Summer Nuclear Station, S.C.

Environmental Report for

Docket Number 50/395
License Number NPF-12

SCE&G®
A SCANA COMPANY

TABLE OF CONTENTS

Section — Page

ACRONYMS AND ABBREVIATIONS AA-1

1.0 INTRODUCTION 1-1
- 1.1 Purpose and Need For Action 1-1
- 1.2 Environmental Scope and Methodology 1-2
- 1.3 V. C. Summer Nuclear Station Licensee and Ownership 1-3
- 1.4 References 1-4

2.0 SITE AND ENVIRONMENTAL INTERFACES 2-1
- 2.1 Location and Features 2-1
- 2.2 Aquatic and Riparian Ecological Communities 2-2
- 2.3 Groundwater Resources 2-10
- 2.4 Critical and Important Terrestrial Habitats 2-12
- 2.5 Threatened or Endangered Species 2-14
- 2.6 Regional Demography 2-18
- 2.7 Economic Base 2-21
- 2.8 Taxes 2-22
- 2.9 Land Use Planning 2-23
- 2.10 Social Services and Public Facilities 2-26
  - 2.10.1 Public Water Supply 2-26
  - 2.10.2 Transportation 2-28
- 2.11 Minority and Low-Income Populations 2-29
- 2.11.1 Minority Populations 2-29
- 2.11.2 Low-Income Populations 2-31
- 2.12 Meteorology and Air Quality 2-32
- 2.13 Historic and Archeological Resources 2-33
- 2.14 Related Federal Projects 2-35
- 2.15 References 2-36

3.0 PROPOSED ACTION 3-1
- 3.1 General Plant Information 3-1
  - 3.1.1 Reactor and Containment Systems 3-1
  - 3.1.2 Cooling and Auxiliary Water Systems 3-3
    - 3.1.2.1 Surface Water 3-3
    - 3.1.2.2 Groundwater 3-4
  - 3.1.3 Transmission Facilities 3-4
- 3.2 Refurbishment Activities 3-7
- 3.3 Programs and Activities for Managing the Effects of Aging 3-9
- 3.4 Employment 3-10
- 3.5 References 3-12

4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS 4-1
- 4.1 Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with Low Flow) 4-6

TABLE OF CONTENTS (Continued)

Section			Page
	4.2	Entrainment of Fish and Shellfish in Early Life Stages	4-8
	4.3	Impingement of Fish and Shellfish	4-10
	4.4	Heat Shock	4-11
	4.5	Groundwater Use Conflicts (Plants Using > 100 gpm of Groundwater)	4-13
	4.6	Groundwater Use Conflicts (Plants Using Cooling Towers or Cooling Ponds that Withdraw Makeup Water from a Small River)	4-14
	4.7	Groundwater Use Conflicts (Plants Using Ranney Wells)	4-16
	4.8	Degradation of Groundwater Quality	4-17
	4.9	Impacts of Refurbishment on Terrestrial Resources	4-18
	4.10	Threatened and Endangered Species	4-19
	4.11	Air Quality During Refurbishment	4-21
	4.12	Microbiological Organisms	4-22
	4.13	Electric Shock From Transmission-Line-Induced Currents	4-25
	4.14	Housing Impacts	4-28
	4.15	Public Utilities: Public Water Supply Availability	4-30
	4.16	Education Impacts from Refurbishment	4-32
	4.17	Offsite Land Use	4-33
		4.17.1 Offsite Land Use - Refurbishment	4-33
		4.17.2 Offsite Land Use - License Renewal Term	4-34
	4.18	Transportation	4-36
	4.19	Historic and Archeological Resources	4-37
	4.20	Severe Accident Mitigation Alternatives	4-38
	4.21	References	4-41
5.0		ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION	5-1
	5.1	Discussion	5-1
	5.2	References	5-3
6.0		SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS	6-1
	6.1	License Renewal Impacts	6-1
	6.2	Mitigation	6-2
	6.3	Unavoidable Adverse Impacts	6-3
	6.4	Irreversible and Irretrievable Resource Commitments	6-4
	6.5	Short-term Use versus Long-term Productivity of the Environment	6-5
	6.6	References	6-6
7.0		ALTERNATIVES TO THE PROPOSED ACTION	7-1
	7.1	No-Action Alternative	7-3
	7.2	Alternatives that Meet System Generating Needs	7-5
		7.2.1 Alternatives Considered	7-7
		7.2.1.1 Construct and Operate Fossil-Fuel-Fired Generation	7-9
		7.2.1.2 Purchased Power	7-10
		7.2.1.3 Reduce Demand	7-12
		7.2.2 Environmental Impacts of Alternatives	7-14
		7.2.2.1 Coal-Fired Generation	7-14
		7.2.2.2 Gas-Fired Generation	7-17

TABLE OF CONTENTS (Continued)

Section — Page

7.2.2.3 Purchased Power ... 7-20
7.3 References ... 7-21
8.0 COMPARISON OF ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL WITH THE ALTERNATIVES ... 8-1
8.1 References ... 8-2
9.0 STATUS OF COMPLIANCE ... 9-1
9.1 Proposed Action ... 9-1
9.1.1 General ... 9-1
9.1.2 Threatened or Endangered Species ... 9-1
9.1.3 Coastal Zone Management Program ... 9-2
9.1.4 Historic Preservation ... 9-2
9.1.5 Water Quality (401) Certification ... 9-2
9.2 Alternatives ... 9-3
9.3 References ... 9-4

APPENDIX A - NRC NEPA ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS
APPENDIX B - NPDES PERMIT
APPENDIX C - SPECIAL-STATUS SPECIES CORRESPONDENCE
APPENDIX D - MICROBIOLOGICAL ORGANISMS CORRESPONDENCE
APPENDIX E - CULTURAL RESOURCES CORRESPONDENCE
APPENDIX F - SEVERE ACCIDENT MITIGATION ALTERNATIVES

List of Tables

Table — Page

1-1 Environmental Report Responses to License Renewal Environmental Regulatory Requirements ... 1-5
2-1 Endangered and Threatened Species that Occur in the Vicinity of VCSNS or in Counties Crossed by Transmission Lines ... 2-41
2-2 Estimated Populations and Annual Growth Rates in Fairfield, Lexington, Richland, and Newberry Counties from 1980 - 2040 ... 2-42
2-3 Property Tax Revenues Generated in Fairfield County, South Carolina; Property Taxes Paid to Fairfield County by V.C. Summer Nuclear Station; and Fairfield County Operating Budget, 1995 – 2000 ... 2-43
2-4 Lexington County Public Water Suppliers and Capacities ... 2-44
2-5 Fairfield County Public and Private Water Suppliers and Capacities ... 2-45
2-6 Traffic Counts for Roads in the Vicinity of VCSNS ... 2-46
2-7 Minority and Low-Income Populations ... 2-47
2-8 Fairfield and Newberry County Sites on the National Register of Historic Places (Within the Vicinity of the VCSNS) ... 2-48

TABLE OF CONTENTS (Continued)

List of Tables (Continued)

Table		Page
4-1	Category 1 Issues that are not Applicable to V.C. Summer Nuclear Station (VCSNS)	4-44
4-2	Category 1 and "NA" Issues that are Applicable to V.C. Summer Nuclear Station (VCSNS)	4-46
4-3	Results of Induced Current Analysis	4-55
4-4	Summary of the Detailed SAMA Analysis	4-55
6-1	Environmental Impacts Related to License Renewal at VCSNS	6-7
7-1	Coal-Fired Alternative	7-23
7-2	Gas-Fired Alternative	7-24
7-3	Air Emissions from Coal-Fired Alternative	7-25
7-4	Air Emissions from Gas-Fired Alternative	7-26
8-1	Impacts Comparison Summary	8-3
8-2	Impacts Comparison Detail	8-4
9-1	Environmental Authorizations for Current VCSNS Operations	9-5
9-2	Environmental Authorizations for VCSNS License Renewal	9-7

List of Figures

Figure		Page
2-1	V.C. Summer Nuclear Station, 50-Mile Locational Vicinity Map	2-49
2-2	V.C. Summer Nuclear Station, 6-Mile Vicinity Map	2-50
2-3	South Carolina Electric & Gas Company, Virgil Summer Nuclear Station Site Area Map	2-51
2-4	V.C. Summer Nuclear Station, American Indian or Alaskan Native Minority Populations	2-52
2-5	V.C. Summer Nuclear Station, Asian Minority Populations	2-53
2-6	V.C. Summer Nuclear Station, Black Races Minority Populations	2-54
2-7	V.C. Summer Nuclear Station, Aggregate of Minority Races Populations	2-55
2-8	V.C. Summer Nuclear Station, Hispanic Ethnicity Populations	2-56
2-9	V.C. Summer Nuclear Station, Low-Income Populations	2-57
3-1	V.C. Summer Nuclear Station, 50-Mile Transmission Line Map	3-14
3-2	V.C. Summer Nuclear Station, 6-Mile Transmission Line Map	3-15
7-1	South Carolina Utility Generating Capability, 2000	7-5
7-2	South Carolina Utility Generating Utilization, 2000	7-5
7-3	SCE&G Energy Capacity	7-6
7-4	SCE&G Utilization by Fuel Type	7-6

ACRONYMS AND ABBREVIATIONS

AADT	Annual Average Daily Traffic
AQCR	Air Quality Control Region
CDC	Centers for Disease Control and Prevention
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CWA	Clean Water Act
DO	dissolved oxygen
DSM	demand side management
EPA	U.S. Environmental Protection Agency
EPACT	Energy Policy Act of 1992
FERC	Federal Energy Regulatory Commission
FES	Final Environmental Statement
FONSI	Finding of No Significant Impact
FPSF	Fairfield Pumped Storage Facility
FWS	U.S. Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement
GIS	Geographic Information System
GWH	gigawatt-hours
gpm	gallons per minute
IPA	Integrated Plant Assessment
IPE	Individual Plant Examination
kV	kilovolt
MGD	million gallons per day
msl	mean sea level
MW	megawatt
MWe	megawatts-electrical
MWt	megawatts-thermal
NEPA	National Environmental Policy Act
NESC®	National Electrical Safety Code®
NMFS	National Marine Fisheries Service
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
PM_{10}	particulates having a diameter of less than 10 microns
PRA	Probabilistic Risk Assessment
PSC	Public Service Commission (of South Carolina)
psig	pounds per square inch gauge

RTO	Regional Transmission Organization
SAMA	Severe Accident Mitigation Alternatives
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCE&G	South Carolina Electric & Gas Company
SHPO	State Historic Preservation Officer
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SSCs	systems, structures, and components
USCB	U.S. Census Bureau
USGS	U.S. Geological Survey
VCSNS	Virgil C. Summer Nuclear Station

1.0 INTRODUCTION

1.1 Purpose and Need for Action

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. South Carolina Electric & Gas Company (SCE&G) operates Virgil C. Summer Nuclear Station (VCSNS) Unit 1 pursuant to NRC Operating License Number NPF-12. The license will expire August 6, 2022. SCE&G has prepared this environmental report in conjunction with its application to NRC to renew the VCSNS operating license, as provided by the following NRC regulations:

- Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application-Environmental Information (10 CFR 54.23) and

- Title 10, Energy, CFR, Part 51, Environmental Protection Requirements for Domestic Licensing and Related Regulatory Functions, Section 51.53, Postconstruction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)].

NRC has defined the purpose and need for the proposed action, the renewal of the operating license for nuclear power plants such as VCSNS, as follows:

> "…The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decision makers." (NRC 1996a, pg. 28472)

The renewed operating license would allow 20 additional years of plant operation beyond the current VCSNS licensed operating period of 40 years.

1.2 Environmental Scope and Methodology

NRC regulations for domestic licensing of nuclear power plants require environmental review of applications to renew operating licenses. Specifically, 10 CFR 51.53(c) requires that an applicant for license renewal submit with its application a separate document entitled *Applicant's Environmental Report - Operating License Renewal Stage*. In determining what information to include in the VCSNS Environmental Report, SCE&G has relied on NRC regulations and the following supporting documents that provide additional insight into the regulatory requirements:

- NRC supplemental information in the *Federal Register* (NRC 1996a, b, c; NRC 1999a)
- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996d; NRC 1999b)
- *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses* (NRC 1996e)
- *Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response* (NRC 1996f)

SCE&G has prepared Table 1-1 to verify conformance with regulatory requirements. Table 1-1 indicates where the environmental report responds to each requirement of 10 CFR 51.53(c). In addition, each responsive section is prefaced by a boxed quote of the regulatory language and applicable supporting document language.

1.3 V. C. Summer Nuclear Station Licensee and Ownership

VCSNS is a joint project between SCE&G, operator and two-thirds owner of the plant, and the South Carolina Public Service Authority (commonly referred to as "Santee Cooper"), owner of the remaining one-third. SCE&G is the principal subsidiary of SCANA Corporation, an energy-based holding company with headquarters in Columbia, South Carolina. SCE&G is involved in the generation, transmission, and delivery of electric power to customers in 24 South Carolina counties in the central and southern portions of the state.

1.4 References

NRC (U.S. Nuclear Regulatory Commission). 1996a. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." Federal Register. Vol. 61, No. 109. June 5.

NRC (U.S. Nuclear Regulatory Commission). 1996b. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Correction." Federal Register. Vol. 61, No. 147. July 30.

NRC (U.S. Nuclear Regulatory Commission). 1996c. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." Federal Register. Vol. 61, No. 244. December 18.

NRC (U.S. Nuclear Regulatory Commission). 1996d. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS). Volumes 1 and 2. NUREG-1437. Washington, DC. May.

NRC (U.S. Nuclear Regulatory Commission). 1996e. Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses. NUREG-1440. Washington, DC. May.

NRC (U.S. Nuclear Regulatory Commission). 1996f. Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response. Volumes 1 and 2. NUREG-1529. Washington, DC. May.

NRC (U.S. Nuclear Regulatory Commission). 1999a. "Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rules." Federal Register. Vol. 64, No. 171. September 3.

NRC (U.S. Nuclear Regulatory Commission). 1999b. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS). Section 6.3, "Transportation" and Table 9-1, "Summary of findings on NEPA issues for license renewal of nuclear power plants." NUREG-1437. Volume 1, Addendum 1. Washington, DC. August.

TABLE 1-1
ENVIRONMENTAL REPORT RESPONSES TO LICENSE RENEWAL ENVIRONMENTAL REGULATORY REQUIREMENTS

Regulatory Requirement	Responsive Environmental Report Section(s)	
10 CFR 51.53(c)(1)	Entire Document	
10 CFR 51.53(c)(2), Sentences 1 and 2	3.0	Proposed Action
10 CFR 51.53(c)(2), Sentence 3	7.2.2	Environmental Impacts of Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(1)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(2)	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(3)	7.0	Alternatives to the Proposed Action
	8.0	Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(4)	6.5	Short-Term Use Versus Long-Term Productivity of the Environment
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(5)	6.4	Irreversible or Irretrievable Resource Commitments
10 CFR 51.53(c)(2) and 10 CFR 51.45(c)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
	7.2.2	Environmental Impacts of Alternatives
	8.0	Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(d)	9.0	Status of Compliance
10 CFR 51.53(c)(2) and 10 CFR 51.45(e)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(3)(ii)(A)	4.1	Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers using makeup water from Small River with Low Flow)
	4.6	Groundwater Use Conflicts (Plants Using Cooling Towers withdrawing makeup water from a Small River)
10 CFR 51.53(c)(3)(ii)(B)	4.2	Entrainment of Fish and Shellfish in Early Life Stages
	4.3	Impingement of Fish and Shellfish
	4.4	Heat Shock
10 CFR 51.53(c)(3)(ii)(C)	4.5	Groundwater Use Conflicts (Plants Using >100 gpm of Groundwater)
	4.7	Groundwater Use Conflicts (Plants Using Ranney Wells)
10 CFR 51.53(c)(3)(ii)(D)	4.8	Degradation of Groundwater Quality
10 CFR 51.53(c)(3)(ii)(E)	4.9	Impacts of Refurbishment on Terrestrial Resources
	4.10	Threatened or Endangered Species
10 CFR 51.53(c)(3)(ii)(F)	4.11	Air Quality During Refurbishment (Non-Attainment or Maintenance Areas)
10 CFR 51.53(c)(3)(ii)(G)	4.12	Microbiological Organisms

TABLE 1-1 (cont'd)
ENVIRONMENTAL REPORT RESPONSES TO LICENSE RENEWAL ENVIRONMENTAL REGULATORY REQUIREMENTS

Regulatory Requirement		Responsive Environmental Report Section(s)
10 CFR 51.53(c)(3)(ii)(H)	4.13	Electric Shock from Transmission-Line-Induced Currents
10 CFR 51.53(c)(3)(ii)(I)	4.14	Housing Impacts
	4.15	Public Utilities: Public Water Supply Availability
	4.16	Education Impacts from Refurbishment
	4.17	Offsite Land Use
10 CFR 51.53(c)(3)(ii)(J)	4.18	Transportation
10 CFR 51.53(c)(3)(ii)(K)	4.19	Historic and Archeological Resources
10 CFR 51.53(c)(3)(ii)(L)	4.20	Severe Accident Mitigation Alternatives
10 CFR 51.53(c)(3)(iii)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(3)(iv)	6.2	Mitigation
	5.0	Assessment of New and Significant Information
10 CFR 51, Appendix B, Table B-1, Footnote 6	2.11	Minority and Low-Income Populations

2.0 SITE AND ENVIRONMENTAL INTERFACES

2.1 Location and Features

Virgil C. Summer Nuclear Station (VCSNS) is located in Fairfield County, South Carolina, approximately 15 miles west of the county seat of Winnsboro and 26 miles northwest of Columbia, the state capital (Figure 2-1). The site is in a sparsely-populated, largely rural area, with forests and small farms comprising the dominant land use. The Broad River flows in a northwest-to-southeast direction approximately one mile west of the site and serves as the boundary between Fairfield County (to the east) and Newberry County (to the west).

