5). Habitat characteristics of bottomland hardwood forests fluctuate seasonally with varying levels of inundation (SERI 2005).

Table 2-4. Common Plant Taxa in Bottomland and Upland Forests Prior to Construction of Grand Gulf Nuclear Station Unit 1

Bottomland Forest		Upland Forest	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
American buckwheat vine	*Brunnichia ovata*	American elm	*Ulmus americana*
asters	*Aster* spp.	asters	*Aster* spp.
bedstraw	*Galium* spp.	brittle bladderfern	*Cystopteris fragilis*
black willow	*Salix nigra*	crossvine	*Bignonia capreolata*
box elder	*Acer negundo*	eastern poison ivy	*Toxicodendron radicans*
chickweeds	*Stellaria* spp.	grasses	Family Poaceae
fleabanes	*Erigeron* spp.	greenbriars	*Smilax* spp.
dewberries	*Rubus* spp.	haircap moss	Family Musci
eastern poison ivy	*Toxicodendron radicans*	hickories	*Carya* spp.
false nettle	*Boehmeria cylindrica*	Japanese honeysuckle	*Lonicera japonica*
grasses	Family Poaceae	sedges	*Carex* spp., *Cyperus* spp.
green ash	*Fraxinus pennsylvanica*	smallflower baby blue eyes	*Nemophila aphylla*
Johnson grass	*Sorghum halepense*	southern red oak	*Quercus falcata*
pecans	*Carya* spp.	swamp privet	*Forestiera acuminata*
peppervine	*Ampelopsis arborea*	sweetgum	*Liquidambar styraciflua*
sedges	*Carex* spp., *Cyperus* spp.	switchcane	*Arundinaria gigantea*
smallflower baby blue eyes	*Nemophila aphylla*	violets	*Viola* spp.
sugarberry	*Celtis laevigata*	Virginia creeper	*Parthenocissus quinquefolia*
trumpet creeper	*Campsis radicans*	water oak	*Quercus nigra*
vetches	*Vicia* spp.	winged elm	*Ulmus alata*
violets	*Viola* spp.		

Source: SERI 2005

Herb, forb, and shrub layers are typically sparse because of the closed canopy and because annual inundation by Mississippi River flood water retards vegetation growth. Opening the overstory canopy by means of storms, natural tree-fall, logging, or cultivation promotes growth of sedges, grasses, and other low-growing vegetation, such as panicgrass (*Panicum* spp.), lizard's tail (*Saururus cernuus*), and trumpet creeper (*Campsis radicans*) (SERI 2005).

Bottomland Emergent Wetlands

Bottomland emergent wetlands (dominated by plants that rise above the surface of the water) may be characterized as palustrine and seasonally flooded. These cover approximately 12 ha (30 ac) and are located at the south and north ends of Hamilton Lake (Figure 2-5). These wetlands are dominated by grasses, such as redtop panicgrass (*Panicum rigidulum*), and sedges (*Carex* spp.); their level of inundation varies seasonally and from year to year (SERI 2005).

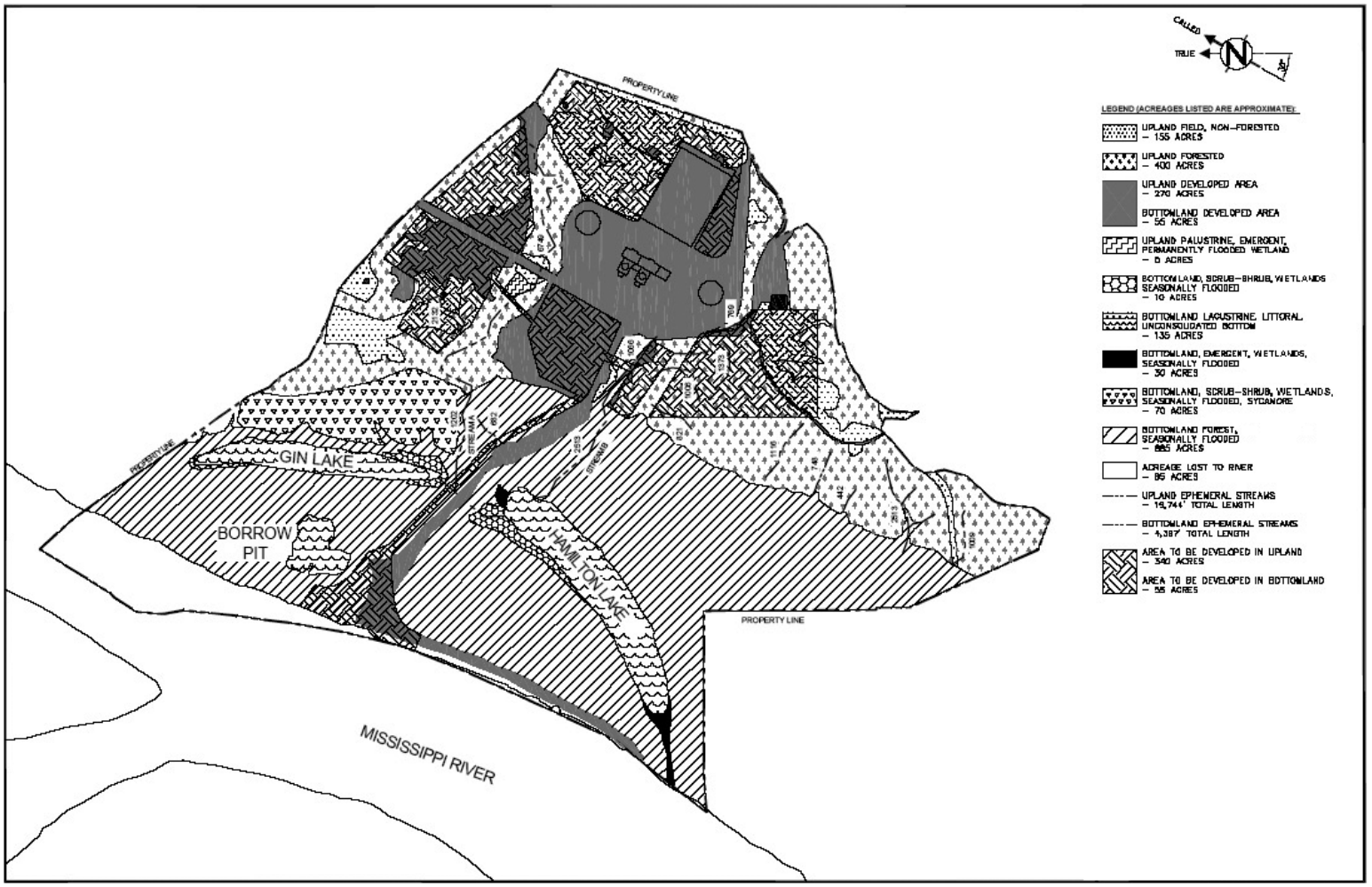

Figure 2-5. Terrestrial Habitat Types and Developed Areas on the Grand Gulf Site (SERI 2005, Figure 2.4-3)

Bottomland Scrub-Shrub Wetlands

Bottomland scrub-shrub (dominated by sapling trees and shrubs) wetlands may also be characterized as palustrine and seasonally flooded. Those located east of Gin Lake (Figure 2-5) cover approximately 28 ha (70 ac) and most likely were a former bottomland field cultivated for forage. The field has been planted with American sycamore trees, which are uniformly about 6 m (20 ft) in height (SERI 2005). In 2002, the perimeter of this area was cultivated to enhance deer habitat and attract deer to the area for hunting (SERI 2005).

Other bottomland scrub-shrub wetlands are located on the north, northwest, and south ends of Gin Lake, and on the northwest bank of Hamilton Lake (Figure 2-5). These cover approximately 4 ha (10 ac) and are dominated by black willow (*Salix nigra*) and swamp privet (*Forestiera acuminata*). Little herbaceous understory vegetation occurs in these wetlands, probably because of recurrent flooding in spring. Common button bush (*Cephalanthus occidentalis*) is found in these wetlands on the south end of Gin Lake (SERI 2005).

Upland Forests

Upland hardwood forests are a combination of two forest community types, oak (*Quercus* spp.)-American elm (*Ulmus americana*) and oak-sweetgum (*Liquidambar styraciflua*) deciduous forest. These dominate upland areas and cover approximately 162 ha (400 ac) (Figure 2-5). Like bottomland hardwood forests, the growth of understory vegetation in upland hardwood forests is limited by canopy closure. However, unlike bottomland forests, upland forests are rarely inundated with water for prolonged periods, so flooding is less a limiting factor on growth of understory vegetation. Consequently, upland forests exhibit a more diverse plant community than bottomland forests, both in structure and taxonomic composition (SERI 2005).

Upland Fields

Upland fields cover approximately 63 ha (155 ac) at the ESP site (Figure 2-5). They have been planted with loblolly pine (SERI 2005).

Vegetation along the Grand Gulf Nuclear Station Unit 1 Transmission Line Rights-of-Way

SERI did not indicate the vegetation communities (including wetland, floodplains, or special habitat areas) crossed by the GGNS Unit 1 transmission line rights-of-way (Baxter-Wilson and Franklin lines) in its environmental report (SERI 2005, 2004d). Further, no such information is available from the transmission and distribution system owner and operator (Entergy Mississippi, Inc.) (Entergy Services 2004a). SERI also did not indicate the transmission line right-of-way maintenance procedures in its environmental report (SERI 2005). However, the procedures generally consist of mechanical means (primarily bushhogging) that are performed on an as-needed basis (Entergy Services 2004b), except for along the Franklin transmission

line right-of-way where it crosses the Homochitto National Forest. In 2003, Entergy Corporation entered into a partnership with the National Wild Turkey Federation to maintain transmission line rights-of-way on the Homochitto National Forest using low-toxicity herbicides for the purpose of producing a more open, grassy habitat (USFS 2003).

Wildlife on the Grand Gulf Site

Forests with diverse plant species and well-developed vertical structure provide many ecological niches that support diverse wildlife populations. The majority of the undeveloped portion of the Grand Gulf site consists of bottomland and upland hardwood forests. Hardwood forests, particularly those in the uplands, are diverse. Generally, as hardwood forests increase in age, the structure of their herb, forb, shrub, mid-story, and canopy layers also increases. Bottomland hardwood forests, while they may not be as rich in species as upland hardwood forests, can be highly productive in terms of wildlife, in part because of annual inundation that continually replenishes soil nutrients (SERI 2005).

Hardwood forests provide the requirements of nesting birds, as well as migration corridors and stop-over habitat for neo-tropical and short-distance migrants. Likewise, hardwood forests provide travel corridors for mammals and habitat for other resident, ground-dwelling animals. Of special significance in hardwood forests is the production of beechnuts, acorns, and similar foodstuffs, collectively termed “mast.” Mast is consumed by a variety of wildlife species. Older hardwood stands also feature trees with cavities of varying size that are important as wildlife dens and roosts (SERI 2005).

Mammals

Table 2-5 lists the mammal species encountered on the Grand Gulf site in 1972 and 1973 prior to construction of GGNS Unit 1 (SERI 2005). The whitetail deer *(Odocoileus virginianus)* is the largest of these species. Based on the Enercon October 2002 reconnaissance visit to the Grand Gulf site (SERI 2005), a substantial deer population continues to use both upland and bottomland forests. In October 2002, two areas were observed where a local archery hunting club of SERI employees had disked and seeded the ground with grass to attract wildlife. One area was in a natural clearing in a bottomland forest stand east of Radial Water Well No. 1. The other area was in a former bottomland field northwest of GGNS Unit 1 near Gin Lake. The SERI (2005) environmental report did not specify the sizes of the two treated areas, but they are on the order of several acres and thus comprise only a small portion of the Grand Gulf site.

Table 2-5. Mammals Collected or Observed Prior to Construction of Grand Gulf Nuclear Station Unit 1

Small Mammals		Large Mammals	
Scientific Name	**Common Name**	**Scientific Name**	**Common Name**
Peromyscus gossypinus	cotton mouse	*Dasypus novemcinctus*	armadillo
Tamias striatus	eastern chipmunk	*Castor canadensis*	beaver
Sciurus niger	eastern fox squirrel	*Lynx rufus*	bobcat
Sciurus carolinensis	eastern gray squirrel	*Sylvilagus floridanus*	eastern cottontail
Reithrodontomys fulvescens	fulvous harvest mouse	*Urocyon cinereoargenteus*	gray fox
Ochrotomys nuttalli	golden mouse	*Didelphis marsupialis*	opossum
Sigmodon hispidus	hispid cotton rat	*Procyon lotor*	raccoon
Mus musculus	house mouse	*Mephitis mephitis*	striped skunk
Cryptotis parva	least shrew	*Sylvilagus aquaticus*	swamp rabbit
Microtus pinetorum	woodland vole	*Odocoileus virginianus*	whitetail deer
Oryzomys palustris	marsh rice rat		
Blarina brevicauda	shorttail shrew		
Peromyscus leucopus	white-footed mouse		
	Source: SERI 2005		

Based on the October 2002 Enercon reconnaissance visit to the Grand Gulf site (SERI 2005), beaver (*Castor canadensis*) use bottomlands and onsite streams, and raccoon *(Procyon lotor),* striped skunk *(Mephitis mephitis)*, and various unidentified small mammals (for example, mice and shrews) use both uplands and bottomlands. Bottomlands are used by hogs. However, whether these are feral domestic hogs *(Sus scrofa)* or collared peccary *(Pecari tajacu)* is unknown (SERI 2005).

Common Bird Species

The list of common bird species observed on or near the Grand Gulf site during the 1972 and 1973 censuses is too long to list here. A complete list can be found in the SERI (2005) environmental report. Instead, groups of birds are discussed in the following paragraphs to provide an overview of the birds using the Grand Gulf site. The species discussed are considered common onsite, except where otherwise noted.

Forest Community Birds

Forest community birds include year-round, summer and winter residents. Examples include: the blue jay (Cyanocitta cristata) and northern cardinal (*Cardinalis cardinalis*), which are year-round residents; the Acadian flycatcher (*Empidonax virescens*) and yellow-billed cuckoo

(*Coccyzus americanus*), which are summer residents; and the American robin (*Turdus migratorius*) and ruby-crowned kinglet (*Regulus calendula*), which are winter residents. Field-forest community birds also include year-round, winter and summer residents. Examples include: the mourning dove (*Zenaida macroura*) and red-winged blackbird (*Agelaius phoeniceus*), which are year-round residents; the orchard oriole (Icterus spurius) and northern rough-winged swallow *(Stelgidopteryx serripennis*), which are summer residents; and the field sparrow *(Spizella pusilla*) and lark sparrow (*Chondestes grammacus*), which are winter residents (SERI 2005).

Water-Dependent Birds

Water-dependent birds observed on Hamilton and Gin Lakes include herons (for example, great blue heron [*Ardea herodias*], tricolored [Louisiana] heron [*Egretta tricolor*]), egrets (such as the cattle egret *[Bubulcus ibis]* and great [common] egret [*Ardea alba*]), ibis (such as the white ibis [*Eudocimus albus*]), wood stork or wood ibis (*Mycteria americana*), belted kingfisher (*Ceryle alcyon*), American coot (*Fulica americana*), pied-billed grebe (*Podilymbus podiceps*), and several waterfowl species (for example, the mallard [*Anas platyrhynchos*], northern pintail [*Anas acuta*], wood duck [*Aix sponsa*]). Use of the lakes by water-dependent species is seasonal. Of the water birds, only the wood duck, great blue heron, and belted kingfisher are permanent residents. According to the environmental report, the remaining species are primarily summer residents, with the exception of the American coot and pied-billed grebe, which occur in the area from fall through early spring (SERI 2005).

Birds of Prey

Birds of prey observed on or near the Grand Gulf site include vultures (such as, the black vulture [*Coragyps atratus*] and turkey vulture [*Cathartes aura*]), hawks (for example the broad-winged hawk [*Buteo platypterus*], northern harrier [*Circus cyaneus*], red-shouldered hawk [*Buteo lineatus*], red-tailed hawk [*Buteo jamaicensis*], sharp-shinned hawk [*Accipiter striatus*]), falcons (such as the American kestrel [*Falco sparverius*]), kites (such as the Mississippi kite [*Ictinia mississippiensis*]), and owls (for example, the great horned owl [*Bubo virginianus*], and eastern screech-owl [*Otus asio*]). Black and turkey vultures, the red-tailed and red-shouldered hawks, and all the owl species are year-round residents. The broad-winged hawk and Mississippi kite are summer residents, and the northern harrier, American kestrel, and sharp-shinned hawk occur on site only during migration. With the exception of the northern harrier (an inhabitant of grasslands and marshes), woodlands and wooded margins are the preferred habitat for the birds of prey observed (SERI 2005).

Upland Game Birds

Of the upland game birds observed on or near the Grand Gulf site, the mourning dove, northern bobwhite (*Colinus virginianus*), and wild turkey (*Meleagris gallopavo*) are year-round residents. The mourning dove is also the most abundant of the upland game birds onsite (SERI 2005).

All the bird species noted above are considered common, with the exception of the wood stork and Louisiana heron (SERI 2005).

Wildlife along the Grand Gulf Nuclear Station Unit 1 Transmission Line Rights-of-Way

SERI did not indicate wildlife or habitat within the GGNS Unit 1 transmission line rights-of-way (Baxter-Wilson and Franklin lines) in its environmental report (SERI 2005, 2004d). Further, no such information is available from the transmission and distribution system owner and operator, Entergy Mississippi, Inc. (Entergy Services 2004a).

State-Listed Species

State-listed threatened and endangered terrestrial species that may occur in the vicinity of the Grand Gulf site are listed in Table 2-6. Location information for State-listed species within 3.2 km (2 mi) and 16 km (10 mi) of the Grand Gulf site was obtained from the Mississippi Natural Heritage Program (MNHP) (MNHP 2004a, 2004b).

