4.0 Environmental Impacts of Operation

Environmental issues associated with operation of the Edwin I. Hatch Nuclear Plant (HNP) during the renewal term were discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437 (NRC 1996; 1999a).[(a)] The GEIS included a determination of whether the analysis of the environmental issues could be applied to all plants and whether additional mitigation measures would be warranted. Issues were then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that did not meet one or more of the criteria of Category 1, and therefore, additional plant-specific review for these issues is required.

This chapter addresses those issues related to operation during the renewal term that are listed in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to HNP. Section 4.1 addresses the Category 1 issues applicable to the HNP cooling-tower-based heat dissipation system, while Category 2 issues applicable to the HNP cooling system are discussed at greater length in Sections 4.1.1 and 4.1.2. Section 4.2 addresses Category 1 issues related to transmission lines and land use, while a Category 2 issue is discussed in Section 4.2.1, and another issue requiring plant-specific review is discussed in Section 4.2.2. Section 4.3 addresses the radiological impacts of normal operation. There are no Category 2 issues related to radiological impacts of normal operation. Section 4.4 addresses the Category 1 issues related to the socioeconomic impacts of normal operation during the renewal term.

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

Category 2 socioeconomic issues are discussed in Sections 4.4.1 through 4.4.5. Environmental justice, an uncategorized issue, is discussed in Section 4.4.6. Section 4.5 addresses the Category 1 issues related to groundwater use and quality. Category 2 groundwater use and quality issues are discussed in Sections 4.5.1 and 4.5.2. Section 4.6 discusses the impacts of renewal-term operations on threatened and endangered species, a Category 2 issue. Section 4.7 addresses new information that was raised during the scoping period. The results of the evaluation of environmental issues related to operation during the renewal term are summarized in Section 4.8. Finally, Section 4.9 lists the references for Chapter 4.

4.1 Cooling System

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to the HNP cooling system operation during the renewal term are listed in Table 4-1. The Southern Nuclear Operating Company (SNC) stated in its Environmental Report (ER; SNC 2000a) that it is not aware of any new and significant information associated with the renewal of the HNP operating licenses (OLs). No significant new information has been identified by the staff during its review. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of the issues, the GEIS concluded that the impacts are SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Altered current patterns at intake and discharge structures. Based on information in the GEIS, the Commission found that "Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of altered current patterns during the renewal term beyond those discussed in the GEIS.

- Temperature effects on sediment transport capacity. Based on information in the GEIS, the Commission found that "These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of temperature effects on sediment transport capacity during the renewal term beyond those discussed in the GEIS.

Table 4-1. Category 1 Issues Applicable to the Operation of the HNP Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Altered current patterns at intake and discharge structures	4.2.1.2.1; 4.3.2.2; 4.4.2
Temperature effects on sediment transport capacity	4.2.1.2.3; 4.4.2.2.
Scouring caused by discharged cooling water	4.2.1.2.3; 4.4.2.2
Eutrophication	4.2.1.2.3; 4.4.2.2
Discharge of chlorine or other biocides	4.2.1.2.4; 4.4.2.2
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4; 4.4.2.2
Discharge of other metals in waste water	4.2.1.2.4; 4.3.2.2; 4.4.2.2
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Accumulation of contaminants in sediments or biota	4.2.1.2.4; 4.3.3; 4.4.3; 4.4.2.2
Entrainment of phytoplankton and zooplankton	4.2.2.1.1; 4.3.3; 4.4.3
Cold shock	4.2.2.1.5; 4.3.3; 4.4.3
Thermal plume barrier to migrating fish	4.2.2.1.6; 4.4.3
Distribution of aquatic organisms	4.2.2.1.6; 4.4.3
Premature emergence of aquatic insects	4.2.2.1.7; 4.4.3
Gas supersaturation (gas bubble disease)	4.2.2.1.8; 4.4.3
Low dissolved oxygen in the discharge	4.2.2.1.9; 4.3.3; 4.4.3
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10; 4.4.3
Stimulation of nuisance organisms	4.2.2.1.11; 4.4.3
AQUATIC ECOLOGY (FOR PLANTS WITH COOLING TOWER-BASED HEAT DISSIPATION SYSTEMS)	
Entrainment of fish and shellfish in early life stages	4.3.3
Impingement of fish and shellfish	4.3.3
Heat shock	4.3.3
TERRESTRIAL RESOURCES	
Cooling-tower impacts on crops and ornamental vegetation	4.3.4
Cooling-tower impacts on native plants	4.3.5.1
Bird collisions with cooling towers	4.3.5.2
HUMAN HEALTH	
Microbial organisms (occupational health)	4.3.6
Noise	4.3.7

- Scouring caused by discharged cooling water. Based on information in the GEIS, the Commission found that "Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of scouring during the renewal term beyond those discussed in the GEIS.

- Eutrophication. Based on information in the GEIS, the Commission found that "Eutrophication has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information, including plant monitoring data and technical reports. Therefore, the staff concludes that there are no impacts of eutrophication during the renewal term beyond those discussed in the GEIS.

- Discharge of chlorine or other biocides. Based on information in the GEIS, the Commission found that "Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information, including the National Pollutant Discharge Elimination System (NPDES) permit for HNP. Therefore, the staff concludes that there are no impacts of discharge of chlorine or other biocides during the renewal term beyond those discussed in the GEIS.

- Discharge of sanitary wastes and minor chemical spills. Based on information in the GEIS, the Commission found that "Effects are readily controlled through NPDES permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information, including the NPDES permit for HNP. Therefore, the staff concludes that there are no impacts of discharges of sanitary wastes and minor chemical spills during the renewal term beyond those discussed in the GEIS.

- Discharge of other metals in waste water. Based on information in the GEIS, the Commission found that "These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information, including the NPDES permit for HNP. Therefore, the staff concludes that there are no impacts of discharges of other metals in waste water during the renewal term beyond those discussed in the GEIS.

- Accumulation of contaminants in sediments or biota. Based on information in the GEIS, the Commission found that "Accumulation of contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal. It is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of accumulation of contaminants in sediments or biota during the renewal term beyond those discussed in the GEIS.

- Entrainment of phytoplankton and zooplankton. Based on information in the GEIS, the Commission found that "Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of entrainment of phytoplankton and zooplankton during the renewal term beyond those discussed in the GEIS.

- Cold shock. Based on information in the GEIS, the Commission found that "Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of cold shock during the renewal term beyond those discussed in the GEIS.

- Thermal plume barrier to migrating fish. Based on information in the GEIS, the Commission found that "Thermal plumes have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of thermal plumes during the renewal term beyond those discussed in the GEIS.

- Distribution of aquatic organisms. Based on information in the GEIS, the Commission found that "Thermal discharge may have localized effects but is not expected to effect the larger geographical distribution of aquatic organisms." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on the distribution of aquatic organisms during the renewal term beyond those discussed in the GEIS.

- Premature emergence of aquatic insects. Based on information in the GEIS, the Commission found that "Premature emergence has been found to be a localized effect at some operating nuclear power plants but has not been a problem and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of premature emergence of aquatic insects during the renewal term beyond those discussed in the GEIS.

- Gas supersaturation (gas bubble disease). Based on information in the GEIS, the Commission found that "Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been satisfactorily mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of gas supersaturation during the renewal term beyond those discussed in the GEIS.

- Low dissolved oxygen in the discharge. Based on information in the GEIS, the Commission found that "Low dissolved oxygen has been a concern at one nuclear power plant with a once-through cooling system but has been effectively mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not

expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of low dissolved oxygen during the renewal term beyond those discussed in the GEIS.

- Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses. Based on information in the GEIS, the Commission found that "These types of losses have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses during the renewal term beyond those discussed in the GEIS.

- Stimulation of nuisance organisms. Based on information in the GEIS, the Commission found that "Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information, including the 316(a) demonstration report (Wiltz 1981). Therefore, the staff concludes that there are no impacts of stimulation of nuisance organisms during the renewal term beyond those discussed in the GEIS.

- Entrainment of fish and shellfish in early life stages (cooling-tower-based heat dissipation systems). Based on information in the GEIS, the Commission found that "Entrainment of fish has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of entrainment of fish and shellfish in early life stages with this type cooling system during the renewal term beyond those discussed in the GEIS.

- Impingement of fish and shellfish (cooling-tower-based heat dissipation systems). Based on information in the GEIS, the Commission found that "The impingement has not been found to be a problem at operating nuclear power plants with this type of cooling system

and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of impingement with this type cooling system during the renewal term beyond those discussed in the GEIS.

- Heat shock (cooling-tower-based heat dissipation systems). Based on information in the GEIS, the Commission found that "Heat shock has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of heat shock with this type cooling system during the renewal term beyond those discussed in the GEIS.

- Cooling-tower impacts on crops and ornamental vegetation. Based on information in the GEIS, the Commission found that "Impacts from salt drift, icing, fogging, or increased humidity associated with cooling-tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of cooling-tower operation on crops and ornamental vegetation during the renewal term beyond those discussed in the GEIS.