This reach of the Broad River, impounded for a small, run-of-the-river hydroelectric plant (Parr Hydro) in 1914, is known as Parr Reservoir (Figure 2-2). Originally 1,850 acres, Parr Reservoir was enlarged to approximately 4,400 acres in 1977 by raising the level of the dam by 9 feet (SCE&G 1978, pg. 2.1-16). This modification was necessary to support the development of the Fairfield Pumped Storage Facility (FPSF) (Figure 2-2), which was built on Frees Creek, a small tributary of the Broad River. In addition, Monticello Reservoir, a 6,500-acre impoundment, was built in the Frees Creek valley to serve as the upper pool for FPSF and the cooling water source for VCSNS. Parr Reservoir, which had historically been the source of water for Parr Hydro, assumed a dual function, providing water for both Parr Hydro and FPSF.

The VCSNS powerblock area (generating facilities and switchyard) is located on the south shore of Monticello Reservoir (Figure 2-3). A nuclear exclusion zone, defined as the area within approximately one mile of the reactor building, is posted and access to land portions of this area is controlled. The nuclear exclusion zone is not a perfect circle; its western axis is slightly longer (5,850 feet, or 1.11 mile) than its eastern axis (5,350 feet, or 1.01 mile) (SCE&G 1978, pg. 2.1-2). The boundary of the exclusion zone also represents the site boundary. The VCSNS property, thus defined, covers approximately 2,245 acres, and includes the southern portion of Monticello Reservoir and parts of the FPSF (Figure 2-3).

Section 3.1 describes key features of the station, including reactor and containment systems, cooling and auxiliary water systems, and transmission facilities.

2.2 Aquatic and Riparian Ecological Communities

Aquatic and riparian communities in the vicinity of VCSNS are influenced by the hydrology and water quality of the Broad River and movement of water between the Broad River/Parr Reservoir and Monticello Reservoir. This section characterizes both the hydrology and water quality of these waterbodies and the distribution and abundance of organisms within them.

Broad River and Parr Reservoir Hydrology and Water Quality

The Broad River originates on the eastern slope of the Blue Ridge Mountains near Lake Lure, North Carolina, and flows 220 miles southeast into South Carolina before joining the Saluda River at Columbia, South Carolina, to form the Congaree River. In South Carolina, the Broad River basin encompasses an approximately 4,500-square-mile watershed drained by 4,719 miles of streams (SCDHEC 1998, pg. 21). Major tributaries include the Pacolet, Tyger, and Enoree Rivers, all of which enter the Broad River from the west (Figure 2-1). The Broad River Basin in South Carolina is entirely within the Piedmont region, which is an area of gently rolling to hilly terrain with relatively broad stream valleys; elevations range from 376 to 1,000 feet above mean sea level (SCDHEC 1998, pg. 22). For most of its length in South Carolina, the Broad River flows through agricultural and forested land, including the Sumter National Forest, which bounds the river for some 30 miles above Parr Reservoir.

The 1998 South Carolina Department of Health and Environmental Control (SCDHEC) report contains additional information on land use in the Broad River Basin, its sub-basins (upper Broad, Pacolet, Tyger, and Enoree), and watersheds within these sub-basins. In addition, it provides details on stream classifications and water quality of all major streams in the region, and describes potential threats to water quality (point sources and non-point sources). The SCDHEC report notes that water quality in the Broad River from the Tyger River to the Parr Shoals dam is suitable for a range of aquatic life, but is experiencing "a significantly increasing trend" in total phosphorous concentrations (SCDHEC 1998, pg. 113) from upstream (agricultural and municipal) sources. In addition, fecal coliform bacteria levels are occasionally elevated in this stretch of the river.

The U.S. Geological Survey (USGS) operates and maintains gauging stations on the Broad River upstream and downstream of Parr Reservoir. Mean daily flow at the Carlisle gauging station (approximately 20 miles upstream of Parr Reservoir) over the 1939-2000 period ranged from 44 to 114,000 cubic feet per second (cfs) and averaged 3,933 cfs (Cooney et al. 2001, pg. 179). At the Alston gauging station, 1.2 miles downstream of Parr Shoals Dam, flows over the period of record (1896-1907; 1980-2000) ranged from 235 to 130,000 cfs and averaged 6,535 cfs (Cooney et al. 2001, pg. 226). Substantially higher flows at Alston, SC, reflect Tyger and Enoree River inflows. These streams enter the Broad River 18 and 13.5 miles, respectively, above the Parr Shoals dam, significantly increasing flows in the main stem of the river.

Parr Reservoir (see Figure 2-2) was created in 1914 by damming the Broad River at Parr Shoals, approximately 26 miles upstream of the confluence of the Broad and Saluda Rivers for Parr Hydro, a small (15 megawatt) run-of-the-river hydroelectric facility (SCE&G 2000). Prior to 1977, the reservoir's surface area was 1,850 acres (SCE&G 1978, pg. 2.1-16). In 1977, the level of Parr Reservoir was raised by 9 feet, which increased its surface area to approximately 4,400 acres. This modification was necessary to support the development of FPSF, which was built on Frees Creek, a small tributary of the Broad River. In addition, Monticello Reservoir was created to serve as the upper reservoir for FPSF and the cooling water source for VCSNS. Parr Reservoir, which had historically been the source of water for Parr Hydro, assumed a dual function, providing a headwater pool for Parr Hydro and a tailwater pool for FPSF.

The daily cycle of operation at the FPSF transfers up to 29,000 acre-feet per day (9.5×10^9 gallons per day) of water from Parr Reservoir to Monticello Reservoir and back (NRC 1981, pg. 2-10). Operations vary, depending on the season and system needs. In summer, FPSF generally pumps water from Parr Reservoir to Monticello Reservoir between the hours of 11 pm and 8 am and generates power (by releasing water) between the hours of 10 am and 11 pm. In winter, FPSF generally pumps water from Parr Reservoir to Monticello Reservoir between 11 pm and 6 am and generates between the hours of 6 am and 1 pm. The level of generation varies from one generator up to the maximum output of eight, depending on demand. Maximum output may not be necessary on all days. Pumping is normally done at maximum capacity. FPSF is normally operated seven days a week.

As a result of FPSF operations, Parr Reservoir is subject to daily fluctuations in water level of as much as 10 feet (NRC 1981, pg. 2-10), but the daily average is approximately 4 feet (Dames & Moore 1985). These water level fluctuations can expose and then reinundate up to 2,550 acres of Parr Reservoir with each cycle of pumpback and generation (release of water). The amount of water pumped from and returned to Parr Reservoir daily represents as much as 88 percent of its total volume (NRC 1981, pg. 2-18).

Temperatures and dissolved oxygen (DO) levels in water leaving Parr Reservoir are monitored at a USGS water quality monitoring station just downstream of the Parr Hydro powerhouse. Temperature and DO levels vary seasonally, and show an inverse relationship, with high temperatures associated with relatively low DO levels and low temperatures associated with relatively high DO levels. Temperatures in water year 1999-2000 (Oct. 1, 1999 through Sept. 30, 2000) ranged from 38.3°F in February to 87.8°F in August, with corresponding DO concentrations of 13.1 milligrams per liter and 4.9 milligrams per liter (Cooney et al. 2001, pp. 221-224).

Currently, Parr Reservoir maintains an intermediate trophic state among reservoirs in South Carolina; its river-like flows and short retention time (approximately four days) produce high DO levels (in most months) and high turbidity in the reservoir. Aquatic life and recreational uses are "fully supported" in Parr Reservoir, according to SCDHEC (1998, pg. 114), meaning that water

quality is adequate to support a balanced indigenous community of organisms, with no restrictions on recreational users.

Monticello Reservoir Hydrology and Water Quality

VCSNS lies on the south shore of Monticello Reservoir (Figure 2-2), which serves as its cooling water source and heat sink. Monticello Reservoir was formed by damming Frees Creek, a small tributary of the Broad River that flowed into Parr Reservoir about 1.2 miles upstream of the Parr Shoals dam. As previously discussed, Monticello Reservoir was designed to serve both as a cooling pond for VCSNS and the upper pool for the FPSF, with an enlarged Parr Reservoir serving as the lower pool. Water flow from the Frees Creek watershed into the newly created Monticello Reservoir was negligible, and FPSF's pumps were used initially to fill the reservoir with water from Parr Reservoir (NRC 1981). Monticello Reservoir's small watershed drains an area of only 11,000 acres, including the reservoir and its subimpoundment (discussed later in this section).

Monticello Reservoir is approximately six miles long with a surface area of 6,500 acres. The average depth is 59 feet and the maximum depth is approximately 126 feet (SCDHEC 1998, pg. 114). FPSF operations can cause water levels in Monticello Reservoir to fluctuate as much as 4.5 feet daily, from 420.5 feet above mean sea level to 425.0 feet above mean sea level. Daily elevation changes vary, depending on system needs.

The most complete source of information on the water quality and biotic resources of Monticello Reservoir is a series of reports prepared in support of a Clean Water Act (CWA) Section 316(a) Demonstration for VCSNS and summarized in a final report (Dames & Moore 1985) submitted to SCDHEC and the U.S. Nuclear Regulatory Commission (NRC) in April 1985. A station-to-station comparison of pre-operational (1978-1982) and operational (1983-1984) water chemistry in Monticello Reservoir showed significant differences in 13 of 27 chemical parameters analyzed (Dames & Moore 1985, pg. 2.2-18). In 10 cases, concentrations of chemicals or measurements were higher in the pre-operational phase and in three cases concentrations were higher in the operational phase. None of these differences were related to operations of VCSNS.

The highest temperature observed in Monticello Reservoir over the 1983-1984 operational phase was 93.6°F at a depth of one foot at Station 14 (the sampling point closest to the discharge canal) in August 1983 (Dames & Moore 1985, pg. 2.2-10). A discernible thermal plume was present on 12 of 24 monthly field surveys at this same location, but survey results were confounded by plant operations (the plant was off-line during four surveys and at 50 percent power or less during three surveys). When plumes were detected, they were observed to a depth of 1 to 3 feet. Below this depth, the influence of the thermal plume was not evident. In more recent years (1995-2000), maximum temperatures at a sampling station just outside the mouth of the discharge canal ranged from 95.2°F to 103.7°F (see Section 4.12 for additional discussion).

Long-term eutrophication studies indicate that Monticello Reservoir's trophic condition is improving (SCDHEC 1998, pg. 114). It is currently rated as one of the least eutrophic reservoirs in South Carolina, and is characterized by low nutrient (total phosphorus and total nitrogen) concentrations.

Broad River/Parr Reservoir Aquatic Communities

The Broad River in the area of VCSNS was characterized (prior to the operation of FPSF and VCSNS) by a high silt load, high DO levels, high suspended solids levels, and low buffering capacity (NRC 1981). Parr Reservoir, a narrow, shallow, run-of-the-river reservoir, had lotic rather than lentic characteristics. Turbidity and flows appeared to limit the production of phytoplankton, and as a consequence they appeared to contribute only marginally to productivity. Zooplankton were also of limited importance. Benthic macroinvertebrates showed very little diversity, but relatively high measures of biomass due to the presence of high densities of the Asiatic clam, *Corbicula*. Fish collections prior to operation of FPSF were dominated by sunfish (bluegill, in particular) and gizzard shad, a forage species. Largemouth bass and white catfish also made up a significant proportion of biomass in collections (NRC 1981).

South Carolina Electric & Gas Company (SCE&G) monitored water quality and aquatic communities in the Broad River, Parr Reservoir, and Monticello Reservoir from mid-1978 through 1984 to assess the impacts of FPSF and VCSNS operations. This represented more than three years of pre-operational data and two years of operational data. These studies, summarized in a final report submitted to SCDHEC in April 1985 as part of a CWA Section 316(a) Demonstration (Dames & Moore 1985), represent the most comprehensive information on the biotic communities of the Broad River in the vicinity of VCSNS.

Parr Reservoir fish collections were dominated numerically in 1983 and 1984 by common warm water species. Approximately 44 percent of fish collected were centrarchids (e.g., bluegill, pumpkinseed, redear sunfish, largemouth bass), while 43 percent were clupeids (gizzard shad and threadfin shad). Gizzard shad and bluegill accounted for the greatest biomass, with 20.9 and 3.4 kilograms/hectare, respectively (Dames & Moore 1985, pp. 2.8-3–2.8-21). Species composition was essentially the same in preoperational (1978-1982) and operational (1983-1984) periods, with collections dominated by centrarchids (sunfish), clupeids (shad), and ictalurids (catfish and bullheads). The species composition was typical of warm, shallow southeastern reservoirs. The fish community of Parr Reservoir appeared to be largely unaffected by operations of VCSNS.

No comprehensive surveys or studies of Parr Reservoir's fish community have been conducted since 1984. The South Carolina Department of Natural Resources (SCDNR) assessed the largemouth bass fishery in the early 1990s and determined that there were fewer largemouth bass per acre in Parr Reservoir than other reservoirs in Fisheries Region III (Hayes 1999). Mean lengths and weights of Parr Reservoir largemouth bass were also lower. Parr Reservoir

largemouth bass grew slowly, with fish reaching a minimum harvestable size of 12 inches at age three (Hayes 1999, pg. 19).

No creel survey has ever been conducted on Parr Reservoir to quantify angler effort, harvest, or success. (Hayes 1999, pg. 15). Anecdotal reports and casual interviews of fishermen suggest that catfish, crappie, and largemouth bass are the most targeted species. The extreme water level fluctuations on the reservoir make navigation difficult at times (water levels can be extremely low after pump-back operations) and appear to limit fishing pressure (Hayes 1999, pg. 15).

SCDNR is currently inventorying the aquatic resources of the Broad River and creating a Geographic Information System (GIS) database for natural resource managers in the region. Work began in the fall of 2000 and is scheduled for completion in the fall of 2002 (Bettinger 2001). This work is being supported by SCE&G, Duke Power, and Lockhart Power Company under the auspices of the Broad River Mitigation Trust Fund, whose Trustees are SCE&G, Duke Power, SCDNR, and the U.S. Fish and Wildlife Service (FWS).

In the fall of 2000 and the spring of 2001, 43 species of fish representing 9 families were collected from 9 sampling stations ranging over approximately 75 miles of the Broad River, from Gaston Shoals (near the North Carolina state line) to Bookman Island (15 miles below the Parr Shoals dam). Overall, the most common fish collected were redbreast sunfish, whitefin shiner, and silver redhorse (Bettinger et al. 2001). No exotic species or nuisance species were collected, and no federally listed species were collected. Live native mussels were extremely rare, found only at a single station in the Bookman Island area (Bettinger et al. 2001). All native mussels found were of the genus *Elliptio*. Fish collections at a station 14 miles upstream of Parr Shoals dam (just upstream of the confluence of the Broad River and the Enoree River) were dominated by common centrarchids (e.g., redbreast sunfish and bluegill), notropids (e.g., whitefin shiner and spottail shiner), and ictalurids (e.g., snail bullhead and margined madtom). Because the surveys were intended to provide baseline information on unimpounded sections of the river (tailwaters of dams and reaches of river between dams), Parr Reservoir was not included in the surveys.

Monticello Reservoir Aquatic Communities

Contract biologists using gill nets and electrofishing gear collected 32 species of fish representing 8 families from Monticello Reservoir in 1983 and 1984 (Dames & Moore 1985, Table 2.8.10), the last two years that sampling was conducted in support of the station's CWA Section 316(a) Demonstration. The Monticello Reservoir fish community in 1983-1984 was dominated by centrarchids (55 percent of fish captured) and clupeids (28 percent of fish captured) (Dames & Moore 1985, p. 2.8-10). Smaller numbers of ictalurids (7 percent), catastomids (5 percent), and percids (3 percent) were also captured. The species composition and relative abundance of Monticello Reservoir fish changed very little from 1978 through 1984. In all preoperational and operational years, centrarchids ranked first in abundance and clupeids ranked second. There was no indication that VCSNS operations had an effect on fish populations in Monticello Reservoir.

