2.4 ECOLOGY

An understanding of the ecological resources that have the potential to be impacted by the construction and operation of new nuclear units on the VCSNS site is essential to the evaluation of ecological impacts in Chapters 4 and 5. This section addresses resources for the two ecological environments, terrestrial, and aquatic.

2.4.1 TERRESTRIAL ECOLOGY

2.4.1.1 Site Description and Habitats

The VCSNS site (as defined in Subsection 2.2.1.1) is located within the Piedmont Physiographic Province and is just east of the Broad River. Piedmont terrain is characterized by gently rolling hills and broad, relatively shallow valleys. The VCSNS site lies within a sparsely populated, largely rural area, with the dominant land use being forests and small farms. Forests surrounding the VCSNS site consist of planted pines and second growth forests of hardwoods and mixed pine-hardwoods.

Current land use at the VCSNS site is discussed in Section 2.2 and shown in Figure 2.2-1. Approximately 370 acres of the VCSNS site consists of generation and maintenance facilities, laydown areas, parking lots, roads, cleared areas, and mowed grass associated with Unit 1, and approximately 125 acres consist of transmission line corridors. No preexisting stresses or stressors to wildlife are known.

The forests at the VCSNS site are characteristic of Piedmont forests, with a variety of canopy types. Most of the canopies are dominated by loblolly pine or are mixed pine/hardwood stands of second growth forest. The majority of the pine forests are managed pine “plantations.” Some hardwood forest occurs, especially on slopes and along streams. No forest on the VCSNS site is a virgin or near-virgin stand.

Native pines dominate the northern portion of the area in which the cooling towers would be located. Hardwoods dominate the central portions of the proposed cooling tower area and a portion of the construction offices/parking area (Figure 2.4-1). Canopy species consist of yellow poplar, American holly, Florida maple, chalk maple, white oak, southern red oak, ash, mockernut hickory, and loblolly pine. Subcanopy species include redbud, pawpaw, red buckeye, Russian olive, muscadine, red mulberry, and hornbeam. Herbaceous plants include bloodroot, wild geranium, fly-poison, wild ginger, mayapple, ebony spleenwort, black cohosh, crown-beard, elephant’s-foot, and wild comfrey. The upper portion of a small intermittent stream extends slightly into the area in which the cooling towers would be located.

The proposed switchyard construction area is primarily planted and natural loblolly pines. The proposed spoils areas are planted and native loblolly pines or cleared areas. The southern portion of the area in which the cooling towers would

be located, as well as the area to the immediate south where the proposed batch plant and two construction laydown areas would be located, is largely old fields and young planted pine. Persisting native vegetation in this area is scarce, but includes blackberries, goldenrod, rabbit-tobacco, black cherry, winged sumac, poison ivy, and several weeds.

The headwater of a south-flowing tributary to Mayo Creek is located just west of the proposed batch plant within a fairly steep forested ravine. This area is outside the area that would be cleared during construction activities (Figure 2.4-1). The forest in this area consists of loblolly pine, with hardwoods (especially American beech) present along the stream.

Most of the area in which the proposed power block would be located consists of planted loblolly pines. However, some portions of this area consist of canopy-sized native loblolly pine, red maple, sweetgum, yellow poplar, white oak, black oak, and black gum. Subcanopy woody plants include considerable amounts of dogwood as well as Russian olive. Just southwest of the power block, the forests slope rapidly to the south and west, and a narrow streamhead drains its more southern regions (toward the west). The stream and associated wetland are located north of the proposed blowdown line and are outside the area that would be disturbed by construction activities (Figure 2.4-1). In general, the area along the stream features black willow, cottonwoods, various sedges (especially Carex), heal-all, rushes, and chain-fern. Exotic Vietnam grass is abundant.

The proposed blowdown line would be adjacent to an existing railroad spur that traverses areas of planted loblolly pines as well as hardwoods of the same species as mentioned above.

Proposed construction facilities would be located in the southeastern portion of the site (Figure 2.4-1). These areas are composed of mixed pine-hardwood forests or planted and native pines.

Wetlands at VCSNS site are associated with small streams. With the exception of the Mayo Creek and in drainages where beavers have created semipermanent ponds, the streams can be dry during periods of dry weather. The only named stream is Mayo Creek, which empties into the Broad River approximately 1.3 miles south of the proposed blowdown discharge area, slightly downstream from the Parr Shoals Dam that forms Parr Reservoir (Figure 2.1-3). Other than Monticello Reservoir and a few beaver ponds, there are no natural or man-made ponds on the site. All streams in the area ultimately drain into Parr Reservoir or to the Broad River downstream from the Parr Shoals Dam. Streamside management zones at the VCSNS site are protected in accordance with best management practices established by the South Carolina Forestry Commission.

Parr Reservoir provides some limited freshwater marsh habitat in shallow backwaters, around low-lying islands, and in an area east of the Fairfield Pumped Storage Facility tailrace that was used in the 1970s for the disposal of dredge spoil. These marshes and adjacent shallows are used by migrating dabbling ducks, including mallard, black duck, and teal. Monticello Reservoir also provides

resting areas for wintering waterfowl and year-round habitat for nonmigratory Canada geese. SCE&G has been recognized by the South Carolina Wildlife Federation for its efforts in establishing a self-sustaining, nonmigratory population of Canada geese on Parr and Monticello Reservoirs (SCE&G 2002a).

The Monticello Reservoir Waterfowl Management Area and the Parr Reservoir Waterfowl Management Area encompass Monticello Reservoir and Parr Reservoir, respectively. Public waterfowl hunting is managed in these two areas by the South Carolina Department of Natural Resources (SCDNR).

SCE&G has sited the proposed facilities and infrastructure to minimize impacts to wetlands. The upper portion of one small intermittent stream and its associated wetland extend slightly into the area in which the cooling towers would be located. The new main access road would cross Mayo Creek and its associated narrow wetland. Otherwise, no streams or wetlands are located in areas in which facilities or structures would be located. Boundaries of the impacted wetlands have been surveyed and a jurisdictional determination has been received from the U.S. Army Corps of Engineers (USACE 2009).

2.4.1.1.1 Terrestrial Wildlife

Wildlife species found in the forested portions of the VCSNS site are those typically found in Piedmont forests of South Carolina, and are discussed below.

Birds

Observations of birds on the VCSNS site were made during several site visits by biologists in 2002, 2006, 2007, and 2008 (Table 2.4-3). These site visits were not designed exclusively as bird surveys and thus, did not include systematic point counts or transects. Instead, avian species were documented by biologists while conducting endangered species surveys, small mammal trapping, or general wildlife and habitat surveys. Birds were identified by direct observation and calls and songs as biologists performed other surveys in the areas shown in color in Figure 2.4-2. Surveys were made in winter, spring, summer, and fall. Sixty avian species were observed during the various surveys (Table 2.4-3). Thirty-nine of the 60 species observed are present year-round in the region and could breed on or near the site. Ten species are present only during the breeding season, and 11 species are present only in winter (Table 2.4-3). Species such as the American crow, blue jay, Carolina chickadee, mourning dove, black vulture, turkey vulture, American robin, dark-eyed junco, Northern cardinal, tufted titmouse, Northern mockingbird, and red-bellied woodpecker were considered common or abundant at the site.

Mammals

Mammal species either observed or indicated by tracks and other signs on the site during the same periods during which birds were recorded (see Table 2.4-3) include whitetail deer, beaver, raccoon, opossum, gray squirrel, Eastern cottontail, bobcat, Eastern mole, hispid cotton rat, house mouse, Eastern woodrat, Eastern

harvest mouse, and white-footed mouse. Other mammals typically found in Piedmont forests of South Carolina, such as the gray fox, spotted skunk, and coyote undoubtedly exist at the site, as do smaller mammals such as shrews and a variety of mice and voles.