- Cooling-tower impacts on native plants. Based on information in the GEIS, the Commission found that "Impacts from salt drift, icing, fogging, or increased humidity associated with cooling-tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of cooling-tower operation on native plants during the renewal term beyond those discussed in the GEIS.

- Bird collisions with cooling towers. Based on information in the GEIS, the Commission found that "These collisions [of birds with cooling towers] have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process,

its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of bird collisions with cooling towers during the renewal term beyond those discussed in the GEIS.

- Microbiological organisms (occupational health). Based on information in the GEIS, the Commission found that "Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of microbiological organisms during the renewal term beyond those discussed in the GEIS.

- Noise. Based on information in the GEIS, the Commission found that "Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of noise during the renewal term beyond those discussed in the GEIS.

Category 2 issues related to cooling system operation during the renewal term that are applicable to HNP are discussed in the sections that follow. These issues are listed in Table 4-2.

4.1.1 Water-Use Conflicts

Surface-water withdrawals may impact riparian and instream habitat. Section 2.2.2 describes HNP surface-water withdrawals.

The impact of consumptive loss on the downstream riparian communities is associated with the small difference it causes in the river surface elevation. SNC has calculated the reduction in surface-water elevation resulting from HNP withdrawals (SNC 2000a, Attachment B). During periods of average river discharge, consumptive loss amounts to about a 0.01 m (0.03 ft) decrease in the downstream surface elevation. During periods of minimum river discharge, consumptive loss results in a lowering of the downstream surface elevation by approximately 0.02 m (0.08 ft).

Table 4-2. Category 2 Issues Applicable to the Operation of the HNP Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
SURFACE WATER QUALITY, HYDROLOGY AND USE (FOR ALL PLANTS)			
Water-use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	4.3.2.1; 4.4.2.1	A	4.1.1
HUMAN HEALTH			
Microbiological organisms (public health)	4.3.6	G	4.1.2

The shoreline of the Altamaha River in the vicinity of HNP and immediately downstream for several miles is characterized by steep bluffs, floodplain forests, and sandbars. Based on average daily flows for a 1-month period over the last 22 years, the riparian communities experienced an average annual surface elevation fluctuation of approximately 2.7 m (9 ft). The consumptive loss incurred by plant operations has the greatest effect on surface elevation during low-flow periods. The duration of low-flow conditions is approximately 2 to 3 months during late summer. The shoreline exposed during these periods is under water during the other 9 to 10 months of the year.

Vegetation is found at elevations that are not flooded for most of the year by the river. When the river stage is high enough to flood the riparian communities, the impact of consumptive loss from plant operations is negligible.

Consumptive loss from plant operations during the low-flow periods would have the greatest impact on instream biological communities (e.g., mussels and fish) if it occurred during the spawning season. For example, if a reduction in flow (or river level) were enough to hinder upstream or downstream movement of anadromous fish or the movement of resident fish into shallow sloughs and oxbows to spawn, then there could be a reduction in spawning success. The spawning season for fish in the Altamaha River occurs in the spring and early summer, the period of highest flows in the Altamaha (SNC 2000a). Consumptive loss from plant operations is not expected to have any impact on instream communities, because the lowest average daily flow for a 1-month period occurs in September, and the highest average daily flow for a 1-month period occurs in March.

Freshwater mussels vary in their ability to withstand emersion (exposure to air). Some species have adapted to withstand prolonged periods of emersion, while others are emersion-intolerant. Mussels move over and through the substrate by means of a protrusible muscular foot. Some species are known to move several feet per hour in response to stagnant conditions or falling water levels. Other species respond to falling water levels by burrowing more deeply into the substrate, seeking moisture. However, most riverine species have evolved under seasonally fluctuating water-level conditions and are unaffected by small fluctuations in water level. Under worst-case conditions, consumptive losses would result in a 0.02-m (0.08-ft) lowering of water level downstream of HNP.

The staff reviewed the Clean Water Act 316(a) demonstration for HNP and the ER relative to potential water-use conflicts due to consumptive loss of stream flow. Based on this review, the staff has concluded that the potential impacts are SMALL, and mitigation is not warranted.

4.1.2 Microbiological Organisms (Public Health)

For plants discharging cooling water to cooling ponds, lakes, canals, or small rivers, the effects of microbiological organisms on human health are listed as a Category 2 issue and require plant-specific evaluation before license renewal. The Category 2 designation is based on the magnitude of the potential public health impacts associated with thermal enhancement of *Naegleria fowleri* and could not be determined generically (NRC 1996). The Nuclear Regulatory Commission (NRC) noted that the impacts of nuclear plant cooling towers and thermal discharges are considered to be of small significance if they do not enhance the presence of microorganisms that are detrimental to water quality and public health (NRC 1996). The assessment criteria relate to thermal discharge temperature, thermal characteristics, thermal conditions for the enhancement of *N. fowleri*, and impacts to public health.

HNP withdraws water for cooling from the Altamaha River via a shoreline intake and discharges it via offshore discharge structures. The cooling-water systems for Units 1 and 2 are identical. A mixing box for the river discharge receives cooling-tower blowdown, demineralized waste, cooling-tower overflow, and excess service water from both units. From the mixing box, two 1.1-m (42-in.) lines run down to the river and extend about 37 m (120 ft) into the river from the shoreline. The point discharge is about 384 m (1260 ft) downriver from the intake structure and about 1.2 m (4 ft) below the surface when the river is at its lowest level.

HNP discharge temperatures are monitored weekly by plant personnel and reported to the Watershed Planning and Monitoring Program of the Environmental Protection Division (EPD) of the Georgia Department of Natural Resources (GADNR). Discharge temperatures range from about 17 to 34°C (62 to 94°F) when the plant is operating. During summer months, when thermophilic organisms are most likely to occur, discharge temperatures have averaged 29 to 32°C (85 to 89°F) over the last 2 years. HNP discharge temperatures are below those known

to be optimal for growth and reproduction of pathogenic microorganisms but could theoretically permit limited survival of these organisms in summer months. Temperatures in the Altahama River immediately downstream of the HNP discharge structure are several degrees cooler than the temperatures in the immediate area of the discharge outfall (NRC 1978).

Another factor limiting concentrations of pathogenic microorganisms in the HNP discharge is the absence of a seed source or inoculant. Waste water is the usual source of pathogens in natural waters. The sewage-treatment plant has been upgraded and expanded to accommodate the sewage demand at HNP. HNP sewage treatment consists of two approximately 130 m^3/d (35,000 gpd) extended aeration-activated sludge-treatment plants. Disinfection in the sewage-treatment plant reduces coliform bacteria and other microorganisms to levels that meet state water-quality standards. The circulating water is also chlorinated to control microbial organisms. Additionally, the Altamaha River upstream of HNP flows through a largely rural area and receives no substantial discharges of municipal, industrial, or agricultural wastes.

The staff has reviewed the thermal characteristics of the Altamaha River and the HNP discharge, and does not expect HNP operation to stimulate growth and reproduction of pathogenic microorganisms in the Altamaha River downstream of the plant. Under certain circumstances, the organisms might be present in the immediate area of the discharge outfall but would not be expected in sufficient concentrations to pose a threat to downstream water users. Many of these pathogenic microorganisms are ubiquitous in nature, occurring in the digestive tracts of wild mammals and birds, but are usually only a problem when the host is immunologically compromised. Although there is a potential for deleterious thermophylic microorganisms to be associated with the cooling system, the actual hazard to public health has not been documented or substantiated. The thermal characteristics of the HNP discharge would not promote the growth of microorganisms that are detrimental to water and public health. Thus, the staff concludes that the potential impacts of microbial organisms on human health resulting from the operation of the plant's cooling-water discharge to the aquatic environment on or in the vicinity of the site are SMALL, and mitigation is not warranted.

4.2 Transmission Lines

The final environmental statement (FES; AEC 1972) described four transmission lines that were built to connect HNP with the Georgia Power Company (GPC) transmission system. These transmission corridors cover approximately 1790 ha (4400 acres) over a total corridor length of approximately 299 km (186 mi). Since the start of operation of HNP Unit 2, two additional lines were constructed to connect the GPC transmission system to Florida. These additional lines, which cover an area of approximately 1120 ha (2760 acres) with a total transmission corridor length of approximately 245 km (152 mi), have also been included in this evaluation.

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, that are applicable to the HNP transmission lines are listed in Table 4-3. SNC stated in its ER (SNC 2000a) that it is not aware of any new and significant information associated with the renewal of the HNP OLs. No significant new information has been identified by the staff during its review. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the GEIS concluded that the impacts are SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-3. Category 1 Issues Applicable to the HNP Transmission Lines During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
TERRESTRIAL RESOURCES	
Power line right-of-way management (cutting and herbicide application)	4.5.6.1
Bird collisions with power lines	4.5.6.2
Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	4.5.6.3
Floodplains and wetland on power line right-of-way	4.5.7
AIR QUALITY	
Air quality effects of transmission lines	4.5.2
LAND USE	
Onsite land use	4.5.3
Power line right-of-way	4.5.3

A brief description of the staff's review and GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Power line right-of-way management (cutting and herbicide application). Based on information in the GEIS, the Commission found that "The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, consultation with the U.S. Fish and Wildlife Service (FWS) and GADNR, or its evaluation of other information.