Based on cove rotenone studies conducted by SCDNR in 1987, 1988, 1995, and 1996, the fish community of Monticello Reservoir remains reasonably balanced and diverse, comprised of warmwater species common to the southeastern U.S. (Nash, Christie, and Stroud 1990; Christie and Stroud 1996, 1997). Three catfish species (blue catfish, channel catfish, and white catfish) made up a substantial proportion (56 percent, by weight) of the reservoir's standing stock in 1996 and provided an important recreational fishery, particularly in summer months. Other species more traditionally regarded as gamefish (largemouth bass, black crappie, white bass) contribute less to the reservoir's standing stocks, but considerable angler effort is directed toward these species in winter, spring, and fall.

In addition to the fish species that are normally sought and harvested by anglers, Monticello Reservoir contains a variety of game and non-game species including clupeids (threadfin shad and gizzard shad, which provide important forage for predators), cyprinids (e.g., common carp, golden shiner, whitefin shiner), catastomids (e.g., silver redhorse, shorthead redhorse, river carpsucker), ictalurids (brown bullhead, flat bullhead, and snail bullhead), centrarchids (e.g., bluegill, redear sunfish, redbreast), and percids (yellow perch and tesselated darter) (Nash, Christie, and Stroud 1990; Christie and Stroud 1996, 1997). All of these species are common to ubiquitous in South Carolina streams, ponds, and reservoirs (Loyacano 1975; Lee et al. 1980; Bennett and McFarlane 1983; SCDNR 1995).

There have been a number of changes in the Monticello Reservoir fish community since VCSNS began operating in 1982, none attributable to station operations. Two species (blue catfish and white perch) that now make up a major portion of the recreational catch first appeared in SCDNR samples in 1995. These species may have been introduced by fisherman or transferred into Monticello Reservoir from Parr Reservoir by pump-back operations. The blue catfish in particular "exploded" in numbers and importance in the reservoir between 1995 and 1996 (Christie and Stroud 1997, pg. 25). In an annual report on the status of fisheries in SCDNR Region IV, Christie and Stroud (1997, pg. 28) voiced concern about the booming population of blue catfish in Monticello Reservoir, noting that Monticello Reservoir has a "…relatively low prey base…" and "the unfortunate introduction of blue catfish may lead to competition for forage between catfish and game species."

The white perch, a semi-anadromous species native to the southeastern coast, is regarded as a "pest" by many inland fisheries managers (SC Bass Federation 2000). It is a species known for its high reproductive potential (high fecundity rate and high hatching rate), slow rate of growth, and long lifespan (up to 17 years), characteristics that tend to create crowded populations of stunted white perch in reservoirs (Wisconsin Sea Grant 1999; SAREP 2000). White perch are known to depress populations of other, more desirable gamefish species, such as walleye and white bass, by competing for limited forage and by feeding heavily on walleye and white bass eggs (Wisconsin Sea Grant 1999).

A number of other fish species (brook silverside, swallowtail shiner, and green sunfish) appeared for the first time in SCDNR's Monticello Reservoir cove rotenone samples in 1995 (Christie and Stroud 1996, pg. 19). These species were known to occur in other waterbodies in the Santee-Cooper drainage basin (which includes the Broad River), but had not been collected previously in Monticello Reservoir by SCDNR. None of these species is expected to have a noticeable effect on the reservoir's fisheries, beyond some minor contribution to the forage base.

Although somewhat less productive than other, older reservoirs in the region, Monticello Reservoir continues to provide fishermen in the South Carolina Midlands and Upstate with a variety of fishing opportunities. Roving creel surveys in 1997-1998 and 1998-1999 that included interviews of selected anglers revealed that roughly half (51 percent in 1997-98; 42 percent in 1998-99) of all fishing effort in Monticello Reservoir was directed at catfish (Christie and Stroud 1999, pp. 20-28). Less effort was expended fishing for black crappie (15 percent in 1997-98; 5 percent in 1998-99), largemouth bass (12 percent in 1997-98; 10 percent in 1998-99), and other species (bluegill, carp, white bass, white perch). The creel surveys indicated that fishing effort (number of hours fished per annum) had increased substantially since the late 1980s. They also showed that fishing pressure (hours fished per acre) was lower on Monticello Reservoir than on other reservoirs in the region (Christie and Stroud 1999, Table 17).

Excluding blue catfish and white perch, both apparently introduced by fishermen, no undesirable non-native fish species appeared in Monticello Reservoir after it was created and no nuisance species appeared to be favored by its operational thermal regimes. There have been no outbreaks of disease, beyond the occasional appearance of *Aeromonas* (*Aeromonas hydrophila*; a bacterium) infections in spawning largemouth bass in the spring. These fish, already stressed by spawning, appeared to have been caught and released by anglers. Handling further stressed these fish and removed protective slime/mucous coating, which resulted in *Aeromonas* infection.

In the late 1980s, a number of limited fish kills (generally involving small catfish) occurred in the VCSNS discharge bay in late summer and early fall. SCE&G set up a monitoring program to help identify the cause of the fish kills. Investigations revealed that the fish kills were associated with relatively high discharge temperatures and Monticello Reservoir drawdowns (through the operation of FPSF). It was determined that reservoir drawdown reduced the inflow of cooler water (from the main body of the reservoir) along the bottom of the discharge canal and into the discharge bay. Reduction or loss of this inflow allowed water temperatures to rise rapidly and kill fish inhabiting the discharge bay. Since the reservoir level was subject to daily fluctuation with the operation of FPSF, fish kills recurred as high reservoir levels (following pumpback operations) allowed more cool water inflow and recolonization of the discharge canal and bay.

SCE&G took several actions over the 1991–1993 period to reduce the frequency and severity of fish kills (SCE&G Environmental Services 1994, pg. 2). In 1991, an elevated area (an old roadbed) was removed from the discharge canal by dredging. This initially appeared to have ameliorated the fish kills, but a major fish kill in August 1992 indicated that removal of the

roadbed had not completely solved the problem. In September 1992, Monticello Reservoir drawdown was limited to 422.5 feet mean sea level to prevent further fish kills.

SCE&G dredged the entire length of the discharge canal in July and August of 1993 to allow more cool water inflow at low reservoir levels. The dredging of the discharge canal altered circulation patterns and increased cool water inflow such that temperature at the bottom of the discharge bay in summer remained significantly (10 to 15 degrees) cooler than "end-of-pipe" discharge temperatures (SCE&G Environmental Services 1996, Figure 2). Fish kills ceased once the dredging of the discharge canal was completed. The discharge bay and canal were monitored intensively over the summers of 1994 and 1995, and no fish kills were observed (SCE&G Environmental Services 1996, pg. 3). None have been observed since that time.

The *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants* (GEIS) (NRC 1996, pg. 4-57) briefly discusses the fish kills in the VCSNS discharge bay and mentions SCE&G's investigations on the specific causes of the kills. It concludes that "these fish kills were localized; they do not appear to have had any adverse effect on the cooling pond (fish) population."

Monticello Subimpoundment Aquatic Communities

Monticello Reservoir is a 6,500-acre impoundment. However, it is hydrologically connected (by a conduit that passes under the Highway 99 causeway) to a smaller 300-acre body of water known as the Monticello Subimpoundment (Figure 2-2). This smaller subimpoundment is managed for recreational boating and fishing by SCE&G and SCDNR. SCE&G maintains the property, which includes boat launch, swimming, and picnic facilities; SCDNR manages the subimpoundment's fisheries by setting creel and size limits on fish. Fishing is permitted on Wednesdays and Saturdays only.

Surveys of the subimpoundment's fishery were last conducted in 1984 (Dames & Moore 1985). At that time, the fish community of the subimpoundment was characterized by relatively low species richness (12 species collected in 1983 and 1984), with collections dominated by gizzard shad and centrarchids (e.g., bluegill, redear sunfish, black crappie, and largemouth bass) (Dames & Moore 1985, pg. 2.8-8 and Figure 2.8-24). The Monticello Subimpoundment continues to be a popular fishing spot for local fishermen.

2.3 Groundwater Resources

The VCSNS site lies within the Piedmont Physiographic Province and is underlain by igneous and metamorphic crystalline rocks, including migmatites in transitional areas between metamorphic and igneous bodies. Piedmont terrain is characterized by gently rolling hills and broad, relatively shallow valleys. Bedrock within the Piedmont is metasedimentary and metavolcanic and consists of granites, gneisses, and schists (SCE&G 2002). Crystalline bedrock has been deeply weathered into a saprolitic mantle of soil 40 to 85 feet thick at the site. The upper soil profile is characterized by a silty and clayey horizon (SCE&G 2002). For a generalized site location map, refer to Figure 2-1.

Groundwater in the region occurs in jointed and fractured crystalline bedrock and in the lower zones of the residual soil overburden. Recharge to these formations is principally by infiltration of precipitation falling on the upland areas. The aquifer at the VCSNS site exists under water table conditions in the saprolite and fractured bedrock. Discharge of groundwater commonly occurs as visible seeps and springs in low-lying areas or to nearby creeks and streams. Some groundwater is discharged via wells but the well yields are very small because the formations generally are not pervious enough to sustain yields greater than a few gallons per minute (gpm) (SCE&G 2002).

The groundwater table generally follows the land surface. The depth to the water table is governed by topography, and the direction of movement is therefore toward streams located in the lower elevations (SCE&G 2002). Within 20 miles of the site, groundwater wells range from 62 to 365 feet deep, but commonly are less than 200 feet deep, with yields of 10 gpm or less. Yields of up to 55 gpm have been reported in a small fraction of the region's wells (SCE&G 2002). The depth to groundwater in the vicinity of the site is typically from 20 to 90 feet, generally in jointed bedrock. There are no springs or groundwater wells downgradient from the site (SCE&G 2002).

The nearest groundwater well is approximately one mile east of VCSNS, just outside the site boundary. The closest public water supply is for the town of Jenkinsville, SC, which has two of its groundwater wells located to the southeast within two miles of the site (SCE&G 2002). The groundwater flow at the site prior to construction of Monticello Reservoir was toward Frees Creek and the Broad River at a rate of approximately one foot per day. The groundwater gradient varied from 0.005 foot/foot along the ridges to 0.07 foot/foot along the steeper sections of the valley walls (SCE&G 2002). After construction and filling of the reservoir, the local groundwater level would have been raised, causing a steepening of the gradient and reversing the groundwater flow direction from the Frees Creek drainage basin. The flow of groundwater ultimately would still be toward the Broad River via Terrible Creek, Mayo Creek, or Little River valleys at a rate of approximately one foot per day (SCE&G 2002). The low permeability of the surrounding soils and bedrock in the vicinity of the reservoir will limit the amount of

groundwater flow from the impoundment (USAEC 1973, Section V.B.2, pg. V-8). No domestic or industrial wells are located downgradient of the groundwater flow direction. (SCE&G 2002).

2.4 Critical and Important Terrestrial Habitats

The VCSNS site covers approximately 2,245 acres, an area that includes portions of Monticello Reservoir and FPSF (see Figure 2-3). Approximately 860 of the 2,200 acres are covered by the waters of Monticello Reservoir. A significant portion of the property (approximately 370 acres) consists of generation and maintenance facilities, laydown areas, parking lots, roads, and mowed grass. Some 125 acres are dedicated to transmission line rights-of-way. However, much of the VCSNS property consists of forested areas (approximately 890 acres). The primary terrestrial habitats at VCSNS are pine forest, deciduous forest, and mixed pine-hardwood forest (SCANA 2000). The pine forests at VCSNS include planted pines and naturally vegetated pines. Most of the deciduous forests at the site are located along stream bottoms and surrounding slopes. Streamside management zones at the site are protected in accordance with Best Management Practices established by the South Carolina Forestry Commission.

Forested areas within the 2,245-acre VCSNS site are managed by SCANA Services' Forestry Operations group, but timber is not routinely harvested. Timber has been harvested in the past to remove diseased trees and trees damaged by tornadoes and wind storms. Once timber is removed, these areas are replanted with tree species appropriate to the terrain, soils, and drainage characteristics of a site. Dry upland areas are normally replanted in improved loblolly pine.

Parr Reservoir (see Figures 2-2 and 2-3) provides some limited freshwater marsh habitat in shallow backwaters, around low-lying islands, and in an area east of the FPSF tailrace that was used in the 1970s for the disposal of dredge spoil. These marshes and adjacent shallows are used by migrating dabbling ducks, including mallard, black duck, and teal. Monticello Reservoir and its subimpoundment also provide resting areas for wintering waterfowl and provide year-round habitat for non-migratory Canada geese. SCE&G has been recognized by the South Carolina Wildlife Federation for its efforts in establishing a self-sustaining, non-migratory population of Canada geese on Parr and Monticello Reservoirs.

Terrestrial wildlife species found in the forested portions of the VCSNS property are those typically found in the Piedmont forests of South Carolina. Wildlife characteristically found in the pine forests and mixed pine-hardwoods of the Piedmont include toads (e.g., Fowler's toad), lizards (e.g., Carolina anole, fence lizard, various skinks), snakes (e.g., black racer, rat snake, ringneck snake), songbirds (e.g., cardinal, bluejay, towhee, various warblers), birds of prey (e.g., red-tailed hawk, red-shouldered hawk), and a number of mammal species (e.g., gray squirrel, eastern cottontail, raccoon, white-tailed deer).

Section 3.1.3 describes the transmission lines that SCE&G and Santee Cooper built to connect VCSNS to the transmission system. Most of the transmission corridors are situated within the Piedmont Physiographic Region, but the southernmost portions of the Summer-Graniteville, Summer-Denny Terrace No. 2, and Summer-Pineland corridors are situated within the Sandhills Physiographic Region. Barry (1980) contains descriptions of the soils, hydrology, and plant

communities of the Piedmont and Sandhills regions. The principal land-use categories traversed by the transmission corridors are row crops, pasture, and forests. Forest habitats along transmission corridors consist primarily of pine forest, pine-hardwood forest, and bottomland hardwood forest.

No areas designated by the FWS as "critical habitat" for endangered species exist at VCSNS or adjacent to associated transmission lines. In addition, the transmission corridors do not cross any state or federal parks, wildlife refuges, or wildlife management areas**.**

The transmission corridors are maintained by mowing, trimming of undesirable vegetation from the sides of the corridors, and by use of "non-restricted use" herbicides. Under normal circumstances, the mowing and herbicide schedule follows a three-year cycle. Trees are "side-trimmed" every 10 years by helicopters carrying hydraulically operated saws. Aerial patrols of transmission corridors are conducted four times a year by SCE&G and twice a year by Santee Cooper. Dead and diseased trees at the edges of corridors are removed if it appears that they could fall and strike the transmission lines or support structures.

SCE&G and Santee Cooper participate with the U.S. Department of Agriculture–Natural Resources Conservation Service, SCDNR, and other organizations in a wildlife management program for transmission line corridors. The "Power for Wildlife" program is designed to help landowners whose property is crossed by transmission lines convert transmission corridors into productive habitat for wildlife. The program offers grant money and wildlife management expertise to landowners who commit to participating in the program for five years.

2.5 Threatened or Endangered Species

In response to an SCE&G request, Holling (2001) reviewed the SCDNR Heritage Trust Program database and found no records of any state- or federally-listed species occurring within one mile of the VCSNS site. Animal and plant species that are state-listed or federally-listed as endangered or threatened, and that are known to occur in counties traversed by the associated transmission lines are listed in Table 2-1 (SCDNR 2002). The federal and state designations shown in Table 2-1 are those of the U.S. Fish and Wildlife Service and SCDNR.

Six bald eagle (*Haliaeetus leucocephalus*) nesting sites occur within a five-mile radius of the Station (Holling 2001). Four of these six nests are believed to be active nesting sites, while the status of two nests is unknown (SCDNR 2001). There are four bald eagle nesting sites on Parr Reservoir. Three (one active, two unknown status) are in roughly the same area (within 0.5 mile of one another), on the western shore of the reservoir, approximately 2 miles west of VCSNS. The fourth is on the Heller's Creek arm of Parr Reservoir, approximately 4 miles northwest of the Station. There is a single bald eagle nesting site on the eastern shore of Monticello Reservoir, approximately 3.5 miles north of VCSNS. There is also a nesting site approximately 2 miles east of Monticello Reservoir (4 miles northeast of VCSNS) on a tributary of the Little River. One active bald eagle nest in Saluda County is approximately 0.5 mile west of the Summer-Graniteville transmission line, and one bald eagle nest in Richland County is located approximately 0.9 mile south of the Summer-Denny Terrace transmission line (SCDNR 2001). The current status of the Richland County nest is unknown, but the nest was "viable" as recently as 1995 (SCDNR 2001). Bald eagles are generally associated with lakes, rivers, and coastal areas (USACE 2002). The bald eagle is federally-listed as threatened and state-listed as endangered. Bald eagles are commonly observed foraging around Monticello Reservoir, the FPSF tailrace canal, Parr Reservoir, and on the Broad River downstream of Parr Shoals dam.