SCE&G conducted surveys for small mammals at VCSNS in October 2008 (TtNUS 2008) and Spring 2009 (TtNUS 2009a). In both trapping events, 20 Sherman™ live traps were placed along each of 11 transects (Figure 2.4-3). Transect locations were selected to cross various habitat types that would be disturbed by construction of Units 2 and 3. In the October 2008 survey, traps were initially placed and baited on October 27, and were checked each morning for four consecutive days (October 28 through 31). Thus, the study period consisted of 880 "trap nights" (20 traps/transect x 11 transects x 4 nights). Three mammals were captured during the October 2008 study: a cotton rat, a house mouse, and a white-footed mouse (TtNUS 2008).

In the Spring 2009 survey, traps were initially opened and baited on April 27, and were checked each morning for four consecutive days (April 28 through May 1). Thus, the 2009 survey also consisted of 880 trap nights. Thirty-nine mammals were captured during the 2009 study; these consisted of 24 cotton rats, six *Peromyscus spp*. (white-footed mice or cotton mice), five house mice, one Eastern woodrat, one Eastern harvest mouse, one least shrew, and one juvenile Eastern cottontail (TtNUS 2009a).

Mammal trapping studies were conducted at VCSNS prior to construction of Unit 1 and were reported in the Operating License Environmental Report (SCE&G 1974). Small mammals were trapped using snap traps, pit traps, and live traps during June 1971, September 1971, January 1972, and March 1972 in five areas. Habitats in the study areas in 1971 and 1972 were generally similar to those in the 2008 and 2009 surveys. Small mammals trapped during the four study periods in 1971 and 1972 consisted of 35 cotton mice, 12 cotton rats, 11 house mice, eight Eastern harvest mice, seven short-tailed shrews, seven Southeastern shrews, three least shrews, three golden mice, one pine vole, and one white-footed mouse (SCE&G 1974).

The difference between the high number of mammals captured in 1971 and 1972 relative to the lower numbers captured in 2008 and 2009 is at least partially due to the more intensive effort in the earlier surveys. A second probable factor in the difference in results between the 1971–1972 surveys and the 2008–2009 surveys is that a large portion of the study area was thinned in 2008 as part of forest management activities, and the thinned areas are largely devoid of groundcover vegetation; such areas lack desirable conditions of cover and food for many small mammal species.

The 39 captures in the Spring 2009 survey stand in sharp contrast to the three captures in the October 2008 survey, especially considering the same level of effort (880 trap nights using the same trap and bait types) in 2009 as in 2008. The trapping methodology was similar in the 2008 and 2009 surveys, except that traps were prebaited during the 2009 survey. Prebaiting consisted of placing the traps in

position approximately one week prior to opening the traps' doors and depositing a handful of bait (rolled oats) beside each trap. The purpose of prebaiting was to increase the probability of captures by providing several nights for small mammals in the vicinity to find and consume the bait, and then develop a habit pattern of returning to the trap during subsequent nights. Differences in capture rates between the Spring 2009 and October 2008 surveys were probably due to prebaiting of traps in 2009, revised transect locations in 2009, and seasonal factors. The species captured in 2008 and 2009 are typical for the region and generally reflect the species captured in the 1971 and 1972 surveys at VCSNS prior to construction of Unit 1.

Reptiles and Amphibians

Reptiles and amphibians encountered during sampling events (Table 2.4-3) included green anole, Eastern fence lizard, ground skink, broad-headed skink, Eastern box turtle, red-bellied watersnake, yellow-bellied slider, and pickerel frog. Reptiles and amphibians were recorded as they were encountered during endangered species surveys, small mammal trapping, and general wildlife and habitat surveys. The species noted above undoubtedly represent only a portion of the reptiles and amphibians on the VCSNS site, particularly along Parr Reservoir.

2.4.1.1.2 Endangered and Threatened Species

The U.S. Fish and Wildlife Service (USFWS) is responsible for designating areas of “critical habitat” for federally listed endangered and threatened terrestrial species. Such areas are considered essential to the species’ conservation, and may require special management and protection. No areas designated by the USFWS as critical habitat exist at or near the VCSNS site. “Critical habitat” or similarly defined classifications do not exist for state-listed species in South Carolina.

A survey for federally and state-listed species classified as threatened or endangered was conducted in May 2002 at the VCSNS site to support license renewal for Unit 1 (SCE&G 2002b). Although the survey was conducted for Unit 1 license renewal, a large portion of the area that would be disturbed during construction of Units 2 and 3 was included in the 2002 survey (Figure 2.4-2). Terrestrial surveys for federally and state-listed species classified as threatened or endangered were also conducted in June and September 2006 (Nelson 2006), April 2007, and October 2007 (Nelson 2007) in areas that would be disturbed by proposed construction of Units 2 and 3 (Figure 2.4-2). These reports (Nelson 2006; 2007) are specific to plants (not animals), but a wildlife biologist present during the plant surveys conducted searches for federally and state-listed terrestrial animals. The plant and animal surveys were conducted throughout the areas shown in Figure 2.4-2.

No animals federally listed as threatened or endangered were observed during the 2002, 2006, and 2007 surveys, and the bald eagle was the only state-listed animal species observed during the surveys. The bald eagle is state-listed as endangered (SCDNR 2006). The bald eagle was federally listed as threatened at

the time of the 2002 survey, but in 2007 the U.S. Fish and Wildlife Service removed the bald eagle from the federal list of threatened and endangered species. At the federal level, the bald eagle is still protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act (USFWS 2007a). Juvenile and adult bald eagles were observed during the surveys along the Fairfield Pumped Storage Facility tailrace canal and along the eastern shoreline of Parr Reservoir. Bald eagles are commonly observed along Monticello Reservoir, the Fairfield Pumped Storage Facility tailrace canal, Parr Reservoir, and on the Broad River downstream of Parr Shoals Dam. There are seven known eagle nests within 5 miles of the VCSNS site. The nearest eagle nest is located near the entrance road to Unit 1, approximately 1 mile northeast of the new reactor units. Another eagle nest is located on the north end of the jetty in Monticello Reservoir, approximately 1.7 miles north of the proposed new reactor units. There is also an eagle nest on the west side of Parr Reservoir approximately 1.8 miles northwest of the proposed new reactor units (Figure 2.4-1).

No federally or state-listed plants were found during the 2002, 2006, and 2007 surveys, which were conducted by Dr. John B. Nelson, Chief Curator of the A. C. Moore Herbarium at the University of South Carolina. Prior to the surveys, Dr. Nelson determined that of the 23 plant species recorded in South Carolina that are federally listed as endangered or threatened or are formal candidates for such listing, five species might occur at VCSNS, based on proximity to known populations elsewhere in South Carolina. These consist of pool-sprite (*Amphianthus pusillus*), smooth coneflower (*Echinacea laevigata*), Schweinitz's sunflower (*Helianthus schweinitzii*), black-spored quillwort (*Isoetes melanospora*), and Georgia aster (*Symphyotrichum georgianum*) (Nelson 2006). However, the surveys revealed that appropriate habitats for pool-sprite, smooth coneflower, Schweinitz's sunflower, and black-spored quillwort do not exist in the areas that would be disturbed by construction (Nelson, 2006, 2007). Georgia aster can occur in a variety of soils and habitats, such as dry open woods, roadsides, transmission line corridors, and other openings, so habitat for this species exists at VCSNS (Nelson 2006). It can be readily identified and distinguished from other asters when flowering, which occurs in September and October. All areas that would be disturbed by construction of Units 2 and 3 were surveyed in September 2006 or October 2007, and no evidence of the Georgia aster was encountered (Nelson 2006, 2007).

