V.C. SUMMER NUCLEAR STATION
UNITS 2 AND 3
TRANSMISSION LINE SITING STUDY
SANTEE COOPER

Prepared for:

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August 25, 2008

EXECUTIVE SUMMARY

The South Carolina Public Service Authority (Santee Cooper) has prepared this report in order to support the combined license application (COLA) for the proposed expansion of the VC Summer Nuclear Station (VCSNS) located in Jenkinsville, South Carolina. An application for a combined construction and operating license for the two proposed nuclear units (Unit 2 and Unit 3) was submitted by SCE&G, acting for itself and as an agent for Santee Cooper, to the Nuclear Regulatory Commission (NRC) on March 31, 2008. The proposed expansion of the VCSNS includes the addition of two new nuclear units (Unit 2 and Unit 3) at the existing facility. Although Santee Cooper and SCE&G are partners in the VCSNS expansion, they have agreed to remain individually responsible for the transmission of their respective portions of the future power generated at the expanded VCSNS. This report has been prepared to evaluate Santee Cooper's proposed transmission lines (VCSNS-Flat Creek and VCSNS-Varnville).

Santee Cooper has determined that two new 230 kV transmission lines will be necessary to transmit their portion of the electricity generated from the two proposed nuclear units. The two new 230 kV transmission lines are referred to as the VCSNS-Flat Creek line and the VCSNS-Varnville line. The VCSNS-Flat Creek line extends approximately 72 miles in a generally northeast direction from the VCSNS to the Flat Creek substation located in Lancaster County, South Carolina. The VCSNS-Varnville line extends approximately 163 miles in a generally southern direction from the VCSNS to the Varnville substation located in Hampton County, South Carolina. Santee Cooper has been able to route 98.96% (approximately 232 miles) of the proposed transmission lines within existing, Santee Cooper maintained transmission rights-of-way. Although these lines are longer than a straight-line corridor between the VCSNS and the respective terminus substations, Santee Cooper has taken this approach in order to minimize impacts as a result of the project and, by connecting to various intermediate substations along each route, to increase overall system-wide reliability. By routing nearly all of the new lines within existing maintained right-of-way (ROW), Santee

Cooper has significantly reduced the impacts of the project when compared to the alternative of acquiring and developing an entirely new ROW. With the exception of 2.44 miles (1.04%) of proposed new ROW, impacts will be limited to the replacement of existing poles and/or the addition of new poles/structures, for the new 230 kV lines, within the boundaries of the existing ROW. The major factors associated with the 2.44 miles of new 100-foot wide ROW will consist of clearing some existing undeveloped woodlands adjacent to existing maintained ROW and spanning the Parr Reservoir (Broad River Impoundment).

In October and November, 2007, Santee Cooper and their consultant, MACTEC Engineering and Consulting, Inc. (MACTEC), met with the following four state and federal agencies to discuss the VCSNS transmission line corridor project: the United States Fish and Wildlife Service (USFWS), the United States Army Corps of Engineers (USACE), the South Carolina Department of Health and Environmental Control (SCDHEC), and the South Carolina State Historical Preservation Office (SCSHPO). A description of the VCSNS transmission corridor project was presented during these meetings, explaining the minimal environmental impacts expected as a result of the majority (98.96%) of the new 230 kV lines being routed within existing maintained ROW.

Initial coordination meetings with state and federal agencies will allow Santee Cooper to move forward with additional assessments that may be required. Santee Cooper will complete the additional work that may be required to meet state and federal regulations and to acquire the appropriate permits necessary to construct the VCSNS-Flat Creek and VSCNS-Varnville 230 kV transmission lines.

Minimal impacts to environmental conditions are expected as a result of this project as Santee Cooper has routed a majority (98.96%) of the proposed VCSNS-Flat Creek and VSCNS-Varnville 230 kV transmission lines within existing maintained rights-of-way. Santee Cooper will minimize impacts during the installation and replacement of new poles/structures through the use of best management practices (BMPs). Impacts associated with required clearing along the 2.44 miles (1.04%) of proposed new ROW will also be minimized through the use of BMPs.

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1.0 INTRODUCTION

1.1 Background Information

In order to meet the projected demand for reliable electrical energy throughout central and southern South Carolina, the South Carolina Electric and Gas Company (SCE&G), a subsidiary of SCANA Corporation, has proposed the addition of two nuclear units to be constructed at the existing V.C. Summer Nuclear Station (VCSNS) located in Jenkinsville, Fairfield County, South Carolina. The South Carolina Public Service Authority, herein referred to as Santee Cooper, has partnered with SCE&G on this project and will be responsible for transmitting a portion of the electricity generated from the proposed units. An application for a combined construction and operating license for the two proposed nuclear units (Unit 2 and Unit 3) was submitted by SCE&G, acting for itself and as an agent for Santee Cooper, to the Nuclear Regulatory Commission (NRC) on March 31, 2008. Once approved, the combined operating license (COL) would authorize the addition of the two units to be constructed at the VCSNS. Electricity generated from these units would be added to the electricity generated by Unit 1, currently in operation.

Although Santee Cooper and SCE&G are partners in the VCSNS expansion, they have agreed to remain individually responsible for the transmission of their respective portions of the future electricity generated at the expanded station. This report has been prepared to evaluate Santee Cooper's proposed transmission lines (described below) and to provide the NRC with additional information about Santee Cooper's portion of the transmission system to compliment the existing information presented in the COLA Environmental Report. SCE&G's transmission lines will be evaluated in a separate report under separate cover and are not included in this report.

1.2 New Transmission Lines

SCE&G and Santee Cooper have determined that a total of six new 230 kV transmission lines (four single-circuit lines and one SCE&G double circuit line) will be necessary to transmit the additional electricity generated from the two proposed units to the power grids. The proposed SCE&G and Santee Cooper transmission lines will assist in fulfilling this need.

The following SCE&G transmission lines will be evaluated in a separate report under separate cover and are not included in this report.

SCE&G Lines

1. VCSNS – Killian
2. VCSNS – Lake Murray No. 2
3. VCSNS – St. George

Santee Cooper Lines

4. VCSNS – Flat Creek: this Santee Cooper 230 kV single-circuit line extends approximately 72 miles in a generally northeast direction from VCSNS to the existing Flat Creek substation located in Lancaster County, South Carolina. The proposed line will intersect the existing Winnsboro and Richburg 69 kV substations prior to terminating at the existing Flat Creek 69 kV substation.
5. VCSNS – Varnville: this Santee Cooper 230 kV single-circuit line extends approximately 163 miles in a generally southern direction from VCSNS to the existing Varnville substation located in Hampton County, South Carolina. The proposed line will intersect and have taps along the way at existing 115 kV substations at Sandy Run, Orangeburg and St. George, as well as an existing 69 kV substation at Pomaria, prior to terminating at the Varnville 230 kV substation.

The two proposed Santee Cooper lines (Figure 1-1), totaling approximately 235 miles, have been routed within existing maintained transmission right-of-way (ROW) to the greatest extent possible. Santee Cooper was able to successfully route 98.96% of the new lines within existing maintained ROW. These existing ROWs currently range from

LEGEND

- VCSNS Substation
- Flat Creek Substation (Terminus of Flat Creek Line)
- Varnville Substation (Terminus of Varnville Line)
- VCSNS - Flat Creek Line
- VCSNS - Varnville Line
- Highways
- Population Centers >14,000
- State Boundary

Drawn By: CGS
Checked By: KMR
Approved By: AWC
Date: July 23, 2008

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Figure 1-1: Regional Location Map

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50 to 200 feet in width, with existing single pole or H-frame structures supporting 69 kV, 115 kV and/or 230 kV lines. A majority (68%) of the corridors are 100-feet wide or less. The remaining 2.44 miles (1.04%) of the combined lines require new 100-foot wide corridors. However, the new clearing for these lines will be adjacent to existing maintained transmission ROW.

2.0 PROJECT DESCRIPTION

2.1 Project Purpose & Need

Santee Cooper operates a vertically-integrated electric utility system, including facilities for generation, transmission, and distribution of electric power and energy at retail and wholesale levels. Santee Cooper has the responsibility to ensure sufficient capacity to provide safe, reliable electrical energy to consumers in its established territory. To help meet these responsibilities, Santee Cooper has partnered with SCE&G in an effort to increase the power production capabilities at the V.C. Summer Nuclear Station (VCSNS). This report has been prepared to evaluate Santee Cooper's proposed transmission lines. Two new 230 kV transmission lines have been planned to accommodate Santee Cooper's portion of the additional generating capacity.

As a result of the proposed VCSNS expansion, Santee Cooper has proposed the addition of two new 230 kV transmission lines that will be of H-frame structure or single pole design, which will connect the switchyard(s) of the VCSNS to the existing Flat Creek and Varnville substations. The VCSNS-Flat Creek line extends approximately 72 miles in a generally northeast direction from VCSNS to the existing Flat Creek substation located in Lancaster County, South Carolina. The proposed line will intersect the existing Winnsboro and Richburg substations prior to terminating at the Flat Creek substation (Figure 2-1, Sheets A01-D01 and A02). The VCSNS-Varnville line extends approximately 163 miles in a generally southern direction from VCSNS to the existing Varnville substation located in Hampton County, South Carolina. The proposed line will intersect the Pomaria, Sandy Run, Orangeburg and St. George substations prior to terminating at the Varnville substation (Figure 2-1, Sheets D01-N01). Any upgrades that may be required at the existing substations will occur within the existing footprint.

LEGEND

- VCSNS Substation
- VCSNS - Flat Creek Line
- VCSNS - Varnville Line
- Flat Creek Substation (Terminus of VCSNS - Flat Creek Line)
- Varnville Substation (Terminus of VCSNS - Varnville Line)

VCSNS - Flat Creek Substations

- Richburg Substation
- Winnsboro Substation

VCSNS - Varnville Substations

- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation

- Airport Area
- Runway
- Index Sheet

Source: USGS 1:100k Quadrangle Map

Drawn By: CGS
Checked By: KMR
Approved By: AWC
Date: July 24, 2008

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Figure 2-1:
Sheet D01
Topographic Map
VCSNS - Flat Creek
71.71 Miles
VCSNS - Varnville
163.04 Miles

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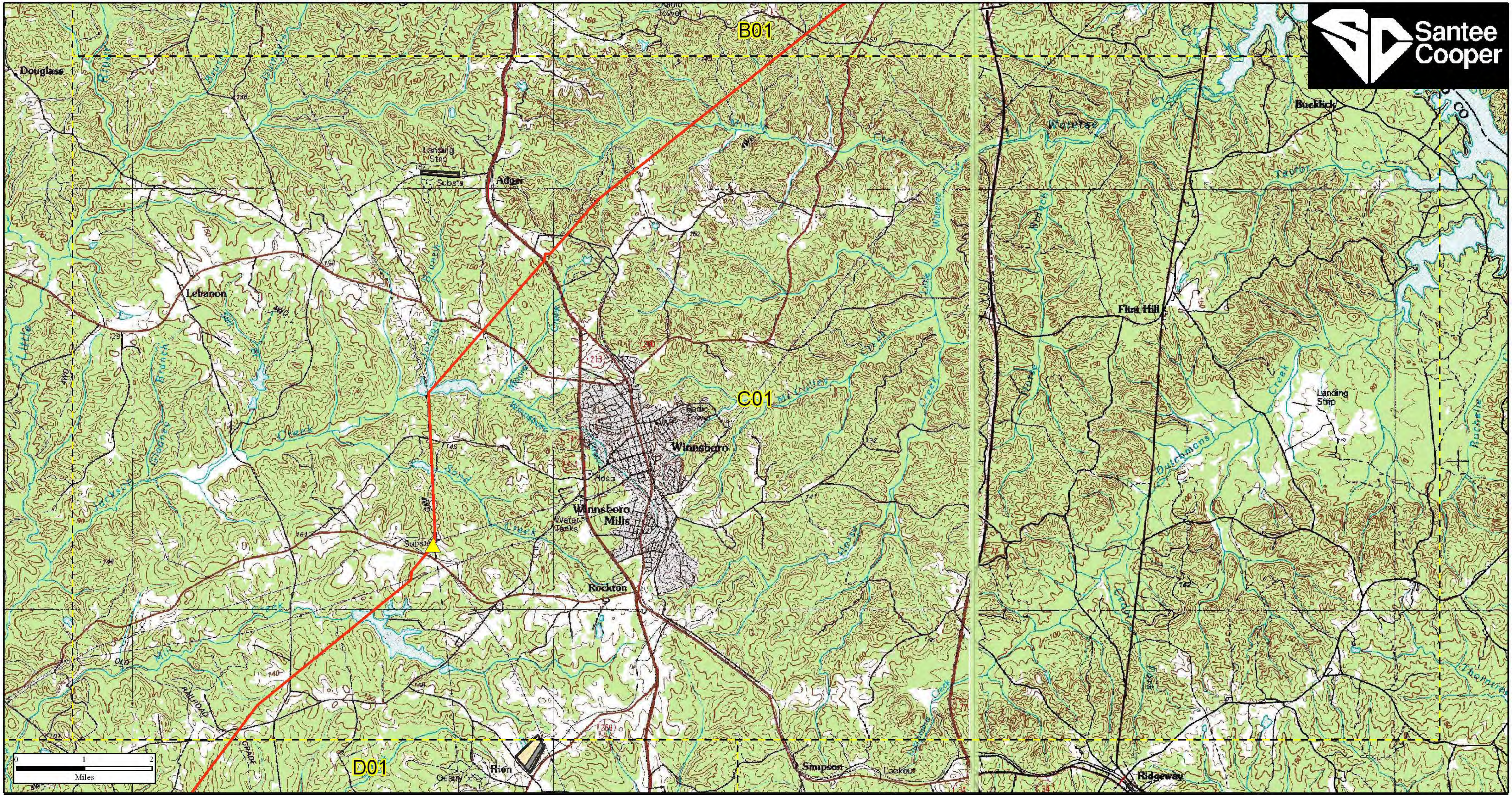


Santee Cooper

LEGEND

★ VCSNS Substation

— VCSNS - Flat Creek Line

▲ Flat Creek Substation
(Terminus of VCSNS - Flat Creek Line)

VCSNS - Flat Creek Substations

▲ Richburg Substation

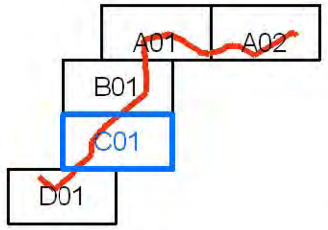
▲ Winnsboro Substation

▭ Airport Area

▬ Runway

▭ Index Sheet

Source: USGS 1:100k Quadrangle Map



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Date: July 24, 2008

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Figure 2-1:
Sheet C01
Topographic Map

VCSNS - Flat Creek
71.71 Miles

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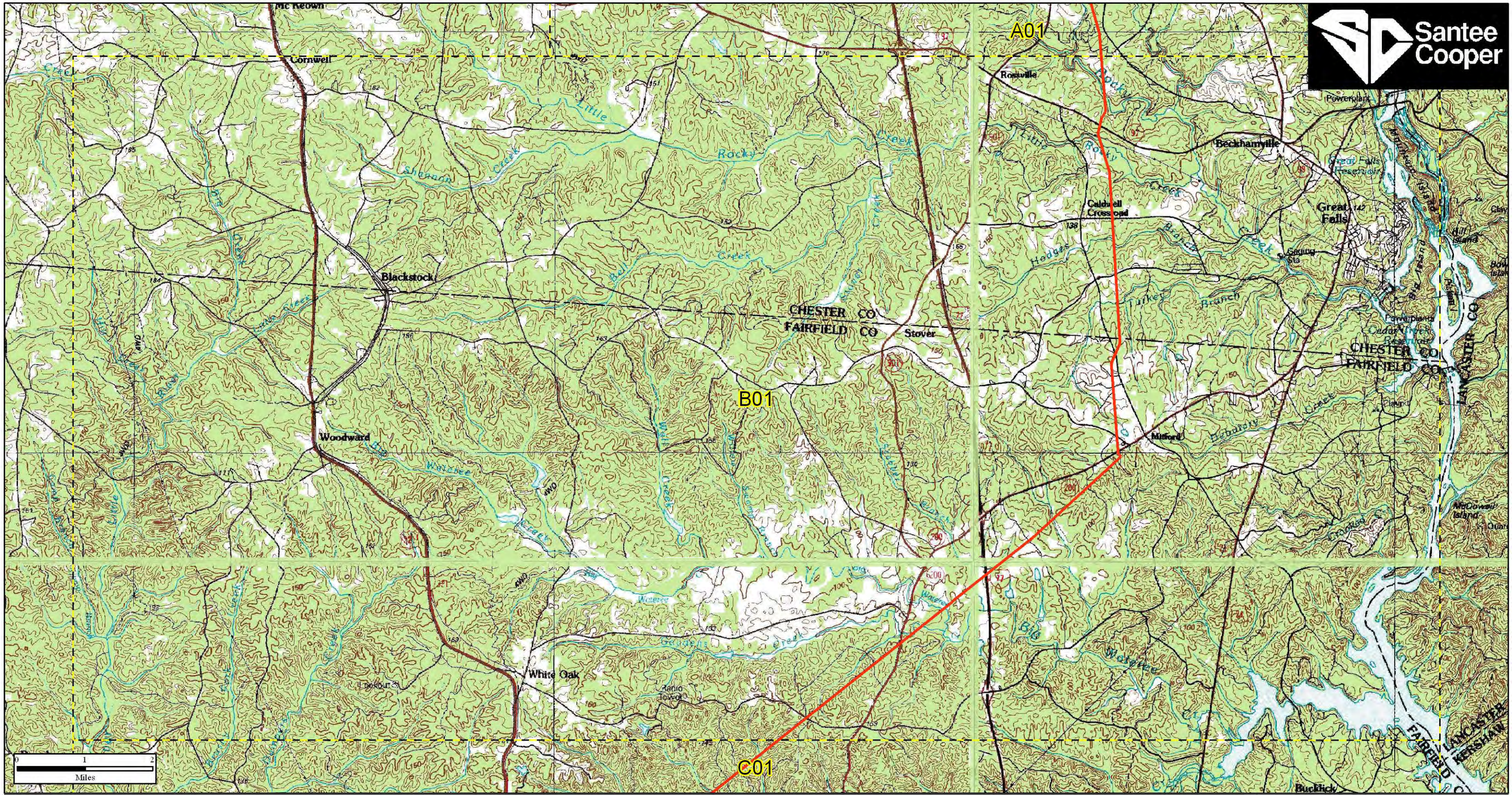

LEGEND

- VCSNS Substation
- VCSNS - Flat Creek Line
- Flat Creek Substation (Terminus of VCSNS - Flat Creek Line)

VCSNS - Flat Creek Substations

- Richburg Substation
- Winnsboro Substation

- Airport Area
- Runway
- Index Sheet

Source: USGS 1:100k Quadrangle Map

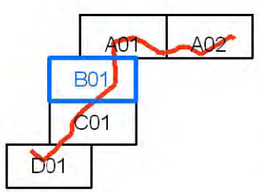

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Figure 2-1:
Sheet B01
Topographic Map

VCSNS - Flat Creek
71.71 Miles

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LEGEND

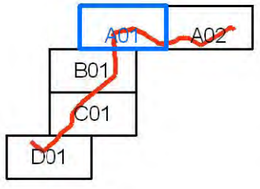
- VCSNS Substation
- VCSNS - Flat Creek Line
- Flat Creek Substation (Terminus of VCSNS - Flat Creek Line)

VCSNS - Flat Creek Substations

- Richburg Substation
- Winnsboro Substation

- Airport Area
- Runway
- Index Sheet

Source: USGS 1:100k Quadrangle Map



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Approved By: AWC
Date: July 24, 2008

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Figure 2-1:
Sheet A01
Topographic Map

VCSNS - Flat Creek
71.71 Miles

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LEGEND

- VCSNS Substation
- VCSNS - Flat Creek Line
- Flat Creek Substation (Terminus of VCSNS - Flat Creek Line)

VCSNS - Flat Creek Substations

- Richburg Substation
- Winnsboro Substation
- Airport Area
- Runway
- Index Sheet

Source: USGS 1:100k Quadrangle Map

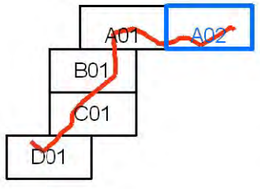

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Figure 2-1:
Sheet A02
Topographic Map

VCSNS - Flat Creek
71.71 Miles

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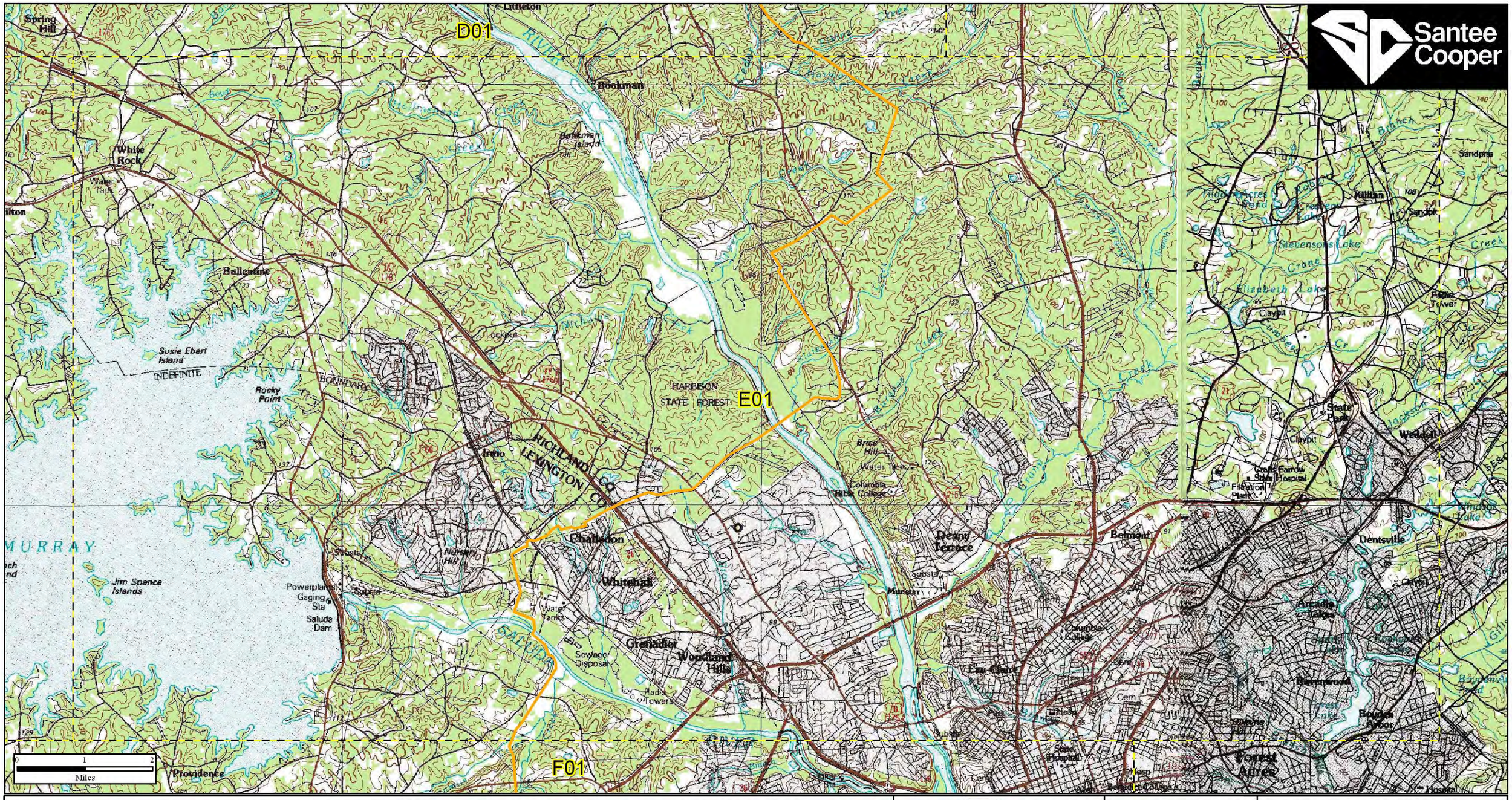

LEGEND

- VCSNS Substation
- VCSNS - Varnville Line
- Varnville Substation (Terminus of VCSNS - Varnville Line)

VCSNS - Varnville Substations

- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation

- Airport Area
- Runway
- Index Sheet

Source: USGS 1:100k Quadrangle Map

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Date: July 24, 2008

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Figure 2-1:
Sheet E01
Topographic Map

VCSNS - Varnville
163.04 Miles

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LEGEND

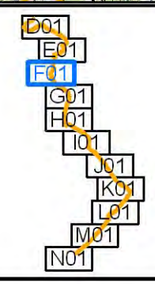
- VCSNS Substation
- VCSNS - Varnville Line
- Varnville Substation (Terminus of VCSNS - Varnville Line)

VCSNS - Varnville Substations

- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation

- Airport Area
- Runway
- Index Sheet

Source: USGS 1:100k Quadrangle Map



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Date: July 24, 2008

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Figure 2-1:
Sheet F01
Topographic Map

VCSNS - Varnville
163.04 Miles

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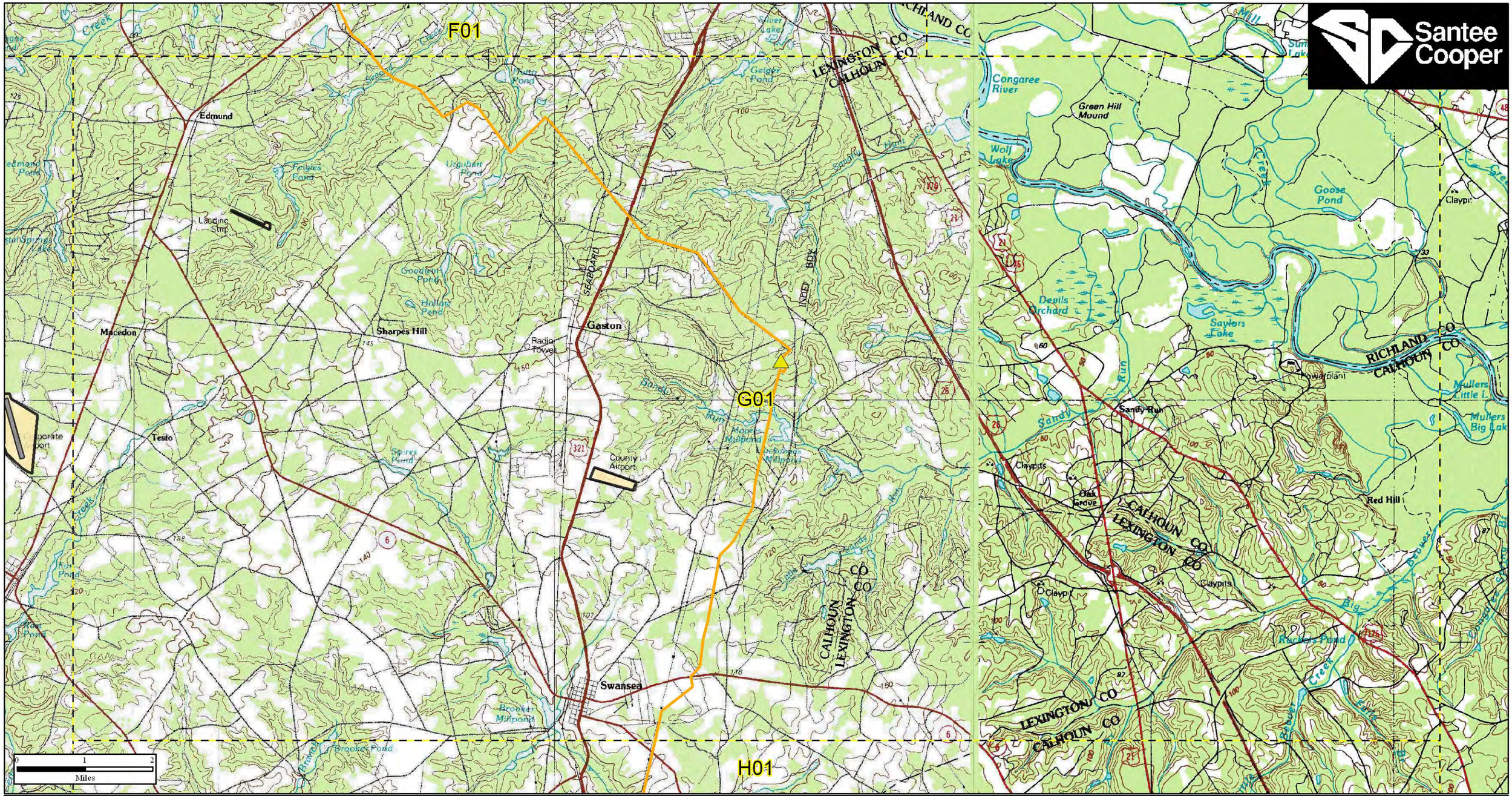

LEGEND

- VCSNS Substation
- VCSNS - Varnville Line
- Varnville Substation (Terminus of VCSNS - Varnville Line)

VCSNS - Varnville Substations

- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation

- Airport Area
- Runway
- Index Sheet

Source: USGS 1:100k Quadrangle Map

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Figure 2-1:
Sheet G01
Topographic Map

VCSNS - Varnville
163.04 Miles

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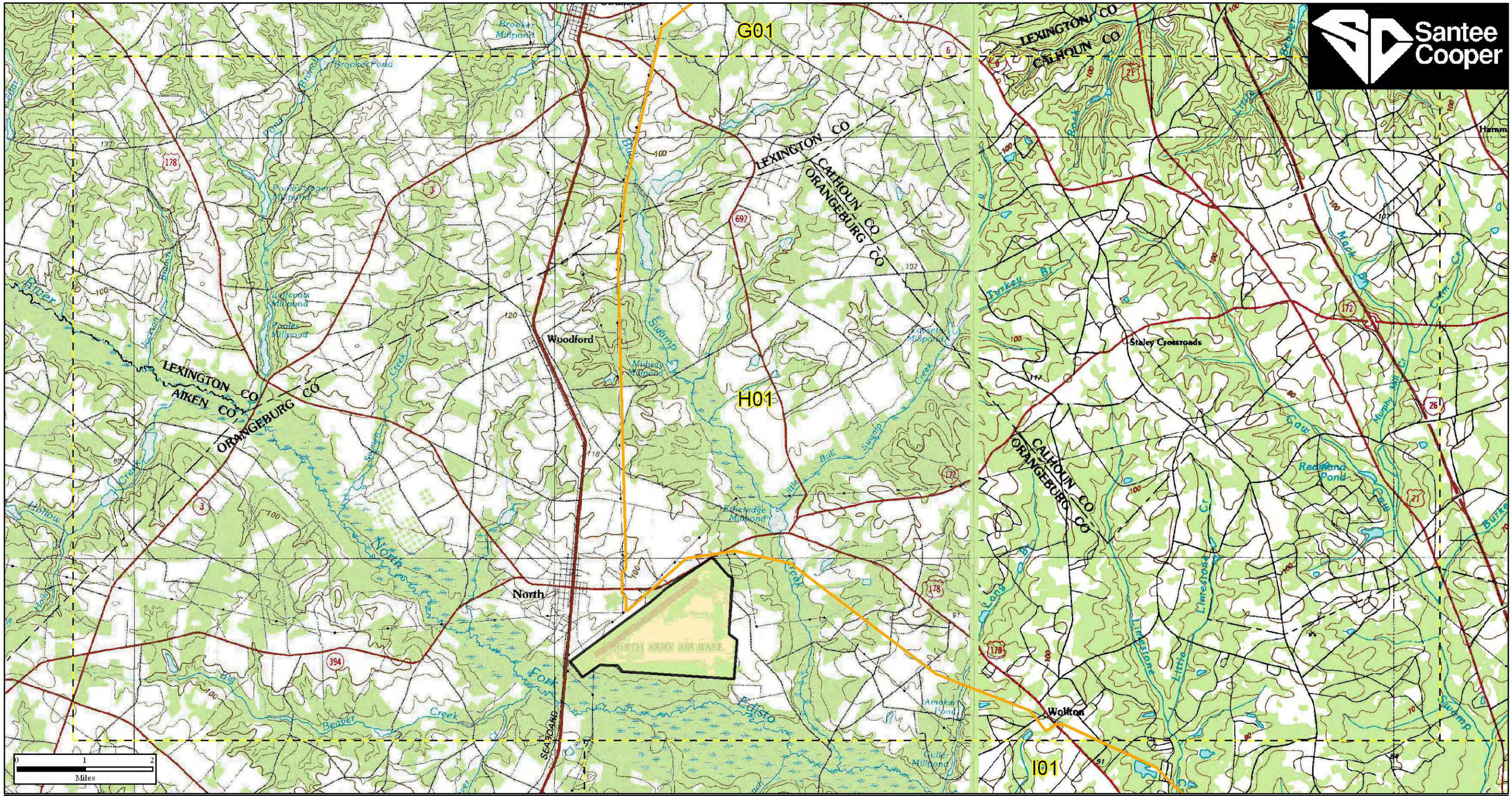

LEGEND

- VCSNS Substation
- VCSNS - Varnville Line
- Varnville Substation (Terminus of VCSNS - Varnville Line)

VCSNS - Varnville Substations

- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation

- Airport Area
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Source: USGS 1:100k Quadrangle Map

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Figure 2-1: Sheet H01 Topographic Map