The wood stork (*Mycteria americana*), state- and federally-listed as endangered, is known to occur in Aiken County. Although they don't nest in Aiken County, wood storks from the Birdsville Colony (near Millen, Georgia) forage in shallow wetlands on the Department of Energy's Savannah River Site and in specially constructed ponds on the National Audubon Society's Silver Bluff Sanctuary, near Jackson, South Carolina (DOE 1997; NAS undated). No transmission corridors associated with VCSNS cross or approach the Savannah River Site or the Silver Bluff Sanctuary.

Red-cockaded woodpeckers (*Picoides borealis*), state- and federally-listed as endangered, are known to occur in Aiken and Richland Counties (SCDNR 2002). Active nest cavities of this cooperative breeder occur in open, mature pine stands with sparse midstory vegetation (FWS 2002). Suitable habitat for this species does not occur at VCSNS, and there are no known active or abandoned cavity trees adjacent to VCSNS-associated transmission line corridors (SCDNR 2001).

Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) is state-listed as endangered. This bat is found in forested areas, especially in pine flatwoods and pine-oak woodlands (Bellwood 1992, pg. 290). It roosts in hollow trees, under bark, in old cabins and barns, and in wells and culverts (Brown, 1997, pg. 72). The species has been recorded in Aiken and Richland Counties (SCDNR 2002), but there are no recorded occurrences in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001).

The gopher tortoise (*Gopherus polyphemus*) is state-listed as endangered, and is known to occur in Aiken County (SCDNR 2002). The gopher tortoise inhabits sandy, well-drained areas where adequate vegetation for foraging exists (Martoff et al. 1980, pg. 162). Gopher tortoises have not been recorded north of Aiken County, and no burrows have been recorded in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001). The species' burrows, which are readily visible, have not been observed at VCSNS. Gopher tortoises are generally not found in areas of Piedmont soils, which characterize most of the transmission corridors associated with VCSNS.

The pine barrens treefrog (*Hyla andersonii*) is state-listed as threatened, and is known to occur in Richland County (SCDNR 2002). This species inhabits trees in swamps adjacent to sandhill habitats (Martoff et al. 1980, pg. 113). There are no recorded occurrences of this species in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001).

Webster's salamander (*Plethodon websteri*) is state-listed as endangered. It has been recorded in Saluda and Edgefield Counties (SCDNR 2002), which represent the eastern extent of its range. Webster's salamander inhabits moist, mixed hardwood forests on steep north-facing slopes with rock outcrops (Martoff et al. 1980, pg. 96). There are no recorded occurrences of this species in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001).

A mountain lion (cougar) was reportedly seen in the vicinity of VCSNS by a local private citizen during the early 1970s. The U.S. Nuclear Regulatory Commission (NRC) subsequently concluded that it was "…very unlikely that the mountain lion (if correctly identified) could be part of a reproducing population" (NRC 1981, pg. 2-18). The Eastern cougar (*Felis concolor cougar*) is state- and federally-listed as endangered, but is presumed by the FWS to be extinct in the wild (FWS 2002). SCDNR has no recent records of this species in the counties traversed by the transmission corridors (SCDNR 2001).

There are occasional sightings of Eastern cougars in eastern Canada and New England, but there have been no credible reports of cougars in the southeast (excluding some animals that had escaped from wild animal parks and small zoos). No breeding populations have been confirmed in the Eastern U.S. since the 1920s. At present, the only known breeding population of cougar in the Eastern U.S. is the Florida panther (*Felix concolor coryi*), which occurs in South Florida.

The pool sprite (*Amphianthus pusillus*), also known as little amphianthus, is state- and federally-listed as threatened. This aquatic plant occurs in small (usually less than one square meter)

shallow pools on the crests and flattened slopes of granite outcrops (FWS 2002). These pools completely dry out in summer droughts. Within South Carolina, the pool sprite is known from three counties (FWS 2002; SCDNR 2002), one of which (Saluda) is crossed by the transmission lines associated with VCSNS. Only one occurrence of this plant is known from Saluda County (FWS 2002), but there are no recorded occurrences in or adjacent to the VCSNS-associated transmission line corridors (SCDNR 2001).

The Georgia aster (*Aster georgianus*), a candidate for federal listing, is found in dry, open woodlands and disturbed areas, such as roadsides and utility rights-of-way that are regularly mowed. Populations have been found in Edgefield, Fairfield, and Richland Counties (SCDNR 2002). There are no recorded occurrences of this species in or adjacent to the VCSNS-associated transmission corridors (SCDNR 2001).

The smooth coneflower (*Echinacea laevigata*), state- and federally-listed as endangered, is known to occur in Aiken and Richland Counties (SCDNR 2002). Habitat for this perennial herb is open woods, cedar barrens, roadsides, clear cuts, limestone bluffs, and transmission line corridors. Fire or other disturbance, such as well-timed mowing or clearing, is essential to maintaining the open habitat required for this species (FWS 2002). There are no recorded occurrences of this species in or adjacent to the VCSNS-associated transmission line corridors (SCDNR 2001).

The rough-leaved loosestrife (*Lysimachia asperulifolia*) is state- and federally-listed as endangered. Habitat for this perennial herb consists of Carolina bays and the ecotones between longleaf pine uplands and pond pine pocosins. The only known location of the rough-leaved loosestrife within South Carolina is at Fort Jackson in Richland County (FWS 2002); there are no recorded occurrences of this species in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001).

Canby's dropwort (*Oxypolis canbyi*) is state- and federally-listed as endangered. This perennial plant is known to occur in 11 counties within South Carolina, one of which (Richland) is crossed by VCSNS transmission lines (SCDNR 2002). This coastal plain species grows in wet meadows, wet pineland savannas, ditches, sloughs, and along the edges of cypress-pine ponds (FWS 2002). There are no recorded occurrences of this species in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001).

Harperella (*Ptilimnium nodosum*) is state- and federally-listed as endangered. Typical habitat for this annual herb is rocky or gravel shoals, margins of swift-flowing streams, and edges of intermittent pineland ponds (FWS 2002). Harperella is known in South Carolina from Aiken and Saluda Counties (SCDNR 2002). There is one recorded population of Harperella approximately 0.5 mile west of the Summer-Graniteville transmission line corridor in Saluda County. The most recent observation of this population in the SCDNR database was from 1985 (SCDNR 2001).

There are no recorded occurrences of this species in or adjacent to the VCSNS-associated transmission corridors (SCDNR 2001).

Relict trillium (*Trillium reliquum*) is state- and federally-listed as endangered. Habitat for this perennial herb is mature, moist, undisturbed hardwood forests (FWS 2002). Relict trillium is known from Aiken and Edgefield Counties (SCDNR 2002). There are no recorded occurrences of this species in or adjacent to the transmission line corridors associated with VCSNS (SCDNR 2001).

Two state- and federally-listed aquatic species have been recorded in counties crossed by VCSNS transmission lines, but could not be affected by plant operations or transmission line maintenance over the license renewal term. The shortnose sturgeon (*Acipenser brevirostrum*), which SCDNR lists as occurring in Aiken County (SCDNR 2002), is found in the Savannah River, which is not crossed by VCSNS transmission lines. Small numbers of shortnose sturgeon may also ascend the Congaree River from Lake Marion, but are blocked from entering the Broad River by a hydroelectric facility (Columbia Hydro) in Columbia. The Carolina heelsplitter (*Lasmigona decorata*), a freshwater mussel, is found in Turkey Creek and two of its tributaries in the Sumter National Forest in western Edgefield County (FWS 1996); the Summer-Graniteville transmission line crosses a very small portion of eastern Edgefield County (see Figure 3-1).

2.6 Regional Demography

The GEIS presents a population characterization method that is based on two factors: "sparseness" and "proximity" (NRC 1996, Section C.1.4). "Sparseness" measures population density and city size within 20 miles of a site and categorizes the demographic information as follows:

Demographic Categories Based on Sparseness

		Category
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles

Source: NRC 1996

"Proximity" measures population density and city size within 50 miles and categorizes the demographic information as follows:

Demographic Categories Based on Proximity

		Category
Not in close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles
In close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles

Source: NRC 1996

The GEIS then uses the following matrix to rank the population category as low, medium, or high.

GEIS Sparseness and Proximity Matrix

Sparseness \ Proximity		1	2	3	4
	1	1.1	1.2	1.3	1.4
	2	2.1	2.2	2.3	2.4
	3	3.1	3.2	3.3	3.4
	4	4.1	4.2	4.3	4.4

Low Population Area | Medium Population Area | High Population Area

Source: NRC 1996, pg. C-159.

SCE&G used 2000 census data from the U.S. Census Bureau website (USCB 2000) and GIS software (ArcView®) to determine demographic characteristics in the VCSNS vicinity. As derived from Census Bureau information, an estimated 136,842 people live within 20 miles of VCSNS. Applying the GEIS sparseness measures, VCSNS has a population density of 109 persons per square mile within 20 miles and falls into a less sparse category, Category 3 (having 60 - 120 persons per square mile).

As derived from Census Bureau information, an estimated 1,027,842 people live within 50 miles of VCSNS. This equates to a population density of 131 persons per square mile within 50 miles. Applying the GEIS proximity measures, VCSNS is classified as Category 3 (having one or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles). According to the GEIS sparseness and proximity matrix, the VCSNS ranks of sparseness Category 3 and proximity Category 3 result in the conclusion that VCSNS is located in a "medium" population area.

All or parts of 21 South Carolina counties and the city of Columbia (state capital), are located within 50 miles of VCSNS (Figure 2-1). A small portion of one North Carolina county (Union) also lies within the 50-mile radius. Approximately 90 percent of VCSNS's employees live in four South Carolina counties: Richland, Lexington, Newberry, and Fairfield. The remaining

8 percent are distributed across 16 South Carolina counties, with numbers ranging from 1 to 9 employees per county.

The Central Midlands Region, composed of Richland, Lexington, Newberry, and Fairfield Counties, is a varied mixture of rural and metropolitan areas with a total population of almost 600,000 (596,253) and an average annual growth rate of 1.7 percent (USCB 1990; USCB 2000). Newberry and Fairfield Counties are rural. Richland and Lexington Counties encompass the metropolitan area of Columbia, the state capital, and comprise 90 percent of the Central Midland Region's population. From 1990 to 2000, South Carolina's average annual population growth rate was 1.5 percent, while Richland, Lexington, Newberry, and Fairfield Counties increased by 1.2, 2.9, 0.9, and 0.5 percent, respectively (USCB 1990; USCB 2000).

In 2000, South Carolina reported a population of approximately 4.0 million people (USCB 2000). By the year 2040, South Carolina is projected to have 5.6 million people, growing at an average annual rate of 1.0 percent (USCB 2000; TtNUS 2002). Between 2000 and 2040, Richland, Newberry, Lexington, and Fairfield Counties are projected to grow at average annual rates of 0.6, 0.4, 1.7, and 0.4 percent, respectively (USCB 2000; TtNUS 2002).

Table 2-2 shows estimated populations and annual growth rates for the four counties with the greatest potential to be socioeconomically affected by license renewal activities. Figure 2-1 shows these counties.

2.7 Economic Base

VCSNS lies in Fairfield County, which is part of the Central Midlands Region. The Central Midlands Region (approximately 600,000 residents in year 2000) encompasses Lexington, Fairfield, Richland, and Newberry counties. The state capital, Columbia, is located in Richland County. The Columbia metropolitan statistical area, which includes Richland and Lexington Counties, had 536,691 residents in 2000 (Central Carolina Economic Development Alliance undated1). "Southern Business & Development" magazine ranked Columbia third in the large market categories that "support business through low taxes, available tax credits, and a commitment to help existing companies prosper and grow." (Realty World America 2002). Nineteen Fortune 500 companies and 41 company headquarters can be found in Columbia. Columbia's top employers in the public sector include: federal, state and local government, Fort Jackson, and the University of South Carolina. Top employers in the private sector include: SCE&G, Richland Memorial Hospital, Blue Cross and Blue Shield of South Carolina, Computer Sciences Corporation (formerly Policy Management Systems), and Bell South (Realty World America 2002). The Central Midlands Region has a transportation network of trucking and railroad terminals, and interstate highway access to nine regional airports, three international airports, and three international seaports, giving the area access to both domestic and international markets (Central Carolina Economic Development Alliance undated2).

Fairfield and Newberry Counties were settled by Scotch-Irish, English, and German immigrants in the mid-18th century. In the 19th century, large scale cotton farming replaced small farms, and the introduction of the railroad made this a leading area for the cotton market (City of Newberry South Carolina 1999). In recent years, emphasis has been on the manufacturing, trade, and government sectors. More specifically, manufacturing is the number one sector for Fairfield and Newberry Counties (34.2 percent and 41.3 percent, respectively). Trade (28 percent) and government services (29.7 percent) are the largest sectors for Lexington and Richland Counties (Central Carolina Economic Development Alliance 1998). Although agriculture played a more significant role in the past, it is no longer a dominant force in the region's economy.

The average monthly unemployment rate for the state of South Carolina for 2001 was 4.7 percent. In comparison, Lexington, Richland, Newberry, and Fairfield Counties had annual monthly unemployment rates of 2.3, 2.9, 6.9, and 11.4 percent, respectively, in 2001 (South Carolina Employment Security Commission 2002).

2.8 Taxes

VCSNS pays annual property taxes to Fairfield County. Taxes fund Fairfield County operations, including the school system, the County General Fund, hospitals, road maintenance, and recreation facilities. For the years 1995 to 2000, VCSNS's property taxes provided about 47 percent of Fairfield County's total property tax revenue and approximately 47 percent of Fairfield County's total operating budget. If the operating license for VCSNS was not renewed and the plant was decommissioned, then impacts to the tax base of the surrounding communities and their economic structures could be significant, as discussed in Section 8.4.7 of the GEIS (NRC 1996).

SCE&G projects that VCSNS's annual property taxes will remain constant at about $12-13 million through the license renewal period. The potential effects of deregulation are not yet fully known, however, and could affect utilities' tax payments to counties. Any changes to VCSNS tax rates due to deregulation, however, would be independent of license renewal. Table 2-3 compares VCSNS's tax payments to Fairfield County tax revenues and operating budgets.

2.9 Land Use Planning

This section focuses on Richland, Newberry, Lexington, and Fairfield Counties because most (approximately 90 percent) of the permanent VCSNS workforce lives in these counties (see Section 3.4) and SCE&G pays property taxes in Fairfield County. All four counties have experienced growth over the last several decades and their Comprehensive Land Use Plans reflect planning efforts and public involvement in the planning process. Land use planning tools, such as zoning, guide future growth and development. All plans share the goals of encouraging growth and development in areas where public facilities, such as water and sewer systems, are planned and discouraging strip development along county roads and highways.

Richland County

Richland County occupies roughly 748 square miles of land area. Approximately 38 percent of the unincorporated portion of the County is developed, while the remaining 62 percent of the unincorporated land in the County is undeveloped. The unincorporated portions of the county were divided into four separate planning areas and two sub-areas to facilitate planning (Richland County 1999).

A recently prepared comprehensive plan (Richland County 1999) noted that zoning controls were not established in Richland County until September 7, 1977. The absence of zoning controls and restrictions produced an environment where existing development patterns have been a mixture of many types of residential, commercial, and industrial uses. The plan noted further that rural open spaces and prime farmlands are being converted to residential and other suburban uses. The plan concluded that, in order to protect significant agricultural lands, natural areas, and open space corridors, Richland County will ultimately have to develop specific zoning and growth management tools for directing future development to sustainable areas. As yet, growth control measures have not been developed or adopted.

The Richland County Comprehensive Plan does, however, contain the "Town and Country Planning Concept" which sets forth the following goals:

- Improve the Middle Landscape in Urban and Suburban Villages – In existing urban and suburban areas, lessen the sprawling character by bringing the landscape into developed areas in order to define and separate neighborhoods. The strategy is to encourage mixed-use village centers that attract employment and services development.

- Promote the Idea of Towns and Villages – In rural areas, promote the development of compact, mixed-use development that has a distinct village edge and connection to the landscape.

- Continue Preservation Through the Use of Riparian Corridors – The County Riparian Corridor network should be used to develop a sub-contiguous county-wide greenway system.

The strategy is to define growth areas, while preserving natural systems and rural landscapes. (Richland County 1999).

Newberry County

Newberry County has a total land area of 648 square miles. According to the Comprehensive Plan for Newberry County (Newberry County 1998), the land is characterized by a mixture of rural and urban uses including agricultural, residential, commercial, industrial, public and semi-private uses, and vacant land. The Comprehensive Plan study was limited to the areas around the municipalities, the lake shores of Lake Greenwood and Lake Murray, the US 76 corridor between the Town of Little Mountain and the City of Newberry, and portions of SC Highways 773, 219, 34 and 121. The unincorporated portions of the county that fall outside the defined study area do not have land use regulations but may eventually need them for future development (Newberry County 1998).