Endangered, threatened, and other special status species known to exist in Fairfield County are listed in Table 2.4-1. Special status species, indicated in Table 2.4-1 as occurring in Fairfield County (in which VCSNS is located), were taken from county records maintained by the USFWS (2008) and the SCDNR (SCDNR 2006). However, SCE&G recognizes that the USFWS and SCDNR's databases reflect only recorded occurrences, and the possibility exists that other (unrecorded) special status species might exist in Fairfield County. Similarly, although the bald eagle was the only special status species observed during the 2002, 2006, and 2007 biological surveys, SCE&G recognizes that the possibility of special-status plants or animals in the area that would be disturbed by construction can never be totally ruled out. This is true especially for animals, some of which are mobile, secretive, and rarely observed even when present. The

biological surveys were conducted during seasons that encompassed plants that bloom in the spring/summer and those that bloom in the fall, and the conclusion derived from the surveys is that federally or state-listed plants are not likely to exist in the areas that would be disturbed by the Units 2 and 3 project. Overall, the biological surveys provide a high degree of confidence that special-status plants and animal species (with the exception of foraging bald eagles along the Parr and Monticello Reservoir shorelines) do not exist in the area that would be disturbed. SCE&G biologists at VCSNS are familiar with special-status species in South Carolina.

2.4.1.1.3 Other Important Species and Habitats

Important species are defined in NUREG-1555 (U.S. NRC 1999) as those that are federally or state-listed as threatened or endangered, proposed for listing as threatened or endangered, commercially or recreationally valuable, essential to the maintenance or survival of species that are rare or commercially or recreationally valuable, critical to the structure and function of the local terrestrial ecosystem, or that serve as biological indicators. Game species fall within the "commercially or recreationally valuable" species category. The primary game species at the VCSNS site are whitetail deer, gray squirrel, Eastern cottontail, Northern bobwhite, mourning dove, wild turkey, and waterfowl. No "travel corridors" for game species cross the VCSNS site, with the exception that migratory waterfowl use Parr and Monticello Reservoirs during migration. With the possible exceptions of the area where the blowdown line would discharge into Parr Reservoir, the proposed raw water intake, and the proposed water treatment plant intake and waste discharge to Monticello Reservoir, areas that would be disturbed by construction activities do not provide foraging habitat for the bald eagle. In summary, the site does not provide habitat for threatened or endangered species; it consists largely of planted pines where plant species diversity is low and does not provide significant habitat for commercially or recreational valuable species.

NUREG-1555 defines important habitats as wildlife sanctuaries, refuges, or preserves; habitats identified by state or federal agencies as unique, rare, or of priority for protection, wetlands, floodplains, or other resources specifically protected by federal or state regulations or Executive Order; or land areas identified as critical habitat for threatened or endangered species. The Monticello Reservoir Waterfowl Management Area and the Parr Reservoir Waterfowl Management Area could be considered wildlife refuges. Parr Reservoir is approximately 3,000 feet from the proposed power block and Monticello Reservoir is approximately 4,000 feet from the proposed power block. With the exceptions of the two waterfowl management areas and wetlands along stream drainages and reservoirs, no "important habitats" as defined by NUREG-1555 exist at VCSNS.

Although the VCSNS site has ticks and mosquitoes, no vector-borne diseases have been reported.

2.4.1.1.4 Summary and Conclusions: Site Habitats and Wildlife

Based on field surveys conducted in 2002, 2006, and 2007, forested portions of areas that would be disturbed by construction of Units 2 and 3 are characteristic of Piedmont forests and do not contain any old growth timber, unique or sensitive plant communities, or threatened or endangered species (with the exception of bald eagles that forage along nearby waterbodies). Timber harvesting in several areas resulted in isolated patches of forest separated by large clearcut areas. Much of the VCSNS site consists of planted pines where plant species diversity is low. Remaining areas of hardwood forest and mixed pine-hardwood forest are used by wildlife species common to the area, but use of the site by wildlife is not significant given the large amount of similar habitat in the vicinity (as defined in Subsection 2.2.1.2, the area within approximately 6 miles of VCSNS).

NUREG-1555 guidance calls for at least one full year of data in order to determine impacts to terrestrial ecosystems. However, NUREG-1555 also states that "The depth and extent of the input to the EIS should be governed by the kinds of terrestrial ecological resources that could be affected by plant construction or operation and by the nature and magnitude of the expected impacts to these resources" (NUREG-1555, page 2.4.1-6). With this in mind, the following facts are germane:

- The proposed VCSNS site is not a "greenfield" site; instead, it is a previously disturbed site (from construction of Unit 1 and subsequent cycles of tree harvesting) in close proximity to existing structures and activities associated with Unit 1.

- Forested areas that would be disturbed by construction of Units 2 and 3 consist of scattered, isolated tracts left by logging operations, where animal diversity is low. Forested portions of the proposed construction and support areas are characteristic of Piedmont forests and do not contain any unique or sensitive plant communities.

- With the exception of wetlands, the area that would be disturbed by construction of Units 2 and 3 does not contain any important habitats as defined by NUREG-1555. Less than one acre of wetlands would be impacted by construction of Units 2 and 3.

- The site does not provide habitat to any known species federally listed as endangered or threatened. The site does not provide habitat to any known species state-listed as endangered or threatened, with the exception of the bald eagle, and potential impacts to the eagle from construction-related activities are expected to be small. With the exception of common game species and the bald eagle, the site does not contain any important species as defined by NUREG-1555.

Information presented in this section indicates that available data are sufficient to meet the intent of NUREG-1555 guidance; specifically, that "…the ecological information is adequate to serve as a basis for assessment of the impacts of

design and siting of the plant, and plant construction and operation" (NUREG-1555, page 2.4.1-6). Because available data are sufficient to characterize terrestrial habitats and species at the proposed site, additional herpetological, or endangered and threatened species surveys were not conducted.

2.4.1.2 Transmission Corridor Habitats and Communities

As discussed in Subsection 2.2.2.2, SCE&G and Santee Cooper have conducted siting studies for the new transmission lines (SCE&G 2008, Santee Cooper 2008, Santee Cooper 2009). Much of the probable routes for the new lines follow existing rights of way. The description of the ecology expected in the new transmission corridors can be found in the two siting studies.

Electric transmission corridors that originate at the Unit 1 switchyard pass through forested and agricultural lands typical of central South Carolina. Land use along the existing transmission corridors is presented in Table 2.2-2. No areas designated by the USFWS as critical habitat for endangered species exist within or adjacent to associated transmission corridors. The Summer-to-Newberry transmission line and the Summer-to-Graniteville transmission line cross the Parr Reservoir Waterfowl Management Area in a single shared corridor. Otherwise, the transmission corridors do not cross any state or federal parks, wildlife refuges or preserves, or wildlife management areas.

Surveys for federally and state-listed species classified as threatened or endangered were conducted during May, June, July, and August 2002 along VCSNS-associated transmission line corridors (SCE&G 2002b). No federally or state-listed plants or animals were found on the transmission corridors.

Endangered and threatened species known to occur in the counties crossed by existing transmission lines (Aiken, Edgefield, Newberry, Fairfield, Saluda, and Richland) are listed in Table 2.4-1. Endangered and threatened species indicated in Table 2.4-1 as occurring in counties crossed by the transmission lines were taken from county records maintained by USFWS (2008) and SCDNR (2006). However, SCE&G recognizes that the USFWS and the SCDNR's databases reflect only recorded occurrences, and the possibility exists that unrecorded special status species might exist in counties crossed by the transmission lines. Similarly, although no endangered or threatened species were observed during the 2002 surveys of the transmission lines (SCE&G 2002b), SCE&G recognizes that the possibility of special status plants or animals along the transmission corridors cannot be ruled out entirely, particularly in light of some animals that are mobile, secretive, and rarely observed even when present.