VCSNS - Varnville 163.04 Miles

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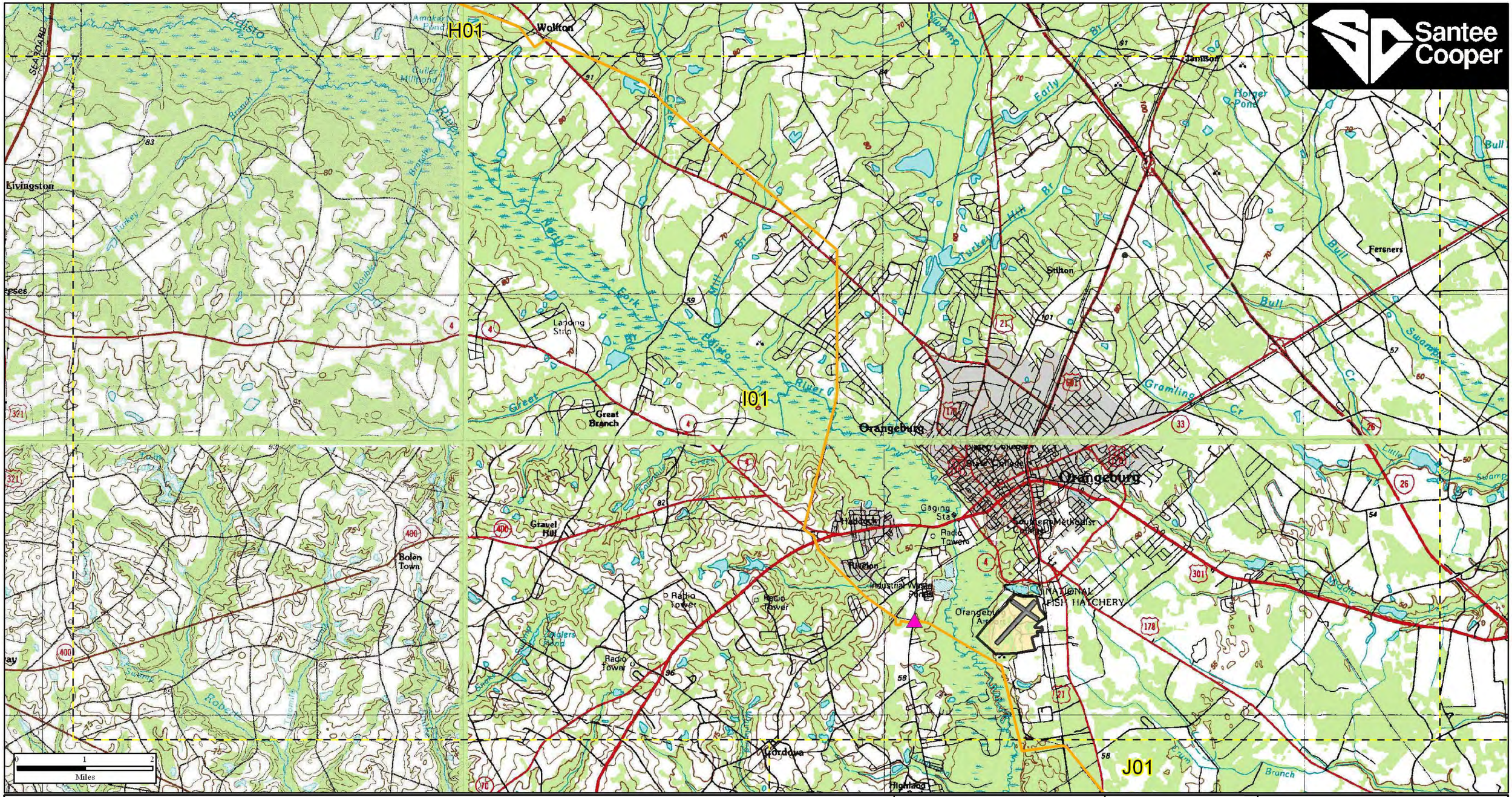

LEGEND

- VCSNS Substation
- VCSNS - Varnville Line
- Varnville Substation (Terminus of VCSNS - Varnville Line)

VCSNS - Varnville Substations

- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation

- Airport Area
- Runway
- Index Sheet

Source: USGS 1:100k Quadrangle Map

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Figure 2-1:
Sheet I01
Topographic Map

VCSNS - Varnville
163.04 Miles

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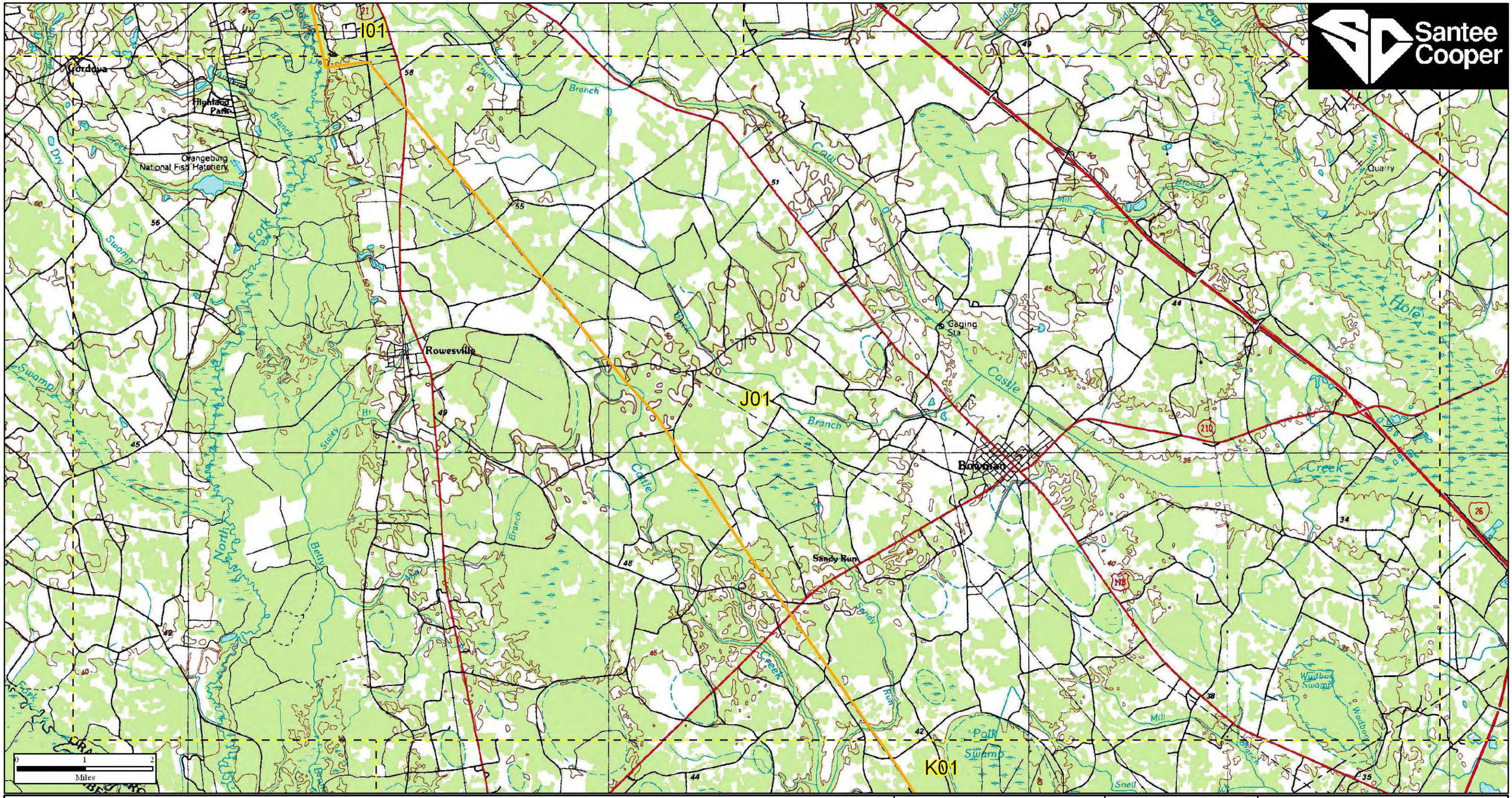

LEGEND

- VCSNS Substation
- VCSNS - Varnville Line
- Varnville Substation (Terminus of VCSNS - Varnville Line)

VCSNS - Varnville Substations

- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation

- Airport Area
- Runway
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Source: USGS 1:100k Quadrangle Map

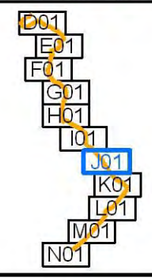

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Figure 2-1:
Sheet J01
Topographic Map

VCSNS - Varnville
163.04 Miles

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LEGEND

- VCSNS Substation
- VCSNS - Varnville Line
- Varnville Substation (Terminus of VCSNS - Varnville Line)

VCSNS - Varnville Substations

- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation

- Airport Area
- Runway
- Index Sheet

Source: USGS 1:100k Quadrangle Map

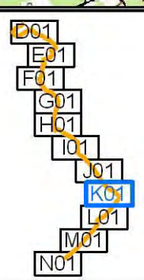

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Figure 2-1: Sheet K01 Topographic Map

VCSNS - Varnville 163.04 Miles

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LEGEND

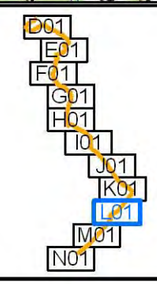
- VCSNS Substation
- VCSNS - Varnville Line
- Varnville Substation (Terminus of VCSNS - Varnville Line)

VCSNS - Varnville Substations

- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation

- Airport Area
- Runway
- Index Sheet

Source: USGS 1:100k Quadrangle Map



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Date: July 24, 2008

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Figure 2-1: Sheet L01 Topographic Map

VCSNS - Varnville 163.04 Miles

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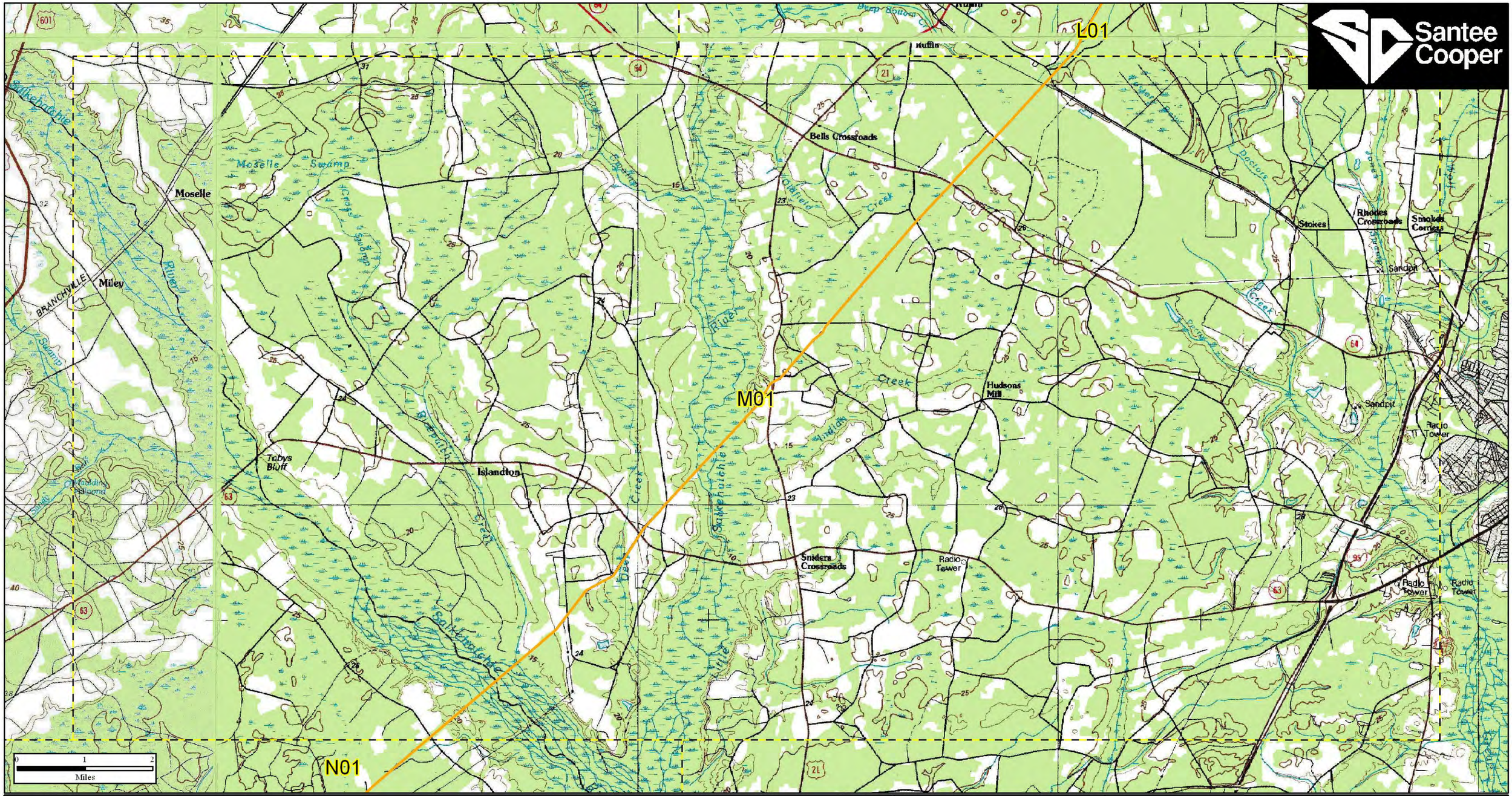


LEGEND

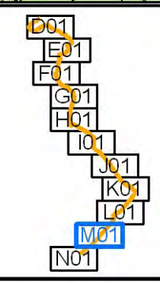
- VCSNS Substation
- VCSNS - Varnville Line
- Varnville Substation (Terminus of VCSNS - Varnville Line)

VCSNS - Varnville Substations

- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation

- Airport Area
- Runway
- Index Sheet

Source: USGS 1:100k Quadrangle Map



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Date: July 24, 2008

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Figure 2-1: Sheet M01 Topographic Map

VCSNS - Varnville 163.04 Miles

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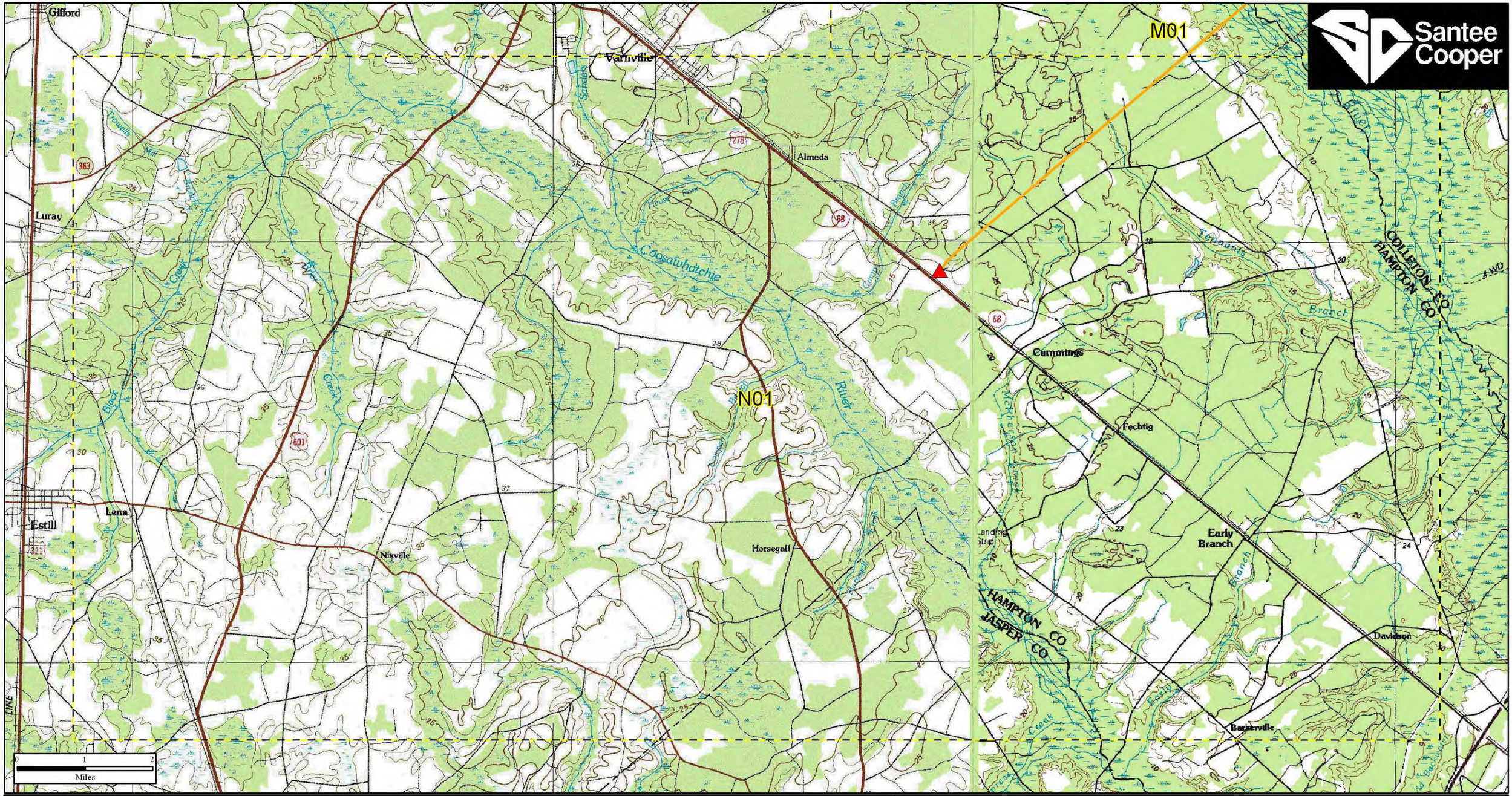

LEGEND

- VCSNS Substation
- VCSNS - Varnville Line
- Varnville Substation (Terminus of VCSNS - Varnville Line)

VCSNS - Varnville Substations

- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation

- Airport Area
- Runway
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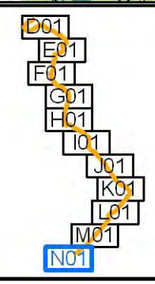
Source: USGS 1:100k Quadrangle Map



Drawn By: CGS
Checked By: KMR
Approved By: AWC
Date: July 24, 2008

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Figure 2-1:
Sheet N01
Topographic Map

VCSNS - Varnville
163.04 Miles

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2.2 Transmission Line Siting Process

Santee Cooper considers the following five factors when selecting a route for new transmission lines: economics, environmental impact, safety, system reliability and long range implications to the transmission system. Economic factors may include the cost of acquiring easements for new ROW, clearing the land, transmission line construction and construction of new substations. Environmental impacts may include wetlands, protected species, cultural resources, wildlife, aesthetics, noise, geology, prime farmland, hydrology, land use, land cover, electromagnetic field, floodplains and air quality.

As specific potential routes for a new transmission corridor are determined, safety, system reliability and long range implications of the transmission system are addressed. The safety of a transmission route is improved by making the route as direct as possible, thus minimizing the number of points of intersection and the number of crossings (roads, rail, water, etc). System reliability is improved by limiting the length of the corridor between substations and routing the corridor to be as accessible as possible (easily accessible terrain, near public access points, etc.), thereby providing more reliable service to end users. Long range implications to the transmission system refer to the design of a “looped” system, rather than a “radial” system, so that power flows to substations from more than one source, which minimizes outages to end users. A “looped” system is where the transmission lines are connected through multiple substations to form a circle (or “loop”). A “radial” system is where transmission lines terminate at a single substation which is not linked to another substation or power source.

The following general options are typically considered by Santee Cooper when evaluating transmission line routing alternatives: underground, overhead in new right-of-way (ROW), overhead in new ROW adjacent and parallel to existing maintained ROW, or overhead within an existing maintained ROW. This analysis presents the alternatives considered to address the electrical transmission component of the VCSNS expansion.

2.2.1 Underground

Although underground utilities may be desirable in highly congested, metropolitan areas, long distance transmission lines are rarely placed underground. This is primarily due to increased installation costs and the higher potential for maintenance complications that are associated with underground lines. The construction cost of locating an underground transmission line can be as much as 10 to 15 times greater per mile than locating the same transmission line aboveground on overhead structures. This does not include the cost of additional substations required for high voltage underground lines due to large line charging currents or the increased expenses over the life of the line associated with line losses and maintenance associated with underground transmission lines.

Although underground lines may be more preferable to certain public constituencies than overhead lines, the extremely high cost associated with the development and maintenance of underground transmission lines limit their development to locations where physical circumstances prevent overhead lines. Another benefit of underground lines is that they limit aesthetic impacts, but other environmental consequences remain. Installation and maintenance of underground utilities require greater disturbance to existing conditions and frequently require the construction of a permanent road along the right-of-way to allow for maintenance and repair. Although vegetation must be cleared for construction and maintenance activities for overhead lines, subsurface disturbance during installation of the line is concentrated at the location of the line's structures and low-growing vegetation is allowed to grow within the ROW. Reliability can also be reduced with the installation of underground utilities, due to the length of time it takes to find and repair or replace damaged equipment.

2.2.2 Overhead in new ROW

Of the three possible overhead routing alternatives, acquiring and developing a new ROW has the potential to cause the largest economic and environmental impacts. While developing a new ROW may be necessary when existing rights-of-way are not available, it is not the primary preferred siting methodology for Santee Cooper. Locating

overhead transmission lines in a new ROW requires the acquisition of new ROW from current property owners. This process can be expensive and time consuming, and challenges of acquisition can often off-set the primary benefit of new ROW, which is the ability to design a new line in the most direct, shortest route possible. Once a right-of-way has been acquired, clearing the ROW is required, which may be difficult and expensive, depending on land cover. Of the three possible overhead routing alternatives, new ROW development would likely have the largest impact on population, vegetation and natural habitats in the vicinity of the ROW because it constitutes entirely new disturbance. Development of new substations may also be required if the route does not pass by existing substations.

2.2.3 Overhead in new ROW adjacent to an existing ROW

Locating overhead transmission lines parallel to an existing maintained ROW typically results in fewer impacts and less time and money than acquiring and developing a new ROW. Although it may still require the acquisition of new easements and new clearing and line installation, the impacts are generally less severe as there is already an existing ROW. Impacts to aesthetics and change in habitat are not as severe as developing a new ROW, as the existing ROW will effectively be widened. However, impacts to natural habitats and existing woody vegetation would be expected as new clearing would be necessary. New substations are generally not required as they should already exist along the route.

2.2.4 Overhead within an existing ROW

Routing new overhead transmission lines within an existing ROW significantly reduces the economic and environmental impacts of the new transmission lines. This option eliminates the need to acquire new easements and does not require new clearing. Development of new access roads and additional substations is unlikely, as the existing ROW is regularly maintained and already connected to substations. Impacts as a result of this option generally involve the replacement of existing transmission line structures. However, placement of structures would also be required in either of the other two overhead options.

2.2.5 Transmission Line Alternatives Summary

Based on the benefits and availability of routing overhead within an existing ROW, Santee Cooper has been able to route a majority of the new 230 kV transmission lines within existing maintained ROW. Of the approximate 235 miles of transmission line corridor, only 2.44 miles (1.04%) consists of new ROW. This 100-foot wide new ROW is located adjacent to existing maintained ROW, while the remaining 98.96% of the proposed lines are routed within existing, Santee Cooper maintained ROW.

3.0 DESCRIPTION OF EXISTING ENVIRONMENT

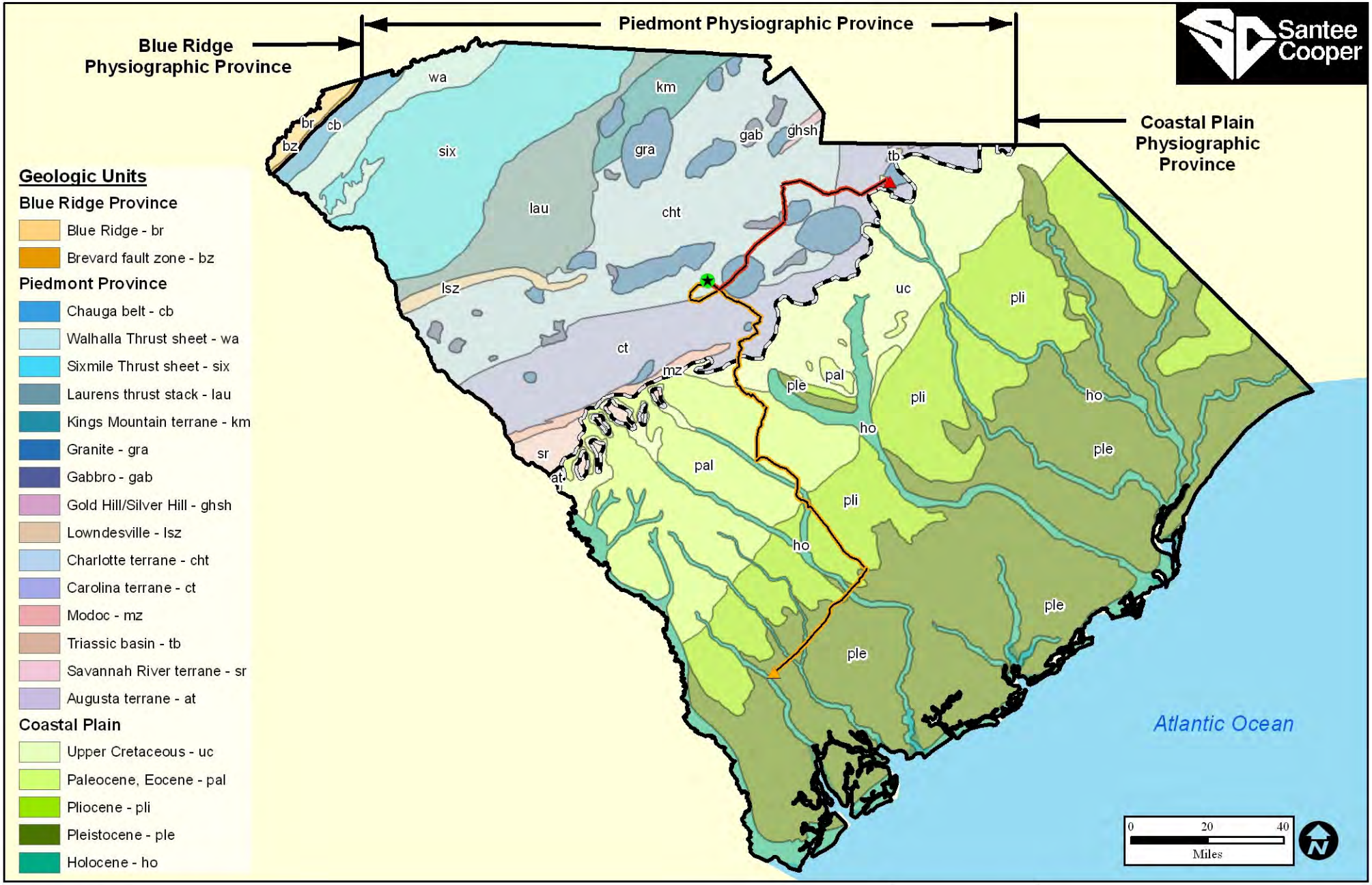
3.1 Geology, Soils and Prime Farmland

3.1.1 Geology

South Carolina overlaps three physiographic provinces, which are regions with similar terrain formed by a common geologic history. The Blue Ridge Physiographic Province covers approximately 150 square miles in the northwestern corner of the state and consists of mountainous terrain with a relatively thin soil layer underlain by crystalline bedrock. The Piedmont Physiographic Province is located southeast of the Blue Ridge Province to the Fall Line, which defines the northwestern extent of the Coastal Plain Physiographic Province. The Piedmont is generally characterized by rolling topography and deeply weathered soils, commonly referred to as saprolite, which are the result of in-situ weathering of the underlying bedrock. The Coastal Plain Physiographic Province consists of a thick sequence of sedimentary deposits that overlay ancient crystalline rocks, which are a continuation of the Piedmont. The sediments form a wedge that increases in thickness from the Fall Line to the Atlantic Ocean. The Coastal Plain is commonly divided into three sub-regions, the Upper, Middle and Lower Coastal Plain, distinguished primarily by the age of the sedimentary deposits.

The VCSNS-Flat Creek line is almost wholly located within the Piedmont Physiographic Province (Figure 3-1). The majority of the line is underlain by metamorphic rocks of the Charlotte Terrane with localized intrusions of igneous rocks (granite and gabbro). Approximately thirteen miles of the corridor in Lancaster County is underlain by metavolcanic and metasedimentary rocks of the Carolina Slate Belt. The last approximately three miles of the line prior to termination at the Flat Creek substation are located in the Upper Coastal Plain Physiographic Province (SCGS 2005).

Approximately 1.2 miles of the VCSNS-Flat Creek line is located within the 1,567-acre Forty Acre Rock Heritage Preserve in Lancaster County, which is managed by the South Carolina Department of Natural Resources (SCDNR). Forty Acre Rock, which is actually



LEGEND

- VCSNS Substation
- Flat Creek Substation (Terminus of Flat Creek Line)
- Varnville Substation (Terminus of Varnville Line)
- VCSNS - Flat Creek Line
- VCSNS - Varnville Line
- Fall Line
- Geological Provinces
- Geologic Units

Source: South Carolina DNR

Drawn By: CGS
Checked By: SEK
Approved By: AWC
Date: July 23, 2008

MACTEC

Figure 3-1: Generalized Geology Map of South Carolina

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fourteen acres in size, is one of the largest contiguous granite exposures in South Carolina. The VCSNS-Flat Creek line is located approximately 800 feet from the area of exposed rock. Forty Acre Rock Heritage Preserve also contains exposures of a notable geologic feature, diabase dike. Dikes are long, narrow bodies of igneous rocks formed by the intrusion of volcanic magma along planes of weakness in a massive parent rock. Diabase is a type of rock, similar to basalt, formed from high-temperature magma and it forms a low-lying ridge because it is more resistant to erosion that the adjacent [parent] rock (SCGA 2008).

The VCSNS-Varnville line is located in the Piedmont and Coastal Plain Physiographic Provinces. Approximately 46 miles of the corridor is located in the Piedmont and is underlain primarily by rocks of the Carolina Slate Belt. The VCSNS-Varnville line crosses the Fall Line into the Coastal Plain near the corridor's intersection with Interstate 20. The approximately 117 remaining miles of the corridor is located in the Coastal Plain. The VCSNS-Varnville line traverses the Upper, Middle and Lower Coastal Plain sub-regions (SCGS 2005).

3.1.2 Soils

According to information obtained from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), the majority of the soils in the vicinity of the VCSNS-Flat Creek line are classified as sandy loam. Table 3-1 describes the map units that are commonly encountered along the VCSNS-Flat Creek line.

Table 3-1: Common soil types in VCSNS-Flat Creek Line

Map Unit	Soil Classification	General Description
Appling	loamy sand	Very deep, well drained moderately permeable soils on ridges and side slopes of the Piedmont uplands; formed in residuum weathered from felsic igneous and metamorphic rocks of the Piedmont uplands
Blanton	sand (Upper Coastal Plain)	Very deep, somewhat excessively drained to moderately well drained, moderately to slowly permeable soils on uplands and stream terraces in the Coastal Plain
Cecil	sandy to sandy clay loam	Very deep, well drained moderately permeable soils on ridges and side slopes of the Piedmont uplands; formed in residuum weathered from felsic, igneous and high-grade metamorphic rocks of the Piedmont uplands
Hiwassee	sandy to sandy clay loam	Very deep, well drained soils on high stream terraces in the Southern Piedmont; formed in old alluvium derived from felsic and mafic rocks
Madison	sandy clay loam	Very deep, well drained, moderately permeable soils that formed residuum weathered from felsic or intermediate, high-grade metamorphic or igneous rocks high in mica content
Pacolet	sandy loam	Very deep, well drained, moderately permeable soils that formed in residuum weathered mostly from felsic igneous and metamorphic rocks of the Piedmont uplands
Wilkes	sandy loam	Shallow, well drained soils with moderately slow to slow permeability; formed in residuum weathered from intermediate and mafic crystalline rocks on uplands in the Piedmont
Winnsboro	sandy loam	Deep, well drained, slowly permeable fine soils that formed in material mostly weathered from dark colored basic rocks of the Piedmont

Source: NRCS 2008a

In general, areas are considered to have a severe erosion potential where the slope of the land surface exceeds 10 to 15 percent. The northern portion of the VCSNS-Flat Creek line, in the vicinity of Forty Acre Rock Natural Heritage Preserve, located in Lancaster County, extends through areas designated as “rock land” where rock outcroppings are common.

Soils in the vicinity of the VCSNS-Varnville line as it traverses the Coastal Plain are generally classified as sandy loam. Soils located south and southwest of the City of Columbia (the approximate location of the northwest extent of the Coastal Plain) are generally classified as sand. This area is referred to as the Sand Hills, as depicted on Figure 3-6. Soils in the vicinity of the VCSNS-Varnville line located northwest of the Fall Line are generally classified as silty loam and sandy loam. Table 3-2 describes the map units that are commonly encountered within portions of the VCSNS-Varnville line located

in the Coastal Plain Physiographic Province. Piedmont soils encountered by the VCSNS-Varnville line are similar to those listed in Table 3-1 for the VCSNS-Flat Creek line.

