CHAPTER 4

ENVIRONMENTAL IMPACTS OF CONSTRUCTION

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CHAPTER 4

ENVIRONMENTAL IMPACTS OF CONSTRUCTION

4.0 ENVIRONMENTAL IMPACTS OF CONSTRUCTION

Chapter 4 presents the potential effects from construction of the new units at the Lee Nuclear Site. In accordance with Title 10 Code of Federal Regulations (CFR) Part 51, effects are analyzed, and a single significance level of potential effect to each resource (i.e., SMALL, MODERATE, or LARGE) is assigned consistent with the criteria that the NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3. Unless the significance level is identified as beneficial, the effect is adverse, or in the case of SMALL, may be negligible. The definitions of significance are as follows:

SMALL Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

MODERATE Environmental effects are sufficient to alter noticeably, but not to destabilize any important attribute of the resource.

LARGE Environmental effects are clearly noticeable and are sufficient to destabilize any important attributes of the resource.

This chapter is divided into six sections:

- Land-Use Impacts (Section 4.1).
- Water-Related Impacts (Section 4.2).
- Ecological Impacts (Section 4.3).
- Socioeconomic Impacts (Section 4.4).
- Radiation Exposure to Construction Workers (Section 4.5).
- Measures and Controls to Limit Adverse Impacts During Construction (Section 4.6).

The following definitions and figures are provided as additional information related to the content of the Chapter 4 sections:

- Lee Nuclear Site region – The area within approximately the 50-mile (mi.) radius around the site (Figure 1.1-1).
- Lee Nuclear Site vicinity – The area within approximately the 6-mi. band around the site boundary (Figure 1.1-2).

- Lee Nuclear Site – The 1900-acre (ac.) area identified by the site boundary (Figure 1.1-3).

4.1 LAND USE IMPACTS

The following subsections describe the effects of site preparation and construction to the Lee Nuclear Site and the surrounding area. Subsection 4.1.1 describes effects to the site and vicinity. Subsection 4.1.2 describes impacts to land use during construction of transmission lines. Subsection 4.1.3 describes effects to historic properties at the site and along transmission corridors.

4.1.1 THE SITE AND VICINITY

The following subsections describe the effects of construction on land use within the site and vicinity.

4.1.1.1 The Site

The Lee Nuclear Station and supporting facilities are located on the 1900-ac. Lee Nuclear Site, as described in Sections 2.1 and 2.2. Plant structures are discussed in Section 3.1. Figure 4.1-1 shows the detailed site plot plan including construction laydown areas.

The total area to be disturbed is provided in Table 4.3-1 and includes permanent structures and construction laydown areas. Construction laydown areas are portions of the site that are temporarily disturbed during construction. Permanent structures are buildings, roads, walls, etc. that are built during the construction period and remain once construction is completed. Construction on the Lee Nuclear Site is scheduled to be completed in 2015. Landscaping for the site is described in Section 3.1.

Land use within the site boundary is detailed in Subsection 2.2.1 and can also be found in Table 2.2-1 and Figure 2.2-1. Most of the construction for the Lee Nuclear Station occurs on 750 ac. of land that has been disturbed by previous construction and site preparation as described in Section 2.2. During construction of the intake and discharge structures, an additional 15 ac. of land disturbance is anticipated to occur. Additional land disturbances are anticipated to occur due to construction of some of the buildings and refurbishment of existing and permanent roadways. Acreage containing permanent structures is reclaimed to grassland, native scrub-shrub, or native forest trees consistent with erosion control, traffic safety, and plant security needs.

The land use needs for construction include transportation, laydown areas, service lines, and debris disposal. Transportation is needed for moving building materials, equipment, and personnel to and from the site. The shipment of construction material to the site is expected to utilize local roadways and railroads. New roadways, either temporary or permanent, are planned for the Lee Nuclear Site. Established roadways provide access to various structures and are adequate for transport of construction materials to and within the site. Reconstruction of the Lee Nuclear Station railroad spur in support of material deliveries and new facility construction activities is expected. Additional information about railroads in the vicinity of the Lee Nuclear Station is located in Subsections 2.5.2.2.5 and 4.4.1.3. A heavy haul road from the end of the railroad spur to the construction areas is planned. Construction of this road is confined to the previously disturbed areas. These roads are illustrated in Figures 3.1-1 and 4.1-1. The laydown areas for staging building materials and equipment used for construction can be seen in Figures 3.1-1 and 4.1-1.

Service lines provide electrical power to the site for construction. Excess dirt and dredgings are disposed in the designated spoils area. All construction waste is anticipated to be disposed off-site. Construction debris and other waste is removed from the site via roads or rail. Construction activities on the site are not expected to include the construction of bridges or any type of water transportation.

Site construction activities that are expected to be located in a floodplain or in wetland habitats are discussed in Subsection 4.2.2 and Section 4.3.

There are no mineral resources, including oil and natural gas, within or adjacent to the site that are being exploited or that are of any known value (Reference 1).

National Wild and Scenic Rivers, recreational opportunities, and zoning laws and ordinances detailed in Subsection 2.2.1 are anticipated to be unaffected by construction. There are no National Wild and Scenic Rivers, recreational opportunities, or zoning laws ordinances otherwise affecting the site. Therefore, no adverse impacts are anticipated. There are no identified tribal lands on the Lee Nuclear Site as stated in Subsections 2.5.3.2 and 2.5.3.7. Appropriate tribal historic preservation offices have been contacted. No concerns have been raised by consulted tribal agencies as to construction of the Lee Nuclear Station. As a result, no adverse effects to tribal lands are anticipated.

The location and description of prime farmland is discussed in Subsection 2.2.1 and illustrated in Figure 2.2-1. There are 2 ac. of land in the southeast corner of the site considered prime farmland that has not previously been disturbed. Although areas of farmland of statewide importance have been identified in the area of proposed construction, many of these have already been excavated or have been previously disturbed.

Related federal activities are discussed in Section 2.8. No other federal projects are related to this COL application; therefore, there are no cumulative adverse effects anticipated. The proposed V.C. Summer Units are over 50 miles downstream and outside the region for Lee Nuclear Station.

Because most of the construction does not disturb any previously undisturbed land and that the location of the 2 ac. of prime farmland are located away from heavily disturbed areas, the impact on the site land use is expected to be SMALL and therefore does not require mitigation.

4.1.1.2 The Vicinity

Land use in the vicinity of the Lee Nuclear Site is described in detail in Subsection 2.2.1.2 and is shown in Table 2.2-1 and Figure 2.2-2. Adverse effects to land use in the vicinity of the site are confined to reactivation of the rail spur, impacts to the roads during construction, and impacts connected with construction of electric transmission lines. Impacts associated with the reactivation of the rail spur and construction of transmission lines are discussed in Subsections 4.1.3.2.2 and 4.1.2, respectively.

Figure 2.5-4 illustrates the road and highway system in Cherokee and York counties. Additional information on the road and highway system in Cherokee and York counties can be found in Subsection 2.5.2. Information pertaining to the effects of construction and operational workers on the local road and highway system is presented in Subsections 4.4.1.3 and 5.8.1.3.

Because minimal changes to the existing railway system are planned, no adverse effects to existing railway service in the vicinity from the construction activities at the Lee Nuclear Site are expected. New rail service is needed along the Lee Nuclear Station railroad spur to support material deliveries and new facility construction activities. Additional information about railroads in the vicinity of the Lee Nuclear Station can be found in Subsection 2.5.2.2.5.

Nine pipelines are located within the vicinity; four contain natural gas, four contain liquid petroleum, and one contains fiber optics. Because the nearest pipelines are located 3 – 4 mi. from the site, no adverse impacts from construction are expected to affect pipelines located within the vicinity of the Lee Nuclear Site. These pipelines are described in Subsection 2.2.1.2.

Within the vicinity, the portion of the Broad River south of the Ninety-Nine Islands Dam to the confluence with the Pacolet River is classified as a State Scenic River. However, it is not classified as a National Wild and Scenic River by the federal government (References 2 and 3). Additional information about the Broad River Scenic Corridor can be found in Subsections 2.2.1.1 and 2.5.2.2.6. Because the Broad River or any other rivers in the vicinity are not classified as National Wild or Scenic Rivers, no adverse impacts to National Wild or Scenic Rivers are anticipated.

No tribal lands are located within the vicinity of the Lee Nuclear Station as detailed in Subsections 2.5.3.2 and 2.5.3.7. Related federal activities are discussed in Section 2.8. No other federal projects are related to this COL application within the vicinity, no adverse cumulative effects are anticipated.

Construction activities that are expected to occur in a floodplain or on wetlands are discussed in Subsections 4.2.2 and 4.3.1.

The only construction effects to land use in the vicinity of the Lee Nuclear Site are expected from the new transmission line corridors and the reclaimed railroad spur. No additional land is expected to be required for the Lee Nuclear Station. Transmission line corridors are discussed in Subsection 4.1.2. The railroad spur is designated as an abandoned railroad; however, its status change to an active railroad spur is not a significant land-use change (Reference 4). No other land-use changes in the vicinity are expected. While the impacts of construction of the transmission line corridors is not known at this time, the overall effect of construction on land use in the vicinity of the site is expected to be SMALL based on minimal impacts to local transportation systems, pipelines, National Wild and Scenic Rivers, and other federal projects.

4.1.2 TRANSMISSION CORRIDORS AND OFF-SITE AREAS

Two transmission line rights-of-way are associated with the plant. Each right-of-way is expected to hold a 230 kV line and a 525 kV line. The new lines are referred to as the Lee Nuclear 230 kV Transmission Line and the Lee Nuclear 525 kV Transmission Line. Duke Energy has identified a number of alternative routes for these transmission lines. Though finalized routes have not been chosen at this time, alternate routes and impacts associated with these routes are discussed in Subsection 9.4.3. Table 9.4-6 shows siting criteria for the 21 identified alternate routes. The twelve criteria used for selection ranking include indicators such as proximity to historical and cultural resources, proximity to occupied housing units, and current and future land use. Beyond the point where the new Lee Transmission Lines connect, modification of the existing transmission lines to carry the additional power load from the plant is expected. Additional information about transmission corridors can be found in Subsection 9.4.3.

The plant connects to the transmission system through a 230 kV switchyard and a 525 kV switchyard located on the Lee Nuclear Site. Corridors for the new transmission lines radiate from the switchyards and extend for approximately 7.5 mi.south of the site where the 230 kV lines fold into the existing Roddey (also known as Catawba-Pacolet) 230 kV Transmission Line. The corridors extend another 7 mi. south where the 525 kV lines fold into the existing Asbury (also known as Oconee-Newport) 525 kV Transmission Line.

It is not known at this time the exact pathway the proposed transmission lines are expected to traverse. As discussed in Subsection 9.4.3, Duke Energy has projected 21 alternative corridors. Land use in these corridors is dominated by agricultural use (see Table 9.4-6). Forested land is normally cleared for the transmission lines. Anywhere from 6 ac. to 42 ac. of forest could be impacted by the construction of transmission lines. For the remaining 360 to 560 ac. of agricultural land under these transmission lines, land use impacts are confined to the immediate area around the transmission towers. Duke Energy does not restrict the use of the land under the transmission lines except for the construction of permanent structures or planting vegetation that might interfere with the transmission line. This does not affect most crop or pasture agricultural land under the transmission lines.

Duke Energy will comply with all applicable laws, regulations (including regulatory requirements of the DHEC, State Historic Preservation Office [SHPO], etc.), permit requirements, and good engineering and construction practices during construction of the transmission corridors.

Because less than 11 percent (6 – 42 ac.) of the land in the transmission right-of-ways is forested, effects to off-site land use from the construction of new transmission corridors is expected to be SMALL, but they could be mitigated by locating the new transmission corridors to avoid sensitive land uses.

4.1.3 HISTORIC PROPERTIES

This subsection of the ER focuses on the effects of Lee Nuclear Station construction on existing historic properties on the Lee Nuclear Site and within 10 mi. of its boundaries. According to 36 CFR 800 (l)(1) (Reference 5), historic properties are defined as those properties that are eligible for inclusion in the National Register of Historic Places (NRHP) or that are already listed on the NRHP. Aboveground historic properties and archaeological sites are among the entities that can be considered for NRHP inclusion. According to 36 CFR 60.4 (Reference 6), aboveground historic properties can possess integrity individually or as contributing properties to historic districts. Furthermore, their significance depends on specific criteria of event, person, design/construction, or information potential, and integrity involves both architectural and aesthetic elements, including location, design, setting, materials, workmanship, feeling, and association. Archaeological sites are generally classified as prehistoric or Historic Period sites, and integrity depends on the existence of intact and patterned surface or subsurface cultural deposits with an emphasis on the site's ability to address scientific research questions. In general, effects from construction on aboveground historic properties include direct damage to the physical integrity of the property, which detracts from its design, materials, or workmanship, or indirect (noise-related or aesthetic/visual) effects to the property or its surroundings, which detracts from its historic setting, feeling, or association. Archaeological sites can be affected directly by physical damage to surface features or subsurface deposits. Such damage disrupts the patterning of the previously intact cultural deposits. Generally, noise-related effects are extraneous to archaeological sites because the integrity of site patterning is unaffected; likewise, aesthetic/visual effects on archaeological sites are extraneous because archaeological site integrity depends on the ability to address research questions that are independent of the preservation of site ambiance.

Because the federal Section 106 process (36 CFR 800) has been initiated for the construction and operation phases at the Lee Nuclear Site and because that process involves the oversight of the South Carolina Department of Archives and History, SHPO, which also oversees state laws on historic preservation, concerns relating to South Carolina state laws and plans for historic preservation are also addressed (see Subsection 2.5.3.2 for further discussion of the Section 106 process). Therefore, no separate consideration of effects or mitigation pursuant to South Carolina state law, beyond the Section 106 consultation, is warranted.

The number, location, and NRHP status of relevant historic properties at the Lee Nuclear Site and in the surrounding area are addressed in Subsection 2.5.3.3 through 2.5.3.5. Additional information is provided in Tables 2.5-20 through 2.5-22.

4.1.3.1 Site and Vicinity

Direct effects on existing historic properties from construction of the Lee Nuclear Station are possible only within the on-site and off-site areas of potential effect (APE) for the Lee Nuclear Site, which are described in Subsections 2.5.3.1 and 2.5.3.8. Indirect (noise-related and aesthetic/visual) effects from station construction are possible on the site and within 10 mi. of its boundaries. The 10-mi. buffer was established by identifying the two points of maximum site boundary extent on the east and west ends of the site, drawing a circle that intercepted both points, and extending 10-mi. spokes from the circle rim to establish a much larger circle. Known archaeological and historic sites within the larger circle were identified, as were the sites within the smaller circle and the Lee Nuclear Site boundary.

This 10-mi. buffer extends through portions of Cherokee and York counties in South Carolina, and it also includes a small area just across the border into North Carolina. However, because of the local vegetation cover and topographic relief, noise-related and aesthetic/visual effects from on-site construction on aboveground historic properties are confined to the site and the area within a 1-mi. radius of the footprint of the cooling towers.

Two portions of the on-site APE at the Lee Nuclear Site have not been surveyed for historic properties. These are the cooling water discharge piping and the alternative road right-of-way to the station overlook on McKowns Mountain. Duke Energy has plans to conduct a Phase I intensive survey of these two on-site areas to identify historic properties once the location of these ROWs have been finalized. Phase I surveys are also planned for the two selected transmission line corridors and the Duke Energy railroad spur discussed in Subsections 4.1.3.2.1 and 4.1.3.2.2 once Duke Energy has permission to enter the property.

Several Phase I surveys have been conducted on the Lee Nuclear Site (Subsection 2.5.3.1). The first survey was conducted in 1974 as part of the environmental evaluation for the Cherokee Nuclear Station. This survey included the 750-ac. portion of the current on-site APE that was disturbed by previous construction. In 1981, a small portion of the site was surveyed as part of the historic properties evaluation for the transmission corridors associated with the Cherokee Nuclear Station. The most recent Phase I surveys of the Lee Nuclear Site began in 2007. They were focused on the APE for the cooling water intake structure, existing road to the overlook, and proposed meteorological tower. Because of the extensive, deep, and destructive soil disturbance associated with the previous on-site construction, the SHPO agreed to limit the scope of the

2007 on-site survey to areas which had not been previously surveyed. The 2007 surveys also included an architectural inventory of the area within a 1-mile radius of the proposed footprints for the cooling tower pads and meteorological tower.

Subsections 4.1.3.1.1 through 4.1.3.1.5 contain assessments of the potential effects of Lee Nuclear Station construction on historic properties. Assessments of construction effects on historic properties outside of the site boundary are based on information from the 2007 architectural inventory and archived records at the South Carolina Department of Archives and History and the South Carolina Institute of Archaeology and Anthropology.

4.1.3.1.1 Prehistoric Archaeological Sites

In the 1974 survey, three prehistoric archaeological sites (38CK10, 38CK11, 38CK13) and one prehistoric component of a multicomponent site (38CK12) were identified within the current on-site APE at the Lee Nuclear Site (see Subsection 2.5.3.3). As a result of the 1974 survey, none of these were listed or deemed eligible for listing on the NRHP, and all were heavily disturbed or destroyed by previous construction. Sites determined to be ineligible for the NRHP do not require protection. As a result of the 2007 survey, it was determined that no other prehistoric archaeological sites are present within the on-site APE; therefore, construction of the Lee Nuclear Station has no effects on such sites.

Three other prehistoric archaeological sites (38CK8, 38CK9, 38CK14) and one prehistoric component (38CK15) lie within the boundaries of the Lee Nuclear Site but outside of the on-site APE. As noted in Subsection 2.5.3.3, the NRHP eligibility of these sites is now considered to be unassessed. Because of their buried locations outside the APE, vegetation clearing, excavation, grading, and other construction activities have no direct or indirect effects on them.

Numerous prehistoric sites and components are located outside of the Lee Nuclear Site boundaries at a distance of 0.3 to 10 mi. Soil-disturbing construction activities within the on-site APE at the Lee Nuclear Site have no direct effects on such distant sites. No indirect effects on these sites occur because noise-related and aesthetic/visual effects are extraneous considerations for buried prehistoric sites.

The effects of station construction on prehistoric archaeological sites on the Lee Nuclear Site, in its vicinity, and within 10 mi. of its boundaries are SMALL. No mitigation is warranted.

4.1.3.1.2 Historic Period Archaeological Sites

In 1974, two Historic Period archaeological sites (38CK17 and 38CK18) and one Historic Period archaeological component of a multicomponent site (38CK12) were identified within the current on-site APE at the Lee Nuclear Site (see Subsection 2.5.3.3). None of these were listed or deemed eligible for listing on the NRHP, and all were heavily disturbed or destroyed by previous construction. Sites determined to be ineligible for the NRHP do not require protection. No other Historic Period archaeological sites are present within the on-site APE; therefore, construction of the Lee Nuclear Station has no effects on such sites.

Four additional Historic Period archaeological sites and components (38CK14, 38CK15, 38CK16, 38CK19) are located within the boundaries of the Lee Nuclear Site but outside of the APE. As noted in Subsection 2.5.3.4, the NRHP eligibility of 38CK14, 38CK15, and 38CK16 is now considered to be unassessed and is designated as such in the 2007 survey. However, because of their buried locations outside of the APE, vegetation clearing, excavation, grading, and other construction activities have no direct or indirect effects on these four sites.

A number of Historic Period archaeological sites and components are located outside of the Lee Nuclear Site boundaries at a distance of 0.5 to 10 mi. Soil-disturbing construction activities within the on-site APE at the Lee Nuclear Site have no direct effects on such distant sites. No indirect effects on these sites occur because noise-related and aesthetic/visual effects are extraneous considerations for buried Historic Period archaeological sites.

The effects of station construction on Historic Period archaeological sites on the Lee Nuclear Site, in its vicinity, and within 10 mi. of its boundaries are SMALL. No mitigation is warranted.

4.1.3.1.3 Historic Sites

No aboveground historic sites are present within the on-site APE or at any other location within the boundaries of the Lee Nuclear Site. Therefore, construction of the Lee Nuclear Station has no effects on aboveground historic sites within the site boundaries.

Ninety-Nine Islands Dam and its associated hydroelectric plant are the two closest aboveground historic sites outside the boundaries of the Lee Nuclear Site. The dam sits adjacent to the east boundary of the Lee Nuclear Site, and its hydroelectric plant is on the east bank of the Broad River approximately 650 ft. northeast of the site. The SHPO has designated both as eligible for listing on the NRHP. The remaining 53 NRHP-eligible sites within 10 mi. of the Lee Nuclear Site are located 2 mi. or more from the site boundaries, and the nearest listed site (Limestone Springs Historic District) is 6 mi. to the northwest in Gaffney, South Carolina (see Subsection 2.5.3.5).

Most of the construction activities within the on-site APE at the Lee Nuclear Site do not extend to the Ninety-Nine Islands Dam and its hydroelectric plant. However, construction of the planned cooling water discharge structure adjacent to the dam has the potential to affect these two historic properties. Duke Energy plans further consultations with the SHPO in regard to construction of the discharge structure and the nature of its effects on these two NRHP-eligible sites. Any identified mitigation measures will be reviewed and approved by the SHPO.

Unlike the case with archaeological sites, indirect (noise-related or aesthetic/visual) effects are an intrinsic consideration in regard to the potential adverse effects of construction on aboveground historic properties outside the boundaries of the Lee Nuclear Site. The 2007 Phase I survey determined that the noise-related and aesthetic/visual APE for aboveground historic sites and architectural resources is the area within a 1-mi. radius of the footprints of the two proposed cooling towers and MET Tower 3 on the Lee Nuclear Site (see Subsection 2.5.3.1). Ninety-Nine Islands Dam and its hydroelectric plant are within the cooling tower radius. However, no noise-related or aesthetic/visual effects from cooling tower construction are anticipated because these factors do not have the ability to alter the design, workmanship, and materials of the dam and plant, which are the crucial elements of their historical integrity. No other aboveground historic sites are present within a 1-mi. radius of the APE. Because of the local vegetation, the topography, and considerable distance from the Lee Nuclear Site, the other eligible and listed historic sites beyond the 1-mi. radius are not affected by noise or aesthetic/visual factors.

The effects of station construction on aboveground historic sites within the Lee Nuclear Site, in its vicinity, and within 10 mi. of its boundaries are SMALL. No mitigation is warranted.

4.1.3.1.4 Historic Cemeteries

None of the cemeteries lie within the on-site APE, none are directly affected by construction on the Lee Nuclear Site. The numerous municipal, church, and small family cemeteries located outside of the site but within 10 mi. of its boundaries are also not directly affected by on-site construction. Indirect effects related to construction noise or visual aesthetics are not anticipated for the four on-site cemeteries or off-site cemeteries because such factors are not sufficient to physically disturb burials or prevent visitor access.

The effects of station construction on historic cemeteries within the Lee Nuclear Site, in its vicinity, and within 10 mi. of its boundaries are SMALL. No mitigation is warranted.

4.1.3.1.5 Traditional Cultural Properties

No traditional cultural properties are located on the Lee Nuclear Site, in its vicinity, or within 10 mi. of its boundaries (see Subsection 2.5.3.7). Therefore, construction on the Lee Nuclear Station has no effects on traditional cultural properties in these areas.

The effects of station construction on traditional cultural properties within the Lee Nuclear Site, in its vicinity, and within 10 mi. of its boundaries are SMALL. No mitigation is warranted.

4.1.3.2 Transmission Corridors and Off-Site Areas

Construction of the Lee Nuclear Station includes the construction of two transmission lines and construction of a railroad spur from East Gaffney to the Lee Nuclear Site. This subsection addresses the effects of construction on historic properties within the transmission corridors and railroad spur right-of way (ROW).

4.1.3.2.1 Transmission Corridors

Duke Energy has plans to avoid already identified archaeological sites and historic sites, particularly those eligible for listing or already listed on the NRHP, during its selection of two transmission line corridors for the Lee Nuclear Station (see Subsection 2.5.3.8.1). A Phase I intensive survey is planned to identify historic properties that might be present within each corridor. Any identified mitigation measures are reviewed and approved by the SHPO.

4.1.3.2.2 Railroad Spur

During construction of the original railroad spur from East Gaffney to the Cherokee site, soil was disturbed within the rail bed and along both sides throughout the full distance of the established right-of-way (ROW). Any portions of the Ellen Furnace Site (38CK68), as discussed in Subsection 2.5.3, within this narrow (100 ft.) ROW were heavily disturbed or destroyed. For the most part, soil-intrusive activities associated with construction of the new railroad spur are confined to these already disturbed areas.