As discussed in Subsection 2.2.2, the specific routes for all of the proposed new transmission lines have not been determined, but likely will cross twelve counties (Aiken, Chester, Colleton, Dorchester, Fairfield, Hampton, Lancaster, Lexington, Newberry, Orangeburg, Richland, and Saluda). Special status species in these counties are listed in Table 2.4-2. Land use in these counties is presented in Table 2.2-4.

Transmission line corridors are maintained in accordance with established procedures to prevent woody growth from reaching the transmission lines (SCE&G 2006, Santee Cooper 2006). The removal of woody species can provide outstanding grassland and marsh habitat for many rare plant species dependent on open conditions.

SCE&G and Santee Cooper participate with the U.S. Department of Agriculture–Natural Resources Conservation Service, the SCDNR, and other organizations in a wildlife management program for transmission corridors. The "Power for Wildlife" program is designed to help landowners whose property is crossed by transmission lines convert transmission corridors into productive habitat for wildlife. The program offers grant money and wildlife management expertise to landowners who commit to participating in the program for five years (SCE&G 2002a).

2.4.2 AQUATIC ECOLOGY

The surface water bodies of interest, those that could potentially be affected by construction and operation of new units at the VCSNS site are the Broad River, Parr Reservoir, Monticello Reservoir, the Monticello Sub-impoundment, and onsite streams, most notably Mayo Creek. The subsection that follows describes the aquatic communities of each of these water bodies.

2.4.2.1 Broad River and Associated Reservoirs

Parr Shoals Power Company (an SCE&G predecessor) created Parr Reservoir in 1914 when it built a low concrete dam across the Broad River at Parr Shoals for a small (now 14 MW) hydroelectric facility (Parr Hydro). The impounded stretch of the Broad River that extends approximately 7 miles upstream of the Parr Shoals Dam is known as Parr Reservoir (Figure 2.1-3). Parr Reservoir, a shallow (15 feet average depth) reservoir with an area of 4,400 acres, is hydraulically connected by Fairfield Pumped Storage Facility to Monticello Reservoir, a much deeper (59 feet average depth) reservoir with an area of 6,500 acres (Figure 2.1-1). The movement of water between Parr Reservoir and Monticello Reservoir is generally dictated by electrical demand, but pumpback operations may be constrained by low Broad River flows during drought periods. Subsection 2.3.2 ("Water Use") contains a more detailed description of FPSF operations.

2.4.2.1.1 Broad River and Parr Reservoir Aquatic Communities

The Broad River originates on the eastern slope of the Blue Ridge Mountains near Lake Lure, North Carolina, and flows south and southeast for approximately 150 miles before joining the Saluda River at Columbia, South Carolina. The Broad River basin encompasses an approximate 4,700-square-mile watershed drained by more than 5,000 miles of streams (NCDENR 2006; SCDHEC 2001). Major tributaries include the Pacolet, Tyger, and Enoree Rivers, all of which enter the Broad River from the west (Subsection 2.3.1). The Broad River basin in South Carolina is entirely within the Piedmont region, which is an area of gently rolling to hilly terrain with relatively broad stream valleys; elevations range from 375 to

1,000 feet above MSL (SCDHEC 1998). For most of its length in South Carolina, the Broad River flows through agricultural and forested land, including the Sumter National Forest, which bounds the river for some 30 miles above Parr Reservoir. Approximately 70% of the Broad River watershed is forested; less than 10% is developed or urban (SCDHEC 1998). However, the cities of Greenville and Spartanburg and a portion of the city of Columbia are in the Broad River basin.

As noted previously, Parr Reservoir was created in 1914 by erecting a 2,000-foot-long dam across the Broad River at Parr Shoals, which is approximately 26 miles upstream of the confluence of the Broad and Saluda Rivers at Columbia, South Carolina (SCE&G 2002a; Rizzo 2006). Before 1977, Parr Reservoir's surface area was 1,850 acres. In 1977, the level of Parr Reservoir was raised by 9 feet, which increased its surface area to approximately 4,400 acres (U.S. NRC 2004). This modification was necessary to support the development of Fairfield Pumped Storage Facility, which was built on Frees Creek, a small tributary of the Broad River. In addition, Monticello Reservoir was created to serve as the upper reservoir for Fairfield Pumped Storage Facility and the cooling water source for Unit 1. Parr Reservoir, which had historically been the source of water for Parr Hydro, assumed a dual function, providing a headwater pool for Parr Hydro and the lower reservoir for operation of Fairfield Pumped Storage Facility. Subsection 2.3.1 describes how water moves between the two reservoirs during generation and pumpback cycles. Generally speaking, water from Monticello Reservoir is released through the Fairfield Pumped Storage Facility penstocks and turbine-generators in the daytime and early evening when electrical demand is high; turbines are reversed to pump water uphill from Parr Reservoir to Monticello Reservoir in the early morning hours when electrical demand is low.

Parr Reservoir maintains an intermediate trophic state among reservoirs in South Carolina; its river-like flows and short retention time (approximately four days) produce high dissolved oxygen levels (in most months) and high turbidity in the reservoir (SCDHEC 1998, 2001). As discussed in "Water Quality" aquatic life and recreational uses are "fully supported" in Parr Reservoir according to SCDHEC, meaning that water quality is adequate to support a balanced indigenous community of organisms, with no restrictions on recreational users.

Aquatic/Wetland Vegetation

A survey of the aquatic plant community of Parr Reservoir was conducted by SCE&G biologists on October 30, 2008 (SCANA Services 2008b). Survey transects were established along seven east-west oriented transects that extend 600 yards north and 600 yards south of the proposed cooling tower discharge location. Survey transects were also established in three tributaries of Parr Reservoir: Hellers Creek (2 transects), Frees Creek, and Cannons Creek. To survey aquatic vegetation, biologists drove a small boat slowly along each transect and recorded all aquatic plants that were observed. A viewing tube facilitated observation of aquatic vegetation in shallow areas. Deeper-water areas were sampled by dragging a sampling rake across the bottom. The locations of transects and sampling areas were recorded using a hand-held GPS unit.

Eleven species of aquatic and wetland plants were observed at the various Parr Reservoir transects (Table 2.4-4) (SCANA Services 2008b). Alligatorweed *(Alternanthera philoxeroides)* and water primrose *(Ludwigia hexapetala)* were found at all transects. Bur-marigold *(Bidens laevis)*, bulrushes *(Scirpus* spp.*),* coontail *(Ceratophyllum demersum)*, lizard's tail *(Saururus cernuus)*, marsh pennywort *(Hydrocotyle umbellata),* pickerelweed *(Pontederia cordata),* and smartweed *(Polygonum persicaria)* were observed in the shallows at more than half of the sampling transects. Cattail *(Typha latifolia)* and rushes *(Juncus* spp.*)* were observed growing at 5 and 4 transects, respectively. No plants were collected from the deeper-water areas of the sampling transects.

All the aquatic and wetland plants found in Parr Reservoir are common species that are widely distributed across the southeastern United States. Two species, alligatorweed and (creeping) water primrose, are on the South Carolina Noxious Weed List (SCDNR undated). Alligatorweed is an emergent perennial plant native to South America that sometimes forms dense mats along shorelines and in canals (CAIP 2008). Water primrose, native to Florida but probably not South Carolina, is an emergent perennial that invades ponds, lakes, and reservoirs across the U.S. (Wood 2006). Both species displace native aquatic plants and can clog ditches and canals, creating problems for agricultural and industrial water users.