Therefore, the staff concludes that there are no impacts of power line right-of-way maintenance during the renewal term beyond those discussed in the GEIS.

- Bird collisions with power lines. Based on information in the GEIS, the Commission found that "Impacts [of bird collisions with power lines] are expected to be of small significance at all sites." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, consultation with the FWS and GADNR, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of bird collisions with power lines during the renewal term beyond those discussed in the GEIS.

- Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock). Based on information in the GEIS, the Commission found that "No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of electromagnetic fields on flora and fauna during the renewal term beyond those discussed in the GEIS.

- Floodplains and wetland on power line right-of-way. Based on information in the GEIS, the Commission found that "Periodic vegetation control is necessary in forested wetlands underneath power lines and can be achieved with minimal damage to the wetland. No significant impact is expected at any nuclear power plant during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, consultation with the FWS and GADNR, or its evaluation of other information. Therefore, the staff concludes that there are no impacts on floodplains and wetlands on the power line right-of-way during the renewal term beyond those discussed in the GEIS.

- Air quality effects of transmission lines. Based on the information in the GEIS, the Commission found that "Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other information. Therefore, the staff concludes that there are no air quality impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

- Onsite land use. Based on the information in the GEIS, the Commission found that "Projected onsite land use changes required during ... the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other information. Therefore, the staff concludes that there are no onsite land-use impacts during the renewal term beyond those discussed in the GEIS.

- Power line right-of-way (land use). Based on information in the GEIS, the Commission found that "Ongoing use of power line right of ways would continue with no change in restrictions. The effects of these restrictions are of small significance." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other information. Therefore, the staff concludes that there are no impacts on use of power line rights-of-way during the renewal term beyond those discussed in the GEIS.

There is one Category 2 issue related to transmission lines, and another issue related to transmission lines is being treated as a Category 2 issue. These issues are listed in Table 4-4 and discussed in Sections 4.2.1 and 4.2.2.

Table 4-4. Category 2 and Uncategorized Issues Applicable to the HNP Transmission Lines During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
HUMAN HEALTH			
Electromagnetic fields, acute effects (electric shock)	4.5.4.1	H	4.2.1
Electromagnetic fields, chronic effects	4.5.4.2	NA	4.2.2

4.2.1 Electromagnetic Fields—Acute Effects

In the GEIS, the Commission found that without a review of the conformance of each nuclear plant transmission line with National Electrical Safety Code criteria (NESC 1997), it is not possible to determine the significance of the electric shock potential. Evaluation of individual plant transmission lines is necessary because the issue of electric shock safety was not addressed in the licensing process for some plants. For the other plants, some may have chosen to upgrade line voltage, or land use in the vicinity of transmission lines may have been changed. To comply with 10 CFR 51.53(c)(3)(ii)(H), the applicant must provide an assessment of the potential shock hazard if the transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of NESC for preventing electric shock from induced currents.

In the ER, SNC states:

> GPC designed and constructed all HNP transmission lines in accordance with the edition of the National Electrical Safety Code...and industry guidance that was current when the line was built. Ongoing right-of-way supervision and maintenance of HNP transmission facilities ensures continued conformance to governing standards and includes routine aerial patrol, helicopter inspection, and ground inspection. At this time, aerial patrols of all corridors are conducted every other month and include checks for encroachments, broken conductors, broken or leaning structures, and signs of trees burning, any of which would be evidence of clearance problems. Slow helicopter inspections (45 miles per hour or less) are conducted annually for 500-kV lines to allow more careful checks of facilities and rights-of-way. Currently all lines are inspected from the ground and measured for clearance at questionable locations every 6 years. Problems noted during any inspection are brought to the attention of the appropriate organizations for corrective action.

According to the ER, there have been no upgrades in line voltage on the HNP transmission lines since they were constructed.

In 1977, the NESC was revised to include identification of the method for establishing minimum vertical clearances for electric lines having voltages exceeding 98 kV. The clearance must be sufficient to limit the induced current due to electrostatic effects to 5 milliamperes (5 mA) if the largest anticipated truck, vehicle, or equipment parked beneath the line were shorted to ground. The Duval and Thalmann transmission lines constructed in 1981 were designed to this limit. However, the four transmission lines initially constructed for HNP were built before this guidance was adopted. Nevertheless, the SNC ER (SNC 2000a) states that the 5-mA limit was used in the design of the 500-kV North Tifton and Bonaire lines because the limit was used by industry for high-voltage lines when the lines were designed.

GPC had not modeled the 230-kV Eastman and Douglas lines to evaluate the maximum induced current in those lines against the 5-mA limit, and computer-modeling capabilities have improved significantly since the 500-kV lines were designed. SNC stated (SNC 2000a) that SNC and GPC conducted an evaluation of all of the lines' adherence to the 5-mA induced current limit (GPC 1999a; 1999b) using the Electric Power Research Institute (EPRI) EFION computer program (EPRI High Voltage Transmission Research Center 1991), which is a generally accepted analytical methodology. The largest vehicle that SNC anticipates being under the HNP transmission lines is a tractor trailer parked on a public highway. Based on GPC minimum line vertical clearance design criteria of 10.3 m (33.7 ft) for 230-kV lines and 12.6 m (41.4 ft) for 500-kV lines at a conductor temperature of 48.9°C (120°F), the maximum induced currents were 1.25 mA for 230-kV lines and 3.84 mA for 500-kV lines for a 16.8-m (55-ft) long tractor trailer, 2.4 m (8 ft) wide and 4.1 m (13.5 ft) high.

The induced currents calculated in this evaluation were reported to be less than the NESC limit of 5 mA. Therefore, the staff concludes that the impact of the potential for electrical shock is SMALL, and mitigation is not warranted.

4.2.2 Electromagnetic Fields—Chronic Effects

In the GEIS, the chronic effects of electromagnetic fields from power lines were given a finding of "not applicable" rather than a Category 1 or 2 designation until a scientific consensus is reached on the health implications of these fields.

The potential for chronic effects from these fields continues to be studied and is not known at this time. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the U.S. Department of Energy. A recent report (NIEHS 1999) states the following:

> The NIEHS concludes that ELF-EMF [extremely low frequency-electromagnetic field] exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement is not sufficient to cause the staff to change its position with respect to the chronic effects of electromagnetic fields. The staff considers the GEIS finding of "not applicable" still appropriate and will continue to follow developments on this issue.

4.3 Radiological Impacts of Normal Operations

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to HNP in regard to radiological impacts are listed in Table 4-5. SNC stated in its ER (SNC 2000a) that it is not aware of any new and significant information associated with the renewal of the HNP OLs. No significant new information has been identified by the staff during its review. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the GEIS concluded that the impacts are SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-5. Category 1 Issues Applicable to Radiological Impacts of Normal Operations During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
HUMAN HEALTH	
Radiation exposures to public (license renewal term)	4.6.2
Occupational radiation exposures (license renewal term)	4.6.3

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Radiation exposures to public (license renewal term). Based on information in the GEIS, the Commission found that "Radiation doses to the public will continue at current levels associated with normal operations." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of radiation exposures to the public during the renewal term beyond those discussed in the GEIS.

- Occupational radiation exposures (license renewal term). Based on information in the GEIS, the Commission found that "Projected maximum occupational doses during the license renewal term are within the range of doses experienced during normal operations and normal maintenance outages, and would be well below regulatory limits." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its

evaluation of other available information. Therefore, the staff concludes that there are no impacts of occupational radiation exposures during the renewal term beyond those discussed in the GEIS.

4.4 Socioeconomic Impacts of Plant Operations During the License Renewal Period

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to socioeconomic impacts during the renewal term are listed in Table 4-6. SNC stated in its ER (SNC 2000a) that it is not aware of any new and significant information associated with the renewal of the HNP OLs. No significant new information has been identified by the staff during its review. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the GEIS concluded that the impacts are SMALL, and plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-6. Category 1 Issues Applicable to Socioeconomics During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
SOCIOECONOMICS	
Public services: public safety, social services, and tourism and recreation	4.7.3; 4.7.3.3; 4.7.3.4; 4.7.3.6
Public services: education (license renewal term)	4.7.3.1
Aesthetic impacts (license renewal term)	4.7.6
Aesthetic impacts of transmission lines (license renewal term)	4.5.8

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Public services: public safety, social services, and tourism and recreation. Based on information in the GEIS, the Commission found that "Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites." The staff has not identified any significant new information during its independent review of the SNC

ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on public safety, social services, and tourism and recreation during the renewal term beyond those discussed in the GEIS.