Animal Species

Two State-listed endangered terrestrial animal species are known to occur on and in the near vicinity (<3.2 km (2 mi)) of the Grand Gulf site: the Louisiana black bear (*Ursus americanus luteolus*) and wood stork (*Mycteria americana*) (Table 2-6). One State-listed endangered bird species has been reported to occur within 16 km (10 mi) of the Grand Gulf site: the least tern (*Sterna antillarum*) (Table 2-6). Two other State-listed endangered species have been reported beyond 16 km (10 mi) of the Grand Gulf site: the bald eagle (*Haliaeetus leucocephalus*) and Florida panther (*Puma concolor coryi*) (Table 2-6). The Florida panther, bald eagle, least tern, and Louisiana black bear are also Federally listed species and are described in Section 2.7.1.2. The wood stork is discussed below.

The wood stork is a highly colonial species, usually nesting and feeding in flocks. The wood stork has been occasionally sighted in all states east of the Mississippi River, and sporadically sighted in some states west of the Mississippi River (FWS 1996). Breeding populations of the wood stork are Federally listed as endangered and currently occur or have recently occurred only in Alabama, Florida, Georgia, and South Carolina (49 FR 7332; FWS 1996). Thus, the above breeding populations are not considered in this EIS.

Table 2-6. State-Listed Terrestrial Species Occurring on and in the Vicinity of the Grand Gulf Site

Scientific Name	Common Name	Status[a]	Distance from the Grand Gulf Site[b]	Source[b]
Mammals				
Puma concolor coryi	*Florida panther*	*SE*	*>16 km (10 mi)*	*MNHP 2004b*
Ursus americanus luteolus	*Louisiana black bear*	*SE*	*onsite and <3.2 km (2 mi)*	*NRC 1981; MNHP 2004a; SERI 2005*
Birds				
Haliaeetus leucocephalus	*bald eagle*	*ST*	*>16 km (10 mi)*	*MNHP 2004b*
Mycteria americana	*wood stork*	*SE*	*onsite and <3.2 km (2 mi)*	*AEC 1973; MNHP 2004a*
Sterna antillarum	*least tern*	*SE*	*<16 km (10 mi)*	*MNHP 2004b*
Plants				
Mimulus ringens	*Allegheny monkeyflower*	*S1-S2*	*18 km (11 mi)*	*SERI 2005*
Celastrus scandens	*American bittersweet*	*S2-S3*	*3.2 km (2 mi) — 16 km (10 mi)*	*MNHP 2004a, 2004b*
Diplazium pycnocarpon	*glade fern*	*S2-S3*	*3.2 km (2 mi) — 16 km (10 mi)*	*MNHP 2004a, 2004b*
Marsilea vestita	*hairy waterclover*	*S1*	*3.2 km (2 mi) — 16 km (10 mi)*	*MNHP 2004a, 2004b*
Platythelys querceticola	*jug orchid*	*S1?*	*3.2 km (2 mi) — 16 km (10 mi)*	*MNHP 2004a, 2004b*

(a) State status rankings developed by the MNHP; for animals SE = State endangered and ST = State threatened; for plants S1 = critically imperiled, S2 = imperiled, and S3 = rare (MNHP 2004a, 2004b). Hyphenated state status ranks indicate a range in the status of the plant species based on insufficient data to make a determination. A question mark indicates uncertainty in the indicated status of the plant species.

(b) Species occurrences on the Grand Gulf site for the Louisiana black bear and wood stork are provided by SERI (2005), NRC (1981), and AEC (1973), respectively. All distances are provided by MNHP (2004a, 2004b).

It is non-breeding wood storks that are known to occur on and in the near vicinity of the Grand Gulf site (MNHP 2004a). Wood storks were observed in summer on Gin and/or Hamilton lakes during 18 years prior to construction of GGNS Unit 1 (AEC 1973). The wood stork should currently be considered a possible non-breeding transient to the Grand Gulf site and vicinity (SERI 2005; MNHP 2004a).

Plant Species

Four State-listed critically imperiled (endangered) or imperiled (threatened) plant species were identified through correspondence with the MNHP (2004a, 2004b). The two critically imperiled plant species are hairy waterclover (*Marsilea vestita*) and jug orchid (*Platythelys querceticola*). The two imperiled plant species are glade fern (*Diplazium pycnocarpon*) and American bittersweet (*Celastrus scandens*). All four species are known to occur beyond 3.2 km (2 mi) but within 16 km (10 mi) of the Grand Gulf site (MNHP 2004a, 2004b). One State-listed critically imperiled/imperiled plant species, the Allegheny monkeyflower (*Mimulus ringens*), was mentioned in SERI's environmental report (SERI 2005). The occurrence of the species nearest to the Grand Gulf site is about 11 miles to the southwest along the west bank of the Mississippi River northeast of St. Joseph, Louisiana (SERI 2005). None of the species have been reported on the Grand Gulf site.

Hairy waterclover grows in creekbeds, wetlands, seasonal pools, ditches, flood basins, and on the shores of lakes and streams, and is adapted to fluctuating water levels (WSDOE 2004). In the southeast region of the United States, hairy waterclover is considered an obligate wetland plant, which occurs almost always under natural conditions in wetlands, per the Regional Interagency Review Panel Revision of the National List of Plant Species that Occur in Wetlands (NRCS 2004).

The jug orchid grows in the humus of swamps, hardwood forests, and hammocks (Garay 1977). In the southeast region of the United States, the jug orchid is considered a facultative wetland plant that usually occurs in wetlands, but occasionally is found in non-wetlands (NRCS 2004; USDA 2004c).

The glade fern grows in moist open woods, moist meadows, and swamps (Connecticut Botanical Society 2004). In the southeast region of the United States, the glade fern is considered a facultative plant that is equally likely to occur in wetlands or non-wetlands (NRCS 2004; USDA 2004c).

American bittersweet grows along roadsides, fence rows, and forest margins. In the southeast region of the United States, insufficient information is available to determine the status of this species as a wetland indicator (NRCS 2004; Oklahoma Biological Survey 2004; USDA 2004c).

The square-stemmed monkeyflower's preferred habitat consists of wet meadows, stream banks, and damp ditches (SERI 2005).

2.7.1.2 Threatened and Endangered Terrestrial Species

This section describes Federally listed and proposed threatened and endangered terrestrial species and designated and proposed critical habitats that may occur on or in the vicinity of the Grand Gulf site and transmission line rights-of-way (Table 2-7). Information on Federally listed species in Claiborne County was obtained through correspondence with the U.S. Fish and Wildlife Service (FWS) (FWS 2004a, 2004b). In addition, a list of Federally listed species occurring in counties other than Claiborne (Franklin, Jefferson, Lincoln, Warren) that are crossed by the two transmission line rights-of-way (Baxter-Wilson and Franklin) was obtained from FWS county listings of such species for the state of Mississippi (FWS 2000). Location information for Federally listed species within 3.2 km (2 mi) and 16 km (10 mi) of the Grand Gulf site was obtained from the MNHP (2004a, 2004b).

Table 2-7. Federally Listed Terrestrial Species by County of Occurrence and Distance from the Grand Gulf Site

Scientific Name	Common Name	Status[a]	County	Distance from the Grand Gulf Site[b]	Source[b]
Mammals					
Puma concolor coryi	Florida panther	FE	Claiborne	>16 km (10 mi)	SERI 2005
Ursus americanus luteolus	Louisiana black bear	FT	Claiborne, Franklin, Jefferson, Warren	onsite and <3.2 km (2 mi)	FWS 2000, FWS 2004a; NRC 1981; SERI 2005
Birds					
Haliaeetus leucocephalus	bald eagle	FT	Claiborne, Warren	>16 km (10 mi)	FWS 2000, FWS 2004a
Picoides borealis	red-cockaded woodpecker	FE	Franklin	>16 km (10 mi)	FWS 2000
Sterna antillarum	least tern	FE	Claiborne, Warren	<16 km (10 mi)	FWS 2000, FWS 2004a
Reptiles					
Alligator mississippiensis	American alligator	FT (S/A)	Claiborne	onsite and <3.2 km (2 mi)	SERI 2005

(a) Federal status rankings developed by the FWS under the Endangered Species Act (1973), FE = Federal endangered, FT = Federal threatened, FT (S/A) = Federal threatened by similarity of appearance (FWS 2004a).
(b) Species occurrences on the Grand Gulf site for the Louisiana black bear provided by SERI 2005 and NRC 1981. All distances provided by MNHP (2004a, 2004b).

Federally Listed Terrestrial Animal Species

Six Federally listed threatened or endangered terrestrial animal species may occur on or in the vicinity of the Grand Gulf site and transmission line rights-of-way. These include the

- Florida panther (*Puma concolor coryi*) (SERI 2005; MNHP 2004a, 2004b, 2004c)
- American alligator (*Alligator mississippiensis*) (SERI 2005; MNHP 2004a, 2004b), which is threatened based on similarity of appearance to the American crocodile (*Crocodylus acutus*) (52 FR 21059)
- Least tern (*Sterna antillarum*) (SERI 2005; FWS 2000, 2004a) for the interior population only (FWS 1990b)
- Red-cockaded woodpecker (*Picoides borealis*) (FWS 2000)
- Bald eagle (*Haliaeetus leucocephalus*) (NRC 1981; SERI 2005; FWS 2000, 2004a), which is threatened but currently proposed for delisting (64 FR 36454)
- Louisiana black bear (*Ursus americanus luteolus*) (SERI 2005; FWS 2000, 2004a; MNHP 2004a, 2004b).

Two of these species, the American alligator (SERI 2005) and Louisiana black bear (NRC 1981; SERI 2005), are known to occur on the Grand Gulf site. Other than for the bald eagle, no known activities by the Federal government that would change the list of species or add critical habitats to the list are currently under way (SERI 2005; MNHP 2004a, 2004b; FWS 2000, 2004a).

Florida Panther

The historic range of the Florida panther was from Louisiana north and east to Tennessee and east to the Atlantic Ocean through most of the southeastern United States. Today only about 70 adult panthers remain in national and state parks and nearby private lands in southwest Florida (Florida Fish and Wildlife Conservation Commission 2004). The species is considered extirpated from the state of Mississippi.

The FWS has commented in the past on numerous sightings of the Florida panther “throughout its historic range,” while stating that no viable populations of the Florida panther now occur outside of Florida (SERI 2005). The MNHP has reported at least one sighting of the Florida panther within 3.2 km (2 mi) of the Grand Gulf site (MNHP 2004c). However, these sightings are from 1973 (MNHP 2004a) and are likely spurious because a viable population of Florida panthers has not been known in the state of Mississippi since the late 1800s (MNHP 2004d).

Further, NRC requested that FWS provide information on Federally listed species that could occur on or in the vicinity of the Grand Gulf site (NRC 2004b). The FWS response (FWS 2004a) did not include the Florida panther, indicating that it does not consider the species a possible resident in the area.

American Alligator

In 1967, the American alligator was classified as Federally endangered throughout its range, including Mississippi. By 1987, following several reclassification actions in other states, it was reclassified to "threatened based on similarity of appearance" to the American crocodile in the remainder of its range, including Mississippi (52 FR 21059). The alligator is no longer biologically imperiled in Mississippi. Its populations are considered disjunct, limited to available habitat, but stable. The declassification helps prevent excessive take of the alligator and protects the American crocodile (52 FR 21059).

During reconnaissance visits to the Grand Gulf site made by Enercon in August and October-November 2002, two alligators were observed, one in a small pond immediately adjacent to the waste water treatment facility on the site of GGNS Unit 1 and the other in the flooded borrow pit (SERI 2005). Thus, alligators appear to be relatively common onsite. Because they pose a nuisance and safety hazard to site personnel, Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) personnel occasionally capture and relocate large alligators from the Grand Gulf site (SERI 2005).

Bald Eagle

The bald eagle is a bird of aquatic ecosystems, frequenting major rivers, large lakes, reservoirs, estuaries, and some seacoast habitats. Fish are the major component of its diet, but waterfowl, seagulls, and carrion are also eaten. Bald eagles usually nest in large trees along shorelines in relatively remote areas that are free of disturbance (64 FR 36454). No critical habitat has been designated for this species (FWS 2004a).

The bald eagle is known from Claiborne County (FWS 2000, 2004a) and Warren County (FWS 2000) (Table 2-7). In the region around the Grand Gulf site, nest sites are usually in dominant living pine (*Pinus* spp.) or bald cypress trees (*Taxodium distichum*), and nesting activity usually occurs between September and January (FWS 2004a). Although a survey of the river shoreline at the Grand Gulf site has not been conducted, it appears to lack such trees. Bald eagles have been known to frequent Yucatan Lake, located across the Mississippi River west of the site (AEC 1973). However, there are currently no known bald eagle sightings within 16 km (10 mi) of the Grand Gulf site (MNHP 2004b). Consequently, nesting on the Grand Gulf site appears possible, though unlikely because of the apparent absence of suitable mature pine or cypress trees in the bottomland adjacent to the river. Bald eagle presence on the Grand Gulf

site during the nesting season should be considered possible in the absence of an aerial or ground survey to confirm or deny the presence of nest trees.

The only bald eagle nest site currently known from Warren County is at Halpine Lake, which is located along the Mississippi River north of Vicksburg about 40 km (25 mi) from the Grand Gulf site. There are no other bald eagle nest sites, and no roost sites or feeding concentrations, currently known from Warren County. Bald eagle locations are obtained on a volunteer basis in Mississippi because there is no funded monitoring program. Most known locations have been reported by sportsmen (fishermen and hunters). Thus, it is possible that eagles use the Mississippi River corridor elsewhere in Warren County for nesting, roosting, and/or foraging, but that such occurrences have not been reported to the State (MMNS 2005).

Interior Least Tern

Interior least terns breed in the Mississippi and Rio Grande River Basins, from Montana to Texas, and from eastern New Mexico and Colorado to Indiana and Louisiana. From late April to August, they nest primarily on barren to sparsely vegetated sand and gravel riverine sandbars, dike field sandbar islands, sand and gravel pits, and shorelines of lakes and reservoirs. Interior least terns are colonial nesters with nests from a few meters to hundreds of meters apart. The wintering area of interior least terns is unknown (FWS 1990b).

Threats include the actual and functional loss of riverine sandbar habitat. Sandbars are not generally stable features of the natural river landscape, but are formed or enlarged, disappear or migrate depending on the dynamic forces of the river. River stabilization to achieve objectives for navigation, hydropower, irrigation, and flood control has destroyed the dynamic nature of these processes. Many remaining sandbars are unsuitable for nesting because of vegetation encroachment or are too low and subject to frequent inundation. Recreational use of sandbars during the breeding season has also contributed to the decline of the species (FWS 1990b).

On the Mississippi River, least terns use sandbars for nesting, foraging (primarily on shad [*Dorosoma* spp.]), and loafing when the river has receded and sandbars are exposed. On the Mississippi River, surveys for interior least terns have been conducted since 1986 over about 909 km (565 mi) from Cape Girardeau, Missouri (River Mile (RM) 1000) to Vicksburg, Mississippi (RM 435). The first intensive survey south of Vicksburg was conducted on July 2004 (ACE 2004a). The nearest areas occupied by terns upstream and downstream of the Grand Gulf site (RM 405) (SERI 2005) were

- Yucatan Dikes (RM 409.8), loafing area for 28 birds on the Mississippi side of the river
- Togo Island Dikes (RM 413.6), nesting colony of 395 birds on the Louisiana side of the river

- Below Bondurant Towhead Dikes (RM 393.0), nesting colony of 59 birds on the Louisiana side of the river (ACE 2004b).

Sandbars develop on the inside bends of the Mississippi River where currents are slower. Sandbars do not develop on the outside bend of the river where currents are swifter and where the river shoreline has been revetted (rip-rap emplaced) to prevent erosion, such as is the case at the Grand Gulf site. The nearest potential tern nesting habitat is near RM 402 on the Louisiana side of the Mississippi River about 4.8 km (3 mi) south of the Grand Gulf site (ACE 2004a).

The point along the Baxter-Wilson transmission line right-of-way within Warren County that is closest to the Mississippi River is at its terminus at the Baxter-Wilson Substation (RM 433.1), located 0.74 km (0.46 mi) from the river. The nearest areas occupied by terns downstream and upstream of the Baxter-Wilson Substation were at Below Racetrack Dikes (RM 429.0) (nesting colony of 91 adults on the Mississippi side of the river) and at Milliken Bend (RM 456.0) (one adult tern observed on the Louisiana side of the river) (ACE 2004b). Both locations are at least 6.4 km (4 mi) from the Baxter-Wilson Substation. Between Togo Island Dikes (RM 413.6) and Below Racetrack Dikes are two other areas occupied by terns, Newton Bend Dikes (RM 419.5, nesting colony of 14 birds on the Mississippi side of the river) and Across from Logo Landing (RM 418.3, nesting colony of 58 birds on the Louisiana side of the river) (ACE 2004b). It is estimated that these two tern nesting areas are approximately 3.2 km (2 mi) from the Baxter-Wilson transmission line right-of-way.

Red-Cockaded Woodpecker

The red-cockaded woodpecker is endemic to open, mature, and old growth pine ecosystems in the southeastern United States. Red-cockaded woodpeckers are a cooperatively breeding species, living in family groups that typically consist of a breeding pair with or without one or two male helpers. In red-cockaded woodpeckers (and other cooperative breeders), a large pool of helpers is available to replace breeders when they die. Helpers do not disperse very far and typically occupy vacancies on their natal territory or a neighboring one (FWS 2003).

Red-cockaded woodpeckers require open pine woodlands and savannahs with large old pines for nesting and roosting habitat (clusters). Large old pines are required as cavity trees because the cavities are excavated completely within inactive heartwood and because of the higher incidence of heartwood decay that greatly facilitates excavation. Cavity trees must be in open stands with little or no hardwood midstory and few or no overstory hardwoods. Suitable foraging habitat consists of mature pines with an open canopy, low densities of small pines, little or no hardwood or pine midstory, few or no overstory hardwoods, and abundant native bunchgrass and forb groundcovers (FWS 2003).