Benthic Macroinvertebrates

SCANA Services collected benthos samples from two locations in Parr Reservoir in June 2008, October 2008, January 2009, and April 2009 as part of a benthic macroinvertebrate community assessment (CBS 2008a, CBS 2008b, CBS 2009a, CBS 2009b). The objective of the assessment was to determine the condition of the macroinvertebrate community at the proposed cooling tower blowdown location relative to a control station at an upstream location. Benthic macroinvertebrates were collected with a petite-Ponar grab sampler from a station in the area of the proposed cooling tower blowdown discharge and from a control station located above Hellers Creek, approximately 9 kilometers upstream of the Parr Shoals Dam. Comparisons of macroinvertebrate communities were based on differences in taxonomic composition between the two sampling locations and on the known pollution tolerances and life histories of the organisms collected at the respective sites. Differences in taxonomic composition were determined using metrics outlined in Rapid Bioassessment Protocol III of the EPA's *Rapid Bioassessment Protocols for Use in Streams and Rivers* (Plafkin *et al.* 1989 *in* CBS 2008a) and SCDHEC's *Standard Operating and Quality Control Procedures for Macroinvertebrate Sampling* (SCDHEC 1999 *in* CBS 2008a).

A total of 400 macrobenthic organisms representing 26 taxa were collected at the two stations on June 18, 2008 (CBS 2008a). Total abundance of benthic organisms was significantly higher, based on a single-factor analysis of variance (ANOVA), at the proposed Parr Reservoir blowdown discharge location than at the Parr Reservoir control station. North Carolina Biotic Index (NCBI) and SCDHEC Bioclassification values were also significantly better at the proposed blowdown location than the control station. There were no significant differences

between the two locations in taxa richness, Ephemeroptera-Plecoptera-Trichoptera (EPT) Index, EPT Abundance, or percentage of dominant taxon.

In September 2008, SCANA Services biologists collected 321 benthic macroinvertebrates representing 13 taxa at the two Parr Reservoir stations (CBS 2008b). The proposed blowdown discharge location had significantly higher EPT Index and EPT Abundance values than the control station. The percentage of the dominant taxon, higher values of which are normally associated with water quality impairment, was significantly higher at the Parr Reservoir control station.

In January 2009, 254 benthic macroinvertebrates representing 19 taxa were collected at the two Parr Reservoir locations (CBS 2009a). The proposed blowdown location had significantly lower NCBI values than the control station, indicative of better water quality. However, the proposed blowdown location also had a significantly higher percentage of the dominant taxon, indicative of poorer water quality.

In April 2009, 201 species representing 12 taxa were collected by SCANA Services at the two locations (CBS 2009b). There were no significant differences between blowdown and control stations in any of the metrics/bioindicators calculated.

In conclusion, the 2008–2009 benthic macroinvertebrate bioassessment showed "little, if any" difference between the benthic macroinvertebrate community in the area of the proposed blowdown discharge and the benthic macroinvertebrate community at a reference location (CBS 2009b).

There were significant differences between sampling dates (seasons) in the various metrics, however. At the proposed Parr Reservoir blowdown location, the EPT Index and EPT Abundance values were significantly higher in September 2008 than in June 2008, January 2009, and April 2009 (CBS 2009b). No significant differences were detected between seasons in total abundance of benthic organisms, taxa richness, NCBI values, or SCDHEC Bioclassification values. At the Parr Reservoir control station, taxa richness was significantly higher in January 2009 than other months, but NCBI and SCDHEC Bioclassification values were significantly lower and higher, respectively (lower NCBI values are associated with better water quality; higher SCDHEC Bioclassification scores are associated with better water quality). There were no significant differences among sampling dates (seasons) in total abundance of benthic organisms, EPT Index, or EPT Abundance. The author of the CBS (2009b) report summarized these seasonal differences as follows: at the proposed blowdown discharge location the September 2008 bioassessment was "slightly better" than the other three assessments, while at the control station the January 2009 bioassessment was "somewhat better" than the other three assessments.

Fish

SCDNR conducted an inventory of the aquatic resources of the Broad River over the 2000–2002 timeframe and created a Geographic Information System

database for natural resource managers in the region. This work was supported by SCE&G, Duke Power, and Lockhart Power Company under the auspices of the Broad River Mitigation Trust Fund, whose Trustees are SCE&G, Duke Power, Lockhart Power, SCDNR, and the USFWS.

SCDNR used boat-mounted electrofishing gear to survey the fish of the Broad River between January 2001 and May 2002 at 10 sampling locations from Gaston Shoals (in Cherokee County, near the North Carolina state line) to Bookman Island, which is roughly midway between the Parr Shoals Dam and Columbia. Boat electrofishing was used to obtain baseline information of species that inhabit relatively deep pool and run habitats in the main channel of the river (Bettinger, Crane, and Bulak 2003). In all, 6,916 fish representing 44 species were collected from these mid-channel transects. Overall, redbreast sunfish (23.1% of the total), bluegill (15.3%), and silver redhorse (12.2%) were the most abundant species, comprising more than 50% of the total number of fish collected. Gizzard shad, whitefin shiner, sandbar shiner, and brassy jumprock were also relatively common, each representing more than 5% of all fish collected.

Nine fish species were collected at all 10 sampling sites: redbreast sunfish, bluegill, silver redhorse, gizzard shad, whitefin shiner, brassy jumprock, redear sunfish, largemouth bass, and snail bullhead. Some species had a more limited distribution in the river. For example, white perch, white bass, pumpkinseed, yellow perch, yellowfin shiner, and longnose gar were collected only in the lower half of the river, while V-lip redhorse and northern hogsucker were collected only in the upper half of the river.

Backpack electrofishing was employed at 10 sites to obtain information on fish from shallow riffle, run, and shoreline habitats. A total of 9,836 fish representing 38 species were collected by electrofishing in the three habitat types (Bettinger, Crane, and Bulak 2003). Three species made up more than 50% of fish collected: whitefin shiner (29.9% of the total), redbreast sunfish (14.5% of the total), and spottail shiner (9.0% of the total). Sandbar shiner, snail bullhead, and thicklip chub were also relatively common; each made up more than 5% of the total.

Fifty-one species of fish representing 9 families were collected from the Broad River over the course of the study (Bettinger, Crane, and Bulak 2003). Three species not previously documented from the Broad River were collected: an undescribed species similar to the highfin carpsucker, smallmouth buffalo, and Santee chub. Hybrid bass were also collected for the first time. The family Cyprinidae contributed the most species (14), followed by Centrarchidae (10), and Catastomidae (10). Overall, the species most commonly collected were redbreast sunfish, whitefin shiner, and silver redhorse. Species richness was comparable to that observed in other Broad River studies and similar-sized rivers in South Carolina.

The Broad River offers typical Piedmont sport fishing opportunities, with a variety of centrarchid (*e.g.*, largemouth bass, redbreast sunfish) and ictalurid (*e.g.*, channel catfish, white catfish) species. The Broad River also supports an expanding smallmouth bass fishery, unique to Piedmont rivers in South Carolina

(Bettinger, Crane, and Bulak 2003). Smallmouth bass were introduced in 1984, and have developed into a “small but unique” fishery that is drawing local and regional attention. Bettinger, Crane, and Bulak (2003) documented spawning of smallmouth bass at three Broad River sites, all upstream of Neal Shoals and well upstream of Parr Reservoir.