- Public services: education (license renewal term). Based on information in the GEIS, the Commission found that "Only impacts of small significance are expected." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on education during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts (license renewal term). Based on information in the GEIS, the Commission found that "No significant impacts are expected during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no aesthetic impacts during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts of transmission lines (license renewal term). Based on information in the GEIS, the Commission found that "No significant impacts are expected during the license renewal term." The staff has not identified any significant new information during its independent review of the SNC ER (SNC 2000a), the staff's site visit, the scoping process, its review of public comments, or its evaluation of other available information. Therefore, the staff concludes that there are no aesthetic impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

Table 4-7 lists the Category 2 socioeconomic issues that require plant-specific analysis and environmental justice, which was not evaluated in the GEIS.

4.4.1 Housing Impacts During Operations

While determining housing impacts, the applicant chose to follow Appendix C of the GEIS (NRC 1996), which presents a population characterization method that is based on two factors, "sparseness" and "proximity" (GEIS, Section C.1.4). Sparseness measures population density within 32 km (20 mi) of the site, and proximity measures population density and city size within 80 km (50 mi). Each factor has categories of density and size (GEIS, Table C.1), and a matrix

Table 4-7. Category 2 Issues Applicable to Socioeconomics and Environmental Justice During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
SOCIOECONOMICS			
Housing impacts	4.7.1	I	4.4.1
Public services: public utilities	4.7.3.5	I	4.4.2
Offsite land use (license renewal term)	4.7.4	I	4.4.3
Public services, transportation	4.7.3.2	J	4.4.4
Historic and archaeological resources	4.7.7	K	4.4.5
ENVIRONMENTAL JUSTICE			
Environmental Justice	Not evaluated		4.4.6

is used to rank the population category as "low," "medium," or "high" (GEIS, Figure C.1). The population in the HNP area was categorized by the NRC as "low" (GEIS, Table C.2). Table 2-12 provides the population distribution for the area surrounding HNP, Units 1 and 2, based on 1990 census data. The population density within a 32-km (20-mi) radius of HNP is approximately 17 persons/km^2 (43 persons/mi^2) and there is no city with a population of 25,000 within 32 km (20 mi), giving the site a Sparseness Category of 2. The population density within an 80-km (50-mi) radius is approximately 17 persons/km^2 (43 persons/mi^2), and there is no city with a population of 100,000 within 80 km (50 mi), giving the site a Proximity Category of 1. These values combine to give the surrounding HNP population a category measure of 2.1; a "low" category as defined by GEIS Figure C.1.

In 10 CFR Part 51, Subpart A, Appendix B, Table B-1, the NRC concluded that impacts on housing availability are expected to be MODERATE to LARGE at plants located in "low" population areas or in areas where growth control measures are in effect. SMALL impacts result when no discernable change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversions are needed to meet the demand.

During the license renewal period, SNC does not anticipate the need to increase onsite or offsite personnel, and expects the outage workforce to be within the range supporting current operations. Strategic planning by SNC projects a constant or slightly reduced workforce in the future based on industry benchmarks for boiling-water reactors similar to those employed at HNP. SNC determined that no refurbishment was necessary at HNP. Thus, SNC concludes that there would be no refurbishment-related impacts to area housing (SNC 2000a). Even

establishing an upper bound on employment, applying an analysis used by the NRC in the GEIS,[(a)] of 60 permanent workers during the license renewal period (plus 185 indirect jobs) would result in an increased demand for housing in Toombs and Appling counties of 174 units or 9 percent of available housing (see Table 2-6). In its ER, SNC concluded that even with the resulting decrease in housing availability for the bounding case scenario of 60 additional workers, there would not be a discernable change in housing availability, rental rates, and housing values. Nor would such hires spur housing construction or conversion. In addition, the staff did not identify any Federal projects or other activities that would add to housing impacts. As such, SNC concluded that license renewal impacts to housing would be SMALL, and would not warrant mitigation (SNC 2000a). The staff has reviewed the available information relative to housing impacts. Although HNP is located in a low-population area, there are no growth-control measures that limit housing development in effect and little or no change in the size of the plant workforce is anticipated. Based on its review, therefore, the staff concludes that the impact on housing during the license renewal period would be SMALL, and mitigation is not warranted.

4.4.2 Public Services: Public Utility Impacts During Operations

Impacts on public utility services are considered SMALL if there is little or no change in the ability of the system to respond to the level of demand, and thus there is no need to add capital facilities. Impacts are considered MODERATE if overtaxing of service capabilities occurs during periods of peak demand. Impacts are considered LARGE if existing levels of service (e.g., water or sewer services) are substantially degraded, and additional capacity is needed to meet ongoing demands for services. The GEIS indicates that, in the absence of new significant information to the contrary, the only impacts on public utilities that could be significant are impacts on public water supplies.

As described in the SNC ER, a municipal water supply is not used at the plant site; therefore, the plant operations do not directly affect any public water supply system. The ER states that operations at the plant site do not have a noticeable impact on offsite wells drawing from the Floridan Aquifer. Because plant demand is not expected to alter offsite groundwater use in the Floridan Aquifer, operations at HNP will not indirectly impact public water supply systems located in the vicinity of the plant (SNC 2000a).

(a) NRC applies a bounding workforce estimate of 60 license renewal workers per nuclear unit to estimate potential housing impacts. These workers are required to conduct increased inspections, surveillance, testing, and maintenance. The NRC uses this estimate as a conservative value to represent the upper bound of potential socioeconomic impacts. SNC anticipates that the increased inspection and maintenance would be performed mostly during the outages that are staggered so they do not coincide, thus making it unreasonable that each unit would require 60 additional workers. Instead, as a reasonably conservative estimate, SNC assumed that only 60 workers (not 120) would at most be required at HNP.

Another concern is the potential indirect impact resulting from additional workers moving to the area and placing additional demands on public water supply systems. As described in the ER, SNC does not anticipate the need to increase the onsite workforce during the license renewal period, and therefore, anticipates no impact on the public water systems as a result of license renewal. However, to demonstrate potential population-related impacts to area public water services, SNC used the upper-bound license renewal workforce of 60 additional full-time workers generating an additional indirect workforce of 185 jobs in the surrounding communities (described in Section 4.4.1 of this report). If each new worker represents one new family, the population in the area could increase by approximately 785, based on a family size of 3.2. SNC assumes that the residential distribution of the workers would be similar to the current worker distribution of 71 percent in Appling and Toombs counties. Thus, 560 of the new residents (out of the 785), would live in Appling and Toombs counties (SNC 2000a).

Section 2.2.8.2 describes the water supply system utilities in Appling and Toombs counties. For Appling and Toombs counties combined, the total available, reserve water service capacity is approximately 36,000 m^3/d (9.4 million gpd). Continuing with the "upper bound" analysis, SNC estimated the plant-related population increase would generate a demand on public water supply systems of 170 m^3/d (45,000 gpd), assuming that 100 percent of the growth attributable to license renewal are served by these municipal systems. This represents approximately 0.5 percent of the available reserved capacity in the two counties. Based on the level of demand that would be placed on the public water systems serving Appling and Toombs counties, SNC concludes that plant-related population growth (even given the upper bound analysis) would require no additional increase in municipal water supply capacity (SNC 2000a). No other projects were identified that would add significantly to water demand in the two counties.

The NRC staff concludes that impacts on groundwater during the license renewal period would be SMALL, either not detectable or so minor that they would not destabilize nor noticeably alter any important attribute of the resource, and that mitigation is not necessary. This conclusion is based on the fact that HNP's use of groundwater does not have a noticeable impact on offsite wells drawing from the Floridan Aquifer, SNC does not anticipate an increase in the workforce if the license is renewed, and the "upper bound analysis" of 560 new residents represents approximately 0.5 percent of the available water-use capacity in the two counties.

4.4.3 Offsite Land Use During Operations

Offsite land use during the license renewal term is a Category 2 issue (10 CFR 51, Subpart A, Appendix. B, Table B-1). Table B-1 of 10 CFR 51 Subpart A, Appendix B notes that "significant changes in land use may be associated with population and tax revenue changes resulting from license renewal."

Section 4.7.4 of the GEIS defines the magnitude of land-use changes as a result of plant operation during the license renewal term as follows:

> SMALL, where there is very little new development and minimal changes to an area's land-use pattern
>
> MODERATE, where there is considerable new development and some changes to the land-use pattern
>
> LARGE, where there is large-scale new development and major changes in the land-use pattern.

SNC has not identified any increases in plant staffing related to the license renewal application; consequently, there are no population related land-use impacts during the license renewal term.