Table 3-2: Common Coastal Plain soil types in VCSNS-Varnville Line

Map Unit	Soil Classification	Geologic Location	General Description
Blaney	sand	Upper Coastal Plain (Sand Hills)	Very deep, well drained, moderately slowly permeable soils on hills and flats
Coxville	sandy loam	Middle/Lower Coastal Plain	Very deep, poorly drained, moderately slowly permeable soils in depressions of marine and fluviomarine sediments
Dothan	Loamy sand	Upper Coastal Plain	Very deep, well drained, moderately slowly to slowly permeable soils on broad uplands; formed in thick beds of unconsolidated, medium to fine-textured marine
Fuquay	sand	Middle Coastal Plain	Very deep, well drained, moderately to slowly permeable soils found on uplands and marine terraces
Goldsboro	loamy fine sand	Middle/Lower Coastal Plain	Very deep, moderately well drained, moderately permeable soils on uplands and marine terraces
Johnston	sandy loam	Upper Coastal Plain	Very deep, very poorly drained, frequently flooded soils, formed in flood plain/swamp areas
Lakeland	sand	Upper Coastal Plain (Sand Hills)	Very deep, excessively drained, rapid to very rapidly permeable soils on uplands; formed in thick beds of eolian or marine sands
Lynchburg	loamy fine sand	Middle/Lower Coastal Plain	Very deep, somewhat poorly drained soils on marine terraces or flats
Neeses	loamy sand	Upper Coastal Plain	Very deep, well drained, slowly permeable soils that formed in clayey and loamy sediments
Noboco	loamy sand	Middle/Lower Coastal Plain	Very deep, moderately to well drained, moderately permeable soils on marine terraces and uplands
Paxville	fine sandy loam	Middle/Lower Coastal Plain	Very deep, very poorly drained, moderately permeable soils on stream terraces and flats
Rains	sandy loam	Middle/Lower Coastal Plain	Very deep, poorly drained, moderately permeable soils in depressions of marine and fluviomarine sediments
Troup	sand	Upper Coastal Plain	Deep, somewhat excessively drained, moderately permeable soils; formed in sandy and loamy marine sediments on uplands

Source: NRCS 2008a

3.1.3 Prime Farmland

The USDA defines prime farmland as land that has the best combination of physical and chemical characteristics for the production of food, feed, forage, fiber, and oilseed crops (NRI, 2001). Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and generally results in the least damage to the environment. Farmlands of Statewide Importance consist of land with favorable, but not 'prime' physical and chemical properties; however, Farmlands of Statewide Importance can be farmed economically to produce high yields of crops when developed and managed with acceptable farming practices. Farmlands of Statewide Importance are identified at the state level. Table 3-3 indicates the acreages of Prime Farmland and Farmland of Statewide Importance that are located within the VCSNS-Flat Creek and VCSNS-Varnville corridors.

Table 3-3: Prime Farmland and Farmland of Statewide Importance (acres)

Classification	VCSNS-Flat Creek	VCSNS-Varnville
Prime Farmland	183	556
Prime Farmland if drained	0	152
Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season	31	29
Prime farmland if protected from flooding or not frequently flooded during the growing season	24	55
Farmland of Statewide Importance	146	681
Total Classified Acres (approximate % of total acres)	**384 (38%)**	**1,473 (57%)**

Source: NRCS 2008b

3.2 Water Resources

3.2.1 Hydrology

According to the USGS National Hydrography Dataset (NHD), which contains hydrographic data at a 1:100,000 scale (USGS 2008), the VCSNS-Flat Creek line crosses an estimated 55 major (likely large perennial) streams located within the Broad, Catawba and Pee Dee River Basins. The widest water crossings were identified at the Fishing Creek Reservoir and an unnamed impoundment west of Winnsboro at locations

where the water bodies are approximately 1,300 feet and 1,200 feet wide, respectively. The VCSNS-Flat Creek line crosses two additional impoundments west of Winnsboro with approximate 500-foot crossings.

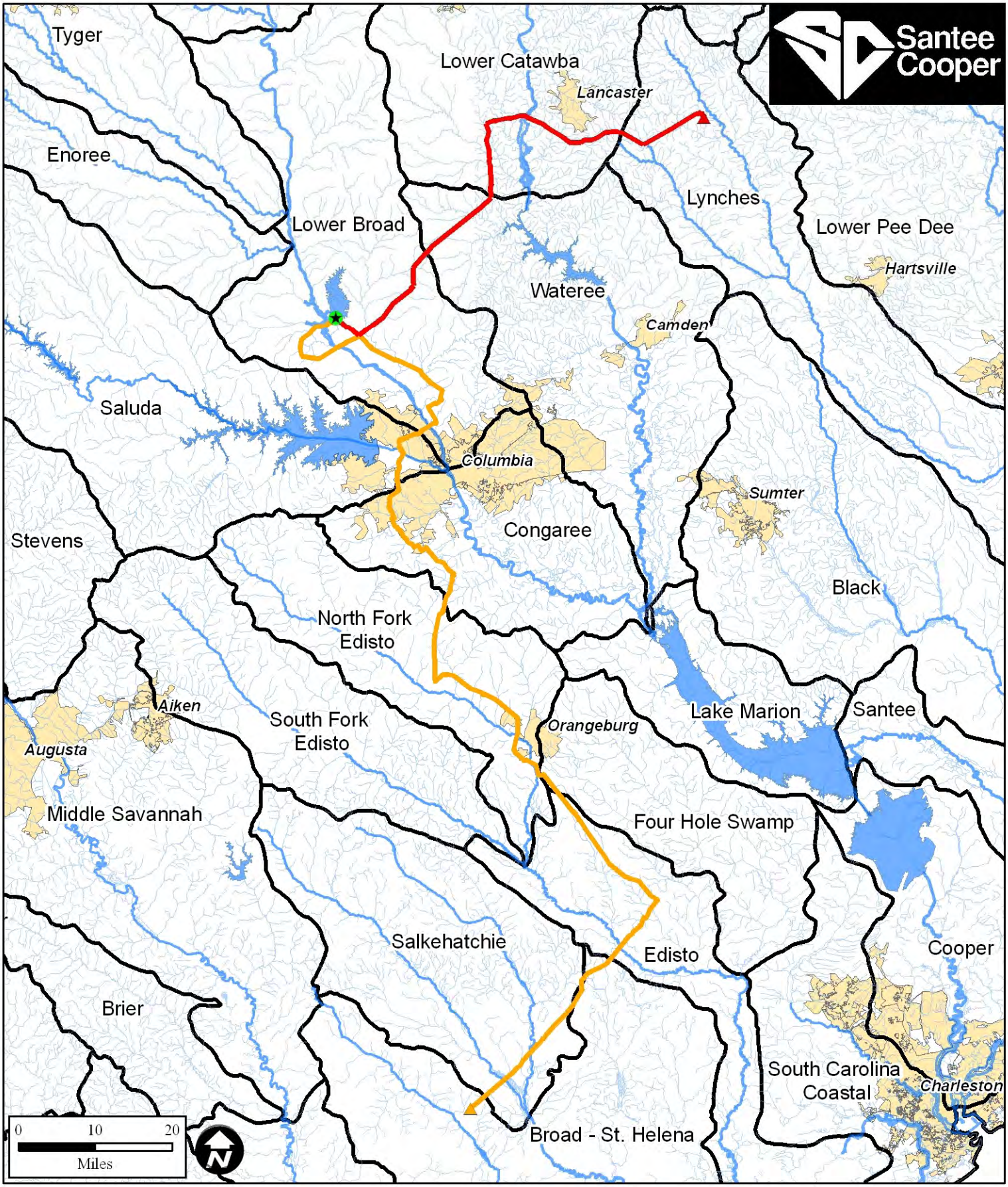
Within the three major river basins, the VCSNS-Flat Creek line traverses 13 watersheds, also defined as hydrologic units by the USEPA, as identified in the following table (listed in order from the VCSNS to the Flat Creek substation) and shown on Figure 3-2. The streams in the identified watersheds are classified by the South Carolina Department of Health and Environmental Control (SCDHEC) as "Freshwaters" (SCDHEC 1998, 2001a and 2005). "Freshwaters" are suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment. They are also suitable for industrial and agricultural uses, and fishing (SCDHEC 2004a).

Table 3-4: Watersheds located along the VCSNS-Flat Creek line

Basin	Watershed	11-Digit Hydrologic Unit Code
Broad River Basin (Lower Broad River)	Broad River	03050106-060
	Little River	03050106-070
	Jackson Creek/Mill Creek	03050106-080
Catawba River Basin (Lower Catawba River)	Wateree River/Lake Wateree	03050104-010
	Big Wateree Creek	03050104-020
	Rocky Creek	03050103-090
	Fishing Creek	03050103-060
	Catawba River	03050103-010
	Camp Creek	03050103-080
	Cane Creek	03050103-040
Pee Dee River Basin (Lynches River)	Little Lynches River	03040202-070
	Flat Creek	03040202-040
	Lynches River	03040202-030

Source: SCDHEC 2004

Based on the USGS NHD dataset (USGS 2008), the VCSNS-Varnville line crosses an estimated 85 major (likely large perennial) streams located within the Salkehatchie, Edisto, Saluda and Broad River Basins. The VCSNS-Varnville line crosses the Saluda River at a location where the river is approximately 240 feet wide and also crosses the Broad River twice at locations where the river is between 475 and 500 feet wide. The



LEGEND

- VCSNS Substation
- Flat Creek Substation (Terminus of Flat Creek Line)
- Varnville Substation (Terminus of Varnville Line)
- VCSNS - Flat Creek Line
- VCSNS - Varnville Line
- Population Centers >14,000
- Major Rivers
- Streams
- Major Lakes
- Watershed Boundary

Source: USGS National Hydrography Dataset (Medium Resolution)

Drawn By: CGS
Checked By: KMR
Approved By: AWC
Date: July 23, 2008

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Figure 3-2: Major Watersheds in Project Area

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new segment of the VCSNS-Varnville line will cross Parr Reservoir (impounded Broad River) at a location where the distance from bank to bank is approximately 2,500 feet. Two transmission structures owned and maintained by SCE&G are currently located between the banks (one structure is on an 'island' in the reservoir and the other structure is in the main channel) within the adjacent existing ROW.

Within the four major river basins, the VCSNS-Varnville line traverses 23 watersheds, as identified in the following table (listed in order from the VCSNS to the Varnville substation) and shown on Figure 3-2. The streams in the identified watersheds are also classified by SCDHEC as "Freshwaters" (SCDHEC 2001b, 2003, 2004b and 2004c).

Table 3-5: Watersheds located along the VCSNS-Varnville line

Basin	Watershed	11-Digit Hydrologic Unit Code
Broad River Basin (Lower Broad River)	Broad River	03050106-050
	Little River	03050106-070
	Cedar Creek	03050106-090
	Broad River	03050106-060
Saluda River Basin (Congaree and Saluda Rivers)	Lower Saluda River	03050109-210
	Congaree Creek	03050110-020
	Congaree River	03050110-010
	Sandy Run	03050110-040
Edisto River Basin (Edisto / North Fork Edisto Rivers and Four Hole Swamp)	North Fork Edisto River	03050203-040
	Bull Swamp Creek	03050203-050
	North Fork Edisto River	03050203-060
	Caw Caw Swamp	03050203-070
	North Fork Edisto River	03050203-080
	Cow Castle Creek	03050206-030
	Cattle Creek	03050205-020
	Indian Field Swamp	03050205-040
	Edisto River	03050205-030
Salkehatchie River Basin (Broad-St. Helena and Salkehatchie Rivers)	Great Swamp	03050208-020
	Buckhead Creek	03050207-090
	Little Salkehatchie River	03050207-080
	Little Salkehatchie River	03050207-110
	Salkehatchie River	03050207-040
	Coosawhatchie River	03050208-070

Source: SCDHEC 2004

3.2.2 Wetlands

Estimates of the extent of potential regulated wetlands and other waters of the U.S. along the existing VCSNS-Flat Creek and VCSNS-Varnville transmission corridors was developed from available U.S. Department of Agriculture (USDA) county soil surveys, U.S. Fish and Wildlife National Wetland Inventory (NWI) maps, and U.S. Geological Survey (USGS) topographic maps. In addition, a wetland field delineation was conducted along the 2.44 miles of the proposed new corridors adjacent to existing maintained transmission ROW (Figure 3-3).

The interpretation of the USDA county soil survey and USFWS NWI wetlands data offer an estimate of the location and extent of jurisdictional wetlands within the existing VCSNS-Flat Creek and VCSNS-Varnville transmission corridors. They include wetlands that may appear isolated and thus outside of the USACE's jurisdiction. No attempt was made to distinguish regulated wetlands from non-regulated wetlands. The presence of stream channels was primarily based on USGS National Hydrography Dataset. This data source is generally reliable in determining the existence of large perennial streams, but does not accurately depict the presence of smaller perennial and intermittent streams. This evaluation represents a reasonable approximation of the boundaries of potential wetlands and other waters of the U.S. The information here offers an approximation of wetlands and other waters of the U.S., which are subject to change following a full delineation and verification by the USACE, Charleston District.

Wetland areas in the Piedmont Physiographic Province are likely to be found in topographic valleys adjacent to perennial streams or in narrow backswamps of larger streams and rivers. They are more limited in size due to the higher topographic relief of the landforms found in this area. Specifically, the Southern Outer Piedmont is composed of irregular plains of gneiss, schist and granite rock types, covered with deep clayey subsoils from the weathered igneous bedrock. The Carolina Slate Belt has mineral-rich metavolcanic and metasedimentary rocks. These rocks are more susceptible to erosion and tend to form slightly lower elevations and wider valleys (Griffith et.al.2002).

LEGEND

- VCSNS - Flat Creek Line
- VCSNS - Varnville Line
- Existing Exclusion Zone
- New Exclusion Zone
- VCSNS - Flat Creek Line New ROW (100ft)
- VCSNS - Varnville Line New ROW (100ft)

Aerial Source: South Carolina DNR (2006 DOQQ)

Drawn By: CGS
Checked By: KMR
Approved By: AWC
Date: July 28, 2008

MACTEC

Figure 3-3: Aerial Photograph of New Right of Way

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Wetland areas in the Coastal Plain Physiographic Province are likely to occur along wide drainageways of meandering streams and rivers with adjacent alluvial swamps and floodplains, and also in shallow depressions of low elevation, flat plains. Landforms are covered typically by fine-loamy and coarse-loamy soils that commonly have high water tables. Some areas, especially depressions and bays have clayey, sandy or organic soils (Griffith et.al.2002).

Wetland habitats occurring on the existing VCSNS-Flat Creek and VCSNS-Varnville transmission lines include Early Successional Wetland, Bottomland Forest and Open Water (rivers, streams, ponds and lakes). Data sources from two federal agencies were used to estimate wetlands. USDA soil surveys were used to define streams, open water and potential wetland habitat types based on soil type. "Whole unit hydric" soil refers to an entire mapping unit being classified as poorly to very poorly drained. This classification is a good indication that wetlands are potentially present. Soil with "hydric inclusions" indicates that the mapping unit is classified as somewhat poorly drained and includes soils that are poorly to very poorly drained. Table 3-6 lists the hydric soil acreages along each corridor. Also listed is the total hydric soil acreage (sum of "whole unit hydric" and "hydric inclusions") for each corridor. Alternatively, on the USFWS National Wetland Inventory (NWI) Land Use/Land Cover Data, wetlands along each corridor generally fall into one of three categories: Forested Wetland, Non-Forested Wetland and Open Water (Cowardin et.al. 1979). The NWI classifies wetland habitat types based on photo-interpretation of aerial and/or satellite imagery.

Table 3-6: Approximate wetland acres based on USDA hydric soil / USFWS NWI data

Analysis		**VCSNS-Flat Creek**		**VCSNS-Varnville**	
		Area	**Percent of Corridor**	**Area**	**Percent of Corridor**
USDA Hydric Soil	*Whole Unit Hydric*	20 Acres	2%	485 Acres	19%
	Hydric Inclusions	45 Acres	5%	593 Acres	23%
	Total Hydric soil	65 Acres	7%	1078 Acres	42%
USFWS NWI Wetlands		17 Acres	2%	238 Acres	9%

Sources: NRCS 2008b and SCDNR 2008c

For the VCSNS-Flat Creek line, the amount of "whole unit hydric" soils (approximately 20 acres) is very similar to the estimated NWI wetlands (approximately 17 acres), each comprising approximately 2% of the corridor. The similar results for the approximate wetland areas along the VCSNS-Flat Creek corridor is likely attributable to two factors; wetlands in the Piedmont Physiographic Province generally occur only within well defined drainages, and these wetlands primarily support deciduous vegetation, which do not mask wetlands on aerial or satellite imagery, unlike pine woodlands and pine plantations. These two factors allow a more precise photo interpretation estimate by the NWI, within the Piedmont Physiographic Province.

On the contrary, for the VCSNS-Varnville line the whole unit hydric soils estimated by the county soil surveys (approximately 485 acres or 19%) is much greater than the NWI wetland estimate (approximately 238 acres or 9%). This discrepancy is likely attributable to less reliable photo interpretation provided by the NWI. Wetland areas are often underestimated by the NWI in the Coastal Plain Physiographic Province due to the masking effect of evergreen pine woodlands and pine plantations. The VCSNS-Varnville corridor lies largely within the Coastal Plain Physiographic Province where wetlands are more likely to cover a broader area than is typical in the Piedmont Physiographic Province.

Intermittent streams carry a small flow of water through the winter months and during rain events. The limits of these streams are generally confined to defined banks. Perennial streams have a nearly year-round flow, a well-defined channel, and support aquatic organisms. Certain larger perennial streams and rivers are classified as navigable waters of the state. The VCSNS-Flat Creek and VCSNS-Varnville transmission corridors presently cross South Carolina navigable water bodies at an estimated 18 locations. Table 3-7 lists the approximate number of major streams (likely perennial) and the number of streams that qualify as State Navigable Waters that are crossed by the VCSNS-Flat Creek and VCSNS-Varnville transmission lines. With the exception of the proposed new crossing of the Parr Reservoir (Broad River Impoundment), these are all existing crossings.

Table 3-7: Major stream and river crossings along the transmission lines

Analysis	VCSNS-Flat Creek	VCSNS-Varnville	Combined Corridors
Approximate Major Streams	55	85	140
State Navigable Waters	5	13	18

Sources: SCDHEC 2008a

The number of river crossings that may be regulated under Section 10 of the Rivers and Harbors Act (33 U.S.C. 403; 30 Stat. 1151) must be determined by the USACE on an individual basis. However, most large rivers and lakes in the Coastal Plain Physiographic Province and certain rivers and lakes in the Piedmont Physiographic Province fall under the jurisdiction of the Section 10 of the Rivers and Harbors Act. The Catawba River is the only Section 10 navigable water crossed by the VCSNS-Flat Creek line. The Section 10 navigable waters crossed by the VCSNS-Varnville line are the Salkehatchie River, the Edisto River and the North Fork Edisto River.

3.2.3 Surface Water Quality

The South Carolina Department of Health and Environmental Control (SCDHEC) has developed regulations to protect the water quality of the State for several measured parameters (SCDHEC 2001b). These regulations are employed with the intent of maintaining and improving surface waters to provide for the survival and proliferation of a balanced aquatic community, and to provide for recreation in and on the water. Under the Clean Water Act, SCDHEC has been delegated certain water quality monitoring duties which include regulatory monitoring, water quality assessment, and program evaluation. Parameters monitored include pH, temperature, dissolved oxygen (DO), 5-day biochemical oxygen demand (BOD_5), turbidity, fecal coliform bacteria, total nitrogen, total phosphorus, ammonia and seven metals. SCDHEC's "Water Classifications and Standards" establish the State's water quality criteria for the protection of human health and aquatic life (SCDHEC 2004a). SCDHEC operates a permanent statewide network of primary ambient monitoring stations and flexible, rotating secondary and watershed monitoring stations. Seventeen waterbodies transected by the transmission corridors (5 intersected by the VCSNS-Flat Creek line and 12 intersected by the VCSNS-Varnville

line) were identified as impaired waters for one or more of the parameters listed above (SCDHEC 2008b).

Two counties transected by the VCSNS-Varnville line are regulated as coastal counties under the Coastal Zone Management Act (CZMA). The CZMA is effective for Dorchester and Colleton counties and is administered by the Ocean & Coastal Resource Management (OCRM) program of the SCDHEC. The OCRM is responsible for implementing the Coastal Zone Management Plan to manage wetland alterations, stormwater and land disturbance activities, and certify federal and state permits.

3.2.4 Flood-prone Areas

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FEMA undated), the VCSNS-Flat Creek line crosses 19 areas that are classified as Zone A (no base flood elevation determined), which have a one-percent annual chance of flooding (i.e., within the flood zone of a 100-year flood event). Along many large creeks and rivers, FEMA has also determined the extent of a river's floodway, based on computer modeling and analysis.

The VCSNS-Varnville line crosses 41 areas classified as Zone A or AE (base flood elevation has been determined). Due to the relatively flat terrain in the Coastal Plain, expansive regulatory floodplain areas are common adjacent to large rivers. The VCSNS-Varnville line crosses the following floodplains in the Coastal Plain (the number in parentheses denotes the approximate length of the floodplain that the line crosses):

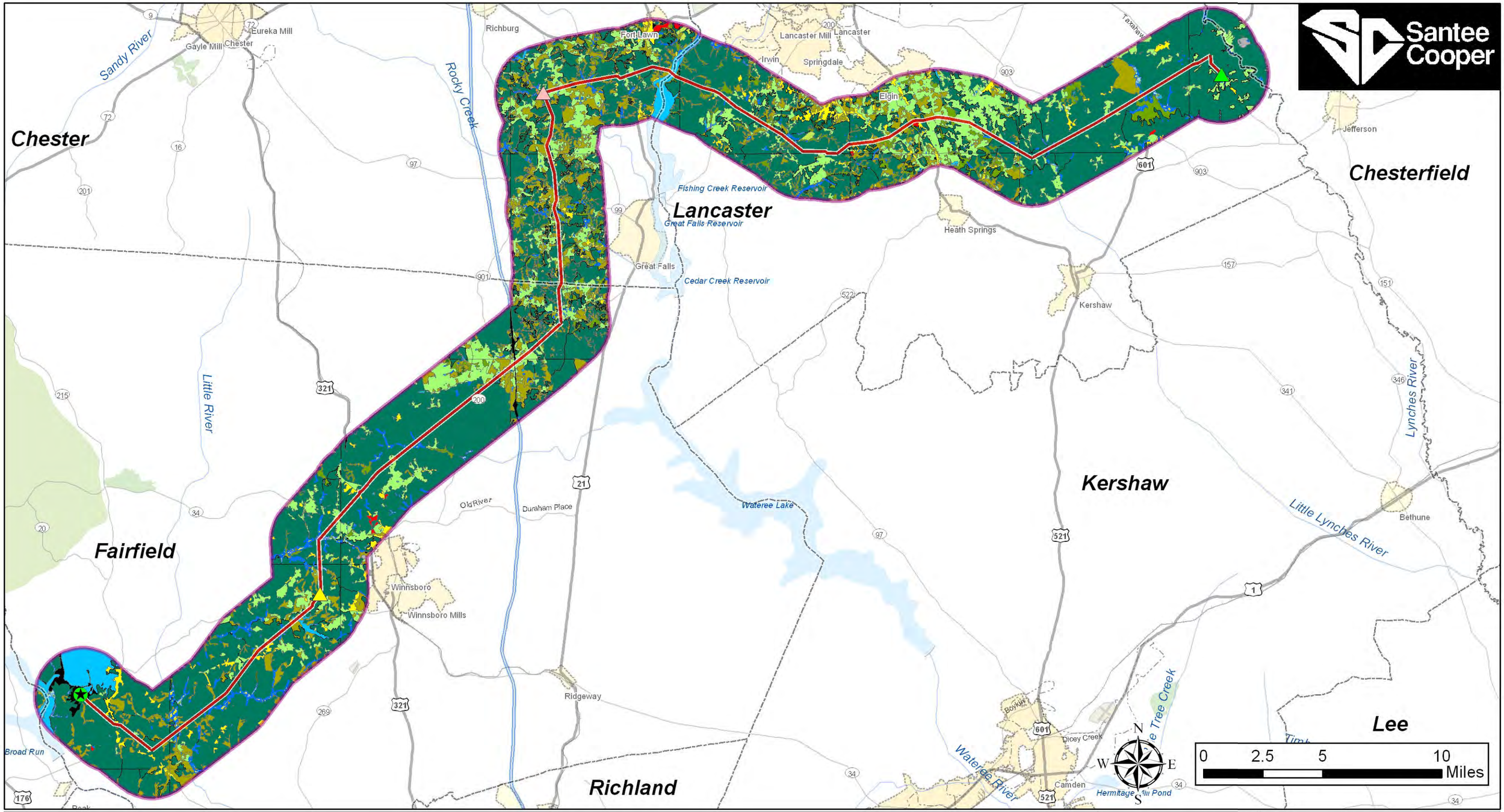
- Salkehatchie River (1.5 miles)
- Little Salkehatchie Rivers (1.5 miles)
- Brickhouse Branch at it's convergence with the Edisto River (2.1 miles)
- Polk Swamp west of St. George (0.25-miles)
- North Fork Edisto River (1.0-mile south of Orangeburg; 0.7-miles northwest of Orangeburg)
- Bull Swamp Creek (0.3 miles)

Extensive floodplains are not common in the Piedmont; however the VCSNS-Varnville line crosses several large rivers, where the regulatory floodplain and floodway are significant. The VCSNS-Varnville line crosses the Saluda River and the Broad River (three crossings), where the regulatory floodplains are estimated to be at least 800 feet wide.

3.3 Land Use

The information in this section summarizes the existing conditions along the corridors as well as the land use adjacent to the corridors. The adjacent land use area described in this section encompasses a two-mile buffer on either side of the transmission corridors. Of the approximate 235 miles of combined lines, approximately 232 miles (98.96%) will be located within existing Santee Cooper maintained rights-of-way (ROW). The existing ROW includes low-growing vegetation, with transmission lines connected to single-pole or H-frame structures lined down the center or down one side of the ROW. The single pole structures range in height from 55 to 80 feet and are typically spaced 400 to 500 feet apart. Average height for the H-frame structures range from 75 to 110 feet tall and are usually spaced 700 to 800 feet apart. Land cover along the existing corridors, associated with the utility (ROW) land use, is provided in Section 3.4.

The properties adjacent to the existing transmission line ROWs include a variety of land uses, a majority of which is classified as undeveloped woodlands. Table 3-8 provides the total distance of each line associated with the corresponding adjacent land use. The land cover classifications listed in Tables 3-8 and 3-9, and depicted in Figures 3-4 and 3-5, were gathered during the GAP Analysis project, administered by the U.S. Geological Survey, Biological Resources Division, from Landsat TM imagery dating from 1991 to 1993, which produced a total of 27 land cover categories. The GAP Analysis land use data was collected from the South Carolina Department of Natural Resources website (SCDNR 2008c).



LEGEND

- VCSNS Substation
- Flat Creek Substation (Terminus of VCSNS - Flat Creek Line)
- Richburg Substation
- Winnsboro Substation
- VCSNS - Flat Creek Line
- 2 Mile Buffer
- County Boundary

LAND USE/LAND COVER - Source: South Carolina DNR (1989 & 1994)

- TRANSPORTATION/UTILITIES
- URBAN/ COMMERCIAL/INDUSTRIAL
- RESIDENTIAL
- MINES/QUARRIES/PITS
- CROPLAND/PASTURE
- TRANSITIONAL AREAS
- HERBACEOUS/SHRUB-BRUSH RANGELAND
- ORCHARD/GROVE/VINEYARD
- DECIDUOUS UPLAND FOREST
- MIXED UPLAND FOREST
- EVERGREEN UPLAND FOREST
- UPLAND PLANTED PINE
- FORESTED WETLAND
- NON-FORESTED WETLAND
- OPEN WATER

Created by: CGS
Checked by: KMR
Approved by: AWC
Date: July 28, 2008

MACTEC

Figure 3-4: Land Use/Land Cover VCSNS - Flat Creek (71.71 miles)

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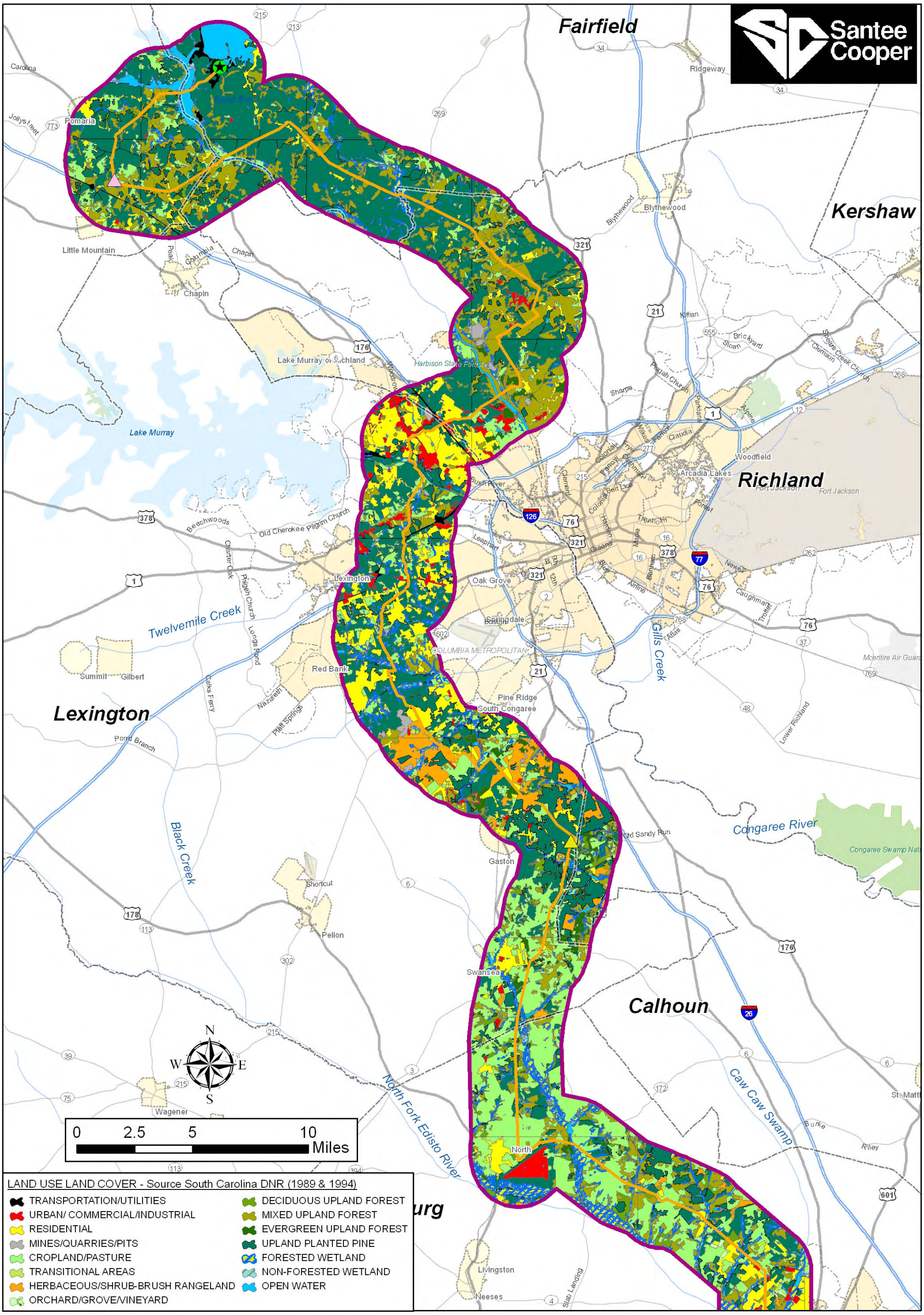

LEGEND

- VCSNS Substation
- Varnville Substation (Terminus of VCSNS - Varnville Line)
- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation
- VCSNS - Varnville Line
- 2 Mile Buffer
- County Boundary

Created by: CGS
Checked by: KMR
Approved by: AWC
Date: July 28, 2008

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Figure 3-5: Land Use/Land Cover
VCSNS - Varnville (163.04 miles)
Sheet 1

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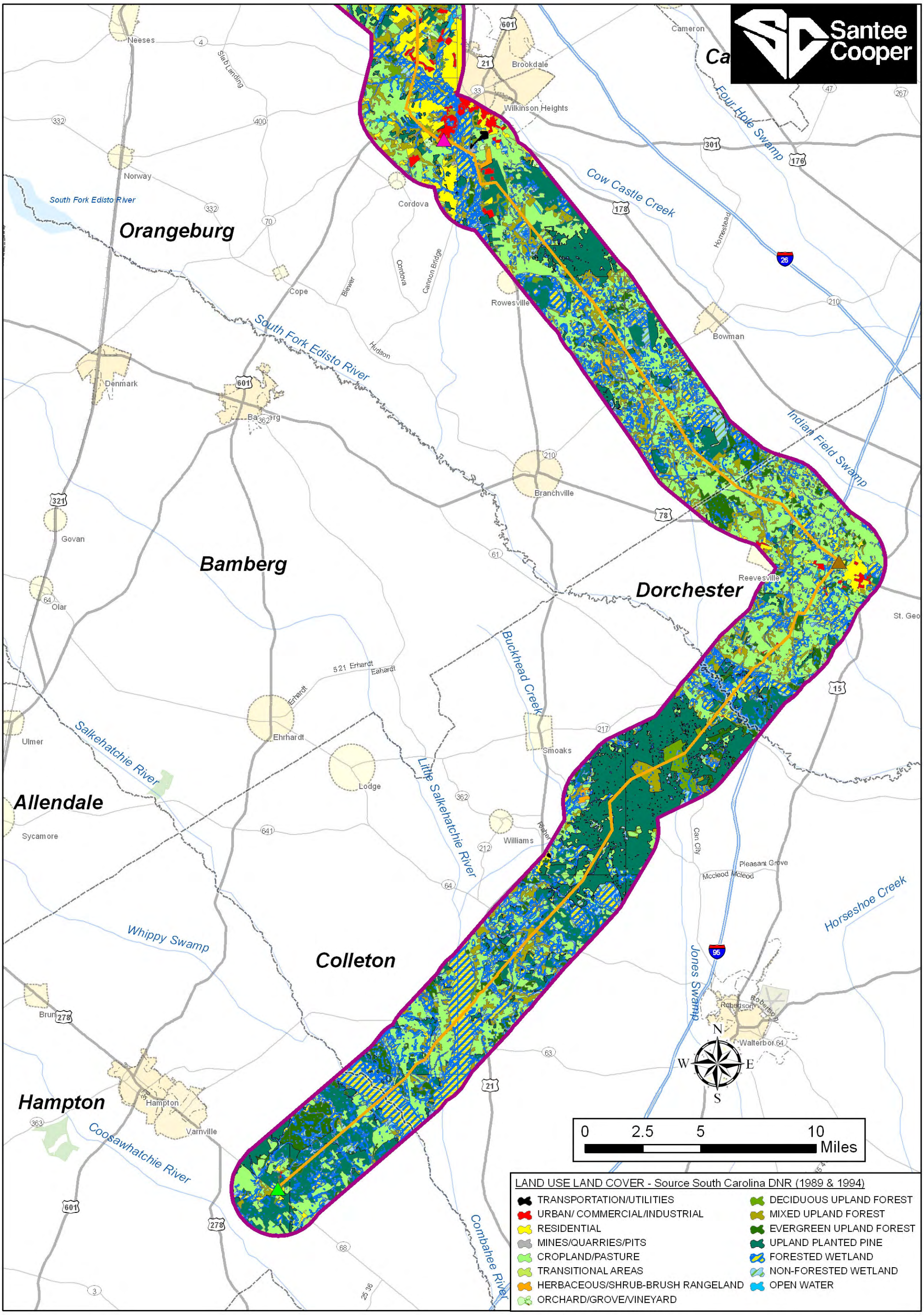

LEGEND

- VCSNS Substation
- Varnville Substation (Terminus of VCSNS - Varnville Line)
- Orangeburg Substation
- Pomaria Substation
- Sandy Run Substation
- St. George Substation
- VCSNS - Varnville Line
- 2 Mile Buffer
- County Boundary

Created by: CGS
Checked by: KMR
Approved by: AWC
Date: July 28, 2008

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Figure 3-5: Land Use/Land Cover
VCSNS - Varnville (163.04 miles)
Sheet 2

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Table 3-8: Land use classifications for property adjacent to existing corridors

Land Use Adjacent to Corridors	Distance	Percent of Each Corridor
VCSNS-Flat Creek		
Commercial Services	0.2 miles	0.2%
Cropland/Pasture	7.5 miles	10.5%
Industrial	0.3 miles	0.4%
Open Water	0.8 miles	1.1%
Residential	0.4 miles	0.5%
Transportation/Utilities	0.2 miles	0.3%
Undeveloped Woodlands	61.9 miles	86.3%
Wetland	0.5 miles	0.7%
VCSNS-Varnville		
Commercial Services	1.3 miles	0.8%
Cropland/Pasture	40.5 miles	24.8%
Industrial	0.6 miles	0.4%
Open Water	1.1 miles	0.7%
Other Urban	0.1 miles	0.1%
Residential	5.3 miles	3.2%
Transportation/Utilities	0.8 miles	0.5%
Undeveloped Woodlands	97.5 miles	59.8%
Wetland	15.8 miles	9.7%

Source: SCDNR 2008c

The remaining 2.44 miles (0.92 miles and 1.52 miles on the VCSNS-Flat Creek and VCSNS-Varnville lines, respectively) of the proposed transmission lines will require some clearing of a 100-foot wide area adjacent to existing maintained ROWs. These new sections of ROW are the initial portions of the transmission lines as they exit the VCSNS (Figure 3-3). The 2.44 miles of new ROW consist of wetlands, open water, existing transportation/utility areas (where no new clearing will take place) and approximately 23 acres of undeveloped woodlands that will require clearing for the new line and associated structures. These new ROW sections currently consist of the land use described in Table 3-9.