Residential development is generally characterized by low- to medium-density single-family development. There are a number of vacant platted lots inside and outside of the study area. Most of these are located along the lake shores, where most of the neighborhood subdivisions have occurred (Newberry County 1998). There are very few multi-family units in the unincorporated areas of the county. The option most selected for affordable housing is the manufactured home. The number of manufactured homes has increased dramatically since 1980. Most are located on individual lots, and more recently in subdivisions (Newberry County 1998).

Unlike a municipality where there is dense commercial development in a downtown or some other commercial district, Newberry County's commercial development is much less dense. In most cases, the commercial development is limited to stores located at the intersections of major roads. The remainder of commercial development exists in areas that serve local residents (Newberry County 1998).

Agriculture is represented by 500 or more acres scattered throughout the Comprehensive Plan study area, an area comprised mostly of incorporated and developed portions of the county.

Generally, there is ample land available for future development in the county; however, the exact locations of growth will be guided by two major constraints: natural features and infrastructure. The study area is criss-crossed with streams and rivers, so there will be areas where topography and floodplain characteristics will constrain development. Infrastructure constraints will be mitigated by the construction of additional roads and water treatment facilities as the need arises (Newberry County 1998).

Lexington County

Lexington County contains over 110,000 parcels located in a 700-square-mile area (Lexington County 1999). Farmland represents 21 percent of the land, as the County is a relatively strong

agricultural center. However, Lexington County is encouraging the growth of residential areas by touting the quality of the school systems and the accessibility of resources. Overall, Lexington County has no specific "growth control" regulations or ordinances; however, it does have a blend of zoning styles, unrelated to growth control, that encourage a quality type of expansion characterized by a reduction in land allocations that are random and sporadic. According to the Lexington County Land Use Plan (Lexington County 1999), land will continue to be available for development for a variety of uses for several decades.

Fairfield County

Fairfield County contains roughly 685 square miles acres. The largest land use category is forest, accounting for 87 percent of the total acreage. This includes public, commercial, and non-commercial forests, as well as farm woodlands. Non-forested land, including all urban or developed land, accounts for the remaining 13 percent. Surface water comprises four percent of the county and is represented by Lake Wateree, the Catawba River, Monticello Reservoir, and the Broad River (Fairfield County 1997).

Roughly three percent of the forested land in the county is government-owned. The primary parcel is the Sumter National Forest, located in the northwestern part of the county. Privately-owned forestland in the county is dominated by corporations, individuals, and the forest products industry. Only six percent of the forested land is owned by farmers, reflecting the continued decline in farming in Fairfield County since the Depression era (Fairfield County 1997).

Developed urban land use represents only two percent of Fairfield County. It is centered in and around the town of Winnsboro. Additional urban concentrations are found along the shores of Wateree Lake, in Ridgeway, in the Mitford community, and, to a lesser extent, around sections of Monticello Reservoir and Jenkinsville. Elsewhere, development is characteristically sparse and rural, characterizing the county's agricultural past (Fairfield County 1997).

The dominant form of residential land use is single-family detached housing. However, mobile homes and other manufactured structures are rapidly increasing in number. Residential development is found in both isolated and cluster patterns along most county roads. (Fairfield County 1997).

In the 20 years that VCSNS has operated, Fairfield County has experienced minimal growth. The population increase from 1990 to 2000 was only 0.5 percent. The county's economic base continues to be manufacturing, followed by government, industry, and services. Land use trends tend to be evolving in synch with the nationwide movement away from agricultural production and toward a commerce built on the processing/production of goods and the distribution of services.

2.10 Social Services and Public Facilities

2.10.1 Public Water Supply

VCSNS pumps and treats water from the Monticello Reservoir for use as potable water and is not connected to a municipal system. Most (90 percent) of the permanent employees of Summer Station reside in Richland, Lexington, Newberry, and Fairfield Counties; therefore, the discussion of public water supply systems will focus on these four areas.

Richland County

Water service is available to Richland County through public and private water systems. The major public system is operated exclusively by the city of Columbia which has primary water lines extending into four major planning areas. Water service is provided as far west as Chapin and Lake Murray and north to the town of Blythewood. Water service in the northeast extends very close to the Kershaw County line. Southeast of the city, water lines reach to the McEntire Air National Guard Base and the Hopkins area. Columbia's position has been to delay further water extension into unserved, sparsely populated areas until a sufficient customer base has formed. Outside of Columbia's service area, water supply depends on private wells. Columbia's water treatment plants at Lake Murray and the Columbia Canal have the capacity to treat 130 million gallons per day (MGD) of drinking water. System water demand ranges from 45 MGD to 90 MGD (Richland County 1999). Average demand is approximately 60 MGD (Summers 2000).

Newberry County

There are four water systems in Newberry County: the Newberry County Water and Sewer Authority, the city of Newberry, the town of Whitmire, and the town of Prosperity. Residents who are not tapped on to one of these systems draw their water from wells.

The Water and Sewer Authority's service area focuses on the unincorporated areas of the county. The system is comprised of 200 miles of 6-inch-diameter or larger pipes and 240 fire hydrants. Demand is 800,000 to 933,00 gallons per day (Newberry County 1998). Eighty-five percent of the water is purchased from the city of Newberry, with the remaining 15 percent drawn from wells (Newberry County 1998). The Water and Sewer Authority is planning to build a water plant on Lake Murray, which will have an ultimate capacity of 6 MGD. The new water plant will serve the southern portion of Newberry County. While water is available at the interstate interchanges, the supply is not sufficient for industrial or large-scale residential development. The Water and Sewer Authority will make the investment to install water tanks or larger lines only when the demand requires it (Newberry County 1998).

The city of Newberry pumps and treats raw water from the Saluda River and has the capacity to produce 8.1 MGD of treated water (Newberry County 1998). The transmission system from the plant to the city consists of one 16-inch line and one 20-inch line capable of carrying 10 MGD (Newberry County 1998). The distribution network contains approximately 142 miles of pipe, 4,556 hydrants, and 4,782 service connections (Newberry County 1998). The treatment plant is capable of being expanded to 10 MGD (Newberry County 1998). Additionally, the city owns storage facilities capable of holding 4 million gallons of treated water (Newberry County 1998).

The town of Whitmire has a 1-MGD surface water plant drawing from the Enoree River. Due to recent spills upriver, however, the town has recently constructed an alternate facility that draws from Duncan Creek. There are 1,133 water customers, 393 of which are outside of the town. In May 1998, the peak flow was 867,000 gallons per day and the average flow was 717,000 gallons per day (Newberry County 1998). The town is exploring the possibility of increasing the capacity of the water plant by an additional 500,000 gallons per day (Newberry County 1998).

The town of Prosperity draws water for 564 customers (42 of these outside the town limits) from 4 wells located within the town. Annual average consumption is 3.1 million gallons monthly, with peak monthly usage of 4.2 million gallons (Newberry County 1998).

Lexington County

The major public providers of water in Lexington County include the city of Columbia, city of West Columbia, Lexington County Joint Municipal Water and Sewer Commission, city of Cayce, town of Lexington, town of Batesburg-Leesville, town of Chapin, town of Pelion, town of Swansea, Gilbert-Summit Rural Water District, Gaston Water District, and the Bull Swamp Water District. The remainder are private systems. Non-public providers include AAA Utilities Inc., Carolina Water Service, and Heater Utilities Inc. Table 2-4 summarizes average daily use and maximum daily capacity for these systems (Lexington County 1999).

Fairfield County

Fairfield County has five public water systems, serving approximately 51 percent of the population. Less than two percent receive water from private residential water systems. The remaining 47 percent rely on individual wells (Fairfield County 1997).

The five public water systems are the town of Winnsboro, the town of Ridgeway, the Jenkinsville Water District, the Mid-County Water District, and the Mitford Water District. Only the town of Winnsboro draws water from a surface supply. The source is a reservoir west of Winnsboro that is part of the Jackson Mill Creek watershed. The

reservoir contains approximately 600 million gallons of water (Fairfield County 1997). The remaining four public systems draw from groundwater sources, which have a relatively low yield in the area. However, each of the systems is currently operating below capacity, with room for additional growth and development. (Fairfield County 1997). Table 2-5 compares average daily use and capacity of Fairfield County water systems.

There are five private water systems in the county. Two systems serve mobile home parks, two serve nursing homes, and the fifth serves a subdivision. All are relatively small in terms of the number served (Fairfield County 1997). A few industrial water systems and 18 miscellaneous systems serve rural parks, schools, landings, and camps (SCDHEC 2000).

2.10.2 Transportation

Road access to VCSNS is via County Road 311 (Ollie Bradham Boulevard), a two-lane paved road (see Figure 2-3). County Road 311 intersects with SC 215 approximately 1.5 miles east of the station. SC 215 has a north-south orientation and is used by employees traveling from the Richland and Fairfield County areas. Additionally, employees traveling from the Richland and Lexington County areas may use US 176 north to SC 213, which intersects with SC 215 two to three miles south of the station. Employees coming from the west and Newberry County area may use several secondary roads such as SC 773 or SC 202 to intersect with US 176 and head south to intersect with SC 213. Traffic count data for each of these highways/roads is shown in Table 2-6 (Jones 2002). The South Carolina Department of Transportation does not make Level of Service determinations for roads in rural, non-metropolitan areas unless deemed necessary. None of the roads listed in Table 2-6 has had a Level of Service determination.

2.11 Minority and Low-Income Populations

Background

In performing environmental justice analyses for previous license renewal applicants, NRC used a 50-mile radius as the overall area that could contain environmental impact sites and the state as the geographic area for comparative analysis. This approach was adopted for identifying minority and low-income populations that could be affected by VCSNS operations.

ArcView® geographic information system software was used to combine U.S. Census Bureau (USCB) TIGER line data with USCB 2000 census data to determine the minority characteristics on a block group level. USCB 2000 low-income census data is not yet available; therefore, 1990 tract data was used for the low-income analysis. Block groups or tracts were included if any of their area lay within 50 miles of VCSNS. The 50-mile radius included 802 block groups in 2000 and 243 tracts in 1990. The geographic area for VCSNS is defined as the entire states of South Carolina and North Carolina separately for block groups and tracts contained in each state. Table 2-7 presents the numbers of census tracts within each county that exceed the thresholds for minority or low-income populations.

2.11.1 Minority Populations

The NRC's "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues" defines a "minority" population as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; or Black races; other; multi-racial; or the aggregate of all minority races; or Hispanic ethnicity (NRC 2001, Appendix D). The guidance indicates that a minority population exists if either of the following two conditions exists:

1. The minority population of the census block or environmental impact site exceeds 50 percent.

2. The minority population percentage of the environmental impact area is significantly greater (typically at least 20 points) than the minority population percentage in the geographic area chosen for comparative analysis.

NRC guidance calls for use of the most recent USCB (decennial) census data. Census data for the year 2000 from the USCB website was used in determining the percentage of the total population within South Carolina and North Carolina for each minority category, and in identifying minority populations within 50 miles of VCSNS.

Each minority population within a block group was divided by the total population for that block group to obtain the percent of the block group's population represented by a given minority. For each of the 802 block groups within 50 miles of VCSNS, the

percentage of each minority population was calculated and compared to the corresponding geographic area's minority threshold percentages to determine whether or not minority populations were present. The geographic area for VCSNS was the state of South Carolina when the block group was contained within South Carolina and the state of North Carolina when the block group was contained within North Carolina. USCB data characterizes South Carolina as 0.3 percent American Indian or Alaskan Native; 0.9 percent Asian; 0.0 percent Native Hawaiian or other Pacific Islander; 29.5 percent Black races; 1.0 percent all other single minorities; 1.0 percent multi-racial; 32.8 percent aggregate of minority races; and 2.4 percent Hispanic ethnicity (USCB 2000). USCB data characterizes North Carolina as 1.2 percent American Indian or Alaskan Native; 1.4 percent Asian; 0.0 percent Native Hawaiian or other Pacific Islander; 21.6 percent Black races; 2.3 percent all other single minorities; 1.3 percent multi-racial; 27.9 percent aggregate of minority races; and 4.7 percent Hispanic ethnicity (USCB 2000).

Based on the "more than 20 percent" or the "exceeds 50 percent" criteria, no Native Hawaiian or other Pacific Islander, other single minorities, or multi-racial minorities exist in the geographic area. Table 2-7 presents the numbers of block groups within each county that exceed the threshold for minority populations.

Based on the "more than 20 percent" criterion, American Indian or Alaskan Native minority populations exist in a single block group (Table 2-7). Figure 2-4 displays the location of this minority block group in York County, South Carolina. The Catawba Indian Nation has tribal lands (approximately 700 acres) in the Rock Hill, South Carolina area (EDA 2000). Total tribal membership is believed to be around 3,000, with approximately half of this number living in York County and Lancaster County, South Carolina (EDA 2000; EPA 2001).

Based on the "more than 20 percent" criterion, the Asian minority population exists in a single block group (Table 2-7). Figure 2-5 displays the location of this minority block group in Richland County, South Carolina.

Based on the "more than 20 percent" criterion, the Black minority population exists in 209 block groups (Table 2-7). Figure 2-6 displays the location of these minority block groups distributed among the counties in the geographic area.

Based on the "more than 20 percent" criterion, aggregate minority populations exist in 230 block groups (Table 2-7). Figure 2-7 displays the location of these minority block groups distributed among the counties in the geographic area.

Based on the "more than 20 percent" criterion, Hispanic ethnicity minority populations exist in two block groups (Table 2-7). Figure 2-8 displays the locations of these minority block groups, which are in Saluda County and Greenwood County, South Carolina.

2.11.2 Low-Income Populations

The USCB has not yet released 2000 census data for low-income households. Therefore, 1990 census data was used from the USCB website (USCB 1990) in determining the percentage of the total households within the States of North Carolina and South Carolina that are deemed low-income households and in identifying low-income households within 50 miles of VCSNS.

NRC guidance defines "low-income" using USCB statistical poverty thresholds (NRC 2001, Appendix D). The "low-income" household numbers for each census tract were divided by the total households for that census tract to obtain the percentage of "low-income" households per census tract. USCB data (USCB 1990) characterize 15.8 percent of South Carolina and 14.0 percent of North Carolina households as low-income. A "low-income population" is considered to be present if:

1. The low-income population of the census block or environmental impact site exceeds 50 percent.

2. The percentage of households below the poverty level in an environmental impact area is significantly greater (typically at least 20 points) than the low-income population percentage in the geographic area chosen for comparative analysis.

Based on the "more than 20 percent" criterion, 15 census tracts contain a low-income population. Eleven of these tracts are found in Richland County, two in York County, and one each in Lexington and Sumter Counties, South Carolina. Figure 2-9 displays the locations of low-income household tracts, while Table 2-7 displays the low-income household tract distributions among the counties in the geographic area.

2.12 Meteorology and Air Quality

VCSNS is located in Fairfield County, South Carolina, which is part of the Columbia Intrastate Air Quality Control Region (AQCR). The AQCR is designated as being in attainment for all criteria pollutants, as are all counties in South Carolina (EPA 2002). The nearest non-attainment area is the Metropolitan Atlanta Intrastate AQCR, approximately 200 miles west-southwest of VCSNS, which is a 1-hour ozone non-attainment area (40 CFR 81.311).

In July 1997, the U.S. Environmental Protection Agency (EPA) issued final rules establishing a new 8-hour ozone standard that would create non-attainment areas for ozone within North and South Carolina. In October 1999, the District of Columbia Court of Appeals ruled against EPA with regard to the federal 8-hour ozone standard. On February 27, 2001 the U.S. Supreme Court upheld the 8-hour ozone standard, but ordered EPA to reconsider its implementation policy and remanded the case to the D.C. Circuit for proceedings consistent with its opinion (66 FR 57268, November 14, 2001). If all other legal challenges to the revised standard are overcome by the EPA a portion of Richland County, which is approximately 15 miles southeast of VCSNS, would become an eight-hour ozone non-attainment area.

2.13 Historic and Archeological Resources

The Final Environmental Statement for construction of VCSNS listed three historic (National Register of Historic Places) sites in the vicinity of the station: the Little River Baptist Church (3.8 miles north of Jenkinsville), the Ebenezer Associate Reformed Presbyterian Church (4.3 miles north of Jenkinsville), and Davis Plantation (0.25 mile south of Monticello) (USAEC 1973, p. XII-11). At that time, it was determined that none of these sites was "endangered" by Summer Station (USAEC 1973, p. XII-11). Additionally, four archeological sites were discovered within or near the boundary of the site and a recommendation was made by Dr. Robert L. Stephenson, State Archeologist, that the area be surveyed and that two of the known sites be excavated (USAEC 1973, p. II-15). This work is described below.