Limiting factors are those that directly affect the number of potential breeding groups because this is the primary determinant of population size. For example, if groups are isolated in space, dispersal of helpers to neighboring territories is disrupted, promoting failure to replace breeders, rendering populations much less likely to persist through time. Thus, habitat fragmentation may directly limit the number of potential breeding groups. Fire suppression, which promotes hardwood encroachment, and lack of cavity trees also limit the number of breeding groups in most populations. Red-cockaded woodpeckers cannot tolerate hardwood encroachment and colonization of unoccupied habitat is an exceedingly slow process because cavities take long periods of time to excavate and birds do not occupy habitat without cavities (FWS 2003).

Of the counties containing the Grand Gulf ESP facility and transmission line rights-of-way (Claiborne, Franklin, Jefferson, Lincoln, Warren), the species is not known, either historically or currently, from Claiborne and Warren counties (Costa and Walker 1995). In Mississippi, the red-cockaded woodpecker is currently known from Bienville, DeSoto, and Homochitto National Forests, and Noxubee National Wildlife Refuge (FWS 2003). All these, except Homochitto National Forest, are located at least 160 km (100 mi) east of the Grand Gulf site. The other three counties (Franklin, Jefferson, Lincoln) traversed by the Grand Gulf ESP transmission line rights-of-way are crossed by the Homochitto National Forest.

The red-cockaded woodpecker is known to have occurred historically in Franklin, Jefferson, and Lincoln counties (Costa and Walker 1995). The FWS (2000) does not list the species as currently existing in Jefferson and Lincoln counties (Table 2-7). Six historic (inactive) red-cockaded woodpecker clusters (colonies) are located within 3.2 km (2 mi) of the Franklin transmission line right-of-way where it crosses the Homochitto National Forest in Franklin and Lincoln counties (USFS 2005a). Of the six, the closest to the Franklin line right-of-way is about 1.2 km (0.75 mi) (USFS 2005a). The U.S. Forest Service is required to maintain foraging habitat in areas of historic clusters located outside Habitat Management Areas (HMAs) designated for the recovery of the species (see below) (USFS 2005b). Historic clusters have not been identified within the Homochitto National Forest in Jefferson County (USFS 2005a).

The red-cockaded woodpecker is also known to currently occur in Franklin County (Table 2-7) (Costa and Walker 1995; FWS 2000). In Franklin County, a red-cockaded woodpecker HMA is situated within the Homochitto National Forest south and west of the intersection of State highways 84 and 98 at Meadville (USFS 2005a). The HMA is located approximately 16 km (10 mi) to the southwest of the Franklin transmission line right-of-way (USFS 2005a). This HMA consists of 19,400 ha (48,000 ac) that support 65 active red-cockaded woodpecker clusters. The HMA also contains enough currently unoccupied habitat that serves as the recruitment area for expansion of the 65 clusters to 250 clusters (USFS 2005c), the recovery plan goal for the species on the Homochitto National Forest (FWS 2003). These clusters have been designated a secondary core population (providing for conservation of the species within

the physiographic recovery unit in which it exists) within the East Gulf Coastal Plain Recovery Unit of the species. The projected time required for the Homochitto population to reach recovery size is 35 years (FWS 2003).

In addition, there are forest management activities (e.g., prescribed burning and thinning) underway to restore old-age longleaf pine (*Pinus palustris*) stands across the Homochitto National Forest (USFS 2005c). The target species for these management activities is the red-cockaded woodpecker (USFS 2005c), although such activities outside the HMA discussed above are not officially part of the recovery plan for the species (FWS 2003; USFS 2005c). Thus, in the future red-cockaded woodpeckers could inhabit restored old-age longleaf pine areas outside the HMA (USFS 2005c).

Louisiana Black Bear

The historic range of the Louisiana black bear (*Ursus americanus luteolus*) included southern Mississippi (south of and including Washington, Humphreys, Holmes, Attala, Neshoba, and Lauderdale counties), all of Louisiana, and eastern Texas. Two subspecies of black bear historically occupied Mississippi, the Louisiana black bear in the south and the American black bear (*U. a. americanus*) in the north. Because the two subspecies are indistinguishable by sight, other free-living bears of the species *U. americanus* within the historic range of *U. a. luteolus* are designated Federally threatened by similarity of appearance (FWS 1995).

The historic habitat of the Louisiana black bear has suffered extensive modification, having been reduced by more than 80 percent as of 1980. The remaining habitat has been reduced in quality by fragmentation and conversion to agriculture. Habitat destruction or modification is the primary threat to the Louisiana black bear. Human-related mortality also continues to pose a threat to the subspecies (FWS 1995).

The key habitat requirements of black bears are food, water, cover, and den sites that are spatially arranged across sufficiently large, relatively remote blocks of land. Remoteness is relative to forest tract size and the presence of roads. Examples of remoteness relative to black bears include a tract of timberland 0.8 km (0.5 mi) from well maintained roads and development, a forested tract of more than 1000 ha (2500 ac), or a tract with 0.5 km (0.3 mi) or less of road per km^2 (0.4 mi^2) of forest (FWS 1995). A geographic information system analysis has not been conducted, but it is evident from Figure 2-4 that much of the Grand Gulf site and immediate environs to the north and south closely approach or satisfy one or more of these criteria.

Louisiana black bears typically inhabit heavily wooded bottomland hardwoods and swamps, although adjacent upland habitat types are also used (LDOTD 2003). Occupied Louisiana black bear habitat has been defined by the FWS (1995) as only those areas where there is evidence of reproduction, such as a female with cubs. Presently within the historic range of the

Louisiana black bear, two known breeding bear populations occur in two Louisiana river basins (Figure 2-6). One range is the Tensas River Basin, consisting of Franklin, Madison, and Tensas parishes. The Tensas River Basin is located in rural northeastern Louisiana and contains an estimated 160 bears (Beausoleil 1999; Boersen 2001). Tensas Parish is located directly across the Mississippi River from Claiborne County and the Grand Gulf site. The other range is the Atchaflaya River Basin, located in south-central Louisiana and divided into two units: upper, and lower/coastal. The upper and coastal units support subpopulations of 52 and 92 bears, respectively (Triant 2001).

Bears have been sighted outside of the two areas, but it is unknown whether these bears are reproducing or are only wandering subadults and males. Additional areas possibly occupied are the Mississippi River corridor, including portions of the Loess Bluffs in southwestern Mississippi and the adjacent Tunica Hills of Louisiana (about 120 km (75 mi) south of the Grand Gulf site), and smaller areas in the lower East Pearl River and lower Pascagoula River basins of southern Mississippi near the Gulf of Mexico (FWS 1995).

Figure 2-6. Louisiana Black Bear Breeding Subpopulations (U.S. Fish and Wildlife Service, Jackson, Mississippi Field Office)

The FWS, Louisiana Department of Wildlife and Fisheries, and the Black Bear Conservation Committee began reintroducing Louisiana black bears into unoccupied habitat on publicly owned land in the Red River/Three Rivers area of east-central Louisiana in March 2001 (FWS 2004d). The northern boundary of the repatriation area is located about 88 km (55 mi) southwest of the Grand Gulf site. To date, 16 adult females and 40 cubs have been reintroduced. These bears have dispersed throughout the repatriation area and beyond (FWS 2004d). Some have dispersed as far north as Vidalia, Louisiana (FWS 2004d), located just across the Mississippi River from Natchez, Mississippi, about 56 km (35 mi) southwest of the Grand Gulf site.

Many bears have been sighted in the Mississippi River corridor within the last 8 years (Figure 2-7) (MNHP 2004e). The Louisiana black bear may use the Mississippi River environs as a travel corridor (SERI 2004d) between the Tensas River Basin and upper Atchaflaya River Basin, and it could thus serve as an important link between the two.

The MNHP has reported bear occurrences within 3.2 km (2 mi) of the Grand Gulf site (MNHP 2004a), and bears have been observed on the Grand Gulf site (NRC 1981). Two bear cubs were reported onsite by a hunter in 1978. Afterward, bear tracks were observed on two occasions and one adult and one young bear were seen at separate times by the biologist onsite (NRC 1981). However, the occurrence of bears onsite has not been documented recently (SERI 2004d). Because the two subspecies (*Ursus a. luteolus* and *U. a. americanus*) are indistinguishable by sight, one must conservatively assume that all the sightings noted above were of the Louisiana black bear. Further, suitable den sites in fallen trees have also been reported from onsite (SERI 2004d), although it is unknown if these trees satisfy the species, size, and location criteria specified in 57 FR 588.

The Grand Gulf site provides large tracts of bottomland and upland hardwood forests that are contiguous with other relatively large, adjacent expanses of hardwood forest. These are suitable for bears because they are relatively remote by the above standards and subject to relatively little human disturbance, particularly those on the Grand Gulf site, because of public access restrictions. Public access restrictions may protect bears from illegal hunting and collisions with cars because of the low traffic volume on roads in and around the site. Black bears are generally highly adaptable and tend to survive in a variety of situations where they are protected from over-harvesting and other negative interactions with humans. Because bears coexist readily with humans when provided areas in which they can avoid contact, the possibility that Louisiana black bears still inhabit the Grand Gulf site is high (SERI 2005).

Some Louisiana black bear sightings from the last 8 years (Figure 2-7) were in counties other than Claiborne (Franklin, Jefferson, Warren) that are crossed by the transmission line rights-of-way (Baxter-Wilson and Franklin). The subspecies is known to occur only in the western most portion of Franklin County where hardwood forests are more prevalent (USFS 2005d). The subspecies is also known to occur only in the western most portion of Jefferson County near

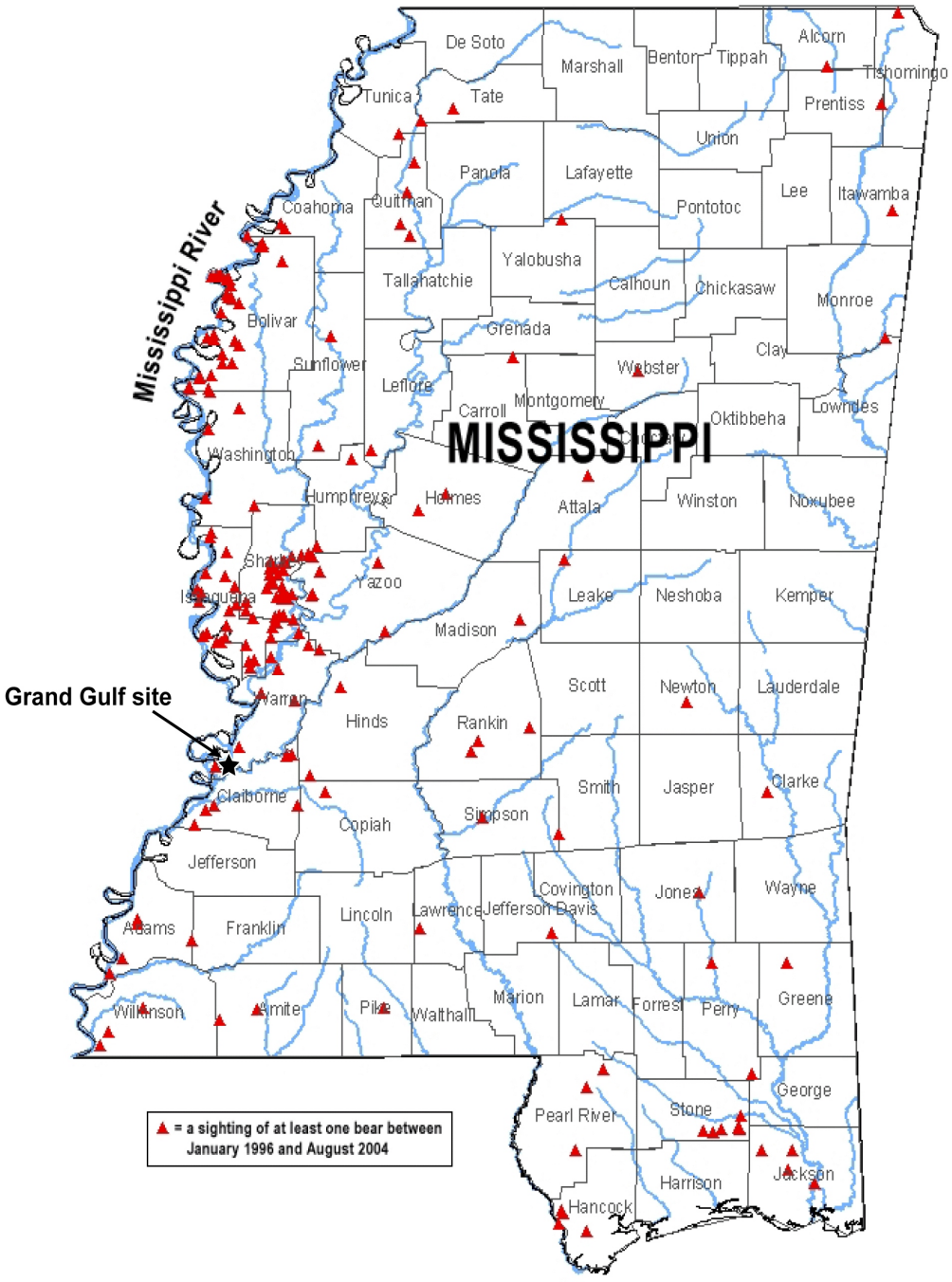

Figure 2-7. Black Bear Sightings from the State of Mississippi from 1996 to 2004 (U.S. Fish and Wildlife Service, Jackson, Mississippi Field Office)

the Mississippi River (USFS 2005d). The Franklin transmission line right-of-way traverses the northeastern portions of Franklin and Jefferson counties and is thus at least 32 km (20 mi) distant from the nearest sighting of the Louisiana black bear in these counties. However, the subspecies is known to occur along the Mississippi River in Warren County (Figure 2-7) in the general area crossed by the Baxter-Wilson transmission line right-of-way.

Three critical habitat areas totaling about 505,900 ha (1.25 million ac) have been proposed for the Louisiana black bear (58 FR 63560): Tensas River Basin, Atchaflaya River Basin Floodway, and lower Iberia-St. Mary Parish. The proposed critical habitat area nearest the Grand Gulf site is the Tensas River Basin, which borders the west bank of the Mississippi River directly across from the site.

Because of their importance, actual den sites or candidate trees (bald cypress and tupelo gum [*Nyssa* sp.] with visible cavities, having a diameter at breast height of 0.9 m (3 ft) and occurring along rivers, lakes, streams, bayous, sloughs, or other water bodies) in occupied habitat may not be harvested (57 FR 588). However, this may not affect the Grand Gulf ESP site because it is currently unknown whether habitat in this area is occupied and whether bald cypress and/or tupelo gum trees of this stature exist onsite.

Federally Listed Terrestrial Plant Species

No Federally listed or proposed threatened or endangered terrestrial plant species or associated designated or proposed critical habitat were identified through consultation with the FWS as potentially occurring on or in the vicinity of the Grand Gulf site (FWS 2004a).

2.7.1.3 Terrestrial Ecology Monitoring

Formal terrestrial ecological monitoring has not been conducted on the Grand Gulf site since construction of GGNS Unit 1. However, reconnaissance visits to the site were made by Enercon on behalf of SERI during the weeks of August 19 to 24 and October 29 to November 1, 2002 (SERI 2005). The purpose of these visits was to describe the wetlands and qualitatively compare existing ecological resources with descriptions provided in the MP&L final environmental report (1973). Information provided in the MP&L final environmental report was based on formal terrestrial ecological monitoring conducted from June 1972 to August 1973 prior to construction of the GGNS Unit 1 facility (SERI 2005).

Descriptions of the various types of wetlands found on the Grand Gulf site based on these reconnaissance visits are provided in Section 2.7.1. There apparently have been no noteworthy environmental alterations on the Grand Gulf site since construction of GGNS Unit 1 that contribute significantly to the existing patterns of plant and animal communities described in Section 2.7.1.

Terrestrial ecological monitoring may be performed in support of an application for an ESP. Monitoring primarily consists of collecting data used to describe the distribution and abundance of important species and habitats and environmental changes that may contribute to the existing patterns of plant and animal communities (NRC 2000).

As noted above, based on Enercon's 2002 reconnaissance visits (SERI 2005), the vast majority of the Grand Gulf site has been left undisturbed since construction of GGNS Unit 1. Thus, no monitoring of environmental changes that contribute to existing patterns of plant and animal communities is needed.

Wetlands are considered an important habitat (NRC 2000). Besides wetlands, no other important habitats are known to occur on the Grand Gulf site or along its transmission line rights-of-way. Wetlands on the Grand Gulf site would be minimally affected by construction (see Section 4.4.1) and then restored.

The only Federally listed species known to inhabit the Grand Gulf site is the Federally threatened American alligator. However, the alligator is threatened only because of its similarity of appearance to the American crocodile. Thus, the threatened classification of the alligator helps protect the crocodile. American alligator populations are themselves considered disjunct, limited to available habitat, but stable (52 FR 21059).

The Federally threatened Louisiana black bear is known to occur within 3.2 km (2 mi) (MNHP 2004a) of the Grand Gulf site and was documented from the site in the late 1970s (NRC 1981). Because the site and its immediate environs to the north and south provide a large block of remote habitat with relatively little human presence, it is very likely Louisiana black bears still exist onsite. However, its occurrence onsite has not been documented recently, and no monitoring via field surveys or other methods has been conducted on the Grand Gulf site or in the near vicinity.

Use of the Grand Gulf ESP site and adjacent areas in upland hardwood forest and bottomland forested wetlands by Louisiana black bears should be established via field surveys prior to construction of a new facility at the Grand Gulf site. The Louisiana black bear could be affected by construction if present in these areas. Consequently, a plan for pre-construction monitoring of use of the Grand Gulf ESP site and near vicinity by the Louisiana black bear should be established in consultation with the FWS, Jackson, Mississippi, Field Office.