Table 3-9: Current land use of proposed new ROW

Land Use in New ROW	Distance	Land Area
VCSNS-Flat Creek		
Transportation/Utilities	0.04 miles	0.5 acres
Undeveloped Woodlands	0.88 miles	10.7 acres
VCSNS-Varnville		
Undeveloped Woodlands	0.97 miles	11.7 acres
Wetlands	0.09 miles	1.1 acres
Open Water	0.47 miles	5.6 acres

Source: SCDNR 2008c

The existing transportation network within the study area is composed of interstate systems, federal highways, primary and secondary state highways, and county roads. The corridors cross over a number of Interstate highways, including I-77, I-26, I-20 and I-95 (Figure 1-1). Rural residential development is generally interspersed with agricultural uses along most local roads and at intersections of county and state highways. Commercial, service, and institutional land uses are also typically grouped together at the intersections of county, state, and U.S. highways, and generally concentrated in the urban areas.

3.4 Land Cover / Vegetation

The South Carolina Department of Natural Resources (SCDNR) Land Use/Land Cover Data (from 1989 and 1994, including USFWS NWI data) was used to determine the general land cover types and acreages in the area of the VCSNS-Flat Creek and VCSNS-Varnville transmission lines (Figures 3-4 and 3-5). Detailed descriptions of the land cover types depicted on the Land Use/Land Cover figure are available through the South Carolina Department of Natural Resources (SCDNR 2008c). In this section, detailed descriptions of the vegetation and habitats (land cover) are provided, that more accurately reflect the existing conditions along the VCSNS-Flat Creek and VCSNS-Varnville transmission lines.

A total of approximately 235 miles (98.96%) of the combined VCSNS-Flat Creek and VCSNS-Varnville transmission lines currently consist of maintained transmission right-of-way (ROW). Land-Cover types that occur along the existing corridor are the result of some form of vegetation management by the utility provider or private landowner. The remaining 1.04% (2.44 miles) includes predominantly wooded areas and open water, within a 100-foot wide strip adjacent to existing maintained transmission right-of-way. In accordance with Santee Cooper's Right-of-Way Management Unit Plan (Appendix B), undesirable vegetation growing within transmission rights-of-way is scheduled for maintenance every 2.5 to 3 years using mechanical equipment and/or treated every 3 years using herbicide applications. To a lesser extent, manual re-clearing (i.e. personnel using bush axes, chain saws, etc.) is used to maintain vegetation on an "as needed"

basis. Exceptions to these maintenance regimes include wetland areas along the corridors, which require special equipment and are sprayed with approved herbicides on a 3 to 4-year rotation, and restricted access easements which require manual re-clearing. The main goal of vegetation management is to ensure that undesirable woody vegetation growth does not interfere with power transmission along the ROWs or the ability to inspect and maintain transmission facilities. Tall-growing trees and vines can cause unsafe conditions and negatively affects reliability by growing into or near conductors.

A literature search, map review, aerial image review and the Right-of-Way Management Unit Plan were used to determine the general land cover types existing within and adjacent to the transmission corridors. On-site habitat assessments were also conducted along the 2.44 miles of the proposed new corridor, adjacent to existing maintained ROW. The land cover descriptions presented in this section represent estimations of the existing land cover characteristics based on current literature, NRCS county soil surveys, SCDNR and 2006 aerial photography. General land cover types located along the ROWs are described below.

Early Successional Upland: This class consists of areas along both the VCSNS-Flat Creek and VCSNS-Varnville transmission lines that are maintained in a very early stage of succession through the use of mechanical cutting and/or application of herbicides on a regular basis. They are open xeric to mesic habitats that lack tall woody vegetation and are dominated by perennial grasses, forbs and shrubby vegetation. This land cover type is the most desirable for safe, reliable, cost-effective transmission of electricity because it results in a minimal amount of undesirable trees. Woody seedlings encounter more difficulty in this type of habitat due to a lack of favorable germinating conditions, competition from tall grasses and forbs, and seed predation by wildlife (Nowak 2005).

The Early Successional Upland land cover type is found along the existing transmission corridors, but does not occur in the proposed new ROW. The Early Successional Upland land cover areas along the existing ROWs have been mapped by SCDNR as:

- Deciduous Upland Forest – 99 Acres
- Evergreen Upland Forest – 45 Acres
- Mixed Upland Forest – 583 Acres
- Shrub/Brush Rangeland – 52 Acres
- Upland Planted Pine – 1691 Acres

This would indicate that as much as 2,470 acres of the above habitats are currently being maintained as Early Successional Upland land cover. This total does not include the 2.44 miles (29.6 acres) of forested area along the proposed new ROW and is an approximation, as it is calculated from estimates of the ROW width, which varies throughout the corridors.

Areas in this land cover within the Piedmont Physiographic Province are generally dominated by many of the following grasses and forbs: Johnson grass (*Sorghum halepense*), purpletop (*Tridens flavus*), goosegrass (*Eleusine indica*), broomsedge (*Andropogon virginicus*), split-beard bluestem (*A. ternarius*), bushy bluestem (*A. glomeratus*), little bluestem (*Schizachyrium scoparium*), lovegrass (*Eragrostis spectabilis*), foxtail grass (*Setaria parviflora*), panic grass (*Panicum spp.*), Indiangrass (*Sorghastrum spp.*), plumegrass (*Erianthus contortus*), Virginia wild rye (*Elymus virginicus*), polkweed (*Phytolacca americana*), fireweed (*Erechtites hieracifolia*), goldenrod (*Solidago canadensis*, *S. petiolaris*), ragweed (*Ambrosia artemisiifolia*), bitterweed (*Helenium amarum*), Verbena (*Verbena spp.*), tickweed (*Verbesina occidentalis*), fleabane (*Erigeron canadensis*), false foxglove (*Agalinis fasciculata, A. setacea*), fleabane (*Boltonia spp., Aster patens*), greenbrier (*Smilax rotundifolia, S. bona-nox, S. glauca*) and patches of bare soil.

This land cover type will also include areas dominated by a slightly more advanced stage of successional growth consisting of various woody vines, shrubs and tree saplings. These areas tend to be closer to the ROW edges where vegetation maintenance is less of a safety issue. Common dominant vegetation includes blackberries (*Rubus betulifolius, R. argutus*), trumpet creeper (*Campsis radicans*), wild grapes (*Vitis rotundifolia, V. cinerea*), Virginia creeper (*Parthanosisus quinquefolia*), pepper vine

(*Ampelopsis arborea, A. cordata*), yellow jessimine (*Gelsemium sepervirens*), smooth sumach (*Rhus glabra*), winged sumach (*R. copalinum*), Russian olive (*Eleagnus pungens, E. angustifolia*), Chinese privet (*Ligustrum sinense*), hog plum (*Prunus umbellate*), winged elm (*Ulmus rubra*), loblolly pine (*Pinus taeda*), shortleaf pine (*P. echinata*), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), sycamore (*Platanus oxidentalis*) and others.

Areas in this land cover within the Coastal Plain Physiographic Province may also include many of the following grass and forb dominants: cockspur grass (*Echinochloa walteri*), toothache grass (*Ctenium aromaticum*), sprangle top (*Leptochloa filiformis*), wire grass (*Aristida* stricta), chufa (*Cyperus esculentus*), flat-top goldenrod (*Euthamia minor*), speedwell (*Veronica peregrina*), partridge pea (*Cassia occidentalis*), croton (*Crotalaria spectabilis*), rattlebush (*Sesbania vesicaria*) and others. More advanced successional stages would also include the following dominants: hawthorn (*Crataegus uniflora, C. punctata*), yaupon holly (*Ilex vomitoria*), wax myrtle (*Myrica cerifera*) and tulip tree (*Liriodendron tulipifera*), but less shortleaf pine, Russian olive and bare soil.

<u>*Early Successional Wetland*</u>: This land cover class includes non-tidal streamsides, floodplains adjacent to large streams or major river crossings, depression wetlands/bays, beaver-impounded wetlands that generally contain hydric soils or standing water and support persistent emergent or aquatic vegetation, marsh vegetation, wet meadow, or evergreen or deciduous wetland shrub vegetation.

The Early Successional Wetland land cover type is found along the existing transmission corridors, but does not occur in the proposed new ROW. The Early Successional Wetland areas along the existing transmission corridors have been mapped by SCDNR as:

- Forested Wetland – 101 Acres
- Non-Forested Wetland – 131 Acres
- Open Water – 24 Acres

This would indicate that as much as 256 acres of the above habitats are currently being maintained as Early Successional Wetland land cover. This total does not include the 2.44 miles (29.6 acres) of forested or open water areas along the proposed new ROW and is an approximation, as it is calculated from estimates of the ROW width, which varies throughout the corridors.

Areas in this land cover within the Piedmont Physiographic Province are generally dominated by: cattail (*Typha latifolia*), spike rush (*Eleocharis obtusa*), woolgrass (*Scirpus cyperinus*), knotweed (*Polygonum pensylvanicum, P. lapathifolium*), marsh mallow (*Hibiscus moscheutos*), valley redstem (*Ammannia coccinea*), soft rush (*Juncus effusus*), panic grass (*Panicum spp*), plume grass (*Erianthus gigantius*), mist flower (*Eupatorium coelestinum*), meadow beauty (*Rhexia mariana*), *Lobelia* (*L. elongata*), camphorweed (*Pluchea camphorate*), coneflower (*Rudbeckia laciniata*), Aster (*Aster pilosus, A. lateriflorus*), violet (*Viola bicolor*), cocklebur (*Xanthium strumarium*), dodder (*Cuscuta gronovii*), giant ragweed (*Ambrosia trifida*), sedge (*Carex ovularis*), rattlebox (*Crotalaria sagittalis*), dock (*Rumex crispus*), seedbox (*Ludwigia decurrens, L. palustris, L. alternafolia*), Vietnam grass (*Microstegium vimineum*), water plantain (*Alisma subcordatum*) and others.

This land cover type includes areas reaching a slightly more advanced stage of successional growth dominated by various woody vines, shrubs and tree saplings. These areas tend to be in the wetter areas that are difficult to access, stream buffers that may be intentionally avoided, and areas closer to the ROW edges where tall vegetation is less of a safety issue. They include blackberries, trumpet creeper, wild grapes, tag alder (*Alnus serrulata*), black willow (*Salix nigra*), ash (*Fraxinus spp*), red maple, sweetgum, tulip tree, cottonwood (*Populus sp.*) and loblolly pine.

Areas in this land cover within the Coastal Plain Physiographic Province may also be dominated by many of the following species: sedge (*Carex intumescens, C. glaucescens, C. joorii*), sawgrass (*Cladium jamaicense*), poorland flatsedge (*Cyperus compressus*), redrood flatsedge (*C. erythrorhizos*), three-way sedge (*Dulichium arundinaceum*), tall fimbry (*Fimbrystylis* dichotoma), umbrella sedge (*Fuirena squarrosa*),

Chapman's beakrush (*Rhynchospora chapmanii*), Asian coinwort (*Centella asiatica*), tall milkwort (Polygala cymosa), candyroot (*P. lutea*), pitcher plant (*Sarracenia spp.*), yellow-eyed grass (*Xyris ambigua, X. caroliniana*), camphorweed (*Pluchea rosea*), rattlebox (*Crotalaria sagittalis*), dock, colic root (*Aletris aurea*), climbing hempvine (*Mikania scandens*) and others. More advanced successional stages might also include: Carolina willow (*Salix caroliniana*), gallberry (*Ilex glabra*), inkberry (*Ilex coriacea*), fetterbush (*Lyonia lucida*), soap bush (*Clethera alnifolia*) and dwarf huckleberry (*Gaylussacia dumosa*).

Upland Pine-Hardwood Forest: This land cover class is primarily located within the Piedmont Physiographic Province and contains hills and ridges with accompanying swales and bottomland. The swales along the corridor are lower than adjacent ridges but have upland vegetation and non-hydric soils. Small rock outcrops are evident on some portions of the proposed new ROW, with those areas with more topographical relief exhibiting more outcrops.

This land cover class is found along a majority of the proposed 2.44 miles of new 100-foot wide ROW that is adjacent to existing maintained ROW (Figure 3-3). These areas along the new corridor have been mapped by the SCDNR as:

- Mixed Upland Forest – 6 Acres
- Upland Planted Pine – 16 Acres

Approximately 22 acres of the 29.6 acres of uncleared new corridor corresponds to Upland Pine-Hardwood Forest land cover.

The Upland Pine-Hardwood Forest land cover class is dominated mainly by a young stand (c.a. 25 years old) of loblolly pine and some shortleaf pine, with an understory of sweetgum, black cherry, Eastern red cedar, persimmon, Russian olive, and beauty berry, and a herb layer of mostly sparse vegetation including long-leaf spikegrass (*Chasmanthium sessiliflorum*), serecia (*Lespedeza cuneata*), ebony spleenwort (*Asplenium platyneuron*) and patches of blackberry (*Rubus argutus*). A few of the ridges, hills and swales are more mesic with a larger hardwood component to the canopy

including white oak (*Quercus alba*), post oak (*Q. stellata*), blackgum (*Nyssa sylvatica*), shagbark hickory (*Carya sp.*), winged elm, dogwood (*Cornus florida*), hop hornbeam (*Ostrya virginica*) and Southern sugar maple (*Acer barbatum*), as well as the herbs Christmas fern (*Polystuchum acrostichoides*) and wild ginger (*Hexastylis arifolia*).

Bottomland Forest: This land cover class is found along bottomlands adjacent to streams and rivers that are crossed by the proposed new 100-foot wide transmission corridors adjacent to existing maintained ROW (Figure 3-3).

This area along the new corridor has been mapped by SCDNR as:

- Non-Forested Wetland – 1.1 Acres

Approximately 1.1 acres of the 29.6 acres of uncleared new corridor corresponds to Bottomland Forest land cover.

Due to the narrow width of the small streams, the dominant tree and shrub species in the adjacent upland continues across this Bottomland Forest land cover, less post oak, white oak and short leaf pine, but with the addition of a few more species such as; sourwood (*Oxydendron arboreum*), American beech (*Fagus grandifolia*), tulip tree (*Liriodendron tulipifera*) and American holly (*Ilex opaca*).

Vegetation associated with the wetter conditions adjacent to larger streams and the Broad River include black willow, tag alder, sycamore, marsh mallow, American three square (*Scirpus americanus*), woolgrass (*Scirpus cyperinoides*), soft rush, water hemlock (*Sium suave*), river oats, jewelweed (*Impatiens capensis*), Asian day flower (*Murdania sp.*), tearthumb (*Polygonum arifolium*), smartweed (*P. densiflorum*), sedge (*Cyperus pseudovegetus, C. haspan*), vassey grass (*Paspalum urvilei*), pickerel weed (*Pontedaria cordata*), sensitive fern (*Onoclea sensibilis*), false nettle (*Boehmeria cylindrica*) and arrow arum (*Peltandra virginica*).

Cropland/Pasture/Residential: Vegetation in these areas support a wide range of land uses compatible with the existing ROW. This land cover class consists of agricultural

fields, wildlife food plots, pasture land, golf courses and residential lawns. Vegetation in this category is mostly cultivated and includes: agricultural crops such as corn, wheat and soybeans; wildlife crops such as millet, lespedeza and pea; forage grasses such as Bermuda and fescue; turf grasses such as centipede (*Eremochloa spp.*), Zoysiagrass (*Zoysia spp.*), bahiagrass *(Paspalum spp.*) and fescue (*Festuca spp.*); and common weeds like dandelion (*Taraxacum officinale*), sickle pod (*Cassia sp*), crabgrass (*Digitaria spp.*) and Florida betony (*Stachys floridana*).

The Cropland/Pasture/Residential land cover is found along the existing transmission corridors, but is not found within the proposed new ROW. These areas along the existing ROW have been mapped by the USFWS as:

- Cropland/Pasture – 694 Acres
- Residential – 96 Acres

This would indicate that as much as 790 acres of the above habitats are currently being maintained as Cropland/Pasture/Residential land cover. This estimate does not include the 2.44 miles (29.6 acres) of new ROW that is currently forested or over open water.

Urban Development: Vegetation in these areas supports a wide range of land uses compatible with the existing ROW. This land cover class consists of impermeable surfaces, buildings, streets, highways, and high-density residential, commercial or industrial developments. Vegetation in this category is mostly limited to maintained landscaping around buildings.

The Urban Development land cover is found along the existing transmission corridors, but does not occur within the proposed new ROW. These areas along the existing ROW have been mapped by USFWS as:

- Commercial/Services – 26 Acres
- Industrial – 16Acres
- Mines/Quarries/Pits - .01 Acres
- Other Urban – 4 Acres
- Transportation/Utilities – 17 Acres

This would indicate that as much as 63 acres of the above habitats are currently being maintained as Urban Development land cover. This total does not include the 2.44 miles (29.6 acres) of forested or open water areas along the proposed new ROW, and is an approximation as it is calculated from estimates of the ROW width, which varies throughout the corridors.

Open Water: This land cover class occurs within both the existing and the new rights-of-way and includes rivers, lakes, ponds or other areas that are regularly flooded or intermittently exposed. This land cover class is mapped by the USFWS as occupying approximately 25 acres along the entire length of the combined transmission corridors. This acreage is in large part due to the crossing of several larger water bodies including the Parr Reservoir, Broad River, Catawba River, Fishing Creek, Saluda River, North Fork Edisto River, Edisto River and various smaller streams and ponds.

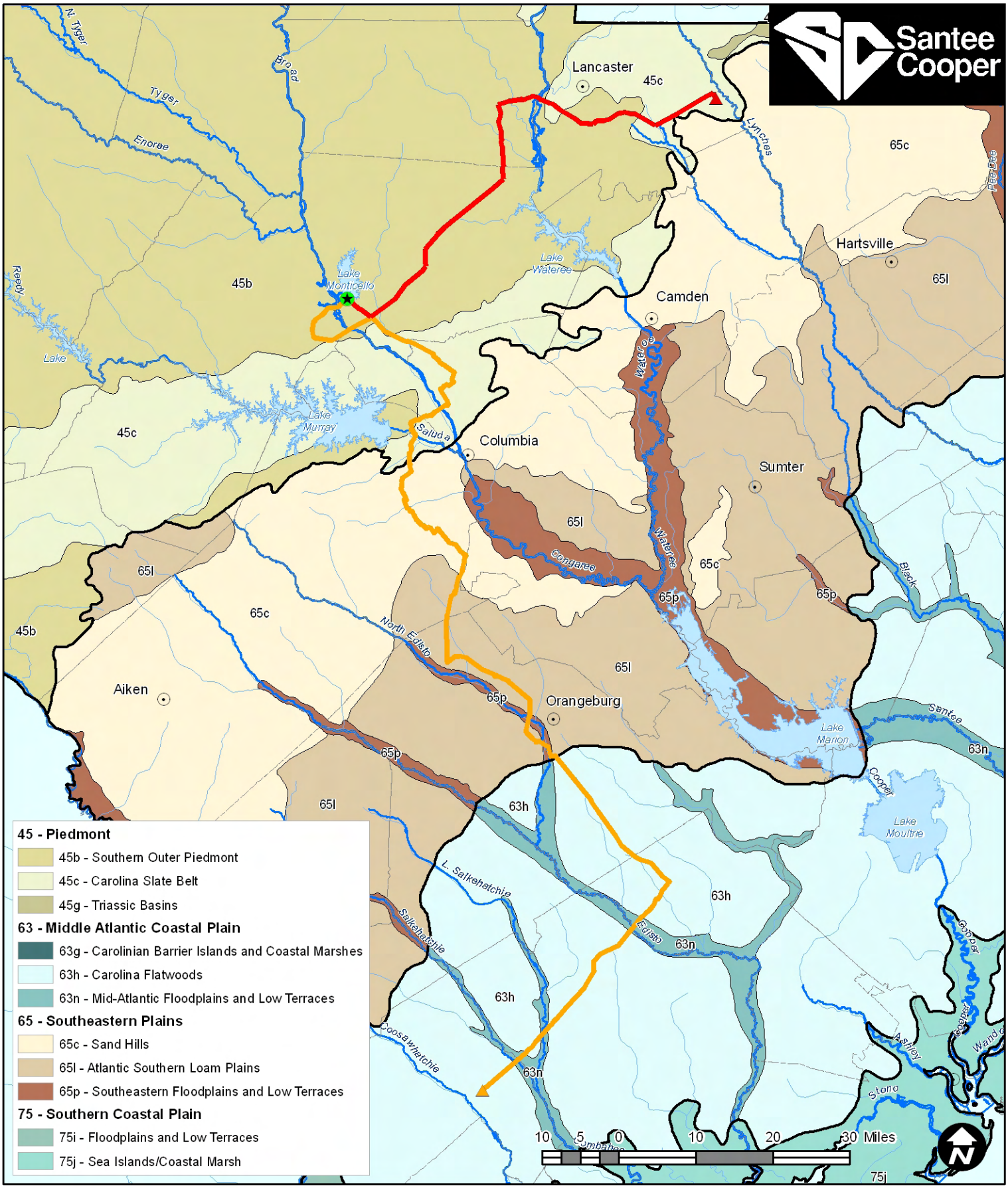
Rock outcrop: Granite domes, large flatrocks or rock outcrops are known to occur within the Piedmont Physiographic Province. The VCSNS-Flat Creek line passes through or near several soil types classified as Rock and through the Forty Acre Rock Heritage Preserve. The existing ROW within the heritage preserve passes approximately 800 feet south of the large granite outcrop, within a topographic valley. Although the analysis of aerial photography revealed no obvious large flatrocks or rock outcrops within the VCSNS-Flat Creek transmission line corridor, the existence of endemic flatrock vegetation within the existing ROW cannot be ruled out. Outcrops are xeric, thin-soiled, open areas of bedrock, where vegetation is restricted to pockets or depressions of thin soil. Species known to occur in this type of habitat include: Eastern red cedar, blueberries, prickly pear cactus (*Opuntia compressa*), pineweed (*Hypericum gentianoides*), granite stonecrop (*Sedum pusillum*), stitchwort (*Minuartia uniflora, M. glabra*), dogtooth violet (*Erythronium americanum*), elf orpine (*Diamorpha smallii*), quillwort (*Isoetes sp.*) and little amphianthus (*Amphianthus plumilus*).

3.5 Wildlife

Wildlife habitats along the existing rights-of-way (ROW) were assessed using Level III Ecoregions (USEPA 2008a) and the South Carolina Department of Natural Resources Land Use data (SCDNR 2008c). Ecoregions identify areas of general ecological similarity, while land cover data identifies specific vegetation composition and structure. The project area traverses the Piedmont, Middle Atlantic Coastal Plain and the Southeastern Plains ecoregions of South Carolina (Figure 3-6). Within the ecoregions, the assessment identified four land cover types, representing diverse wildlife habitats throughout the ROW. Land cover types valued as wildlife habitat include pasture/grasslands, shrublands, marsh/emergent wetlands and cultivated fields.

On-site habitat assessments were conducted along the 2.44 miles of proposed new ROW. These areas are adjacent to existing maintained ROW. This assessment identified upland habitats comprised of pine and mixed mesic hardwood, typical of the Piedmont ecoregion. The bottoms consisted of narrow drainage features that were bed and bank intermittent or perennial creeks. Small rock outcrops occur on some portions of the proposed new ROW.

The habitats identified within the existing ROW can be described as early successional plant communities. These plant communities consist of herbaceous annuals and perennials that are capable of colonizing and occupying areas exposed to full sunlight. These habitats may be created through natural and human disturbances. Some examples of natural disturbances resulting in early successional habitats include, wind events, flooding and fire. Human disturbances are activities which result from vegetation management or manipulation. The habitats in the existing ROW are largely a result of the maintenance of the vegetation within these areas. The Santee Cooper ROW Management Unit Plan includes mechanical vegetation removal, herbicide application and wildlife enhancement programs, such as the POWER (Protect Our Wildlife at Every Right-of-Way) program. Examples of wildlife enhancement activities include cultivation of forage crops to supplement wildlife feeding and management of hedge rows to provide critical cover for nesting, brood rearing and predator protection.



LEGEND

- VCSNS Substation
- Flat Creek Substation (Terminus of Flat Creek Line)
- Varnville Substation (Terminus of Varnville Line)
- VCSNS - Flat Creek Line
- VCSNS - Varnville Line
- Level III Ecoregion
- Level IV Ecoregion
- Population Centers >14,000
- County Boundary

Ecoregion Source: Griffith, G.E, Omernik, J.A et al. (2002)

Drawn By: CGS
Checked By: KMR
Approved By: AWC
Date: July 24, 2008

MACTEC

Figure 3-6: Ecoregions of South Carolina

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The variety of wildlife habitats maintained and managed in the existing ROW support an abundance of game and non-game species (King and Byers, 2002; Lanham and Simmons 2002; Thomas 2002; Yahner et al. 2002). This includes species designated as priority species by the South Carolina Department of Natural Resources (SCDNR) and those considered important by the Nuclear Regulatory Commission (NRC).

The SCDNR identified species having the greatest conservation concern across the state and developed conservation strategies including habitat protection and management (SCDNR 2008). The South Carolina Comprehensive Wildlife Conservation Strategy (CWCS) also established a list of priority species to focus conservation efforts. Priority listed species benefiting from early successional shrubland habitats created in transmission ROW's include Indigo bunting (*Passerina cyanea*), Eastern kingbird (*Tyrannus tyrannus*), Common yellowthroat (*Geothlypis trichas*) and Rufous-sided towhee (*Pipilo erythrophthalmus*), meadow vole (*Microtus pennsylvanicus*), star-nosed mole (*Condylura cristata*), canebrake rattlesnake (*Crotalus horridus*), snapping turtle (*Chelydra serpentina*) and tiger salamander (*Ambystoma tigrinum*). Although the CWCS does not address insect taxa, Lanham and Nichols (2002) documented 101 butterfly and skipper species using utility ROW's in South Carolina's Piedmont.

As indicated in the COLA, the NRC's designation of important wildlife species includes many game species because of their commercial and recreational value. Vegetation management and cultivation of lands within ROW's provide forage and cover for game species including whitetail deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallopavo*), bobwhite quail (*Colinus virginianus*), gray squirrel (*Sciurus carolinensis*), Eastern cottontail (*Sylvilagus floridanus*) and mourning dove (*Zenaidura macroura*).

Open water/wetland habitats provided at Parr Reservoir are designated waterfowl management areas by SCDNR. This designation places limitations on waterfowl hunting in the area. Migratory species such as mallard (*Anas platyrhynchos*), wood duck (*Aix sponsa*) and American coot (*Fulica americana*) use the area as wintering grounds (Jerman 2000). A non-migratory population of Canada geese (*Branta canadensis*) has also been established at Parr Reservoir (COLA 2008).

In addition to existing habitats, many avian species benefit from the presence of structures associated with transmission corridor ROWs, including transmission lines, distribution poles and towers (APLIC 1996). Osprey (*Pandion haliaetus*) commonly nest on power line structures throughout the coastal plain of South Carolina. Transmission lines provide perching sites for many avian species including American kestrel (*Falco sparverius*), loggerhead shrike (*Lanius ludovicianus*) hawks (*Accipiter spp.*, *Buteo spp.*) turkey vulture (*Cathartes aura*), bald eagle (*Haliaeetus leucocephalus*), crows (*Corvus spp.*) and common grackle (*Quiscalus quiscula*). Perching sites are necessary for foraging, hunting, predator protection and communal roosting.

3.6 Endangered, Threatened and Candidate Species

Plants and animals listed as federally threatened and endangered are protected under the Endangered Species Act (P.L. 92-205) (ESA), which is administered and enforced by the United States Fish and Wildlife Service (USFWS). Consultation between the action agency and the USFWS is required under section 7 of the ESA (16 USC 1531-1534) for proposed projects that “may affect” federally endangered and threatened species and/or if the project requires a permit, authorization, or license from the federal government. Candidate species are those species that the USFWS has sufficient information regarding biological vulnerability and threat(s) to support a proposal to list as endangered or threatened, but are not yet legally protected. Although the bald eagle has been removed from the endangered species list, it remains federally protected under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act (MBTA).

A current list of federally endangered, threatened and candidate species for each county the corridors transect was compiled from the USFWS Charleston Field Office website on July 14, 2008 (USFWS 2008) and the South Carolina Department of Natural Resources (SCDNR) Natural Heritage Program website (SCDNR 2008a). The list from the USFWS was last updated in March 2008 and the list from the SCDNR was last updated on January 17, 2006. This list was reviewed by a qualified biologist in order to eliminate listed species that would not be found within existing maintained rights-of-way based on

habitat requirements and occasional human disturbance. The results of this review are provided in Table 3-10. The South Carolina Rare and Endangered Species Inventory website, a Geographic Information System natural resources data layer that includes the locations of all documented occurrences of federally endangered, threatened and candidate species, was also reviewed for known occurrences of such species proximate to the transmission lines.