Tax revenue can affect land use because it enables local jurisdictions to be able to provide the public services (e.g., transportation and utilities) necessary to support development. Section 4.7.4.1 of the GEIS states that the assessment of tax-driven land-use impacts during the license renewal term should consider (1) the size of the plant's payments relative to the community's total revenues, (2) the nature of the community's existing land-use pattern, and (3) the extent to which the community already has public services in place to support and guide development. If the plant's tax payments are projected to be small relative to the community's total revenue, tax-driven land-use changes during the plant's license renewal term would be small, especially where the community has preestablished patterns of development and has provided adequate public services to support and guide development. If the plant's tax payments are projected to be medium to large relative to the community's total revenue, new tax-driven land-use changes would be moderate. This is most likely to be true where the community has no preestablished patterns of development (i.e., land-use plans or controls) or has not provided adequate public services to support and guide development in the past, especially infrastructure that would allow industrial development. If the plant's tax payments are projected to be a dominant source of the community's total revenue, new tax-driven land-use changes would be large. This would be especially true where the community has no preestablished pattern of development or has not provided adequate public services to support and guide development in the past.

Appling County is the only jurisdiction that taxes HNP directly, and it is the principal jurisdiction that receives direct tax revenue as a result of HNP's presence. Because there are no major refurbishment activities and no new construction as a result of the license renewal, no new sources of plant-related tax payments are expected that could significantly influence land use in Appling County. However, during the license renewal term, new land-use impacts could result from the use by Appling County of the tax revenue paid by SNC for HNP. As discussed in

Section 2.2.8.6 and as shown in Table 2-15, SNC paid Appling County $8.5 million in 1998 for HNP. This amount represented approximately 68 percent of the Appling County tax revenue, which, for the purpose of this analysis, is considered large relative to the county's total tax revenue.

Notwithstanding the high proportion of Appling County tax revenue paid by SNC, Appling County has experienced a minor population increase of 5.9 percent over the last decade. Toombs County has experienced a growth of 8 percent over this period (Table 2-8). Appling and Toombs counties do not have growth-control measures that limit housing. Land-use projections for Appling County show that new commercial and industrial developments are expected to concentrate in Baxley and along the U.S. Highway 341 corridor, which runs parallel to the Norfolk Southern rail line. New residential development is being encouraged near the cities of the county, particularly Baxley. The remainder of Appling County is expected to remain in agricultural and forest use.

Continuation of Appling County's tax receipts from HNP keeps tax rates below what they otherwise would have to be to fund the county's government and also provides for a higher level of public infrastructure and services than otherwise would be possible. Both Appling and Toombs counties' property tax rates are among the lowest 10 percent in Georgia. Appling County directly benefits from the location of the HNP site in the county while Toombs County benefits from having a greater percentage of the HNP workforce living in the county (see Table 2-7). Continued operation of HNP provides significant economic stability to the two counties and is likely to encourage new business development in the counties. Overall, this effect is positive because Appling and Toombs counties have higher unemployment rates and lower per capita income levels than the statewide averages (see Section 2.2.8.6).

Based on review of the issues related to land use and the criteria in the GEIS, the staff concludes that the net impact of plant-related population increases is likely to be SMALL. The staff also concludes that tax-related land-use impacts are likely to be SMALL. There are several reasons for these conclusions. First, SNC does not intend to refurbish HNP, Units 1 and 2, in conjunction with license renewal. Thus, there will be no increase in employment at the HNP site as a result of license renewal activities. Second, SNC has stated that the permanent workforce at HNP will remain stable during the renewed license operating period of 20 years (SNC 2000a). Third, the population increase in Appling County, not related to HNP employment, between 1990 and 1999 was only 5.9 percent (see Table 2-8). Finally, visual inspection by the staff and discussions with real estate agents in Baxley did not reveal significant housing development in Appling County. Approximately 150 new housing units (or two percent of the available housing stock in 1990 [Table 2-6]) are being developed in Appling County (30 stick-built and 120 manufactured homes) each year. Most of these units are being located in rural

parts of the county.[a] Additional mitigation for land-use impacts during the license renewal term does not appear to be warranted.

4.4.4 Public Services: Transportation Impacts During Operations

On October 4, 1999, 10 CFR 51.53(c)(3)(ii)(J) and 10 CFR Part 51, Subpart A, Appendix B, Table B-1 were revised to clearly state that "Public Services: Transportation Impacts During Operations" is a Category 2 issue (see NRC 1999a for more discussion of this clarification). This issue is treated as such in this SEIS.

Moderate population growth (less than 12 percent) is expected in Toombs and Appling counties between 1999 and 2010 (see Table 2-8). Even if there were an increase in plant employment of 60 workers (the upper bound), there would only be an approximate 1.4 percent increase in traffic volume on U.S. Highway 1 north of the HNP site and approximately 1.1 percent increase in traffic volume south of the plant. However, none of the expected growth identified in Table 2-8 will be due directly to increases in employment at HNP. Future general population increases may increase highway congestion at specific locations.

There are plans to widen U.S. Highway 1 to four lanes from Baxley to Interstate 16 within 5 years (SNC 2000a). Given these facts, the NRC staff concludes that any impact of HNP on transportation service degradation is likely to be SMALL and not require mitigation.

4.4.5 Historic and Archaeological Resources

The SNC license renewal application for HNP does not include plans for future land disturbances or structural modifications beyond routine maintenance activities at the plant. Therefore, there would be no identifiable adverse effects to known historic and archaeological resources. Consultation between the license renewal applicant and the Georgia State Historic Preservation Office resulted in a determination by the State office that no known historic properties included in or eligible for inclusion in the National Register of Historic Places would be affected by the proposed action (SNC 1999a; GADNR 1999a).

Continued operation of the power plant and protection of the natural landscape and vegetation within the site boundaries would provide *de facto* protection during the term of the license renewal period for known or undiscovered resources located in an undisturbed area with secured access. HNP's commitment to continue conservation and security of the Bell Cemetery will continue to enhance long-term preservation of that property.

(a) Based on an interview with a group of real estate agents in Baxley, May 9, 2000.

However, additional care should be taken during normal operational and maintenance conditions to ensure that historic properties are not inadvertently impacted. These activities may include not only operation of the plant itself, but also land management-related actions such as recreation, wildlife habitat enhancement, or maintaining/upgrading plant access roads throughout the plant site. The environmental impacts of activities undertaken by SNC are managed through the Environmental Protection Plan (Appendix B to each units' technical specifications) and the licensee's program to implement the requirements of 10 CFR 50.59, "Changes, tests, and experiments." Based on the finding that SNC did not identify any major refurbishment activities related to the renewal of the HNP OLs and that operation will continue within the bounds of plant operations as evaluated in the FESs (AEC 1972 and NRC 1978), it is the staff's conclusion that the potential impacts on historic and archaeological resources are expected to be SMALL, and mitigation is not warranted.

4.4.6 Environmental Justice

Environmental justice refers to a Federal policy in which Federal actions should not result in disproportionately high and adverse impacts on minority or low-income populations. Executive Order 12898 (59 FR 7629) directs Federal executive agencies to consider environmental justice under the National Environmental Policy Act of 1969 (NEPA). The Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice (CEQ 1997). Although it is not subject to the Executive Order, the Commission has voluntarily committed to undertake environmental justice reviews. Specific guidance is provided in NRC Office of Nuclear Reactor Regulation Office Letter 906, "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues" (NRC 1999b).

The staff examined the geographic distribution of minority and low-income populations recorded during the 1990 Census (U.S. Census Bureau [USCB] 1991) within 80 km (50 mi) of HNP, supplemented by field inquiries to the local planning departments and social service agencies in Toombs and Appling counties.

A minority population is defined to exist if the percentage of minorities within the census blocks affected by the proposed action exceeds the percentage of minorities in the entire State of Georgia by 20 percent, or if the percentage of minorities within the census block is at least 50 percent. Generally, minority populations are small and dispersed in an 80-km (50-mi) radius around the HNP site. Identified concentrations of minority populations are located primarily in the small towns in the area, including Vidalia, Baxley, Douglas, and Waycross (see cross-hatched areas in Figure 4-1). When individual minority populations are present, these are Black populations (SNC 2000a). Other minorities are present, including substantial numbers of Hispanics in Long and Liberty counties, but they do not meet the criterion of "minority populations" in the staff guidance (NRC 1999b).