The only exception to this is the approximately 1300 ft. of new rail bed and track required to detour the railroad spur at the location of Reddy Ice, an ice manufacturing and distribution plant on the west end of the railroad bed (see Subsection 2.5.3.8.2). The current railroad route crosses the driveway to the ice plant. As part of the right-of-way agreement, Duke Energy and the owner have agreed to detour the route to a new path just north of the main ice plant buildings.

Duke Energy plans to conduct a Phase I intensive survey to better assess previous construction effects on historic properties in the ROW and to identify any additional historic properties that might be present. When the results of the survey are available, the effects of the railroad construction on historic properties can be assessed. Any identified mitigation measures are reviewed and approved by the SHPO.

4.1.3.3 Inadvertent Discoveries During Construction

If artifacts, features, or human remains are encountered inadvertently during construction of the Lee Nuclear Station, an event considered unlikely, Duke Energy plans to stop work immediately in the area of the discovery and contact the SHPO.

Human remains and artifacts subject to the Native American Graves Protection and Repatriation Act are managed in compliance with its provisions and the regulations in 43 CFR 10 (Reference 7).

4.1.4 REFERENCES

1. U.S. Geological Survey, Active Mines and Mineral Processing Plants in the United States 2003, Website, http://tin.er.usgs.gov/mineplant/, accessed August 11, 2006.

2. Broad Scenic River Advisory Council, Broad Scenic River Management Plan: 2003 Update, Report 32, 2003.

3. National Wild and Scenic Rivers System, Wild and Scenic Rivers by State, Website, http://www.nps.gov/rivers/wildriverslist.html, accessed August 11, 2006.

4. U.S. Department of Transportation, National Transportation Atlas Databases (NTAD) 2006 Shapefile Format, CD-ROM, 2006.

5. 36 CFR 800, "Protection of Historic Properties."

6. 36 CFR 60, "National Register of Historic Places."

7. Native American Graves Protection and Repatriation Act, 25 USC 3001 et seq.

4.2 WATER-RELATED IMPACTS

This section describes Lee Nuclear Site preparation activities, plant water supply, hydrological alterations that could result from plant construction activities, and the physical effects of hydrological alterations on other water users. Subsection 4.2.1 describes recent and ongoing demolition activities of the Cherokee plant. Subsection 4.2.2 addresses hydrologic alterations and Subsections 4.2.3 and 4.2.4 address water-related use and water quality impacts of plant construction activities.

Impacts to surface water bodies caused by nuclear power plant construction will be mitigated by implementation of a South Carolina Department of Health and Environmental Control (SCDHEC) construction stormwater pollution prevention plan (SWPPP) and compliance with required SCDHEC and U.S. Army Corps of Engineers regulatory permits and applicable conditions specified in these permits. Construction related impacts to wetland areas and groundwater resources are expected to be SMALL because this site requires few changes to the aquatic habitats to accommodate the construction of a new plant. Much of the potential water related modifications of this site were made during original construction of the Cherokee plant. Land clearing and construction of three dams, which will all be utilized for the new Lee Station, was performed during the construction of the Cherokee project.

Water bodies adjacent to the plant construction site that could be affected by construction activities include the Broad River (specifically, the Ninety-Nine Islands Reservoir above the Ninety-Nine Islands hydroelectric dam) and on-site impoundments. The on-site impoundments include the Make-Up Pond B, Make-Up Pond A, and the Hold-Up Pond A. These features represent the majority of the surface water in the vicinity of the site (Figure 2.3-5). Subsection 2.3.1.3 provides additional information regarding these surface water bodies.

Duke Energy has selected the Westinghouse AP1000 certified plant design for the Lee Nuclear Station. The proposed AP1000 units, referred to as Units 1 and 2, are rated at 3400 megawatts thermal (MWt), with a net electrical output of at least 1000 megawatts electrical (MWe) (Reference 2). The units use mechanical-draft cooling towers for circulating water system and service water system cooling, with makeup water coming from the Broad River and potentially from the Make-Up Pond B during low-flow conditions. The Units 1 and 2 elevations are currently set at 590 feet (ft.) above mean sea level (msl). An extensive site stormwater system is expected to be installed as part of the construction of Units 1 and 2.

The proposed plant construction is within the existing contiguous area of land that was cleared and excavated for previous construction activities. The topography in the main plant construction area ranges from a low elevation of approximately 512 ft. above msl along the riverbank to a high elevation of about 660 ft. above msl northwest of the existing excavation. The elevation of McKowns Mountain is 810 ft. above msl, the highest point on the Lee Nuclear Site.

The site is currently graded such that storm water runs west to the Make-Up Pond B and east to the Make-Up Pond A. These two water-bodies remove any eroded sediment from storm water. The current storm water grading will be improved as part of the construction of Units 1 and 2.

4.2.1 DEMOLITION ACTIVITIES PRIOR TO CONSTRUCTION

Under a U.S. Nuclear Regulatory Commission (NRC) construction permit, approximately 750 acres (ac.) of ground was disturbed during the 1977–1982 construction of Duke Power Company's Cherokee Nuclear Station. Approximately 25 ac. was excavated into underlying bedrock for construction of the reactor units.

The partially built reactor containment building was demolished in 2007 prior to new construction. No demolition was conducted within any waters of the United States. Other structures, including several site buildings, were also demolished. Demolition included removal of the buried condenser cooling water pipe for Cherokee Unit 1. Remaining buried utilities removal is expected to occur during construction of the Lee Station. Demolition was performed in accordance with SCDHEC environmental regulations, including surveys for and removal of legacy wastes and asbestos, and development of erosion control measures and an SWPPP for land-disturbing activities. Scrap steel removed as part of the demolition was sold to a commercial recycling firm. Waste concrete from demolition is used on-site for riprap or non-safety-related engineered fill. Two construction warehouses were refurbished for use during construction and operations.

The dewatering associated with the removal of the Cherokee Unit 1 power block structures have had a minor impact on groundwater in the immediate vicinity of the excavation. Once the dewatering drawdown was achieved, maintenance dewatering flow was the result of rainwater collecting in the excavation. Low groundwater inflows were anticipated based on the low permeability of the soils in the overburden.

4.2.2 HYDROLOGIC ALTERATIONS

This subsection identifies proposed construction activities that could result in hydrologic alterations at the Lee Nuclear Site.

The construction site layout is provided in Figure 4.1-1. Significant rough grading is not required during construction of the Lee Nuclear Station. The Lee Nuclear Station is expected to be constructed at the existing grade. A minor amount of finish grading will be performed during construction to enhance stormwater movement away from safety-related structures.

Dewatering of the excavation during construction and the resultant cone of depression due to pumping are expected to temporarily affect groundwater flow in the vicinity of the excavation.

Construction of the power station area involves removal of bedrock below the Lee Nuclear Station Unit 2 footprint and backfilling the excavated area between Units 1 and 2. Removal of surface material south of the previous switchyard is required to create a larger switchyard footprint for the 230 kilovolt (kV) and 525 kV equipment. Construction of the power station area requires excavations for various service utilities. Most of the land disturbing activities do not occur near water bodies, and so the impact to surface waters is projected to be SMALL. Where land-disturbing activities occur near water bodies there is a potential for erosion to impact the water body. In those instances erosion control measures, described in Subsection 4.2.4.4, are implemented to mitigate any erosion impacts.

The Lee Nuclear Site is not located in the 100-year floodplain or the 500-year floodplain for the Broad River. The safety-related facilities, systems, and equipment are expected to be housed in structures that provide protection from potential flooding.

Wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. At the Lee Nuclear Site, wetlands occupy a total of 46.4 ac., or 2.4 percent of the site. They are currently represented by alluvial wetland, non-alluvial wetland, and non-jurisdictional wetland that total 3.2 ac. (0.2 percent), 10.8 ac. (0.6 percent), and 32.4 ac. (1.7 percent) of the total site area, respectively. A detailed discussion of wetlands is provided in Subsection 2.4.1.1.1. The Lee Nuclear Station will not require any construction within jurisdictional wetlands.

4.2.2.1 Intake Construction

Water intakes are expected to be constructed at the Broad River, Make-Up Pond A, and Make-Up Pond B. Cofferdams are expected to be built to isolate the intake construction areas from the river and ponds, allowing water to be removed for excavation work. Dry access would be created to construct the intake structures. Partially weathered rock, soil, and sediment would be removed, classified, and delivered to an on-site stockpile or spoils area on the south side of the site toward McKowns Mountain Road. Rock may be delivered to a crusher for use in on-site non-engineered fill operations. Unsuitable fill materials would be segregated from general fill materials within this on-site stockpile.

The raw water river intake structure is expected to be built on the north end of the site along the Broad River, as illustrated in Figure 3.1-1 and Figure 3.4-1. The Broad River is expected to be dredged in areas affected by construction of the intake structure. The cofferdam at the Broad River raw water intake would be constructed using two banks of Z-shaped sheet piles with gravel ballast in-fill approximately 220 ft. long and extending approximately 75 ft. into the river. Approximately 47,000 cubic yards (cu. yd.) of soil and partially weathered rock are expected to be removed. Duration of the river intake construction would be about 16 months. It would take about 4 months to complete the cofferdam. Construction of the cofferdam would be scheduled to avoid the spawning seasons as much as possible (Subsection 4.3.2.1). While in place, the cofferdam would constrict flow through the Broad River by reducing the width of the river from approximately 240 ft. to 165 ft. Reducing the width of the river by approximately one-third would result in increasing the velocity of the river, increasing the energy for bottom scour and bank erosion. Following construction, the cofferdam would be removed behind a weighted silt curtain to protect the river from excess silt load during removal. The removal of the cofferdam would take approximately 2 months. Flow velocities are expected to return to preconstruction conditions, and the resulting decrease in energy is expected to allow the river bottom and bank to return to preconstruction conditions. The potential adverse impact on aquatic biota is SMALL as a result of avoiding the spawning season during construction of the raw water intake structure.

At Make-Up Pond A, the existing intake structure and remains of the existing water treatment plant would be removed. Approximately 40,000 cu. yd. of materials would also be removed. At Make-Up Pond B, the existing nuclear service water intake inlet box and a portion of the existing steel intake pipes would be removed and disposed of off-site. Approximately 72,000 cu. yd. of material, mostly partially weathered rock, would be removed for construction of this intake structure. Cofferdams would be placed within both Make-Up Ponds A and B to allow localized dewatering during construction of the intakes.

There is a potential for short-term impacts to local water quality during construction of each intake structure, and in the unlikely event that the Broad River cofferdam wall is overtopped by extreme flood waters or sedimentation controls are temporarily disabled. Construction activities would be conducted in compliance with U.S. Army Corps of Engineers (USACE) Section 404 permit requirements. Impacts to hydrology and aquatic ecology in the make-up ponds are expected to be SMALL.

4.2.2.2 Discharge Construction

A 3-ft. diameter high-density poly-ethylene (HDPE) line is expected to contain the nonradioactive and radioactive wastewater lines, as well as the cooling tower blowdown return flows to the Broad River. Construction and placement (as illustrated in Figure 4.1-1) of this HDPE line from the waste treatment systems to the Ninety-Nine Islands Hydroelectric Station dam involves removal of groundcover and excavation of a trench to contain the line.

To mitigate impacts to the local water quality environment, SCDHEC-required erosion controls, described in Subsection 4.2.4.4, are to be employed. This HDPE line is then routed along the upstream side of the Ninety-Nine Islands Hydroelectric Station dam to the logsluice adjacent to the hydroelectric station intakes. The line is submerged 6 ft. below the minimum pool water level and the discharge pipe will be attached to the dam with steel braces. Installation of the discharge line is accomplished using divers. Within Make-Up Pond A, a cofferdam is planned for use during construction of the discharge structure, and it is expected to be similar to those used in construction of the intake structures. Construction activities would be conducted in compliance with U.S. Army Corps of Engineers (USACE) Section 404 permit requirements. Impacts to hydrology and aquatic ecology during construction of discharge structures are expected to be SMALL.

4.2.2.3 Dredging of Existing Ponds

The central portion of Make-Up Pond A may be dredged to improve flow conditions surrounding the intake. If needed, dredging would be performed using barge-mounted equipment. This increased depth would ensure that this basin functions as intended during operations. Dredging is not expected to impact the small wetland area at the south end of Make-Up Pond A because of the distance between these areas and the limited circulation within the pond.

The existing cofferdam in the forebay of Make-Up Pond B would be breeched locally for a distance of approximately 100 ft. to ensure communication between the two bathymetric divisions during operations. Additional dredging, if needed, would be performed on both sides of the existing cofferdam to assure good communication of low-level waters.

Construction activities would be conducted in compliance with USACE Section 404 permit conditions, and erosion and sedimentation control measures. Based on performance of actions according to the USACE Section 404 Permit, the potential impacts to hydrology are expected to be SMALL.

4.2.2.4 Construction of Rail Line

As discussed in Subsection 2.2.2, Duke Energy plans to reactivate the previously constructed rail line. See Figure 4.1-1. This reactivation involves installation of new ballast and track. Because the rail line will not require ground disturbing activity associated with installation of the new ballast, ties and track, any impact to the site surface and groundwater hydrology is expected to be SMALL.

4.2.2.5 Transmission Line Construction

Duke Energy has not selected the transmission line routes but has presented several alternative routes (Section 9.4). The siting alternatives analysis for these transmission lines included criteria to minimize construction in, or proximate to, streams or wetland locations. Structure strips for transmission towers were sited such that streams and wetlands are spanned by the conductors. Spanning wetlands minimizes construction activities involving both wheeled and tracked equipment, to minimize potential impact to the wetlands. While large trees will be removed from the ROW; grasses, agricultural crops, and low shrubs will remain after construction and temporary and permanent vegetation will be put in place as erosion controls during construction. All ROW clearing and construction of the transmission towers will be performed in accordance with SCDHEC erosion control requirements and reflected in an SCDHEC approved erosion control measures and SWPPP, as required by the National Pollutant Discharge Elimination System (NPDES) stormwater permit. This approach utilizes the practices described in Subsection 4.2.4.4 to mitigate impacts to hydrology and water quality. Impacts to hydrology and water quality from construction of transmission lines are expected to be SMALL based on the wetland areas disturbed. Generally, along the transmission line, the major permanent conversion is from forested wetlands to unforested open type wetlands.

4.2.2.6 Potentially Affected Federal Projects

The Lee Nuclear Site is situated adjacent to the Broad River. The Lee Nuclear Station construction has no effect on Federal projects except the Ninety-Nine Islands Hydroelectric Project. Construction of the Lee Station will require a minor modification to the existing Ninety-Nine Islands Dam face and the abutment to accommodate the wastewater and cooling tower blowdown discharge to be located immediately upstream of the hydroelectric turbine intakes. By locating the Lee Station discharge in this location on the hydroelectric project, the maximum degree of hydraulic mixing is ensured to be provided even in low flow river events.

4.2.2.7 Effects of Alterations on Water Users

No adverse effects to any water resources used by municipalities, residents, or industrial facilities in the vicinity of the Lee Nuclear Site are expected during construction.

The effects of the construction activities at the Lee Nuclear Site are anticipated to have negligible, if any, impact on current water uses. This is because downstream water use is limited to hydroelectric power generation and a limited number of municipal potable water withdrawals well downstream of Ninety-Nine Islands. Surface-water use rights concerning the Broad River involve non-impairment of designated uses. No impairments from construction are anticipated. In addition, constructing intake structures for withdrawing water from the Broad River, as well as other activities during construction will require a USACE Section 404 permit and conditions that will mitigate against potential impacts.

Potable water for use during construction, including temporary fire protection, concrete batching, and other construction uses, is supplied by the Draytonville Water District.

Because groundwater at the site will not be used during construction, no effects of construction on groundwater uses are expected. Because offsite wells are approximately 1 mile (mi.) from the site, dewatering during construction is not projected to affect local wells.

Potable water is supplied by the Draytonville Water District. Water for temporary fire protection, concrete batching, and other construction uses would be derived from the potable water supply.

4.2.2.8 Effects of Alterations on Terrestrial or Aquatic Ecosystems

The greatest potential impacts to terrestrial or aquatic ecosystems during construction are expected to be from runoff that may contain higher than normal concentrations of silt and clay. Construction area runoff is directed to settling ponds prior to discharge to minimize this threat. NPDES limitations for the discharge of stormwater will be met during construction activities mitigating any erosion impacts on aquatic ecosystems. Section 4.3 describes the effects of alterations on terrestrial or aquatic ecosystems. The jurisdictional (alluvial and non-alluvial) wetland areas (illustrated in Figure 4.3-1) are not affected by the resultant drawdown of dewatering because of the distance from the dewatering activities and the proximity of on-site impoundments.

4.2.2.9 Construction Stormwater Control and Other Minimizing Actions

The SCDHEC Bureau of Water Division requires construction activities that discharge into waters of the United States to obtain an individual NPDES permit or secure coverage under the general NPDES permit. An NPDES permit must be in place prior to conducting any activities for which an application for a stormwater discharge permit is required. If the planned construction is expected to disturb more than 5 ac. of land, the facility must: (1) obtain individual NPDES permit or general NPDES permit coverage, (2) implement best management practices including structural (i.e., erosion control devices and retention ponds) and operational measures to prevent the movement of pollutants (including sediments) off-site via stormwater runoff, and (3) develop a SWPPP.

The Lee Nuclear Site construction project will prepare and maintain a SWPPP in compliance with the NPDES permit that addresses:

- Spill management and control for operations.
- Storage and management of chemicals.
- Oil storage and management.

Construction impacts on existing surface and ground water hydrology will be eliminated or reduced and effectively managed by development and implementation of a site-specific construction SWPPP and planning construction activities and laydown to avoid proximity to wetlands and surface water bodies. The construction SWPPP will address employee training and installation of soil erosion measures such as:

- Silt fences
- Sediment tubes

- Slope breakers
- Other sedimentation and soil erosion-prevention measures.

The SWPPP also will contain:

- Preventive maintenance procedures for construction equipment to prevent leaks and spills.
- Procedures for storage of chemicals and waste materials.
- Spill control practices.
- Re-vegetation plans.
- Procedures for regular inspections of soil erosion control measures.
- Procedures for visual inspections and monitoring of discharges that could create an impact on surface and groundwater quality.

Of importance is the fact that much of the proposed new site footprint is located within areas where construction was previously completed and established stormwater drainage systems and roadways exist.

4.2.3 WATER USE IMPACTS

This section discusses potential impacts to water uses from construction activities at the Lee Nuclear Site.

4.2.3.1 Water Sources for Construction

Duke Energy does not plan to use groundwater or surface water for construction. Water for temporary fire protection, concrete batching, and other construction uses is expected to be obtained from the Draytonville Water District.

Water for construction of the Lee Nuclear Station is expected to be supplied from the Draytonville Water System. Construction activities for the new Lee Nuclear Site facilities require water supplies at a rate of approximately 250,000 gpd for concrete batch plant operation, dust suppression, and sanitary needs.

The recommended usage requirement for estimating potable water consumption for workers in hot climates is 3 gpd for each worker that includes drinking water and sanitary needs (Reference 1). Based on the maximum site worker population of 4512 people, the potable water consumption is estimated at 13,536 gpd. Further discussion on potable water consumed is discussed in Subsection 4.4.2.3.

A dewatering system is currently installed within the footprint of the excavation. Once construction is complete, Westinghouse specifications indicate that dewatering system for operations would not be needed. This is because the AP1000 does not need a dewatering system if the groundwater table is greater than 2 ft. below ground level. The groundwater table is discussed in Subsection 2.3.1.5.7.

4.2.3.2 Surface Water-Use Impacts

The Broad River and the on-site holding basins are the waters that could potentially be affected by construction activities. The on-site impoundments include the Make-Up Pond B, the Make-Up Pond A, and the Hold-Up Pond A. These features represent the majority of the surface water in the vicinity of the site. A temporary cofferdam or sheet pilings are expected to be utilized for dredging activities during construction of the raw water intake.

The closest municipal user to the Lee Nuclear Site discharge is the City of Union located approximately 20 mi. downstream from the Lee Nuclear Site. The other municipal water users within 50 mi. downstream of the Lee construction site include Carlisle Cone Mills, and VC Summer Nuclear Plant. The effects of the construction activities at Lee Nuclear Site are anticipated to have negligible, if any, impact on water quality or its current municipal water uses because no consumptive use of Broad River water is anticipated during construction. Short-term increases in turbidity from new construction at the Lee Nuclear Site would not be expected to impact water supplies as all construction related discharges will be regulated and monitored to ensure that TSS is within the expected discharge standards.

No flowing streams that affect water quality in the Broad River are in close proximity of the Lee Nuclear Site. No Clean Water Act Section 303(d) water quality limited-designated streams discharge upstream of the Lee Nuclear Site in the Broad River (Subsection 2.3.3.3.1 and Table 2.3-22).

4.2.3.3 Groundwater-Use Impacts

The Lee Nuclear Site is located within the Piedmont physiographic province (Figure 2.3-7). The Piedmont aquifer system is basically two layered. A shallow water-table aquifer is composed of saprolitic silty residual soil, which is typically low yielding. The underlying bedrock aquifer consists of weathered and unweathered crystalline igneous and metamorphic rocks, which store and transmit water through fractures. The shallow aquifer is unconfined, meaning that the upper surface of the saturated zone is not effectively separated from the ground surface by a low-permeability clay layer. The bedrock fracture system is a network of discontinuities that increase in prevalence upward through the crystalline rock as it transitions into saprolite. Because of the permeability of the transition zone, the bedrock aquifer is considered unconfined and not effectively isolated (i.e., the saprolite and bedrock zones function as one interconnected aquifer system) (Subsection 2.3.1.5.5).

Dewatering of the excavation during construction and the resultant cone of depression due to pumping are expected to temporarily affect groundwater flow in the vicinity of the excavation. The dewatering associated with the removal of Cherokee Unit 1 provides an experience based example of the impacts to groundwater from excavation dewatering. This ongoing experience at the on-site demolition project has shown that the dewatering has had a minor impact on groundwater in the immediate vicinity of the excavation. Once the dewatering drawdown was achieved for site characterization and demolition, maintenance dewatering flow was the result of rainwater collecting in the excavation and groundwater inflow. These low groundwater inflows are expected to be similar for other excavations on the Lee Station site because the soils on site generally have very low permeability. Therefore the extent of dewatering impacts on groundwater resources is anticipated to be SMALL and limited to the immediate area around the excavation.

4.2.3.4 Measures to Mitigate Water Impacts

Water use for new construction of the facility is temporary. Because most of the water needed for construction is expected to come from the Draytonville Water District, the ultimate source of which is the Broad River, there are no expected longterm effects to the water supply or detrimental impacts that would affect any other user's consumption.

There are three permitted surface water intakes for public water supply located downstream from the Lee Nuclear Site (Figure 2.3-18). The closest of these is the city of Union, which withdraws water from the Broad River about 20 mi. downstream from the site and has a maximum withdrawal rate of 23.8 Mgd (Subsection 2.3.2.1.1). The other two water intakes includes Carlisle Cone Mills located 30 mi. downstream and V.C. Summer Nuclear Plant located 52 mi. downstream.

The use of proven construction methods, exercising SMALL land disturbance, and developing and implementing best management practices associated with the site-specific SWPPP, erosion control measures, and NPDES permit requirements should eliminate or reduce the potential for any water-use impacts.

4.2.4 WATER QUALITY IMPACTS

Duke Energy has conducted aquatic ecosystem studies on the Broad River and compared the findings with set standards for water quality management. In addition, ecological health of the water is monitored in the area around the Lee Nuclear Site (Subsection 2.3.3).

4.2.4.1 Effluents to Surface Waters

Effluents from construction activities are expected to be non-significant. Water is expected to be provided to the project for construction by the Draytonville Water District in sufficient quantities to produce concrete for all project foundations and structures, provide dust-suppression water for unpaved roads, and provide sufficient water for other construction activities as needed. Water use for these construction activities is not expected to generate runoff to streams, impoundments or other surface waters.

Water from washing concrete batch plant equipment will be allowed to settle in a wash pit prior to routing to a permitted discharge. Other than washings from concrete batch plant equipment, the water is consumed. Water use for these activities is expected not to create runoff.

Stormwater that impacts the construction areas is directed to existing and/or new settling basins and directed to a monitored discharge, to minimize any water quality impacts. Discharges and monitored runoff are expected to enter the on-site holding basins in SMALL amounts.