Table 3-10: Federally endangered, threatened and candidate species potentially in the study area

Common Name	Scientific Name	Status	General Habitat Type
Bald eagle	*Haliaeetus leucocephalus*	BGEPA	coastlines, rivers, large lakes or streams
Red-cockaded woodpecker	*Picoides borealis*	E	mature pine forests
Wood stork	*Mycteria americana*	E	feed in fresh and brackish wetlands; nest in cypress or other wooded swamps
Shortnose sturgeon	*Acipenser brevirostrum*	E	most major river systems along the eastern seaboard
Frosted* flatwoods salamander	*Ambystoma cingulatum*	T, PCH	open mesic pine/ wiregrass flatwoods dominated by longleaf pine, fire maintained; isolated, shallow, small depressions for breeding
Carolina heelsplitter	*Lasmigona decorata*	E, CH	cool, slow-moving, small to medium sized streams and rivers; mud, muddy sand, or muddy gravel substrates along stable, well shaded stream banks
Pondberry	*Lindera melissifolia*	E	swamp and pond margins, sandy sinks, swampy depressions, wet flats
Canby's dropwort	*Oxypolis canbyi*	E	pond-cypress savannahs dominated by grasses, sedges or ditches next to bays; borders and shallows of cypress-pond pine ponds and sloughs
Smooth coneflower	*Echinacea laevigata*	E	prairie remnants, open woods, cedar barrens, roadsides, clearcuts, dry limestone bluffs, power line ROW's, usually on magnesium and calcium rich soils
Schweinitz's sunflower	*Helianthus schweinitzii*	E	prairie and glade remnants, clearings and edges of upland woods on clayey soils with high gravel content
Rough-leaved loosestrife	*Lysimachia asperulaefolia*	E	sandhills in ecotones or edges between longleaf pine uplands and pond pine pocosins; moist to seasonally saturated sands; on shallow organic soils overlaying sand
Black spored quillwort	*Isoetes melanospora*	E	rock-rimmed shallow pools on granite outcrops
Little amphianthus	*Amphianthus pusillus*	T	vernal pools on large isolated granite domes or gently rolling granite outcrops

Common Name	Scientific Name	Status	General Habitat Type
Georgia aster	*Symphyotrichum georgianum*	C	prairie remnants, road ROW's, utility ROW's, other openings
Bog asphodel	*Narthecium americanum*	C	savannahs, usually with water moving through substrate; sandy bogs along streams and rivers

Source: USFWS 2008 and SCDNR 2008a

E Federally endangered
T Federally threatened
P Proposed in the Federal Register
CH Critical Habitat
BGEPA Federally protected under the Bald and Golden Eagle Protection Act
C Candidate: the USFWS has on file sufficient information on biological vulnerability and threat(s) to support proposals to list these species; however, they are not legally protected at this time.

In addition to the literature search conducted along the length of the corridors, a threatened and endangered species survey was conducted along the 2.44 miles of new ROW to determine the occurrence of, or potential for, federally listed endangered or threatened species to exist within this area. Completion of this survey complies with current state and federal regulations [Federal Endangered Species Act of 1973 (16 USC 1531-1543) and the South Carolina Non-Game and Endangered Species Conservation Act of 1974 (58-2384)].

The South Carolina Heritage Trust Program Rare and Endangered Species Inventory (Inventory) digital database was compared to the study area for the VCSNS-Flat Creek and VCSNS-Varnville lines and found no documented occurrences of federally endangered, threatened or candidate species within the ROW (SCDNR 2008a). A complete pedestrian survey to search for federally protected species and/or their preferred habitats was not conducted on the entire study area. However, an on-site pedestrian survey was conducted for the 2.44 mile combined segments of the proposed new ROW, near the VCSNS, which is primarily forested and directly adjacent to a presently cleared, maintained ROW. The new portions of the two transmission lines were traversed on foot on July 15 -17, 2008 to determine if suitable habitat exists for federally protected species. The 2.44 mile segments occur within Fairfield and Newberry counties. The USFWS lists the bald eagle as the only federally protected species known to occur in Fairfield and/or Newberry counties. However, the Carolina heelsplitter is listed as a possible species due to critical habitat in these counties and Georgia aster, a candidate species, is known to occur in these counties. The SCDNR was contacted via

email on July 11, 2008 to determine if any additional information regarding protected species was available for the USGS Jenkinsville South Carolina Quadrangle map, which encompasses the 2.44 mile area. Ms. Julie Holling, Data Manager, SCDNR responded on July 15, 2008 via email that "no additional information has been reported" for this area.

The following are brief descriptions of the species listed in Table 3-10.

Bald Eagle: A bald eagle nest is known to occur upstream from the VCSNS-Varnville line in the Broad River drainage (SCDNR 2008). The bald eagle was listed as endangered on March 11, 1967 (USFWS 1967). The species was reclassified from endangered to threatened throughout the lower 48 states on July 12, 1995 (USFWS 1995a). It was proposed to be removed from the federal endangered species list on July 6, 1999 (USFWS 1999). On July 9, 2007, the bald eagle was removed from the endangered species list (USFWS 2007a). However, the bald eagle remains federally protected under the BGEPA and MBTA.

The bald eagle, with a wingspread of about seven feet, is mainly dark brown and adults have a pure white head and tail. The bald eagle feeds primarily on fish, but also takes a variety of birds, mammals and turtles when fish are not readily available (USFWS 1992a). It nests in large, sturdy trees typically near large open water bodies. Many nests are used annually. It has been documented that egg laying for the bald eagle peaks in late December in the South (Murphy 2008). The nesting season in the Southeast extends from October to May 15 (USFWS 1987a).

Based on review of the SCDNR Heritage Trust Database (SCDNR 2008a), no bald eagle nests are known to occur within one mile of either of the transmission corridors. The on-site survey of the 2.44 miles of proposed new ROW revealed no large trees with open canopies suitable for nesting.

Red-Cockaded Woodpecker (RCW): The U.S. Department of the Interior identified the RCW as a rare and endangered species in 1968 (USDOI 1968). In 1970, the RCW was officially listed as endangered (USFWS 2003). With passage of the ESA in 1973, the RCW received the protection afforded listed species under the ESA. The endangered status of the RCW primarily is due to four environmental factors that have been shown to limit its numbers: (1) hardwood encroachment; (2) a shortage of suitable cavity trees; (3) loss and fragmentation of habitat, and (4) demographic isolation (Conner and Rudolph 1991, Walters 1991, Rudolph and Conner 1994).

The RCW is endemic to pine forests of the southeast (Ligon 1970). RCWs are territorial, non-migratory, cooperative breeders (Lennartz et al. 1987). RCWs are unique in that they excavate cavities for roosting and nesting in living pines (USFWS 2003) and use living pines almost exclusively for foraging substrate, preferring longleaf pine when available (Walters 1991). RCWs require open pine woodlands and savannahs with large old pines for nesting and roosting habitat (i.e., cavity trees). Cavity trees must be in open pine stands with little or no hardwood midstory and few or no overstory hardwoods. Hardwood encroachment resulting from fire suppression is a well-known cause of cluster abandonment. RCWs also require abundant foraging habitat. Suitable foraging habitat consists of mature pines with an open canopy, low densities of small pines, little or no hardwood or pine midstory, few or no overstory hardwoods, and abundant native bunchgrass and forb groundcovers (USFWS 2003). For purposes of surveying, suitable nesting habitat consists of pine, pine/hardwood, and hardwood/pine stands that contain pines 60 years in age or older and that are within 0.5 mile of suitable foraging habitat. For the purposes of surveying, suitable foraging habitat consists of a pine or pine/hardwood stand in which 50 percent or more of the dominant trees are pines and the dominant pine trees are generally 30 years in age or older (USFWS 2003).

Wood Stork: The wood stork is known to occur in several counties transected by the transmission lines. The wood stork is a large wading bird characterized by its featherless head and black and white markings. This species nests in colonies known as rookeries and roosts and feeds in flocks, often in association with other species of

long-legged water birds. Wood storks utilize freshwater and estuarine wetlands for feeding, nesting and roosting. These sites are utilized for many years and are characterized by woody vegetation, primarily cypress or swamp hummocks over open water (USFWS 1997a).

A limited number of nesting sites (rookeries) are known in South Carolina, none of which are near the transmission lines. However, because this species covers vast areas during active foraging, it may occur over a broad region. Wood storks commonly feed throughout the estuarine marshes along the coast and are frequently observed in the surrounding counties during the summer months. Estuarine marshes and impoundments tend to be preferred foraging habitat; however, this species will also use open mature forested wetlands.

Shortnose Sturgeon: The shortnose sturgeon is known to occur downstream from the VCSNS-Varnville line in the North Fork of the Edisto River (SCDNR 2008a). The shortnose sturgeon shares the same general external morphology of all sturgeon (NOAA 2006). Its unique mouth, protractible, subterminal, with barbells, is well suited for bottom feeding and a benthic existence. The shortnose sturgeon is the smallest of the three sturgeon species that occur in eastern North America, having a maximum known total length of 143 cm and weight of 23 kg (NOAA 2006).

The shortnose sturgeon was often taken incidentally in the commercial fishery for Atlantic sturgeon. In the 1950s, sturgeon fisheries declined on the east coast. This led the USFWS to conclude that the fish had been eliminated from the rivers in its historic range (except the Hudson River) and was in danger of extinction. The USFWS believed the population level of the shortnose sturgeon had declined because of pollution and over fishing, both directly and incidentally in shad gillnets (NOAA 2006). Shortnose sturgeon initially received federal protection by the USFWS in March, 1967 and under the ESA in 1974.

It is an anadromous fish that spawns in the coastal rivers along the east coast of North America from the St. John River in Canada to the St. Johns River in Florida. It prefers the nearshore marine, estuarine and riverine habitat of large river systems. Shortnose sturgeon do not appear to make long distance offshore migrations (NOAA 2006). They live primarily in the slower moving riverine waters for much of their life or nearshore marine waters. Periodically they will migrate into faster moving fresh water areas to spawn (NOAA 2006). The shortnose sturgeon requires large rivers unobstructed by dams or in which the dams are situated above their preferred spawning areas (Gilbert 1989).

The threats to the shortnose sturgeon are not clearly known. Construction of dams and pollution of many large northeastern river systems during the period of industrial growth in the late 1800's and early 1900's may have resulted in substantial loss of suitable habitat (NOAA 2006). In addition, habitat alterations from discharges, dredging or disposal of material into rivers, or related development activities involving estuarine/riverine mudflats and marshes remain constant threats.

<u>Flatwoods Salamander:</u> The flatwoods salamander occurs in isolated populations scattered across the lower southeastern Coastal Plain in Florida, Georgia, and South Carolina (USFWS 1999). The species is known to occur in Orangeburg County. The flatwoods salamander was listed as threatened on April 1, 1999 (USFWS 1999b). Critical habitat for the flatwoods salamander was proposed on February 7, 2007 (USFWS 2007c). On August 13, 2008 the USFWS proposed to split the listing of the flatwoods salamander into two species: the frosted flatwoods salamander (*A. cingulatum*) and the reticulated flatwoods salamander (*A. bishopi*) and proposed critical habitat for both species (USFWS 2008b). The frosted flatwoods salamander is the species that occurs in South Carolina.

Adult and sub-adult flatwoods salamanders live in underground burrows and migrate in the fall to breeding ponds. Typical breeding sites are isolated wetland depressions, which dry completely on a cyclic basis, thus eliminating fish species, a potential predator. The breeding ponds are generally dominated by pond cypress (Taxodium ascendens)

and swamp black gum (Nyssa biflora). The groundcover is typically made up of clumps of sedges and grasses and other herbaceous species. Growing season fires through the breeding ponds are thought to improve breeding habitat for this species by maintaining a more open depressional pond. After breeding, adult salamanders leave the ponds and return to the surrounding upland landscape. High quality habitat for the flatwoods salamander includes a number of isolated wetland breeding sites within a landscape of mesic to wet longleaf pine flatwoods having an abundant herbaceous ground cover (USFWS 1999).

Carolina Heelsplitter: The Carolina heelsplitter is known to occur both upstream and downstream of the VCSNS-Flat Creek line in the Flat Creek drainage (SCDNR 2008a) and there is designated critical habitat for the Carolina heelsplitter in this drainage (USFWS 2002a). The Carolina heelsplitter, a freshwater mussel, can reach up to 4.6 inches in length, 1.6 inches in width, and 2.7 inches in height (USFWS undated). Like other freshwater mussels, the Carolina heelsplitter feeds by filtering food particles from the water column. The specific food habits of the species are unknown. The Carolina heelsplitter's life span, the fish host species, and many other aspects of its life history are unknown (USFWS 1997b).

The Carolina heelsplitter was first listed as endangered on June 30, 1993 (USFWS 1993), and critical habitat for the species was designated on July 2, 2002 (USFWS 2002a). The species was historically known from several locations within the Catawba River and Pee Dee River systems in North Carolina and the Saluda and Pee Dee River systems in South Carolina (USFWS 1993, 2002a).

The species was discovered in 1995 in the Savannah River system (USFWS 2002a). There are no known records from the Broad River system although surveys were conducted from 1987-1990 (USFWS 1993). Currently only six populations are presently known to exist (Union County, NC – Waxhaw Creek, Catawba River system; Lancaster County, SC – Gills Creek, Catawba River system; Lancaster, Chesterfield and Kershaw Counties, SC – Flat Creek, Pee Dee River system; Edgefield and McCormick Counties, SC – Mountain Creek, Savannah River system) (USFWS 2002a).

Historically, the species was reported from small to large streams and rivers, usually found in mud, muddy sand, or muddy gravel substrates along stable, well-shaded stream banks. The stability of the stream banks appears to be a habitat feature essential to the species (USFWS 1993). In some areas, the highest concentrations of the Carolina heelsplitter are in (bank) undercuts and along shaded banks stabilized with extensive tree roots, buried logs and rocks (USFWS undated). The best populations are typically found in areas with significant woodland as a dominant land use.

It appears several factors have contributed to the decline and loss of populations of the Carolina heelsplitter, and threaten the remaining populations. These factors include: 1) pollutants in wastewater discharges (sewage treatment plants and industrial discharges); 2) habitat loss and alteration associated with impoundments, channelization, and dredging operations; 3) channel and streambank scouring associated with increased storm-water runoff; and 4) the runoff of silt, fertilizers, pesticides, and other pollutants from various land disturbance activities with inadequate or poorly maintained erosion prevention and stormwater control measures (USFWS undated). Large reaches of the main stems of the Pee Dee, Catawba, Saluda, and upper Savannah Rivers, that likely once supported the Carolina heelsplitter, have been significantly affected by impoundments, as well as the other factors listed above, and have lost much of their historic freshwater mussel abundance and diversity.

<u>Pondberry</u>: Pondberry was listed as endangered on July 31, 1986 (USFWS 1986). Pondberry is a dioecious, deciduous shrub with pale yellow flowers. The fruit is a bright red drupe that matures in the fall. Flowering occurs late in February to mid-March; fruiting occurs from August to early October. The leaves have a strong, sassafras-like odor when crushed (USFWS 1992a). Pondberry is found in shallow depression ponds of the sandhills, along margins of cypress ponds in the pineland coastal areas of South Carolina, and in seasonally wet, low areas among bottomland hardwoods in interior areas.

Canby's dropwort: Canby's dropwort was listed as endangered on February 25, 1991 (USFWS 1991a). It is a perennial herb with erect, hollow stems, aromatic foliage and elongate, stoloniferous rhizomes. It has minute white flowers produced in terminal or axillary umbels; sepals may be tinged red. The fruit is a strongly-winged schizocarp. The species flowers from May through early August and fruits in early fall (USFWS 1991a).

This species occurs in pond cypress savannas, shallows and edges of cypress/pond pine sloughs, and wet pine savannas. The healthiest populations seem to occur in open bays or ponds which are wet most of the year and have little or no canopy cover. Typical sites are characterized by open conditions with savannah-like herbaceous layers. Ideal soils for this species have a medium to high organic content and a high water table, acidic, deep, and poorly drained (Aulbach-Smith 1985). The groundwater table must not be altered in order to maintain this species (USFWS 1991a).

Smooth coneflower: Smooth coneflower was federally listed as endangered on October 8, 1992 (USFWS 1992b). It is a rhizomatous perennial herb in the aster family, which grows to a height of about 1.5 meters, with smooth stems, few leaves and pink to purplish flowers. The species flowers and fruits from late May through October.

The habitat of smooth coneflower consists of "open woods, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line rights-of-way, usually on magnesium- and calcium-rich soils associated with . . . diabase (in North Carolina and South Carolina), and marble (in South Carolina and Georgia)" (USFWS 1995b). Smooth coneflower appears to need bare soil that is rich in magnesium and/or calcium for seedling germination and growth. Some form of disturbance is also essential (USFWS 1995b).

Schweinitz's sunflower: Schweinitz's sunflower was listed as endangered on May 7, 1991 (USFWS 1991b). This species is rhizomatous and has yellow flowers on stems 1 – 2 meters tall. The species flowers and fruits from late August through October. Typical habitat for this species are prairie and glad remnants (especially on utility line and road

ROW's), clearing, and edges of upland woods on clayey soils with a high gravel content (USFWS 1992a).

Rough-leaved loosestrife: Rough-leaved loosestrife was listed as endangered on June 12, 1987 (USFWS 1987b). This perennial herb grows to up to about 6 decimeters and has whorls of 3 – 4 leaves encircling the stem at intervals beneath the showy yellow flowers (USFWS 1992a). Flowering occurs from mid-May through June, with fruits present from July through October (USFWS 1992a). This species typically occurs on the fire-maintained grass-shrub edge between longleaf pine upland and pond pine pocosins (USFWS 1992a).

Black spored quillwort: Black spored quillwort was listed as endangered on February 5, 1988 (USFWS 1988). It is an aquatic plant species that grows up to 7 cm tall. The plant reproduces by spores (Cummings and Yarrow 1996) and can be identified in the field from May through October. This species occurs on large isolated granite domes or gently rolling granite flatrocks (USFWS 1992a). This species is typically found in shallow flat-bottomed pools found on the crest and flatteed slopes of unquarried outcrops. These pools range in size from 0.3 square meter to 10 square meters; retain water for several weeks following heavy rains and completely dry out with summer dry periods (USFWS 1992a).

Little amphianthus: Little amphianthus was listed as endangered on February 5, 1988 (USFWS 1988). It is a small, fibrous-rooted aquatic annual with white flowers and it has both floating and submerged leaves (1992a). Flowering occurs from late March through April. This species, like the black spored quillwort, occurs on large isolated granite domes or gently rolling granite flatrocks (USFWS 1992a). This species is typically found in shallow flat-bottomed pools found on the crest and flatteed slopes of unquarried outcrops. These pools range in size from 0.3 square meter to 10 square meters; retain water for several weeks following heavy rains and completely dry out with summer dry periods (USFWS 1992a).

Georgia Aster: Georgia aster, a candidate species, is not legally protected at this time. It is a relict species of post oak savannah/prairie communities that existed in the southeast prior to widespread fire suppression and extirpation of large native grazing animals (USFWS 2002b). Most remaining populations occur on roadsides, utility ROW's and other openings that mimic natural disturbance. Georgia aster occupies a variety of dry, upland habitats. The primary controlling factor appears to be the availability of light. The species is a good competitor with other early successional species, but tends to decline when shaded by woody species (USFWS 2002b).

Bog asphodel**:** Bog asphodel, a candidate species, is not legally protected at this time. It is known to occur historically in Dorchester County, South Carolina. However, all extant populations are in the Pine Barrens region of New Jersey (USFWS 2007b). The species is found in savannah areas, usually with water moving through the substrate as well as sandy bogs along streams and rivers (USFWS 2007b). This plant is intolerant of full-shade, and is vulnerable to alterations or succession of its habitat (USFWS 2007b). Bog asphodel is a perennial herb that grows 25-40 cm high, has basal leaves, and a dense raceme of small, showy, bright-yellow flowers (USFWS 2007b).

3.7 Cultural Resources

A comprehensive cultural resources literature and records review was conducted by TRC Companies, Inc., in July 2008 for a two kilometer (1.25 mile) radius, as specified by the NRC Environmental Standard Review Plan (USNRC 1999), along the length of the VCSNS-Flat Creek and VCSNS-Varnville transmission line corridors. The purpose of the research was to collect information on previously identified structures and archeological sites within 1.25 miles of the VCSNS-Flat Creek and VCSNS-Varnville transmission line corridors, with special attention to NRHP-listed and -eligible properties within or immediately adjacent to the transmission corridors. Records, maps and cultural resource reports were reviewed at the South Carolina Department of Archives and History (SCDAH) and South Carolina Institute of Archaeology and Anthropology (SCIAA), both located in Columbia, South Carolina. This research, using the SCDAH's Cultural Resources Information System (CRIS) and other resources, revealed that there

are a total of 511 previously recorded cultural resources within a 1.25-mile radius of the transmission corridors. Of this total, 17 sites within the 1.25-mile radius of the transmission lines are listed on the National Register of Historic Places (NRHP), 11 sites have been recommended eligible for the NRHP and 14 sites are potentially eligible for the NRHP. Table 3-11 provides information on the cultural resources that are listed, eligible for listing or have been recommended eligible for listing on the NRHP, in addition to 22 structures that contribute to NRHP eligible Orangeburg Downtown Historic District and two structures that have been determined eligible for the NRHP, but have not been listed due to owner objections (TRC 2008).

Table 3-11: Archaeological sites within 1.25-Mile Radius of the Transmission Line Corridors

Site No.	Description	NRHP Status	Year
VCSNS-Flat Creek Corridor			
Archeological Sites			
38CS0220	Early Archaic to Early Woodland	Potentially Eligible	N/A
Properties			
N/A	Rockton and Rion Railroad	Listed	1945
N/A	Bob Lemmon, House	Listed	1910
N/A	Furman Institution Faculty Residence	Listed	1837
Surveyed Structures			
0616	Unnamed Store	Eligible	ca. 1930
0646	Lancaster Cotton Oil Company	Eligible	ca. 1910
0750	Mungo's Store/Gas Station	Potentially Eligible	ca. 1923
0751	C. B. Mungo House	Potentially Eligible	ca. 1912
0792	John Thomas Mackay House I	Eligible	ca. 1935
0793	John Thomas Mackey House II	Eligible	1847-48
VCSNS-Varnville Corridor			
Archeological Sites			
38CN0076	Late Archaic artifact scatter	Potentially Eligible	N/A
38DR0070	Early Archaic-Mississippian	Potentially Eligible	N/A
38DR0136	Middle and Late Archaic	Potentially Eligible	N/A
38FA0330	19th C. Cemetery, Pearson Monument	Eligible	N/A
8HA0137	Early Archaic / Middle Woodland Village	Potentially Eligible	N/A
38LX0151	Early Woodland lithic / ceramic scatter	Potentially Eligible	N/A
38LX0256	Unknown Prehistoric lithic scatter	Potentially Eligible	N/A
38LX0279	Early-Late Archaic	Potentially Eligible	N/A
38OR0099	19th- 20th C.	Potentially Eligible	N/A
38RD0018	Paleo-Indian –Late Archaic village	Listed	N/A
Properties			
N/A	Appleby's Methodist Church/Cemetery	Listed	1850
N/A	Carroll Place/Koger House and graves	Listed	1820

Site No.	Description	NRHP Status	Year
N/A	Dr. John Glenn, House	Listed	1845
N/A	High Point	Listed	1870
N/A	Mayfair	Listed	1820
N/A	Mount Olive Presbyterian Church	Listed	1869
N/A	The John Jacob Hite Farm	Listed	1870
N/A	79003321 Summer-Huggins House	Listed	1825
N/A	Hope Rosenwald School	Listed	1925-54
N/A	St. John's Lutheran Church	Listed	Unknown
N/A	Pomaria	Listed	1825
N/A	83002204 Cattle Creek Campground	Listed	1900
N/A	Chappell Farm	Listed	1830
Surveyed Structures			
0183	house, unidentified	Potentially Eligible	ca. 1900
0185	Jacob Culler House	Eligible	ca. 1805
0212	house, unidentified	Potentially Eligible	ca. 1819
0347	Swansea Community House	Eligible	ca. 1939
4893.00	DuBard house	Eligible	ca. 1850
4896	Dr. Lever House	Eligible	ca. 1795
5009	Pine Grove School	Eligible	ca. 1923
360-0075	Unknown	Contributes to Eligible Historic District	ca. 1920
360-0076	Unknown	Contributes to Eligible Historic District	ca. 1895
360-0077	Unknown	Contributes to Eligible Historic District	ca. 1900
360-0078	W.D. Jeffcoat House	Contributes to Eligible Historic District	ca. 1920
360-0079	Unknown	Contributes to Eligible Historic District	ca. 1935
360-0080	North Cash Depository	Contributes to Eligible Historic District	ca. 1910
360-0081	Unknown	Contributes to Eligible Historic District	ca. 1895
360-0082	Argoe House	Contributes to Eligible Historic District	ca. 1925
360-0083	Argoe Building	Contributes to Eligible Historic District	ca. 1940
360-0087	J.H. Hydrick Building	Contributes to Eligible Historic District	ca. 1910
360-0088	J.F. Etheredge House	Contributes to Eligible Historic District	ca. 1935
360-0089	Zeigler Building	Contributes to Eligible Historic District	ca. 1910
360-0090	Whetstone Building	Contributes to Eligible Historic District	ca. 1910
360-0091	Bell Building	Contributes to Eligible Historic District	ca. 1940
360-0092	F.L. Witt Building	Contributes to Eligible Historic District	ca. 1910
360-0093	Unknown	Contributes to Eligible Historic District	ca. 1910
360-0094	Unknown	Contributes to Eligible Historic District	ca. 1905
360-0095	Unknown	Contributes to Eligible Historic District	ca. 1905
360-0096	Unknown	Contributes to Eligible Historic District	ca. 1910
360-0097	Unknown	Contributes to Eligible Historic District	ca. 1949
360-0098	Johnson Building	Contributes to Eligible Historic District	ca. 1923
360-0099	Unknown	Contributes to Eligible Historic District	ca. 1950
440 0935	Badham House	Eligible	ca. 1912
440 0936	Davis Boarding House	Potentially Eligible	ca. 1910
19990064	Leaphart-Harman House	Determined Eligible/Owner Objection	Late 18th century
19990066	Samuel T. Lorick House	Determined Eligible/Owner Objection	ca. 1830

Source: TRC 2008. N/A – Not Available Ca. – Circa

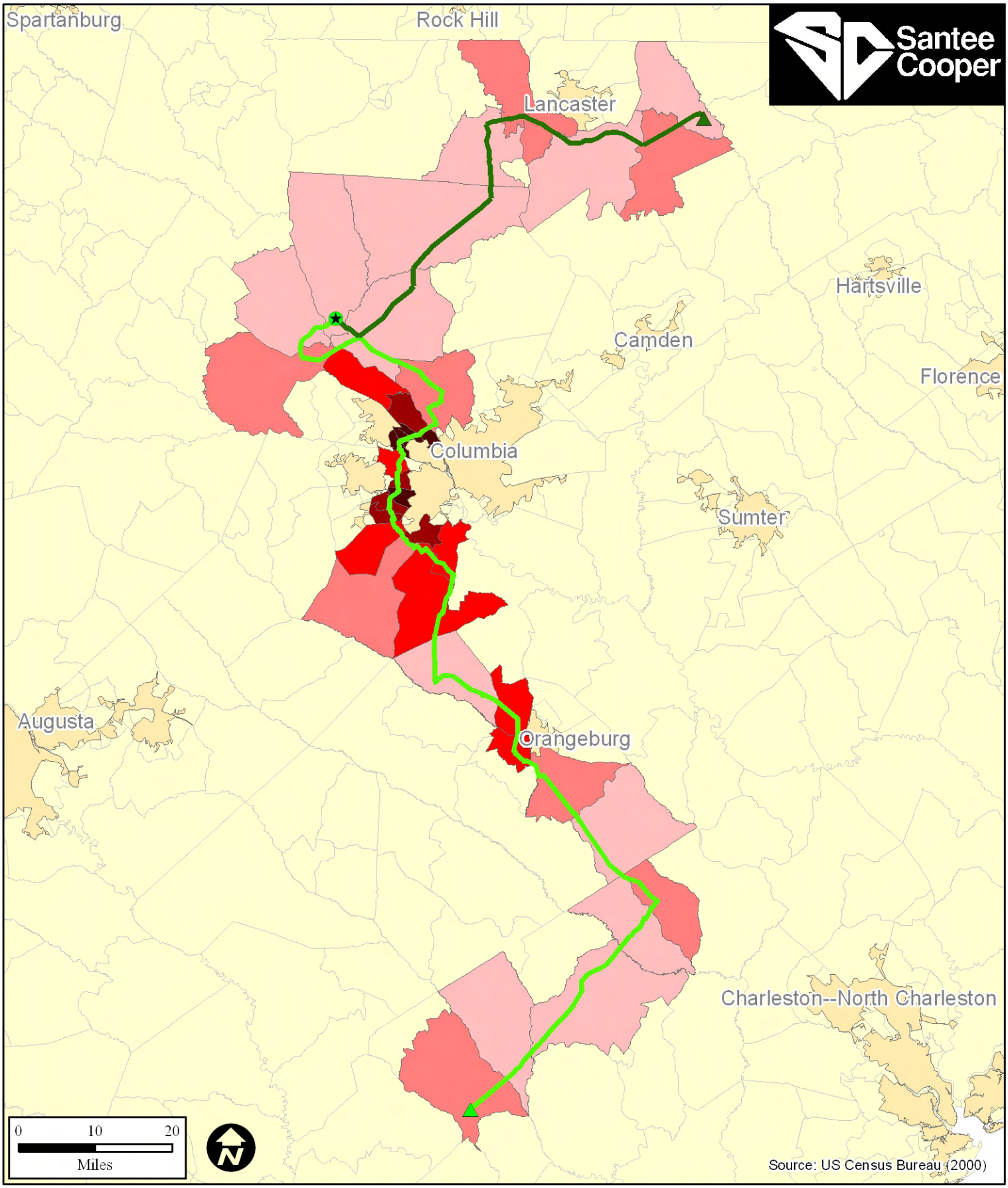
The remainder of the 511 previously recorded cultural resources within the 1.25-mile radius of the VCSNS-Flat Creek and VCSNS-Varnville transmission lines have been recommended ineligible for the NRHP, have not yet been assessed or need additional work to complete the assessment for NRHP eligibility. Specifically, forty-three sites within the 1.25-mile radius of the transmission lines have not yet been assessed or need additional work to complete the assessment for NRHP eligibility (TRC 2008).

Twenty-one of the 511 previously recorded cultural resources within the 1.25-mile radius of the transmission lines are located within 100 feet of the transmission lines. Nineteen of these 21 sites have been recommended ineligible for the NRHP. The remaining two of these 21 sites (Site #38LX0116 and Site #38RD1115, both along the VCSNS-Varnville line) have not yet been assessed for NRHP eligibility (TRC 2008).

3.8 Resident Population

Population density for the census tracts that the transmission corridors traverse were collected from the U.S. Census in year 2000 and are shown in Figure 3-7 and Table 3-12. Fourteen of the 39 census tracts (36%) which the transmission lines transect have a population density of less than 50 persons per square mile. A total of 23 of the 39 census tracts (59%) transected by the transmission lines have a population density of less than 100 persons per square mile. Only three of the counties transected by the corridor have a population higher than the state average of 133 persons per square mile: Dorchester, Lexington and Richland, with population densities of 309, 424 and 168 persons per square mile, respectively. Each of the remaining nine counties transected by the transmission corridors has less than the state average population density (US Census 2000).

The routes of the transmission line corridors were chosen to minimize the number of people potentially impacted by the transmission lines. A vast majority of the length of the proposed transmission lines will be placed within existing transmission line corridors. Only 2.44 miles of new right-of-way (ROW) will be expanded, and there are no residences or buildings identified in the new ROW. These 2.44 miles of new ROW are located in Fairfield and Newberry counties. The population densities in Fairfield and



LEGEND

- VCSNS Substation
- Flat Creek Substation (Terminus of Flat Creek Line)
- Varnville Substation (Terminus of Varnville Line)
- VCSNS - Flat Creek Line
- VCSNS - Varnville Line

Population Density (Persons/Square Mile)

- 0 - 50
- 50 - 100
- 100 - 500
- 500 - 1000
- > 1000
- Population Densities Not Included
- Population Centers >14,000

Drawn By: CGS
Checked By: KMR
Approved By: AWC
Date: July 23, 2008

MACTEC

Figure 3-7: Population Density by Census Tract

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Newberry counties are well below the state average of 133 persons per square mile, at 34 and 57 persons per square mile, respectively (US Census 2000).