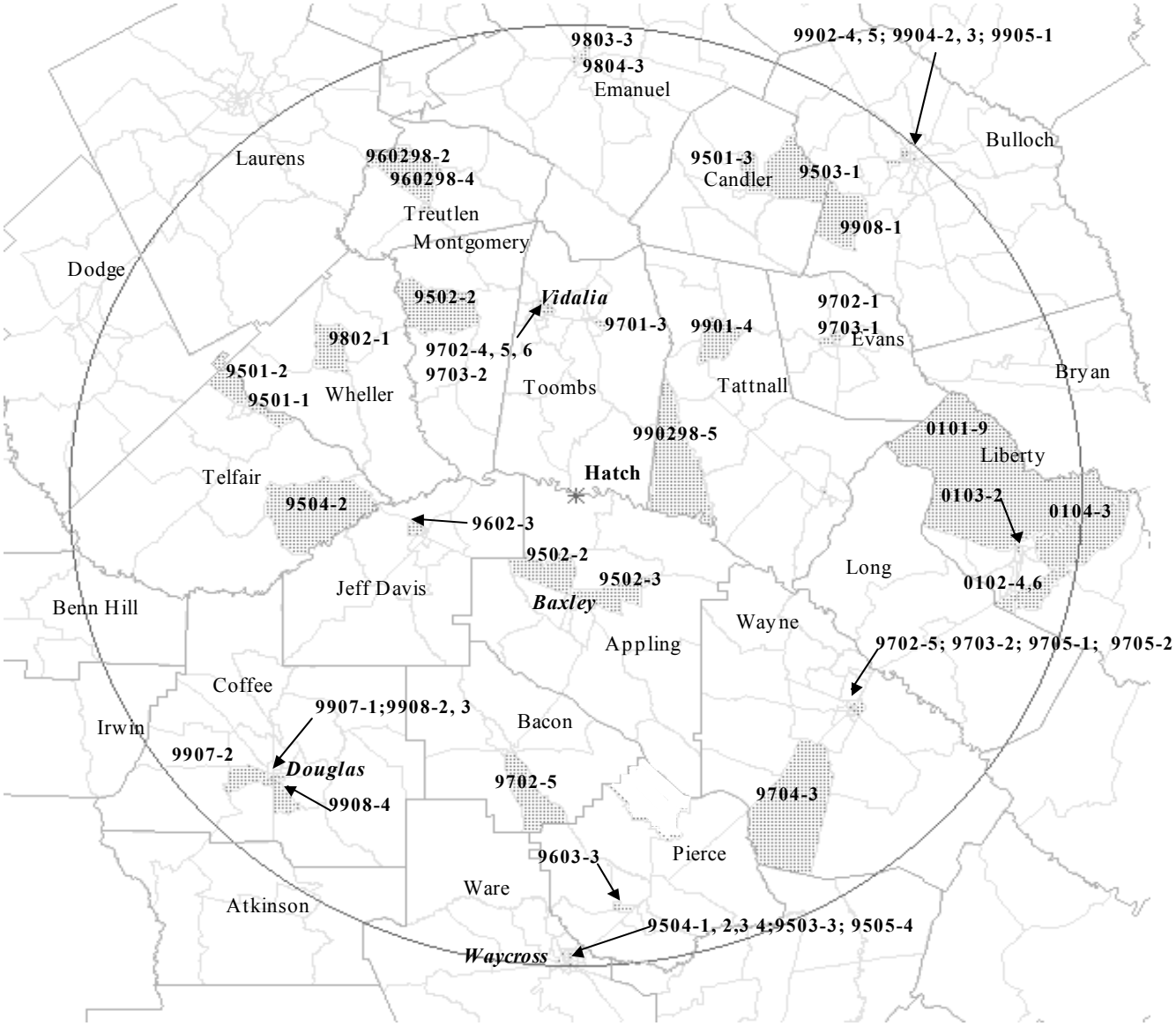

Figure 4-1. Geographic Distribution of Populations Classified as Minority Populations (Shown in Shaded Areas) -- 80 km (50-mi) Radius

A low-income population is defined to exist if the percentage of households below the poverty level is 20 percentage points or more above the percentage of households below the poverty level in the entire State of Georgia. Figure 4-2, also based on the 1990 Census (USCB 1991),

shows the geographic distribution of low-income populations (cross-hatched census blocks) within the 80-km (50-mi) radius of the plant. The largest concentrations of low-income populations within the 80-km (50-mi) radius are located in the counties of Wheller, Montgomery, Bulloch, and Wayne and the towns of Vidalia, Baxley, Douglas, and Waycross. Some small groups are scattered throughout the rural areas of Emanuel, Chandler, Tattnall, and Bacon counties.

With the locations of minority and low-income populations identified, the staff proceeded to evaluate whether any of the environmental impacts of the proposed action could affect these populations in a disproportionate manner. Based on staff guidance (NRC 1999b), air, land, and water resources within about 80 km (50 mi) of HNP were examined. Within that area, a few potential environmental impacts could affect human populations; all of these were considered SMALL for the general population. These include:

- groundwater-use conflicts (discussed in Section 4.5)
- electric shock (discussed in Section 4.2.1)
- microbial organisms (discussed in Section 4.1.2)
- postulated accidents (discussed in Chapter 5.0 of this SEIS and Chapter 5 of the GEIS)
- surface water-use conflicts (discussed in Section 4.1.1)

The pathways through which the environmental impacts associated with HNP license renewal can affect human populations are discussed in each associated section (e.g., Section 4.1.1 for surface water-use conflicts). The staff then evaluated whether these impacts could have a disproportionately high and adverse effect on the minority and low-income populations. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing, through which the populations could be disproportionately affected. In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations. The staff concludes that HNP offsite impacts to minority and low-income populations would be SMALL, and no special mitigation actions are warranted.

4.5 Groundwater Use and Quality

There are no Category 1 issues applicable to HNP groundwater use and quality during the renewal term. Category 2 issues related to groundwater use and quality during the renewal term that are applicable to HNP are discussed in the sections that follow. These issues, listed in Table 4-8, require plant-specific analysis.

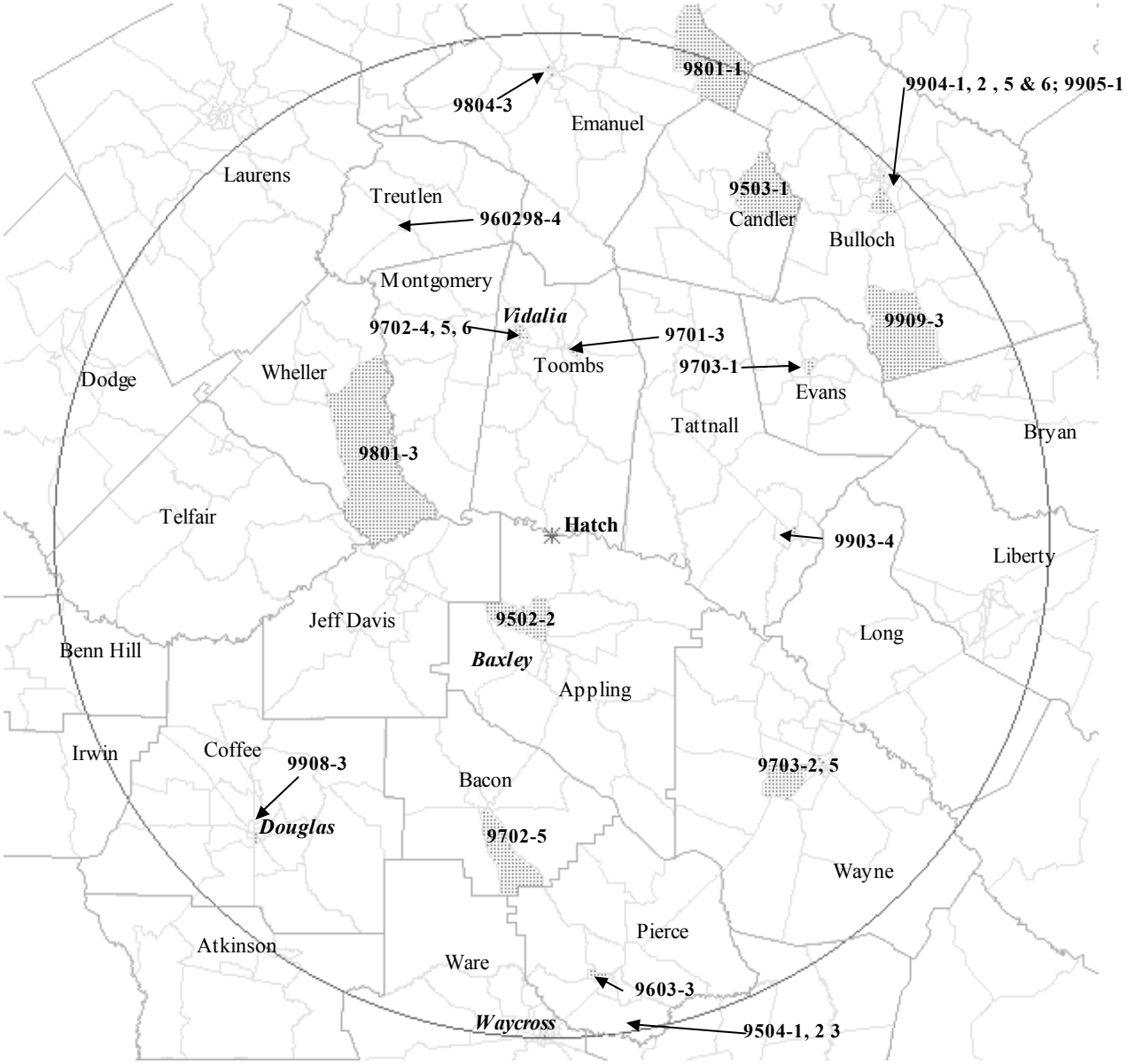

Figure 4-2. Geographic Distribution of Populations Classified as Low-Income Populations (Shown in Shaded Areas)—80-km (50-mi) Radius