Stormwater that falls on the Lee Station construction areas is directed to existing and/or new settling basins prior to discharge to surface or groundwater. All stormwater discharges are directed to monitored discharge points to minimize and document any potential water quality impacts. Discharges and monitored runoff are expected to enter the on-site holding basins in SMALL amounts and with limited and controlled quantities of suspended sediments.

Water discharges are monitored in accordance with applicable NPDES requirements and state water quality standards at the time of construction; no Native American standards apply.

4.2.4.2 Impacts to Surface Water Quality

As noted above, effluents from stormwater settling basins may contain small amounts of particulates. Considering the natural turbidity of the Broad River, this additional sediment load should be insignificant. Dredging for sediment removal is expected to be required in the cooling water system intake channel prior to startup of the raw water system. A temporary increase in turbidity could occur in the Broad River near the site during dredging activities. Dredging operations are conducted in compliance with SCDHEC requirements, and are not expected to affect long-term water quality. This temporary effect is also not expected to have a significant impact on water use or water quality.

4.2.4.3 Impacts to Groundwater Quality

Groundwater is anticipated to be encountered during construction activities inside of the excavation. Dewatering during construction would cause temporary changes in the groundwater gradient to direct flow within the lateral area of influence towards the excavation. Water quality within the aquifer should not be impacted since the water would flow from the aquifer into the excavation.

4.2.4.4 Measures to Mitigate Water Quality Impacts

All construction area runoff will be directed through the Make-Up Pond B, Make-Up Pond A, or Hold-Up Pond A to permitted temporary construction outfalls. The routing of runoff to these water bodies will achieve the necessary reduction in total suspended solids to meet state water quality discharge standards. Each discharge outfall will be equipped with an oil recovery boom in the event of an unanticipated discharge of oil or grease.

Construction impacts to receiving waters near the intake and discharge areas are affected only by the specific construction planned for these locations. All construction within any waters of the United States will have specific plans to avoid all discharge of sediment laden waters to the Broad River or any surface water on the site. Large areas of the construction site are not expected to be affected by construction generated sediments or oil and grease because of the measures used to minimize all disturbance to native soils, and the locally disturbed areas are expected to recover with native plants rapidly to minimize any long term erosion and sedimentation. See Subsection 4.2.2.9 for SWPPP mitigation measures. During dredging of the intake structure a cofferdam or sheet pilings will be installed to eliminate or reduce water quality impacts in the Broad River.

4.2.5 REFERENCES

1. U.S. Department of Health and Human Services, Public Health Service Centers for Disease Control, National Institute for Occupational Safety and Health, Working in Hot Environments, April 1986, Website, http://www.cdc.gov/niosh/hotenvt.html, accessed March 16, 2007.

2. Westinghouse Electric Company LLC, *AP1000 Standard Combined License Technical Report, Construction Plan, and Startup Schedule*, APP-GW-GLR-036, Revision 0, August 2006.

4.3 ECOLOGICAL IMPACTS

Although the Lee Nuclear Site has no operating nuclear power plant, the NRC granted a construction permit to Duke Power Company in 1975. Extensive development of the site for the Cherokee Nuclear Station began in 1977 and continued until it was cancelled in 1982. Thus, the amount of vegetation clearing and grading to level the construction area that occurred there during initial site preparation is probably comparable to the amounts that took place during construction of many operating plants. Consequently, many of the construction effects on ecological systems at the Lee Nuclear Site have already taken place. Terrestrial and aquatic habitats on the site adapted to these activities and restabilized.

In 1996, the U.S. Nuclear Regulatory Commission (NRC) published NUREG-1437, a generic environmental impact statement for license renewal of nuclear power plants. In part, NUREG-1437 was written to enhance the efficiency of the license renewal process by documenting well understood generic environmental effects common to most plants and to separate them from effects that need to be addressed in plant-by-plant renewal proceedings. NUREG-1437 can be applied to Lee Nuclear Station construction impacts because NUREG-1437 also takes into account the significance of effects during refurbishment. Refurbishment is defined as large or significant construction activity at an existing site.

The NRC's standard review plan for Environmental Reports, NUREG-1555, emphasizes evaluating the impact of station construction and operation on important species, as defined in NUREG-1555, and their habitats. Consequently, the discussion in this section will focus on those important species. The NRC staff recently issued an update of Subsection 4.3.1 (Terrestrial Ecosystems) and Subsection 4.3.2 (Aquatic Ecosystems) of that document. This chapter also considers the changes reflected in those updates.

4.3.1 TERRESTRIAL ECOSYSTEMS

Site preparation and plant construction activities in terrestrial habitats at the Lee Nuclear Site (see Figure 4.3-1) include the following:

- Installing erosion and sediment control devices and practices.
- Clearing vegetation by cutting or grubbing.
- Disposing of vegetative debris or recycling the debris for later use on the site.
- Leveling the land by grading or filling as needed.
- Excavating to install building and other structural foundations.
- Excavating trenches for new water intake and blowdown discharge pipelines and other station piping and utility connections.
- Installing pipelines and other utilities and backfilling the trenches.
- Disposing of spoil either on or off the site.
- Pouring concrete foundations.

- Constructing buildings and other structures on the new foundations.
- Leveling by grading or filling for new parking lots and internal roadways.
- Paving roadways and parking lots.
- Final grading and landscaping to permanently control erosion and runoff.

The total area of land to be disturbed during these activities is discussed in Subsection 4.3.1.1.1 and summarized in Table 4.3-1. Estimating the maximum area of soil to be disturbed at any time during construction depends on review of a detailed construction schedule that is not now available. The current schedule for construction is discussed in Section 1.1.

4.3.1.1 Lee Nuclear Site

All of the terrestrial ecological effects from constructing a new plant at the Lee Nuclear Site are negligible to SMALL impacts. None are MODERATE or LARGE. Thus, these effects are subject to mitigation by generally accepted measures employed during construction or already in place at operating plants. Application of such measures is warranted at the Lee Nuclear Site. Mitigation beyond the application of these measures is not warranted.

4.3.1.1.1 Upland Vegetation

Figure 4.3-1 is an overlay of the construction footprint of the Lee Nuclear Station on the ecological type map (Figure 2.4-1). Figure 4.3-2 is an overlay of permanent facilities on the ecological type map. Analysis of the effects of the footprint on ecological types suggests that temporary and long-term alteration and loss of about 270 acres (ac.) of habitat (Table 4.3-1) is the primary effect on vegetation resulting from new construction at the site. However, this analysis also indicates that construction and support areas contain no old growth timber, unique or sensitive plants, or unique or sensitive plant communities. Most of the construction is expected to occur in previously disturbed areas with low habitat value (Table 4.3-1) and does not, therefore, noticeably reduce the local diversity of plants and plant communities.

The Mixed Hardwood (MH), Mixed Hardwood-Pine (MHP) and Pine-Mixed Hardwood (PMH) cover types are upland forests of good-quality habitat. They account for less than 15 percent (see Table 4.3-1) of the area to be disturbed. They occur mainly in the borrow and spoils areas and along the intake and discharge pipeline ROWs (see Figures 4.3-1 and 4.3-2). The boundaries of these and other vegetated areas subject to clearing and grubbing will be prominently marked prior to site preparation. Merchantable timber within marked areas may be harvested. Merchantable timber occurs only in areas of the MH, MHP, and PMH cover types (see Table 4.3-1). Remaining trees will then be felled. Stumps, shrubs, and saplings will be grubbed, and groundcover and leaf litter will be cleared to prepare the land surface for grading.

Felled trees, stumps, and other woody material would be disposed of by burning, chipping and spreading the wood chips, and/or sent to an offsite landfill. Opportunities to recycle woody material for use elsewhere on the site may be considered. Recycling opportunities could include cutting logs into firewood, using wood chips to mulch landscaped areas, using logs to line pathways, piling logs and brush in open fields to improve terrestrial wildlife habitat, and placing stumps (root wads) in stream channels to prevent bank erosion and enhance aquatic habitat.

The Nonjurisdictional Wetland (NJW) cover type refers to the depression surrounding the planned locations of the original reactors in the central portion of the core construction area. Duke Energy dewatered the depression, and dewatering to remove seasonal rainwater continues. This has a negligible effect on wetland resources.

The Open/Field/Meadow (O/F/M) and Upland Scrub (USC) cover types are nonforested or partially forested early successional areas dominated by small trees, shrubs, grasses, herbs, or bare soil maintained by cattle grazing and/or mowing. Analysis indicates that about 75 percent (see Table 4.3-1) of the temporary and permanent facilities at the site are planned for location in these relatively low-quality habitat areas.

In partially forested or shrubby areas like the above, contractors will be expected to clear the construction area of woody vegetation and then, where necessary, fill and regrade the site to restore the once-level surface. In O/F/M areas lacking significant woody vegetation, including portions of the ROW for the raw water intake pipeline and portions of the discharge pipeline where additional fill and grading would be unnecessary, heavy equipment is likely to scalp vegetation at ground level, leaving the plant rootstock intact. Most nonwoody vegetation within construction zones is destroyed by equipment and/or by stockpiling or disposing of soil.

All land clearing will be conducted according to federal and state regulations, permit requirements, Duke Energy's existing good construction practices, and established best management practices (BMPs). BMPs seek primarily to keep soil in place (erosion control) and secondarily to capture any sediment that is moved by storm water before it leaves the site (sediment control). There are numerous erosion and sediment control techniques that can be used effectively depending on specific conditions at the site. The measures to be employed at the Lee Nuclear Site will be incorporated in a storm water pollution prevention plan (SWPPP) using appropriate state or local specifications prior to initiating construction. Included will be guidance offered by the South Carolina Department of Health and Environmental Control Storm Water Management Program. Among the general measures to be considered for inclusion in the SWPPP are:

- Minimize the area to be disturbed by protecting vegetated buffers using silt fences or other sediment controls.
- Phase construction activity to minimize the duration of soil exposure and stabilizing exposed soil as quickly as possible after construction. Temporary cover BMPs include temporary seeding, mulches, matrices, and blankets and mats while permanent cover BMPs include permanent seeding and planting, placing sod, channel stabilization, and vegetative buffer strips.
- Control storm water flowing through the site by diversion ditches or berms to direct runoff away from unprotected slopes and direct sediment-laden runoff to a sediment-trapping structure such as the Make-Up Pond B, Make-Up Pond A, or Hold-Up Pond A.
- Establish perimeter controls such as vegetative buffer strips supplemented with silt fences and fiber rolls around the perimeter of the site, especially where it fronts the Broad River, to help prevent soil erosion and stop sediment from leaving the site and entering the river.

- Establish controls like the above around small, nonalluvial wetlands on the site to help prevent sediment from entering the wetlands.
- Establish stabilized construction entrances to and exits from the site to limit the amount of sediment tracked onto public roads.
- Control fugitive dust by watering access roads and the construction site as needed.
- Schedule periodic and regular inspection and maintenance of all BMPs put into place.

Following construction, contractors would seed all temporary work spaces (such as laydown areas or temporary parking lots) with herbaceous plants and/or grass, and in some cases plant native shrubs and trees, according to a revegetation and/or landscaping plan for the facility.

Regeneration of trees and large shrubs would be prevented by mechanical mowing, cutting, trimming, or herbicide application on the permanent ROW for the cooling system intake and discharge pipelines. Once it exits a forested stand adjacent to the Broad River, the intake ROW follows the existing fence in an area largely vegetated with the O/F/M type. Constructing the intake and discharge pipeline ROWs requires clearing about five ac. of the approximately 1000 ac. of forested habitat on the site (see Table 2.4-1). This is also discussed in Subsections 5.3.2 and 5.3.3, which addresses effects from the cooling system. The effect on the continuing availability of forested habitat on-site is negligible.

Clearing of forest vegetation, although very limited in this case, has several secondary effects. Vegetation clearing often results in higher soil temperatures, increased soil erosion, and loss of nutrients from the ecosystem. These factors, in combination with soil damage from grading, unmitigated soil compaction, and soil mixing, could adversely affect soil fertility. The cumulative result of these effects would be reduced plant vigor and lower seedling survival, possibly requiring fertilization to regrow adequate cover in areas to be landscaped or otherwise revegetated.

Clearing forest vegetation could also affect vegetation growing on the edges of cleared areas. Some edge trees are exposed to elevated levels of sunlight and wind, which increases moisture evaporation and the probability of wind throws in older stands of shallow-rooted species. However, as discussed in Subsection 2.4.1, most of the upland forests at the Lee Nuclear Site are not of advanced age. Clearing vegetation could temporarily reduce competition for available soil moisture and light and may allow early successional species to establish and persist in clearings and on the edges of the uncleared areas.

Within a relatively short period after construction, some native species begin to invade cleared areas. Typically, these colonizing species germinate either from buried or fugitive seed, although some species resprout from rootstocks. Over a period of time and in the absence of further disturbance, these colonizing species are replaced by later successional species. Eventually, disturbed areas not otherwise revegetated slowly develop stable communities similar to those that existed prior to construction. However, because the O/F/M and USC vegetation types most common in the Lee Nuclear Station footprint are relatively low-quality habitats, the loss of existing vegetation is a SMALL effect.

4.3.1.1.2 Wetlands

At the Lee Nuclear Site, jurisdictional wetlands and waters of the United States occupy about 14 percent of the site but do not occur within the footprint of new construction (see Figure 4.3-1 and Table 4.3-1). In addition, the largest nonjurisdictional wetland area to be reused is a once-flooded but now dewatered excavation created during construction of the containment structure for Cherokee Unit 1. Demolition of this structure is complete. The other nonjurisdictional wetland occupies an area also disturbed during Cherokee Unit 1 construction. Reuse of these areas has a negligible effect on wetlands.

Alluvial and nonalluvial wetlands are normally forested and associated with waterways. As mentioned earlier, the Lee Nuclear Site now supports little alluvial wetland along the Broad River. Alluvial wetlands that existed earlier in the southern portion of the site were inundated in the 1970s by impounding a backwater of the river to form the existing Make-Up Pond A.

Two small areas of alluvial wetland exist on the northern border of the site west (or upstream) of the proposed raw water intake structure. These wetlands are not within the construction footprint. Construction of the river intake structure will comply with the U.S. Army Corps of Engineers Section 404 permit and SCDHEC guidance for erosion control. Use of erosion controls should prevent the introduction of sediment into the wetland. No adverse impacts are expected to occur in or to these wetlands. Figures 4.1-1 and 4.3-2 show the construction outline of the plant site, including the intake structure and the clear separation between the wetland and the intake. Subsection 4.2.2 states that no construction will occur within wetlands. It is anticipated that the intake pipeline and access road will pass by the wetland in question with no impact. All intake construction will be behind the cofferdam, thus preventing the liberation of sediment during construction. There are no anticipated impediments to flow except for areas behind the cofferdam. As discussed below, construction in the area is also conducted in accordance with permit conditions designed to mitigate adverse impacts on wetlands.

Seven small, nonalluvial wetlands also occur on the site. These partially forested wetlands are associated with small streams, backwaters of ponds, and man-made and natural depressions. Examination of Figures 4.3-1 and 4.3-2 suggests that none of the nonalluvial wetlands on the site currently fall within the construction footprint. However, like the stream channels and open water areas shown on Figure 2.4-2, the alluvial and nonalluvial wetlands are under the legal jurisdiction of the U.S. Army Corps of Engineers (USACE). The USACE regulates dredging, filling, or any other physical alteration of such areas under its Section 404 permit program pursuant to the federal Clean Water Act. Duke Energy's standard practices prohibit all dredge and fill activities that result in discharge of sediment into jurisdictional waters or wetlands without first obtaining the USACE permit. All work in regulated areas will be done according to BMPs or other conditions included in the permit. Although each permit is site-specific, BMPs typically require the following when construction occurs in proximity to waterways or wetlands:

- Keep disturbance of vegetation and the substrate to a minimum.
- Grade and reseed disturbed areas (using native vegetation) to minimize erosion and preclude sedimentation.
- Avoid environmentally sensitive areas such as those with "important" habitats or species.

- Construct waterway crossings only if no reasonable alternate exists and minimize placing fill material in the waterway or adjacent wetlands.
- Use board roads or removable mats.
- Totally remove any temporary fill material and restore the site to its original elevation.

The size and location of the work area for staging and constructing the intake and discharge structures and associated pipelines is delineated to calculate the acres of wetland, if any, to be affected. It is not anticipated that any wetlands are directly impacted by intake or discharge construction. The Section 404 permit issued by the USACE will specify any needed mitigation. In accordance with the terms of the permit, construction contractors would be required to implement good construction practices, use best management practices (e.g., installing sediment filter devices such as sediment tubes or silt fences, as necessary, to prevent flow of spoil from the ROW), and restrict sediment flow into the wetland. In some cases, using straw or hay bales could introduce noxious weeds such as thistle to the ROW. Erosion fabric and silt fencing are preferred alternatives to bales.

Following construction, the pipeline ROW is likely to be seeded with annual grasses or other species that do not require fertilizer or other amendments. Following initial seeding, the disturbed area would be allowed to revegetate naturally with native herbaceous and small shrub species, largely approximating the O/F/M cover type now there. Precluding large shrubs and trees also establishes a permanent corridor that would be maintained for safety and to facilitate visual survey of the ROW.

The total acreage of wetland disturbance is very small and the effects in these areas are minimal in the long-term. Therefore, the environmental effect on wetlands at the Lee Nuclear Site is also negligible to SMALL.

4.3.1.1.3 Wildlife

Three levels of effect duration are usually considered when describing the effects of a construction project on wildlife. These include temporary, short-term, and long-term (or permanent) durations. A temporary effect generally occurs during construction when wildlife is displaced from areas adjacent to construction zones or when species shift their established movement patterns.

Short-term effects may last from the time of construction to several years following construction. Examples include loss of grass and shrub habitats and disruption of burrowing species in areas where construction-related surface soil disturbance occurs.

Long-term or permanent effects can include the loss of forests, forested wetlands, mature riparian habitat, snags used by cavity-nesting species, and vegetative cover used during critical periods (e.g., hiding cover used during nesting or birthing periods). As discussed in Subsection 4.3.1.1.1, high quality forested habitats at the site to be cleared within the construction footprint total about 33 acres (or less than 15 percent of the area to be affected [see Table 4.3-1]). This is a permanent impact but is SMALL in relation to the availability of forest habitats on the site and elsewhere in the area.

In addition, effects on wildlife can be direct or indirect. Direct effects are those immediate actions associated with some phase of the project that would decrease levels of wildlife populations. Examples of direct project effects include (1) wildlife mortality during pipeline ROW clearing and trenching, (2) wildlife-vehicle collisions, (3) wildlife avoidance of the project area, leading to decreased habitat utilization or effectiveness, (4) birds colliding with construction cranes and other equipment, and (5) wildlife adversely affected by pollution of air, water, and soil.

NUREG-1437 reviews numerous studies of avian mortality resulting from collisions with transmission lines and other man-made objects such as cooling towers. Collisions with transmission lines and towers are discussed in Subsection 5.6.1. The issue is whether collision mortality is large enough to cause long-term reductions in bird populations. As presented in NUREG-1437, the analysis of this issue is based on published literature addressing bird collisions with all types of man-made objects. Literature review failed to find any published studies specifically addressing collisions with construction equipment. Construction equipment such as tall cranes is a temporary feature on any construction site and is subject to relocation on the site as construction progresses. Lack of research or monitoring of this aspect of avian collision mortality suggests that collisions with construction equipment are now perceived as a negligible to SMALL source of impact by both the scientific community and the utility industry.

Many millions of birds die each year from natural causes and recreational hunting, and millions are killed each year in the United States as a result of colliding with windows of houses and other buildings, radio and TV towers, vehicles, transmission and distribution lines, telephone lines, cooling towers, smokestacks, and many other man-made objects. However, in no case have such collisions been identified as a biologically significant source of mortality causing notable reductions in otherwise healthy populations. Accordingly, this is considered to be a SMALL impact.

Indirect or secondary effects can occur through habitat alterations, whether through elimination, structural change, subdivision, or some other activity that renders habitats unusable to wildlife. Secondary effects are also associated with increased human occupation of an area because of a construction project, including locally increased access to areas of wildlife habitat. Indirect effects often occur away from a project site and/or may occur after the project has been completed. They are diffuse and lack strong cause-and-effect relationships with a project. Such effects are difficult, if not impossible, to measure or predict.

Effects are considered significant if proposed construction could affect wildlife species and their habitats in a manner that results in adverse consequences to birth rate, growth, and/or survival of a wildlife population. Because these parameters cannot be accurately predicted or measured as consequences of a construction project, an effects assessment is focused on important wildlife habitats that are especially diverse, regionally uncommon, or of special concern to federal or state agencies and other land management or land protection agencies or groups.

Important terrestrial habitats include the following:

- Wildlife sanctuaries, refuges, and preserves.
- Habitats identified by state or federal agencies as unique, rare, or of priority for protection.
- Wetlands and floodplains.

- Land areas identified as critical habitat for species listed as threatened or endangered by the U.S. Department of the Interior Fish and Wildlife Service (USFWS).

There are no designated wildlife sanctuaries, wildlife refuges, or wildlife preserves on or in the vicinity of the Lee Nuclear Site. No unique and rare habitats, or habitats with priority for protection are located on the site. The site does not represent a significant or important regional wildlife travel corridor. Thus, effects on important habitat, including the wetlands discussed above, are negligible to SMALL.

Effects on special status wildlife species are described in Subsection 4.3.1.1.4.

Despite lacking important habitat, direct mortality of common wildlife species could occur throughout the construction period at the Lee Nuclear Site, but this impact would be largely limited to the actual construction period and is, therefore, temporary and SMALL. Clearing, grading, excavating, and/or burying habitats within the construction zone leads to mortality of individual small mammals, reptiles, amphibians, invertebrates, nesting birds with eggs or young, and other less mobile species. Animals are sometimes trapped in open trenches or injured by falling into them. Loss of individuals or small numbers of common species is an insignificant effect and is probably compensatory mortality at the population or community level.

Burrowing vertebrates are especially vulnerable. Their burrows also provide shelter for other vertebrates. Toads, salamanders, turtles, lizards, and snakes use burrows originally excavated by other species. Other mammals, including rabbits, ground squirrels, mice, weasels, skunks, and birds, also use such burrows. The density of burrowing species at the Lee Nuclear Site is unknown.

As with the impact of bird collisions with man-made objects, the issue is whether the direct mortality of individuals is large enough to cause long-term reductions in local populations of the species in question. The less-mobile inhabitants of the O/F/M and USC cover types are common residents of the area as are the species that inhabit burrows. The likelihood that loss of individuals or small groups on the site would influence population levels in the general area is negligible. This is considered to be a SMALL impact on populations of common terrestrial species.

Construction machinery and vehicles sometimes collide with wildlife on construction sites or while traveling to and from these sites. Wildlife species particularly vulnerable to collisions with vehicles include opossums, skunks, rabbits, deer, turtles, snakes, amphibians, and birds, particularly those such as mourning doves and meadowlarks that inhabit shrubs or fields adjacent to roads or readily adapt to habitats in close proximity to human activity.

The number of wildlife-vehicle collisions is directly related to local population levels of wildlife and traffic volume. But vehicle-related mortality does not appear to contribute substantially to the overall mortality rate of any wildlife populations. While increased on- and off-road traffic are expected to result in more wildlife mortality through the construction period, significant effects on wildlife populations are not anticipated unless endangered, threatened, or rare wildlife species are affected.

During construction, mobile wildlife avoid areas on and adjacent to construction sites if human activities are threatening and/or unpredictable to them. Noise, machine activity, and dust from disturbed ground displace birds, mammals, and other species from the actual construction area.

Although not strictly analogous to normal construction activity, studies cited in NUREG-1437 show that off-road vehicles in desert ecosystems reduce numbers of breeding birds, small mammals, and reptiles. Density of some species of nesting birds is also known to decrease in fields near well-traveled highways.

The presence of physical barriers, vegetation and foliage, wind, and daytime temperatures all affect noise attenuation and sound detection. Avoiding noisy sites partially offsets the risk of birds and other wildlife colliding with equipment or vehicles. On the other hand, fauna displaced to adjoining terrestrial habitats causes a temporary increase in population density within those habitats. If the increases exceed the carrying capacity of adjacent habitats, the habitats could experience degradation and the displaced fauna could compete with other fauna for food and cover, resulting in a die-off of individuals until populations decline to the carrying capacity.