Table 3-12: Population Density

Location	Total Population	Land Area, square miles	Population Density, Persons / mile^2
VCSNS-Flat Creek Corridor			
Fairfield County	**23,454**	**686.6**	**34.2**
Total Tracts transected by VCSNS-Flat Creek line in Fairfield County	**11,530**	**510.1**	**22.6**
Fairfield County Tract 9601	2,217	151.7	14.6
Fairfield County Tract 9602	4,094	218.9	18.7
Fairfield County Tract 9605	5,219	139.5	37.4
Chester County	**34,068**	**580.5**	**58.7**
Total Tracts Transected by VCSNS-Flat Creek Line in Chester County	**7,434**	**152.4**	**48.8**
Chester County Tract 208	4,941	69.3	71.3
Chester County Tract 209	2,493	83.1	30.0
Lancaster County	**61,351**	**549.0**	**111.8**
Total Tracts Transected by VCSNS-Flat Creek Line in Lancaster County	**18,912**	**345.6**	**54.7**
Lancaster County Tract 101	3,306	75.0	44.1
Lancaster County Tract 102	7,880	97.7	80.7
Lancaster County Tract 103	5,063	142.6	35.5
Lancaster County Tract 104	2,663	30.3	88.0
VCSNS-Varnville Corridor			
Fairfield County	**23,454**	**686.6**	**34.2**
Total Tracts Transected by VCSNS-Varnville Line in Fairfield County	**7,436**	**291.2**	**25.5**
Fairfield County Tract 9601	2,217	151.7	14.6
Fairfield County Tract 9605	5,219	139.5	37.4
Newberry County	**36,108**	**630.8**	**57.2**
Total Tracts Transected by VCSNS-Varnville Line in Newberry County	**12,773**	**256.4**	**49.8**
Newberry County Tract 9501	3,378	115.5	29.3
Newberry County Tract 9506	9,395	140.9	66.7
Richland County	**320,677**	**756.4**	**423.9**
Total Tracts Transected by VCSNS-Varnville Line in Richland County	**31,252**	**133.5**	**234.1**
Richland County Tract 102	5,308	74.46	71.3
Richland County Tract 103.03	10,182	15.95	638.4
Richland County Tract 103.04	6,014	2.98	2018.1
Richland County Tract 103.07	5,015	36.35	138.0
Richland County Tract 104.08	4,733	3.77	1255.4

Location	Total Population	Land Area, square miles	Population Density, Persons / mile^2
Lexington County	**216,014**	**699.3**	**308.9**
Total Tracts Transected by VCSNS-Varnville Line in Lexington County	**78,490**	**312.9**	**250.9**
Lexington County Tract 207.02	5,943	22.01	270.0
Lexington County Tract 207.04	5,847	11.37	514.2
Lexington County Tract 208	13,714	95.85	143.1
Lexington County Tract 209.01	8,365	35.37	236.5
Lexington County Tract 209.02	8,446	107.43	78.6
Lexington County Tract 210.07	3,948	4.51	875.4
Lexington County Tract 210.14	1,933	10.21	189.3
Lexington County Tract 210.16	7,687	5.73	1341.5
Lexington County Tract 210.17	6,261	7.53	831.5
Lexington County Tract 210.18	4,471	6.19	722.3
Lexington County Tract 211.04	6,381	3.94	1619.5
Lexington County Tract 211.05	5,494	2.73	2012.5
Orangeburg County	**91,582**	**1106.2**	**82.8**
Total Tracts Transected by VCSNS-Varnville Line in Orangeburg County	**24,358**	**326.3**	**74.7**
Orangeburg County Tract 105	4,044	121.04	33.4
Orangeburg County Tract 106	5,289	73.48	72.0
Orangeburg County Tract 109	7,193	33.34	215.7
Orangeburg County Tract 115	3,863	17.99	214.7
Orangeburg County Tract 120	3,969	80.43	49.3
Dorchester County	**96,413**	**574.7**	**167.8**
Total Tracts Transected by VCSNS-Varnville Line in Dorchester County	**7,593**	**146.0**	**52.0**
Dorchester County Tract 101	2,531	84.3	30.0
Dorchester County Tract 102	5,062	61.7	82.1
Colleton County	**38,264**	**1056.4**	**36.2**
Total Tracts Transected by VCSNS-Varnville Line in Colleton County	**9,384**	**291.6**	**32.2**
Colleton Tract 9702	1,926	126.4	15.2
Colleton Tract 9704	7,458	165.2	45.2
Hampton County	**21,386**	**559.8**	**38.2**
Total Tracts Transected by VCSNS-Varnville Line in Hampton County	**8,521**	**138.7**	**61.4**
Hampton County Tract 9802	8,521	138.7	61.4

Source: US Census 2000

3.9 Aesthetics and Noise

3.9.1 Aesthetics

A majority (98.96%) of the combined VCSNS-Flat Creek and VCSNS-Varnville transmission lines have been routed within existing maintained transmission line rights-of-way (ROW). These existing ROW are cleared of tall growing woody vegetation and

are generally lined with single pole and/or H-frame structures averaging in height from 55 to 80 feet (Photograph 2, Appendix A).

The remaining 2.44 miles (1.04%) of the combined VCSNS-Flat Creek and VCSNS-Varnville transmission lines will require a new 100-foot wide ROW. Currently, the 2.44 miles of proposed new ROW primarily consists of undeveloped woodlands adjacent to existing maintained ROW. A majority of the undeveloped woodlands is classified as Upland-Pine Hardwood Forest (see Section 3.4). This area contains hills and ridges with accompanying swales and bottomland. The proposed new ROW also contains a small amount of Bottomland Forest and Early Successional Wetland near the Parr Reservoir (Broad River impoundment). In addition to the Broad River, intermittent streams are located within the new ROW. As the 2.44 miles of proposed new ROW is adjacent to existing ROW, the forest has already been somewhat fragmented. The new ROW contains a total of approximately 1.88 miles of forest, approximately 0.09 miles of wetlands and approximately 0.47 miles of open water. Additional details on the land cover within the proposed new ROW can be found in Section 3.4 (Land Cover/Vegetation) of this report. Representative photographs of the 2.44 miles of proposed new transmission corridor are located in Appendix A.

3.9.2 Noise

There are three types of noise potentially produced by transmission lines and their associated structures: corona noise, insulator noise and aeolian noise. Corona noise is typically described as a crackling, hissing or sizzling sound. Corona noise is caused by the electrical discharge brought on by the ionization of air into charged particles, caused by the electrical field at the surface of conductors along a transmission line. When the strength of the electric field exceeds the breakdown strength of the surrounding air, a corona discharge occurs. This electrical discharge produces very small amounts of energy, part of which is in the form of small local pressure changes, which result in audible noise. Corona noise associated with transmission lines is typically 40 to 50 dBA (A-weighted decibel) or less. However, corona noise can be an issue during high moisture conditions (precipitation or very high humidity) for transmission lines greater

than 345 kV, when the crackling or hissing sound can reach 50 to 60 dBA. In addition to these infrequent weather conditions, insects and other contaminants can also be a source of corona noise (Aspen Environmental Group undated).

Insulator noise sounds similar to corona noise, but is caused by dirty, nicked or cracked insulators. Insulator noise is primarily a problem with older ceramic or glass insulators. It is not usually a problem with new transmission lines that have polymer insulators.

Aeolian noise is caused by wind blowing through conductors and/or transmission line structures. This type of noise is usually infrequent and depends on wind velocity and direction. When wind blows steadily, and perpendicular to the lines, it can cause aeolian vibration. This vibration can produce noise when the frequency of the vibration matches the natural frequency of the transmission line. Dampeners are often used to minimize aeolian noise.

According to the U.S. Department of Energy (DOE), the typical corona noise level during rain is 31 dBA directly under a 115 kV transmission line and 29 dBA measured from the edge of a 50 foot ROW. The typical corona noise level during rain is 42 dBA directly under a 230 kV transmission line and 39 dBA at the edge of a 50 foot ROW. For comparison, Table 3-13 provides common sounds and their associated noise levels.

Table 3-13: Noise levels of common sounds

Common Sounds	**Noise Level in dBA**
Normal breathing	10
Rustling leaves	20
Whisper	20-30
Ambient noise in an average home	50
Normal conversation at 3 feet	60-65
Vacuum cleaner	60-82
Freeway traffic at 165 feet	70
Garbage disposal at a distance of 3 feet	80
Rock concert	90-115
Jet flyover at 1,000 feet	110

Source: Aspen Environmental Group undated

3.10 Electromagnetic Fields

Electric and magnetic fields are created everywhere that electricity is generated, transmitted or used. In the United States, electricity is transmitted to users as 60 hertz (Hz) alternating current, which generates electric and magnetic fields with cycle frequencies of 60 Hz. This 60 Hz frequency falls in the 3 Hz to 3000 Hz range, called extremely low frequency (ELF). In addition to man-made electromagnetic fields, such as electricity and other higher frequency field sources such as radio and television antennas and cellular phones, humans are also exposed to very low levels of naturally occurring electromagnetic fields derived from the earth's ambient static field and natural phenomena such as lightning and static electricity. The following table identifies the typical magnetic field strength for some common household appliances.

Table 3-14: Common sources of magnetic fields; measured in milliGauss (mG)

Source of EMF	**Distance from Source**			
	6 Inches	**1 Foot**	**2 Feet**	**4 Feet**
Copy Machines	90	20	7	1
Fluorescent Lights	40	6	2	-
Video Display Terminals (PCs with color monitors)*	14	5	2	-
Hair Dryers	300	1	-	-
Electric Shavers	100	20	-	-
Ceiling Fans	n/a	3	-	-
Color Televisions*	n/a	7	2	-
Dishwashers	20	10	4	-
Garbage Disposals	80	10	2	-
Microwave Ovens**	200	40	10	2
Electric Ovens	9	4	-	-
Electric Ranges	30	8	2	-
Refrigerators	2	2	1	-
Digital Clock***	n/a	1	-	-
Analog Clock(conventional clock face)***	n/a	15	2	-
Electric Clothes Dryers	3	2	-	-
Washing Machines	20	7	1	-
Irons	8	1	-	-
Vacuum Cleaners	300	60	10	1

Source: USEPA 1992

* Some appliances produce both 60-Hz and higher frequency fields. For example, televisions and computer screens produce fields at 10,000-30,000 Hz (10-30 kHz) as well as 60-Hz fields.

** Microwave ovens produce 60-Hz fields of several hundred milligauss, but they also create microwave energy inside the appliance that is at a much higher frequency (about 2.45 billion hertz). We are shielded from the higher frequency fields but not from the 60-Hz fields.

*** Most digital clocks have low magnetic fields. In some analog clocks, however, higher magnetic fields are produced by the motor that drives the hands. In the above table, the clocks are electrically powered using alternating current, as are all the appliances described in this table.

Existing portions of the VCSNS-Flat Creek and VCSNS-Varnville transmission lines currently consist of various voltage transmission lines. The existing VCSNS-Flat Creek line is predominantly 69 kV (58.03 miles), with the remainder consisting of a 230kV line. The existing VCSNS-Varnville line is predominantly 115kV (114.56 miles), with the remaining segments consisting of 69 kV and 230 kV lines. Typical magnetic field data for individual 69 kV, 115 kV and 230 kV lines are detailed in the following table.

Table 3-15: Magnetic fields near 69 kV, 115 kV and 230 kV transmission lines

Transmission Line Voltage	Magnetic Field Directly under Line	Magnetic Field at Edge of Right-of-Way (50 feet)
69 kV	20 – 25 mG [1]	5 – 10 mG [1]
115 kV	20 mG [2]	5 mG [2]
230 kV	57.5 mG [2]	19.5 mG [2]

[1] Source: American Transmission Company 2008
[2] Source: Lee, et all 1996

Since the late 1970's, much research has been done on the possible human health effects resulting from exposure to extremely low frequency electromagnetic fields (ELF EMF) from overhead transmission lines. According to the 2007 World Health Organization (WHO) Environmental Health Criteria (EHC) 238, "exposure to power-frequency electric fields causes well-defined biological responses, ranging from perception to annoyance, through surface electric charge effects" (WHO 2007a). The National Institute of Environmental Health Sciences Electric and Magnetic Fields Research and Public Information Dissemination Program (NIEHS EMF RAPID) found that there was weak evidence that short term human exposure to ELF EMF causes changes in heart-rate variability, sleep disturbance, or suppression of melatonin (NIEHS 2002).

From the limited credible evidence suggesting that exposure to ELF fields may cause cancer, the NIEHS international panel concluded that ELF EMF should be considered as a "possible human carcinogen" (NIEHS 1999), specifically associated with childhood leukemia and chronic lymphocytic leukemia. The review of literature in the EHC 238, published in 2007, primarily focused on studies conducted after the 2002 International Agency for Research on Cancer (IARC) review. The 2007 EHC 238 states "New human, animal and in vitro studies, published since the 2002 IARC monograph, do not change

the overall classification of ELF magnetic fields as a possible human carcinogen" (WHO 2007).

According to the NIEHS EMF RAPID 2002 Questions & Answers, there are no federal U.S. standards limiting occupational or residential exposure to EMF, but "at least six states have set standards for transmission line electric fields, and two of these also have standards for magnetic fields" (NIEHS 2002). There are currently no federal or state exposure standards for electric or magnetic fields applicable in South Carolina. The typical expected magnetic field from a 230 kV transmission line is much lower than the requirements for those states with existing limitations. The World Health Organization has also concluded that, "since current scientific information is only weakly suggestive and does not establish that exposure to ELF fields at levels normally encountered in our living environment might cause adverse health effects, there is no need for any specific protective measures for members of the general public" (WHO 1998).

3.11 Safety

This section discusses the potential safety risk of electric shock related to the increased electric field associated with the VCSNS-Flat Creek and VCSNS-Varnville transmission lines. Increased electric fields can be a potential problem because high voltage transmission lines can cause an ungrounded metal object within its electric field to become electrically charged. The magnitude and strength of the charge are directly related to the mass of the ungrounded metal object and its orientation to the transmission line. If a person or animal touches this electrically charged object, it will receive an electric shock.

To explain how this electric shock can occur, one must understand that the electric charge in the metal object will attempt to move to the ground, which has an electric potential of zero. This movement of the charge through the metal object is called current. As there is no direct connection between the transmission line (the source of the charge) and the object, this current is referred to as "induced". If the object is grounded with a grounding wire, then the total current induced into the object would flow

to the earth, rather than building up a charge in the object. However, if a metal object is insulated from the ground (is not grounded by a wire or other means) it can store the electric charge. The lack of grounding is typically an issue with mobile objects (such as vehicles), which cannot be permanently grounded. If a person touches this "capacitively charged" object, they will receive an electric shock from the sudden discharge of the capacitive charge through their body to the ground.

It is important to evaluate the amount of induced current that could flow to an ungrounded object in order to understand the potential for electric shock. The amount of induced current that can be transmitted and/or stored by an object is affected by the object's characteristics, the degree of grounding and the electric field strength. In order to minimize these safety issues, the National Electrical Safety Code (NESC) has set an induced current limit of 5 milliamperes (mA) for the largest anticipated vehicle under a transmission line exceeding 98 kV (IEEE 1997). In order to meet the 5 mA standard, higher voltage transmission lines typically require an increased height above ground level (agl). The existing transmission lines in the two proposed corridors vary between 69 kV, 115 kV and 230 kV lines. Typical electric field data for individual 69 kV, 115 kV and 230 kV lines are detailed in the following table.

Table 3-16: Typical electric field for 69 kV, 115 kV and 230 kV transmission lines

Transmission Line Voltage	Electric Field Directly under Line	Electric Field at Right-of-Way (50 feet)
69 kV	0.08 kV/m [1]	N/A [3]
115 kV	1.0 kV/m [2]	0.5 kV/m [2]
230 kV	2.0 kV/m [2]	1.5 kV/m [2]

[1] Source: Southern California Public Power Authority 2007
[2] Source: Lee et all 1996

To put these electric field values in perspective, it may help to understand the range of electric fields to which the public could be exposed. Including the areas directly underneath a transmission line (at ground level), the electric fields in publicly accessible places range from less than 0.001 kV/m to 12 kV/m, with the higher electric fields existing close to high-voltage transmission lines of 230 kV and above (Bracken 2006).

3.12 Air Quality

The U.S. Environmental Protection Agency (EPA) has set National Ambient Air Quality Standards (NAAQS) for six criteria air pollutants which are common throughout the United States**.** The six current criteria air pollutants are: Carbon Monoxide (CO), Lead (Pb), Nitrogen Dioxide (NO2), Ozone (O3), Particulate matter (PM) and Sulfur Dioxide (SO2). According to the EPA, a county which meets or does better than each of the NAAQS is classified as an attainment area for the respective pollutant; while an area that does not meet any one of the individual standards is referred to as a nonattainment area for that pollutant (USEPA undated). Every county transected by the VCSNS-Flat Creek and VCSNS-Varnville transmission lines is currently in attainment for each of the six criteria air pollutants.

Two of the six EPA criteria pollutants have the potential to be affected by the development and operation of transmission lines (ozone and nitrogen dioxide). Corona activity, which can occur near transmission lines during moist conditions, can produce tiny amounts of oxidants. Approximately 90 to 95 percent of the oxidants are ozone, while the remaining 5 to 10 percent are primarily nitrogen oxides. Nitrogen dioxide is a major contributor to smog and acid rain. The ground-level ozone found in smog can damage lung tissue, cause congestion, reduce vital lung capacity and damage vegetation. Acid rain can damage buildings and crops and degrade lakes and streams. The nitrogen dioxide NAAQS is currently set at 53 part per billion (ppb), averaged annually. Each county transected by the transmission corridor is currently in attainment for nitrogen dioxide.

The NAAQS for ground level ozone has changed several times in the last three years. On June 15, 2005 the former 1-hour ozone standard (120 ppb) was revoked for all areas, with the exception of a limited number of 8-hour ozone nonattainment Early Action Compact (EAC) areas. Portions of Richland and Lexington Counties are included as one of fourteen EAC areas identified throughout the nation and the VCSNS-Varnville transmission line transects this EAC area. In the EAC areas, the EPA will not revoke the former 1-hour ozone standard until April 15, 2009 (USEPA 2008b). In 2005, the NAAQS

for all non-EAC areas consisted of an 8-hour standard of 80 ppb. On March 12, 2008, the EPA strengthened the NAAQS for ground-level ozone in all non-EAC areas by reducing the 8-hour ozone standard from 80 ppb to 75 ppb. The remaining counties transected by the VCSNS-Flat Creek and VCSNS-Varnville transmission lines do not include EAC areas and therefore, they are presently under the new 8-hour ozone standard of 75 ppb.

3.13 Aviation

This section details the Federal Aviation Administration (FAA) requirements for notification of construction which has the possibility of interfering with air traffic. The airports which are located within a specified distance/elevation of the new structures for each corridor are also listed in this section. FAA Regulations, Part 77, establishes standards for determining obstructions in navigable airspace and sets forth requirements for FAA notification of proposed construction. These regulations require FAA notification for proposed new construction, or alteration of existing structures, higher than 200 feet above ground level (agl). Notification is also required if the obstruction is more than specified heights lower than 200 feet agl and the obstruction falls within any restricted airspace associated with aircraft approach patterns. The requirement of notification for obstructions of specified heights lower than 200 feet agl is determined by a ratio of the distance between the obstruction and the airport, and the difference in the elevation of the airport and the elevation of the highest point of the obstruction, as listed in the following table (FAA 2008a).

Table 3-17: FAA notification requirements for construction within airport restricted space

Airport Type/Runway Length	Restricted Space	Specified Ratio
Airports with runway longer than 3,200 feet	20,000 feet (3.8 miles)	100:1
Airports with runway 3,200 feet or shorter	10,000 feet (1.9 miles)	50:1
Heliports	5,000 feet (0.95 miles)	25:1

Source: FAA 2008a

The electronic “Notice Criteria Tool” on the FAA website was used to determine which, if any, airports or heliports near the corridors are located close enough to the corridor to cause the new transmission line structures to fall within the notification criteria. The new

transmission line structures will have a height range of 75 to 110 feet, but to be conservative, a height of 120 feet was used on the "Notice Criteria Tool" to determine whether FAA notification will be required. According to the FAA, construction near private airports or heliports does not require FAA notification. The following table lists airports and heliports within 20,000 feet (3.8 miles) of the transmission corridors and indicates whether FAA notification is required for the new transmission line structures closest to each airport (FAA 2008b). These airports are included in Figure 2-1.

Table 3-18: Airports requiring FAA notification

Airport/Heliport	Distance between Obstruction and Airport	FAA Notification Required	Location of Airport on Figure 2-1 by Sheet Number
VCSNS-Flat Creek Line			
Summers Station Heliport[1]	0.3 miles	No	D01
Fairfield County Airport	3.1 miles	No	C01
Kirk Air Base	1.9 miles	**Yes**	A02
Lancaster County Airport – McWhirter Field	3.1 miles	No	A01
VCSNS-Varnville Line			
SLED[2] Heliport, Columbia	0.9 miles	No	E01
Columbia Metropolitan Airport	3.7 miles	**Yes**	F01
Lexington Medical Center	3.3 miles	No	F01
Darden Airport	2.8 miles	No	G01
Lexington County Airport, Gaston	2.2 miles	No	G01
North Air Force Auxiliary Field	0.6 miles	**Yes**	H01
Orangeburg Municipal Airport	0.4 miles	**Yes**	I01

Source: FAA 2008b
[1] Summers Station Heliport is located at the VCSNS
[2] South Carolina Law Enforcement Division (SLED) Heliport
Note: Due to the actual size of the heliports and smaller airports, they may not appear visible on Figure 2-1, though the heliports/airports are physically located in the area represented by the corresponding sheet of Figure 2-1, as noted in this table.

4.0 ENVIRONMENTAL IMPACTS

Transmitting the additional electricity generated as a result of the proposed expansion of the VCSNS will require Santee Cooper to increase the number and size of the lines exiting the VCSNS. Santee Cooper has been able to minimize impacts, while still meeting their obligation to transmit additional electricity generated, by routing two new 230 kV transmission lines within existing maintained ROW to the greatest extent possible (nearly 99% of approximately 235 miles of combined transmission line). With the exception of the 2.44 miles (1.04% of the total lines) of proposed new ROW, development impacts will be limited to replacing existing single pole or H-frame structures with new, non-wood single pole or H-frame structures; moving existing transmission lines to the side of the existing ROW and adding new, non-wood single pole or H-frame structures within the existing ROW; and for some segments of the corridors, simply hanging new 230 kV line on existing H-frame structures. Adding the VCSNS-Flat Creek and VCSNS-Varnville 230 kV lines within the existing rights-of-way and developing the 2.44 miles of proposed new ROW adjacent to existing maintained ROW will be conducted in a phased approach over the course of several years. While limited impacts (discussed in the environmental topics below) may occur as a result of the installation and replacement activities, Santee Cooper will utilize best management practices (BMPs), as defined in Santee Cooper maintenance documents (Appendix B) and based on common industry standards, to the greatest extent possible in order to minimize impacts.

4.1 Landform, Geology and Soils

Physiographic features, including landforms, soils and farmlands, will be subject to limited impacts during the installation/replacement of transmission line structures, due to the disturbance of the land associated with such activities. Potential impacts to the geologic environment as a result of the development of the VCSNS-Flat Creek and VCSNS-Varnville transmission lines within the 98.96% of existing right-of-way include erosion, sedimentation and relocation of soils. Additional minor impacts associated

with the development of the 2.44 miles of proposed new right-of-way include topographic changes, variation of existing drainage patterns, and potential loss of mineral resources and restriction on the use of prime farmland soils.

During the repositioning and/or replacement of structures along the existing right-of-way, soil will be removed for the installation of structure foundations. Removal of soil during the installation of new structures is considered unavoidable. However, in most cases, removal of soil by augering will not have an environmental impact as removed soils are spread on the ground floor within the right-of-way and effectively seeded to promote vegetative growth. In areas where rock is encountered within the proposed foundation, coring and/or blasting may be required to remove the material. Where new structure foundations are required, vibratory caissons will be used to secure the structure.

Installation of the transmission lines will require the use of heavy equipment, which may disturb vegetative cover, topsoil and shallow subsoils along the right-of-way. If soils become exposed during construction activities, engineering controls will be implemented to prevent erosion and sedimentation. Exposed soils will be protected during construction by implementing appropriate BMPs to prevent potentially eroded soils from migrating beyond the right-of-way. Following the installation of a particular line segment, the area within the right-of-way will be protected from erosion, while vegetation is reestablished. The ground floor within the right-of-way will be maintained in accordance with Santee Cooper's current Right-of-Way Management Unit Plan (Appendix B). Implementation of these control measures are expected to minimize erosion and sedimentation during construction and maintenance activities. As a result, significant impacts to soils or geological features are not expected.

Although the majority of the transmission lines to be installed and/or replaced are located within existing maintained rights-of-way that traverse numerous areas of Prime Farmland and Farmlands of Statewide Importance, only a portion of these designated areas are currently used for agricultural activities. During construction and maintenance of the lines, impacts to farmlands will be minimized by entering rights-of-

way from the perimeter of agricultural fields. Santee Cooper allows and encourages farming activities by property owners within their transmission line rights-of-way.

Development of the 2.44 miles of proposed new ROW will primarily consist of clearing existing woody vegetation within the new 100-foot ROWs. In the performance of this work, vegetation will be removed from the ROW, exposing soils to potential erosion from both precipitation and wind. In order to minimize the potential for erosion of soils, a designed sedimentation and erosion control program as part of a Stormwater Pollution Prevention Plan (SWPPP) will be prepared for the development of the transmission lines within the proposed new ROW. The implementation of these control measures and any others specified in the SWPPP, are expected to minimize erosion and sedimentation during construction activities. Implementation of the SWPPP will minimize the minor impacts that may occur to landform and geology during the development of the 2.44 miles of proposed new ROW.

4.2 Water Resources

4.2.1 Hydrology and Water Quality

Minimal impacts, primarily consisting of erosion and sedimentation, are likely to occur during land disturbing activities along the VCSNS-Flat Creek and VCSNS-Varnville transmission line corridors. During maintenance activities along the existing rights-of-way, including replacement of structures, Santee Cooper will use BMPs to minimize erosion/sedimentation impacts to adjacent properties and surface waters. These activities are not expected to contribute to the parameters measured by the SCDHEC for impaired water-bodies.

Preliminary planning indicates that installation and replacement of transmission structures at river and stream crossings can be accomplished by setting the transmission structures on the banks in such a way that runoff will be diverted, resulting in minimal impacts to adjacent streams and rivers. Transmission structures are not currently expected to be set within river channels, although proposed new ROW associated with the VCSNS-Varnville line may require one or two structures to

be set within the Parr Reservoir (Broad River Impoundment). Specific plans for the development of these portions of the transmission lines have not been completed. However, Santee Cooper will prepare one or more Stormwater Pollution Prevention Plan (SWPPP), in accordance with SCDHEC's *Standards for Stormwater Management and Sediment Reduction,* (SCDHEC 2002), for development of the 2.44 miles of proposed new ROW. Adherence to the project specific SWPPP will minimize impacts to sediment quality during transmission line construction along the proposed new ROW.

4.2.2 Wetlands Impacts

Jurisdictional waters of the U.S., including streams and wetlands, are defined by 33 CFR Part 328.3(b) and are protected by Section 404 of the Clean Water Act (33 USC 1344). Certain activities, such as construction, dredging, filling or other alterations, in jurisdictional wetlands, streams or other waters of the U.S. may require a Section 404 Clean Water Act permit which is regulated by the United States Army Corps of Engineers (USACE). In October 2007 Santee Cooper engaged the USACE to discuss the need for the VCSNS-Flat Creek and VCSNS-Varnville transmission lines as a result of the proposed VCSNS expansion.

Following a discussion of the proposed project, the USACE agreed that only a preliminary approximate wetland determination would be appropriate for this project. The scope of work would include approximating the limits of the Waters of the U.S. from aerial photography and from other published sources (NWI, Soil surveys, etc.) with only limited ground truthing to verify wetland areas along the transmission corridors. The USACE confirmed that this limited scope would accommodate review requirements of the project impacts and would be satisfactory for other agency's impact determinations. The USACE requested the following information/items for USACE review, prior to potential permitting:

- Sketches, drawings and photos of new structures and installation process (photos should show examples both before and after installation)
- Discussion of the conversion of forest to herbaceous habitat in the 2.44 miles of new ROW
- Approximate wetland delineation on the new ROW
- Detailed drawings of the navigable water crossings

Following the meeting, subsequent correspondence with the USACE confirmed that Santee Cooper's need to replace transmission structures within existing ROW is not regulated by the USACE; however, Santee Cooper will continue to consult with the USACE and will provide them with the requested information prior to filing any required permit applications.

Santee Cooper also consulted with the South Carolina Department of Health and Environmental Control (DHEC) in November 2007. Following a presentation of the VCSNS project and Santee Cooper's responsibilities regarding the two transmissions corridors, DHEC concurred that the impacts to areas in their jurisdiction, including water quality and State navigable waters, would be limited. Since State Navigable Waters permits generally include detailed information relating to the designed transmission structures at the specific crossing locations, DHEC concurred that this specific information need not be collected initially. Following a review of the scope of the wetland investigation and permitting scenarios, previously discussed with the USACE, DHEC concurred that the proposed methodology was sufficient given the limited expected impacts resulting from the majority of the routing of the transmission lines (98.96%) within existing maintained rights-of-way.

Along the existing portions of the corridors it will not be necessary to further disturb wetlands and other waters of the U.S., beyond minor and temporary construction-related impacts resulting from the removal of existing structures and installation of the new transmission structures and lines. New structures may be installed on the footprint of existing structures, adjacent to existing structures, or in other locations within the ROW, and will not require the placement of fill in jurisdictional areas. This

disturbance will not create additional wetland impacts greater than the minimal impacts that may occur during existing ROW maintenance procedures. However, Santee Cooper will manage construction equipment in wet areas to minimize rutting and other soil disturbance.

Necessary wetland impacts along the 2.44-miles of new corridor will consist of clearing of vegetation according to Part A2 (Clearing Specifications; Appendix B) of Santee Cooper's Section IV Technical Requirements. Following development of the 2.44 miles of proposed new corridor, Santee Cooper will maintain the right-of-way in accordance with their current ROW Management Unit Plan. No fill or other significant discharge in wetlands is expected along either the VCSNS-Flat Creek or VCSNS-Varnville transmission lines.

Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403; 30 Stat. 1151) requires project approval by the USACE prior to the commencement of any work in or over navigable waters of the United States, or which affects the course, location, condition or capacity of such waters. Activities requiring Section 10 permits include the construction of cable or pipeline crossings. Navigable waters regulated by Section 10 are generally restricted to larger rivers and lakes; however, precise definitions of "navigable waters of the United States" or "navigability" are ultimately dependent on judicial interpretation and cannot be made conclusively by administrative agencies. A general definition of "Navigable waters of the United States" is those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. Once the COLA is approved, Santee Cooper will advance the design of the proposed VCSNS-Flat Creek and VCSNS-Varnville transmission lines and will file for the appropriate USACE permit(s), as necessary.

Construction in a navigable waterway of South Carolina, including cables and pipelines, are regulated by the SCDHEC under Section 404 of the Clean Water Act (33 USC 1344). State Navigable Waters are those waters which are now navigable, or have been navigable at any time, or are capable of being rendered navigable by the

removal of accidental obstructions, by rafts of timber or by small pleasure or sport fishing boats. The VCSNS-Flat Creek and VCSNS-Varnville transmission lines will cross navigable waters of the state at 18 locations along the combined length of the transmission corridors. These lines will be installed to acceptable DHEC specifications. Once the COLA is approved, Santee Cooper will advance the design of the proposed VCSNS-Flat Creek and VCSNS-Varnville transmission lines and will file for the appropriate DHEC (including CZM certification by OCRM) permit(s), as necessary.

Routing the majority (98.96%) of the VCSNS-Flat Creek and VCSNS-Varnville transmission lines within existing maintained ROW limits the potential for significant wetland impacts as a result of this project. Using existing corridors eliminates the impacts that would be associated with filling and clearing of significant acreages for new transmission structures and new rights-of-way.

Limits of jurisdictional wetlands and other waters of the U.S. will be estimated from remote sources before construction activities commence. USACE recommended measures for protection of wetlands, streams and other waters, will be followed during and after installation of the new 230 kV transmission lines, and will be used to mitigate temporary impacts from construction activities, such as rutting and destruction of vegetative cover. These measures generally are specified in Santee Cooper's SWPPP with DHEC. They include the use of mulches, hay bales, silt fences or other devices capable of preventing rutting, erosion and migration of sediments. Disturbed land surfaces will be stabilized upon project completion.

The total area of disturbance will be minimized and the destruction of vegetative cover from construction activities will be limited to the required footprint. Measures will include limiting; the loss of topsoil, destruction of the existing seed bank, and the compaction of soils by heavy equipment. For unavoidable disturbances, engineering controls will be employed to prevent erosion and sedimentation, and disturbed or cleared areas will be seeded with native perennial grasses and forbs during the appropriate season to succeed temporary erosion control vegetation.

Existing and future transmission line maintenance may involve vegetation management in wetlands. Ground crews may travel within wetlands using All Terrain Vehicles (ATVs). Foliar treatment using selective, low volume herbicide applications may also be used in wetland areas. Only EPA-approved herbicides registered for use in wetlands will be used, per Santee Cooper's ROW Management Unit Plan. Thus, it is expected that only minor and temporary impacts to wetlands will be associated with development and maintenance of the VCSNS-Flat Creek and VCSNS-Varnville transmission lines.

4.2.3 Floodplain Impacts

The VCSNS-Flat Creek and VCSNS-Varnville transmission lines both cross regulated 100-year floodplains and associated floodways at numerous creek and river crossings. Santee Cooper will avoid locating new transmission line structures in regulatory floodplains or the floodway wherever possible. Single and H-frame structures are not typically regulated by local floodplain ordinances. Although placement of some structures within the regulatory floodplain may be necessary, these types of structures do not typically present a substantial obstacle to floodwaters and floating debris.

4.3 Land Use

A majority (98.96%) of the approximate 235 miles of combined transmission lines will not significantly affect local or regional land use, as the VCSNS-Flat Creek and VCSNS-Varnville transmission lines are routed, and will be installed, within existing Santee-Cooper maintained ROW. However, the two sections of proposed new ROW, totaling 2.44 miles, will affect existing land use in these areas. Land use in these areas total approximately 5.6 acres of open water, 1.1acres of wetlands, 22.4 acres of undeveloped woodlands and 0.5 acres of transportation/utilities (for which land use will remain unchanged). The 0.92 miles of proposed 100-foot wide ROW associated with the VCSNS-Flat Creek line predominantly consists of undeveloped woodlands adjacent to the northeast of existing Santee Cooper maintained ROW. The 1.52 miles of proposed 100-foot wide ROW associated with the VCSNS-Varnville consists of undeveloped woodlands adjacent to the north of existing maintained ROW, in addition

to the crossing of the Parr Reservoir (Broad River Impoundment). The undeveloped woodland portions of these two small sections of proposed new ROW will be cleared to maintain an adequate clear zone along the transmission line. This unavoidable minor impact will permanently change the land use of approximately 22.4 acres of undeveloped woodlands to transportation/utilities.