Below-Ground

SCE&G subsequently funded an archeological survey that was conducted by a team from the University of South Carolina Institute of Archeology and Anthropology in 1972. According to the survey report, which was ultimately produced in 1979, completion of the "Parr Hydroelectric Project" would render approximately 12,000 acres inaccessible for archeological research.

The proposed Parr Hydroelectric Project consisted of a series of related actions:

1. elevation of the Parr Reservoir Dam, raising the level of the Parr Reservoir

2. construction of a series of dam on Frees Creek to create the upper reservoir for a new pumped-storage facility and supply cooling water for VCSNS

3. construction of the FPSF and VCSNS

The archeological survey was conducted to assess the nature and distribution of the sites present and to assess the effect of the project on these resources.

The Institute of Archeology and Anthropology team identified 27 additional sites and performed the excavation of two others (Teague 1979). Four or five sites were covered by water when Monticello Reservoir was filled in 1978 and are now inaccessible; the remaining sites lie along the banks of Monticello and Parr Reservoirs. Periods represented included the Early Archaic, Middle Archaic, Woodland, Mississippian, and Early Historic.

Because the Parr Hydroelectric Project report covered only the land upon which the project would have an impact, the Institute of Archeology and Anthropology archeological site files and maps were reviewed to determine the existence of sites within 1-mile and 6-mile radii of the Station. This broadened scope revealed 39 archeological sites within a 6-mile radius and one archeological site within a 1-mile radius of VCSNS.

Above-Ground

Since the publication of the 1973 Final Environmental Statement, 41 "above-ground" locations have been added to the National Register of Historic Places for Fairfield County. Ten of these sites fall within a 6-mile radius of the Station (Table 2-8) (U.S. Department of the Interior 2002a). Twenty-eight locations have been added to the National Register for Newberry County. Four of these sites fall within a 6-mile radius of the Station (Table 2-8) (U.S. Department of the Interior 2002b). No sites listed on the National Register of Historic Places fall within a 1-mile radius of the Station.

One item of special note — there are two other historic sites within a 6-mile radius of the Station that are not listed on the National Register of Historic Places but are protected by SCE&G. One is the Mayo family cemetery, which is in a wooded area approximately 2.5 miles south of the Station on land that is owned by SCE&G but is not part of the VCSNS property. This small family plot contains headstones dating back to 1895. The other historic site, approximately 1.5 miles southwest of the Station, is a large monument erected in 1934 by the Daughters of the American Revolution marking the grave of General John Pearson, a Fairfield County native who served with distinction in the Revolutionary War. This monument is in a wooded area on land that is not part of the VCSNS property, but is maintained as a buffer zone around the site. SCE&G's Forestry Operations group is familiar with these sites, which are marked on their timber inventory and land cover maps, and takes appropriate measures to protect them when conducting forest management activities in the vicinity of either historic site.

2.14 Related Federal Projects

The Federal Power Commission (which became FERC) issued a license (Project Number 1894) to SCE&G on June 30, 1974 for the Parr Hydroelectric Project, which consisted of a set of related actions (elevation of Parr Shoals dam, enlargement of Parr Reservoir, construction of FPSF, impoundment of Frees Creek for Monticello Reservoir) as described in Sections 2.2 and 2.13. The Federal Power Commission prepared an EIS for this "major federal license" that evaluated potential environmental impacts of this action, including the inundation of 9,350 acres of land (eliminating farmland, timber, wildlife habitat, and 25 homes) and enhanced recreational opportunities provided by the public recreational facilities at the expanded Parr Reservoir and new Monticello Reservoir. The Federal Power Commission concluded that the loss of 9,350 acres of farmland and wildlife habitat was "significant" (Federal Power Commission 1974, pg. 2), but that "…with prudent evaluation and selection of construction methods and project operation, no serious cumulative adverse environmental impacts are foreseen."

FPSF began commercial operation in 1978, four years before VCSNS. The FERC license for the Parr Hydroelectric Project, including FPSF, expires on June 30, 2020. Under current rules, SCE&G will have to file a notice of intent with FERC by the year 2015 declaring whether or not it intends to seek a new license for the hydroelectric project. At least two years before the current FERC license expires (i.e., prior to June 30, 2018) SCE&G will have to file an application for a new license.

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TABLE 2-1
ENDANGERED AND THREATENED SPECIES THAT OCCUR IN THE VICINITY OF VCSNS OR IN COUNTIES CROSSED BY TRANSMISSION LINES

Scientific Name	Common Name	Federal Status[a]	State Status[a]
Birds			
Haliaeetus leucocephalus	Bald eagle	T	E
Mycteria americana	Wood stork	E	E
Picoides borealis	Red-cockaded woodpecker	E	E
Mammals			
Corynorhinus rafinesquii	Rafinesque's big-eared bat	-	E
Reptiles			
Gopherus polyphemus	Gopher tortoise	-	E
Amphibians			
Hyla andersonii	Pine barrens treefrog	-	T
Plethodon websteri	Webster's salamander	-	E
Fish			
Acipenser brevirostrum	Shortnose sturgeon	E	E
Invertebrates			
Lasmigona decorata	Carolina heelsplitter	E	E
Vascular Plants			
Amphianthus pusillus	Pool sprite	T	T
Aster georgianus	Georgia aster	C	-
Echinacea laevigata	Smooth coneflower	E	E
Lysimachia asperulifolia	Rough-leaved loosestrife	E	E
Oxypolis canbyi	Canby's dropwort	E	E
Ptilimnium nodosum	Harperella	E	E
Trillium reliquum	Relict trillium	E	E

a. E = Endangered; T = Threatened; C = Candidate for listing; - = Not listed.
Source: SCDNR 2002.

TABLE 2-2
ESTIMATED POPULATIONS AND ANNUAL GROWTH RATES IN FAIRFIELD, LEXINGTON, RICHLAND, AND NEWBERRY COUNTIES FROM 1980 - 2040

Population and Average Annual Growth Rate in the Previous Decade								
	Fairfield County		Lexington County		Richland County		Newberry County	
Year	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1980	20,700[a]	0.4	140,353[a]	5.8	269,735[a]	1.5	31,242[a]	0.7
1990	22,295[a]	0.8	167,611[a]	1.9	285,720[a]	5.9	33,172[a]	0.6
2000	23,454[a]	0.5	216,014[a]	2.9	320,677[a]	1.2	36,108[a]	0.9
2010	24,200[b]	0.5	244,600[b]	1.7	329,000[b]	0.7	36,400[b]	0.5
2020	25,300[b]	0.5	280,400[b]	1.5	350,100[b]	0.6	38,100[b]	0.5
2030	26,474[c]	0.5	321,473[c]	1.5	377,575[c]	0.6	40,304[c]	0.6
2040	27,565[c]	0.4	359,133[c]	1.2	400,258[c]	0.6	42,091[c]	0.4

a. U.S. Bureau of Census 2000.
b. Central Midlands Council of Governments 1999.
c. Projections.

TABLE 2-3
PROPERTY TAX REVENUES GENERATED IN FAIRFIELD COUNTY, SOUTH CAROLINA; PROPERTY TAXES PAID TO FAIRFIELD COUNTY BY V.C. SUMMER NUCLEAR STATION; AND FAIRFIELD COUNTY OPERATING BUDGET, 1995 – 2000

Year	Total Fairfield County Property Tax Revenues[a] (excluding debt)	Property Tax Paid By V.C. Summer Station	Percent of Total Property Taxes	Operating Budget for Fairfield County[a] (excluding debt)
1995	23,338,821	11,671,000	50	23,096,221
1996	24,472,690	12,324,000	50	24,387,997
1997	25,256,855	12,629,000	50	25,234,991
1998	26,730,639	12,943,000	48	26,795,321
1999	27,772,061	12,529,000	45	27,508,743
2000	29,604,792	12,272,000	41	29,540,322

a. Douglas, R. 2002.

TABLE 2-4
LEXINGTON COUNTY PUBLIC WATER SUPPLIERS AND CAPACITIES

Water Supplier	Average Daily Use (Gallons per day)	Maximum Daily Capacity (Gallons per day)
City of Columbia[a]		
Columbia Canal/Lake Murray	60,000,000	130,000,000
City of West Columbia[b]	4,900,000	12,000,000
City of Cayce[b]	3,200,000	6,400,000
Town of Lexington[b]	1,500,000	2,800,000
Town of Batesburg-Leesville[b]	1,100,000	2,100,000
Town of Chapin[b]	Not available	Storage tank holds 2 million gallons
Town of Pelion[b]	80,000	Purchases water from Lexington Joint Municipal Water and Sewer Commission
Town of Swansea[b]	162,000	From wells – capacity not indicated
Gilbert-Summit Rural Water District[b]	30,000	540,000
Gaston Rural Community Water District[b]	Not available	300,000

a. Richland County 1999.
b. Lexington County 1999.

TABLE 2-5
FAIRFIELD COUNTY PUBLIC AND PRIVATE WATER SUPPLIERS AND CAPACITIES

Water Supplier	Average Daily Use (Gallons per day)	Maximum Daily Capacity (Gallons per day)
Community Systems		
Town of Winnsboro[b]	1,782,600	3,100,000
Town of Ridgeway[b]	145,000	1,010,400
Jenkinsville Water District[b]	126,000	172,300
Mid-County Water District 1[b]	72,700	241,900
Mid-County Water District 2[b]	65,000	100,000
Mitford Water District[b]	79,800	400,000
Private Residential Systems		
Royal Hills SD[a]	2,000	12,000
Chappel MHP[b]	Not available	25,000
Coley's MHP[b]	Not available	30,000
Fairview Manor[a]	Not available	60,000
Lambright Care[a]	Not available	Not Available
Industrial Systems		
VC Summer Nuclear Station[b]	27,800	1,296,000

a. Fairfield County 1997.
b. SCDHEC 2000.

TABLE 2-6
TRAFFIC COUNTS FOR ROADS IN THE VICINITY OF VCSNS

Route No.	Route Location	Est. AADT (Total of Both Directions)	AADT Year
US 176	SC 34 to SC 219	900	2000
US 176	SC 219 to Richland Co. line	1450	2000
SC 213	Newberry Co. line to SC 215	2300	2000
SC 213	US 176 to Fairfield Co. line	1750	2000
SC 215	Richland Co. line to SC 213	1500	2000
SC 215	SC 213 to Chester Co. line	1250	2000
SC 202	I-26 to US 176	1100	2000
SC 202	US 76 to I-26	1850	2000
SC 773	US 76 to US 176	2700	2000

AADT = Annual Average Daily Traffic volume.
Source: Jones 2002.

TABLE 2-7
MINORITY AND LOW-INCOME POPULATIONS

		Minority Populations									Low-Income Populations	
County	State	2000 Block Groups	American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Black Races	All other Single Minorities	Multi-racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity	1990 Tracts	1990 Tracts Low-Income
Union	NC	2	0	0	0	0	0	0	0	0	2	0
Aiken	SC	13	0	0	0	2	0	0	2	0	5	0
Calhoun	SC	7	0	0	0	4	0	0	4	0	3	0
Cherokee	SC	4	0	0	0	0	0	0	0	0	2	0
Chester	SC	31	0	0	0	9	0	0	9	0	10	0
Edgefield	SC	11	0	0	0	7	0	0	8	0	4	0
Fairfield	SC	19	0	0	0	13	0	0	14	0	5	0
Greenwood	SC	45	0	0	0	11	0	0	11	1	10	0
Kershaw	SC	40	0	0	0	5	0	0	6	0	9	0
Lancaster	SC	44	0	0	0	7	0	0	7	0	12	0
Laurens	SC	49	0	0	0	8	0	0	8	0	10	0
Lee	SC	2	0	0	0	2	0	0	2	0	1	0
Lexington	SC	135	0	0	0	7	0	0	12	0	33	1
McCormick	SC	1	0	0	0	1	0	0	1	0	1	0
Newberry	SC	32	0	0	0	3	0	0	3	0	6	0
Orangeburg	SC	5	0	0	0	1	0	0	1	0	3	0
Richland	SC	235	0	1	0	104	0	0	115	0	73	11
Saluda	SC	16	0	0	0	3	0	0	5	1	4	0
Spartanburg	SC	13	0	0	0	0	0	0	0	0	5	0
Sumter	SC	7	0	0	0	5	0	0	5	0	6	1
Union	SC	29	0	0	0	5	0	0	5	0	9	0
York	SC	62	1	0	0	12	0	0	12	0	30	2
TOTALS		802	1	1	0	209	0	0	230	2	243	15

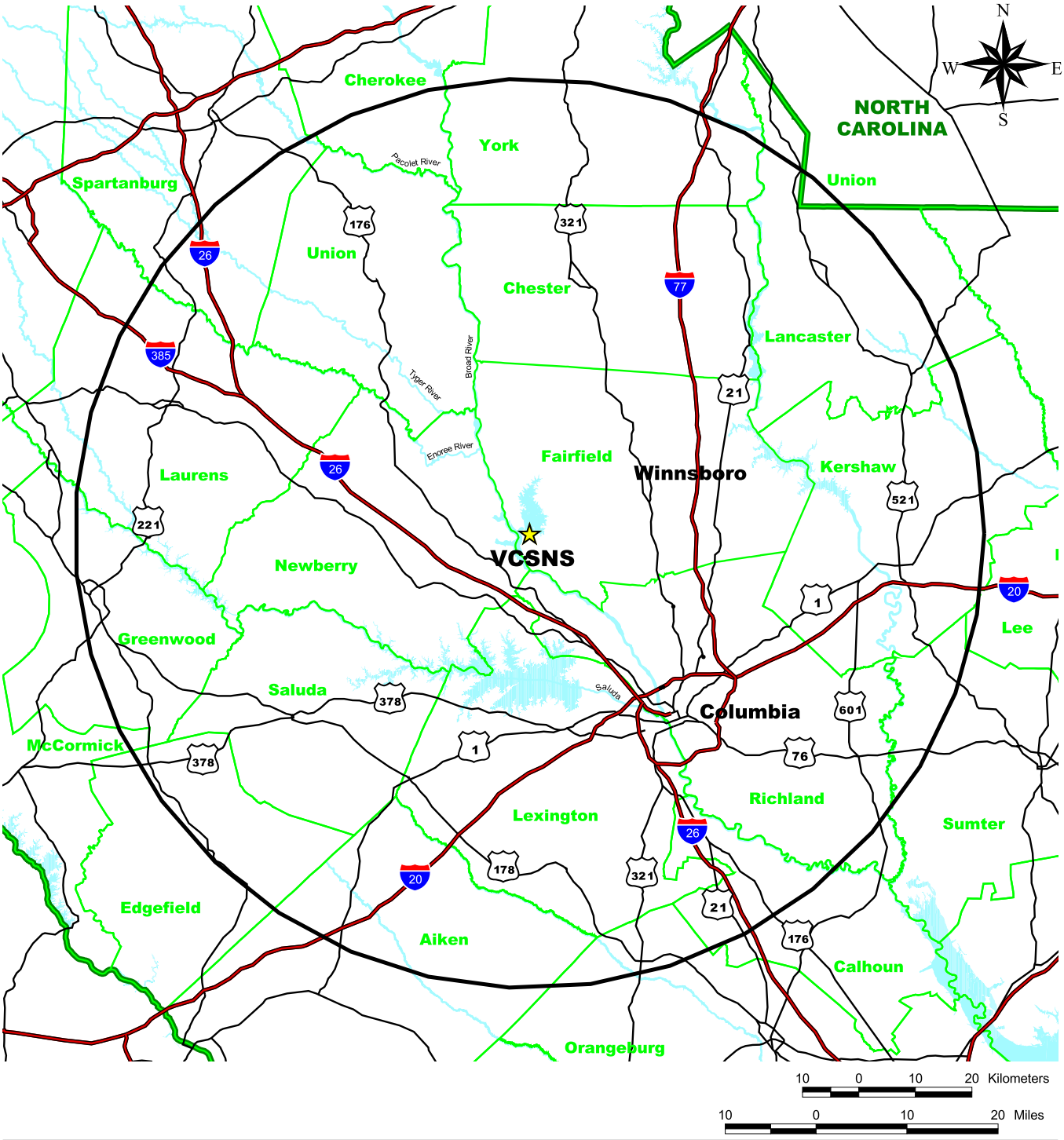
State Averages

States	American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Black Races	All other Single Minorities	Multi-racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity	1990 Tracts Low-Income
North Carolina	1.2%	1.4%	0.0%	21.6%	2.3%	1.3%	27.9%	4.7%	14.0%
South Carolina	0.3%	0.9%	0.0%	29.5%	1.0%	1.0%	32.8%	2.4%	15.8%

TABLE 2-8
FAIRFIELD AND NEWBERRY COUNTY SITES
ON THE NATIONAL REGISTER OF HISTORIC PLACES
(WITHIN THE VICINITY OF THE VCSNS)