2.7.2 Aquatic Ecology

The aquatic resources in the vicinity of the proposed Grand Gulf ESP site are associated with the major aquatic features of the Grand Gulf site: the Mississippi River and two onsite oxbow lakes, Hamilton and Gin (Figures 2-1 and 2-2). Also associated with the Grand Gulf site are a

flooded, fabricated borrow pit, three small ponds, and two perennial streams. In addition, ephemeral drainages and wetlands are found around the site. The Grand Gulf site does not front on the Big Black River to the north or on the Bayou Pierre River to the south (MP&L 1973; SERI 2005).

The habitat of the Mississippi River has the following features: backwater, river bank, and main channel. The backwater habitat is associated with the large bend in the river at the site, which creates slow moving, relatively shallow, quiet water. The substrate in the backwaters is loosely consolidated, silty clay sediment of low plasticity. The river bank habitat is steep with swift current, consolidated, high-plastic clay substrate, and eroding slopes. In 1979, the river bank downstream of the discharge structure and barge slip was stabilized with articulated concrete mats (NRC 1981). The main channel is deep with strong, turbulent currents and coarse-grained substrate (MP&L 1973; SERI 2005).

Hamilton and Gin are oxbow lakes on the Grand Gulf site. These lakes are what remain of the former river channel after the Mississippi River moved to the west. Hamilton and Gin lakes are relatively small and shallow with characteristics similar to the backwater habitat. The surface area of these lakes has decreased since 1973, and the last estimates made in 2001 indicate the surface area of Hamilton Lake is 26 ha (64 ac) and Gin Lake is 22 ha (55 ac). The average depth of these lakes is approximately 2 to 3 m (8 to 10 ft). However, during high-water events, the Mississippi River submerges these lakes. Hamilton Lake receives water from two perennial streams, which carry storm water from the existing facility. Gin Lake is connected to Hamilton Lake via a culvert beneath Heavy Haul Road (MP&L 1973; SERI 2005).

A flooded, fabricated borrow pit north of the barge slip was created in the 1970s when fill was excavated for use in the construction of GGNS Unit 1. The depth of the pit is not known. The surface area in 2001 was estimated to be 6.5 ha (16 ac) in size. The pit does not appear to be hydrologically connected to the lakes except during high water of the river (SERI 2005).

Before the development of the Grand Gulf site, the three small ponds were constructed onsite to provide water for cattle stock. At the time of construction of Unit 1, five small ponds existed, each under 0.8 ha (2 ac) in size. Since 1973, two of the ponds have been filled and no longer exist (MP&L 1973; SERI 2005).

The two perennial streams onsite are called Streams A and B. Stream A extends west from the site's sanitary waste water treatment facility. Currently, Stream A receives continual flow from facility storm water and processed discharge from the waste water treatment facility. Stream B extends west from the cooling towers on the south side of Heavy Haul Road. Flow in Stream B is intermittent, consisting mostly of storm runoff, and runs into Hamilton Lake. A sedimentation basin has been constructed on both Stream A and B, called Outfall 13 and 14, respectively (MP&L 1973; SERI 2005).

Ephemeral drainages occur on the upland bluffs and eastern portions of the Grand Gulf site. These drainages are estimated to be approximately 7358 m (24,140 ft) in length (MP&L 1973; SERI 2005).

2.7.2.1 Biological Communities

The staff evaluated the effect of construction and operation of the proposed Grand Gulf ESP facility on aquatic ecological resources (habitat and wildlife) existing at and in the vicinity of the site and along the transmission line rights-of-way. The last time the aquatic resources were extensively characterized was from September 1972 to August 1973 during the preconstruction studies for GGNS Unit 1 (MP&L 1973; SERI 2005). In 2002, two reconnaissance surveys were made to assess qualitatively the ecological resources of the Grand Gulf site. No data pertaining to aquatic resources on the site or along the transmission line rights-of-way were presented. Since the most recent information on aquatic resources summarized in the Final Environmental Report (MP&L 1973) is over 30 years old, the staff will obtain (consistent with Environmental Standard Review Plan, Chapter 2.4.2 (NRC 2000)) a recent description of the aquatic biota in the vicinity of the site and transmission line rights-of-way prior to or during the CP or COL phase.

The studies conducted prior to construction of GGNS Unit 1 characterized the aquatic resources in the Mississippi River, Hamilton and Gin lakes, two ponds, and Stream A. A total of 86 fish species were collected, representing 20 families and 42 genera (MP&L 1973; SERI 2005). The presence of other aquatic species was also reported (MP&L 1973).

Mississippi River

Preconstruction studies from 1972 to 1973 included collections of fish, benthic macroinvertebrates, and plankton. The characterization of the river was divided into several habitat types related to the flow rate and substrate: backwater, river bank, and main channel. A total of 69 fish species were caught. This was the same number of species found in the Mississippi River during the same time period at the River Bend Nuclear Station, 232 km (144 mi) downstream from GGNS. However, the fish species diversity was less than that characterized in the lower Mississippi River prior to the release of endrin (a pesticide) around Memphis in 1963 to 1964 that resulted in catastrophic fish kills (MP&L 1973).

The dominant species in the Mississippi River based on numbers and weight were gizzard shad (*Dorosoma cepedianum*), freshwater drum (*Aplodinotus grunniens*), blue catfish (*Ictalurus furcatus*), and flathead catfish (*Pylodictis olivaris*). The numbers varied within the particular habitats of the river. In the backwater habitat, the dominant species were gizzard shad, blue catfish, river carpsucker (*Carpiodes carpio*), freshwater drum, and shovelnose sturgeon (*Scaphirhynchus platorynchus*). In the river bank, the dominant fish were gizzard shad, freshwater drum, silver chub (*Macrhybopsis storeriana*), flathead catfish, and blue catfish. The

main channel was not easily characterized for dominant species because collection techniques were hampered by the currents, irregular bed configurations, and bottom associated debris (MP&L 1973).

Juvenile fish increased in numbers from March through July. The results indicated that shad spawned from March through June. Drum appeared to spawn over a shorter period and may have included two spawning periods. Young-of-the-year for gizzard shad and drum were highest in June and July. Larval fish were collected in early March. While catfish and suckers were prominent as adults, they were not among the larvae collected in the river because they are spawned in backwaters and do not enter the riverine environment until they are juveniles (MP&L 1973).

Benthic macroinvertebrate populations were most common in the backwaters of the riverine environment. Dipteran larvae (aquatic true fly larvae), tube-forming worms, and bivalves (mussels and clams) represented the dominant groups of macroinvertebrates. Where the river banks were stable (consolidated silt and clay), mayflies were the most common macroinvertebrate. The 1973 report stated that macroinvertebrates were found in areas where the river bank was stable, but few or no macroinvertebrates were found where the river bank was constantly eroding (MP&L 1973). Nevertheless, in 1981, MP&L concluded that macroinvertebrates would not colonize areas where the banks were stabilized with articulated concrete mats (NRC 1981). Macroinvertebrates were also absent in the main channel of the river, probably because of strong currents and coarse sand-gravel sediment (MP&L 1973).

Drifting benthic macroinvertebrates were also collected in the river and adjacent backwaters. The majority of the drifting macroinvertebrates was composed of dipteran pupae and larvae, predominantly of the genus *Chaoborus*. A total of 96 macroinvertebrate taxa were collected in drift samples (MP&L 1973).

Another predominant invertebrate was the river shrimp (*Macrobrachium ohione*). These shrimp were caught mainly along the river banks with their numbers peaking in October and dropping from November to April, when water temperatures were coldest (MP&L 1973).

Plankton in the Mississippi River were characterized as zooplankton and phytoplankton. The density of zooplankton ranged over two orders of magnitude during the study period. A total of 46 taxa were identified, and the dominant taxa changed over time. A stalked protozoan (*Carchesium* sp.), various cladocerans, and a colonial rotifer were the dominant zooplankton. Fall and spring blooms of phytoplankton were observed. A total of 49 phytoplankton genera were identified, with centric diatoms being the most dominant (MP&L 1973).

Hamilton and Gin Lakes

Preconstruction studies from 1972 to 1973 included collections of fish, benthic macroinvertebrates, and plankton. Hamilton Lake had 46 fish species, and Gin Lake had 36 species. Several of the fish species in Hamilton and Gin lakes are thought to be from the Mississippi River. When the river floods the lakes, fish are brought into the area and then are trapped in the lakes when the flood waters recede. This relationship was demonstrated when large numbers of young-of-the-year paddlefish (*Polyodon spathula*) were observed in both lakes in July 1973, shortly after the river separated from the lakes. After another flood a month later, the number of paddlefish had decreased (MP&L 1973). The difference in fish diversity between the two lakes was attributed to the connection of Hamilton to the river during periods when the river is not at flood stage.

While more species were present in Hamilton Lake, the dominant fish were the same in both lakes. The top 80 percent of the population was made up of gizzard shad, bluegill (*Lepomis macrochirus*), threadfin shad (*Dorosoma petenense*), and largemouth bass (*Micropterus salmoides*). Several stragglers, fish that normally inhabit the river, were found in Hamilton and Gin lakes (MP&L 1973).

Benthic macroinvertebrates in Hamilton and Gin lakes more closely resembled the populations collected in the backwaters of the river. Chironomids, tubificid worms, and bivalves were the most dominant taxa (MP&L 1973).

The composition and abundance of plankton in Hamilton and Gin lakes varied based on the frequency and duration of flooding by the river. When the lakes were not flooded, they developed distinct plankton populations. However, during flood events, the populations more closely resembled those characterized in the river (MP&L 1973).

Hamilton and Gin lakes did not support vascular aquatic plants in the preconstruction studies. The only aquatic plant recorded in the lakes was the big duckweed, *Spirodela* spp. In reconnaissance visits in 2002, no emergent vegetation was found in the lakes except along the periphery (SERI 2005).

Two Ponds and Stream A

Only fish were sampled in two of the three ponds and Stream A during the GGNS preconstruction studies. The source of fish in the ponds is thought to be recruitment from either Stream A or Stream B. One of the ponds (referred to as “bluff pond 1”) contained only bluegill and mosquitofish (*Gambusia affinis*). The other pond (“bluff pond 2”) contained bluegill, mosquitofish, and a few channel catfish (*Ictalurus punctatus*) (MP&L 1973).

Stream A had 21 species, which consisted of resident fish and those that probably entered the stream during floods from the river and lakes. The dominant species included bluntnose minnow (*Pimephales notatus*), green sunfish (*Lepomis cyanellus*), longear sunfish (*Lepomis megalotis*), silvery minnow (*Hybognathus nuchalis*), and blackspotted topminnow (*Fundulus olivaceus*) (MP&L 1973).

Commercially Important Fisheries

Commercial fishing is limited in the area with most occurring on the Mississippi River near the Grand Gulf site and on the Big Black and Bayou Pierre rivers. Approximately twelve commercial fishing operations are in the area. They catch predominately catfish but also harvest bigmouth (*Ictiobus cyprinellus*) and smallmouth buffalo fish (*Ictiobus bubalus*) (SERI 2005).

Recreationally Important Fisheries

Recreational fishing occurs on the Mississippi River and Hamilton and Gin lakes. Fishing is allowed on these lakes; however, access was denied briefly in 2001 to 2002. April through September are the most popular months for sport fishing with Saturday being the busiest day of the week. On the weekends from April through September, as many as 200-250 anglers may be in the vicinity. On the weekdays, the number of anglers may drop to fewer than 150 depending on weather conditions (SERI 2005). Recreational fishing in the area is from boats and the bank as well as using trotlines in the lakes. The most common fish caught include catfish, bluegill, and bass (MP&L 1973; SERI 2005).

Nuisance Species

No reports indicate aquatic nuisance species are in the waters associated with the Grand Gulf site (MP&L 1973; NRC 1981; SERI 2005).

Aquatic Resources Associated with Transmission Line Rights-of-Way

Transmission line rights-of-way for GGNS Unit 1 cross waterways in Claiborne County. The Baxter-Wilson right-of-way crosses the Big Black River approximately 12 km (7.5 mi) to the northeast of the Grand Gulf site. Also, the Baxter-Wilson substation in Warren County is less than 0.75 km (0.47 mi) from the shores of the Mississippi River. The Franklin right-of-way crosses Bayou Pierre approximately 5.5 km (3.4 mi) to the south of the Grand Gulf site. SERI did not indicate the aquatic resources that could be associated with the waterways crossed by these transmission line rights-of-way (SERI 2005). No information on aquatic resources was available from the transmission and distribution system owner and operator (Entergy Mississippi, Inc.) (Entergy Services 2004a). SERI did not indicate the transmission line right-of-way maintenance procedures in its environmental report (SERI 2005). However, Entergy

Mississippi, Inc. indicated that the maintenance procedures consist of mechanical means (primarily bushhogging) that are performed on an as-needed basis (Energy Services 2004b).

State-Listed Species

State-listed threatened and endangered aquatic species that may occur in the vicinity of the Grand Gulf ESP site are listed in Table 2-8 (MNHP 2004a, 2004b).

Animal Species

Two State-listed endangered aquatic animal species are known to occur within 3.2 km (2 mi) of the Grand Gulf ESP site: the pallid sturgeon (*Scaphirhynchus albus*) and crystal darter (*Crystallaria asprella*) (Table 2-8). A third State-listed endangered aquatic animal species is known to occur between 3.2 km (2 mi) and 16 km (10 mi) of the Grand Gulf ESP site: the bayou darter (*Etheostoma rubrum*) (Table 2-8). The pallid sturgeon and bayou darter are also Federally listed species and are described in Section 2.7.2.2.

Table 2-8. State-Listed Aquatic Species Occurring in the Vicinity of the Grand Gulf Early Site Permit Site

Scientific Name	Common Name	Status[(a)]	Distance from the Grand Gulf ESP Site	Source
Fish				
Scaphirhynchus albus	pallid sturgeon	SE	<3.2 km (2 mi)	MNHP 2004a
Etheostoma rubrum	bayou darter	SE	<16 km (10 mi)	MNHP 2004a
Crystallaria asprella	crystal darter	SE	<3.2 km (2 mi)	MNHP 2004a

(a) State status rankings developed by the MNHP (2004a, 2004b); SE = State endangered - animals

The endangered crystal darter has a historical range throughout the Mississippi, Missouri, and Ohio rivers. The crystal darter is a large, cigar-shaped fish, which is bi-colored with the lower half being white or silvery. These fish live in swift areas of sand and gravel raceways of large rivers. Crystal darters are found in the Bayou Pierre River and tributaries, which flow as close as 3 km (1.9 mi) east of the Grand Gulf ESP site (Ross 2001; MNHP 2004b; Katula 2004).

Plant Species

No State-listed or proposed threatened or endangered aquatic plant species are known to occur on or in the vicinity of the Grand Gulf ESP site (MNHP 2004a, 2004b; SERI 2005).

2.7.2.2 Threatened and Endangered Aquatic Species

FWS and the National Oceanic and Atmospheric Administration (NOAA) Fisheries staff provided information on Federally listed species, including their presence or absence in Claiborne County and any proposed threatened and endangered aquatic species and designated and proposed critical habitats that may occur on or in the vicinity of the proposed Grand Gulf ESP site (FWS 2004a, 2004b; NMFS 2004). The location information for Federally listed species within 16 km (10 mi) of the Grand Gulf site was obtained from the MNHP (2004a, 2004b). Table 2-9 presents information on Federally listed aquatic species.

Table 2-9. Federally Listed Aquatic Species Occurring in the Vicinity of the Grand Gulf Early Site Permit Site

Scientific Name	Common Name	Status[(a)]	Distance from the Grand Gulf ESP Site	Source
Fish				
Acipenser oxyrinchus desotoi	Gulf sturgeon	FT	<16 km (10 mi)	NMFS 2004
Scaphirhynchus albus	pallid sturgeon	FE	<3.2 km (2 mi)	FWS 2004a
Etheostoma rubrum	bayou darter	FT	<16 km (10 mi)	FWS 2004a
Molluscs				
Potamilus capax	fat pocketbook mussel	FE	<16 km (10 mi)	FWS 2004b

(a) Federal status rankings developed by FWS and NOAA Fisheries under the Endangered Species Act (FWS 2004a, 2004b; NMFS 2004).
FE = Federal endangered
FT = Federal threatened

Federally Listed Aquatic Animal Species

Four Federally listed threatened or endangered aquatic animal species may occur in the vicinity of the Grand Gulf ESP site. These include the

- Gulf sturgeon (*Acipenser oxyrinchus desotoi*) (Ross 2001; NMFS 2004; SERI 2005)
- Pallid sturgeon (*Scaphirhynchus albus*) (FWS 2004a; SERI 2005)

- Bayou darter (*Etheostoma rubrum*) (FWS 2004a; SERI 2005)
- Fat pocketbook mussel (*Potamilus capax*) (FWS 2004b).

Of the Federally listed species mentioned above, only the pallid sturgeon was collected on the Grand Gulf site in the 1970s during the last effort to characterize aquatic resources. No known activities are underway by the Federal government that would change the list of species or add critical habitats to the list.

Gulf Sturgeon

The gulf sturgeon has been jointly managed and listed as a threatened species by NOAA Fisheries and FWS. Historically, the range for this anadromous sturgeon has included the lower Mississippi, where it feeds in the Gulf of Mexico and returns to freshwater for spawning. They have a sub-cylindrical body with bony plates, and their snout is greatly extended and blade like, with four fleshy barbels in front of its mouth. Their bodies are gray-brown on the back and sides, grading to white on their belly. Critical habitat has not been designated for the Gulf sturgeon in the lower Mississippi River. Gulf sturgeon have not been collected in the region of the Grand Gulf ESP site, but have been collected upstream in the region of Vicksburg. The species could be a transient or seasonal migrant (68 FR 13370; FWS MFC 1995; Ross 2001; SERI 2005; NMFS 2004).

Pallid Sturgeon

The pallid sturgeon has a range of more than 5633 km (3500 mi) through the Missouri-Mississippi River drainage, including the lower Mississippi River. The species was designated as endangered throughout its entire range in 1990. Pallid sturgeon have a long, uniformly grayish-white body, flattened, shovel-shaped snout, with a long, slender completely armored caudal peduncle, and no spiracle. They are found in the main channels of large, highly turbid, free-flowing rivers with sand flats or gravel bars. Pallid sturgeon mainly feed on other fish. Little information is available on the spawning or migration habits of the pallid sturgeon except that they are likely to spawn in the spring and summer months, similar to other North American sturgeons (55 FR 36641; FWS 1993, 2004a; Ross 2001; LDOTD 2003).