Disturbance and displacement are generally temporary. Most affected wildlife species return to the surrounding area soon after construction is completed. Some even become on-site nuisances and require population control. The exception to this is the permanent disturbance created by new facilities, particularly those, like cooling towers, that emit noise. Most of the wildlife populations on the site or in nearby habitats are not adversely affected by temporary disturbance or displacement.

Construction within or near some habitats, including those used for significant life history functions such as nesting, may result in a greater effect. In general, the degree of construction effect in these habitats depends on the time or season of the disturbance which, in this case, occurs throughout the year. Additionally, the resulting alteration and/or loss of habitat adversely affects some wildlife species more than others. Species restricted to single habitats and those with very small home ranges (e.g., some small mammals and reptiles commonly found in the O/F/M and USC cover types) are most affected. For these species, clearing and grading clearly reduces available habitat within the immediate area. Wildlife that uses several habitat types and species with larger home ranges are less affected by local habitat loss or alteration.

Construction activities could affect the productivity of nesting birds. Parent birds can desert eggs or young, but the potential for nest desertion varies among species and is more likely early in the nesting season rather than after the young have hatched. Other potential effects from disturbance include (1) damage to eggs and young by frightened adults, (2) cooling, overheating, and loss of moisture from eggs or young if adult birds remain away from nests too long, (3) missed feedings of chicks, (4) premature fledging of older nestlings, and (5) increased exposure to predators if adults leave nests unattended. As also discussed elsewhere in this subsection, these impacts are experienced at the level of the individual or small groups of individuals. The likelihood that such losses on the site would influence population levels in the general area is negligible. This is considered to be a SMALL impact on populations of common species.

Minimizing the direct impact of heavy construction equipment on ground-nesting bird species, including those covered by the Migratory Bird Treaty Act, and the possible indirect disturbance of other nesting species would require limiting the use of such equipment during the period from spring to early summer. Accordingly, clearing and grubbing with heavy equipment would be scheduled to avoid the nesting season as much as possible. If avoidance proves infeasible, Duke Energy would expect to consult further with the U.S. Fish and Wildlife Service concerning issuance of an incidental take permit, which would allow construction activity to proceed as required by the overall construction schedule.

An accidental release of chemicals, including petroleum products, typically occurs during most construction projects. The consequences to wildlife would be most severe if toxic compounds entered surface waters. Refueling vehicles and storage of fuel, oil, and other fluids during construction could create a potential contamination hazard to aquifers and surface waters. The possibility of emissions and spills from construction equipment would be minimized by scheduling equipment maintenance within an established maintenance yard located away from waterways and water bodies (see Figure 4.3-2) where fuel, oil, and other fluids are stored. In addition to the SWPPP discussed earlier, construction would also be covered by a spill prevention plan in effect.

Whether incorporated into the SWPPP or produced as a stand-alone document, the spill prevention plan clearly identifies ways to reduce the possibility of spills, contain and clean-up spills, dispose of contaminated materials, and train personnel responsible for spill prevention and response. The plan will also specify material handling procedures and storage requirements. The overall intent of the plan is to minimize the possibility of a serious spill and promote rapid response and clean-up. This reduces the likelihood of a spill and minimizes the potential adverse effects. Thus, serious spills represent a SMALL potential adverse impact.

Usually included as a minimum in the spill prevention plan is the following:

- Drawings showing the locations of all chemical and petroleum-related storage areas, storm drains, surface water bodies, and waterways on or near the site.
- Description and list of all types of equipment to be used to adequately clean up a spill.
- Specification concerning notifying appropriate authorities, such as police and fire departments, and hospitals.
- Proper waste handling and safety procedures for each type of waste.
- Description of procedures for immediate clean up of spills and proper disposal of contaminated clean-up materials.
- Identification of personnel responsible for implementing the plan in the event of a spill.
- Description of a program for educating employees and contractors on the potential hazards to humans and the environment from spills and leaks.
- Schedule for updating the plan and clean-up materials as changes occur to the types of chemicals and other materials stored and used on site.

Effects on forested habitats are long-term because forests would not be replaced. However, planned disturbance of hardwood and mixed hardwood stands at the Lee Nuclear Site is very limited in area. The additional forest clearing required for the proposed construction does not substantially change the amount of forest edge habitat or the local vegetative structure beyond that which already exists because the site is now a mosaic of mainly small stands. Consequently, the effects of construction in woodlands slightly lower the overall carrying capacity of the site for wildlife, but construction has no significant effect on wildlife beyond the site. Thus, the overall effect of the project on common wildlife species of the type now occupying the site is SMALL.

Once the facility is completed, routine maintenance of lawns and other ornamental vegetation on-site periodically disturb wildlife in the immediate area, particularly small mammals and nesting birds. However, it has no effect on species such as raccoons, opossums, and the numerous birds that quickly adapt to disturbed or developed areas. In addition, the core construction area of the site was apparently mowed periodically by those who purchased the property from Duke Power Company. Thus, periodic maintenance at the new facility basically constitutes a continuation of existing conditions with respect to disturbing wildlife that inhabit the core area of the site.

4.3.1.1.4 Species of Special Interest

Important terrestrial species of special interest are as follows:

- State- or federally-listed (or proposed for listing) threatened or endangered species.
- Commercially or recreationally valuable species.
- Species essential to the maintenance and survival of species that are rare or commercially or recreationally valuable.
- Species critical to the structure and function of the local terrestrial ecosystem.
- Species that may serve as biological indicators to monitor the effects of the proposed facilities on the terrestrial environment.

The general construction effects of the proposed project, as discussed in preceding subsections, also apply to endangered and threatened wildlife and to other species of special interest. However, because the distributions and abundance of most threatened and endangered species are limited or in decline, any construction effects could have a greater effect on the size or viability of these populations than on populations of nonendangered or nonthreatened species.

In addition, habitat availability is often a limiting factor for species of special interest, and the short- or long-term loss of suitable habitat can contribute to the decline of populations. Further, direct short-term effects, such as mortality and displacement, can be much more severe than with other more common species because mortality of individuals can have a significant effect on the total population. Displacement from suitable to less suitable habitats in surrounding areas may also decrease reproductive success and individual survival.

As discussed in detail in Subsections 2.4.1.3.1 and 2.4.1.4.3, the dwarf-flowered heartleaf (also called dwarf-flowered wild ginger) and pool sprite, both federally listed as threatened, and Schweinitz’s sunflower, listed as endangered, are the federal plant species of interest in the project area. In addition to these species, USFWS named the Georgia aster, a candidate species, and the prairie birdsfoot-trefoil, Biltmore greenbriar, American kestrel, loggerhead shrike, southeastern myotis bat, and robust redhorse as species of special concern.

At the state level, the South Carolina Department of Natural Resources (SCDNR) also lists the dwarf-flowered heartleaf and pool sprite as threatened and Schweinitz’s sunflower as endangered.

No other federally- or state-listed endangered or threatened species are thought to occur within the county. However, SCDNR lists additional nonprotected species with the remote potential to occur in the project area. Consideration of the availability of suitable habitat at the Lee Nuclear Site, based on field reconnaissance in 2006, limits the possibility that many of these species actually occupy the site. Of the 54 terrestrial species listed in Table 2.4-5, unavailability of appropriate habitat and targeted field search reduces the list to four plants (not including the pool sprite and Schweinitz's sunflower), one mammal, two birds, and one frog.

Among the plants, only the southern adder's tongue fern was confirmed to occur at the site. However, the probability of adverse effects on this species is remote because the known population exists in an area outside the construction footprint.

The southeastern myotis bat is a possible seasonal resident of the site. However, none were observed at the site during the 2006 survey and no indirect evidence of their occupation was found despite searching for possible indirect evidence such as the use of abandoned buildings as seasonal roosts. The bat, like other mobile species such as birds, avoids active construction sites if the level of activity disturbs them. As a largely nocturnal species, it probably continues to use the river and on-site impoundments, especially if construction lighting attracts large numbers of insects. As with other bats, the echo-location capability of the species helps to avoid collisions with man-made and other objects that might occupy or be constructed on the site. Accordingly, the possibility of adversely affecting the species should it be a resident is also SMALL.

The American kestrel and loggerhead shrike are possible or probable residents of the site, but they are unconfirmed. Both actively forage in open cover types such as the O/F/M and USC areas from which they are displaced during construction. Like the bat, they are mobile and move to undisturbed habitat nearby if disturbances due to construction and/or operation of facilities at the Lee Nuclear Site exceed their tolerance levels.

Finally, the northern cricket frog is also a possible site resident. Unlike other species discussed above, this frog is not highly mobile and is confined to small, shallow ponds and pools of water or slow-moving streams, especially during the breeding season. This type of habitat is absent from the proposed construction footprint.

Should any of the above species actually occupy habitat in the construction area at the Lee Nuclear Site, the effects on these species from construction could involve habitat loss and direct and indirect effects on individuals, as discussed earlier in this section. At the level of the individual (or pair), such species would be affected because the Lee Nuclear Site is a small portion of the habitat available in the region or vicinity, however there would be no long-term effects on population levels, even locally. Accordingly, potential effects on species of special concern are SMALL.

The NRC also includes as important species those that are essential to the maintenance and survival of species that are rare or commercially or recreationally valuable. No species of special interest that possibly occur at the Lee Nuclear Site and no such species known to exist on-site have clearly established and essential trophic relationships to any other specific species. Thus, the possibility that construction at the site affects any essential species is SMALL.

Forests at the Lee Nuclear Site contain harvestable timber in limited commercial quantities. Duke Energy does not now sell timber and is unlikely to harvest timber commercially on the site in the future except as needed to clear very small stands of timber during the construction period or to manage on-site timber stands after the plant becomes operational. The type of commercial timber found on-site is common in the area. The on-site timber resource is not essential to maintaining commercial timber harvest opportunities immediately adjacent to the site or elsewhere in the area. This represents a SMALL economic effect.

Similarly, Duke Energy will prohibit any commercial and recreational trapping and recreational hunting that might have occurred on the site in the past by local residents. The recreational species of interest such as deer, rabbits, squirrels, and game birds on-site may be readily hunted elsewhere in the area. The continued availability of the recreational species on the site is not essential to maintaining recreational hunting and fishing opportunities immediately adjacent to the site on land owned by others or elsewhere in the area on land Duke Energy does not control. This represents a SMALL effect on recreational hunting opportunities previously available to local residents.

The NRC also includes as important species those that are critical to the structure and function of the local terrestrial ecosystem or those that serve as bioindicators. None of the latter species inhabit the site, and none are affected by construction.

As discussed in Section 2.4, the Kings Mountain Geological Belt ecoregion is largely forested with oak-hickory-pine stands of highly variable floristic composition. Other than species that are rare throughout the Piedmont province, most of the species at the Lee Nuclear Site are common in southeastern forests and the streams that flow through them. Many of the less common species on-site are also more abundant elsewhere.

Because of the wide variety of ecological communities within the region, the abundance of individual species, especially plants, can vary significantly from location to location where different species serve similar ecological roles in the community. Accordingly, there is no evidence suggesting that any individual species at the Lee Nuclear Site is critical to structure or function at the ecosystem level or that any adverse effect occurs at that level.

4.3.1.2 Off-Site Facilities

As discussed in Subsection 2.2.2, Duke Energy plans to reactivate the previously constructed railroad line. This reactivation involves installation of new ballast and track. Because there is limited ground disturbance associated with installing the new ballast and track, little or no upland vegetation is cleared except for shrubs and trees that have encroached on the previously cleared ROW. Thus, impact to upland habitat associated with the reactivation is expected to be negligible to SMALL.

The impacts of land clearing, grading, and leveling to construct the new transmission lines are generally similar to those experienced on site with two major exceptions. First, clearing and grading occur where necessary to allow safe passage of the line. Second, the ability to relocate proposed tower sites laterally along the ROW means that towers can usually be sited to avoid environmentally sensitive sites such as those that might contain small populations of special interest plants, water bodies and waterways, and wetlands. Transmission line construction is also covered by Duke Energy's SWPPP and spill prevention plan and the BMPs incorporated into them. Measures used to maintain the transmission line ROW after construction is completed are discussed in Section 5.6.

4.3.2 AQUATIC ECOSYSTEMS

Site preparation and plant construction activities in aquatic habitats at the Lee Nuclear Site (see Figure 4.3-1) include the following:

- Installing a new water intake structure in the Broad River (Ninety-Nine Islands Reservoir).
- Installing a new blowdown discharge structure on the upstream side of the existing Ninety-Nine Islands Hydroelectric Dam.
- Dredging to enlarge the capacity of the existing Make-Up Pond A.
- Refurbishing the existing water intake structures in the Make-Up Pond A and Make-Up Pond B.
- Routing storm water to the Make-Up Pond A, existing Make-Up Pond B, and existing Hold-Up Pond A during the construction period.

4.3.2.1 Lee Nuclear Site

Eight on-site stream channels (see Figure 2.4-1) have hydrologic connections to the river. These channels total approximately 8100 ft. in length, but none are within the footprint of new construction. Similarly, the on-site ponds and nonalluvial wetland areas (see Subsection 4.3.1.1.2) are not within the construction footprint.

Installing new ballast and track along the existing railroad ROW will not directly impact any waterways or water bodies. Similarly, construction of towers along the two new electrical transmission line ROWs is not expected to impact aquatic environments because the tower sites will be selected to avoid construction activity in such areas.

Like effects on wildlife and plants, effects on aquatic resources are evaluated based on whether they are temporary, short term, or long term. Three major groups of aquatic organisms are typically included: plants, benthic macroinvertebrates, and fish.

Effects on fish populations or the recreational or commercial value of a fishery are evaluated in detail if there is potential for substantial direct mortality to a specific fish population or community, or potential for long-term loss of substantial amounts of important habitat such as spawning areas.

No commercial fishing now occurs in the Broad River north of Ninety-Nine Islands Dam where the river is also termed the Ninety-Nine Islands Reservoir. Recreational fishing now occurs there and will not be curtailed or impeded by any construction-related activity. Other recreational use of the river will similarly not be impeded during construction or eventually by operation of the Lee Nuclear Station, including construction, maintenance, and routine operation of the new intake and discharge structures.

Constructing a new raw water intake is unavoidable because the new station depends on the availability of river water for cooling. A cofferdam will enclose the construction site to contain potential construction related sedimentation to the river. This construction will be as limited as is reasonable and likely to be completed within six to nine months of being initiated to limit construction-related occupation of the riparian zone and river bottom. The cofferdam will then be removed prior to high flows in the spring season limiting inconvenience to recreational users to the maximum extent.

All of the aquatic ecological effects from constructing a new plant at the Lee Nuclear Site are negligible to SMALL issues. None will be MODERATE or LARGE. Thus, these effects are subject to mitigation by generally accepted measures employed during construction or already in place at operating plants. Application of such measures is warranted and likely to occur at the Lee Nuclear Site. Mitigation beyond the application of these measures is not warranted.

4.3.2.1.1 Broad River (Ninety-Nine Islands Reservoir)

Installation of the new raw water intake and discharge structures requires construction within the river. Dredging of the intake structure area on the river could create a temporary loss of riparian habitat in the immediate area of construction. The permanent loss of habitat would be limited to the length of the screenhouse as the native shoreline vegetation will be allowed to reestablish right up to the structure. Localized shoreline and bottom sediments could potentially be disturbed during the short construction period. However, as mentioned above, a cofferdam will enclose the construction site. In combination with a sheet pile wall along the river bank, these structures will largely eliminate sedimentation. The cofferdam also allows use of conventional construction equipment such as an excavator and crane that will operate from the river bank not within the river itself. Implementation of BMPs will limit erosion along the reestablished bank.

The river would also receive (1) dewatering effluent, after treatment to reduce suspended sediments, from trenching, (2) runoff from the plant area via specific monitored outfalls, and (3) minor, localized turbidity during construction and startup of the intake and discharge structures.

River biota should not be significantly affected by construction, with the exception of some very localized displacement of fish during placement of the sheet pile used to enclose the intake construction site and loss of benthos and benthic habitat in the immediate areas of the construction of the intake and discharge structures. Temporary displacement of a small number of fish is not expected to have an impact on the fish populations in the reservoir. These are temporary potential effects.

Downstream aquatic vegetation will not experience any appreciable increase in sedimentation, smothering by redeposited silt, or reduction of photosynthesis due to turbidity because all construction-related discharges to the river will be regulated through specific temporary points of discharge and treated to reduce suspended sediment loads to South Carolina discharge standards. In addition, each discharge outfall will be equipped with an oil recovery boom to be used in the event of an unanticipated release of oil or grease. The Broad River now carries high silt loads to which the native aquatic plants and other aquatic species are well adapted.

Construction in the river will be scheduled to minimize the extent of aquatic habitat impacted during construction. Some siltation and increased turbidity may be generated by installing sheet pile and the other structures used to isolate construction activities from the aquatic environment. This siltation is expected to be limited in magnitude and duration and is not expected to appreciably increase the Broad River's overall sediment bed load nor result in a significant loss of benthic macroinvertebrates because steep banks and mud/silt substrates in the reservoir limit macroinvertebrate density. Work on the intake structure is anticipated to last approximately

16 months. Approximately 4 months are expected to be dedicated to installing the cofferdam assembly, and it should take another 2 months to remove it. Actual construction is expected to be completed within 7 – 10 months in order to limit construction-related occupation of the riparian area and river bottom (Subsection 4.3.2.1). Both construction and removal of the cofferdam are expected to be scheduled to avoid spawning runs to the extent practical, and minimize the extent and magnitude of the impact to aquatic habitats. The cofferdam is expected to be removed prior to high flows in the spring (Subsection 4.3.2.1). No commercial fishing exists in this area, and recreational fishing is not expected to be curtailed (Subsection 4.3.2.1.4).

The diffuser pipe is expected to be constructed using divers and a barge. This portion of the project is planned to last 3 months and is scheduled for the late summer to fall time frame. Construction of a cofferdam is not expected to be necessary. No diversion of the river flow is anticipated nor is any disturbance of river substrate expected. Actual construction occupation of the river is expected to be minimal. The pipe sections would be assembled onshore, positioned using the barge, and attached to the Ninety-Nine Islands Dam using divers. The use of divers and very short construction time is expected to minimize stress to the aquatic community. The timing of this part of the construction should avoid any disruption in the spawning runs or seasonal migration.

Increased sedimentation and turbidity from construction have the greatest potential to adversely affect fisheries resources. Although severely restricted by installing sheet pile and enclosing the construction site within a cofferdam, suspended sediment can interfere with respiration and feeding in both adult and young fish, but fish are highly mobile and able to leave areas with abnormally high levels of silt or sediment. High sediment loading is also a common phenomenon in the Broad River that occurs during each significant rainfall event in the watershed, indicating that resident fish have successfully adapted to the condition. Other potential effects include interruption of fish spawning, fish entrainment, and fish mortality from toxic substance spills. Most of the common fish in the river do not migrate during spawning runs except for a seasonal movement of suckers upstream (see Subsection 2.4.2.2.1) in the spring toward the riverine environment below Cherokee Falls Dam. Accordingly, no spawning runs would be interrupted by constructing the new intake and discharge structures in the river at the site.

In the unlikely event of a direct impact to the local populations, river biota should return to repopulate this lower reach of the Ninety-Nine Islands Reservoir to a more typical state in a short period after the cessation of construction activities.

In this case, most of the site has already been cleared and graded, and the on-site impoundments have been in place for at least 25 years. Construction of the new intake and discharge will have a limited impact on the river as previously discussed. Refurbishing the Make-Up Pond B and Make-Up Pond A water intakes, if necessary, will have no impact on the river. Should holding capacity in the existing Make-Up Pond A need to be enlarged, construction equipment will work from the site separated from the river by the berms used to form the basin. In addition, erosion and sediment control measures earlier discussed in Subsection 4.3.1.1.1 would be in place to prevent sediment flow into the river. Increased sedimentation and siltation in the Broad River which now carries a high silt load is a SMALL effect largely controlled at acceptable levels by the best management practices for construction in and adjacent to rivers.

Entrainment of fish from the river would not be likely to occur during water withdrawal for hydrostatic testing of the new water intake and discharge pipelines because hydrostatic testing of the intake equipment and raw water piping system will occur in the fall or winter when entrainable early life stages have matured into more mobile juvenile and subadult stages. To minimize impingement of small fish during water withdrawal for testing, the intake is designed so that velocity of water through the screens is below 0.5 ft. per second (fps). Most fish, even juvenile stages, should be able to overcome these velocities without impinging on the 3/8-in. mesh screens.

Direct spills of toxic material into the river could be deleterious to fish, benthic macroinvertebrates and mussels, depending on the type, quantity, and concentration of spilled material. To reduce the potential for surface water contamination, fuel and other potentially toxic materials are stored and transferred to equipment well away from waterways in a pre-established maintenance yard, thereby minimizing the chance of direct surface-water contamination with any potentially toxic materials used on the construction site.

Leaks and spills would also be minimized through scheduled equipment maintenance performed in the maintenance yard located away from the river. The spill prevention plan for this project (see Subsection 4.3.1.1.3), which is specific to the construction period, would also provide a procedure for immediate response and cleaning of accidental spills so their potential effects would be mitigated. Personnel using fuel or lubricants in the field are trained to respond to, clean, and report spills. Additionally, adequate spill response materials are always available in every transport vehicle used regularly on the project site. Contaminated materials are managed and disposed in accordance with federal and state laws and regulations, and the spill prevention plan prevents any adverse effects of these materials on the environment. Therefore, the potential effects to the Broad River of construction of the Lee Nuclear Station are SMALL and do not warrant any additional mitigation.

Work will be compliant with the conditions of applicable permits (Subsection 4.3.2.1.2). The USACE (Section 404 wetlands and Section 10 navigable waters programs), the Cherokee County floodplain administration, and SCDHEC (Section 401 certification and NPDES program) are expected to each have independently enforceable permit authority over activities undertaken in the river.

4.3.2.1.2 On-Site Impoundments

With the exception of possible dredging to increase the capacity of the existing Make-Up Pond A, and refurbishing the intake structure, no other significant changes are anticipated on this water body. At the Make-Up Pond B the existing intake structure will also be refurbished. There are no anticipated changes planned for the remaining on-site impoundments.

As in the river, biota in the Make-Up Pond A and Make-Up Pond B will be affected by displacing fish. In addition, extensive dredging will likely remove any benthic organisms with the dredge spoil and this could include insect larvae and mussels, and emergent plants. The new and deeper Make-Up Pond A will likely be repopulated by benthic organisms and larvae from the adjacent upstream southern section of the Make-Up Pond A which will not be dredged. Without the enlargement of the basin, the littoral wetlands in the southern portion of the basin will be more susceptible to increased sedimentation and smothering by redeposited silt introduced from the pumped flows from the Broad River.

The basin has stabilized since it was constructed. Other than rainwater runoff, it is not now subject to high silt loading as occurs in the river. Therefore, organisms, including fish, residing there have not adapted to highly turbid water as have those inhabiting the river. Increased silting during dredging therefore has a greater, although unpredictable, potential to adversely impact Make-Up Pond A residents than residents of the river. Additionally, once the new intake is operational, silt laden river water will be pumped into the basin. The resultant turbidity in the Make-Up Pond A will depend on the volume of water pumped and its silt load. Thus, an increase in turbidity in the Make-Up Pond A is inevitable as a temporary effect during construction and a long-term effect during operation of the new plant.

Should current Make-Up Pond A residents be unable to quickly adapt to higher than normal levels of silt in the water during dredging, these species may be lost. However, as shown in Table 2.4-9, the fish in question (that could theoretically be relocated from the Make-Up Pond A to the Make-Up Pond B or to the river), are very common Centrarchids of local interest for recreational fishing. They are now abundant in the river itself, suggesting an ability to live in very silty water. Total loss of these species in the Make-Up Pond A would be a SMALL regional ecological impact of no significance to the local recreational fishery because public recreational fishing in the Make-Up Pond A will not be allowed.

Less common species inhabiting the Make-Up Pond A are the paper pondshell and eastern floater mussels. The latter species also occupies the Make-Up Pond B, but neither was found in the river. As discussed in Subsection 2.4.2.4, mussels are uncommon in the Broad River and on the site where they occur only in low numbers. That the paper pondshell and eastern floater now live in the on-site impoundments but not the river indicates a preference for non-turbid, lentic habitat. Like fish, these mussels could be lost should they be unable to adapt to higher levels of silt in the water during dredging and long-term operation. However, they occur only in low numbers. Their loss from the Make-Up Pond A would be a SMALL ecological impact.