Site Name	City	Location
Fairfield County		
James Beard House	W of Ridgeway	Ridgeway
Davis Plantation	S of Monticello on SC 215	Monticello
Ebenezer Associate Reformed Presbyterian Church	4.3 mi. N of Jenkinsville on SC 213	Jenkinsville
Dr. John Glenn House	SC 215	Jenkinsville
Kincaid-Anderson House	NE of Jenkinsville of SC 213	Jenkinsville
Little River Baptist Church	3.8 mi. N of Jenkinsville on SC 213	Jenkinsville
Mayfair	Off SC 215	Jenkinsville
McMeekin Rock Shelter	Address Restricted	Winnsboro
Monticello Methodist Church	Off SC 215	Monticello
Monticello Store and Post Office	Off SC 215	Monticello
Newberry County		
Folk-Holloway House	Jct. of Holloway and Folk Sts.	Pomaria
Hatton House	Holloway St. between Folk St. and US 176	Pomaria
Pomaria	SE of Pomaria on US 176	Pomaria
St. John's Lutheran Church	SE of Pomaria	Pomaria

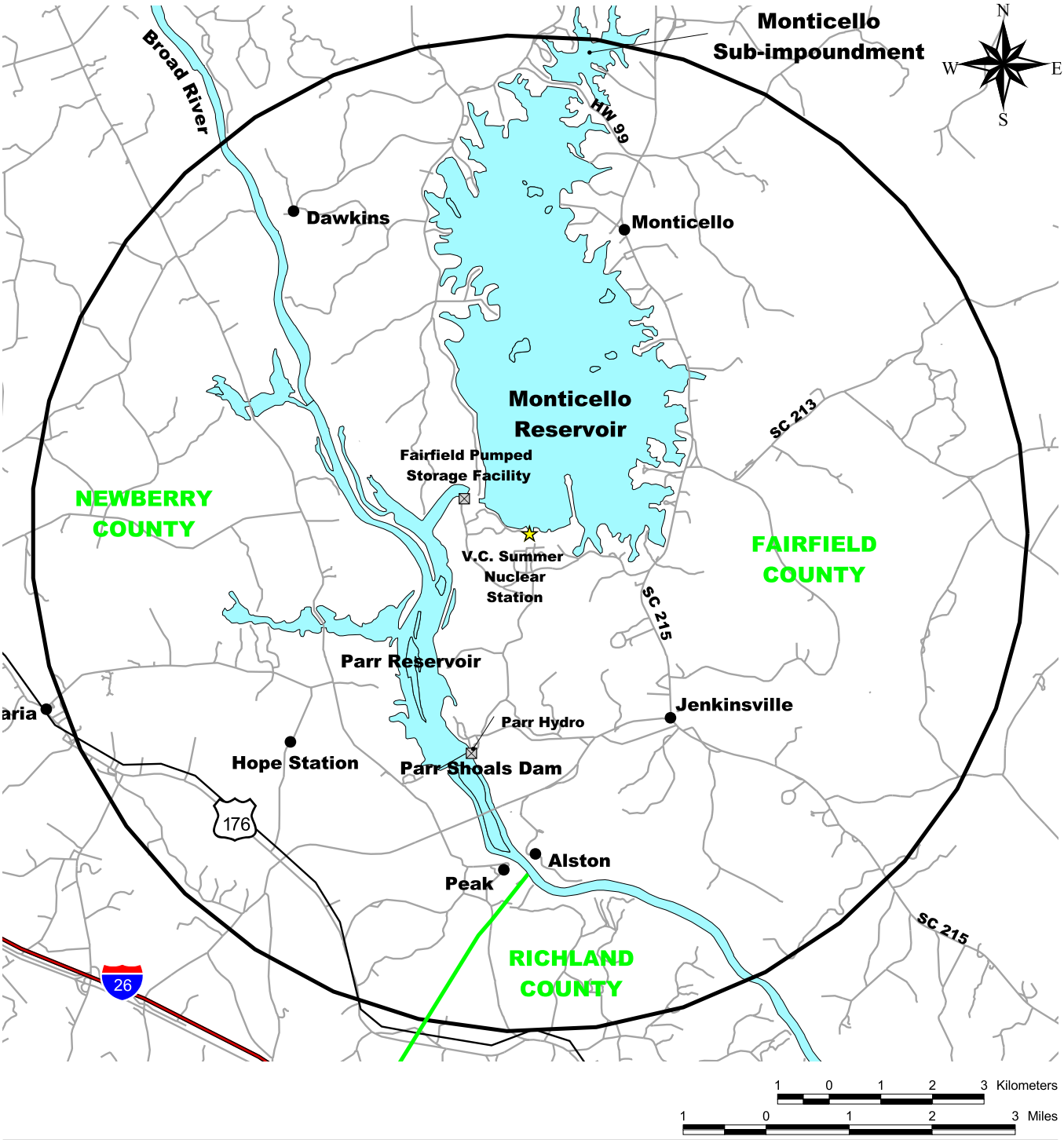
Source: U.S. Department of Interior 2002a, b.



LEGEND

- V.C. Summer Nuclear Station
- 50 mile radius of V.C. Summer
- Interstates
- Major roads
- County Boundaries
- State Boundary
- Lakes and Rivers

FIGURE 2-1
V.C. Summer Nuclear Station,
50-Mile Locational Vicinity Map
LICENSE RENEWAL APPLICATION



LEGEND

- Six mile radius of V.C. Summer
- Interstates
- Major roads
- Minor roads
- County Boundaries
- Lakes and Rivers

FIGURE 2-2
V.C. Summer Nuclear Station,
6-Mile Vicinity Map
LICENSE RENEWAL APPLICATION

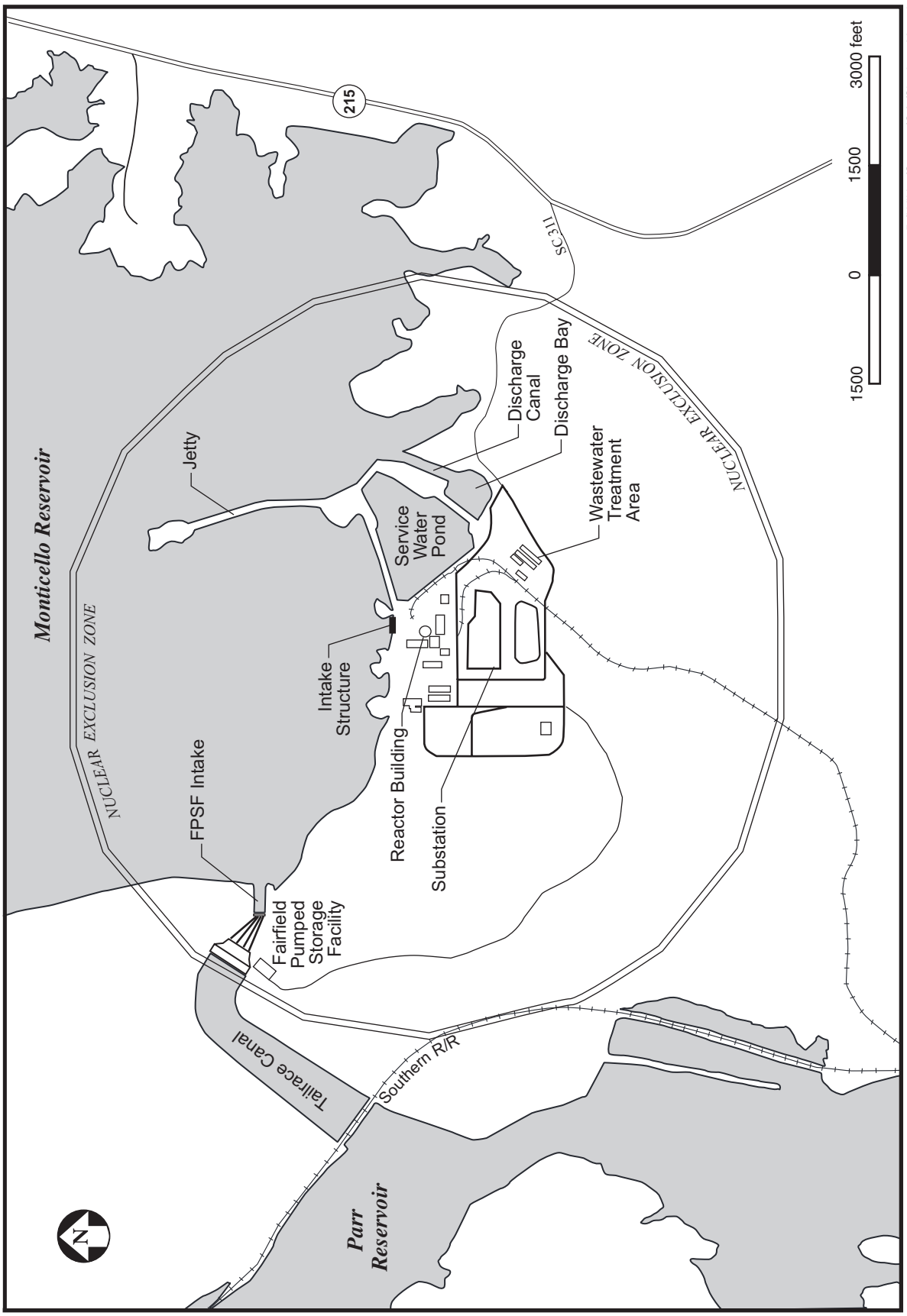
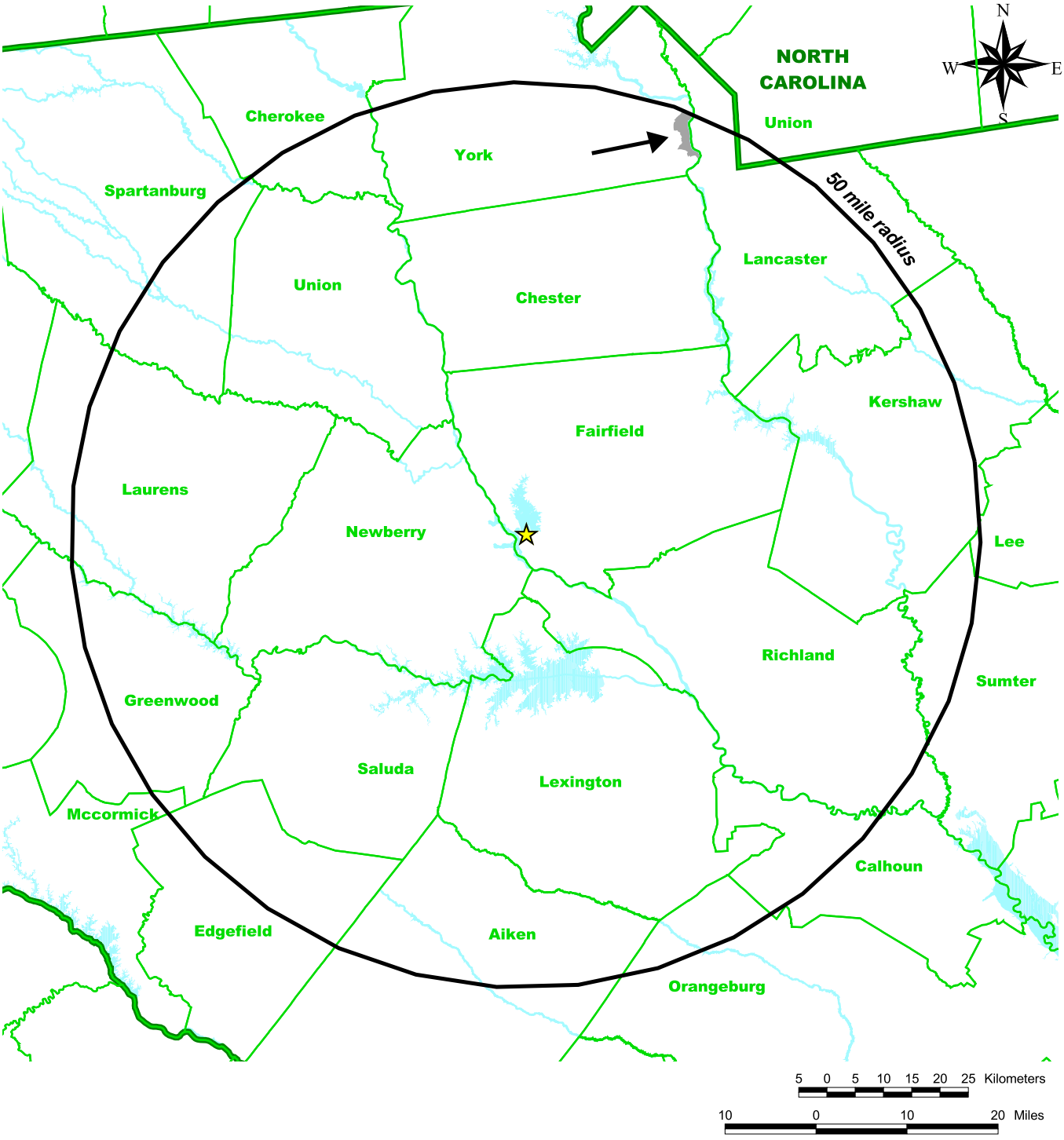


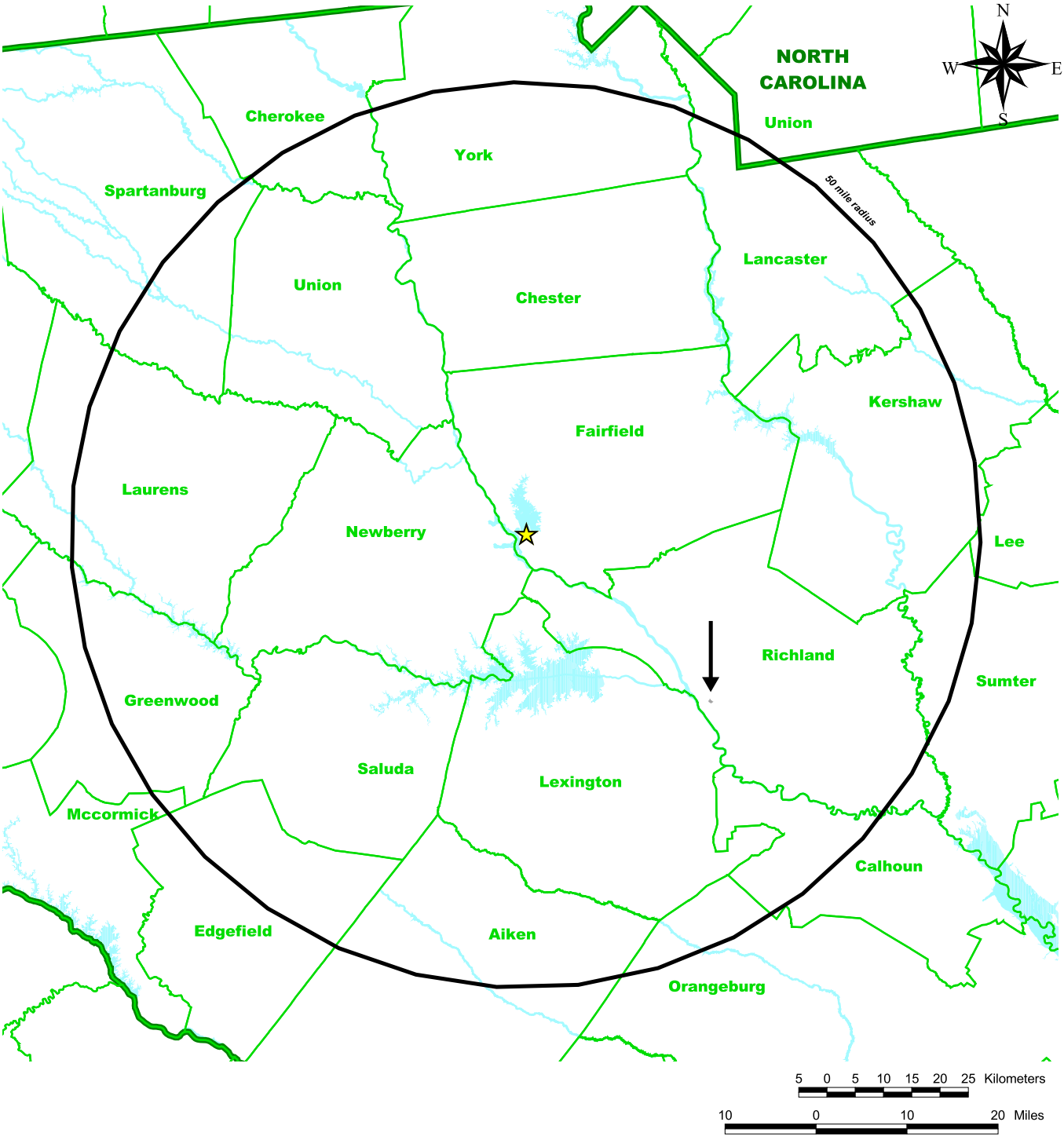
Figure 2-3. South Carolina Electric & Gas Company, Virgil C. Summer Nuclear Station Site Area Map.