Pallid sturgeon have been collected in the region of the Grand Gulf ESP site. During the 1972 to 1973 preconstruction studies for the GGNS, a specimen was collected offshore of the site. In 2001, trawl surveys were conducted on the lower Mississippi River in the Vicksburg area, approximately 61 km (38 mi) upstream from the Grand Gulf ESP site. Several pallid sturgeon were caught in regions with moderate to strong currents, a sand or sand/gravel substrate, and areas with structure (for example, sand reefs, dunes, or secondary channel) (Ross 2001; SERI 2005; Hartfield 2003).

Bayou Darter

The threatened bayou darter is endemic to the Bayou Pierre River and tributaries, approximately 20 km (12 mi) east of the Grand Gulf site. Bayou darters are small (26 to 45 mm (1.0 to 1.8 in.)), the smallest representative of the subgenus, *Nothonotus*. The darters live in swift, shallow riffles or runs over coarse gravel and pebbles. Based on the known distribution of the bayou darter (Ross 2001), the species is likely to inhabit the waters in the vicinity of the transmission line right-of-way. Loss of habitat through erosion of the tributaries has been a concern (40 FR 44149; FWS 1990a, 2004a; Ross 2001; SERI 2005).

Fat Pocketbook Mussel

The fat pocketbook mussel was historically found throughout the Mississippi River drainage from Minnesota to Louisiana. In 1976, the fat pocketbook mussel was designated as endangered throughout its entire range. The mussel has a shiny, thin to moderately thick, rounded shell. The shell has an S-shaped hinge and is tan or light brown with no rays. Fat pocketbook mussels prefer sand, mud, and fine gravel substrate of large rivers. The greatest impact to the mussel throughout its historical range is from habitat loss and reduction in water quality. In 2003, the mussel was found near Vicksburg in the Mississippi River, as well as south of the Grand Gulf ESP site (41 FR 24062; FWS 1989, 2004b, 2004c).

Federally Listed Aquatic Plant Species

No Federally listed or proposed threatened or endangered aquatic plant, species, or associated designated or proposed critical habitat are known to occur on or in the vicinity of the Grand Gulf ESP site (FWS 2004a; SERI 2005).

2.7.2.3 Aquatic Ecology Monitoring

NRC does not impose conditions of operation related to water quality, including aquatic monitoring requirements. Regulation of water quality under the Clean Water Act (CWA 1977) is the responsibility of the U.S. Environmental Protection Agency (EPA). The EPA has delegated the NPDES permit program for the State of Mississippi to the MDEQ. NRC's role is limited to assessing aquatic impacts as part of its National Environmental Policy Act (NEPA 1969) evaluation. The use of radial collector wells for current intake of Mississippi River water for operational use has not required the assessment or monitoring of the impacts to aquatic organisms under the NPDES permit for operations at GGNS Unit 1. The last monitoring of aquatic ecology at the Grand Gulf site was part of pre-construction monitoring for GGNS Unit 1 (MP&L 1973; SERI 2005).

NRC expects SERI to work with the State to develop and implement any required monitoring programs.

2.8 Socioeconomics

The population data for the area affected by the proposed Grand Gulf ESP site are primarily based on the 2000 U.S. Census, as mapped with the LandView 5 geographic information system by SERI (SERI 2005). When economic, employment, or population trends were analyzed over time, comparisons were made between data from the 1990 U.S. Census and the 2000 U.S. Census. SERI used LandView 5 software to develop the demographic data that are used in this section of the EIS. SERI augmented the census data with information from other agencies and public organizations in the states of Mississippi and Louisiana (CPRP 2002; Irwin 1997). The area defined by an 80-km (50-mi) radius from the center of the proposed power block includes all or a portion of 25 counties and parishes in Mississippi and Louisiana. Table 2-10 identifies the counties and parishes.

Table 2-10. Counties and Parishes within 80 Kilometers (50 Miles) of the Grand Gulf Early Site Permit Site

Mississippi Counties			Louisiana Parishes	
Adams	Issaquena	Sharkey	Caldwell	Madison
Amite	Jefferson	Simpson	Catahoula	Richland
Claiborne	Lincoln	Warren	Concordia	Tensas
Copiah	Madison	Wilkinson	East Carroll	West Carroll
Franklin	Rankin	Yazoo	Franklin	
Hinds				

Source: SERI 2005

2.8.1 Population Characteristics

Figure 2-8 shows the estimated population in 2002 within 16 km (10 mi) of the location for the Grand Gulf ESP facility. On this map, the power block for the proposed facility is located in the center with concentric circles in 1.6-km (1-mi) increments up to 8 km (5 mi) from the proposed location and then in one 8-km (5-mi) increment up to 16 km (10 mi) from the proposed location. Population data for the area surrounding the Grand Gulf ESP site indicate low population densities and a rural setting. The nearest population center is Port Gibson, Mississippi, located approximately 10 km (6 mi) to the southeast with a population of 1840 based on the 2000 U.S. Census (USCB 2003). The majority of the population in this area is African American. Four larger towns are located within 80 km (50 mi) of the Grand Gulf ESP site. Vicksburg, Mississippi, located 40 km (25 mi) to the north-northeast, had a 2000 U.S. Census

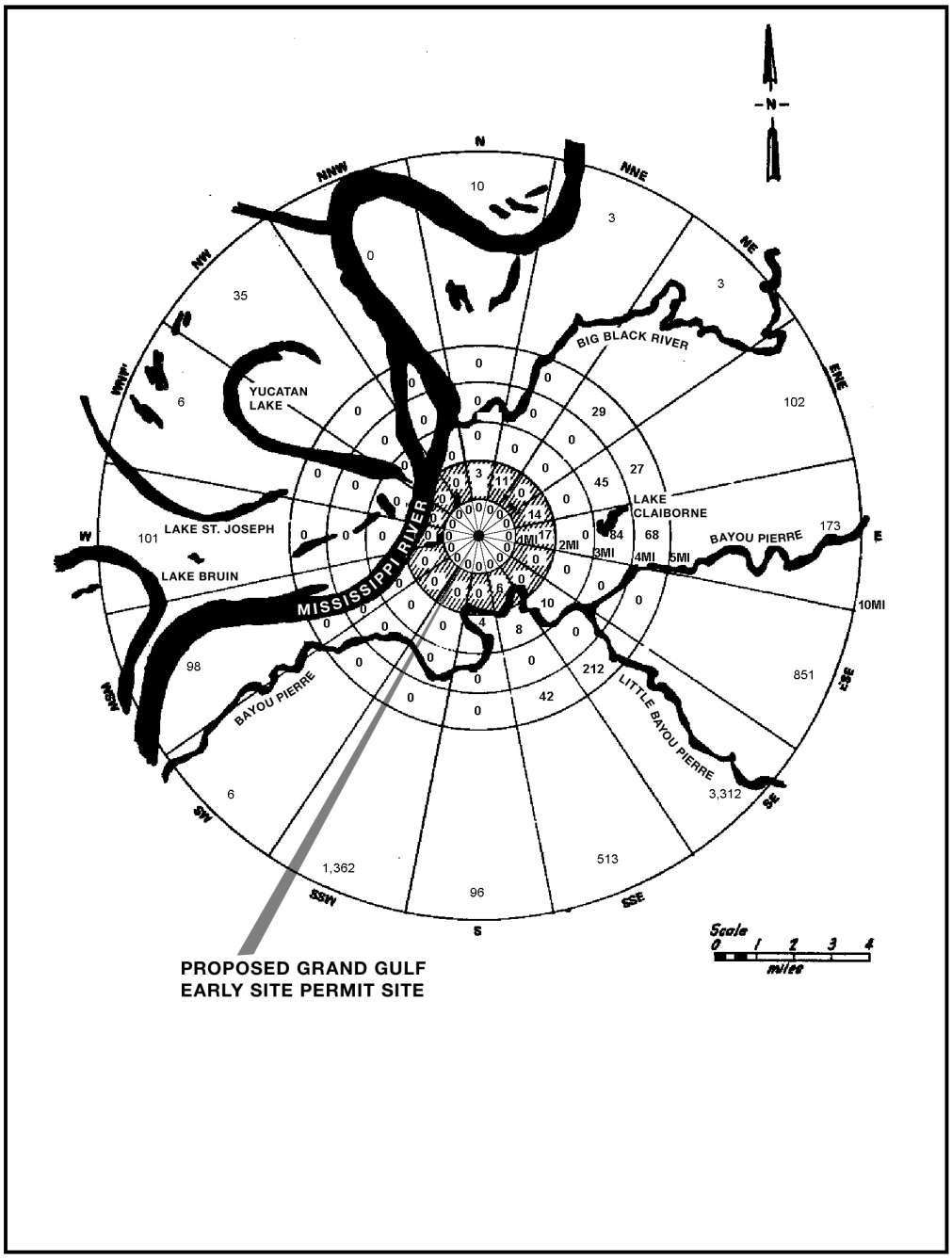

Figure 2-8. Estimated Population in 2002 within 16 Kilometers (10 Miles) of the Grand Gulf Early Site Permit Site (SERI 2005, Figure 2.5-1)

population of 26,407. Clinton, Mississippi, located to the northeast, and Natchez, Mississippi, located to the southwest, had 2000 U.S. Census populations of 23,347 and 18,464, respectively.

Jackson, Mississippi, the largest nearby metropolitan area, located about 88 km (55 mi) northeast of the site, had a 2000 U.S. Census population of 184,256. The larger population centers to the north, northeast, and southwest provide employment, services and entertainment for the region. Rural communities, similar to Port Gibson, are located throughout the outlying areas and provide limited services (USCB 2003).

The estimated population for 2002 and the projected populations for 2030 (the projected first year of operation) and for each decade for five decades through the year 2070 (the projected end of the initial facility license term) are based on the 2000 U.S. Census (see Table H-1 in Appendix H). The projected populations for the years 2030 through 2070 for each segment are based on averages of the population growth projections obtained from the Louisiana State University and the Mississippi Center of Policy Research and Planning for the Louisiana parishes and Mississippi counties, respectively. Discussion regarding the population projection methodology used by the states of Mississippi and Louisiana is provided in Site Safety Analysis Report Section 2.1.3.1 (SERI 2005).

Figure 2-9 shows the estimated resident population in 2002 within 16 to 80 km (10 to 50 mi) of the Grand Gulf ESP facility. The 2002 projected resident population and the population projection for each of five decades from 2030 (the projected first year of facility operation) to 2070 (the projected end of the initial license term) are given in Table H-2 in Appendix H for each area shown in Figure 2-9 formed by concentric circles (distance) and the radial lines (direction). The basis for estimating the projected population distributions is similar to that described for the population distribution within the 0- to 16-km (0- to 10-mi) zone.

The resident and transient population is subject to seasonal variations (from visitors to the Grand Gulf Military Park and hunting camps and from visitors who fish) and daily workday variations (GGNS Unit 1 employment and other activities of an occasional nature, such as the logging crews of forest product company, Anderson-Tully of Vicksburg, Mississippi, who occasionally work on the company's owned and leased land within 8 to 16 km (5 to 10 mi) of the Grand Gulf ESP site) (SERI 2004a). Table 2-11 shows transient population associated with recreation and large employers. Although there are a number of large employers in the general area of the Grand Gulf ESP, commuting data from the 2000 U.S. Census show that more residents commute out of Claiborne, Copiah, Rankin, Jefferson, and Adams County than commute in. The four nearest counties (Claiborne, Copiah, Jefferson, and Warren) show net out-commuting, so that their daytime working population is less than their resident working

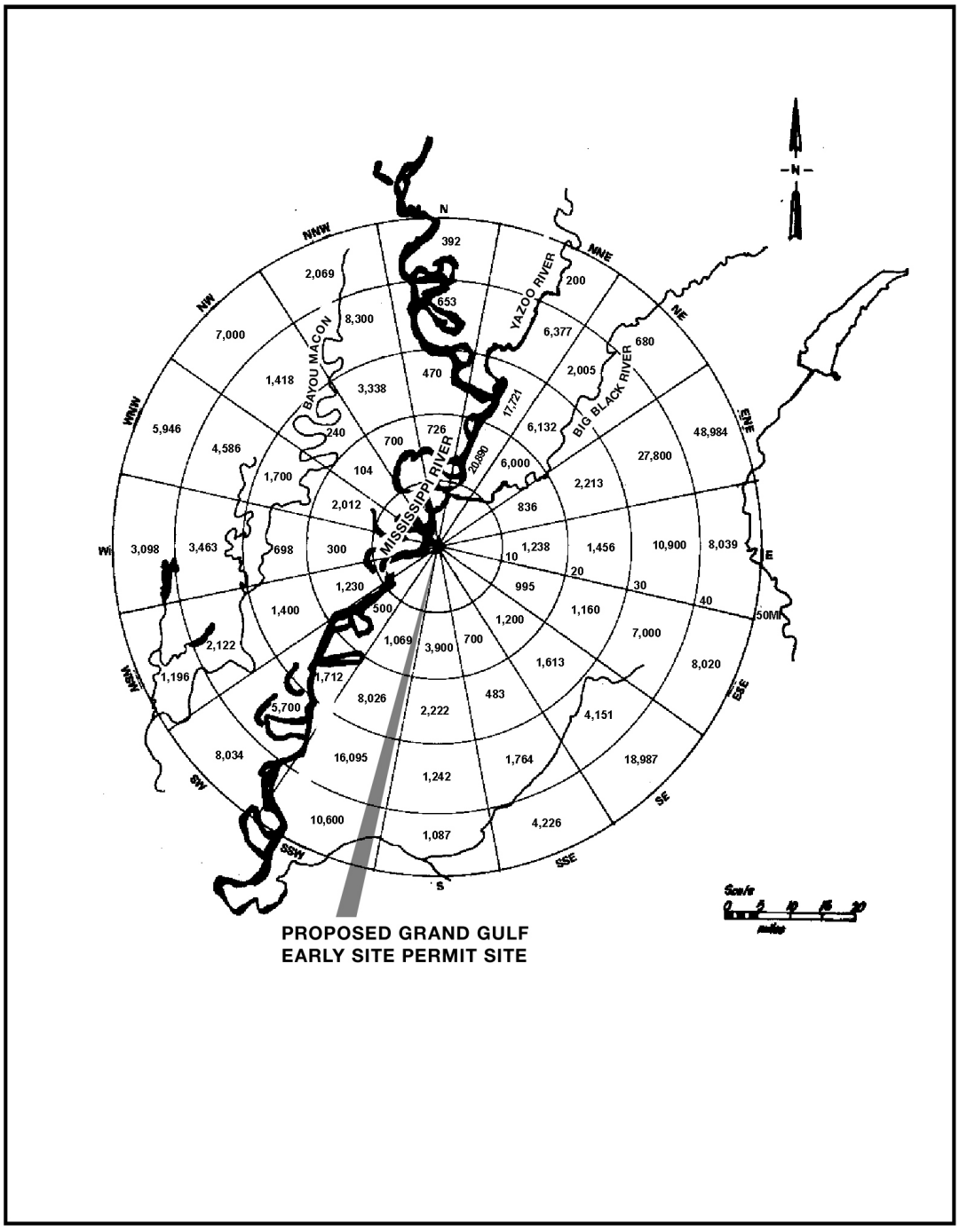

Figure 2-9. Estimated Population in 2002 Between 16 and 80 Kilometers (10 and 50 Miles) from the Grand Gulf Early Site Permit Site (SERI 2005, Figure 2.5-2)

Table 2-11. Transient Population Near Grand Gulf Early Site Permit Site

Location	Peak Time	County/Parish	Distance from GGNS Site	Peak Population
Recreation Visitors				
Grand Gulf Military Park	Sundays in June and July	Claiborne (MS)	2.4 km (1.5 mi)	250-300
Warner Tully YMCA Camp	May-August	Claiborne (MS)	5.6 km (3.5 mi)	120
Lake Claiborne	Summer Weekends	Claiborne (MS)	5.6 km (3.5 mi)	200
Lake Bruin State Park	Summer Weekends	Tensas (LA)	15 km (9.5 mi)	--
Hunting Camps (Mississippi Side)	Hunting Season Weekends	Various	Various	4500
Hunting Camps (Louisiana Side)	Hunting Season Weekends	Various	Various	300-400
Other Hunters	First Day of Gun Hunting	Various	Various	500-600
Anglers	Summer Weekends	Various	Various	200-250
Delta Steamboats	Summer (Largest Vessel)	Various	Various	597
Vicksburg Area Attractions	Summer Weekends	Warren (MS)	Approx 40 km (25 mi)	9800
Selected Major Employers[(a)]				
Grand Gulf Nuclear Station	Outage Weekdays	Claiborne (MS)	--	800
Bruce Hardwood Floors	Weekdays	Claiborne (MS)	10 km (6 mi)	200
Prolon, Inc.	Weekdays	Claiborne (MS)	10 km (6 mi)	90
American Paper Tube	Weekdays	Claiborne (MS)	10 km (6 mi)	20
Alcorn State University	Weekdays (Football Game Days)	Jefferson (MS)	17 km (10.5 mi)	~3300 (20,000)
Panola Company	Weekdays	Tensas (LA)	19 km (12 mi)	42
Texas Road Gin	Weekdays	Tensas (LA)	19 km (12 mi)	40 (Seasonal)
LeTourneau, Inc.	Weekdays	Warren (MS)	24 km (15 mi)	652
Cooper Lighting HID	Weekdays	Warren (MS)	40 km (25 mi)	1005
Anderson-Tully Co.	Weekdays	Warren (MS)	40 km (25 mi)	550
Tyson Foods	Weekdays	Warren (MS)	48 km (30 mi)	650
International Paper Company	Weekdays	Warren (MS)	56 km (35 mi)	370
API Outdoors Inc.	Weekdays	Madison (LA)	56 km (35 mi)	100
International Paper Company	Weekdays	Adams (MS)	56 km (35 mi)	600
Dynasteel Corp.	Weekdays	Adams (MS)	56 km (35 mi)	120
Mississippi River Corp.	Weekdays	Adams (MS)	56 km (35 mi)	100
Kelly's Kids	Weekdays	Adams (MS)	56 km (35 mi)	100
La Sevilla Fashions, Inc.	Weekdays	Franklin (LA)	64 km (40 mi)	250
Mastercrafters Corp	Weekdays	Franklin (LA)	64 km (40 mi)	170
American Railcar Industries	Weekdays	Franklin (MS)	64 km (40 mi)	63
Franklin Timber Co.	Weekdays	Franklin (MS)	64 km (40 mi)	30
Alford Lumber Co.	Weekdays	Franklin (MS)	68 km (42 mi)	30
Delphi	Weekdays	Lincoln (MS)	74 km (46 mi)	617
Columbus Lumber Co., LLC	Weekdays	Lincoln (MS)	74 km (46 mi)	150
Keystone-Seneca Wire Cloth Co.	Weekdays	Lincoln (MS)	74 km (46 mi)	120
Gatlin Corp., Inc.	Weekdays	Lincoln (MS)	74 km (46 mi)	72

(a) Many of the employees reside within 80 km (50 mi) of the site. Peak population is assumed to be the same as employment.