Biota in the Make-Up Pond B should not be significantly affected by refurbishing the existing water intake structure, with the exception of some very localized displacement of fish during placement of the sheet pile used to enclose the intake construction site and loss of benthos and benthic habitat in the immediate areas of the construction. Temporary displacement of a small number of fish is not expected to have an impact on the fish populations in the reservoir. Additionally, turbidity is not expected to increase significantly except during placement of the cofferdam because water within the enclosure will be treated before discharge. These are temporary potential effects.

Like nonalluvial wetlands discussed above, the acreage of possible disturbance to emergent wetlands within the basin is yet to be determined. As jurisdictional wetlands, emergent wetlands are also under the authority of USACE to regulate dredging. The Section 404 permit issued by USACE will also regulate the dredging and enlarging activities of the Make-Up Pond A. As in the river, construction in the basin will be done according to best management practices, the conditions identified in the Section 404 permit, state water quality standards and the SWPPP used for project construction.

Effects to the other on-site water bodies should not occur. Siltation and elevated turbidity associated with storm water runoff, as well as accidental spills during construction elsewhere on the site are not likely to occur widely on the site. The construction will direct storm water flows to specific outfalls where suspended sediments will be treated before discharge to any waters of the United States. The best management practices, including use of silt fences, storm water retention basins and cofferdams, should reduce these effects on impoundments, and the spill prevention plan should provide for rapid response to a spill, relegating potential adverse effects to a SMALL level that warrants no special mitigation.

4.3.2.1.3 Streams

As stated above in Subsection 4.3.2, none of the eight on-site stream channels is within the footprint of new construction. The BMPs and other specific permit conditions should reduce the possibility of adverse effects, as they are in the river and in on-site impoundments. The spill prevention plan should provide for rapid response to a spill. Therefore, potential effects to streams are SMALL and warrant no special mitigation.

4.3.2.1.4 Species and Habitats of Special Interest

Important aquatic species include the following:

- State- or federally-listed (or proposed for listing) threatened or endangered species.
- Commercially or recreationally valuable species.
- Species essential to the maintenance and survival of species that are rare and commercially or recreationally valuable.
- Species critical to the structure and function of the local aquatic ecosystem.
- Species that may serve as biological indicators to monitor the effects of the proposed facilities on the aquatic environment.

There are no federally-listed threatened or endangered aquatic species that have the potential to occur in Cherokee County, South Carolina. However, the robust redhorse has been stocked by SCDNR in the Broad River downstream of the Lee Nuclear Site. It is a species of special interest. There is no record of the species occurring in the Broad River at the site, and the possibility that it will expand its range upstream to the site is remote because of the presence of intervening dams.

The Carolina darter, fantail darter, highfin carpsucker, and V-lip redhorse are species of concern at the state level. Like the robust redhorse, there are no records of the Carolina darter being found in the river at or near the site, and the possibility that it occurs at that location is equally remote (see Subsections 2.4.2.5.2 and 2.4.2.5.8). Neither the robust redhorse nor the Carolina darter should be affected by construction in the unlikely event they actually occur in the river at the site.

As also described in Subsection 2.4.2.5.2, the presence of the fantail darter was recorded adjacent to the Lee Nuclear Site at Sample Station 463 during the 2006 winter fish sampling program by capture of a single specimen. The highfin carpsucker and V-lip redhorse are also possible residents. The highfin carpsucker is rarely collected and its presence is unconfirmed. Similarly, presence of the V-lip redhorse is possible because of a recent range extension, but this is also unconfirmed.

Should any of the above species actually occupy habitat at the Lee Nuclear Site, the effects on them due to construction could involve habitat loss and the direct and indirect effects on individuals discussed earlier in this section. However, their potential occurrence without documentation in the literature or capture of a single specimen (as in the case of the fantail darter) suggests only marginal ability to inhabit silty rivers. Additionally, because there is no apparent population of these fish above the dam, effects would occur at the level of the individual and would not affect population levels. Accordingly, the potential effect on aquatic species of special concern is SMALL.

The diversity and abundance of the species discussed in Subsection 2.4.2 suggest a typical Piedmont warm-water recreational fishery of popular game fish. An introduced smallmouth bass fishery that is unique to rivers in the Piedmont region of the state only occurs in the Broad River downstream of Ninety-Nine Islands Dam. The species was collected from the Ninety-Nine Islands Reservoir tailrace during fish sampling in 2006.

The smallmouth bass in the Ninety-Nine Islands Dam tailrace are restricted to the cooler waters of the tailwater area and some limited distance downstream. Thus, this fishery has very limited distribution in the river.

Despite the presence of game fish, Ninety-Nine Islands Reservoir is not an area of high recreational fishing interest due to turbidity, remoteness, and sand and gravel mining. It is undoubtedly fished by local residents whose ability to use the river is not impeded during construction or operation of the facility. There is no commercial fishery in the river. The general mitigation measures discussed previously would also apply to mitigation of adverse effects on the darter and recreational species of concern and should render the impacts SMALL.

Important aquatic species also include those that are essential to the maintenance and survival of species that are rare and commercially or recreationally valuable, those that are critical to the structure and function of the local ecosystem, and those that are bioindicators of the health of local water bodies and streams. None of the species inhabiting the river are known to fulfill such roles. There are none to be affected by the proposed construction, with the exception of benthic macroinvertebrates and a mussel that occurs in low numbers at the site but is elsewhere very common. Previously discussed mitigation measures to protect water quality during construction would also protect the above-mentioned species at the site. Accordingly, adverse effects to these groups are SMALL.

4.3.2.2 Off-Site Facilities

As discussed in Subsection 2.2.2, Duke Energy plans to reactivate the previously constructed railroad line. This reactivation will involve installation of new ballast and track within the established ROW. Because there will be limited ground disturbance, no waterways or water bodies will be affected. Thus, there will be no impact to aquatic resources associated with the reactivation.

Similarly, the impacts of land clearing, grading, and leveling to construct the new transmission lines are unlikely to impact any aquatic resources because Duke Energy has the capability to relocate proposed tower sites laterally along the ROW to avoid construction within water bodies, waterways, and associated wetlands. Transmission line construction and management practices associated with proximity to waterways or wetlands are discussed in Subsection 4.2.2.5.

TABLE 4.3-1 (Sheet 1 of 2)
COVER TYPES TO BE CLEARED DURING CONSTRUCTION AT THE LEE NUCLEAR SITE

	Estimated	Cover Type					
	Total Acreage	MH	MHP	PMH	NJW	OFM	USC
Construction Period							
Heavy Haul Road and Haul Path	10.94				3.36	7.58	
Parking	18.18					17.96	0.22
Laydown	32.66	1.8	0.42	0.01	0	24.59	5.86
Batch Plant	2.81					2.81	
Borrow Area	38.02		3.92	1.76	0.00	30.48	1.86
Spoils Area	10.02		6.35			3.64	0.03
Other	16.66	0.07	3.92	1.74	2.03	11.23	1.86
Subtotal	129.29	1.85	14.61	3.50	5.39	98.30	9.83
Permanent Facilities							
Power Block	31.00				24.28	6.72	
Cooling Towers	28.29					28.29	
Switchyard	21.37					21.37	
Meteorological Tower	4.33		2.48	1.85			
Warehouses and other	9.22	0.01	0.00	0.00	0.00	9.20	0.00
Parking	12.71					12.71	
Vehicle Maintenance	3.70					2.49	1.20
Wastewater Treatment	10.50	0.02	0.00	3.33	1.70	5.46	0.00
Simulator Training	0.22					0.20	0.02

TABLE 4.3-1 (Sheet 2 of 2)
COVER TYPES TO BE CLEARED DURING CONSTRUCTION AT THE LEE NUCLEAR SITE

	Estimated	Cover Type					
	Total Acreage	MH	MHP	PMH	NJW	OFM	USC
Clarifier Area	0.14						0.14
Support and Administration	2.97				1.17	1.80	
Security Training Area	0.33					0.33	
Intake/Discharge Structures and Pipelines (with a 75 foot ROW)	16.08	2.61	0.67	2.07	0.00	5.26	5.47
Subtotal	140.83	2.64	3.14	7.25	27.15	93.82	6.83
Total	**270.13**	**4.49**	**17.75**	**10.75**	**32.54**	**192.12**	**16.67**
Percent of Total	**100**	**1.7**	**6.6**	**4.0**	**12.0**	**71.1**	**6.2**

4.4 SOCIOECONOMIC IMPACTS

The discussion of socioeconomic impacts is presented in three subsections. Subsection 4.4.1 describes physical impacts of site construction on the community. Subsection 4.4.2 describes the social and economic impacts of station construction on the surrounding region. Subsection 4.4.3 describes environmental justice impacts as a result of site construction.

4.4.1 PHYSICAL IMPACTS

Construction activities can cause temporary localized physical impacts to off-site structures, roads, air quality, odors, noise, or aesthetics. Many of these impacts can directly or indirectly affect humans near the site. As discussed in Subsection 2.5.1, the area near the site is rural with a low population density. As illustrated in Table 2.5-2, the 2007 projected population within 5 miles (mi.) of the site is only 6000 individuals. This is a density of 76 individuals per square mile.

4.4.1.1 Construction Activities

A detailed description of the Lee Nuclear Site and vicinity is provided in Sections 2.1 and 2.2. The site is largely excavated due to previous development activities, with some buildings and roadways in place. Within the Lee Nuclear Site boundary, rehabilitation of existing buildings and roads is necessary, as well as the construction of new buildings.

The total number of on-site workers at peak construction rises to 4512, then diminishes until the new units are operational. Based on experience with other large construction projects in the region, it is assumed that 70 percent of the workforce would in-migrate to the region and of that 70 percent, 25 percent would bring their families.

Most of the construction for the Lee Nuclear Station occurs on 750 acres (ac.) of land that has been disturbed by previous construction and site preparation. Additional land disturbance is expected to occur during construction of the intake and discharge structures, as well as some of the temporary and permanent roadways and buildings. Off-site construction encompasses construction of the rail spur and transmission corridors. Construction activities result in elevated noise and dust levels and traffic on roads. In addition to dust, construction equipment locally increases air emissions. Blasting to remove native rock could result in both noise and shock impacts. Erection of cranes and buildings may affect aesthetic qualities of the community.

4.4.1.2 Impacts to Off-Site Structures

Construction activities are not anticipated to impact any off-site buildings, primarily due to distance. Figure 2.5-26 indicates the nearest residence is approximately 0.74 mi. from the site, and the nearest business is approximately 0.78 mi. from the site. Because of their distance from the site, no off-site industrial or commercial facilities are impacted by construction activities.

No historically significant buildings or recognized cultural resources exist within the Lee Nuclear Site boundary. Construction impacts on historically significant buildings are discussed in Subsection 4.1.3.

4.4.1.3 Impacts to Transportation

Transportation is described in Subsection 2.5.2.2 and Section 4.1. No public transportation routes are located within the site boundary. Construction is planned for new roads and improvements on existing roads inside the Lee Nuclear Site boundary. Physical impacts due to on-site road construction would be limited to plant construction workers.

As detailed in Subsection 2.2.1.2, an abandoned railroad spur enters the site on its northern boundary, extends across the northern half of the site, and ends in a former construction area. Upgrading this existing rail spur is necessary to support equipment delivery. The upgrade of this abandoned railroad spur requires new ballast and track and is expected to take place within the existing right-of-way. Because reconstruction of the rail line spur outside the site boundary makes use of a pre-existing right-of-way that is already zoned for industrial use and has already been disturbed, construction impacts are expected to be minimal.

Plant construction at the Lee Nuclear Site results in traffic increases on local roads. Subsection 4.1.1 describes the transport of construction materials and workforce to the site by public roads. Both construction workers and truck deliveries access the site via McKowns Mountain Road, as described in Subsection 2.5.2.2.

As discussed in Subsection 2.5.2.2.3, AADT counts in 2006 indicate that approximately 7000 vehicles travel on U.S. 29 between South Carolina 329 and South Carolina 5, and a maximum of approximately 5600 vehicles travel on South Carolina 5 between U.S. 29 and South Carolina 55. Approximately 5000 vehicles also travel along South Carolina 105 between South Carolina 211 and South Carolina 18. Approximately 1600 vehicles travel on South Carolina 329 between South Carolina 105 and U.S. 29, and approximately 425 vehicles travel on South Carolina 97 between South Carolina 5 and the York County line.

Approximately 950 vehicles travel (average per day) McKowns Mountain Road between South Carolina State Highway 105 (South Carolina 105) and the end of the road (near the Broad River) (Reference 6). McKowns Mountain Road is also known as Cherokee County Road 33 (County Rd. 33). According to the Highway Capacity Manual, the capacity of a two-lane highway is 1700 vehicles per hour for each direction of travel. The capacity is nearly independent of the directional distribution of the traffic on the facility, except that for extended lengths of two-lane highway, the capacity will not exceed 3200 vehicles per hour for both directions of travel combined (Reference 13).

Construction is expected to take place during a single 10 to 12 hour shift, with the possibility of night testing or the addition of another shift, as warranted.

A conservative estimate of 100 daily truck deliveries is assumed for this analysis with all deliveries occurring during daytime hours. It is also assumed that there is one worker per vehicle.

Because interstate and state highways are constructed to much heavier traffic loads than local roads, construction workers have a minimal impact on the interstate and state highways in the region as the additional influx of drivers is still within the design of the roadway.

Based on the size of the construction workforce and associated number of vehicles added to the roadway, the impacts from construction workers and deliveries on smaller two-lane state and county highways, and local roads, primarily McKowns Mountain Road are SMALL to

MODERATE within the immediate vicinity of the site. Potential mitigation measures include widening McKowns Mountain Road to accommodate the additional traffic, installing traffic-control lighting and directional signage, creating an additional entrance to the site to alleviate traffic at the primary plant entrance, establishing a centralized parking area away from the site and shuttling construction workers to and from the site, encouraging carpooling, and staggering shifts to avoid traditional traffic congestion time periods.

4.4.1.4 Impacts to Aesthetics

The locations of parks and reservoirs in the region are described in Subsection 2.2.1.2. Because the area is bounded by woods and water features, mainly plant employees and recreational sportsmen utilizing the Broad River and Ninety-Nine Islands Reservoir (directly adjacent to Lee Nuclear Site) have visual access to nearby plant construction.

Section 3.1 describes construction materials which ultimately lessen the visual impact of the site on the vicinity. The tallest structures on-site during the construction period are expected to be the MET tower and cranes used for construction of the facilities. As these structures primarily consist of iron framework, they carry a lower visual weight than the reactor domes, which will be the most visible structures on-site as the Lee Nuclear Station nears completion.

As the viewshed analysis in Subsection 2.2.1 states, the Lee Nuclear Station uses short and compact mechanical-draft cooling towers that are expected to have minimal effects on local viewsheds. Towards the end of construction, the most visible structures on the site are the reactor domes at 180.5 feet (ft.) above ground level, which is set in place towards the end of the construction period. The reactor domes at the Lee Nuclear Station are most visible from local parks in Gaffney, South Carolina, King's Mountain State Park (7.8 mi. northeast), Cowpens National Battlefield (located in Chesnee, South Carolina), and Croft State Park (located in Spartanburg, South Carolina). Because the visual effects are inversely proportional to distance, the effects of the reactor domes on the remaining regional parks are minimal.

Figure 4.4-1 illustrates the visual effect of the reactor domes as a function of distance and angle of vision occupied by the domes. As the distance from the domes increases, the angle of vision occupied by the domes decreases significantly. Most of the parks in the region are located more than 25 mi. from the site. Although the reactor domes may be visible at that distance, they occupy less than one-fifth of a degree of vision.

The impact of construction at the Lee Nuclear Site on aesthetics and recreational opportunities is expected to be SMALL and requires no mitigation efforts.

4.4.1.5 Noise Impacts

The potential effects of noise from the Lee Nuclear Site construction have been analyzed by projecting noise levels at the site and vicinity from various construction-related sources. Projected levels are compared to ambient measurements described in Subsection 2.5.5, as well as to federal noise level guidelines. The results of these comparisons are then used to determine the magnitude of noise impacts at the various receptors identified in Subsection 2.5.5.

The U.S. Department of Housing and Urban Development (HUD) has established noise impact guidelines for residential areas based on day-night average sound levels (Ldn) (Reference 1). Some states and municipalities have established noise-control regulations or zoning ordinances that specify acceptable noise levels. The State of South Carolina and Cherokee County have not developed a noise regulation that specifies the community noise levels that are acceptable.

Ldn is a special version of equivalent sound levels (Leq) and is the most common measure of environmental noise levels. The Ldn is valid for a 24-hour period and is computed the same as a 24-hour Leq except that the prevailing sound level in the calculation has a 10-decibel (dB) penalty added between the hours of 2000 and 0700. Noise impacts for the Lee Nuclear Station are assessed using the Ldn of 60 – 65 A-weighted decibels (dBA, indicating attenuated noise level) as the level below which noise levels would be considered acceptable for residential and outdoor recreational uses. A 2-dBA increase would be considered a "substantial" increase in noise (Reference 1). As described in Section 4.3.7 of NUREG-1437, noise levels below 60 – 65 dBA are considered to be of small significance.

Typical construction noise is generated by internal combustion engines (e.g., front-end loaders, tractors, scrapers/graders, heavy trucks, cranes, concrete pumps, generators), impact equipment (e.g., pneumatic equipment, jack hammers, pile drivers) and other equipment such as vibrators and saws. The amount of impact construction noise has on the surrounding environment depends on numerous factors including sound intensity, frequency, duration, location on site, the number of noise sources, time of day, weather conditions, wind direction, and time of year.

Nuisance noise can be caused by the operation of heavy equipment, particularly vehicle and machine backup alarms. Equipment noise can also be categorized as being either continuous or impulse in nature. Stationary equipment is considered to operate in one location for one or more days at a time; pumps, generators, compressors, screens, are typical examples of stationary equipment. In addition, pile drivers and pavement breakers are sometimes categorized as stationary equipment. Mobile equipment includes machinery that performs cyclic processes, such as bulldozers, scrapers, loaders, and haul trucks. The equipment type, age, specific model, and condition, as well as the operation performed all influence the level of noise produced by the equipment. Because of design improvements and technological advances, new machines have been quieted for many situations. Newer equipment is noticeably quieter than older models due primarily to better engine mufflers, refinements in fan design, and improved hydraulic systems (Reference 8).

Many noise studies utilize noise levels based upon limited available data samples and documentation collected more than 30 years ago (Reference 5). Noise levels as generated by typical equipment are shown in Table 4.4-1. This information is being utilized to illustrate a worst-case scenario.

Attenuated noise levels (dBA) calculated in Table 4.4-1 are considered maximum noise levels. Construction equipment does not operate at maximum levels continuously; therefore actual noise levels are expected to be less than those predicted at the fence line. Utilization of modern equipment, mufflers, hydraulic systems, etc., reduces these noise levels further. For the majority of the construction activities, noise levels are considered to be comparable to or below the background levels (50 – 55 dBA) and below the 60 – 65 dBA classification of acceptable noise levels by HUD at each of the receptors.

Nearby locations with potential sensitivity to noise were identified from the site reconnaissance conducted in 2006. Sensitive receptors near the site, shown on Figure 2.5-26, include:

- The family cemeteries (locations 1 – 4) and church cemetery (location 10).
- The nearest residences (location 15).
- The nearest business (a hydroelectric power plant - location 14).
- The nearest churches (McKowns Mountain Baptist Church – location 10, Nazareth Baptist Church – location 11, Mt Ararat Baptist Church – located out of range of Figure 2.5-26, approximately 12,548 ft. from the potential noise source, Church of God – located out of range of Figure 2.5-26, approximately 10,529 ft. from the potential noise source, and Sardis Church – location 17).
- An elementary school (located to the northwest, out of range of Figure 2.5-26, approximately 20,200 feet from potential noise source).
- A hospital located out of range of Figure 2.5-26, in the town of Gaffney, South Carolina (approximately 8 mi. northwest of the site).
- Recreation locations including a small boat ramp and fishing area (location 7).

Sensitive receptors located within the property line of the Lee Nuclear Site included the four family cemeteries, wildlife, and migratory birds. The nearby residences are southeast and south of the property boundary.

Those construction activities that generate noise above 60 – 65 dBA levels at the nearest residence (location 15) and beyond the fence line would be temporary, and in most instances would not affect receptors beyond the fence line. Most of the construction at the Lee Nuclear Site is well beyond 2000 ft. from the nearest residence. The two eastern historic family cemeteries (locations 1 and 2) may be affected by construction noise. Recreational activities (boating and fishing) on the Broad River may be affected by construction noise, mostly along the northern property line. Altering terrain during construction activities in these locations could increase or decrease impact noise levels at these receptors. Generally, most construction activities would occur during normal daylight hours between 0700 and 1700. There are occasions when construction activities must be scheduled during night-time hours. Typical instances include continuous concrete pours to insure homogeneity and strength of the structures. At these times the noise level remains upwards of 60 – 90 dB at a distance of 100 ft. from the equipment (References 3 and 5).

Sensitive receptors (excluding the western cemetery, location 4 on Figure 2.5-26) are not located within the fence line of the facility. Unusual noise due to construction activities may be necessary, such as steam blows, blasting, and testing of emergency warning siren, and could result in temporarily excessive noise levels. Based upon the projected noise levels at various site and vicinity receptors, noise impacts from the Lee Nuclear Site construction are SMALL.

According to the 2006 U.S. Department of Transportation (DOT) National Transportation Atlas Databases, an abandoned railroad spur connects the site to the main line running through Gaffney, South Carolina. Although this line is considered abandoned by the DOT, the tracks have physically been removed and only the berm remains. Duke Energy plans to reactivate this spur prior to station construction. The railroad is used frequently during construction activities. Therefore, railroad noise impact on the surrounding community is considered to be of MODERATE significance. Potential mitigation measures include operating the railroad during day time hours and limiting the speed of the trains.

4.4.1.5.1 Transmission Line Noise Due to Construction

New transmission line construction is required for the Lee Nuclear Station. Construction activities associated with this work include the use of heavy equipment for clearing and excavation as well as concrete batching, welding and crane operation. Noise associated with this construction is expected to be typical of similar construction activities which are quantified in Table 4.4-1. Transmission line corridor construction would generally have a shorter duration at each location along the corridor and be a substantial distance from most receptors (1500 ft. corridors with a minimum right of way of 150 ft.). Table 4.4-1 describes typical construction noise sources and the attenuation expected with distance. This table does not take into consideration noise attenuation due to foliage, ground cover, earthen berms, elevations, etc. that would attenuate the noise further. Table 4.4-1 also indicates the maximum noise level. Very few construction activities require equipment to operate at 100 percent for the full shift, therefore these levels would be a worst case scenario. Noise produced by construction and improvement of transmission line towers, transmission lines, and corridors is temporary. To date, transmission line corridors have not been finalized, therefore specific locations cannot be determined. However, the impact to any specific area will gradually increase, concentrate for a period of weeks and then diminish as construction moves away from any particular location. However, important habitats, recreational areas and other sensitive areas are avoided to the extent possible during the route selection; therefore, impacts due to transmission line construction will be SMALL to surrounding communities.

4.4.1.5.2 Traffic Noise Due to Construction

Noise analysis was conducted related to traffic noise along the access road to the Lee Nuclear Site, McKowns Mountain Road and the connecting highways (described in Subsection 2.5.2.2.1). Analysis consisted of sound level measurements, current traffic counts, predicted traffic counts and the United States Department of Transportation Federal Highway Administration Traffic Noise Model 2.5 (FHTA TNM 2.5). Current traffic counts average 950 vehicles per day along McKowns Mountain road between highway 105 and the end of the road (Broad River). Construction workforce traffic and especially the delivery of heavy equipment are likely to temporarily impose noise impacts to receptors along McKowns Mountain Road during the construction period. Receptors include residences and churches along McKowns Mountain Road. McKowns Mountain Baptist Church (location 10, Figure 2.5-26) is the closest receptor to the road and entrance of the Lee Nuclear Site. Current peak traffic noise measured at McKowns Mountain Baptist Church was 69 dBA (Table 5.8-1).