4.4 Land Cover / Vegetation

The Early Successional Upland and Early Successional Wetland habitats that occur along the VCSNS-Flat Creek and VCSNS-Varnville transmission line corridors may have temporary and limited impacts during the installation and/or replacement of new structures, transmission lines and associated equipment. The installation of new structures will require minimal disturbance of vegetation for structure foundations and the temporary placement of backfill material. The construction process may trample or require limited clearing of vegetation for the movement of heavy equipment and for providing safe staging areas for erecting structures. Portions of the 2.44 miles of proposed new ROW that currently contain Upland Pine-Hardwood Forest and Bottomland Forest will require approximately 23 acres of new clearing.

Disturbance to vegetation or topsoil can affect the species composition of existing habitat by leaving the habitat susceptible to invasion by non-native weedy species and pioneer tree species, both of which are undesirable for long-term maintenance goals. However, construction activities within existing ROWs generally have a temporary effect on vegetation, due to the recovery potential of the established seed bank and root systems of disturbance-adapted species. Permanent conversion of forest habitat to grassland and shrubland habitats will alter the species composition and the habitat structure (layered forest) of approximately 23 acres within the 2.44 miles of proposed new ROW, as well as affect adjacent habitats (streams, rivers, lakes and adjacent forest). Loss of tree canopy cover for water bodies/streams within the 2.44 miles of proposed new ROW will change edge habitat and shading quality. Minimal losses of forest wildlife habitat are unavoidable in these areas; however, only limited alteration of

edge habitat and forest fragmentation will occur because the 2.44 miles of proposed new ROW is immediately adjacent to existing, maintained ROW.

Routing 98.96% of the VCSNS-Flat Creek and VCSNS-Varnville transmission lines within existing maintained ROW will significantly decrease the extent and degree of environmental impacts as a result of this project. Using existing maintained transmission rights-of-way will prevent significant impacts from the loss of forested habitat that would result if routing required a greater percentage of new ROW.

The land under the transmission line will be maintained in an early successional grassland or shrub/scrub vegetation (via mechanical mowing and herbicide applications), or agricultural fields. To manage right-of-way vegetation, Santee Cooper and their contractors follow procedures outlined in their ROW Management Unit Plan (Appendix B).

Prior to the construction phase this will include:

1) tree pruning/removal via accepted forestry and/or arborist practices,
2) some stump removal and grubbing only when necessary,
3) shrubby vegetation trimming and clearing,
4) localized (stump) treatment with herbicides to prevent sprouting,
5) active erosion control measures if deemed necessary, and
6) regular inspections of contractor's work by Santee Cooper staff.

During the operation/maintenance phase this will include:

1) mechanized and manual re-clearing at 2.5 - 3 year intervals
2) herbicide use via selective, low-volume applications
3) tree maintenance via removal of "danger trees" outside the ROW, if necessary, and side-trimming encroaching limbs growing within the ROW
4) regular inspections for early identification of potential problems

Approximately 23 acres of forested land along the 2.44 miles of proposed new ROW will be converted to an open vegetation habitat as a result of transmission line construction. However, given the high proportion of forested land cover in the areas

proximate to the VCSNS-Flat Creek and VCSNS-Varnville transmission lines, the acres to be converted for this project are minimal. No significant or critical woodland habitats will be altered as a result of this project.

The total area of disturbance along the majority of the VCSNS-Flat Creek and VCSNS-Varnville transmission corridors will be minimized and the disturbance of vegetative cover from construction activities will be temporary and limited to the required footprint of the installed structures. Mitigative measures to limit the loss of topsoil, minimize disturbances of the existing seed bank, and limit the compaction of soils by heavy equipment will be implemented during the construction process. For unavoidable disturbances, engineering controls will be employed to prevent erosion and sedimentation, and disturbed or cleared areas will be seeded with native perennial grasses and forbs during the appropriate season, in order to succeed temporary erosion control vegetation. Low growing vegetation along streams, ponds and lakes will remain unaltered to the maximum extent possible, so that a vegetative buffer will be maintained along the length of streams and/or waterbodies.

4.5 Wildlife

Installation and replacement of structures within the approximate 232 miles of existing maintained ROW will have a minimal impact on the vegetative structure and composition of wildlife habitat types. Seasonality of construction has the potential to disrupt localized breeding bird populations and may impact local avian reproduction. This is particularly relevant for species using utility structures as nesting platforms (APLIC 1996). These impacts are both short term and reversible, and are expected to be limited for this project.

Operation and maintenance of the transmission line structures and ROW will not adversely affect most wildlife species. However, operation of electric transmission lines creates a threat of collision and electrocution for many avian species. The maintenance of transmission line structures has the potential to disrupt avian

reproduction during certain times of the year (APLIC 1996). A discussion of impacts due to avian/utility structure interactions is addressed in Section 4.6.

The continued practice of using Santee Cooper's ROW Management Unit Plan will achieve desired ROW maintenance goals while providing safe and productive habitats for wildlife species. The Santee Cooper ROW Management Unit Plan uses a variety of vegetation management techniques, including both mechanical clearing and herbicide application. Herbicide application is limited to selective treatments on woody vegetation and is supervised by trained and certified personnel with USEPA-approved herbicides.

For species which prefer edge-type habitats, the transmission corridor will provide good habitat and may result in an increase in abundance. In general, no significant impacts to wildlife are expected as a result of the development and operation of the VCSNS-Flat Creek and VCSNS-Varnville transmission lines.

4.6 Endangered, Threatened and Candidate Species

The South Carolina Heritage Trust Program Rare and Endangered Species Inventory (Inventory) digital database was compared to the study area for the VCSNS-Flat Creek and VCSNS-Varnville lines and an additional on-site pedestrian survey was conducted for the combined 2.44 miles of proposed new ROW. The Heritage Trust Program Inventory found no documented occurrences of federally endangered, threatened or candidate species within the approximate 235 miles of the combined transmission line corridors (SCDNR 2008a) and no evidence of protected species and/or supporting habitat was identified during the on-site survey of the 2.44 miles of proposed new ROW.

The following endangered, threatened or candidate species are known to occur in one or more counties transected by the VCSNS-Flat Creek and VCSNS-Varnville transmission corridors: bald eagle, red-cockaded woodpecker, wood stork, shortnose sturgeon, flatwoods salamander, Carolina heelsplitter, pondberry, Canby's dropwort, smooth coneflower, Schweinitz's sunflower, rough-leaved loosestrife, black spored

quillwort, little amphianthus, Georgia aster and bog asphodel. Based on county protected species lists, the bald eagle, Carolina heelsplitter and Georgia aster were the only species from above that were identified as occurring in the counties (Fairfield and Newberry) where the 2.44 miles of proposed new ROW is located.

As noted in the COLA, the bald eagle is the only federally or state listed animal specie observed during several protected species surveys at the VCSNS. The bald eagle is state-listed as endangered and remains federally protected under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act (COLA 2008). With regard to the transmission line corridors, a bald eagle nest is known to occur upstream from the VCSNS-Varnville line, along the Broad River (SCDNR 2008a). To comply with the BGEPA, there will be a minimum of a 660-foot buffer between development and any known active bald eagle nest. Large raptors, such as bald eagles, are also protected by the Migratory Bird Treaty Act (MBTA). Raptors are at risk for electrocution, collision, etc. from certain transmission line designs. The new structures that will be installed within the VCSNS-Flat Creek and VCSNS-Varnville transmission corridors will be "raptor safe" and meet the guidelines outlined in *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 2006* (APLIC 2006). By using these measures, raptors, including bald eagles, will not likely be adversely impacted by the structure replacement and installation along the VCSNS-Flat Creek and VCSNS-Varnville transmission line corridors.

The red-cockaded woodpecker (RCW) occurs in mature open pine forests. According to the USFWS RCW survey protocols, determinations for the presence or absence of RCWs must be undertaken for projects that will involve the removal of pine trees 30 years or older (USFWS 2003). No mature pine trees will be removed during the structure installation/replacement activates along the existing VCSNS-Flat Creek and VCSNS-Varnville transmission corridors. Although trees of sufficient age occur, and will be removed, within the 2.44 miles of proposed new ROW, the habitat in this area is not suitable to support RCW foraging or nesting. Therefore, there will not likely be an adverse impact on RCW as a result of this project.

The wood stork is known to occur in several counties that the VCSNS-Flat Creek and VCSNS-Varnville transmission lines will cross. However, there are no known occurrences of nesting colonies along or near the ROWs. Wetland areas along the ROW's may be suitable foraging habitat for the wood stork. However, installation and replacement of new structures along the VCSNS-Flat Creek and VCSNS-Varnville transmission lines will not have significant impacts on these wetlands and therefore, no significant impacts are likely for the wood stork.

To minimize potential adverse impacts to the Carolina heelsplitter and the shortnose sturgeon from sedimentation and erosion, maintenance of the corridors will adhere to Santee Cooper's ROW Management Unit Plan. Carolina heelsplitter was included in the habitat survey of the 2.44 miles of proposed new ROW. Historically, the species was reported from small to large streams and rivers, usually found in mud, muddy sand, or muddy gravel substrates along stable, well-shaded stream banks. The 2.44 mile segment of the new ROW crosses the Parr Reservoir at an area with no shade. The existing adjacent ROW has been maintained as scrub-shrub for over 30 years. Carolina heelsplitter and shortnose sturgeon are not expected to be impacted by the VCSNS-Flat Creek or VCSNS-Varnville transmission lines.

The frosted flatwoods salamander occurs in fire maintained, open mesic pine and wiregrass flatwoods dominated by longleaf pine. They breed in isolated, shallow, small depressions. No significant disturbance of pine flatwood habitat will be required during the installation and replacement of new structures along the VCSNS-Flat Creek and VCSNS-Varnville transmission lines. In addition, wetland depression areas that would be suitable breeding habitat for frosted flatwoods salamanders will be maintained in their present state.

Habitat for smooth coneflower, Schweinitz's sunflower, pondberry, Canby's dropwort, rough-leaved loostrife, black spored quillwort, little amphianthus, bog asphodel and Georgia aster can include transmission line ROW's. Soils suitable for the growth of Schweinitz's sunflower (e.g., Cecil, Iredell) are known to occur within the existing ROW in Lancaster County. Although blanket use of herbicides for maintenance can threaten

species that occur in the ROW (USFWS 1992a), some form of disturbance is required to maintain the open habitat required by these species (USFWS 1997c). Santee Cooper selectively uses herbicides to control woody growth; blanket herbicide application generally is not used (Santee Cooper's ROW Management Unit Plan). This type of selective vegetation management will maintain and may actually increase the amount of suitable habitat for the Schweinitz's sunflower and other species that thrive in this habitat. Habitat for Georgia aster was included in the habitat survey of the 2.44 miles of proposed new ROW and currently, this area is completely forested with a closed canopy. Based on a lack of suitable habitat, the Georgia aster is not present in the 2.44 miles of proposed new ROW.

In October 2007, Santee Cooper met with the USFWS Charleston Ecological Field Services Office to discuss the need for the VCSNS-Flat Creek and VCSNS-Varnville transmission lines as a result of the proposed VCSNS expansion. Based on the outcome of this meeting, the USFWS requested additional surveys along areas of the transmission lines that present suitable habitat for protected species. The USFWS requested that Santee Cooper submit a sampling plan identifying areas of suitable habitat for protected species within the rights-of-way, in addition to Santee Cooper's standard operating procedure (SOP) for clearing and maintenance of ROWs. Once the COLA is approved, Santee Cooper will advance the design of the proposed transmission lines and will coordinate with the USFWS for concurrence.

4.7 Cultural Resources

During the cultural resources literature and records review, a total of 511 previously recorded cultural resources were identified within a 2-kilometer (1.25-mile) radius along the length of VCSNS-Flat Creek and VCSNS-Varnville transmission line corridors. Within the 2-kilometer radius, research identified 17 sites that are listed on the NRHP, 11 sites that have been recommended eligible for listing on the NRHP, and 14 sites that are potentially eligible for listing on the NRHP. In addition, research identified 43 sites which have not been assessed or require additional work prior to assessment; 22 properties which contribute to the NRHP eligible Orangeburg Historic District; and two

properties which were determined eligible for listing on the NRHP, but have not been listed due to owner objections. Moreover, twenty-one of the total 511 previously recorded cultural resources are located within 100 feet of the transmission lines; however, 19 of these 21 sites have been recommended ineligible for the NRHP and the other two sites have not yet been assessed for eligibility for the NRHP.

Santee Cooper met with the South Carolina State Historic Preservation Office (SCSHPO) in November 2007 to provide project information and details regarding Santee Cooper's transmission line siting associated with the expansion of the VCSNS. Santee Cooper will continue to coordinate with the SCSHPO and will comply with requirements necessary for Section 106 compliance and SCSHPO concurrence for the project.

4.8 Resident Population

The VCSNS-Flat Creek and VCSNS-Varnville transmission lines have been routed within existing transmission corridors to the greatest extent possible (98.96% of the entire length). The remaining 2.44 miles (1.04%) of proposed new ROW is located adjacent to existing maintained ROW and no residences are located proximate to these new ROW areas. For these reasons, the resident population in the counties and census tracts transected by the two transmission lines will be minimally impacted by this project.

4.9 Aesthetics and Noise

4.9.1 Aesthetics

Routing a majority of the new 230 kV transmission lines within existing maintained ROW will result in minor potential aesthetic impacts. Limited aesthetic impacts within the 98.96% of existing transmission line corridors will be associated with the replacement of existing, generally wood poles with taller, non-wood structures. The new structures (at a height of 75 to 110 feet) may exceed the height of the natural tree line, making them more visible from local roads and residences.

The 2.44 miles of proposed new ROW will include a 100 foot wide area of new clearing adjacent to existing maintained rights-of-way. The proposed new ROW currently consists of the following habitats: Upland-Pine Hardwood Forest, Bottomland Forest, Early Successional Wetlands and Open Water (Parr Reservoir/Broad River Impoundment). Approximately 23 acres of combined forest and wetlands (1.1 acre) will require permanent clearing for the new transmission lines; however, the species composition and habitat structure (layered forest) of the area will not be significantly altered as the new clearing will be adjacent to existing maintained ROW. No new forest fragmentation will occur as a result of this project. Due to the significant wooded areas and limited access to the 2.44 miles of proposed new ROW, this area is not easily visible from local roads (Broad River Road) and/or residences. Based on limited visibility and existing maintained ROW adjacent to the proposed new ROW, impacts to the aesthetics of this area are expected to be minimal.

4.9.2 Noise

The World Health Organization (WHO) recognizes that, "noise in the form of a buzzing or humming sound may be heard around electrical transformers or high voltage power lines" (WHO 1998). A typical audible noise level under a 230 kV transmission line during rain is 42 dBA (audible noise is less when it is not raining); under similar conditions at 50 feet from the line the noise level is 39 dBA; and at 100 feet from the line the noise level is 36 dBA (Lee, et all 1996). All of these expected noise levels are less than the level of ambient noise in an average home. Although corona noise can be audible if someone is very close to the transmission lines, it quickly dissipates with distance and is often overshadowed by typical background noises. Bonneville Power Administration (BPA) has developed a general guideline based upon public response to transmission line audible noise. The guideline indicates that few complaints should be expected if audible noise is limited to less than 53 dBA (Lee, et all 1996). As the audible noise from a 230 kV transmission line is expected to be much lower (approximately 39 dBA at the edge of the ROW) than this guideline and since no structures or buildings are allowed within the transmission line rights-of-way, it is unlikely that residents in adjacent properties will be significantly affected by the limited

noise. There should be minimal impacts related to this noise from the operation of the VCSNS-Flat Creek and VCSNS-Varnville transmission lines.

Equipment used during project construction activities will temporarily increase short-term noise levels in the project area. The following table shows the typical noise levels from construction equipment.

Table 4-1: Noise level of construction equipment

Construction Equipment	**Noise Level (dBA at 50 feet)**
Truck	88
Drill Rig	98
Air Compressor	81
Dozer	85
Grader	85
Crane	83

Source: USDOT 2006

There are numerous available methods of mitigating construction noise. The easiest and most successful method is prohibiting construction work during sensitive nighttime hours. The use of well-maintained heavy equipment with quality exhaust mufflers can also reduce noise levels during construction (Thalheimer 2000). The impacts from construction activity are temporary and will be minimal.

4.10 Electromagnetic Fields

The VCSNS-Flat Creek and VCSNS-Varnville transmission lines will have a voltage of 230 kV. The typical magnetic field from a 230 kV transmission line is 57.5 mG directly under the line and 19.5 mG at the edge of a 50 foot right-of-way (as shown in Table 3-15). This level of exposure is less than what most individuals are exposed to from many household appliances.

Several factors will help minimize magnetic and electric fields near the transmission lines. First, the new 230 kV transmission lines will be installed on new structures that will be approximately 20 to 30 feet higher than the existing structures. This additional height will decrease the electric and magnetic field levels of the existing 69 kV and 115 kV lines that may be collocated with the new 230 kV line.

Second, where the new 230 kV lines will be collocated with existing transmission lines, collocation can result in a reduction in the total magnetic field by causing a cancellation effect between each conductor (Stoffel 1994). Data from existing Santee Cooper collocated 115 kV and 230 kV transmission lines show magnetic field levels of approximately 9.4 mG underneath the two lines (Santee Cooper 2002, 2003). This confirms some cancellation effect, as discussed by Stoffel (1994), when compared to the expected 20 mG and 57.5 mG magnetic field levels of the 115 kV and 230 kV transmission lines individually.

Third, routing the new 230 kV transmission lines within existing corridors minimizes potential impacts to previously unaffected residents and property owners from extremely low frequency electromagnetic field (ELF EMF). Therefore, ELF EMF is not expected to be a health concern due to the low magnetic field levels associated with the new lines and location of the new lines within existing transmission corridors.

4.11 Safety

The VCSNS-Flat Creek and VCSNS-Varnville 230 kV transmission lines are expected to generate a maximum electric field of approximately 4 kV/m, calculated under a worst-case scenario (described below), within the ROW at approximately one meter above ground level (EPRI 1975). The maximum electric field is typically located at the lowest point of line sag and near, but not directly underneath, the transmission line. Induced currents can be calculated for common objects under a set of theoretical (worst-case) assumptions: the object is perfectly insulated from the ground, is located in the highest electric field, and is touched by a perfectly grounded person. Table 4-2 summarizes the calculated induced current for common mobile objects within a right-of-way, under these theoretical conditions. Calculations include experimentally determined induction coefficients and a maximum electric field of 4 kV/m (Essex 2005).

Table 4-2: Calculated induced current for various vehicles

Object	**Length[1] (feet)**	**Induced Current (mA)**
Pickup Truck	17	0.4
Farm Tractor and Wagon	31	1.2
Combine	30	1.52
School Bus	34	1.56
Tractor-Trailer	52	2.56

Source: Essex 2005

[1] For large objects (30 feet and longer), these calculations assume that the object is oriented parallel to the transmission line loop within the maximum electric field strength. For objects perpendicular to the transmission line loop, the induced current would be less.

Based on these calculations, a single 230 kV transmission line could potentially result in an induced current of up to 2.56 mA under the worst case conditions. Requirements of the 2007 National Electrical Safety Code (NESC) limit the induced current on objects under transmission lines to 5 mA or less. The design of these new transmission lines will meet or exceed the requirements of the NESC in effect at the time of design. In order to mitigate for the potential increased risk of electric shock, the 230 kV transmission lines will be installed on new structures that will be approximately 20 to 30 feet higher than the existing structures supporting 69 kV and/or 115 kV lines. In addition, sources of induced current and the potential for voltage shock can be reduced by grounding stationary metal objects, such as fences, located within the ROW. Santee Cooper's ROW easement also restricts development (buildings, etc.) and other human activities that could interact with the transmission line. With these additional measures, construction and operation of the VCSNS-Flat Creek and VCSNS-Varnville transmission lines will not result in significant safety risks to the members of the public in the vicinity of the proposed project.

4.12 Air Quality

The counties in which the VCSNS-Flat Creek and VCSNS-Varnville transmission lines will be located are in attainment with the national standards for all six criteria pollutants (USEPA 2008c). The development and operation of the VCSNS-Flat Creek and VCSNS-Varnville transmission lines is not expected to cause or contribute to a violation of the National Ambient Air Quality Standards (NAAQS). Construction and

operation of the transmission lines will result in extremely limited emissions of nitrogen dioxide and ozone.

Ozone can be a minor issue around transmission lines due to corona discharge, which is an electrical discharge caused by the ionization of air around a transmission line, and which increases with high moisture content. Typically, concentrations of ozone due to corona discharge measured at ground level, even during heavy rain, are significantly less than the most sensitive instruments can measure (approximately one ppb) and are minimal (0 – 8 ppb) at the height of the transmission line (HDR 2008). Ozone is a very reactive form of oxygen and it combines readily with other elements and compounds in the atmosphere. Due to its reactivity, it is relatively short-lived.

As previously discussed, incremental concentrations of ozone due to corona are expected to be less than one-tenth of the NAAQS 8-hour ozone standard (75 ppb) near the transmission line, and insignificant at ground level. Nitrogen oxide production due to corona is approximately one-fourth of the production of ozone due to corona (HDR 2008). Therefore, nitrogen oxide levels are expected to be less than 2 ppb at an elevation near the transmission line (much lower than the NAAQS of 53 ppb) and insignificant at ground level.

Ozone and nitrogen dioxide production near the transmission lines are expected to have an insignificant impact on the environment. The transmission lines will have a minimal impact on the air quality of the immediately surrounding areas.

4.13 Aviation

Portions of the VCSNS-Flat Creek and VCSNS-Varnville transmission line corridors are located within the established FAA restricted space of four airports. Completion of a "Notice of Proposed Construction or Alteration" (form SF 7460-1) will be required for new structures located in the restricted space of the four following airports: Kirk Air Base, Columbia Metropolitan Airport, North Air Force Auxiliary Field and Orangeburg Municipal Airport (FAA 2008b). According to the FAA, construction near private heliports does not require FAA notification.

Once the COLA is approved by the NRC, the notification forms will be submitted to the FAA and will include requested information about the replacement of the affected transmission line structures. This information includes the following attachments to form SF 7460-1: the type and location of the structures to be installed/replaced; scaled drawings showing the location of the alteration in relation to nearest runways; the perpendicular distance of the proposed structure to the nearest runway centerlines; the distance along centerline (actual or extended) from the end of the runway to the perpendicular intercept point of the structure; ground elevation at the site of the proposed structure; height of the proposed structure, including antennas or other appurtenances; accurate geodetic coordinates conforming to NAD 83; and sketches, drawings, etc. showing the type of structure proposed (FAA 2008a). Santee Cooper will submit the SF 7460-1 form within the required timeframe prior to scheduled construction.

If the FAA conducts their aeronautical study and determines that the proposed structures do not exceed obstruction standards, the impact of the transmission lines on aviation would be minimal (FAA 2008a). Should the FAA conduct their aeronautical study and determine that one or more of the proposed structures would be acceptable contingent upon implementing mitigating measures (such as marking, lighting, etc), the impact of these transmission lines on aviation would remain minimal. However, if one or more of the proposed structures is determined to be a hazard to aviation, it would be

considered objectionable by the FAA and changes to the design (location, height, etc) of the improper structure(s) would be required.

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Appendix A

Photolog

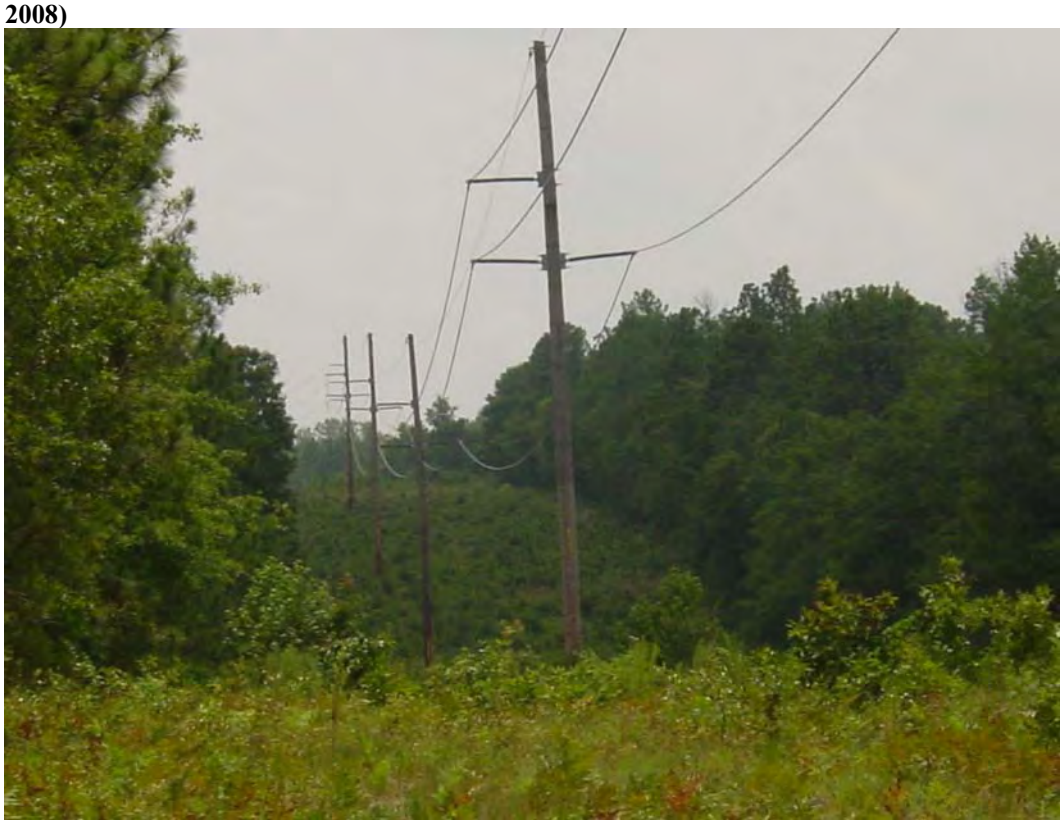
Photograph 1 – Typical Santee Cooper sign on transmission line power pole. (July 2008)

Photograph 2 – Santee Cooper transmission Right-of-Way (ROW) with metal monopoles supporting power distribution lines. Photo taken on V.C. Summer Nuclear Station (VCSNS) – Varnville line at Pine Plain Road in Lexington County, SC. (July 2008)

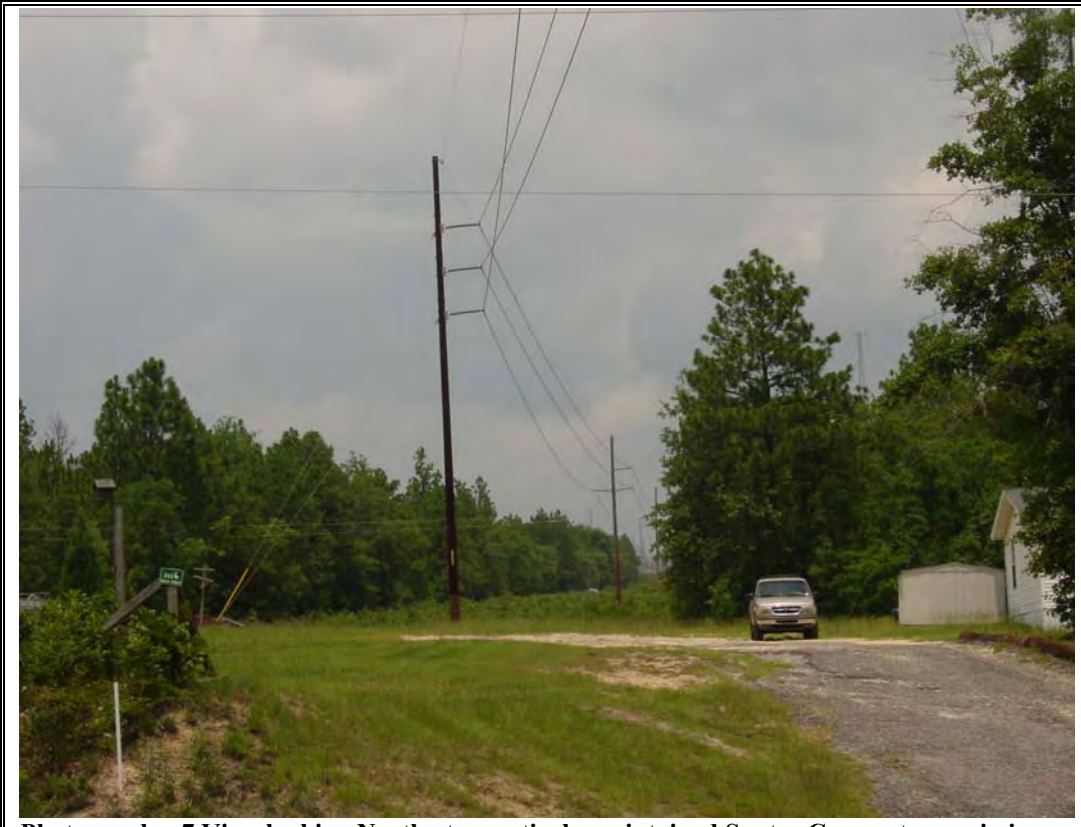
Photograph 3 – Santee Cooper transmission ROW located near Sandy Run substation on VCSNS Varnville line near Pine Plain Road in Lexington County, SC. Metal monopoles are supporting the power lines. (July 2008)

Photograph 4 – Example of transmission ROW with concrete H-poles supporting power lines. All newly constructed transmission ROWs will use metal or concrete poles. This photo was taken off of Highway 394 in Aiken County, SC. (July 2008)

Photograph 5 – View looking down an actively maintained Santee Cooper transmission ROW on VCSNS Varnville line with wooden poles supporting power lines. Sandy Run substation is viewed in the distance. Photo taken near Frank Moorer Road in Lexington County, SC. (July 2008)



Photograph 6 – View looking down an actively maintained Santee Cooper transmission ROW on VCSNS Varnville line. Wooden power poles are utilized extensively in existing transmission corridors, but metal/concrete poles will be used exclusively in newly constructed ROWs. (July 2008)



Photograph – 7 View looking North at an actively maintained Santee Cooper transmission corridor on VCSNS Varnville line using only wooden power poles to support transmission lines. Photo taken near Mack Road in Lexington County, SC. (July 2008)

Photograph 8 – View looking at a transmission ROW with metal monopoles supporting transmission lines. All newly constructed transmission ROWs will use metal or concrete poles.

Photograph 9 – View looking down an actively maintained transmission ROW coming directly out of V.C. Summer Nuclear Station. Wooden H-poles are supporting transmission lines. (July 2008)

Photograph 10 – Looking West along a perennial Piedmont stream that flows perpendicularly across an existing transmission corridor near VCSNS. Photo taken in forest immediately adjacent to transmission corridor. (July 2008)

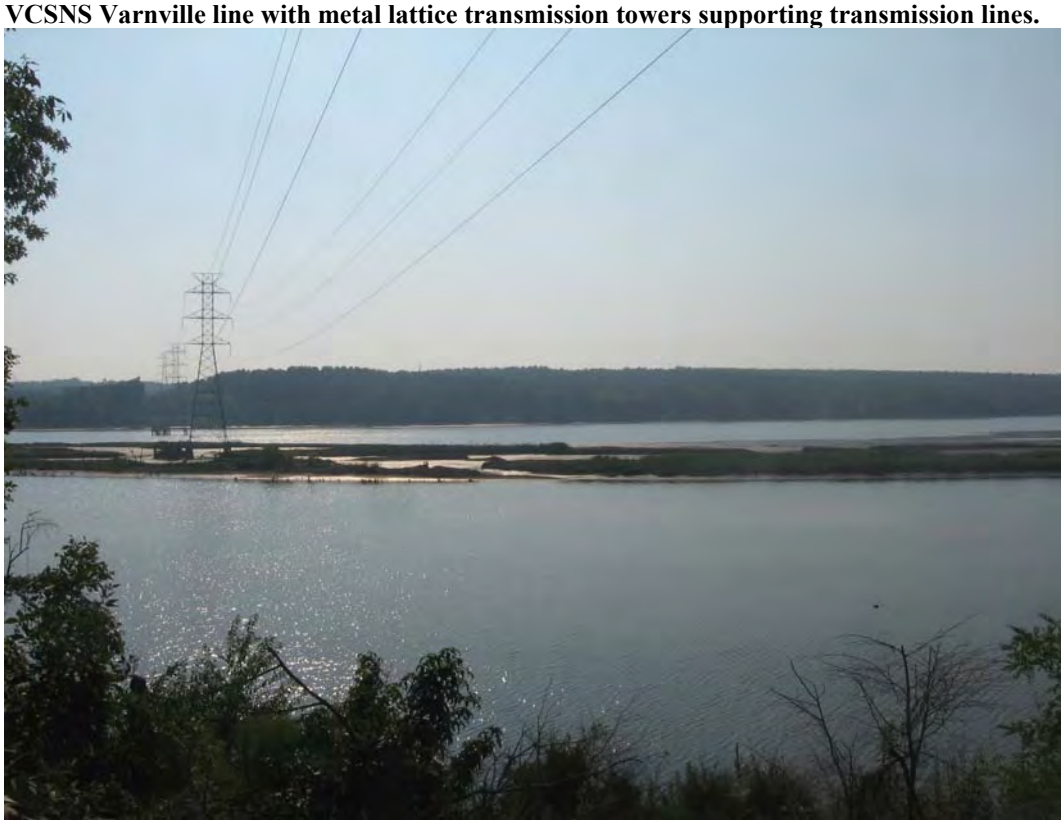
Photograph 11 – View looking Southwest down an existing transmission ROW on the VCSNS Varnville line into a jurisdictional wetland located at the bottom of the ridge. (July 2008)

Photograph 12 – Looking into jurisdictional wetland located within the proposed new 2.44 mile segment of transmission ROW coming out of V.C. Summer Nuclear Station. (July 2008)

Photograph 13 – View of an existing transmission ROW on VCSNS Flat Creek line with wooden H-poles supporting transmission lines. Wooden poles are used extensively on existing transmission lines, but metal/concrete poles will be used exclusively on newly constructed transmission corridors. (July 2008)

Photograph 14 – View looking West at existing transmission ROW crossing Parr Reservoir and the Broad River. (July 2008)

Photograph 15 – View looking East along existing, actively maintained transmission ROW on VCSNS Varnville line with metal lattice transmission towers supporting transmission lines.