4.5.1 Groundwater-Use Conflicts (Potable and Service Water)

Site Wells 1 and 2, described in Section 2.2.2, are screened in the principal artesian (Floridan) aquifer. During HNP construction, pump tests were conducted to determine the groundwater characteristics for this unit. The wells pumped for 9 hours at rates of approximately 2.85 m^3/min (752 gpm) (Well 1) and approximately 3.02 m^3/min (797 gpm) (Well 2). Drawdown in the wells stabilized at 1.5 m (5 ft) in Well 1 and 2.4 m (8 ft) in Well 2. Based on published literature, the transmissivity in the vicinity of the site is approximately 0.019 m^3/s/m (130,000 gpd/ft) and the effective permeability is 0.03 and 0.06 m/min (0.1 and 0.2 ft/min). Data gathered during pumping tests and existing data for this aquifer indicate that a properly designed well installed within this aquifer unit can safely yield over approximately 4.2 m^3/min (1100 gpm). A third site well, Well 3, was added to supply domestic water to the recreation facility. The well yield for Well 3 (less than 3.8 m^3/d [1000 gpd]) will not significantly impact the water usage of the aquifer. Two smaller wells for irrigation of ornamental vegetation were placed in service in early 2000. Those wells typically draw 34 m^3/d (9000 gpd) each and are used as needed.

Table 4-8. Category 2 Issues Applicable to Groundwater Use and Quality During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
GROUNDWATER USE AND QUALITY			
Groundwater-use conflicts (potable and service water; plants that use >379 L/min [>100 gpm]).	4.8.1.1 4.8.2.1	C	4.5.1
Groundwater-use conflicts (plants using cooling towers withdrawing makeup water from a small river)	4.8.1.3 4.4.2.1	A	4.5.2

Within the immediate vicinity of the site, the primary use of groundwater is for domestic needs, with a limited amount for livestock. Most domestic wells are screened within the unconfined aquifer. The closest offsite well that is screened to the principal aquifer is located approximately 300 m (1000 ft) southwest of the site (Figure 2-3). Currently, there is no industrial demand for groundwater within the vicinity of the site, and no groundwater is used for irrigation. The nearest appreciable demand is 16 km (10 mi) south of the site, where the town of Baxley has four wells withdrawing approximately 5,300 m^3/d (1.4 million gpd) from the principal aquifer.

As described above, each of the onsite production wells is capable of producing approximately 2.8 m^3/min (750 gpm). The pump test conducted during construction demonstrated that at this rate of pumping there was no interference between site Wells 1 and 2. These two wells are

located approximately 542 m (1780 ft) apart, therefore, the effective radius is conservatively assumed to be approximately 600 m (2000 ft). The onsite well closest to the facility boundary is Well 1 at approximately 1000 m (3400 ft). Based on the conservative pumping rate of 2.8 m^3/min (750 gpm) and a conservative effective radius of 600 m (2000 ft), the resulting drawdown in Well 1 would not extend to the facility boundary. Given that the actual plant groundwater requirements, approximately 0.48 m^3/min (126 gpm), are about one fifth of that used to determine the effective radius, the drawdown of the groundwater potentiometric surface attributable to plant operations would be substantially less than that demonstrated by the original site pump test data, creating no interference with offsite wells.

The site production wells are located in the Floridan Aquifer. This aquifer unit is isolated geologically from the minor confined aquifer by a confining unit that is approximately 30 m (100 ft) thick. Since monitoring began at the facility in 1969, there has been little to no fluctuation of the water level in the minor confined aquifer. Water levels in the unconfined aquifers have been observed to vary according to normal seasonal fluctuations. There have been no observed effects in the monitoring wells installed in the shallow onsite aquifers from the pumping of groundwater from the Floridan onsite wells. Irrigation Wells 4 and 5 are also located in the Floridan Aquifer. A sixth well has been permitted in the formation above the Floridan Aquifer but has not been constructed.

Due to the high potential yields of the Floridan Aquifer and the low production yields required by HNP, HNP will have little effect on the regional water table. There is some limited domestic and agricultural use of groundwater in rural areas surrounding the site, but no groundwater-use conflicts have been identified as a result of current withdrawals. Therefore, the continued operation of HNP is considered to have a SMALL impact on regional groundwater use and does not require mitigation.

4.5.2 Groundwater-Use Conflicts (Makeup Water)

The alluvial aquifer at the site is primarily south of the Altamaha River within the facility boundary, and consists of approximately 16.7 m (55 ft) of poorly sorted sand, gravel, and clay. The alluvial aquifer contains groundwater under water table conditions. Clayey soils dominate in the upper portion of the aquifer. Recharge to the aquifer is mainly through the infiltration of local precipitation. Recharge is also provided in a limited amount by discharge from the Altamaha River during high stages and by the minor confined aquifer of the Hawthorn Formation, to which the alluvium is hydraulically connected. Groundwater typically discharges to the Altamaha River. Although no aquifer data exist for the unit, the alluvium in the region is considered to be a large potential source of water.

Based on the information provided in Section 4.1.1, the consumptive use of HNP is estimated to lower the river elevation by 0.02 m (0.08 ft) during low-flow conditions. Such a small change

would not appreciably alter the potentiometric gradient in the alluvial aquifer. Therefore, the impact to the groundwater resource from the reduced streamflow is SMALL and does not require mitigation.

4.6 Threatened or Endangered Species

Threatened or endangered species are listed as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, as shown in Table 4-9. This issue requires consultation with appropriate agencies (FWS or National Marine Fisheries Service [NMFS]) to determine if threatened or endangered species are present and whether they would be adversely affected during the license renewal term.

Table 4-9. Category 2 Issue Applicable to Threatened or Endangered Species During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
THREATENED OR ENDANGERED SPECIES (FOR ALL PLANTS)			
Threatened or endangered species	4.1	E	4.6

Assessment of the potential occurrence of endangered or threatened species in the vicinity of HNP was initiated in December 1997 when SNC requested database information from GADNR concerning known occurrences of State- or Federal-listed species in the vicinity of HNP (GPC 1997). SNC commissioned a field survey of the HNP site and all of the transmission lines associated with HNP, as well as a freshwater mussel survey in a 19-km (12-mi) reach of the Altamaha River up and downstream of HNP (Law 1998). The draft of the terrestrial survey was completed in September 1999 (Tetra Tech, Inc. 1999). These surveys detected the presence of several Federal-listed species and a number of State-listed species of concern (Table 2-5). Most of the documented occurrences were within transmission corridors well away from the HNP site, but a few species were documented at or near the HNP site. SNC determined that its operation and maintenance procedures would remain unchanged during the license renewal term, and did not threaten the existence of the listed species at HNP or in associated transmission corridors.

SNC forwarded the results of the freshwater mussel and terrestrial surveys to FWS and GADNR in September 1999 (SNC 1999b; 1999c), along with a request for concurrence with a "no effect" determination regarding license renewal.

GADNR concurred with the SNC conclusions (GADNR 1999b), but FWS did not (FWS 1999). FWS indicated that it could not concur with a "no effect" determination, and requested

additional information about the plant operations, and how these operations may affect the shortnose sturgeon. FWS also requested that SNC further investigate the potential occurrence of the flatwoods salamander in the vicinity of HNP or associated transmission lines.

SNC representatives met with FWS during November 1999 and provided a biological information update concerning the flatwoods salamander and shortnose sturgeon in December 1999 (SNC 1999d). Based on the information provided by the applicant, FWS concurred with a no adverse affect determination regarding endangered or threatened species under the purview of FWS in January 2000 (FWS 2000).

SNC contacted NMFS during September 1999 requesting concurrence with a "no effect" determination concerning the shortnose sturgeon in the Altamaha River (SNC 1999e). NMFS determined that, based on the information provided, it was unable to concur with a "no effect" determination concerning the potential effects of license renewal on the shortnose sturgeon (NMFS 1999). SNC representatives met with NMFS and provided additional information concerning shortnose sturgeon near HNP and operational effects of HNP on the Altamaha River in October 1999 (GPC 1999c) and February 2000 (SNC 2000b). On August 31, 2000, the NRC staff submitted its biological assessment of the impact of HNP operations on shortnose sturgeon to NMFS's Southeast Regional Office, in St. Petersburg, Florida (NRC 2000), initiating an informal consultation under Section 7 of the Endangered Species Act. This consultation is continuing and will be concluded in the future.

During its preparation of the biological assessment, the staff collected and evaluated information related to the shortnose sturgeon's life cycle, range, migration patterns, and spawning. The staff also evaluated potential impacts related to (1) entrainment and impingement of shortnose sturgeon at the HNP intake structure and (2) thermal effects.