Much of the traffic during the construction period occurs at the beginning and end of the work day. Traffic noise during the peak hours is noticeable at the nearby residences and churches. Truck traffic would be the most bothersome and approaches levels of 70 - 90 dBA at 50 ft. from the road at 55 miles per hour (DOT FHWA Traffic Noise Analysis and Abatement Policy and Guidance). During peak hours (beginning and end of 10 hour work shift, and assuming maximum number of peak construction vehicles), noise levels at McKowns Mountain Baptist Church could approach 75 dBA (Leq 1 hour) at 55 miles per hour. Since McKowns Mountain Baptist Church is near the entrance of the Lee Nuclear Site, construction vehicle speeds will be reduced, therefore reducing the noise impact to McKowns Mountain Baptist Church and near by residences. By limiting the speed to 30 miles per hour at the plant entrance, for example, would lower the noise impact to McKowns Mountain Baptist Church to near current peak traffic noise levels of 69 dBA.

Noise impacts along highways in the area are likely to increase slightly because the highways are utilized by tractor trailers, machinery transports, automobiles, etc., during the construction period. Construction workers and deliveries could have a MODERATE to LARGE noise impact, primarily on the residences, churches, and businesses along McKowns Mountain Road and the smaller feeder roads.

Potential mitigation measures include widening McKowns Mountain Road to accommodate the additional traffic, creating an additional entrance for heavy truck deliveries to the site to alleviate traffic at the primary plant entrance, utilizing the rail spur for larger deliveries, establishing a centralized parking area away from the site and shuttling construction workers to and from the site, encouraging carpools, staggering shifts so they do not coincide with traditional traffic congestion times, and limiting speeds along McKowns Mountain Road.

4.4.1.5.3 Noise Impacts to Construction Workers at the Lee Nuclear Site

Occupational noise exposures are regulated by the Occupational Safety and Health Administration (OSHA) to protect the hearing of construction workers through the use of hearing protection, engineering controls and administrative controls. Compliance with OSHA regulations and guidelines for worker safety will be diligent and exposure to noise will be limited to the extent possible.

4.4.1.6 Impacts to Air Quality

Regional air quality, including SCDHEC air quality standards, is discussed in Subsection 2.7.1.2.6. Areas having air quality that is worse than the National Ambient Air Quality Standards (NAAQS) are designated by the U.S. Environmental Protection Agency (EPA) as non-attainment areas. The Lee Nuclear Site is not located in a non-attainment area. The nearest non-attainment area to Lee Nuclear Site is Spartanburg County, South Carolina, a non-attainment area under the 8-hour ozone standard.

Temporary and minor impacts to local ambient air quality could occur as a result of normal construction activities. Fugitive dust and fine particulate matter emissions, including those less than 10 microns in size (PM10), are generated during earth-moving and material-handling activities. Construction equipment and off-site vehicles used for hauling debris, equipment, and supplies also produce emissions. The pollutants of primary concern include PM10 fugitive dust, reactive organic gases, oxides of nitrogen, carbon monoxide, and, to a lesser extent, sulfur dioxides. Variables affecting construction emissions (e.g., type of construction vehicles, timing and phasing of construction activities, and haul routes) cannot be accurately determined until the project is initiated. Actual construction-related emissions cannot be effectively quantified before the project begins. General estimates are available, however, and the impacts on air quality can be minimized by compliance with all federal, state, and local regulations that govern construction activities and emissions from construction vehicles (Reference 12).

Additional air quality impacts would be expected from a concrete batch plant operating during construction. A concrete batch plant requires an air permit to operate, and normally the operator or contractor is required to provide that permit. The air quality concern from the concrete batch plant would be particulates. Particulates are a concern when loading dry concrete and aggregate into the system, but once the water is added into the drum mix, particulates are no longer emitted. Air quality issues from the concrete batch plant operation would be minimal using particulate controls that are required by the state of South Carolina Department of Health and Environmental Control (SCDHEC), General Conditional Major Operating Permit (GCMP-04). The Nuclear Energy Institute estimates an average of 460,000 cu. yd. of concrete is necessary for nuclear power plant construction. This number was derived based on four different reactor models including AP1000. Based on this number, an estimated potential to emit for particulate at 10 microns (PM10) would be 53 tons, which would qualify the concrete batch plant as a Minor Source under the SDCHEC regulations. Because a concrete batch plant qualifies as a Minor Source of particulate emissions under both the U.S. Environmental Protection Agency and SCDHEC regulations, the offsite air quality impact is projected to be SMALL.

Specific mitigation measures to control fugitive dust are identified in a dust control plan, or similar document, prepared prior to project construction. These mitigation measures could include any or all of the following:

- Stabilize construction roads and spoil piles.
- Limit speeds on unpaved construction roads.
- Routinely water unpaved construction roads to control dust.
- Perform housekeeping (e.g., remove dirt spilled onto paved roads).
- Cover haul trucks when loaded or unloaded.
- Minimize material handling (e.g., drop heights, double handling).
- Cease grading and excavation activities during high winds and during extreme air pollution episodes.
- Phase grading to minimize the area of disturbed soils.
- Use temporary or permanent vegetation on road medians and slopes.

While emissions from construction activities and equipment are unavoidable, a mitigation plan minimizes impacts to local ambient air quality and the nuisance impacts to the public in proximity to the project. A possible mitigation plan includes:

- Phase construction to minimize daily emissions.
- Perform proper maintenance of construction vehicles to maximize efficiency and minimize emissions.

Because construction at the Lee Nuclear Site does not involve significant rough grading activities, impacts to air quality from construction are SMALL with the above measures and do not warrant mitigation beyond these measures.

4.4.2 SOCIAL AND ECONOMIC IMPACTS

This subsection evaluates the demographic, economic, infrastructure, and community impacts to the vicinity and region as a result of constructing two Westinghouse AP1000 nuclear units at the Lee Nuclear Site. The evaluation assesses impacts of construction-related activities and an in-migrating construction workforce on population, regional labor, tax revenues, infrastructure and community services, housing, education, and recreational activities within the vicinity and region.

4.4.2.1 Demography

Population estimates and projections for the region are discussed in Subsection 2.5.1.

Industry, heavy construction, and unemployment numbers are discussed in Subsection 2.5.2.

During peak construction, there are 4512 total on-site workers. Figure 4.4-2 illustrates the temporal distribution of workers for construction of the new units. Some of the different trade skills represented in the labor pool include electrical workers, welders, pipe fitters, etc. To ensure the necessary labor pool is available, as the demand for workers increases, construction companies recruit employees from local technical school programs and work with school administrators to build up curriculum in the necessary labor trade areas. National labor trade union organizers, such as the American Federation of Labor, have made it a high priority to train new entrants in the construction industry as the need for labor ramps up. In addition, local recruiting of craft personnel, supplemental skills training, attractive compensation packages, and use of specialty contractors are expected to mitigate competition for craft workers between industries.

Current employment levels in the construction industry in both North and South Carolina saw significant growth between 1997 and 2002, particularly in South Carolina which saw more than a 140 percent increase in the number of heavy construction workers (see Subsection 2.5.2.1). There are large pools of construction workers in nearby Charlotte, North Carolina and Spartanburg, South Carolina. Of the current pool of construction workers located in Spartanburg, Greenville, and Charlotte, approximately 20 percent (or 8776 workers) are estimated to have industrial construction experience (Reference 13). Based on experience with large construction projects in the region, it is assumed that 30 percent of the construction workforce come from within the existing local/regional industry and the other 70 percent migrate into the region, and that 25 percent of the construction workforce that in-migrate brings a family. In 2000, the average family size in the United States was 3.18 people. To be conservative, an average household size of four was used to estimate the increase in population in the 50-mi. region. With a total on-site workforce of 4512, the population within the region increases by 5552 people (one-quarter of 70 percent of the 4398 construction workers plus 36 percent of the 114 operation workers, multiplied by household size of four, plus the number of individuals moving to the region without families). In 2005, Cherokee County and York County estimated populations were 53,844 and 190,097, respectively. Projected population levels for Cherokee and York counties in 2015 are 60,590 and 214,000, respectively, based on a growth rate similar to that between 2000 and 2005. It is assumed that 50 percent of in-migrating on-site workers would settle in Cherokee County and 50 percent would settle in York County. Cherokee County offers a location closer to the site, but York County offers more amenities including, but not limited to, schools with higher national test scores and convenient shopping. The influx of on-site workers and families during peak construction would likely represent a 4.5 percent increase in population in Cherokee County and a 1.3 percent increase in population in York County. Therefore on-site workers and their families represent a very small percent of the existing county populations and the impact is anticipated to be SMALL.

4.4.2.2 Economy

The economy of the region surrounding the Lee Nuclear Site, including industry, workforce, unemployment, and future economic outlook, is described in Subsection 2.5.2.

The in-migration of construction workers is likely to create new indirect service jobs in the area and increases the amount of money used to purchase goods and services. The U.S. Department of Commerce Bureau of Economic Analysis, Economics and Statistics Division provides multipliers for industry jobs, earnings, and expenditures. The economic model used is the regional input-output modeling system (RIMS II). This model is based on benchmark national input/output multipliers and incorporates buying and selling linkages among regional industries to create multipliers for both jobs and monetary expenditures. The resulting multipliers were used to estimate the number of indirect jobs and expenditure of money in Cherokee and York counties. For every construction worker, an estimated additional 0.455 indirect job is created in the two counties (Table 4.4-2) (Reference 2).

The expenditures of the peak construction workforce in the region for shelter, food, and services could, through the multiplier effect of expenditures, create a number of new jobs. Duke Energy estimates that an in-migrating workforce of 3120 (70 percent of 4398 construction workers plus 36 percent of 114 operation workers) would create 1424 new jobs in the region. Because most indirect jobs are service-related and not highly specialized, it is assumed that most, if not all, indirect jobs are filled by the existing workforce within the 50-mi. region. Any permanent effects are discussed in Chapter 5.

In the year 2004, there were 2253 people unemployed in Cherokee County, and 6735 people unemployed in York County. Some or all of the indirect jobs created by the construction workforce are expected to be filled by unemployed workers in these counties. The money spent in the local area by these new workers, their families, and the newly employed persons in each county add to the economy of the area.

According to the Nuclear Energy Institute, the following quantities of bulk materials are required to construct an average nuclear power plant: 460,000 cubic yards of concrete; 46,000 tons (T.) of reinforcing steel and embedded parts; 25,000 T. of structural steel, miscellaneous steel, and decking; 26,000 ft. of large-bore pipe and 43,000 ft. of small-bore pipe; 220,000 ft. of cable tray; and 1.2 million ft. of conduit (Reference 15). Other materials for construction of the Lee Nuclear Station would include asphalt for paving, lumber, quarried rock, gravel, fencing, electrical supplies, plumbing supplies, and roofing. Some of these materials are expected to be purchased locally.

At this time, annual expenditures within the region for materials and services during construction of Lee Nuclear Site are not known.

When comparing the influx of construction workers with the relatively small population of the vicinity, the increase in expenditures and benefits is significant. When comparing the influx of construction workers with the larger population of the region, the increase in expenditures and benefits is proportionally smaller. Expenditures and benefits include the creation of jobs, employee purchasing, and increased tax revenues. Thus the impacts from plant construction employees are considered a MODERATE to LARGE beneficial impact in the vicinity and a SMALL beneficial impact in the region.

4.4.2.2.1 Regional Taxes and Political Structure

Regional taxes and the political structure within the Lee Nuclear Site region are discussed in Subsection 2.5.2.3. Several types of taxes are generated by construction activities and purchases, and by site workforce expenditures. These would include income taxes on corporate profits, wages, and salaries; sales and use taxes on corporate and employee purchases; and personal property taxes associated with employees. No property taxes related to the Lee Nuclear Station are expected to be collected during construction. Duke Energy and Cherokee County have an agreement for payments made in lieu of taxes; however, those payments start at the beginning of operation and are discussed in Subsection 5.8.2.2.1.

The increase in collected taxes is viewed as a benefit to the state and local jurisdictions in the region. It is anticipated that the impacts of construction on the economy of the region would be beneficial and SMALL. Conversely, the impact for host Cherokee County is anticipated to be LARGE and beneficial. Therefore, no mitigation for either anticipated impact is warranted.

4.4.2.3 Infrastructure and Community Services

Local public services affected by plant construction include: education, transportation, public safety, social services, public utilities, tourism, and recreation. These are described in detail in Subsection 2.5.2. In general, impacts to each of these services from plant construction are expected to be minimal. It is likely that the percentage of construction workers, accompanied by their families, moving into the region would concentrate in several large communities with well-developed public services, such as Gaffney and York, South Carolina. This diversification of settlement would minimize the likelihood of any one community's services being overburdened. Some of the construction personnel would commute from existing homes in the region, and therefore, present no additional burden upon local public services.

The demand on potable water utilities and waste treatment increases during construction at the Lee Nuclear Site. Considering the estimated number of on-site workers with families moving into the vicinity during the peak construction phase, the population in Cherokee County increases by 4512 workers at the plant and 1216 family members (50 percent of the anticipated 2432 in-migrating worker family members are expected to settle in Cherokee County, and 50 percent are expected to settle in York County). The county currently consumes 8 million gallons per day (Mgd) for use compared to a plant capacity of 18 Mgd. It is anticipated that the average per capita amount of water consumed per day is 90 gallons per day (gpd), which accounts for an overall increase in consumption of 515,520 gpd from the additional population; this equates approximately to a 6.4 percent increase over current consumption during peak construction. Therefore, the increase in consumption due to the construction workforce and their families would not exceed the current plant capacity. Potable water capacity within Cherokee County, South Carolina increases to 18 Mgd when the Cherokee Water Plant returns to operation. In York County, South Carolina, the largest provider of potable water is the City of Rock Hill with a capacity of 26 Mgd and current utilization of approximately 84 percent.

There are two wastewater treatment facilities in Cherokee County, South Carolina with a combined maximum capacity of 9 Mgd. Currently one plant is operating at 60 percent capacity

(Clay Wastewater Treatment Plant) and one plant is operating at 40 percent capacity (Broad River Wastewater Treatment Plant). As a conservative estimate, it is assumed that the entire 515,520 gpd produced by the increase in population are to be processed through the wastewater treatment plants. Based on the total combined capacity of 9 Mgd, the two plants have sufficient capacity to take an increase of 515,520 gpd for treatment through these facilities. In addition, three wastewater treatment plants in York County, South Carolina, have a combined capacity of 24 Mgd (Reference 11). Therefore, the wastewater treatment plants could accommodate the expected increase in population.

The impacts of water treatment services due to increased population are expected to be SMALL, with no mitigation required.

Potable water for construction is provided by the Draytonville Water District (which purchases its water supply from the Gaffney Board of Public Works, South Carolina). Wastewater treatment is provided by the Gaffney Board of Public Works. The physical impacts of onsite construction activity on water treatment services is expected to be SMALL to MODERATE.

During the peak construction phase, 5552 total in-migrating workers and family members are expected to move into the region, with 50 percent, or 2776 people, expected to reside in Cherokee County and the other 50 percent, or 2776 people, expected to reside in York County. There are 105 police officers and 350 firefighters in Cherokee County, South Carolina, and 263 police officers and 688 firefighters in York County, South Carolina. Based on 2005 county population estimates, the ratio of current residents to police officers in Cherokee County, South Carolina is 513:1 and the firefighter ratio is 154:1. The ratio of current residents to police officers in York County, South Carolina, is approximately 721:1 and the firefighter ratio is 276:1. Based on the projected increase in county population by 2015, and in-migrating construction and operations workers with families, the resident-to-firefighter ratios would become 181:1 and 315:1 in Cherokee and York counties, respectively. The resident-to-police officer ratios would become 603:1 and 825:1 in Cherokee and York counties, respectively. Although these ratios increase during the construction of the Lee Nuclear Station, the increases would only be short term.

According to the U.S. military, the proper ratio of police officers to population is somewhere between 1 and 4 officers per 1000 citizens (between 1000:1 and 250:1), with cities needing higher levels than other areas. The U.S. currently has approximately 2.3 police officers per 1000 residents (Reference 14). With the increase in residents in Cherokee and York counties, the number of police officers to residents is still within acceptable levels.

The Draytonville-McKowns Mountain-Wilkinsville Volunteer Fire Department will respond to fires on-site during the construction period. Prior to nuclear fuel receipt, toward the end of the construction period, an on-site fire brigade is expected to be in place. This on-site fire brigade augments the capabilities that Draytonville Volunteer Fire Department provides.

The impacts of on-site construction activity on local police and firefighters are expected to be SMALL and offset by increased tax revenue, allowing more police and firefighters to be hired in the respective jurisdictions as warranted.

Cherokee County, South Carolina, is home to only one hospital, Upstate Carolina Medical Center. Upstate Carolina Medical Center, located in Gaffney, South Carolina, contains 125 beds with nearly 100 medical staff members (Reference 7). There are no medical facilities in York County within 10 mi. of the Lee Nuclear Site. Lee Nuclear Station employs its own on-site emergency first-aid and medical services. Social services such as Medicaid and welfare are funded through the federal and state governments. The construction boom due to Lee Nuclear Station should not have an impact on these social services.

The impacts of on-site construction activity on local medical services are expected to be SMALL but temporary, and require no mitigation.

Traffic counts for roads within the vicinity of the site are discussed in Subsection 2.5.2.2.3. Effects of construction on transportation are discussed in Subsection 4.4.1.3. Effects of construction on education are discussed Subsection 4.4.2.5.

4.4.2.4 Housing

Regional housing availability is described in Subsection 2.5.2.6. It is not known where Lee Nuclear Site construction workers reside. A conservative assumption is used that the majority of Lee Nuclear Site construction employees live in Cherokee and York counties, South Carolina. However, a few may opt to live in some of the surrounding counties.

Because construction of Lee Nuclear Site is not a permanent condition, during the peak construction phase it is probable that not all construction workers move into the region and need housing. Cherokee and York counties have a total of 6915 vacant housing units, with 1376 and 2059 available for sale or rent, respectively. For this analysis, a conservative assumption is made that all 3079 in-migrating construction workers (or 70 percent of the total anticipated workers) and 41 in-migrating operation workers (or 36 percent of total operations workers) need housing during the peak construction phase, thus one housing unit per on-site worker is required for a total of 3120 units. Table 4.4-3 describes household growth trends in Cherokee and York counties, and Table 2.5-18 shows housing unit ages by decade for communities in the vicinity.

Land-use planning and zoning laws within site and vicinity are described in Subsection 2.2.1. Land-use effects from construction of the Lee Nuclear Station are described in Subsection 4.1.1.

Due to the availability of housing for sale or rent and the presence of recreational vehicle parks, the impact of the construction of Lee Nuclear Station on local housing is expected to be MODERATE to LARGE in Cherokee and York counties, South Carolina.

Possible mitigation of the MODERATE to LARGE impacts from housing construction workers would most likely be market driven. Because site construction occupies a limited time span, mitigation measures such as temporary housing arrangements in hotels and motels, trailer homes, and recreational vehicle parks could be used. This may cause competition with recreational users; however, temporary housing is a market-driven industry that adjusts with new facilities to compensate for the demand.

4.4.2.5 Education

A detailed description of the Lee Nuclear Site regional public education system is described in Subsection 2.5.2.8.

At peak construction it is estimated that 3120 on-site workers and their families in-migrate into the region, resulting in an estimated total of 5552 people (one-quarter of 70 percent of the 4398 construction workers plus 36 percent of the 114 operation workers, multiplied by a household size of four, plus the number of individuals moving to the region without families). According to the 2005 Census estimate, Cherokee and York counties' percentages of children between the ages of 5 and 18 are 19 and 18 percent, respectively (Reference 4). Applying the same percentage to the total in-migrating population, the anticipated school-age population derived from the construction family total is 1027 (5552 multiplied by the average of 18.5 percent based on total population). It is assumed that 50 percent of the in-migrants settle in Cherokee County and 50 percent settle in York County. It is anticipated that with the in-migration of construction workers, the public school student population in Cherokee County increases by 5.5 percent. The number of students attending public schools in York County increases by approximately 1.5 percent (see Subsection 2.5.2.8.2 for base student population counts per county). Currently there are 43,983 school-age students in York and Cherokee counties. For the combined school districts of Cherokee and York counties, this represents a 2.3 percent change in student population.

The impacts of construction on the educational systems of Cherokee County, South Carolina, is expected to be MODERATE but temporary, depending on the speed with which current school district expansion plans are implemented, as described in Subsection 2.5.2.8. Possible mitigation measures for the MODERATE impacts would include hiring additional teachers (current student-to-teacher ratio is 14:1) and purchasing modular classrooms, as needed. In the long run, the costs of providing education for additional students should be offset by the increase in tax revenue generated by the plant. The impacts on education in York County, South Carolina, are expected to be SMALL. Officials with Cherokee County Public Schools have indicated that the school system is capable of handling the influx of students generated by the anticipated construction workforce. York County officials for the two school districts most likely to be affected indicated that additional facilities are needed to accommodate the influx of students. However, given enough lead time, arrangements can be made to increase capacity for the incoming students.

4.4.2.6 Recreation

Hunting, fishing, and wildlife watching in the portions of North Carolina and South Carolina included in the region are an important recreational pastime. Other recreational opportunities in the region include local, state, and national parks visitation, outlet shopping, and special events. Local tourism and recreation is described further in Section 2.5.2.5.

Because the nearest park to the Lee Nuclear Site is Kings Mountain State Park, approximately 7.8 mi. northeast, and the largest shopping draw in the region is the Prime Outlets at Gaffney, South Carolina, more than 5 miles from the site, the impacts of construction on recreation would be SMALL and require no mitigation.

4.4.3 ENVIRONMENTAL JUSTICE IMPACTS

Executive Order 12898 (Reference 9) directs federal executive agencies to consider environmental justice under the National Environmental Policy Act (Reference 10). This Executive Order ensures that minority and/or low-income populations do not bear a disproportionate share of adverse health or environmental consequences of a proposed project, such as the Lee Nuclear Station.

Subsection 2.5.4 describes the evaluation process used to identify minority and low-income populations living within the region that meet the conditions associated with the NRC guidance.

Tables 2.5-23 and 2.5-24, and Figures 2.5-6, 2.5-7, 2.5-8, 2.5-9, 2.5-10, 2.5-11, 2.5-12, 2.5-13, 2.5-14, 2.5-15, 2.5-16, 2.5-17, 2.5-18, 2.5-19, 2.5-20, 2.5-21, 2.5-22, 2.5-23, 2.5-24, and 2.5-25 identify census blocks, block groups, and relative distances of minorities and low-income populations around the Lee Nuclear Site.

In general, the spatial distribution of minority populations in the region is a gradient, increasing to the south, with clusters occurring in urban areas. Minority populations occur within the vicinity of the project site. Figure 2.5-14 and Figure 2.5-23 illustrate the distribution of all minority populations that were identified in Subsection 2.5.4. Locally, there were no minority populations identified adjacent to the site. Because the effects of construction occur primarily to the site and adjacent properties, it is anticipated that there are no disproportionate impacts on minority populations since they do not occur adjacent to or on the site.

The nearest low-income population to the site is over 15 mi. away. All of the identified low-income populations are located within or near urban areas. Because of their distance from the site and geographic location, it is anticipated that any impacts due to construction are minimal and proportionate to the majority population.

4.4.3.1 Potential Environmental Impacts

For the purposes of this environmental justice assessment, environmental impacts under consideration due to plant construction include potential impacts due to land-use, water, and ecology. Potential impacts due to land-use are discussed in detail in Section 4.1. Impacts due to water are described in Section 4.2. Ecological impacts are described in Section 4.3.

As outlined in Subsection 4.4.1.1, Lee Nuclear Site construction remains within the site boundary. Therefore most of the impacts on the population are on the properties adjacent to the site.

As discussed in Section 4.1, all of the potential land-use impacts which are confined to the site are SMALL. Because no minority and low-income populations occur on the site, the potential for disproportionately high impacts on minority and low-income populations is SMALL. No additional land must be procured beyond the current site, and no relocations to local off-site roads as a result of construction of a new facility are expected.

As described in Sections 4.2 and 4.3, all of the potential water-related and ecological effects are SMALL. Moreover, water-related and ecological impacts are confined to the site and its immediate vicinity where no minority or low-income populations occur. Therefore, the potential for disproportionately high impacts on minority and low-income populations is SMALL.

Based on input from these sections, and the minimal construction outside the Lee Nuclear Site boundary, physical impacts are expected to be SMALL. That combined with the distribution patterns, stated earlier, further imply that disproportionate impacts are minimal to minority populations and the impacts to low-income populations are SMALL. Appropriate site-specific mitigation plans are enacted.