Source: SERI 2005

population (USCB 2005b). SERI calculated a transient population of about 10,700 within 16 km (10 mi) of GGNS for 2002. Between 16 and 48 km (10 and 30 mi), the weighted transient population for 2002 was estimated at about 14,800 (SERI 2005). Total population (transient plus resident population) to 48 km (30 mi) was estimated by SERI at 128,300; this was projected to increase to 137,800 by 2030 and to 152,200 by 2070 (SERI 2005). In 2030, transient population for 0 to 48 km (0 to 30 mi) was projected at 29,800. By 2070, it was projected at 33,000 (vs. 25,500 in 2002). Since much of the projected increase is actually double-counted resident population, the staff considers both the estimate for 2002 and the projections to be overestimates.

2.8.2 Community Characteristics

The community surrounding the Grand Gulf ESP site is rural, largely minority, low-income, and economically isolated (Table 2-12). The county in which the proposed site is located (Claiborne County, Mississippi) and three of the counties next to the proposed site (Copiah and Jefferson counties in Mississippi and Tensas Parish in Louisiana) are classified as persistent poverty counties (Tootle 1999). County poverty estimates in the 2000 U.S. Census indicate that 32.4 percent of individuals are below the poverty level in Claiborne County, compared to the state of Mississippi with 19.9 percent of individuals below the poverty level (USCB 2004c).

Table 2-12. Minority and Low-Income Populations

	Percentage Minority	Percentage Low Income
United States	30.9	12.4
Mississippi	39.3	19.9
Counties Within 50 km (80 mi)	27.9	21.0
Claiborne County	84.9	32.4
Port Gibson	80.6	31.3

Sources: USCB 2003, 2004f

2.8.2.1 Economy

Approximately 750 people work at GGNS Unit 1, with up to 970 personnel onsite during outages (SERI 2005), making Entergy one of the large, stable employers in the four-county region. Table 2-13 shows an April 2003 distribution of residence locations of SERI's employees at GGNS. About 46 percent of the employees lived in Warren County (Vicksburg), about 18 percent in Claiborne County, 15 percent in Hinds County, almost 6 percent in Jefferson County, over 4 percent each in Copiah and Franklin counties, almost 3 percent in Lincoln County, and the rest scattered.

Table 2-13. Residence Locations of the Workforce at the Grand Gulf Nuclear Station, April 2003

	Number[(a)]	Percent of Workforce
Claiborne County	**125**	**17.9**
Port Gibson	102	14.6
Pattison	12	1.7
Hermanville	10	1.4
Warren County	**325**	**46.4**
Vicksburg	325	46.4
Hinds County	**106**	**15.1**
Clinton	51	7.3
Jackson	19	2.7
Raymond	11	1.6
Utica	10	1.4
Jefferson County	**40**	**5.7**
Fayette	27	3.9
Lorman	13	1.9
Copiah County	**31**	**4.4**
Wesson	16	2.3
Hazelurst	12	1.7
Franklin County	**30**	**4.3**
Natchez	23	3.3
Lincoln County	**20**	**2.9**
Brookhaven	19	2.7
Other	**23**	**3.3**
Total	**700**	**100.0**

(a) The cities listed are those with at least ten resident workers and are not all of the cities that make up the county total.

Source: SERI 2004a

Comparisons of county employment statistics by industry type indicate that the total number of jobs for Claiborne County and the two adjacent Mississippi counties (Copiah and Jefferson) decreased between 1990 and 2000, offset by gains in Hinds and Warren counties (see Table 2-14). Several industries experienced severe job decline between 1990 and 2000, including agriculture, forestry, and fishing jobs (down almost 50 percent); manufacturing; professional, scientific, management, administrative, waste management, and other services jobs (each down almost 16 percent); wholesale trade (down 13 percent); finance, insurance, real estate, and rental and leasing (down 11 percent); and construction (down 2 percent) (USCB 2004a, 2004e). In contrast, employment in retail trade and entertainment services increased by 15 percent; public administration by over 14 percent; transportation and warehousing, utilities, and information services by 11 percent; and educational, health, and social services by 10 percent. A study conducted by the Rural Health Works in Mississippi estimates that employment in the health care sector represents 5.3 percent of the total

Table 2-14. Employment Changes in the Five Mississippi Counties Nearest to the Grand Gulf Early Site Permit Site (Claiborne, Copiah, Hinds, Jefferson, and Warren), 1990 to 2000

Mississippi County	Workers Employed 1990	Workers Employed 2000	Percentage Change in Workers Employed 1990-2000	Percentage Unemployment Rate 1990	Percentage Unemployment Rate 2000
Claiborne	3,490	2,990	-14.3	15.3	11.8
Copiah	10,540	10,420	-1.1	9.4	7.7
Hinds	121,360	125,340	3.3	5.6	4.7
Jefferson	2,300	2,230	-3.0	22.8	19.5
Warren	20,780	25,630	23.3	7.5	5.0
Totals	**158,470**	**166,610**	**5.1**	**6.6**	**5.3**

Source: SERI 2004a

workforce within Claiborne County. The study also concludes that local health care services typically represent a much larger sector of rural economies than for urban communities (Berry et al. 2002).

The annual 2004 county labor force data show Claiborne County had an unemployment rate of 10.1 percent as compared to the surrounding four contiguous counties in Mississippi (Copiah, Hinds, Jefferson, and Warren) and Tensas Parish, Louisiana. The surrounding counties had an average unemployment rate of 6.0 percent, and the state of Mississippi had an unemployment rate of 6.2 percent (U.S. Bureau of Labor Statistics 2005).

2.8.2.2 Transportation

Transportation routes are limited in the vicinity of the Grand Gulf ESP site. The major highway in the vicinity is U.S. Highway 61, which passes by the existing GGNS to the east-southeast. U.S. Highway 61 parallels the Mississippi River from New Orleans, Louisiana to St. Louis, Missouri. This highway runs through Port Gibson and is approximately 7.2 km (4.5 mi) from the Grand Gulf ESP site at the closest point. From the town of Port Gibson, the highway goes north to Vicksburg, Mississippi, and runs southwest to Natchez, Mississippi.

The Natchez Trace Parkway lies east of Port Gibson and runs southeast to Natchez and northeast to Clinton, Mississippi. Figure 2-10 shows the estimated average daily traffic count in 2000 on roads in the vicinity of the Grand Gulf ESP site. Bald Hill Road has been reconstructed from Grand Gulf Road to Headly Road to accommodate commercial traffic to/from

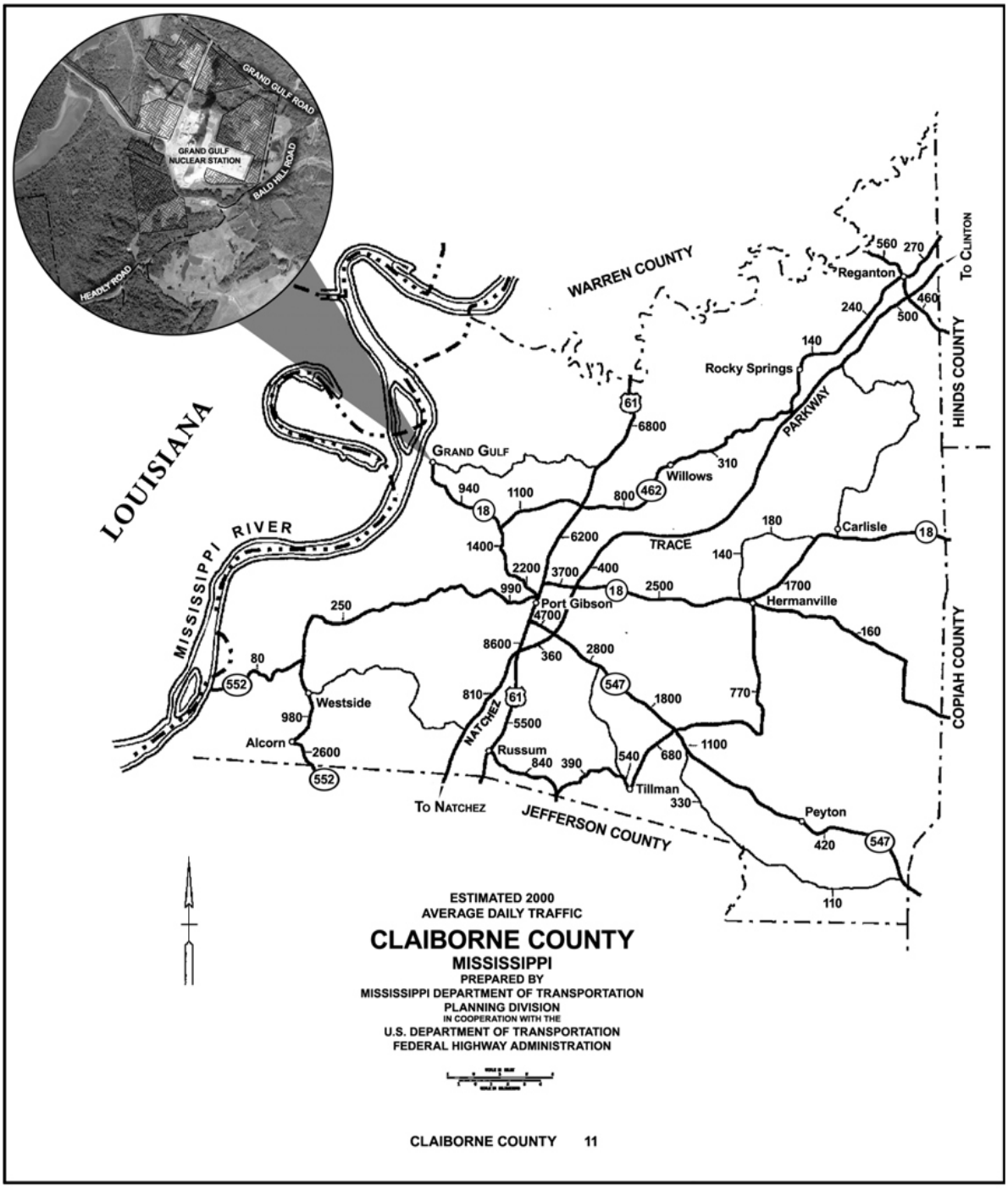

Figure 2-10. Estimated Average Daily Traffic in Claiborne County, Mississippi in 2000 (adapted from SERI 2005, Figure 2.5-3)

Port Claiborne. New highway construction to extend the present path of Highway 18 is scheduled for early 2006 (see Figure 2-11). This proposed extension will connect Highway 18 to Grand Gulf Road, providing additional access to the Grand Gulf ESP site (SERI 2004a; Williford, Gearhart, and Knight 2005).

A Kansas City Southern freight train passes within 45 km (28 mi) to the north-northeast of the site twice daily. The train runs from Vicksburg to Meridian, Mississippi, then returns to Vicksburg (KCS 2002). No rail line serves Claiborne County or the Grand Gulf site directly (MDOT 2004b). An active spur line from the Kansas City Southern line runs south from Vicksburg about 11 km (7 mi).

2.8.2.3 Taxes

Mississippi Code Title 27 addresses taxation of nuclear generating plants and the distribution of tax revenues from nuclear plants (Mississippi Tax Code 2003). This code states that any nuclear generating plant located in the State, which is owned or operated by a public utility rendering electric service within the State, is exempt from county, municipal, and district ad valorem taxes. In lieu of the payment of county, municipal, and district ad valorem taxes, the nuclear power plant owner pays the State Tax Commission a sum based on the assessed value of the nuclear generating plant.

GGNS is taxed by the State for a sum equal to 2 percent of the assessed value but not less than $20 million annually. At least $7.8 million goes to Claiborne County (SERI 2004c). Of this amount, $3 million is allocated contingent upon Claiborne County upholding its commitment to the GGNS offsite emergency plan. The $7.8 million represents roughly 83 percent of all Claiborne County revenues (Mississippi State 2002).

The Mississippi State Tax Commission transfers $160,000 annually to the town of Port Gibson provided that the city maintains its commitment to the GGNS offsite emergency plan. Ten percent of the remainder of the payments are transferred from the Mississippi State Tax Commission to the General Fund of the State. The balance of the tax revenue from the GGNS site is transferred to the counties and municipalities in the state of Mississippi where electric service is provided. The tax revenues are distributed in proportion to the amount of electric energy consumed by the retail customers in each county, with no county receiving an excess of 20 percent of the funds (Mississippi Tax Code 2003). This distribution, based on energy consumed, also includes Claiborne County.

Depending on the type of facility (unregulated merchant facility or a facility regulated by the Public Service Commissions of Mississippi and Louisiana), the tax structure of the Grand Gulf ESP facility may be similar to the above for GGNS (a regulated facility), or may be some mutually agreeable amount for an unregulated merchant facility.

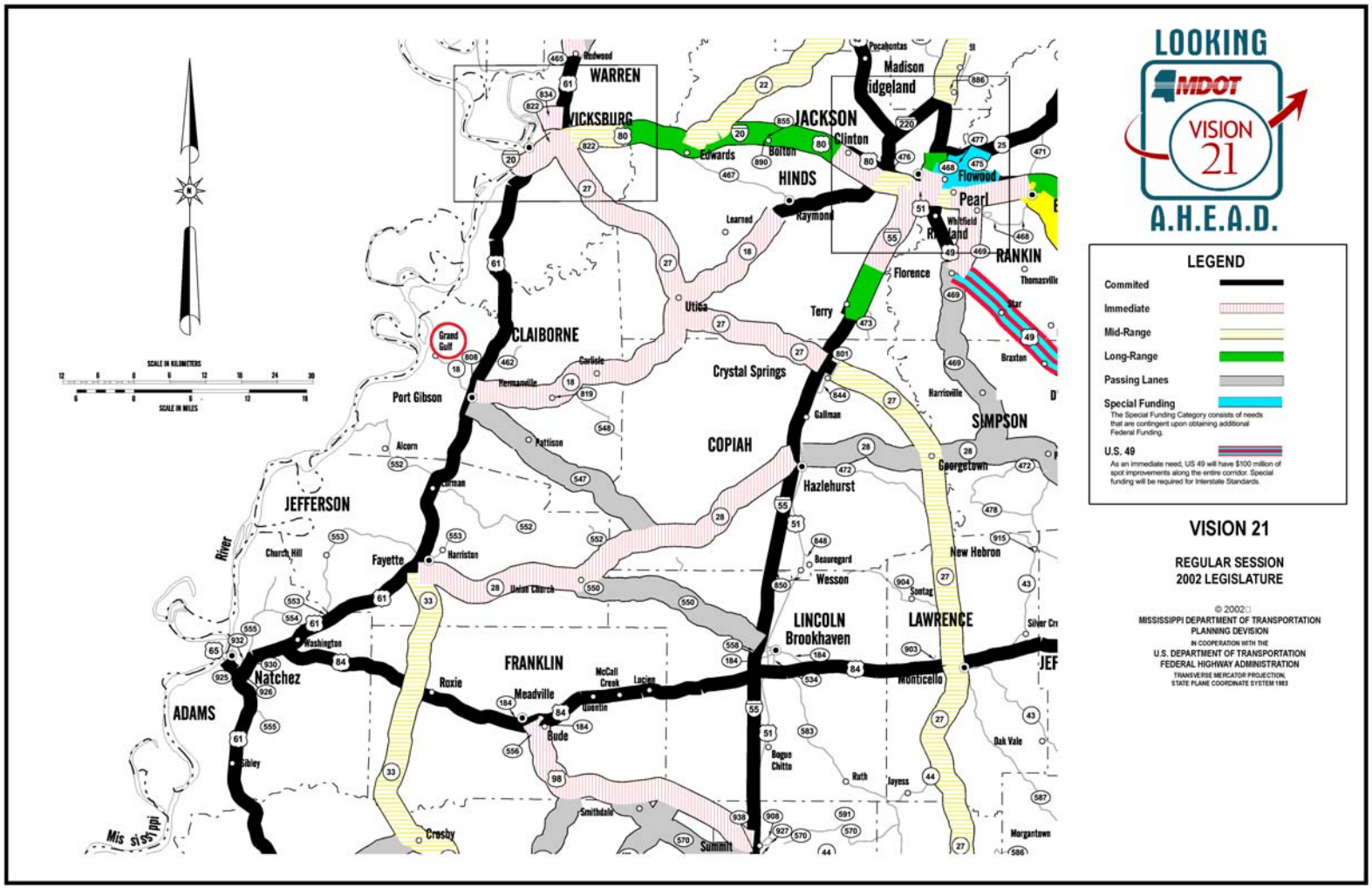

Figure 2-11. Mississippi Department of Transportation 2002 Road Development Plan (adapted from SERI 2005, Figure 2.5-4)

2.8.2.4 Aesthetics and Recreation

The Grand Gulf Military Park is located approximately 3 km (2 mi) north of the location proposed for the Grand Gulf ESP power block and is contiguous to the GGNS site. The park is open daily and had over 88,000 visitors in 2001. The highest volume of guests visit the park on Sundays while Saturday is typically the second largest attendance day. The park is most heavily used during the months of June and July when 250 to 300 people visit the site per day, depending on the weather conditions (SERI 2004a).