LEGEND

- ☆ V.C. Summer Nuclear Station
- American Indian or Alaskan Native Minority Populations

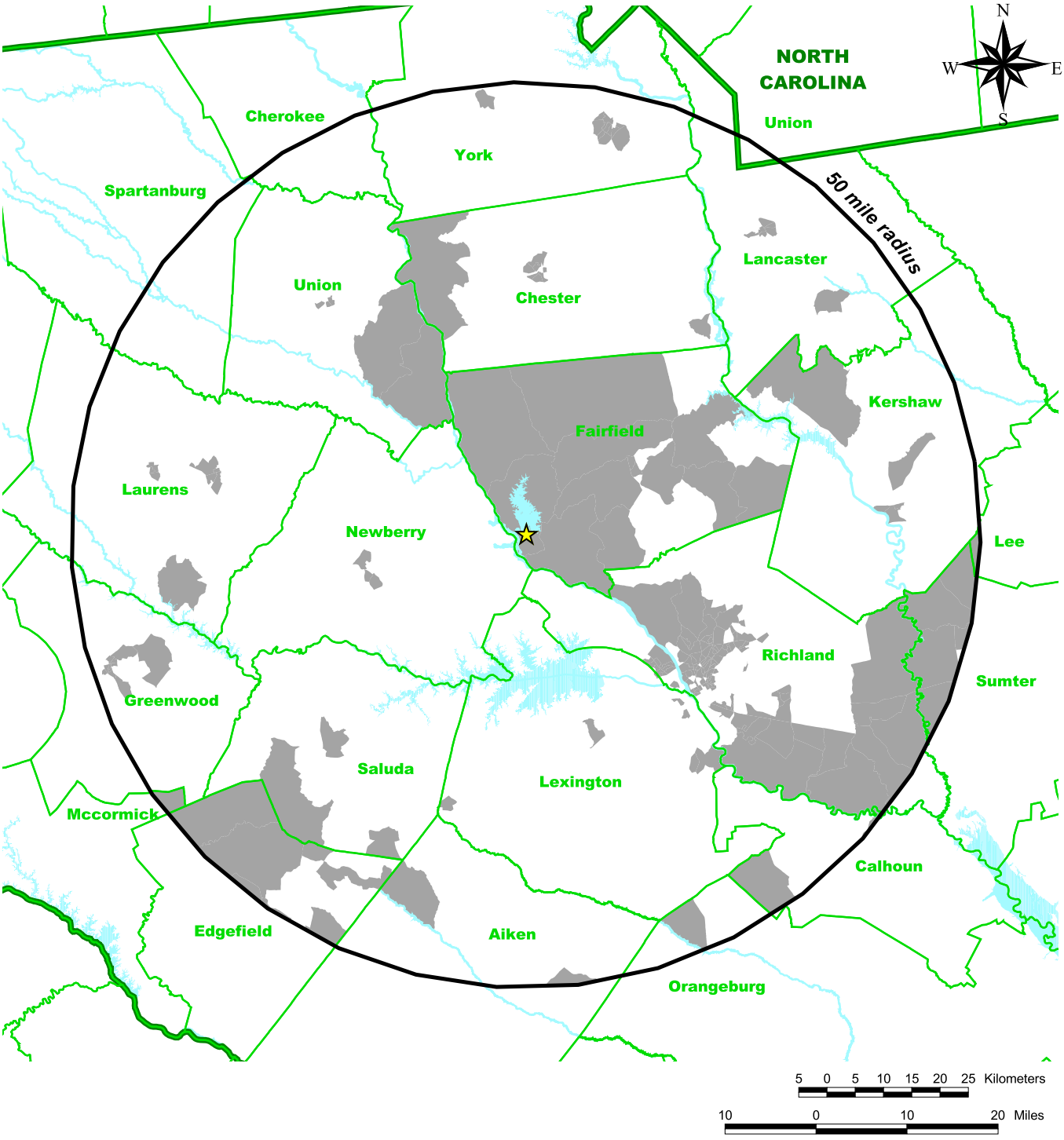
FIGURE 2-4
V.C. Summer Nuclear Station,
American Indian or Alaskan Native Minority Populations
LICENSE RENEWAL APPLICATION



LEGEND

☆ V.C. Summer Nuclear Station
Asian Minority Populations

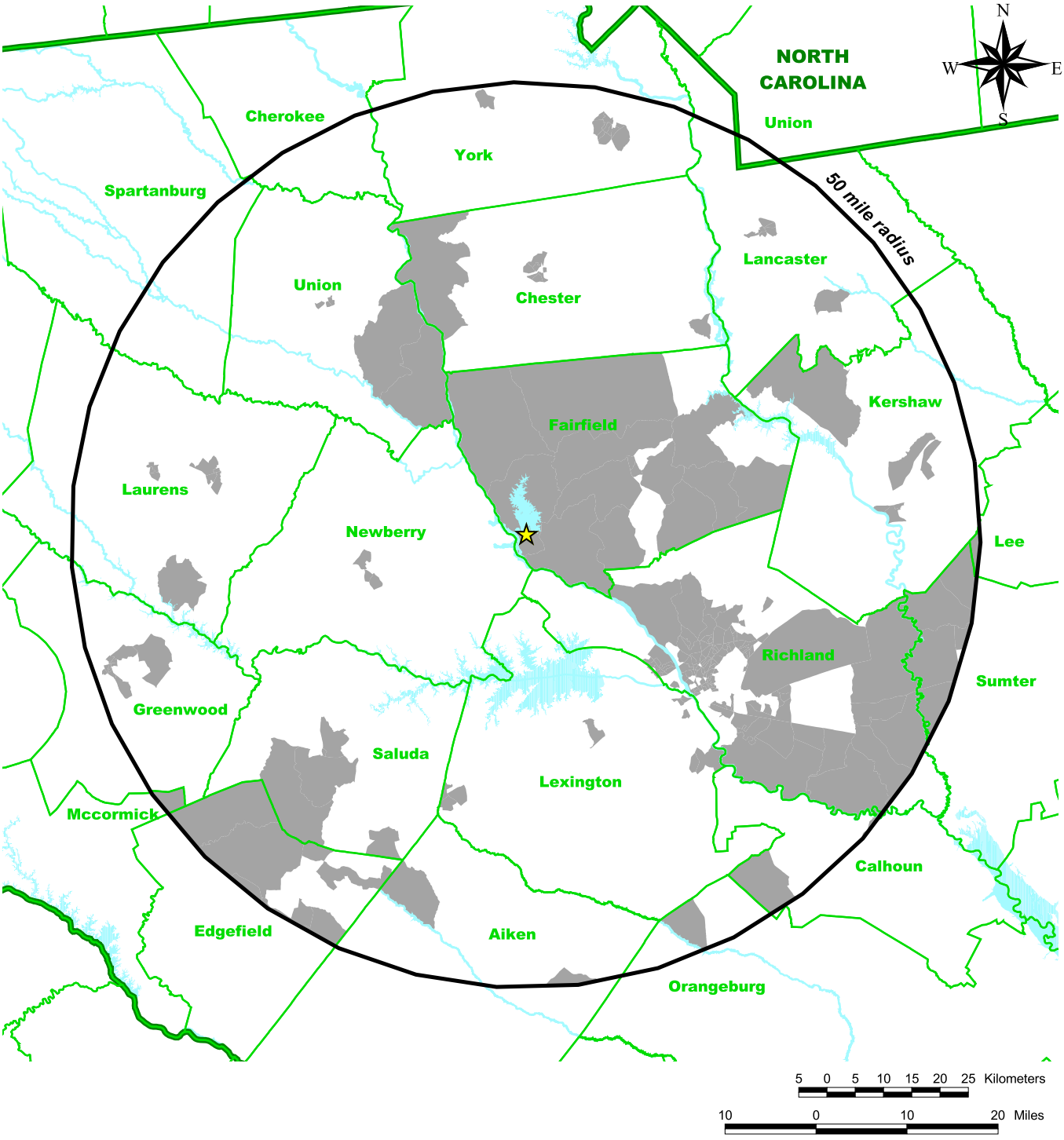
FIGURE 2-5
V.C. Summer Nuclear Station,
Asian Minority Populations
LICENSE RENEWAL APPLICATION



LEGEND

- ☆ V.C. Summer Nuclear Station
- Black Races Minority Populations

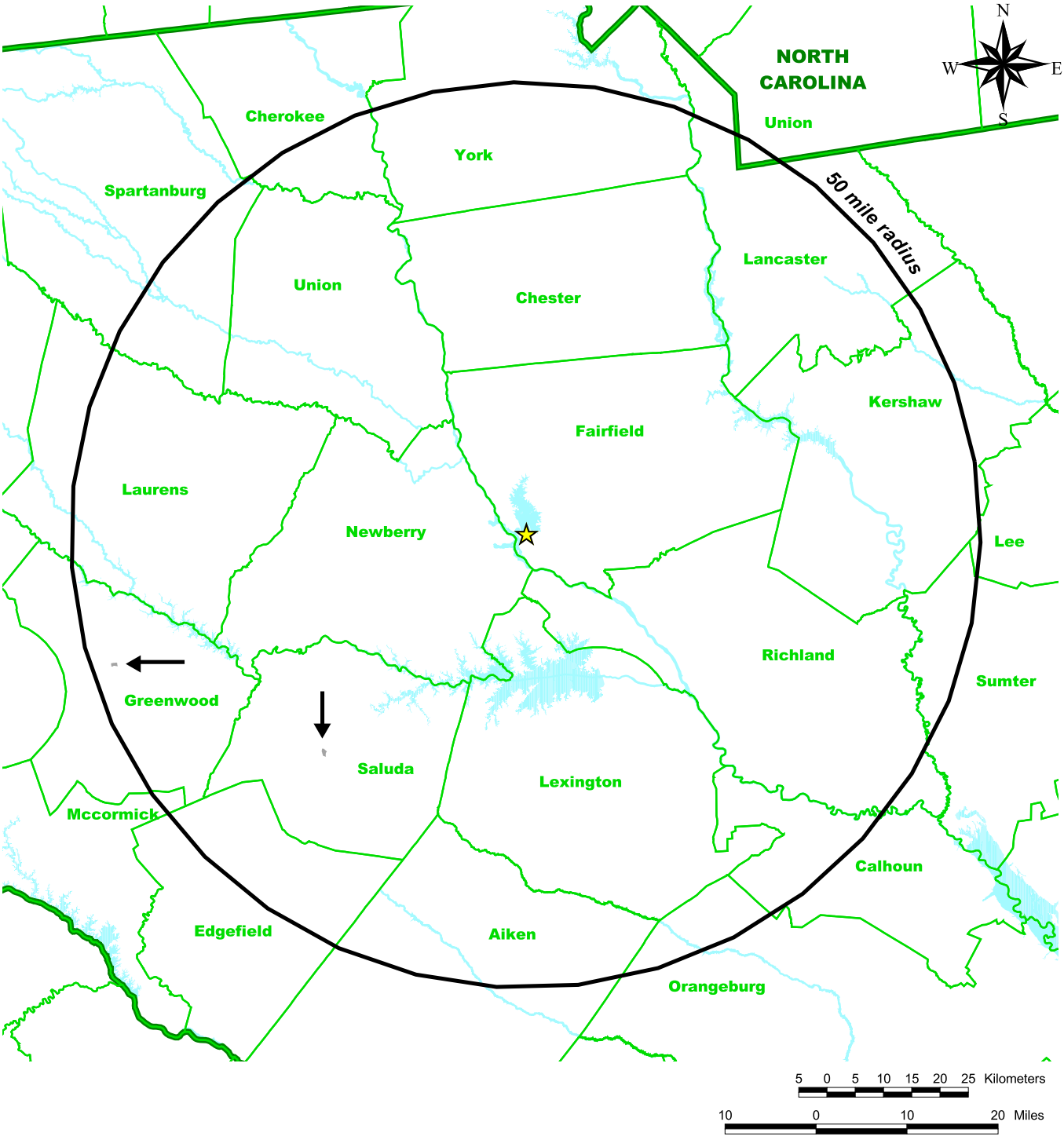
FIGURE 2-6
V.C. Summer Nuclear Station,
Black Races Minority Populations
LICENSE RENEWAL APPLICATION



LEGEND

- ☆ V.C. Summer Nuclear Station
- Aggregate of Minority Races Populations

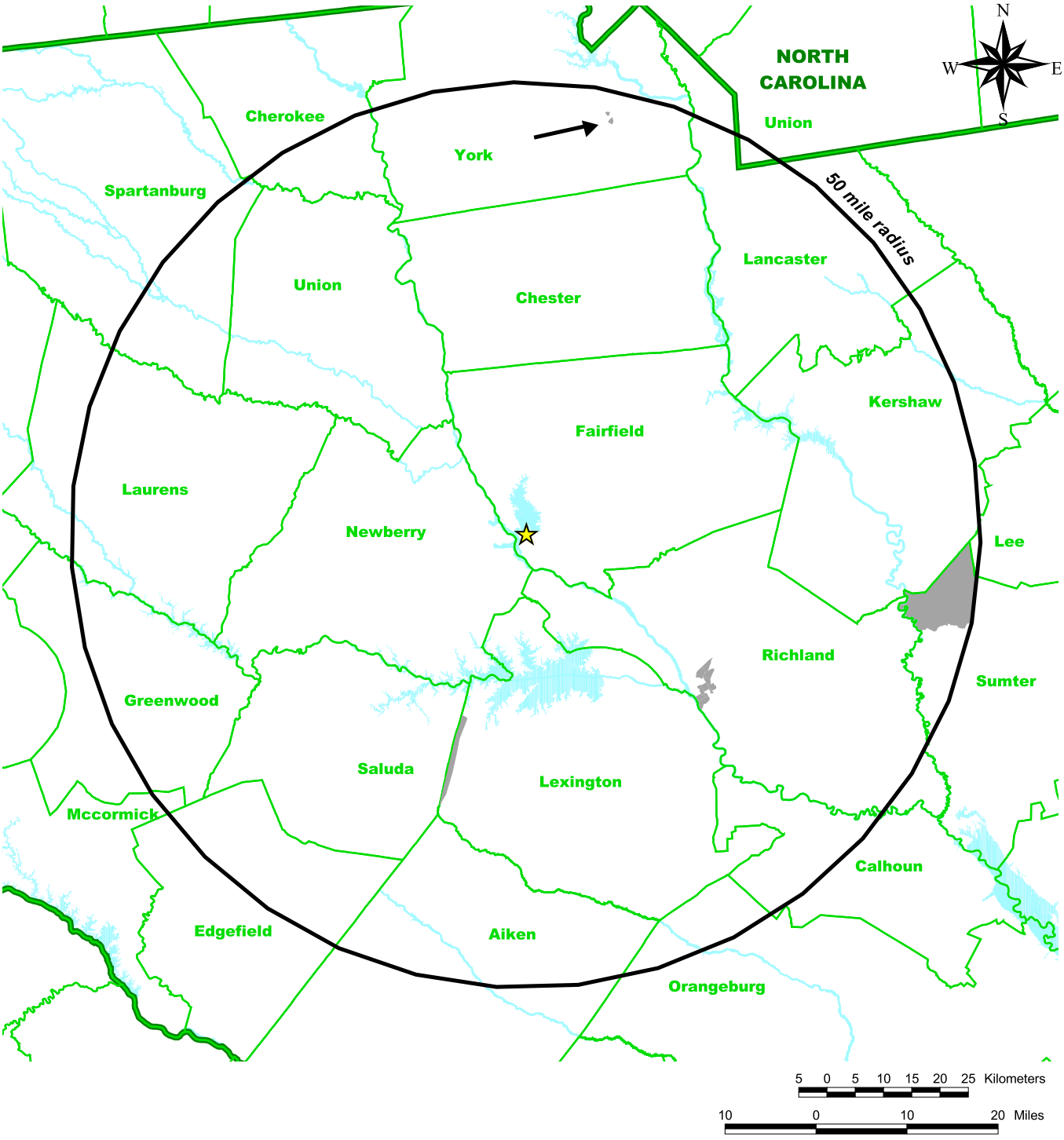
FIGURE 2-7
V.C. Summer Nuclear Station,
Aggregate of Minority Races Populations
LICENSE RENEWAL APPLICATION



LEGEND

☆ V.C. Summer Nuclear Station
Hispanic Ethnicity Populations

FIGURE 2-8
V.C. Summer Nuclear Station,
Hispanic Ethnicity Populations
LICENSE RENEWAL APPLICATION



LEGEND

☆ V.C. Summer Nuclear Station

Low-Income Populations

FIGURE 2-9
V.C. Summer Nuclear Station,
Low-Income Populations
LICENSE RENEWAL APPLICATION