4.4.3.2 Potential Socioeconomic Impacts

The socioeconomic effects with the greatest potential to have an impact of minorities and low-income populations are transportation, noise, and education. The remainder of the socioeconomic effects, which include housing, public safety, social services, public services, economy, and recreational resources, are SMALL or beneficial.

Transportation during construction is expected to have a SMALL to MODERATE impact on local roads including McKowns Mountain Road. The minority populations are distributed among the majority population along these routes. Therefore there are no expected disproportionate impacts on minority populations. There are no low-income populations in the vicinity; as a result, low-income populations are not disproportionately affected.

The impacts of plant construction on the housing market in Cherokee and York counties are expected to be MODERATE to LARGE based on an estimated deficit in the number of available houses. However, this effect is expected to last only during the construction phase. Based on the distribution pattern of minorities and low-income the impact of this housing deficit on minority populations is not disproportionate. However, competition for rental and temporary housing and market driven rate increases are anticipated to impact low-income populations.

This impact is reduced due to the fact that the nearest low-income populations are 15 mi. away. Using Table 2.5-1, the population at 10 mi. is 43,132 people. If all 5552 of the total site population and family members associated with the peak construction phase (one-quarter of 70 percent of the 4398 construction workers plus 36 percent of the 114 operation workers, multiplied by a household size of four, plus the number of individuals moving to the region without families) move into that radius, there would be a population increase of nearly 13 percent. Using Table 2.5-2, the next radius is 25 mi., resulting in a population increase of 1.3 percent. The number of available houses is proportional to the population. The effect on the housing market of adding population numbers to the area decreases as the distance from the site increases. Therefore, the effects are reduced at the distances that the low-income populations start to appear.

The impacts on the local education system are expected to be SMALL to MODERATE. Because these impacts affect every school in the two-county area, there are no disproportionate impacts on minority or low-income populations.

Because the remainder of the effects are small and because of the distribution of minorities and low-income populations among the majority populations in the region, disproportionate socioeconomic impacts in these categories on minority and low-income populations are SMALL.

Several positive socioeconomic impacts, principally applicable to the counties in the region, would be realized by the construction of a new facility at the Lee Nuclear Station. These are described in Subsection 4.4.2, and include increased employment opportunities, as well as possible income increases, both directly and indirectly related to plant construction.

Minority and low-income populations are distributed among the majority population and are not disproportionately impacted due to any benefits.

Based on the analysis in Subsection 2.5.4.4, no significant natural resource dependencies in any population have been identified in the region.

4.4.3.3 Transmission Corridors

At this time it is not known how the impacts of new transmission corridors affect minority and low-income populations.

4.4.3.4 Conclusion

Based upon the environmental justice analysis, impacts on minority and low-income populations within the vicinity and region are expected to be SMALL with no mitigation required.

4.4.4 REFERENCES

1. 24 CFR Part 51.103, “Criteria and Standards.”

2. U.S. Bureau of Economic Analysis, Economics and Statistics Administration, RIMS II Multipliers for the Duke, SC Region, Website, http://www.bea.gov/bea/regional/rims/, accessed May 8, 2007.

3. The Center to Protect Workers Rights (CPWR), *Construction Noise: Hazard Alert*; June 10, 2002.

4. U.S. Census Bureau, American FactFinder, Website, http://factfinder.census.gov/servlet/ACSSAFFFacts?, accessed May 2, 2007.

5. Pacific Gas & Electric Company, Diablo Canyon Steam Generation Project, *Construction Equipment Noise Ranges, City of Salinas, June 2002 and Typical Construction Equipment Noise Generation Levels*, San Francisco, CA, January 2004.

6. South Carolina Department of Transportation, “Average Daily Traffic - June 22, 2006.”

7. Health Management Associates, Inc, Upstate Carolina Medical Center, Website, http://www.hma-corp.com/sc1.html, accessed January 9, 2007.

8. U.S. Department of Transportation, Federal Highway Administration, *Effective Noise Control During Night Time Construction*, Washington, DC, 2006.

9. President William J. Clinton, “Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” February 1994.

10. National Environmental Policy Act of 1969, 41 USC 4321 et seq.

11. U.S. Environmental Protection Agency, CWNS 2000 Standard Report - Facilities in Operation - South Carolina, Website, http://cfpub.epa.gov/cwns/populationP1_00.cfm?state=South%20Carolina, accessed July 19, 2007.

12. U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, Vol. I, Stationary Point and Area Sources, Section 11.2.4 "Heavy Construction Operations," AP-42, Fourth Ed. September 1985.

13. U.S. Department of Labor, Bureau of Labor Statistics, Metropolitan Area Occupational Employment Estimates as Reported May 2006 for Spartanburg, SC, Greenville, SC, and Charlotte, NC/SC, Website, http://www.bls.gov/oes/current/oessrcma.htm, accessed August 31, 2007.

14. United States Army, Military Review, July-August, 2007, pages 110-112.

15. Nuclear Energy Institute, “What’s Needed to Build a Reactor,” *Nuclear Energy Insight*, August-September Issue, Page 5, 2007.

TABLE 4.4-1
ATTENUATED NOISE LEVELS (dBA) EXPECTED FROM CONSTRUCTION EQUIPMENT

Type of Noise Generating Equipment	Distance From Source (in feet)			
	50[a]	100	400	2000[b]
Heavy Trucks	89	83	71	57
Dump Trucks	88	82	70	56
Concrete Mixer	85	79	67	53
Jack Hammer	88	82	70	56
Scraper	89	82	71	57
Dozer	102	96	84	70
Generator	76	70	58	44
Crane	88	82	70	56
Loader	86	80	68	54
Grader	91	85	73	59
Dragline	85	79	67	53
Pile Driver	95	89	77	63
Fork Lift	95	89	77	63

Noise attenuation calculation. Initial noise level (dBA) = 20 log (d^1/ d^2) where d^1 is the original distance from the source and d^2 is the measured distance from the source.

a) Maximum Noise levels (dBA) at 50 feet, Source: Golden et al. (1980).

b) 2000 feet is the approximate minimum distance from the potential major construction activities and nearest receptor (location 15, Measurement Position Figure 2.5-26).

TABLE 4.4-2
IMPACTS OF THE ON-SITE WORKFORCE DURING PEAK CONSTRUCTION PHASE ON CHEROKEE AND YORK COUNTIES

Demographic	AP1000 2 Units
In-Migrating Construction Workforce Peak	4398
In-Migrating Operation Workforce at Peak	114
Indirect Jobs from Construction Workforce at Peak	1385
Indirect Jobs from Operation Workforce at Peak	39
Total Indirect Jobs	1424
2004 Unemployment[(a)]	
Two County Area	8988
Cherokee County	2253
York County	6735
Total Number of Indirect Jobs as a Percentage of Unemployed Population	16%
New Residents	
Region	5552
Cherokee County (50%)	2776
York County (50%)	2776

a) See Table 2.5-11

TABLE 4.4-3
TRENDS IN CHEROKEE AND YORK COUNTIES HOUSING GROWTH

CHEROKEE COUNTY HOUSING

Year	Population	Percent Change	People/yr	Households/yr
2006	53886	0.42%	225	56
2000	52537	1.53%	803	201
1990	44506			
SC Avg. Household Size			Average	128
4				

YORK COUNTY HOUSING

Year	Population	Percent Change	People/yr	Households/yr
2006	199035	2.88%	5737	1434
2000	164614	2.01%	3312	828
1990	131497			
SC Avg. Household Size			Average	1131
4				

(Reference 1 and Reference 2)

4.5 RADIATION EXPOSURE TO CONSTRUCTION WORKERS

This section evaluates the potential radiological dose impacts to construction workers at the Lee Nuclear Station resulting from the operation of the Lee Nuclear Station, Unit 1. Because a portion of the Unit 2 construction period overlaps operation of Unit 1, construction workers at Unit 2 would be exposed to direct radiation and gaseous radioactive effluents from Unit 1. Doses to construction workers during construction of Unit 1 are not evaluated because the only radiation sources prior to startup of Unit 1 are background sources.

4.5.1 SITE LAYOUT

The Lee Nuclear Station, Units 1 and 2, power block areas are shown on final safety analysis report (FSAR) Figure 2.1-201. Construction activity for Unit 2 would be outside the protected area for Unit 1 but inside the restricted area boundary.

4.5.2 RADIATION SOURCES

Construction workers at the site would not be exposed to any radiation sources until Unit 1 becomes operational. Workers constructing Unit 2 could be exposed to direct radiation, and to gaseous radioactive effluents emanating from the routine operation of Unit 1. Radiation dose to construction workers is due to direct radiation and airborne effluents from Lee Nuclear Station Unit 1 and background radiation.

The radiation exposure at the site boundary is evaluated in the Westinghouse AP 1000 design control document (DCD) Section 12.4.2. As stated in the DCD, direct radiation from the containment and other plant buildings is negligible. Additionally, there is no contribution from refueling water because the refueling water is stored inside the containment instead of in an outside storage tank.

Small quantities of monitored airborne effluents are normally released through the plant vent or the turbine building vent. The plant vent provides the release path for (1) containment venting releases, (2) auxiliary building ventilation releases, (3) annex building releases, (4) radwaste building releases, and (5) gaseous radwaste system discharge. The turbine building vents provide the release path for the (1) condenser air removal system, (2) gland seal condenser exhaust, and (3) turbine building ventilation releases. The expected radiation sources (nuclides and activities) in the gaseous effluents are listed in DCD Table 11.3-3.

Exposure of Unit 2 construction workers to radioactive liquid effluents is not evaluated because the plant discharge structure to the Broad River and the Unit 1 cooling tower blowdown piping will be completed during Unit 1 construction. The only exposure of Unit 2 construction workers to liquid effluents would be due to tie-in of the Unit 2 piping. The radiation exposure for this activity should be minimal.

The determination of construction worker doses due to Unit 1 operation depends on the airborne effluent released and the atmospheric transport to the worker location. The atmospheric dispersion calculation used the guidance provided in Regulatory Guide 1.111, meteorological data for the year 12/1/2005 through 11/30/2006, and downwind distances to the construction worker locations. The XOQDOQ computer code (NUREG/CR-2919) was used to determine the χ/Q and D/Q values for the nearest location along the Unit 1 protected area fence in each direction as well as the nearest point of the Unit 2 shield building construction area. The χ/Q and D/Q results and the distances used are given in Table 4.5-1.

The methodology used to calculate the doses to construction workers due to the normal effluent releases complies with the guidance provided in Regulatory Guide 1.109. Construction worker doses were estimated by use of the GASPAR II computer code (NUREG/CR-4653). The Total Effective Dose Equivalent (TEDE), which is the sum of the Deep Dose Equivalent (DDE) and the Committed Effective Dose Equivalent (CEDE), was determined based on the GASPAR II results. The annual TEDE dose was corrected for the actual time the construction workers will be on site by multiplying by a ratio of hours worked per year to hours in a year. The exposure pathways considered in GASPAR II are:

- External exposure to contaminated ground.
- External exposure to noble gas radionuclides in the airborne plume.
- Inhalation of air.

4.5.3 CONSTRUCTION WORKER DOSE ESTIMATES

Construction worker doses were conservatively estimated using the following information:

- The estimated maximum dose rate for each pathway.
- A construction worker exposure time of 2080 hours per year.
- A peak loading of 2100 construction workers per year for Unit 2 construction.

4.5.4 COMPLIANCE WITH DOSE RATE REGULATIONS

Lee Nuclear Station Unit 2 construction workers are, for the purposes of radiation protection, members of the general public. This means that the dose rate limits are lower than the 100 mrem/year limit to be considered a radiation worker. The construction workers (with the exception of certain specialty contractors loading fuel or using industrial radiation sources for radiography) do not deal with radiation sources.

There are three regulations that govern dose rates to members of the general public. Dose rate limits to the public are provided in 10 CFR § 20.1301, 10 CFR § 20.1302, and 10 CFR Part 50, Appendix I. The design objectives of 10 CFR Part 50, Appendix I apply relative to maintaining dose as low as reasonably achievable (ALARA) for construction workers. In addition, 40 CFR Part 190 applies as it is referred to in 10 CFR § 20.1301. The requirements of 10 CFR § 20.1201 through 20.1204 do not apply to the construction workers as they are considered members of the public and not radiation workers.

4.5.4.1 10 CFR Part 20.1301

The 10 CFR § 20.1301 limits annual doses from licensed operations to individual members of the public to 100 mrem TEDE. In addition, the dose from external sources to unrestricted areas must be less than 2 mrem in any one hour. This applies to the public both outside and within access controlled areas. Given that the relevant sources are relatively constant in time, the hourly limit is met if the annual limit is met. The maximum dose rates are given in Table 4.5-2. For an occupational year, i.e., 2080 hours on site, dose at the Unit 2 construction area would be 0.29 mrem TEDE. The use of 2080 hours assumes the worker works 40 hours per week for 52 weeks per year. The maximum dose anywhere on site that would be accessible to a construction worker would be 5.9 mrem per year in the southeast sector at the Unit 1 fence line. This assumes the worker stood at this point on the fence line for all working hours for the entire year. This value is less than the limits specified above for members of the public. Therefore, construction workers can be considered to be members of the general public for the purpose of not requiring radiation protection or monitoring.

4.5.4.2 10 CFR Part 50, Appendix I

The 10 CFR Part 50, Appendix I criteria apply only to effluents. The purpose of the criteria is to assure adequate design of effluent controls. The annual limits for liquid effluents are 3 mrem to the total body and 10 mrem to any organ. For gaseous effluents, the pertinent limits are 5 mrem to the total body and 15 mrem to organs, including skin. Table 4.5-3 shows that there is no dose rate to workers in a construction zone from effluents that exceed the Appendix I dose limits. Therefore, the criteria have been met.

4.5.4.3 40 CFR Part 190

The 40 CFR Part 190 criteria apply to annual doses, here called dose rates because the units are in mrem per year, received by members of the general public exposed to nuclear fuel cycle operations, i.e., nuclear power plants. Therefore, these regulations apply to Lee Nuclear Station Unit 2 construction workers on the plant site, just as they apply to members of the general public who live off site. The most limiting part of the regulation states “The annual dose equivalent (shall) not exceed 25 mrem (per year) to the whole body.” In the case of Lee Nuclear Station Unit 1 effluent releases, if this regulation is met for the whole body, then the thyroid and organ components will also be met.

Table 4.5-4 shows that the whole body dose rate is 0.3 mrem/2080 hours. The units are expressed to be clear that an occupancy of 2080 hours is assumed. Therefore, the requirements of 40 CFR Part 190 will be met for all construction workers.

4.5.5 COLLECTIVE DOSES TO LEE NUCLEAR STATION UNIT 2 WORKERS

The collective dose is the sum of all doses received by all workers. It is a measure of population risk. The total worker collective dose is 0.61 person-rem. This estimate is based upon the construction workforce of 2100 and assumes 2080 hours per year occupancy for each worker.

4.5.6 RADIATION PROTECTION AND ALARA PROGRAM

Due to the exposures from Lee Nuclear Station Unit 1 normal operations, there will be a radiation protection and ALARA program for Lee Nuclear Station Unit 2 construction workers. This program will meet the guidance of Regulatory Guide 8.8 to maintain individual and collective radiation exposures ALARA. This program will also meet the requirements of 10 CFR § 20.1302.

Because the construction workers are not radiation workers, but are, for the purposes of radiation protection, members of the general public, individual monitoring and training of construction workers on Lee Nuclear Station Unit 2 is not required. Construction workers will be treated, for purposes of radiation protection, as if they are members of the general public in unrestricted areas.

TABLE 4.5-1
CONSTRUCTION WORKER χ/Q AND D/Q VALUES

Location	Direction	Distance Miles	Distance Meters	χ/Q Sec/m^3	D/Q m^2
Unit1 Fence	S	0.17	267.	3.7E-05	6.5E-08
Unit1 Fence	SSW	0.14	221.	4.2E-05	8.2E-08
Unit1 Fence	SW	0.12	189.	5.7E-05	1.0E-07
Unit1 Fence	WSW	0.11	184.	6.8E-05	9.3E-08
Unit1 Fence	W	0.11	184.	7.6E-05	8.4E-08
Unit1 Fence	WNW	0.12	189.	6.7E-05	7.5E-08
Unit1 Fence	NW	0.11	170.	7.8E-05	1.1E-07
Unit1 Fence	NNW	0.10	166.	5.5E-05	1.2E-07
Unit1 Fence	N	0.10	166.	4.0E-05	1.3E-07
Unit1 Fence	NNE	0.10	166.	2.7E-05	1.4E-07
Unit1 Fence	NE	0.08	133.	3.8E-05	2.0E-07
Unit1 Fence	ENE	0.08	129.	4.1E-05	1.4E-07
Unit1 Fence	E	0.08	129.	3.5E-05	8.0E-08
Unit1 Fence	ESE	0.08	133.	1.3E-04	2.0E-07
Unit1 Fence	SE	0.10	156.	2.6E-04	3.2E-07
Unit1 Fence	SSE	0.14	230.	6.5E-05	9.3E-08
Unit 2 Shield Building	W	0.14	225.	5.3E-05	6.3E-08

NOTE:

1. Distances and directions from the plant vent to the nearest location on the Unit 1 fence in each direction and to the Unit 2 shield building construction area.

TABLE 4.5-2
CONSTRUCTION WORKER DOSE
COMPARISON TO 10 CFR 20.1301 CRITERIA

Type of Dose	Dose Limits (1) (TEDE)	Estimated Dose (2)
Annual dose	100 mrem	0.29 mrem
Maximum dose rate in any hour	2 mrem/hr	1.45E-04 mrem/hr

NOTES:

1. 10 CFR 20.1301 criteria
2. Dose at Unit 2 construction area.

DOSE RATE AT UNIT 1 FENCE LINE

DIRECTION	ANNUAL TEDE (mrem/yr)
S	0.9
SSW	1.0
SW	1.4
WSW	1.6
W	1.7
WNW	1.5
NW	1.8
NNW	1.4
N	1.1
NNE	0.8
NE	1.2
ENE	1.1
E	0.9
ESE	3.1
SE	5.9
SSE	1.5

TABLE 4.5-3
COMPARISON WITH 10 CFR PART 50 APPENDIX I, CRITERIA
FOR EFFLUENT DOSES

	Annual Dose (mrem)	
	Annual Limit (1)	**Estimated Dose (2)**
Whole body dose from liquid effluents	3 mrem	Insignificant
Organ dose from liquid effluents	10 mrem	Insignificant
Whole body dose from gaseous effluents	5 mrem	0.3
Skin dose from gaseous effluents	15 mrem	1.1
Organ dose from all effluents (thyroid)	15 mrem	0.5

NOTES:

1. 10 CFR 50, Appendix I, criteria.
2. Dose at Unit 2 construction area.

TABLE 4.5-4
COMPARISON OF CONSTRUCTION WORKER DOSE
FROM GASEOUS EFFLUENT DISCHARGES TO 40 CFR PART 190 CRITERIA

Type of Dose	Annual Dose Limits (1)	Evaluated Dose (2)
Whole body dose	25 mrem	0.3 mrem
Thyroid doses	75 mrem	0.5 mrem
Other organ doses (skin)	25 mrem	1.1 mrem

NOTES:

1. 10 CFR 20.1301 requires that the dose to an individual from radioactive effluents also meet 40 CFR 190 limits.

2. At the Unit 2 construction area.

4.6 MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING CONSTRUCTION

A modified Leopold Matrix has been constructed to assess the cause-and-effect relationships between potential environmental disturbances and the corresponding affected environmental receptors/resources (Table 4.6-1). This section is a summation of measures and controls from Sections 4.1, 4.2, 4.3, 4.4, and 4.5.

The table compares environmental disturbances versus environmental receptors (resources). The top horizontal axis on the impact matrix represents the principal environmental disturbances that could result from construction activities. The left vertical axis depicts the environmental receptors or resources that could potentially be affected by those disturbances. The table also summarizes measures and controls that have been identified for mitigating construction impacts.

The significance indicators provided in Table 4.6-1 are designated using the following descriptors: SMALL (S), MODERATE (M), or LARGE (L). The significance indicators are defined in the beginning of Chapter 4.

The assignment of significance levels (S, M, L) in Table 4.6-1 are based on the assumption that for each impact, corresponding mitigation measures and controls (or equivalents) are implemented. A blank cell in the elements column (“potential environmental impacts”) denotes “no impact” of that type on the environmental resource.

Each “Effect Description or Activity” attribute is assigned a number. Similarly, each “Specific Measures and Controls” attribute is assigned a number in which corresponds to the “Effect Description or Activity.”

The measures and controls described previously and in Table 4.6-1 are considered reasonable from a practical, engineering, and economic view. They are based on statutes and regulatory requirements, or they are accepted practices within the construction industry. Therefore these controls and measures are not expected to present an unreasonable or undue hardship on Duke Energy.

Based on a review of the construction impacts described in this chapter, applicable measures and controls for reducing these impacts at the Lee Nuclear Station include:

- The completion of Phase I archaeological survey was performed to clearly identified areas of interest or concerns.
- The completion ecological surveys to characterize local terrestrial and aquatic ecosystems.
- The completion of planning and engineering studies to determine how best to locate and construct infrastructure facilities (parking lots, storage facilities, office buildings, roads, etc.) so as to reduce construction impacts.
- Geologic borings, soil tests, and groundwater well data are used in combination with the planning and engineering studies to develop a stormwater pollution prevention plan in accordance with SC DHEC NPDES stormwater permit.

- Fugitive dust emissions are suppressed by spraying water on excavated soil.
- Construction is conducted in compliance with U.S. Occupational Safety and Health Administration regulations and SC Occupational Safety and Health regulations.
- Material safety data sheets are required for use of applicable hazardous materials at the Lee Nuclear Station. Construction employees are trained in the appropriate use of hazardous materials. Hazardous materials are used in accordance with applicable federal, state, and local laws and regulations.
- Hazardous wastes are treated, stored, and disposed of in accordance with the Resource Conservation and Recovery Act (RCRA) (Reference 1), and any other applicable federal, state, and local laws and regulations. Construction employees are trained in the appropriate handling and disposal of hazardous wastes.
- Construction activities are performed in accordance with applicable local, state, and federal ordinances, laws, and regulations intended to prevent or minimize adverse environmental effects of construction activities on air, water, and land, and on workers and the public.
- Pertinent construction permits and environmental requirements are included in construction contracts.

4.6.1 REFERENCES

1. Resource Conservation and Recovery Act, 42 USC 6901 et seq.
2. Federal Water Pollution Control Amendments of 1977 (Clean Water Act), 33 USC 1251 et seq.

TABLE 4.6-1 (Sheet 1 of 5)
SUMMARY OF MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING CONSTRUCTION

Section Reference		Potential Environmental Impacts[(a)] [(b)]													Effect Description or Activity	Specific Measures and Controls
		Noise	Erosion	Air and Dust Emissions	Traffic	Effluents and Wastes	Surface-Water Impacts	Groundwater Impacts	Land Use, protection/restoration	Water Use, protection/restoration	Terrestrial Ecosystem Impacts	Aquatic Ecosystem Impacts	Socioeconomic Impacts	Radiation Exposure to Construction Workforce		
4.1	**Land-Use Impacts**															
4.1.1	The Site and Vicinity		S						S						1. Ground-disturbing activities, including grading and re-contouring. 2. Construction of new buildings and impervious surfaces. 3. Removal of existing vegetation. 4. Use of hazardous materials. 5. Stockpiling of soils.	(1 and 2) Limit ground disturbances to the smallest amount of area necessary to construct and maintain the plants. (1 and 2) Avoid wetlands when possible. (1 and 2) Ground disturbing activities are performed in accordance with South Carolina Department of Health and Environmental Control (SCDHEC) stormwater permit requirements. Use erosion control and stabilization measurements to minimize impacts. (1, 2, and 3) Limit vegetation removal to the area designated for construction activities. (4) Minimize potential spills of hazardous wastes/materials through training and rigorous compliance with applicable regulations. (5) Restrict soil stockpiling and reuse to designated areas on the Lee Nuclear Site.
4.1.2	Transmission Corridors and Off-site Areas		S								S				1. Construction of transmission line in new corridor.	(1) Site new corridor to avoid critical or sensitive habitat or species and avoid wetlands. (1) Limit vegetation removal and construction to defined corridors during fall and winter to avoid nesting activities. (1) Minimize potential impacts via avoidance and compliance with permitting requirements and best management practices.
4.1.3	Historic Properties		S						S						1. Erosion and ground-disturbing activities including grading and re-contouring, and construction of new transmission lines that could effect cultural resources.	(1) Conduct cultural resource surveys, including subsurface sampling prior to initiating ground disturbing activities to identify buried historic, cultural, or paleontological resources. (1) Consult with State Historic Preservation Office if a cultural resource is discovered. (1) Establish Duke Energy procedures to halt work if a potential historic, cultural or paleontological resource is discovered.