The staff found no evidence that the water-intake operations and thermal effects of the HNP license renewal will adversely impact the shortnose sturgeon. There is no evidence that HNP operations have influenced the migration of shortnose sturgeon to and from spawning grounds upstream of the plant. Monitoring of entrainment and impingement at HNP indicate that few, if any, sturgeon are impinged at the intake screens or entrained in the water pumped to the cooling towers. In its biological assessment, the staff concluded that operation of HNP may affect, but is not likely to adversely affect, the shortnose sturgeon. When NMFS provides its conclusions, any remaining issues will be resolved as operating plant issues because any impacts on the shortnose sturgeon are occurring now, as well as in the future.

In a letter dated April 25, 2001 (SNC 2001), SNC updated the biological status information it had supplied to NMFS in a letter dated February 2, 2000 (SNC 2000b). The additional information provided in the update is consistent with previous information supplied by SNC and further supports the conclusion the staff reached in its biological assessment. In its April 25,

2001, letter, SNC also offered to participate in the existing Shortnose Sturgeon Recovery Team and agreed to include a description of the shortnose sturgeon in plant training for the intake structure screen operation. SNC's participation on the recovery team will assist those who are working to promote the recovery of this species. The training will help to ensure that operators are able to recognize a shortnose sturgeon if one is ever impinged at the plant intake structure.

Based on the results of its assessment for the shortnose sturgeon and its review of freshwater mussels and terrestrial surveys, the staff concludes that the impacts of an additional 20 years of operation and maintenance of HNP and its associated transmission lines would be SMALL, and further mitigation is not warranted.

4.7 Evaluation of Potential New and Significant Information on Impacts of Operations During the Renewal Term

The staff has not identified new and significant information on environmental issues listed in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 related to operation during the renewal term. The staff reviewed the discussion of environmental impacts associated with operation during the renewal term in the GEIS and the licensee's program for determining new and significant impacts, and has conducted its own independent review, including public scoping meetings, to identify issues with significant new information. Processes for identification and evaluation of new information are described in Chapter 1 under License Renewal Evaluation Process.

4.8 Summary of Impacts of Operations During the Renewal Term

Neither SNC nor the staff is aware of significant new information related to any of the applicable Category 1 issues associated with the HNP operation during the renewal term. Consequently, the staff concludes that the environmental impacts associated with these issues are bounded by the impacts described in the GEIS. For each of these issues, the GEIS concluded that the impacts would be SMALL and that "plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation."

Plant-specific environmental evaluations were conducted for 11 Category 2 issues applicable to HNP operation during the renewal term and for environmental justice. For all these issues, the staff concluded that the potential environmental impact of renewal term operations of HNP would be of SMALL significance in the context of the standards set forth in the GEIS and that mitigation would not be warranted.

In addition, for chronic effects from electromagnetic fields, the staff concluded that a consensus has not been reached by appropriate Federal health agencies that there are adverse effects from electromagnetic fields. The staff considers the GEIS finding of "not applicable" still appropriate, and therefore, no further evaluation of this issue is required.

4.9 References

10 CFR 51.53, "Postconstruction environmental reports."

10 CFR Part 51, Subpart A, Appendix B, "Environmental effect of renewing the operating license of a nuclear power plant."

Council on Environmental Quality (CEQ). 1997. *Environmental Justice: Guidance Under the National Environmental Policy Act*. Council on Environmental Quality, Executive Office of the President, Washington, D.C.

Endangered Species Act of 1973, as amended, 16 USC 1531, et seq.

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations." 59 *Federal Register* 7629-7633 (1994).

Federal Water Pollution Control Act (FWPCA) of 1977, as amended, 33 USC 1251 et seq. (Also known as the Clean Water Act).

Georgia Department of Natural Resources (GADNR). 1999a. Letter from Mr. W. Ray Luce, GADNR to Mr. C.R. Pierce, Southern Nuclear Operating Company. October 29 ,1999.

Georgia Department of Natural Resources (GADNR). 1999b. Letter from Mr. David Waller, Director, GADNR, to Mr. C. R. Pierce, Southern Nuclear Operating Company. October 13, 1999.

Georgia Power Company (GPC). 1997. Letter from Mr. William J. Chandler, GPC, to Mr. Greg Krakow, Data Manager, Georgia Department of Natural Resources. December 16, 1997.

Georgia Power Company (GPC). 1999a. *Engineering Study on Induced Short Circuit Currents*.

Georgia Power Company (GPC). 1999b. *Short Circuit Study on 230-kV Lines from Plant Hatch*.

Georgia Power Company (GPC). 1999c. Letter from Mr. M. C. Nichols, GPC, to Mr. David Bernhart, National Marine Fisheries Service. October 18, 1999.

Law Engineering and Environmental Services. 1998. *Freshwater Mussel Survey, Altamaha River, Appling and Toombs Counties, Georgia*. Prepared for Southern Nuclear Operating Company. December 2, 1998.

National Electrical Safety Code (NESC). 1997. Institute of Electrical and Electric Engineers, Inc., New York.

National Environmental Policy Act (NEPA) of 1969, as amended, 42 USC 4321, et seq.

National Institute of Environmental Health Sciences (NIEHS). 1999. *NIESH Report on Health Effects from Exposure to Power Line Frequency and Electric and Magnetic Fields*. NIH Publication No. 99-4493, National Institutes of Health, Research Triangle Park, North Carolina.

National Marine Fisheries Service (NMFS). 1999. Letter from Mr. William Hogarth, Regional Administrator, NMFS, to Mr. C. R. Pierce, Southern Nuclear Operating Company. October 8, 1999.

Southern Nuclear Operating Company (SNC). 1999a. Letter from Mr. C. R. Pierce, SNC, to Mr. Ray Luce, State Historical Preservation Officer. Historic Preservation Division, Georgia Department of Natural Resources. September 15, 1999.

Southern Nuclear Operating Company (SNC). 1999b. Letter from Mr. C. R. Pierce, SNC, to Ms. Sandra Tucker, Field Supervisor, U.S. Fish and Wildlife Service. September 15 ,1999.

Southern Nuclear Operating Company (SNC). 1999c. Letter from Mr. C. R. Pierce, SNC, to Mr. David Waller, Director, Wildlife Resources Division, Georgia Department of Natural Resources. September 15 ,1999.

Southern Nuclear Operating Company (SNC). 1999d. Letter from Mr. C. R. Pierce, SNC, to Ms. Sandra Tucker, Field Supervisor, U.S. Fish and Wildlife Service. December 7, 1999.

Southern Nuclear Operating Company (SNC). 1999e. Letter from Mr. C. R. Pierce, SNC, to Mr. Charles Oravetz, Protected Species Division, National Marine Fisheries Service. September 15, 1999.

Southern Nuclear Operating Company (SNC). 2000a. *Application for License Renewal for the Edwin I. Hatch Nuclear Plants, Units 1 and 2. Appendix D, Applicant's Environmental Report–Operating License Renewal Stage, Edwin I. Hatch Nuclear Plant.*

Southern Nuclear Operating Company (SNC). 2000b. Letter from Mr. C. R. Pierce (SNC) to Mr. Charles Oravetz, Chief, Protected Species Branch, National Marine Fisheries Service. February 2, 2000.

Southern Nuclear Operating Company (SNC). 2000b. Letter from Mr. H. L. Sumner, Jr. (SNC) to Mr. Andrew J. Kugler (NRC). April 25, 2001.

Tetra Tech, Inc. 1999. *Threatened & Endangered Species Surveys, E. I. Hatch Nuclear Plant & Associated Transmission line Corridors (1998 - 1999)*. December 3, 1999.

U.S. Atomic Energy Commission (AEC). 1972. *Final Environmental Statement for the Edwin I. Hatch Nuclear Plant, Unit 1 and Unit 2.* Washington, D.C.

U.S. Census Bureau (USCB). 1991. *1990 Census.*

U.S. Fish and Wildlife Service (FWS). 1999. Letter from Ms. Sandra Tucker, Field Supervisor, FWS, to Mr. C. R. Pierce, Southern Nuclear Operating Company. November 8, 1999.

U.S. Fish and Wildlife Service (FWS). 2000. Letter from Ms. Sandra Tucker, Field Supervisor, FWS, to Mr. C. R. Pierce, Southern Nuclear Operating Company. January 23, 2000.

U.S. Nuclear Regulatory Commission (NRC). 1978. *Final Environmental Statement for the Edwin I. Hatch Nuclear Plant Unit 2.* Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999a. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report, Section 6.3—Transportation, Table 9.1, Summary of findings in NEPA issues for license renewal of nuclear power plants*. NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999b. *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues.* Attachment 4 to Office of Nuclear Reactor Regulations, Office Letter No. 906, Revision 2*,* Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2000. Letter from Ms. Cynthia A. Carpenter, NRC, to Mr. Charles Oravetz, Chief, Protected Species Branch, National Marine Fisheries Service. August 31, 2000.

Wiltz, J. W. 1981. *Plant Edwin I. Hatch 316(b) Demonstration on the Altamaha River in Appling County, Georgia*. Georgia Power Company, Environmental Affairs Center.