The Broad River in the area of VCSNS was characterized (before the operation of Fairfield Pumped Storage Facility and Unit 1) by a high silt load, high dissolved oxygen levels, high suspended solids levels, and low buffering capacity (U.S. NRC 1981). Parr Reservoir, a narrow, shallow, run-of-the-river reservoir, had lotic rather than lentic characteristics. Turbidity and flows appeared to limit the production of phytoplankton, and as a consequence they appeared to contribute only marginally to productivity. Zooplankton were also of limited importance. Benthic macroinvertebrates showed very little diversity, but relatively high measures of biomass due to the presence of high densities of the Asiatic clam, *Corbicula*. Fish collections before operation of Fairfield Pumped Storage Facility were dominated by sunfish (bluegill, in particular) and gizzard shad, a forage species. Largemouth bass and white catfish also made up a significant proportion of biomass in collections (U.S. NRC 1981).

SCE&G monitored water quality and aquatic communities in the Broad River, Parr Reservoir, and Monticello Reservoir from mid-1978 through 1984 to assess the impacts of Fairfield Pumped Storage Facility and Unit 1 operations. This represented more than three years of preoperational data and two years of operational data. These studies, summarized in a final report submitted to SCDHEC in April 1985 as part of Clean Water Act Section 316(a) Demonstration (Dames & Moore 1985), are a useful source of information on the biotic communities of the Broad River in the 1970s and 1980s.

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

SCDNR assessed the largemouth bass fishery in the early 1990s and determined that there were fewer largemouth bass per acre in Parr Reservoir than other reservoirs in Fisheries Region III (Hayes 1999). Mean lengths and weights of Parr Reservoir largemouth bass were also lower. Parr Reservoir largemouth bass grew slowly, with fish reaching a minimum harvestable size of 12 inches at age three (Hayes 1999).

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

SCE&G commissioned Normandeau Associates to conduct surveys of Parr Reservoir fish community in the fall of 2006 and spring of 2007. Fish were collected at three locations in the lower reservoir. Three gear types (electrofishing, gill nets, hoop nets) were employed, but all (476) fish were collected by electrofishing and gill netting (Normandeau 2007). Four groups dominated collections: Ictaluridae (33.8 percent of total; 3 species), Moronidae (24.8 percent; one species), Centrarchidae (17.6 percent; 6 species), and Catastomidae (6.7 percent; 2 species). Seventeen fish species, all relatively common Piedmont species, were collected. Channel catfish (26.1% of the total), white perch (24.8% of the total), gizzard shad (12.6% of the total), largemouth bass (7.8% of the total), blue catfish (7.1% of the total), and bluegill (7.1% of the total) were the species most often collected (Normandeau 2007).

Normandeau collected additional samples at the same three locations in July 2008 and February 2009 using electrofishing gear and gill nets (Normandeau 2008, Normandeau 2009). Hoop nets, which were ineffective collecting fish in 2006-2007, were not used in 2008. Collections in July 2008 were dominated by gizzard shad (52.4 percent of total). Substantial numbers of bluegill (14.3 percent), white perch (7.6 percent), largemouth bass (6.1 percent), blue catfish (4.3 percent), and channel catfish (3.7 percent) were also collected (Normandeau 2008). The numerical dominance of gizzard shad in July 2008 samples reflects the fact that large numbers of small (50-100 mm TL) gizzard shad were present. Gizzard shad young-of-the-year grow rapidly, but are heavily preyed upon by a variety of predatory fish species including largemouth bass, crappies, and catfishes (Michaletz 1997). Thus, large numbers of young shad are typically present in summer (most spawning occurs in April and May), but numbers tend to decline in fall and winter as predation takes its toll. Gizzard shad are also prone to sudden die-offs in late summer (Mettee *et al*. 1996).

In February 2009, as predicted, gizzard shad made up a relatively small percentage (6.9 percent) of fish collected from Parr Reservoir (Normandeau 2009). Bluegill ranked first in abundance in winter 2009 samples, comprising 33.6 percent of the total. Bluegill were followed in abundance by largemouth bass (9.2 percent of total), spottail shiner (9.2 percent of total), channel catfish (9.2 percent of total), and blue catfish (8.4 percent of total). This was essentially the same group that dominated previous quarterly surveys, with one exception: white perch were noticeably less abundant in winter 2009 samples than in previous quarterly sampling rounds. This is probably a reflection of the species' schooling behavior rather than an actual reduction in numbers. A gregarious species, white perch tend to be collected in substantial numbers or not at all.

The Normandeau surveys, although limited in scope, suggest that the Parr Reservoir's fish community has been substantially altered since the 1980s by introductions of non-native fish species. Two non-native species—white perch and blue catfish—made up 21.8% of all fish collected from Parr Reservoir during the 2006–2009 Normandeau surveys. When Parr Reservoir fish population data from 1983-1984 are compared to data collected over the 2006-2009 timeframe there appears to be a pronounced shift in community structure. As described earlier in this section, fish collections in 1983-1984 were numerically dominated by centrarchids and clupeids, with smaller numbers of ictalurids present. Collections in 2006, 2007, 2008, and 2009 suggest that centrarchids currently represent a smaller proportion of the fish community, while moronids (the so-called "temperate basses," and in particular, the white perch) have become a major component of the Parr Reservoir fishery. Ictalurids (catfish) also appear to have become relatively more abundant, due in part to the appearance of a new, non-native catfish species, the blue catfish, which became established in recent years. No blue catfish were collected from Parr Reservoir (or any other Broad River station) by Dames and Moore biologists in the 1980s or by SCDNR biologists conducting the Broad River Aquatic Resources Inventory surveys in 2001-2002 (Bettinger, Crane, and Bulak 2003). Five years later, the blue catfish has become firmly established in Parr Reservoir and, one presumes, upstream and downstream in the Broad River drainage. The State Management Plan for Aquatic Invasive Species in South Carolina (SCAIS Task Force 2006) notes that white perch have become established throughout the state, and compete with native white and black crappies. White perch have displaced white bass (also nonnative, but generally more highly regarded by fishermen) in some upstate reservoirs. With regard to the blue catfish, the State Management Plan notes that this species has become established in several Coastal Plain rivers and has "…negatively affected a previously popular fishery for native catfish and redbreast sunfish" (SCAIS Task Force 2006).

SCE&G sampled fish in the vicinity of the proposed cooling tower discharge quarterly over the October 2007–July 2008 period to determine if this location supported a typical assemblage of Parr Reservoir fishes and to rule out the presence of any special-status fish species (SCANA Services 2008a). A total of 422 fish representing 22 species were collected over the study period. Four species (blue catfish, bluegill, largemouth bass, and notchlip redhorse) were collected in every quarter. Threadfin shad ranked first in abundance (37 percent of total), despite the fact that they were collected only during the fall 2007 sampling event. Bluegill (18.7 percent), spottail shiner (7.6 percent), shorthead redhorse (6.6 percent), notchlip redhorse (6.1 percent), and largemouth bass (5.5 percent) were also frequently collected (SCANA Services 2008a).

No state or federally listed fish species and no fish species designated "species of concern" by SCDNR were collected from Parr Reservoir by Normandeau or SCE&G in 2006, 2007, 2008, or 2009. All fish collected were common Piedmont species, with one exception. SCE&G collected a single robust redhorse (*Moxostoma robustum*) at the proposed cooling tower blowdown discharge in July 2008 (SCANA Services 2008a). Normandeau also collected a single robust redhorse in July 2008 at Parr Reservoir Station 1, in the Fairfield Pumped Storage

Facility tailrace canal (Normandeau 2008). The robust redhorse is a large, long-lived member of the redhorse sucker family. In 1995, a group of concerned stakeholders composed of state and federal agencies, electric utilities, and conservation organizations signed a Memorandum of Understanding creating the Robust Redhorse Conservation Committee (SCANA Services 2008a). The Committee, which includes a representative from SCE&G, is committed to restoring the robust redhorse throughout its former range. From 2004 to 2007, SCDNR stocked a total of 21,872 fingerling robust redhorse in the Broad River above the Parr Shoals Dam (SCANA Services 2008a). Five robust redhorse suckers have been captured in the Broad River drainage in 2008 by various state and private entities conducting fish research and monitoring.