TABLE 4.6-1 (Sheet 2 of 5)
SUMMARY OF MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING CONSTRUCTION

Section Reference		Potential Environmental Impacts[a] [b]													Effect Description or Activity	Specific Measures and Controls
		Noise	Erosion	Air and Dust Emissions	Traffic	Effluents and Wastes	Surface-Water Impacts	Groundwater Impacts	Land Use, protection/restoration	Water Use, protection/restoration	Terrestrial Ecosystem Impacts	Aquatic Ecosystem Impacts	Socioeconomic Impacts	Radiation Exposure to Construction Workforce		
4.2	**Water-Related Impacts**															
4.2.2	Hydrologic Alterations		S				S								1. Increased turbidity of Broad River during construction and dredging.	(1) Installation of rip rap, stemwalls, etc. to stabilize banks. (1) Develop and implement a site specific construction SWPPP. (1)Conduct construction and dredging activities in compliance with United States Army Corp of Engineers (USACE) requirements, SCDHEC and NPDES Stormwater permit. (1) Dispose of pond dredge soils in an approved county landfill or onsite spoil area.
4.2.3	Water-Use Impacts						S			S					1. Water use in dust suppression, concrete batch operations, and to establish new cover.	(1) No measures or controls are necessary because impacts are expected to be too small to warrant consideration of any mitigation measures and water will be obtained from local municipality.
4.2.4	Water Quality Impacts		S			S	S	S		S					1. Potential construction of intake and discharge structures, or disposal of dredging wastes or materials. 2. Potential erosion, and sediment and stormwater runoff from construction activities into water bodies. 3. Potential minor spills of hazardous materials or wastes.	(1) Install coffer dams or use other standard engineering controls to protect affected water bodies. (2) Install stormwater drainage system at construction site and stabilize disturbed soils. (2) Use best management practices to minimize erosion and sedimentation. (3) Use best construction practices to maintain equipment, and prevent spills and leaks. (3) Develop Storm Water Pollution Prevention Plan (SWPPP) as required by SCDHEC stormwater permit for construction practices. (3) Develop spill response plan for construction practices.

TABLE 4.6-1 (Sheet 3 of 5)
SUMMARY OF MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING CONSTRUCTION

Section Reference		Potential Environmental Impacts(a) (b): Noise	Erosion	Air and Dust Emissions	Traffic	Effluents and Wastes	Surface-Water Impacts	Groundwater Impacts	Land Use, protection/restoration	Water Use, protection/restoration	Terrestrial Ecosystem Impacts	Aquatic Ecosystem Impacts	Socioeconomic Impacts	Radiation Exposure to Construction Workforce	Effect Description or Activity	Specific Measures and Controls
4.3	**Ecological Impacts (i.e., effects on the physical environment)**															
4.3.1	Terrestrial Ecosystems	S	S	S			S				S				1. Loss of vegetation, mostly with low wildlife habitat value and individual wildlife, to land clearing/ grading. 2. Disturbance of small wetlands by river dredging and on-site excavation. 3. Displacement of wildlife by construction noise and fugitive dust. 4. Loss of wildlife to oil or chemical spill. 5. Bird collisions with cranes, buildings, and other high manmade structures.	(1) Perform land clearing/grading and excavation in compliance with regulations, permits, and best management practices. Perform revegetation/landscaping with fertilization. (2) Comply with Clean Water Act (CWA) Section 404 permits (Reference 2) and best management practices (erosion fabric or silt fences). (3) Water access roads and cleared areas to attenuate fugitive dust. (4) Locate equipment maintenance in an established yard away from wetlands and water. (5) Impact is very small and no reasonable mitigation measures have been identified.
4.3.2	Aquatic Ecosystems		S			S	S			S		S			1. Potential impacts to surface water from stormwater pollution and spills. 2. Erosion and runoff into nearby water bodies. 3. Potential impacts to surface-water from increased sediment load during construction. 4. Temporarily degraded aquatic habitat due to construction near the Broad River or wetlands.	(1) Develop and implement a construction SWPPP plan. (1) Develop SRP plan for construction activities. (2 and 3) Implement erosion and sediment control plans that incorporate recognized best management practices. (2, 3, and 4) Install appropriate barriers and use best management practices to protect river prior to construction.

TABLE 4.6-1 (Sheet 4 of 5)
SUMMARY OF MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING CONSTRUCTION

Section Reference		Potential Environmental Impacts[(a)] [(b)]														
		Noise	Erosion	Air and Dust Emissions	Traffic	Effluents and Wastes	Surface-Water Impacts	Groundwater Impacts	Land Use, protection/restoration	Water Use, protection/restoration	Terrestrial Ecosystem Impacts	Aquatic Ecosystem Impacts	Socioeconomic Impacts	Radiation Exposure to Construction Workforce	Effect Description or Activity	Specific Measures and Controls
4.4	**Socioeconomic Impacts (i.e., Effects on the Human Community)**															
4.4.1	Physical Impacts	S-M		S	S-M	S							S		1. Potential temporary and limited impacts to sensitive populations from noise, fugitive dust, and exhaust emissions during construction. 2. Potential impacts to existing traffic in amount and flow due to construction traffic. 3. Potential for increased traffic accidents due to increased construction traffic. 4. Potential construction accidents. 5. Increased debris to existing landfills. 6. Impact on aesthetics and recreational opportunities.	(1) Implement construction contractual requirements to reduce the risk of potential exposure to noise, dust and exhaust emissions. (2) Stagger shifts, encourage car pooling; time deliveries to avoid shift change or commute times. (3) Perform construction activities in accordance with US OSHA and SC OSHA requirements. (3 and 4) Provide appropriate job-training to construction workers. (1) Use dust control measures (such as watering, stabilizing disturbed areas, covering trucks). (1,2,3, and 4) Post signs near construction entrances and exits to make the public aware of potentially high construction traffic areas. (3) Develop traffic control mitigation plan. (5) Establish procedures to ensure that all waste is disposed of according to applicable regulations such as the Resource Conservation and Recovery Act (RCRA) (Reference 1).
4.4.2	Social and Economic Impacts					M				S			S-M		1. Potential short-term housing shortage. 2. Potential short-term school overcrowding. 3. Increase in potable water use. 4. Increase in non-recyclable refuse.	(1) Temporarily house employees in hotels, rental properties, park facilities. (2) Increased revenues to offset additional school resources, police and fire protection. (3) Increase water production at local facilities that are not operating at full capacity. (4)Use existing landfills.
4.4.3	Environmental Justice Impacts	S-M			S-M				S	S	S	S	S		1. No disproportionably high or adverse impacts identified.	(1) No mitigation measures required beyond those identified above.

TABLE 4.6-1 (Sheet 5 of 5)
SUMMARY OF MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS DURING CONSTRUCTION

Section Reference		Potential Environmental Impacts[(a) (b)]													Effect Description or Activity	Specific Measures and Controls
		Noise	Erosion	Air and Dust Emissions	Traffic	Effluents and Wastes	Surface-Water Impacts	Groundwater Impacts	Land Use, protection/restoration	Water Use, protection/restoration	Terrestrial Ecosystem Impacts	Aquatic Ecosystem Impacts	Socioeconomic Impacts	Radiation Exposure to Construction Workforce		
4.5	**Radiation Exposure to Construction Workers**															
4.5.1	Worker Impacts													S	1. Actions to protect construction workers while the first unit is operating and the second is being built.	(1) Take measures that could include monitoring workers, providing radiation worker training, and developing work plans that minimize worker radioactive exposure.

a) The assigned significance levels [Small (S), Moderate (M), or Large (L)] are based on the assumption that for each impact, the associated proposed mitigation measures and controls (or equivalents) are implemented.

b) A blank in the elements column denotes "no impact" on that specific element due to the assessed impacts.

4.7 CUMULATIVE IMPACTS RELATED TO CONSTRUCTION ACTIVITIES

In accordance with NUREG-1555, Environmental Standard Review Plan 4.7, this section summarizes the potential cumulative environmental impacts associated with construction of the Lee Nuclear Station.

4.7.1 CUMULATIVE ENVIRONMENTAL IMPACTS

The U.S. Environmental Protection Agency (EPA) provides the following guidance in identifying and determining cumulative impacts: “Cumulative impacts can affect a broad array of resources and ecosystem components. In addition to considering the biological resources that are the staple of the National Environmental Policy Act analysis, examples of other resources that should be considered include socioeconomic services and issues, human health, recreation, quality of life issues, and cultural and historical resources” (Reference 1).

Cumulative impacts associated with preconstruction and construction of the Lee Nuclear Station are listed in Table 4.6-1. The table provides a summary of cumulative impacts associated with preconstruction and construction of the Lee Nuclear Station and impacts in the region due to pre-existing human activities.

This analysis uses the U.S. Nuclear Regulatory Commission's (NRC) three-level standard of significance for each impact (SMALL, MODERATE, or LARGE). The use of these significance levels provides a characterization of the cumulative impacts on the region's ecological resources, socioeconomic resources, human health, recreation, quality of life issues, and cultural and historical resources that are associated with construction of the Lee Nuclear Station. Section 4.0 defines the significance levels that were used in the evaluation of environmental impacts resulting from Lee Nuclear Station construction. The significance level of a potential impact to each resource (i.e., SMALL, MODERATE, or LARGE) is assigned consistently with the criteria that the NRC established in 10 *Code of Federal Regulations* Part 51, Appendix B, Table B-1, Footnote 3. The impact categories evaluated in this subsection are consistent with those used in the “Generic Environmental Impact Statement for License Renewal of Nuclear Plants,” NUREG-1437, Volumes 1 and 2.

The potential impacts resulting from construction of two new nuclear units at the Lee Nuclear Site are evaluated in Sections 4.1 through 4.5, in light of the pre-existing conditions in the region caused by past and present human actions. For the duration of the construction, the evaluation took into account the potential impacts from factors known or likely to affect the environment. This included considering conditions at the site and in the surrounding region from past and present human activities.

The primary cumulative environmental impact related to construction is sedimentation associated with alteration of the flow regime and introduction of soil from stormwater run-off. Minimization of erosion from upland construction will be effected by the use of erosion controls under an approved erosion control plan. Revegetation and stabilization of the shoreline will also occur after construction is complete (Subsection 5.3.1.1.2). Sedimentation may also occur through the creation of a sediment load from construction of structures in the Broad River. Minimizing these sedimentation impacts will be accomplished through the use of a cofferdam enclosing the cooling water intake construction area (Subsection 4.3.2.1). Once the cofferdam is in place, further sedimentation impacts to the Broad River should be eliminated. The forebay of the Ninety-Nine Islands Dam (Subsection 2.3.1.2.1.2) would act as a sediment trap. Consequently, through the use of a cofferdam and effective erosion controls, sedimentation impacts are considered to be temporary, negligible, and localized. This fact and the distance between the dam and downstream users on the Broad River should ensure that no sedimentation impacts are seen in the aquatic environment downstream of the dam.

The details of this and all other planned measures for the prevention or control of environmental impacts are provided in Table 4.6-1.

For most impact areas, Duke Energy anticipates the potential impacts resulting from preconstruction and construction to be generally SMALL, and additional mitigation would not be warranted. However, several impacts from preconstruction and construction could result in a SMALL to MODERATE impact, or in one case, a temporary MODERATE impact. In these cases, mitigation measures may be warranted, as discussed in the applicable impact evaluation summaries in Sections 4.1 through 4.5.

4.7.2 IDENTIFICATION OF CUMULATIVE IMPACTS ASSOCIATED WITH KNOWN FEDERAL, NON-FEDERAL, AND PRIVATE ACTIONS

The evaluation of cumulative impacts associated with the Lee Nuclear Station project identifies the Lee Nuclear Site region (50-mi. radius) as the geographic area to be considered in evaluating cumulative impacts. The region surrounding the Lee Nuclear Site consists of a 50-mi. radius that includes all or part of 23 counties in two states (10 in North Carolina and 13 in South Carolina). Subsection 2.2.3 provides a description of the region while Table 2.2-1 provides a tabulation of areas within the region, organized by land-use category.

Two past actions that have contributed to cumulative impacts have occurred within the region. The Ninety-Nine Islands Hydroelectric Station is licensed by the Federal Energy Regulatory Commission to operate on the Broad River. The Ninety-Nine Islands Hydroelectric Project is adjacent to the Lee Nuclear Site. The Lee Nuclear Station would withdraw make-up water from the Ninety-Nine Islands Reservoir, which is within the Ninety-Nine Islands Hydroelectric Project boundary. Impacts to the environment from operation of the Ninety-Nine Islands Hydroelectric Project are documented in Reference 2. The interactions of Lee Nuclear Station construction and the operation of Ninety-Nine Islands Hydroelectric Station are considered in the Lee Nuclear Station construction impacts discussed in this chapter and do not need to be further discussed in this subsection.

Construction of the Cherokee Nuclear Station occurred on the site of the proposed Lee Nuclear Station. This construction action resulted in significant changes to the topography of the site and the formation of Make-Up Ponds A and B and Hold-Up Pond A. The impacts from construction of the Cherokee Nuclear Station are discussed in References 3 and 4. These impacts predate the current proposed action by over 20 years. The environment has stabilized since these impacts and is described in Chapter 2.

The construction of Cliffside Steam Station Unit 6 is a current project within the region. However, construction is expected to be completed prior to construction of the Lee Nuclear Station. Consequently, impacts related to construction of Cliffside Unit 6 are not expected to interact with construction impacts from the Lee Nuclear Station. The impacts from construction of Cliffside Unit 6 are discussed in Reference 5.

4.7.3 REFERENCES

1. U.S. Environmental Protection Agency (EPA), *Office of Federal Activities (2252A), Consideration of Cumulative Impacts in EPA Review of NEPA Documents*, EPA 315-R-99-002, 1999.

2. Duke Power Company, *Ninety-Nine Islands Hydroelectric Project, Federal Energy Regulatory Commission Application for License*, FERC Project No. 2331-002, 1991.

3. Duke Power Company, *Duke Power Company Project 81, Cherokee Nuclear Station, Environmental Report*, Docket No. 50-491 - 493, Volume I, as amended through Amendment No. 4, October 13, 1975.

4. U.S. Nuclear Regulatory Commission, *Final Environmental Statement Related to Construction of Cherokee Nuclear Station, Units 1, 2, and 3, Docket Nos. STN 50-491, STN 50-492, and STN 50-493*, NUREG-75/089, Washington, DC, 1975.

5. Duke Energy Carolinas, *Cliffside Project, Cleveland County and Rutherford County, Updated Rule R8-61(a) Information*, Docket No. E-7, Sub 790, North Carolina Utility Commission, 2006.

4.8 SEPARATION OF CONSTRUCTION AND PRECONSTRUCTION IMPACTS

In the context of this Environmental Report section, the term *construction* has two decidedly different meanings. When printed in italics hereafter, the term *construction* is referring to the specific term that is defined in 10 *Code of Federal Regulations* (CFR) 50.10, as discussed below. When italics are not used, the term "construction" is referring to the more commonly used general term that includes the sum total of the activities necessary to build the two-unit nuclear plant, including the associated supporting structures and facilities.

In addition to the cumulative impacts attributable to preconstruction and construction of the entire Lee Nuclear Station, which are summarized in Table 4.6-1, a breakdown or separation of estimated *construction* and preconstruction environmental impacts is provided in Table 4.8-1 for the purpose of assessing impacts attributable specifically to the *construction* of structures, systems, or components (SSC) as defined in 10 CFR 50.10(a)(1).

Table 4.8-1 provides estimates of the percentages of impacts attributable to *construction* and preconstruction, as well as a summary of the basis for the estimates. In order to divide the impacts from *construction* and preconstruction activities for the purposes of Table 4.8-1, Duke Energy determined the percentages of activities that are associated with construction of the nuclear island, and used those percentages as a surrogate for the percentages of impacts that are attributable to construction activities and preconstruction activities. A precise estimate of the percent of activities that fall within the scope of 10 CFR 50.10(a)(1) is not available, whereas Duke Energy does have a basis for the labor estimates of those activities that are associated with the nuclear island. Because the difference between these activities and 10 CFR 50.10(a)(1) *construction* activities is relatively small with respect to the determination of environmental impacts from a passive plant such as the AP1000, Duke Energy believes that the percentage of nuclear island activities provides a useful order-of-magnitude estimate of the impacts of the 10 CFR 50.10(a)(1) *construction* activities.

The estimated *construction*-related impacts presented in Table 4.8-1 were based primarily on two factors, namely the area associated with *construction* of the nuclear island and the labor hours associated with *construction* of the nuclear island. Information related to these two factors is provided as follows:

Construction Area

The Lee Nuclear Site is a contiguous area consisting of approximately 1900 acres (ac.), exclusive of off-site linear facilities (discharge pipelines, electric transmission line corridors, and rail corridors). The total area to be developed for the Lee Nuclear Station is estimated to be approximately 415 ac. (exclusive of the electric transmission lines). Of these developed areas, approximately 50 ac. are expected to be developed for the nuclear island (25 ac. each for Lee Nuclear Station Units 1 and 2). The area that is expected to be developed for *construction* of the nuclear island therefore represents approximately 12 percent of the total area that is expected to be developed ultimately (excluding the transmission lines). For the purposes of this assessment, the impacted area associated with safety-related SSCs is considered to be less than 15 percent.

Labor Hours

Preliminary construction estimates for all phases of development of two AP1000 units on the Lee Nuclear Site concluded that the estimated labor hours associated with construction of the nuclear island are approximately 30 percent of the total labor hours associated with development of the entire two-unit plant site.

TABLE 4.8-1 (Sheet 1 of 3)
SUMMARY OF CONSTRUCTION- AND PRECONSTRUCTION-RELATED IMPACTS FOR SAFETY-RELATED STRUCTURES, SYSTEMS, OR COMPONENTS

Section Reference	Potential Impacts and Significance [(a)]	Estimated Impacts (%) Preconstruction	Estimated Impacts (%) Construction [(b)]	Basis of Estimate
ER Section 4.1 Land-Use Impacts				
ER Subsection 4.1.1 The Site and Vicinity	S – Erosion S-M – Land-Use Protection/Restoration	85	15	Estimates are based on the area of land use that would be dedicated to safety-related structures, systems, or components (SSCs) and the assumption that the construction of SSCs would occur on no more than approximately 50 acres (ac.)(25 ac. each for Lee Nuclear Site Units 1 and 2) of the project area being developed (that is, 415 ac., excluding off-site electric transmission lines) (12%, restated as <15%).
ER Subsection 4.1.2 Transmission Corridors and Off-Site Areas	S – Erosion S – Terrestrial Ecosystem	100	0	Neither transmission corridors nor any other off-site areas associated with construction of the Lee Nuclear Station are included in the definition of construction of SSCs.
ER Subsection 4.1.3 Historic Properties	S – Erosion S – Land-Use Protection/ Restoration	100	0	The impact on historic properties would apply only to preconstruction activities, because they would be identified prior to land clearing, grading, installation of drainage systems, erosion controls and other environmental mitigation measures, and construction of temporary roads and laydown areas.
ER Section 4.2 Water-Related Impacts				
ER Subsection 4.2.1 Hydrologic Alterations	S – Erosion S – Surface Water	85	15	Estimates are based on the area of land use that would be dedicated to safety-related SSCs and the assumption that the construction of SSCs would occur on no more than approximately 50 ac. (25 ac. each for Lee Nuclear Station Units 1 and 2) of the project area being developed (that is, 415 ac., excluding off-site electric transmission lines) (12%, restated as <15%).
ER Subsection 4.2.2 Water-Use Impacts	S – Surface Water S – Water-Use Protection/ Restoration	85	15	Estimates are based on the area of land use that would be dedicated to safety-related SSCs and the assumption that the construction of SSCs would occur on no more than approximately 50 ac. (25 ac. each for Lee Nuclear Station Units 1 and 2) of the project area being developed (that is, 415 ac., excluding off-site electric transmission lines) (12%, restated as <15%).

TABLE 4.8-1 (Sheet 2 of 3)
SUMMARY OF CONSTRUCTION- AND PRECONSTRUCTION-RELATED IMPACTS FOR SAFETY-RELATED STRUCTURES, SYSTEMS, OR COMPONENTS

Section Reference	Potential Impacts and Significance [(a)]	Estimated Impacts (%) Preconstruction	Construction [(b)]	Basis of Estimate
ER Subsection 4.2.3 Water Quality Impacts	S – Erosion S – Effluents and Wastes S – Surface Water S - Groundwater S – Water-Use Protection/ Restoration	85	15	Estimates are based on the area of land use that would be dedicated to safety-related SSCs and the assumption that the construction of SSCs would occur on no more than approximately 50 ac. (25 ac. each for Lee Nuclear Station Units 1 and 2) of the project area being developed (that is, 415 ac., excluding off-site electric transmission lines) (12%, restated as <15%).
ER Section 4.3 Ecological Impacts (i.e., impacts on the physical environment)				
ER Subsection 4.3.1 Terrestrial Ecosystems	S – Noise S – Erosion S – Dust Emissions S – Surface Water S – Terrestrial Ecosystem	100	0	Ecological impacts would occur during preconstruction activities, and mobile wildlife species are expected to vacate the site until construction is complete. Impacts to native plants would occur during land clearing and preparation.
ER Subsection 4.3.2 Aquatic Ecosystems	S – Erosion S – Effluents and Wastes S – Surface Water S – Water-Use Protection/ Restoration S – Aquatic Ecosystem	100	0	The impact on aquatic ecosystems would apply only to preconstruction activities, because they would be identified prior to land clearing, grading, installation of drainage systems, erosion controls, and other environmental mitigation measures, and construction of temporary roads and laydown areas.
ER Section 4.4 Socioeconomic Impacts (i.e., impacts on the human environment)				
ER Subsection 4.4.1 Physical Impacts	S-M – Noise S – Dust S-M – Traffic S – Effluents and Wastes S – Socioeconomic	75	25	Most perceptible noise impacts at off-site locations would occur during the most intense operations in the power block area and would include pile driving for SSCs. Air emissions would occur in the vicinity of the SSCs (power block area) during construction. Estimates are based on the average of the percent of labor hours dedicated to safety-related SSCs (35%) and the percent of land dedicated to SSCs (<5%) (Average stated as 20%).
ER Subsection 4.4.2 Social and Economic Impacts	M – Effluents and Wastes S – Water-Use Protection/ Restoration S-M – Socioeconomics	60	40	Estimates are based on the percent of total project labor hours that would be dedicated to the construction of safety-related SSCs, all of which would be in the power block areas of the Lee Nuclear Station (approximately 40%).

TABLE 4.8-1 (Sheet 3 of 3)
SUMMARY OF CONSTRUCTION- AND PRECONSTRUCTION-RELATED IMPACTS FOR SAFETY-RELATED STRUCTURES, SYSTEMS, OR COMPONENTS

Section Reference	Potential Impacts and Significance [(a)]	Estimated Impacts (%) Preconstruction	Construction [(b)]	Basis of Estimate
ER Subsection 4.4.3 Environmental Justice Impacts	S-M – Noise S-M – Traffic S – Land-Use Protection/ Restoration S – Water-Use Protection/ Restoration S – Terrestrial Ecosystem S – Aquatic Ecosystem S – Socioeconomics	60	40	Estimates are based on the percent of total project labor hours that would be dedicated to the construction of safety-related SSCs, all of which would be in the power block areas of the Lee Nuclear Station (approximately 40%).
ER Section 4.5 Radiation Exposure to Construction Workers				
ER Subsection 4.5.1 Worker Impacts	S – Radiation Exposure to Construction Workers	80	20	Estimates are based on 50% of the workforce remaining during completion of the SSCs for Lee Nuclear Station Unit 2 (half of 40%).

a) The assigned potential impact significance levels of SMALL (S), MODERATE (M), or LARGE (L) are based on the assumption that mitigation measures and controls would be implemented.

b) “Construction,” as defined in 10 CFR 50.2, “Definitions,” refers to the construction of safety-related SSCs for a facility.