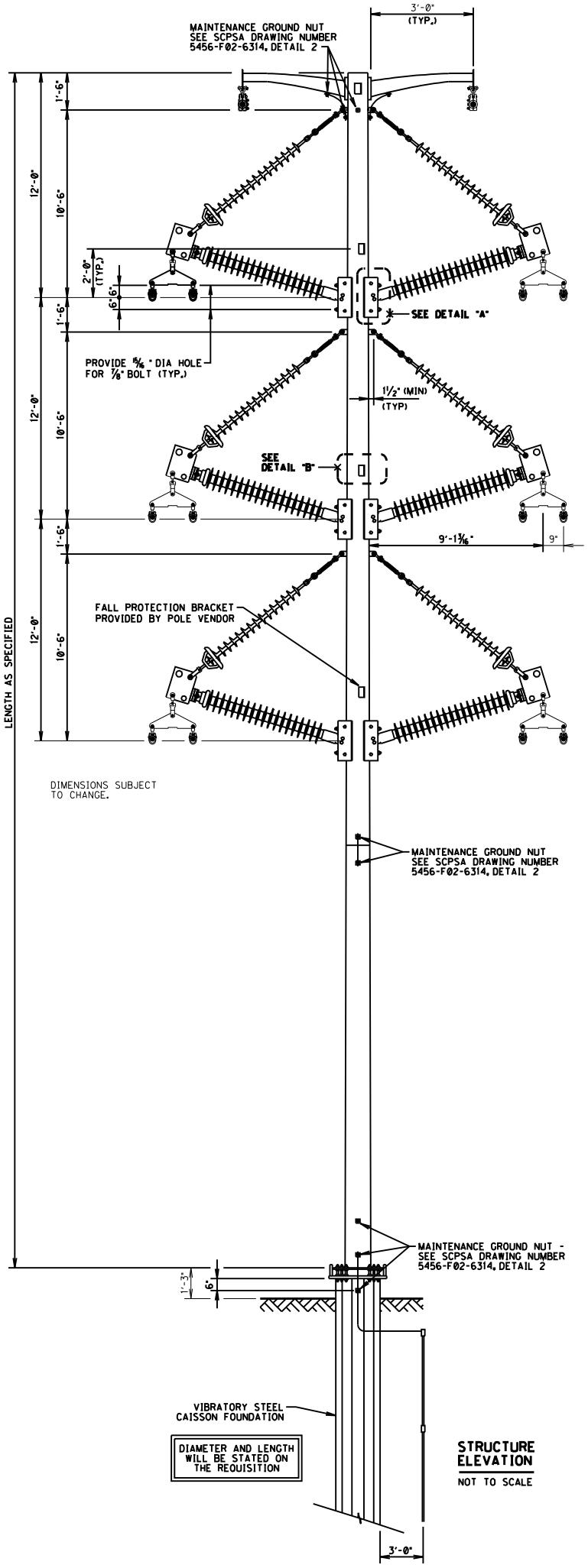
Photograph 16 – View looking East at Santee Cooper ROW crossing Parr Reservoir and the Broad River. (July 2008)

Photograph 17 – View looking East along existing, actively maintained Santee Cooper transmission ROW. Photo taken shows the transmission corridor crossing a jurisdictional wetland associated with Parr Reservoir. (July 2008)

Photograph 18 – View Looking South along the jurisdictional wetland associated with Parr Reservoir and into the forested wetland further back. Photo was taken from within the transmission ROW. (July 2008)

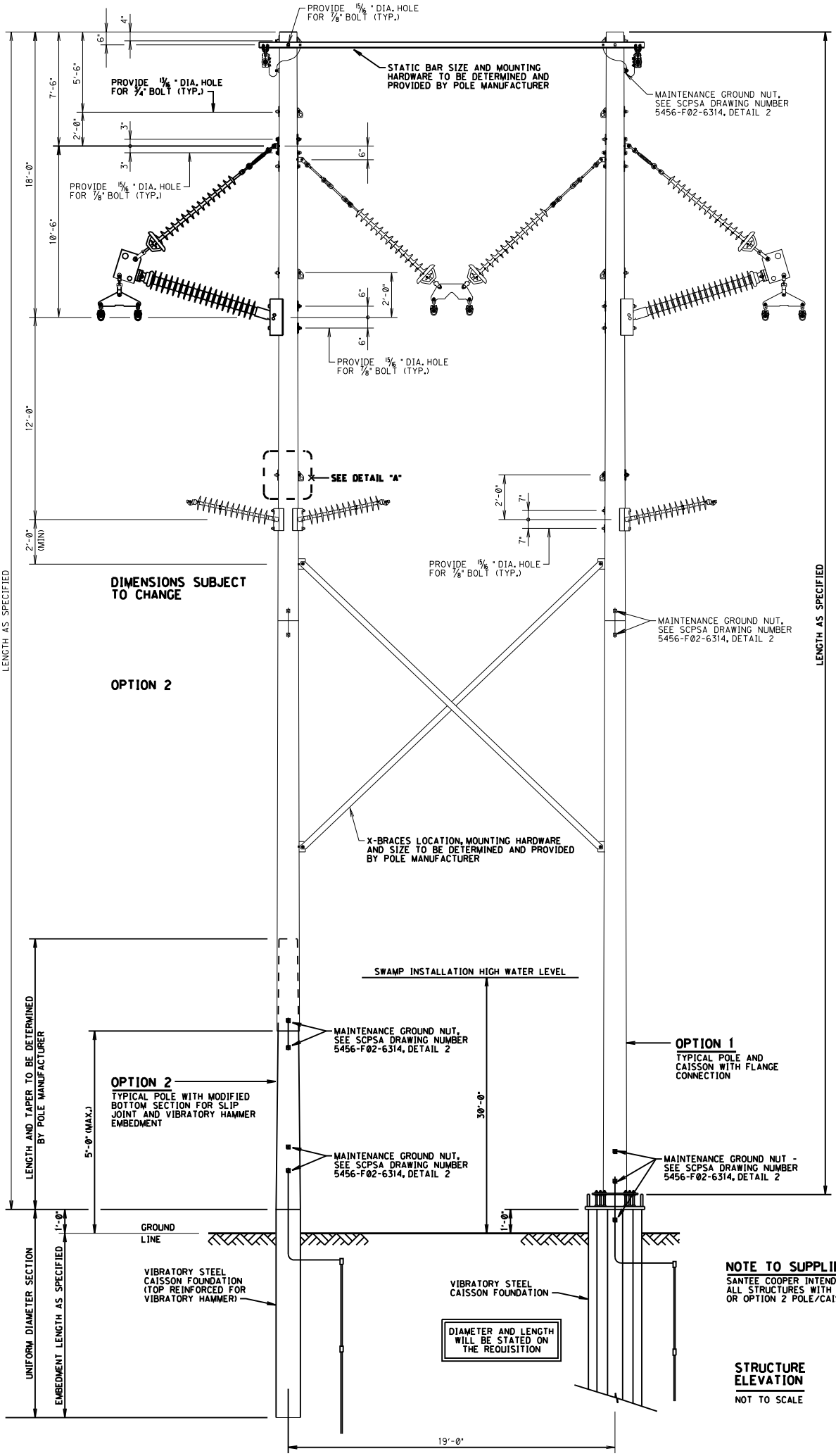
Appendix B

Santee Cooper Support Documents



STRUCTURE ELEVATION

NOT TO SCALE


PROVIDE 15/16" DIA. HOLE FOR 7/8" BOLT (TYP.)
STATIC BAR SIZE AND MOUNTING HARDWARE TO BE DETERMINED AND PROVIDED BY POLE MANUFACTURER
MAINTENANCE GROUND NUT, SEE SCPSA DRAWING NUMBER 5456-F02-6314, DETAIL 2
PROVIDE 15/16" DIA. HOLE FOR 3/4" BOLT (TYP.)
PROVIDE 15/16" DIA. HOLE FOR 7/8" BOLT (TYP.)
SEE DETAIL "A"
DIMENSIONS SUBJECT TO CHANGE
OPTION 2
LENGTH AS SPECIFIED
X-BRACES LOCATION, MOUNTING HARDWARE AND SIZE TO BE DETERMINED AND PROVIDED BY POLE MANUFACTURER
SWAMP INSTALLATION HIGH WATER LEVEL
OPTION 1
TYPICAL POLE AND CAISSON WITH FLANGE CONNECTION
OPTION 2
TYPICAL POLE WITH MODIFIED BOTTOM SECTION FOR SLIP JOINT AND VIBRATORY HAMMER EMBEDMENT
LENGTH AND TAPER TO BE DETERMINED BY POLE MANUFACTURER
5'-0" (MAX.)
30'-0"
GROUND LINE
UNIFORM DIAMETER SECTION
EMBEDMENT LENGTH AS SPECIFIED
VIBRATORY STEEL CAISSON FOUNDATION (TOP REINFORCED FOR VIBRATORY HAMMER)
VIBRATORY STEEL CAISSON FOUNDATION
DIAMETER AND LENGTH WILL BE STATED ON THE REQUISITION
19'-0"
NOTE TO SUPPLIER:
SANTEE COOPER INTENDS TO PURCHASE ALL STRUCTURES WITH EITHER OPTION 1 OR OPTION 2 POLE/CAISSON LEGS.
STRUCTURE ELEVATION
NOT TO SCALE

RIGHT-OF-WAY MANAGEMENT UNIT PLAN
2008

I. OBJECTIVE

To provide a cost effective and integrated Transmission Vegetation Management Program (TVMP) that protects system availability from undesirable vegetation growth.

II. GOALS

- Comply with NERC Standard FAC-003-1
- Ensure that undesirable woody vegetation growth does not interfere with the inspections and maintenance of transmission facilities by line personnel
- Utilize WMIS (Work Management Information System) to ensure that all maintenance items are scheduled and completed as designed
- Ensure that annual maintenance production totals are compatible with established maintenance cycles
- Promote a positive public image

III. ORGANIZATION

The Right-of-Way Management section is comprised of three distinct units that are responsible for a variety of right-of-way related maintenance activities. *Mechanical Reclearing* is the largest of the three units with respect to the number of company personnel and is responsible for the mechanical reclearing and soil stabilization of selected transmission rights-of-way. This unit is made up of a Supervisor, two (2) crew leaders, ten (10) equipment operators. A second unit, *Right-of-Way Management*, is responsible for herbicide related vegetation maintenance, scheduling of right-of-way maintenance work through WMIS, encroachment enforcement, and administering the POWER for Wildlife Program. This unit is made up of a Superintendent, Supervisor, Right-of-Way Specialist, Technical Associate, Administrative Associate, and an equipment operator. A third unit, *Contract Reclearing*, is responsible for all tree related maintenance throughout the transmission system. In addition, this unit currently oversees the activities of Environmental Interns during the summer months. This unit is made up of a Supervisor, Right-of-Way Forester (vacant position) and a Sr. Right-of-Way Specialist.

The overall supervision and direction of this section is the responsibility of the Superintendent, Right-of-Way Management. Reporting directly to the Superintendent are supervisors from each of the maintenance units, a Right-of-Way Specialist, and an Administrative Associate.

IV. CUSTOMERS

The majority of Right-of-Way Management programs support the daily operations and maintenance of Transmission Operations. However, the diversity of personnel skills and equipment, within this section, has allowed the customer base to increase over the years. Other customers include Project Management, Survey, Substation Maintenance, Distribution, and landowners along transmission rights-of-way. Services include side trimming, clearing of existing rights-of-way, facility spraying (e.g., substations, material storage sites, etc.), erosion control oversight (capital projects), and planting recommendations for POWER for Wildlife applicants.

V. RESPONSIBILITIES

Right-of-Way Management is responsible for maintaining approximately 36,000 brush acres as well as danger trees on the periphery of the right-of-way on over 3,900 miles of transmission lines. The Santee Cooper transmission system is located throughout the state which creates a number of vegetation maintenance problems due to the differing topography, soil types, and climates found throughout the state. In order to maintain an efficient and cost-effective right-of-way maintenance program, it is important to consider these problems and provide an integrated, proactive approach that is cyclic in nature.

Current maintenance programs include mechanical reclearing, low volume herbicide spraying, and tree maintenance which are recognized industry wide as well as by the new NERC vegetation management standards as an effective means of controlling undesirable woody vegetation. Although each program is independent of the other, together they provide the basis of an integrated vegetation management program that can effectively deal with any vegetation related condition while protecting system availability. Also, Right-of-Way Management administers several other programs that are included with the responsibilities listed below.

A. **Mechanical Reclearing:** Approximately 19,000 acres of transmission rights-of-way are recleared on a 2 ½ - 3 year cycle, using medium to heavy 4WD tractors and associated mowing implements, to ensure that vegetation growth does not adversely effect system reliability. Also, reclearing personnel utilize herbicides to control vegetation throughout their respective mow area. This includes applying granular herbicide at the base of selected transmission structures in order to reduce the potential of damage from wild fires and/or facilitate ground rot inspections by line personnel. Also, crews treat wetland areas (i.e., areas where equipment can not traverse) with a foliar herbicide application, using a Marsh Master, to control woody vegetation.

Typically, the entire right-of-way will be recleared according to the easement specifications less any areas that are planted (i.e., agricultural lands and wildlife food plots will be skipped). An exception to this would be on rights-of-way where steep topography creates areas with extreme relief and transmission structures are positioned at the two highest topographical points. As long as clearances are maintained naturally and operations and maintenance are not

affected, it is more cost effective to leave this portion of the right-of-way undisturbed during reclearing operations.

1. **Manual Reclearing:** Manual reclearing plays a relatively small role in Santee Cooper's over-all vegetation management plan. Typically, the only two conditions that would initiate a manual reclearing operation is an easement restriction (i.e., any wording in the easement that would preclude the use of mechanical equipment and/or herbicides) or when a potential reliability issue is identified in a problem area (i.e., when a right-of-way inaccessible to mechanical equipment has vegetation growing at or near the conductor).

   Utilizing chain saws, brush saws, and/or bush axes, personnel reclear the right-of-way of any woody vegetation. Typically, low growing shrubs including waxy species are left uncut.

B. **Herbicide Spray Programs:** The goal of the herbicide program is to control woody vegetation that could interfere with the normal transmission of electricity while promoting low growing native vegetation. This will increase plant bio-diversity and enhance wildlife habitat along transmission corridors. The current practice of applying herbicides is to selectively treat undesirable vegetation using a low volume methodology.

The amount of herbicide applied is dependent on the species composition, density, and size of the vegetation present. The selective application technique requires less active ingredient to be applied per acre, as compared to the broadcast method. Only herbicides that have been approved by the USEPA (United States Environmental Protection Agency) are used in applications along the right-of-way. Also, all herbicides are applied in accordance with manufacturer labeling. In addition, personnel are trained in the use of current formulations and application techniques and hold a South Carolina Certified Pesticide Applicator License.

1. **Whole Line Spraying:** Transmission rights-of-way that are treated from one substation to the next, without any skips, are considered to be whole line applications. Currently, 15,600 acres of transmission rights-of-way have been designated for whole line work. Both existing and new line sections selected for the Whole Line program are treated approximately 1 – 1 ½ after scheduled maintenance or initial clearing with resulting vegetation heights ranging from 2' to 4' feet at the time of treatment. This vegetation height provides adequate foliage for herbicide uptake and requires less active ingredient per acre to control undesirable vegetation as compared to treating taller vegetation. Also, as the vegetation begins to succumb to the effects of the herbicide, there is a less noticeable brownout.

   Utilizing a **selective** low volume approach, personnel equipped with backpacks will treat only undesirable vegetation along selected rights-of-way. Hardwoods such as sweetgum, red maple, ashes, and various oaks that are tall growing and prolific sprouting species, as well as, pines are targeted. By removing these trees, desirable plants such as grasses and forbs can compete for nutrients and, in the long term, provide substantial

biological control. Selective spraying will result in a greater bio-diversity of plant life thus enhancing wildlife habitat for most game and non-game species.

After the initial herbicide application, there will be a follow-up inspection (e.g., aerial & ground) during the next growing season to identify any areas that may require a follow-up treatment. Spray rotations will then take place on a 3 year rotation. Because the density of undesirable vegetation will have been reduced, subsequent herbicide applications should require less herbicide to control the vegetation present.

2. **Wetland Area Spraying:** Wetland areas are defined as any area, typically a low area, on a transmission right-of-way that is inaccessible to mechanized reclearing equipment due to poor soil conditions. Currently, approximately 3,500 acres of significant sized wetland areas have been identified within the transmission system. **Note: ~ 1,100 acres and ~2,500 acres of wetland areas are managed in the whole line and mow areas, respectively.**

   Ground crews (includes both contractors and in-house personnel) utilize backpacks and/or an ATV (Argo, Marshmaster, etc.) equipped with a hydraulic spray system to foliar treat only the undesirable vegetation present. Current procedures dictate a **selective,** low volume (10 - 40 gallons mix/acre) herbicide approach that minimizes the amount of active ingredient applied per acre.

   The herbicide products used during Wetland Area Spraying are determined by the species present and to a greater extent by the site location. In areas that have standing water and are connected to a larger aquatic system (e.g., river, swamp, etc.), only EPA approved herbicides registered for use in wetland or aquatic sites are used.

   Wetland areas are typically scheduled on either a three or four year rotation depending on the vegetation species that are present, densities of woody vegetation, and height of conductors. As with whole line applications, vegetation densities should decrease with subsequent applications requiring less herbicide to be applied.

C. **Tree Maintenance Programs:** Trees growing outside the right-of-way boundaries provide the greatest potential threat to the transmission system. When these trees reach a sufficient height or have limbs extending into the right-of-way that are in close proximity to a conductor(s) (i.e., no closer than the minimum clearance that is set forth in the Institute of Electrical and Electronics Engineering (IEEE) Standard 516-2003, section 4.2.2.3), they are considered problem trees. Three distinct operations that include side trimming, patrolling, and danger tree maintenance are used to remove and/or trim reported problem trees along approximately 3,900 miles of transmission line.

1. **Side Trimming:** Transmission lines with tree limbs encroaching into the right-of-way that create a problem for maintenance and operations are scheduled for side trimming. Typically, this occurs on narrow rights-of-way or when several lines have been stacked on a single transmission corridor. Maintenance options include removing encroaching limbs from the air and/or the ground. The aerial operation consists of using a set of belt driven saws, suspended from a helicopter, to cut the limbs back to the edge of the right-of-way. Ground operation consists of using a machine called a Jarraff or Skytrim to perform a similar function. This machine has an extendable boom with an attached circular saw that can reach and trim tree limbs high above the ground. Both options provide a cost effective method for ensuring that adequate clearances between transmission conductors and live trees are maintained.

2. **Patrolling:** Patrol crews (e.g., typically 3 men) are used throughout the system to remove trees reported through WMIS as dead, diseased, and/or leaning and pose a threat to system availability. Due to the crew size and required equipment, they are very mobile and able to deal with tree issues in remote locations.

3. **Danger Tree Maintenance:** Danger Tree maintenance is currently being completed on selected capital construction and/or special right-of-way reclamation projects. The establishment of a normal system-wide cycle for O&M operations is being considered. During these O&M operations, easements are researched and landowners are contacted approximately six months prior to this operation. Once this has been accomplished, maintenance personnel utilize an instrument (e.g., clinometer) that measures angles to determine whether a tree located off the right-of-way is tall enough to hit the transmission conductor if it were to fall. Depending on the species of tree, height, age, and site index, the tree will either be felled whole or topped. The decision to top or fell is made by the forester in charge of the operation based on his opinion of tree survivability after topping. However, the landowner may request that any or all trees be felled if a timber sale is planned. Felled trees are de-limbed and decked between the spans in which they were cut. Typically, the easement provides that any felled trees belong to the grantor and/or current landowner. The resulting debris (tree tops and limbs) are left in the right-of-way to decay.

D. **Erosion Control Program:** Reported erosion problems are rated from low to extreme based on soil type, topography, and proximity of eroded area to a transmission structure. This information is used to prioritize and schedule erosion control measures that will provide long-term control and ensure system reliability.

Corrective action measures include grading the eroded area and, if necessary, constructing earthen terraces to divert surface waters across the right-of-way. Crews then will plant the area with an appropriate seed mix for the season and soil characteristics. To enhance stability and ensure that the terraces and repaired rights-of-way are not impacted by rains before grasses are established, hay bales or other erosion control structures are installed to protect them.

E. **Wildlife Habitat Enhancement Program:** In an effort to reduce the overall number of right-of-way acres requiring maintenance and at the same time encourage wildlife habitat enhancement, Santee Cooper entered into a partnership in a new state wide program called POWER (Protect Our Wildlife at Every Right-of-Way) for Wildlife. This Program originated in 2000 and provides monetary grants to approved landowners that were willing to maintain and enhance their rights-of-way for wildlife habitat. Landowners interested in the Program are required to submit an application along with a vegetation plan that shows a five-year commitment to right-of-way maintenance and wildlife habitat enhancement on their property. Applications are rated on several criteria including current soil conditions, benefit to the utility, and the ability of the landowner to maintain the right-of-way for the long term. To date, 1,800+ acres along Santee Cooper's transmission corridors have been maintained to enhance wildlife habitat. Also, planted areas are marked with POWER for Wildlife signage that is provided by Santee Cooper.

F. **Flood Control Program:** This section inspects problem rights-of-way and schedules flood control activities, when necessary, to remove dam debris resulting from beaver activities. This protects transmission facilities such as switches, poles, and guy anchors from premature corrosion and rotting.

G. **Facility Spraying Program:** This section is responsible for herbicide treatments within transmission and distribution substations, communication sites, crew quarters, and material storage yards to control vegetation growth. This is done primarily for safety reasons and also for aesthetics. Individuals responsible for the grounds within substations and warehousing yards are contacted at the beginning and during the spray season to ensure that their needs are being adequately met.

H. **Line Inspections:** New Central Electric transmission rights-of-way are inspected to ensure that right-of-way conditions are favorable for O&M acceptance by Santee Cooper. Danger trees, erosion, correct right-of-way widths, and stump levels are some of the major items that are inspected.

I. **Gate/Lock Program:** Right-of-Way Management is responsible for the budgeting, requisitioning, and supplying of gates and locks to support Transmission Operation requirements. The main goal of this Program is to help facilitate access to and along transmission rights-of-way for key maintenance personnel.

J. **Encroachment Program:** All encroachments (structures, pools, utility crossings, etc.), both permissible and non-permissible, that are located within transmission rights-of-way will be processed through this section. The intent of this program is to identify, document, and remove any encroachment that interferes with transmission maintenance & operations or is a public safety issue. All other encroachments will require an agreement with the respective landowner or an assignee. A detailed corporate procedure (3-06) on how to process encroachments is available on *I*Port.

VI. CONCLUSION

Right-of-Way Management continues to evaluate current maintenance programs to ensure that system reliability and right-of-way integrity are not compromised due to the lack of maintenance. The programs discussed in this plan continue to evolve as added maintenance responsibilities are presented due to the increasing size of the transmission system.

An integrated maintenance program will continue to be an integral part in keeping reclearing costs contained as new acres are added to the system. Also, Right-of-Way Management personnel will have to keep abreast of changing environmental regulations so landowner rights and natural resources are protected.

PART A2 - RIGHT-0F-WAY CLEARING

4A2: 1 METHOD OF CLEARING RIGHT!OF!WAY

4A2: 1.1 General

4A2: 1.1.1 Areas to be cleared, along with the extent and types of clearing, will be shown on the plan and profile drawings which will be furnished to the BIDDERS at the pre-bid meeting.

4A2: 1.1.2 Standard forestry practices will be followed to determine whether topping or removal of danger trees is recommended; however, the OWNER is the sole determinant as to which method is used. All danger trees that are removed will be cut in a manner to minimize the damage to the existing vegetation.

4A2: 1.1.3 The CONTRACTOR will be permitted to chip trees and spread contents along the right-of-way in upland areas. However, this will not be allowed in wetland areas or areas stipulated by special easements.

4A2: 1.1.4 All clearing, tree trimming, tree topping and danger tree removal shall be performed only to the extent indicated and as directed by the OWNER.

4A2: 1.1.5 Appropriate drawings and easements will show where restrictions and/or special provisions apply to clearing operations. These restrictions and/or special provisions shall be strictly observed by the CONTRACTOR.

4A2: 1.1.6 All operations included as part of the CONTRACTOR=S WORK shall closely follow the cutting of timber so that the length of time a segment of line is being worked on shall be the shortest time practicable, consistent with orderly and efficient conduct of overall clearing operations. As the WORK of clearing is completed in each

area, the CONTRACTOR shall promptly remove all tools and equipment and clean up the area. If, during the clearing operations, the CONTRACTOR makes deep ruts, stump holes or mounded areas, either on the right-of-way, or in obtaining access to the right!of!way, which in the judgment of the OWNER would cause future erosion or nuisance, all such conditions shall be graded to conform to previous natural levels to the satisfaction of the OWNER.

4A2: 1.1.7 All roads and paths, regardless of whether they show recent use or not, shall be left clear of logs, except as designated by the OWNER as an erosion control measure. No logs are to be left in ditches, drains, or creeks of any description.

4A2: 1.1.8 The CONTRACTOR will be required to treat all hardwood stumps six inches or greater in diameter within the right-of-way with an approved EPA herbicide to prevent or inhibit future sprouting. This treatment should be applied within 24 hours of the tree being cut. If the treatment is not applied within 24 hours, the treatment must be applied with an oil application to break down the hardened wood to allow the herbicide to work. The CONTRACTOR must mix a dye with the herbicide so the OWNER can identify the stumps treated. The herbicide must be applied to the cambium layer (the outside 2 - 3 inch layer from the bark inward) of the stump. The herbicide and oil application (if required) must be approved by the OWNER prior to using. This work shall be included in the cost of clearing the right-of-way on the Bid Schedule.

4A2: 1.2 <u>Clear!Cut Clearing with Previous Logging (Type I)</u>

4A2: 1.2.1 The CONTRACTOR shall cut and remove all trees and underbrush within the

right!of!way which have been left after the logging operation. No stumps shall be left extending more than three (3) inches above the natural ground surface.

4A2: 1.2.2 All trimming and all trees, limbs, branches, and brush on the right!of!way which have a diameter of less than four (4) inches DBH (Diameter Breast Height) shall be piled and burned or otherwise disposed of as directed by the OWNER.

4A2: 1.2.3 Height of trees to be classified as Adanger trees≅ will vary with the width of the right!of!way and with the location of the line to the centerline of the right!of!way. The OWNER will be responsible for marking the danger trees.

4A2: 1.3 <u>Clear!Cut Clearing Without Previous Logging (Type II)</u>

4A2: 1.3.1 The CONTRACTOR shall cut and remove all trees and underbrush within the right!of!way and all trees outside this limit which have been termed Adanger trees≅ as further specified herein. No stumps shall be left extending more than three (3) inches above the natural ground surface.

4A2: 1.3.2 Height of trees to be classified as Adanger trees≅ will vary with the width of the right!of!way and with the location of the line to the centerline of the right!of!way. The OWNER will be responsible for marking the danger trees.

4A2: 1.3.3 All timber will be sold to the CONTRACTOR unless otherwise specified in Part B.

4A2: 1.3.4 When timber is to remain the property of the OWNER or the property owner, as specified in Part B, all trees that have been cleared which are greater than four (4) inches DBH shall be trimmed of

limbs and branches and left in tree lengths. Trees, limbs, and branches less than four (4) inches DBH shall be piled and burned or otherwise disposed of as directed by the OWNER. Pine and hardwood shall be separated and stacked in full lengths along the edge of the cleared right!of!way with all butts in each stack turned the same direction. No such logs shall be stacked in such a manner as to rest against live trees. The CONTRACTOR shall allow the timber buyers to use equipment on the right!of!way to pick up and haul the timber off the right!of!way.

4A2: 1.4 Grubbing

Grubbing will be necessary only in the areas as specified on the plan and profile. If required, after the initial clearing operation, all stumps and debris within the right!of!way will be removed and disposed of as directed by the OWNER.

4A2: 1.5 Screen Clearing (Type III)

4A2: 1.5.1 Screen clearing will be done on both sides of roads and river crossings when specified on plan and profile drawings. Screening areas will extend from the edge of the road or river into the wooded area to be cleared for a distance as specified on the plan and profile. No stacking, staging or burning will be permitted in the screening area.

4A2: 1.5.2 When designated for screen clearing, all existing vegetation within the right!of!way limits, including forest types or ornamental trees, shall be preserved to the greatest extent possible, except where its removal is required for erection of line structures or conductor installation.

4A2: 1.5.3 Conductor clearances will be obtained by trimming or topping.

Where the amount of trimming or topping required is such as to endanger the normal life of a tree, or destroy its natural symmetry, that tree shall be removed.

4A2: 1.5.4 All trimming, topping or tree removal shall be done in such a manner as to develop a softened effect that blends the right!of!way clearing into the surrounding undisturbed vegetation without sharply defined breaks or patterns.

4A2: 1.5.5 When trees are specified to be topped or trimmed, this WORK should be done in such a way to prevent excessive broken limbs or other serious damage to the portion of the tree left in place. Trees trimmed and/or topped must meet ANSI A300 standards.

4A2: 1.5.6 The slashing along with any tree removed shall be removed from the right!of!way or chipped. Chips may not be spread in screen areas.

4A2: 1.6 <u>Clearing In Wetlands</u>

4A2: 1.6.1 The right!of!way will not be clear cut. The natural short shrubby vegetation will be preserved. The large canopy trees and small sapling trees (like maple and sweetgum 4' tall or greater) shall be cut.

4A2: 1.6.2 There will be no change in pre!clearing ground contours and final ground contours. Any ruts or depressions made during clearing must be corrected immediately. The method of correction must be approved by the OWNER.

4A2: 1.6.3 No material shall be placed in any location or any manner so as to impair surface water flow into, out of, or across a wetland area. The natural flow of the water shall not be redirected.

4A2: 1.6.4 No activities shall be permitted that will cause an erosion problem.

4A2: 1.6.5 The trees must be cut to three (3) inches above the soil surface. In areas of standing water, trees shall be cut within three (3) inches of the water surface. If the water recedes prior to the completion of the clearing contract, the CONTRACTOR will be required to re-cut the stumps to three (3) inches above the soil surface at no extra cost. The root system must be preserved to the maximum extent possible.

4A2: 1.6.6 Windrowing or burning will not be allowed.

4A2: 1.6.7 Grubbing, discing, raking, grading, digging, filling, or any other soil disturbing activities, except to correct any ruts, will not be allowed.

4A2: 1.6.8 High flotation rubber tired and track vehicles will be allowed for the removal of the felled trees in order to minimize the disturbance to the soil in wetland areas. The method of clearing must be approved by the OWNER prior to the start of WORK.

4A2:1.7 Special Clearing

Any clearing other than Type I, Type II, Type III, and wetlands will be termed as special clearing and specified in Part B.

Appendix C

List of Preparers

List of Preparers

Santee Cooper staff supplied information relating to the siting and design of the transmission lines, maintenance and clearing descriptions, and support information for the Safety and Electromagnetic Fields sections of the report.

TRC Companies, Inc. (TRC) completed a cultural resources literature and records review for the transmission line corridors. TRC's Draft Report dated July 2008 was used to prepare the Cultural Resources sections of this report.

D&D West, Inc. completed the wetland and protected species surveys along the 2.44 miles of proposed new ROW and provided the initial text for the protected species section of the report.

MACTEC STAFF:
Allen Conger (B.S. Natural Resources and Ecology) served as the principal project scientist, which included providing direction and supervision of field activities and senior technical review of the report. Mr. Conger is the senior Natural Resources Manager for MACTEC and has over 20 years experience in preparing natural resources assessments.

Karl M. Rains (B.A. Business Administration, M. Environmental Law, M. Earth and Environmental Resources Management) served as the project coordinator, responsible for compilation of the report sections and initial technical review. He was the primary author of the Executive Summary, Introduction, Project Purpose & Need, and the summary of environmental impacts.

Angela Vandelay (B.S. Chemical Engineering, M.S. Environmental Engineering) provided technical assistance during report preparation. She was the primary author for report sections related to transmission line alternatives, land use, cultural resources, resident population, aesthetics & noise, electromagnetic fields, safety, air quality and aviation.

Susan Kelly (B.S. Civil Engineering, M.S. Hydrogeology) provided technical assistance during report preparation. She served as primary author for the report sections related to geology/soils, prime farmland, hydrology/water resources and floodplains.

Pamela Ferral (B.S. and M.S. Fisheries and Wildlife Science) provided technical assistance during report preparation. She served as primary author for report sections related to wildlife and co-authored protected species sections of the report.

Ron Chicone (B.S. Biology) provided technical assistance during report preparation. He provided GIS support and served as primary author for report sections related to wetlands and land cover/vegetation.

William Medlin (B.S. Biological Sciences) provided field services and technical assistance during report preparation. He assisted D&D West with the wetland and protected species surveys along the 2.44 miles of proposed new ROW and prepared the Photo-log (Appendix A) and cover art for the report.

Casey Scott (B.S. Biology, M.S. Water Resources) assisted with quantifications from GIS resources and created all of the figures for the report.

Brian Mueller (B.S. Water Resources-Limnology) generated quantifications and provided QA support for GIS needs. Mr. Mueller is a GIS manager for MACTEC and has 20 years experience in natural resources assessments.