2.4.2.1.2 Monticello Reservoir Aquatic Communities

Unit 1 lies on the south shore of Monticello Reservoir (Figure 2.1-3), which serves as its cooling water source and heat sink. Monticello Reservoir was formed by damming Frees Creek, a small tributary of the Broad River that flowed into Parr Reservoir about 1.2 miles upstream of the Parr Shoals Dam. As previously discussed, Monticello Reservoir was designed to serve both as a cooling pond for Unit 1 and the upper pool for Fairfield Pumped Storage Facility, with an enlarged Parr Reservoir serving as the lower pool. Water flow from the Frees Creek watershed into the newly created Monticello Reservoir was negligible, and the Fairfield Pumped Storage Facility's pumps were used initially to fill the reservoir with water from Parr Reservoir (U.S. NRC 1981). Monticello Reservoir's small watershed drains an area of only 11,000 acres, including the reservoir and its subimpoundment (discussed later in this section).

Monticello Reservoir (excluding the Sub-impoundment) is approximately 6 miles long with a surface area of 6,500 acres. The average depth is 59 feet and the maximum depth is approximately 126 feet (SCDHEC 2001). Fairfield Pumped Storage Facility operations can cause water levels in Monticello Reservoir to fluctuate as much as 4.5 feet daily, from 420.5 feet above MSL to 425.0 feet above MSL (NAVD29; U.S. NRC 2004). Daily elevation changes vary, depending on system needs. Long-term eutrophication studies indicate that Monticello Reservoir's trophic condition is improving (SCDHEC 1998; SCDHEC 2001). It is one of the least eutrophic reservoirs in South Carolina, and is characterized by low nutrient (total phosphorus and total nitrogen) concentrations (NRC 2004).

Aquatic/Wetland Vegetation

A survey of Monticello Reservoir aquatic vegetation was conducted on November 6, 2008. Survey locations were established in the vicinity of two public boat landings (north and east shore of the reservoir), an SCE&G private boat landing (west shore of the reservoir), the proposed raw water intake, the proposed water treatment intake, and a control station on the northwest shore of the reservoir. To survey aquatic vegetation, biologists drove a small boat slowly along each transect and recorded all aquatic plants that were present. A viewing tube facilitated observation of aquatic vegetation in shallow areas. Deep water areas were sampled by pulling a sampling rake across the bottom. The locations of

transects and sampling areas were recorded using a hand-held GPS unit. No aquatic plants were observed growing in the shallow water of the six sampling locations at Monticello Reservoir. Stonewort *(Nitella* spp) was collected from a deeper-water area offshore of the public boat landing on the eastern shore of the reservoir. Stonewort, which appears to be a submerged vascular plant, is actually a branched, multi-cellular algae (TAES 2008). It is typically found in lakes and reservoirs in the Carolinas, where it forms a layer on the bottom that may be thin or very heavy, depending on the trophic state of the waterbody (Stager and Cahoon 1987; Aulbach 2007). Small bait fish often congregate over these patches of *Nitella*.

Benthic Macroinvertebrates

SCANA Services collected benthos samples from three locations in Monticello Reservoir in June 2008, October 2008, January 2009, and April 2009 as part of a benthic macroinvertebrate community assessment (CBS 2008a, CBS 2008b, CBS 2009a, CBS 2009b). Benthic macroinvertebrates were collected with a petite-Ponar grab sampler from stations in the area of the proposed raw water intake, the proposed water treatment intake, and from a control station on the west side of the reservoir, approximately 5 kilometers north of VCSNS Unit 1. The objective of the assessment was to determine the condition of the macroinvertebrate communities at the proposed water treatment and raw water intake relative to conditions at a control station. Comparisons of macroinvertebrate communities were made based on differences in taxonomic composition among the three sampling locations and on the known pollution tolerances and life histories of the organisms collected. Differences in taxonomic composition were determined using metrics outlined in Rapid Bioassessment Protocol III of the EPA's *Rapid Bioassessment Protocols for Use in Streams and Rivers* (Plafkin *et al.* 1989 *in* CBS 2008a) and SCDHEC's *Standard Operating and Quality Control Procedures for Macroinvertebrate Sampling* (SCDHEC 1999 *in* CBS 2008a).

A total of 341 macrobenthic organisms representing 27 taxa were collected at the three Monticello Reservoir stations on June 18, 2008 (CBS 2008a). EPT abundance at both the proposed water treatment intake station and proposed raw water intake were significantly higher than the control station based on a single-factor analysis of variance (ANOVA). The proposed water treatment intake station had significantly higher NCBI and SCDHEC Bioclassification scores than either the proposed raw water intake station or the control station.

In September 2008, SCANA Services biologists collected 262 benthic macroinvertebrates representing 24 taxa at the three Monticello Reservoir stations (CBS 2008b). Taxa richness and taxa abundance were significantly lower at the proposed water treatment intake station than at the proposed raw water intake station or control station. Likewise, EPT Abundance was significantly lower at the water treatment intake station than the other two stations. The raw water intake station had significantly better NCBI and SCDHEC Bioclassification scores than either of the other two stations.

In January 2009, 277 benthic macroinvertebrates representing 16 taxa were collected at the three Monticello Reservoir stations (CBS 2009a). Only two of the bioassessment metrics showed significant differences. EPT Index and EPT Abundance values were significantly higher at the proposed raw water intake location than at the other two locations.

In April 2009, SCANA Services biologists collected 405 benthic macroinvertebrates representing 24 taxa at the three Monticello Reservoir stations (CBS 2009b). There were significant differences in four of the bioassessment metrics. Taxa richness was significantly higher at the proposed water treatment intake station than at the raw water intake or control stations. EPT Index and EPT Abundance values were significantly higher at the proposed raw water intake station. SCDHEC Bioclassification values were significantly lower at the control station than the other two stations.

A review of results from four quarters of macroinvertebrate sampling on Monticello Reservoir suggests that there are no meaningful differences among the three stations. No clear-cut patterns emerged with respect to the relative complexity of benthic communities at the three locations or the degree of impairment. For example, taxa richness was lowest at the proposed water treatment intake location in September 2008, but was highest at the same location in April 2009. The CBS study concludes that "Monticello Reservoir…showed few differences among the control, water treatment intake, or raw (water) intake points" (CBS 2009b). With respect to differences among sampling dates at a given station (seasonal differences), the CBS study concludes that "none of the assessments showed any large differences across time."

Fish

The most complete source of information on the fishes of Monticello Reservoir is a series of reports prepared in support of a Clean Water Act Section 316(a) Demonstration for Unit 1 and summarized in a final report (Dames & Moore 1985) submitted to SCDHEC and NRC in April 1985.

Biologists using gill nets and electrofishing gear collected 32 species of fish representing eight families from Monticello Reservoir in 1983 and 1984 (Dames & Moore 1985)**,** the last two years that sampling was conducted in support of the station's Section 316(a) Demonstration. The Monticello Reservoir fish community in 1983–1984 was dominated by centrarchids (55% of fish captured) and clupeids (28% of fish captured) (Dames & Moore 1985). Smaller numbers of ictalurids (7%), catastomids (5%), and percids (3%) were also captured. The species composition and relative abundance of Monticello Reservoir fish changed very little from 1978 through 1984. In all preoperational and operational years, centrarchids ranked first in abundance and clupeids ranked second. There was no indication that Unit 1 operations had an effect on fish populations in Monticello Reservoir.