The Warner-Tully YMCA Camp consists of 44 ha (108 ac) of land located approximately 5 km (3 mi) northeast of the Grand Gulf ESP site. Approximately 800 campers use the Warner-Tully Camp facilities each year. The YMCA camp is open from late May to the end of August (SERI 2004a).

Lake Claiborne is a private development of residential and recreational facilities, located approximately 5 km (3 mi) east of the Grand Gulf ESP site. Lake Claiborne, Inc., has a total of about 450 members who have access to the lake and picnic area. There are 51 permanent residents in the development. A maximum of 200 people use these facilities on a summer weekend (SERI 2005).

Lake Bruin State Park consists of 21 ha (53 ac) located on the shore of Lake Bruin, Louisiana, approximately 15 km (9.5 mi) southwest of the proposed site. From July 2001 to June 2002, the park had approximately 36,000 visitors (SERI 2004a).

There are approximately 150 hunting camps within Claiborne County. These camps are primarily used for deer hunting and other types of hunting as well as sport fishing. The camps are too numerous to estimate an accurate number of people who use them. Each camp, depending on the size of the camp, could have up to 20-30 hunters on a weekend day during hunting season (SERI 2004a).

Several hunting clubs are located across the Mississippi River from the Grand Gulf ESP site in Tensas Parish, Louisiana. About 300 to 400 deer and duck hunters are members of these clubs (SERI 2004a).

Deer season in Mississippi traditionally opens early in October for archery and late November for guns. The season continues through early January. The greatest number of hunters, approximately 500 to 600, typically hunt within the vicinity on the first day of gun season. After the opening weekend, approximately 70 percent of the hunting population use the camps until the end of the season in early January (SERI 2004a). Louisiana deer season is similar in duration to that of Mississippi, beginning in early October and ending in late January (LFWS 2004).

Sport fishing in the area occurs in the months of April through September with Saturday being the busiest day of the week. As many as 200 to 250 anglers may be in the vicinity on weekends during the months noted. The number of anglers may drop to fewer than 150 during the week, depending on the weather conditions (SERI 2004a).

The Delta Queen Steamboat Company operates three paddle wheel tour boats on the Mississippi River: the Delta Queen (174 passengers), the Mississippi Queen (416 passengers), and the American Queen (436 passengers) (DQSC 2004a). Scheduled departures and ports of call indicate that these vessels pass the Grand Gulf ESP site several times during the season, from April through November (DQSC 2004b).

The GGNS site is visible from Grand Gulf Military Park and the existing natural draft cooling tower is visible from the Mississippi River. Otherwise, the site is well screened by topography and forested areas surrounding it. The Grand Gulf ESP site is therefore already aesthetically altered by the presence of an existing nuclear power plant and cooling tower.

2.8.2.5 Housing

There were 226,000 occupied housing units reported in the 2000 U.S. Census for the counties that currently supply workers to the GGNS. Table 2-15 provides regional housing information by county for these counties. U.S. Census data for 2000 indicates 567 vacant housing units are located within Claiborne County, representing 13 percent of the total housing in the county (USCB 2004d). In the ten-county area, 21,760 housing units were reported as vacant for the 2000 U.S. Census. Based on the vacancy numbers, no overall housing shortage appears to exist in the region, although availability is more limited in Claiborne County and Jefferson County. From 2000 to 2004, mortgage loan amounts (a proxy for housing prices) in Claiborne County have risen slowly in a thin market, indicating little activity but no evidence of declining values (Section 5.1.1).

2.8.2.6 Public Services

Water Supply and Waste Treatment

Port Gibson Water Works supplies Port Gibson with municipal water and sewer services. Approximately 95 percent of Port Gibson's population is connected to the municipal water and sewer system, which is presently at 90 percent capacity. Operational averages for the water and sewer services provided by Port Gibson Water Works are provided in Table 2-16.

GGNS has its own water and sewage facility. The GGNS currently operates at about one-third capacity during normal operation and two-thirds capacity during outages. The facility consumes 379,000 L/d (100,000 gpd) of water for general operations and separately uses 189,000 L/day (50,000 gpd) for the activated sludge system (SERI 2005).

Table 2-15. Regional Housing Information by County for the Year 2000

Mississippi County	Total Housing Unit	Occupied	Owner Occupied	Renter Occupied	Vacant Housing	Seasonal/ Recreational
Adams	15,175	13,677	9,615	4,062	1,498	176
Claiborne	4,252	3,685	2,956	729	567	149
Copiah	11,101	10,142	8,107	2,035	959	176
Franklin	4,119	3,211	2,764	447	908	434
Hinds	100,287	91,030	58,131	32,899	9,257	421
Jefferson	3,819	3,308	2,658	650	511	169
Lincoln	14,052	12,538	9,788	2,750	1,514	205
Madison	28,781	27,219	19,288	7,931	1,532	203
Rankin	45,070	42,089	32,471	9,618	2,981	393
Warren	20,789	18,756	12,785	5,971	2,033	199
Total	**247,445**	**225,655**	**158,563**	**67,092**	**21,760**	**2,525**

Source: USCB 2004d

Table 2-16. Capacity and Use of Port Gibson Water and Sewer Systems

Units	Maximum Well Water Capacity	Average Well Water Consumption	Peak Well Water Consumption	Water Storage Capacity	Sewer Capacity
Liters/Day	3.8 million	3,000,000	3,600,000	2,840,000	760,000
Gallons/Day	1 million	800,000	950,000	750,000	200,000

Source: SERI 2005

Police, Fire, and Medical

The Claiborne County Sheriff's department handles the present duties for law enforcement within the immediate (8-km (5-mi)) area of the Grand Gulf ESP site. Additional law enforcement resources from the town of Port Gibson assist when needed. GGNS maintains its own security force to handle security within the Grand Gulf site property boundaries.

Fire capabilities are maintained by Claiborne County Fire Department along with the volunteer fire department from the town of Port Gibson. GGNS Unit 1 maintains an emergency response team onsite, including a fire brigade to respond to fires within the facility buildings and structures.

Emergency planning responsibilities are assigned to a number of departments and agencies. Federal, State, and local officials will implement appropriate protective actions in case of an emergency (MDOT 2004a; Scott 2004). The Claiborne County Sheriff's Department has performed adequately in all of its offsite emergency responsibilities in Federal Emergency Management Agency emergency planning exercises. However, with a staff of only nine deputies, the department has concerns about the adequacy of its staffing to cover simultaneously its emergency responsibilities at GGNS as well as offsite evacuation in the event of actual emergencies (Scott 2004).

The Claiborne County Hospital has 32 beds. The staff consists of five doctors, ten registered nurses, six nurse's aides, and three X-ray technicians (SERI 2004a). Information for hospitals located in the adjoining counties is listed in Table 2-17 (SERI 2004a). The local hospital does not have the full range of services available all of the time. A Mississippi Department of Health publication in 2003 indicated that Claiborne County is a health professional shortage area (MDH 2005a). Residents of Claiborne County obtain a significant proportion of their hospital services in Vicksburg rather than locally (Berry et al. 2002). In an emergency, the Claiborne County Hospital has the space, equipment, and staff to handle about three to four casualties at a time. It has one decontamination room (14 years old) that is not co-located with the emergency room. Claiborne County officials are concerned this is not sufficient should there be an emergency at the Grand Gulf ESP facility. They believe their communications and transportation capability to evacuate patients is not adequate. County officials do have verbal agreements and are in contact with other licensed facilities within 96 km (60 mi) and believe that emergency responders would come to help from other counties, but they would like to have much more capability under local control (Scott 2004).

Table 2-17. Hospitals in the Vicinity of the Grand Gulf Early Site Permit Site

County	Number of Hospitals	Number of Beds
Claiborne	1	32
Copiah	1	49
Hinds	6	2468
Jefferson	1	30
Warren	2	354
Total	**11**	**2933**

Source: SERI 2004a

2.8.2.7 Education

Claiborne County and the four adjacent counties in Mississippi contain 114 primary and secondary schools with a student population of 61,097 (see Table 2-18).

Table 2-18. Number of Students and Public Primary and Secondary Schools in Mississippi Counties Surrounding the Grand Gulf Early Site Permit Site

Mississippi County	Number of Schools	Student Population
Claiborne	4	2,011
Copiah	6	4,911
Hinds	85	43,281
Jefferson	5	1,714
Warren	14	9,180
Total	**114**	**61,097**

Source: NCES 2002

2.9 Historic and Cultural Resources

This section discusses the cultural background and the known and potential historic and cultural resources at the Grand Gulf ESP site and surrounding environs of Claiborne County.

2.9.1 Cultural Background

The area in and around the Grand Gulf ESP site has a rich history and has demonstrated the presence of significant prehistoric and historic cultural resources. Thirty-five sites in Claiborne County are eligible for listing on the National Register of Historic Places, sixteen of which are located within the 16-km (10-mi) vicinity of the Grand Gulf ESP site (SERI 2005). These are mostly historic buildings, homes, churches, and cemeteries.

One site, the Grand Gulf Military Park, a 162-ha (400-ac) park listed in the National Register of Historic Places, is located adjacent to the GGNS. Within the park are archaeological deposits, standing structures, objects, and artifacts from the historic town of Grand Gulf and from Civil War events that occurred in the area. Files at the Mississippi Department of Archives and History indicate that a total of 13 archaeological sites, including the park site, are within 3 km (2 mi) of the Grand Gulf ESP site, none of which are eligible for listing on the National Register of Historic Places.

Although no prehistoric sequence has been published for the immediate area, the general sequence for the region can be described as follows:

- 10,000 - 8000 B.C. During this period, the area was sparsely inhabited by peoples typically referred to as big-game hunters.
- 8000 - 2000 B.C. People developed a more generalized hunting and gathering economy and spread throughout the Mississippi valley. People would move from place to place, obtaining foods and other items as they became seasonally available.
- 2000 B.C. - A.D. 1000. The economy changed from seasonal food gathering to settled life. Small villages developed around mounds of earth constructed by the people to bury their dead.
- A.D. 1000 - 1542. The economy added farming crops, such as corn, beans, and squash. Earth mounds developed into flat-topped “temple” mounds as population densities increased.
- A.D. 1542 - ca.1650. Diseases brought on by contact with Europeans led to massive epidemics, decimating the local American Indian populations.

Settlement by non-Indians increased throughout the 1700s as settlers moved into the frontier. American Indian groups such as the Choctaw, Chickasaw, Natchez, Tunica, and others resisted the new inhabitants but eventually abandoned traditional lands, moving to areas where they were less threatened by the dominant population. During this time, Mississippi went from being a French possession to an English possession in 1763, to a Spanish possession in 1781, and eventually to the United States in 1795. Mississippi became a U.S. Territory in 1798, and achieved statehood in 1817 (Headley 1996).

Port Gibson was founded in 1783 as the first settlement in the general area, serving the surrounding rural farms, where the main crops grown were cotton, corn, field peas, oats, and sweet potatoes (Hendrickson and McKeehen 1926). In 1802, the residents organized Claiborne County, which became the second area in Mississippi to achieve this status. By this time, the area was populated mainly by Anglo-Americans from the east and peoples of African descent. A second shipping point, Grand Gulf, formed in 1833. Grand Gulf eventually decreased in importance and faced heavy erosion in later years. An important Civil War battle occurred there in 1861 (Bearss 1989).

2.9.2 Historic and Cultural Resources at the Grand Gulf ESP Site

When the original GGNS site was planned, an archaeological survey of the 850-ha (2100-ac) proposed site was commissioned by MP&L. The survey, performed by the Mississippi Department of Archives and History, identified eight prehistoric sites on the GGNS site (Brookes and Inmon 1973). Seven of the sites were scatters of lithic and ceramic debris and were not considered important enough for inclusion in the National Register of Historic Places. These sites are designated 22-Cb-523 though 22-Cb-529, using the Smithsonian archaeological site numbering system. These sites were located in the zone of construction and were likely destroyed or are located outside the Grand Gulf ESP site.

Three sites not located in an area of proposed construction have been investigated: Grand Gulf Mound, Callendar House, and the Grand Gulf and Port Gibson railroad. Grand Gulf Mound (22-Cb-522), the eighth prehistoric site, was considered important enough to excavate. This was a burial mound located on a terrace on the bluffs overlooking the Mississippi River. More than half the mound had been damaged by artifact collectors and other activities by the time Mississippi Department of Archives and History visited it in 1972 (Brookes 1976). Following the recommendation of the Department, MP&L fenced the mound. The Department commenced excavation soon thereafter. The investigators concluded this was an early Marksville burial mound dating from approximately A.D. 50 to A.D. 200. Evidence indicated an affinity to peoples in the north, probably the Illinois Valley. Today the fence is still standing, but little remains of the mound.

In addition to the archaeological investigations conducted prior to construction of GGNS, MP&L commissioned a survey of the existing architectural resources of Claiborne County (Douglas 1974). One resource, the Callendar House, a mid-19th century simple Greek Revival house unique to the county, was located on the eastern portion of the GGNS (Douglas 1974). The house was built by C.D. and Lizzie Hamilton about 1866 and later owned by the Maxwell brothers and finally the Callendar family (Headley 1996). In the early 1970s, the house was in poor condition, and despite an interest in preserving the house, it did not survive. NRC staff inspected the house location on April 13, 2004 (Stapp 2004). Portions of the Callendar House site had been quarried for soil, and no evidence of the house was found on the surface. A barn, ca. 1920s, was still standing and evidence of roads and fields remained. The Callendar House site is considered an unrecorded archaeological resource, as subsurface archaeological deposits probably exist. However, the site likely would not be considered eligible for listing on the National Register of Historic Places because of a lack of integrity.

Finally, a 100-m (300-ft) segment of an important 19th century historic railroad, known as the Grand Gulf and Port Gibson Railroad, still exists within the site boundary and was inspected by NRC staff on April 13, 2004 (Stapp 2004). The steel rails are gone, but the railroad bed exists in good condition; it is not located in an area proposed for new construction. Discussions with

Mississippi Department of Archives and History personnel indicate this would not be the best representative portion of the railroad to preserve and, therefore, no mitigation would likely be required should this portion be affected during facility construction (Stapp 2004).

2.9.3 Historic and Cultural Resources Consultation

To meet consultation requirements found in the National Historic Preservation Act of 1966, as amended, and NEPA, the NRC staff elected to integrate its compliance with the National Historic Preservation Act with its NEPA review, in accordance with 36 CFR 800.8. The NRC staff informed the public about the ESP application and consulted with various entities. A public scoping meeting for the EIS was held on January 21, 2004, in Port Gibson. No comments specific to historic or cultural resources were made at the meeting.

As part of the NEPA/National Historic Preservation Act integrated review, the NRC staff initiated consultation with the Advisory Council on Historic Preservation, the Mississippi Department of Archives and History, the Mississippi Band of Choctaw Indians, the Choctaw Nation of Oklahoma, and the Tunika Biloxi Indian Tribe of Louisiana (NRC 2004q, 2004r, 2004s, 2004t, 2004u, respectively). None of the organizations identified deficiencies in the NRC staff's identification and assessment of the effects of the proposed action on any historic or cultural resources.

On April 14, 2004, the NRC staff met with staff from the Grand Gulf Military Park to discuss potential visual effects of the proposed cooling tower and any other issues of concern; no concerns were identified (Stapp 2004).

NRC staff also initiated discussions with the Mississippi Department of Archives and History and the Vicksburg National Military Park to understand potential impacts on historic and cultural resources. The Mississippi Department of Archives and History recommended that if construction efforts were to occur in two specific areas, one located north and one southwest of the GGNS, archaeological investigations should be undertaken prior to construction (SERI 2005) (see Section 4.6). Staff affiliated with the Vicksburg National Military Park indicated that it was unlikely that any significant Civil War-era resources would be affected by the planned activities (SERI 2005).

2.10 Environmental Justice

Environmental justice refers to a Federal policy under which each executive agency identifies and addresses, as appropriate, disproportionately high and adverse impacts on human health

or environmental effects of its programs, policies, and activities on minority[a] or low-income populations. Executive Order 12898 (59 FR 7629) directs Federal executive agencies to consider environmental justice under NEPA. The Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice (CEQ 1997). Although it is not subject to the Executive Order, the Commission has voluntarily committed to undertake environmental justice reviews. The staff uses as guidance the NRC Office of Nuclear Reactor Regulation office instruction number LIC-203 (NRC 2001[b]).

The staff examined the geographic distribution of minority and low-income populations within 80 km (50 mi) of the Grand Gulf ESP site, employing the 2000 U.S. Census for minority and low-income populations (USCB 2004e). The populations within 80 km (50 mi) of the Grand Gulf ESP site encompassed parts of sixteen counties in Mississippi and nine parishes in Louisiana. The staff supplemented its analysis by field inquires to county planning departments, social service agencies, and county personnel in Claiborne, Jefferson, and Warren counties in Mississippi. NRC guidance encourages supplemental inquiries to ensure that minority and low-income groups are not overlooked.

For the purpose of the staff's review, a minority population is defined to exist if the percentage of each minority, or aggregated minority category within the census block groups[c] potentially affected by the ESP for the Grand Gulf ESP site, exceeds the corresponding percentage of minorities in the entire state of Mississippi or Louisiana by 20 percent, or if the corresponding percentage of minorities within the census block group is at least 50 percent. A low-income population is defined to exist if the percentage of low-income population within a census block group exceeds the corresponding percentage of low-income population in the entire state of Mississippi or Louisiana (as applicable) by 20 percent, or if the corresponding percentage of low-income population within a census block group is at least 50 percent.[d]

(a) Minority categories are defined as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; Black races; Hispanic ethnicity; and "other," considered a separate minority category. The 2000 U.S. Census included multi-racial data. Some minority populations can be composed of one or more minority races (USCB 2005a).

(b) NRC also issued a policy statement on Environmental Justice and an update to LIC 203 (see 69 FR 52040 and NRC 2004a, respectively).

(b) A census block group is a combination of census blocks, which are statistical subdivisions of a census tract. A census block is the smallest geographic entity for which the U.S. Census Bureau (USCB) collects and tabulates decennial census information. A census tract is a small, relatively permanent statistical subdivision of counties delineated by local committees of census data users in accordance with USCB guidelines for the purpose of collecting and presenting decennial census data. Census block groups are subsets of census tracts (USCB 2004b).

(d) Low-income households should be identified using the annual statistical poverty threshold from the U.S. Census Bureau (NRC 2004a).

The staff followed the convention of employing 2000 U.S. Census block group data to identify minority and low-income block groups within the 80-km (50-mi) radius of the Grand Gulf ESP site. Using this convention, the 80-km (50-mi) radius includes 129 census block groups for minority populations and 34 census block groups for low-income populations. Both Mississippi and Louisiana have relatively large percentages of low-income and minority persons. Figures 2-12 and 2-13 (which are based on the 20 percent and 50 percent rules described in this section) show those areas that have exceptionally high minority populations and exceptionally high proportions of low-income households within the 80-km (50-mi) radius of the Grand Gulf ESP site. Minority populations are present in all of the counties and parishes within the 80-km (50-mi) radius of the Grand Gulf ESP site. Minority populations are primarily concentrated on the Mississippi side of the river in Claiborne and Jefferson counties, and Hinds County has the largest number of minorities. Claiborne County is entirely composed of minority block groups and contains 10 of the 129 block groups containing exceptionally significant minority populations.

Data from the 2000 U.S. Census characterize low-income populations within the 80-km (50-mi) radius of the Grand Gulf ESP site. The United States' percentage of low income population was 12.4 percent in the 2000 U.S. Census, while in Louisiana it was 19.2 percent and in Mississippi 19.9 percent (USCB 2004e). Applying the NRC criterion of "more than 20 percent greater than the state" yields the census block groups containing exceptionally high percentages of low-income households. Figure 2-13 shows these locations of the exceptionally high percentages of low-income populations within 80 km (50 mi) of the Grand Gulf ESP site. In fact, most of the area near the proposed site, especially Claiborne and Jefferson counties, has percentages of low-income populations in the range of 20 to 30 percent of the population. Nine out of 10 census block groups in Claiborne County, 17 out of 24 in Copiah County, 5 out of 6 in Jefferson County, 12 out of 18 in Concordia Parish, and 6 out of 7 in Tensas Parish have low-income persons making up more than 20 percent of the population. The heaviest concentrations of low-income populations are in southern Claiborne County, central Jefferson County, and eastern Tensas and Concordia parishes (USCB 2004e).

Data were gathered on the health status of the total and Black/African American populations in Claiborne County and were compared with data available at the state and national level. Data are shown in Table 2-19. Local death rate data are not available by income level.

Although Table 2-19 does not show directly age-adjusted cancer death rates by sex, the low combined rates for both sexes are low enough that the age-adjusted cancer death rates are likely to be somewhat lower for Claiborne County residents of both sexes than for either Mississippi or for the United States as a whole. Moreover, the Black/African American population has a lower death rate due to cancer than the total population in Claiborne County, whereas elsewhere in Mississippi and in the nation the rate for Blacks/African Americans is higher. The comparison of infant mortality rates in the county is not meaningful because of the

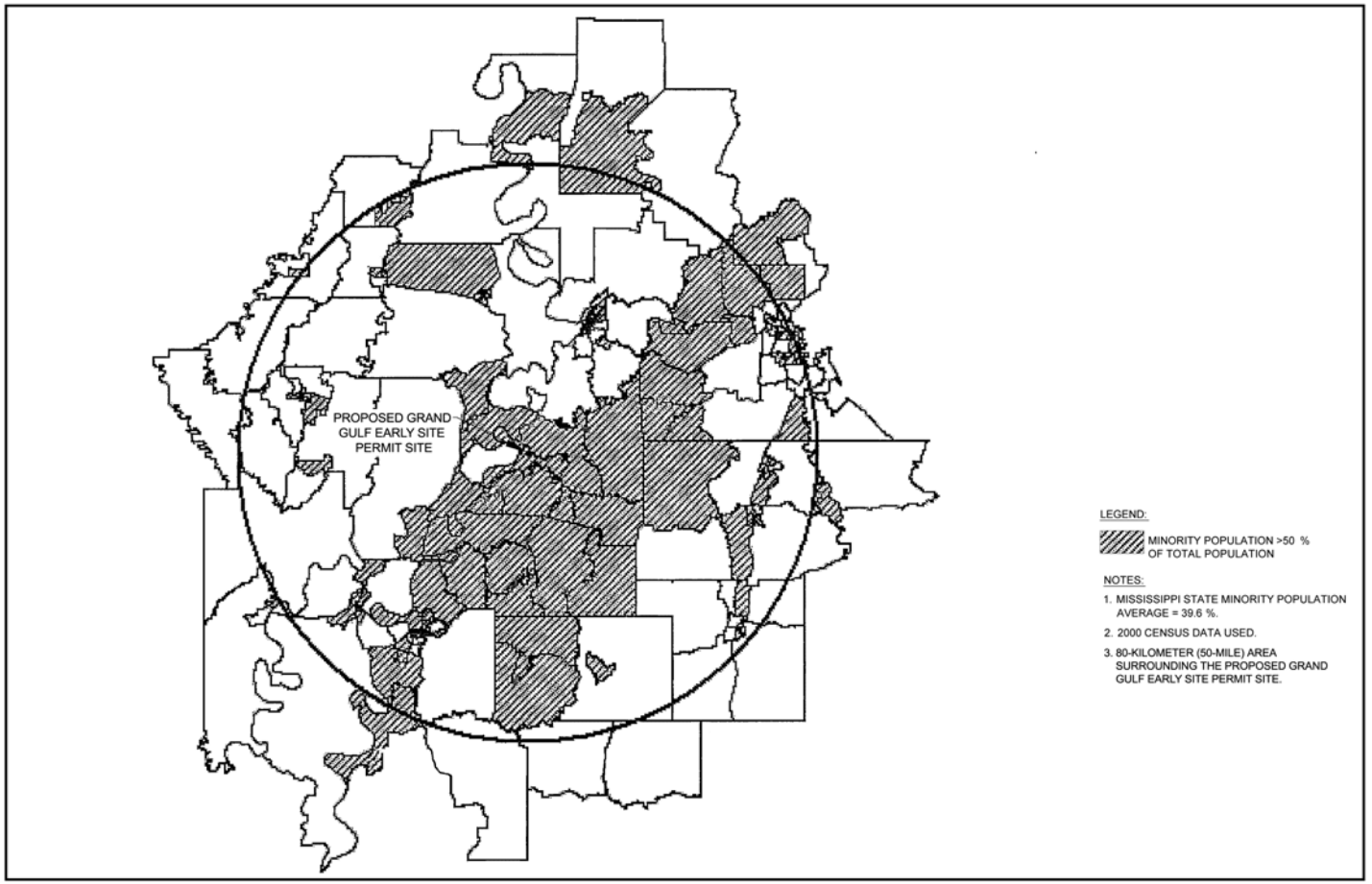

Figure 2-12. Minority Populations within 80 Kilometers (50 Miles) of the Grand Gulf Early Site Permit Site (adapted from SERI 2005, Figures 2.5-6, 2.5-7)

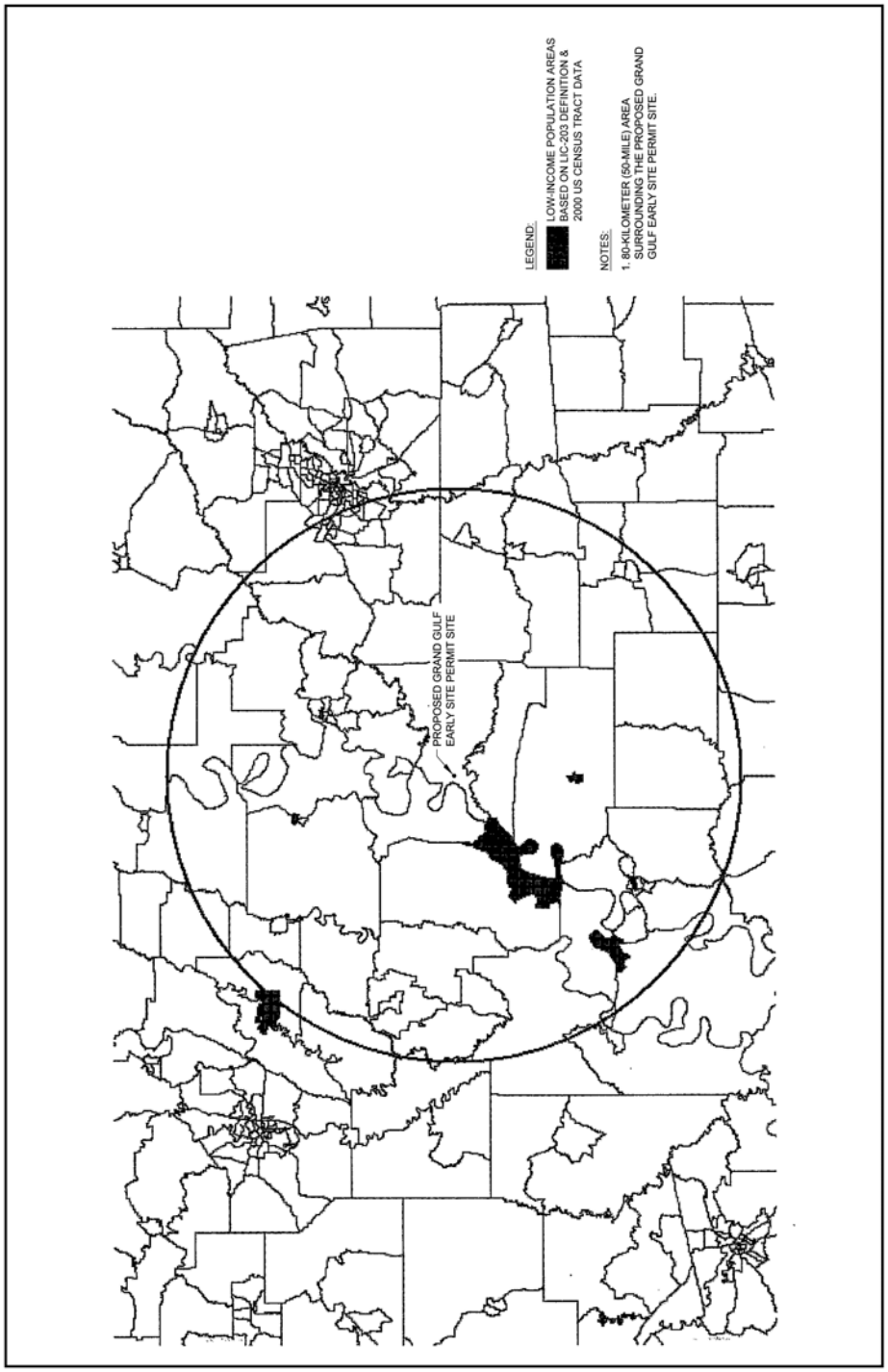

Figure 2-13. Low-Income Populations within 80 Kilometers (50 Miles) of the Grand Gulf Early Site Permit Site (adapted from SERI 2005, Figures 2.5-8, 2.5-9)

very low numbers of white births (9) and infant deaths (3), although the derived white death rates are considerably higher than in the state or the nation. However, a major risk factor for death for infants is low birth weight, which can be related to poverty (and often, teen pregnancy), but is not usually related to environmental emissions. Out of 142 births in 2003, Claiborne County had 28 illegitimate teen births and 12 immature births (infant less than 2500 grams). The statistics on overall causes of death in the population show rates similar to those in Mississippi and the nation, with slightly lower overall local rates for Blacks/African Americans than for the population as a whole. Although the number of deaths in the County is small and casts doubt on the statistical significance of the derived rates by cause, the county heart disease and cancer death rates for Blacks/African Americans are below corresponding state and national rates and also are below those for whites in the county. The local black rate of death due to stroke is near the national black rate, which is significantly higher than the rate for the white population. In the county, the white rate (representing 3 individuals) is above that for blacks (7 individuals). The 10 accidental deaths in the county in 2003 yielded accidental death rates considerably above state and national rates. There were only 7 deaths due to chronic lung disease in the county, with derived white rates higher than those for the Black/African American population. Overall, based on death statistics, there is not any evidence that the Black/American population in Claiborne County is less healthy than the local white population, the population of the state, or that of the nation. In particular, there is no evidence in the health statistics of environmental conditions that make the Black/African American population exceptionally vulnerable.

Data were also gathered on subsistence hunting and fishing practices. There are no known studies of exceptional levels of hunting and fishing activity among minority and low-income individuals that directly relate to the nearest counties and to the Mississippi River. There is one study that was published in 1996 that attempted to identify, describe, and classify sport and subsistence fishing associated with rivers in the Delta region of Mississippi and to identify, describe, and classify how fish caught from rivers are used in Delta communities (Brown et al. 1996). The study collected responses on fishing from a stratified random sample of households in Charleston and Marks, Mississippi and a 16-km (10-mi) radius around each town. Activity centered mainly on the Yazoo and Tallahatchie Rivers. About 124 (37 percent) of the 336 respondents had fished in the previous year. Of these, 34 (27 percent) were white males, 22 (18 percent) were white females, 16 (13 percent) were black males, and 43 (35 percent) were black females. Twenty-eight (22.5 percent) of the active fishing population stated a preference to fish rivers. Both the survey and qualitative data showed local rivers are primarily the province of white commercial fishers and catfishers. Other groups tended to use ponds and lakes. Primary fish sought (roughly in order of preference) by both groups were catfish, crappie (*Pomoxis* sp.), bass, and bream. Bream were more popular among blacks than whites and bass more popular among whites than blacks. Whites were somewhat more likely than blacks to use boats (and bass preference was strongly associated with boat fishing), but over 70 percent of both groups fished from the bank. Both whites and blacks tended to keep their

Table 2-19. Selected Health Statistics for Minority and Total Population in Claiborne County, Mississippi, and United States

	Claiborne County (2003)[a]		Mississippi (2003)		United States (2002)	
	Total Population	Black/African-American Population[b]	Total Population	Black/African-American Population	Total Population	Black/African-American Population
Age-Adjusted Cancer Deaths (rate per 100,000 population)						
Male (For county, both sexes)	182.6	173.1	303.8	371	247.5	339.4
Female	Note: County Rates Not Available by Sex		169.5	192.4	165.5	194.3
Infant Mortality (rate per 1,000 live births)						
All Causes	21.1	22.6	10.3	14.8	7	14.4
Selected Leading Causes of Death (age adjusted rates per 100,000 population)						
All Causes	900	810	980	830	845.3	1083.3
Diseases of Heart	304.3	244.3	300.6	244.2	240.8	308.4
Malignant Neoplasms	182.6	173.1	205.6	171.6	193.5	238.8
Cerebrovascular Diseases	86.9	71.3	59.8	54.8	56.2	76.3
Emphysema and Chronic Lower Respiratory Diseases	60.8	50.9	48.1	18.2	43.5	31.2
Accidents	86.9	81.4	57.2	44.7	36.9	36.9

(a) There were 142 total births to Claiborne County residents in 2003, 9 white and 133 non-white. There were no white infant deaths and 3 non-white. Thus, rates are unreliable for the county due to small sample size.
(b) County rates are for the "non-white" population. In the case of Claiborne County, the non-white population is overwhelmingly Black/African-American.
Sources: Kochanek et al. 2004; MDH 2005a, 2005b

catch for later consumption. Blacks were slightly more likely to eat their catch themselves the same day it was caught, give the fish away to relatives, sell or swap fish, or bring the fish to "fish fry" social events, while whites were more likely to freeze their catch for later consumption.

2.11 Related Federal Projects

The staff reviewed the possibility that activities of other Federal agencies might affect the granting of an ESP to SERI. Any such activities could result in cumulative environmental

impacts and the possible need for a Federal agency to become a cooperating agency for preparation of the EIS (10 CFR 51.10(b)(2)).

After reviewing the Federal activities in the vicinity of the Grand Gulf ESP site, the staff determined that there were no Federal project activities that would make it desirable for another Federal agency to become a cooperating agency for preparation of this EIS. Future Federal actions related to this project include permits and licenses that may be required at the time of a CP or COL application. Other Federal actions may be required at the CP or COL stage, such as transmission-related studies by FERC. However, these activities have not been started and will be evaluated at the CP or COL stage. In summary, no other Federal activities or projects are associated with the ESP application.

This review identifies any related Federal activities that may, by granting the ESP, contribute to potential cumulative effects within the site, vicinity, or region. In the case of the proposed Grand Gulf ESP, an additional nuclear facility at the GGNS site would create a situation where the potential for cumulative effects might increase when considering the overlap of the affected regions of the ESP facility, GGNS Unit 1, and River Bend Nuclear Station. As such, the 80-km (50-mi) region around the ESP site would encompass portions of Adams, Amite, Franklin, and Wilkinson counties in Mississippi, and Concordia Parish in Louisiana. These areas would be within the 80-km (50-mi) region of 3 nuclear power stations if a new nuclear facility was constructed at the Grand Gulf ESP site. Similar overlaps of regions exist at the alternative sites considered. No other related Federal activities or cooperating agencies that affect facility siting or water supply have been identified.

2.12 References

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation."

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, "Reactor Site Criteria."

18 CFR Part 35. Code of Federal Regulations, Title 18, *Conservation of Power and Water Resources*, Part 35, "Filing of Rate Schedules and Tariffs," Section 28(f), "Standardization of Generator Interconnection Agreements and Procedures."

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes."

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