Based on cove rotenone studies conducted by SCDNR in 1987, 1988, 1995, and 1996, the fish community of Monticello Reservoir remains balanced and diverse,

comprised of warmwater species common to the southeastern United States (Nash, Christie, and Stroud 1990; Christie and Stroud 1996, 1997)**.** Three catfish species (blue catfish, channel catfish, and white catfish) made up a substantial proportion (56%, by weight) of the reservoir's standing stock in 1996 and provided an important recreational fishery, particularly in summer months. Other species more traditionally regarded as gamefish (largemouth bass, black crappie, and white bass) contribute less to the reservoir's standing stocks, but considerable angler effort is directed toward these species in winter, spring, and fall.

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

There have been a number of changes in the Monticello Reservoir fish community since Unit 1 began operating in 1982, none attributable to station operations. Two species (blue catfish and white perch) that now make up a major portion of the recreational catch first appeared in SCDNR samples in 1995. These species may have been introduced by fisherman or transferred into Monticello Reservoir from Parr Reservoir by pump-back operations. The blue catfish in particular "exploded" in numbers and importance in the reservoir between 1995 and 1996 (Christie and Stroud 1997). In an annual report on the status of fisheries in SCDNR Region IV, Christie and Stroud (1997) voiced concern about the booming population of blue catfish in Monticello Reservoir, noting that Monticello Reservoir has a "…relatively low prey base… and the unfortunate introduction of blue catfish may lead to competition for forage between catfish and game species." Concern about competition with native sport fishes has led states including Maryland and Florida to propose or enact laws restricting the sale, possession, importation, and/or transportation of blue catfish (Maryland DNR 2006; FWC 2006).

The white perch, a semi-anadromous species native to the southeastern coast, is regarded as a nuisance species by many inland fisheries managers. It is a species known for its high reproductive potential (high fecundity rate and high hatching rate), slow rate of growth, and long lifespan (up to 17 years), characteristics that tend to create crowded populations of stunted white perch in reservoirs (Wisconsin Sea Grant 1999; Marcy et al. 2005; NCWRC undated)**.** White perch are known to depress populations of other, more desirable gamefish species, such as walleye and white bass, by competing for limited forage and by feeding heavily on walleye and white bass eggs (Wisconsin Sea Grant 1999).

A number of other fish species (brook silverside, swallowtail shiner, and green sunfish) appeared for the first time in SCDNR's Monticello Reservoir cove rotenone samples in 1995 (Christie and Stroud 1996). These species were known

to occur in other water bodies in the Santee-Cooper drainage basin (which includes the Broad River), but had not been collected previously in Monticello Reservoir by SCDNR. None of these species is expected to have a noticeable effect on the reservoir‘s fisheries, beyond some minor contribution to the forage base.

SCE&G commissioned Normandeau Associates to conduct surveys of the Monticello Reservoir fish community in the fall of 2006 and spring of 2007. A total of 820 fish representing 21 species were collected in 2006–2007 (Normandeau 2007). As was the case in the 1980s (Dames & Moore 1985), collections were dominated by centrarchids (chiefly bluegill) and gizzard shad. More than 52% of all fish collected in 2006 and 2007 were bluegill and gizzard shad. The most notable change in the fish community since surveys were last conducted in the 1980s was the presence of the two nonnative species—blue catfish and white perch—already discussed at length in this section. These two nonnative species comprised 11.0% and 9.5%, respectively, of all fish collected (Normandeau 2007). Although no statistical tests of significance were performed, a comparison of “before” (Dames and Moore 1985) and “after” (Normandeau 2007) relative abundance data suggests that the appearance and subsequent increase in abundance of blue catfish in Monticello Reservoir may be associated with the corresponding decline in abundance of the native white catfish.

Monticello Reservoir fish were sampled by Normandeau Associates again in July 2008 and February 2009 to obtain additional information on possible seasonal differences in the reservoir's fish populations. A total of 782 fish were collected in July 2008 using gill nets and electrofishing gear. Three species—gizzard shad (42.2 percent), bluegill (23.2 percent), and blue catfish (20 percent)—made up more than 85 percent of all fish captured. Smaller numbers of white perch (3.6 percent), channel catfish (2.6 percent), largemouth bass (1.4 percent), and white catfish (1.4 percent) were also collected. Relatively high numbers of gizzard shad in Parr and Monticello Reservoir collections in July 2008 reflect the fact that large numbers of small (50-100 mm TL) gizzard shad were present. Gizzard shad young-of-the-year grow rapidly, but are subject to high rates of mortality. Thus, it is understandable that large numbers of young are present in summer, but these numbers decline in fall and winter.

A total of 461 fish representing 20 species were collected from Monticello Reservoir in February 2009 (Normandeau 2009). Bluegill (33.4 percent of total), white perch (21.5 percent), largemouth bass (7.6 percent), gizzard shad (6.7 percent), and channel catfish (5.6 percent) were the five species most often collected. Bluegill, whitefin shiner, and white perch dominated electrofishing collections, while white perch dominated gill net samples. Almost 40 percent of all fish in gill nets were white perch. When July 2008 and February 2009 Monticello Reservoir data were combined, gizzard shad (29.0 percent of total), bluegill (27.0 percent), blue catfish (13.7 percent), and white perch (10.2 percent) ranked first, second, third, and fourth in abundance, respectively. The 2008–2009 sampling results essentially mirrored the results of 2006-2007 sampling, with the two non-native species (white perch and blue catfish) making up a slightly higher percentage of the total in 2008–2009.

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

Excluding blue catfish and white perch, no undesirable nonnative fish species appeared in Monticello Reservoir after it was created and no nuisance species appeared to be favored by its operational thermal regimes. There have been no outbreaks of fish diseases, beyond the occasional appearance of *Aeromonas* (*Aeromonas hydrophila*; a bacterium) infections in spawning largemouth bass in the spring. Fish with infections are generally individuals that have been caught and released by anglers. Handling stresses these fish and removes the protective slime/mucous coating, which results in *Aeromonas* infection.

In the late 1980s, a number of limited fish kills (generally involving small catfish) occurred in the Unit 1 discharge bay in late summer and early fall. SCE&G set up a monitoring program to help identify the cause of the fish kills. Investigations revealed that the fish kills were associated with relatively high discharge temperatures and Monticello Reservoir drawdowns (through the operation of Fairfield Pumped Storage Facility). It was determined that reservoir drawdown reduced the inflow of cooler water (from the main body of the reservoir) along the bottom of the discharge canal and into the discharge bay. Reduction or loss of this inflow allowed water temperatures to rise rapidly and kill fish inhabiting the discharge bay. Since the reservoir level was subject to daily fluctuation with the operation of Fairfield Pumped Storage Facility, fish kills recurred as high reservoir levels (following pumpback operations) allowed more cool water inflow and recolonization of the discharge canal and bay.

SCE&G took several actions over the 1991–1993 period to reduce the frequency and severity of fish kills (SCE&G 2002a). In 1991, an elevated area (an old roadbed) was removed from the discharge canal by dredging. This initially appeared to have solved the problem, but a fish kill in August 1992 indicated that removal of the roadbed had not completely eliminated the kills. In September 1992, the Monticello Reservoir drawdown was temporarily limited to 422.5 feet MSL to prevent further fish kills.

SCE&G dredged the entire length of the discharge canal in July and August of 1993 to allow more cool water inflow at low reservoir levels. The dredging of the discharge canal altered circulation patterns and increased cool water inflow such that temperature at the bottom of the discharge bay in summer remained

significantly (10° to 15°) cooler than “end-of-pipe” discharge temperatures (SCE&G 2002a). Fish kills ceased once the dredging of the discharge canal was completed. The discharge bay and canal were monitored intensively over the summers of 1994 and 1995, and no fish kills were observed (SCE&G 2002a). None have been observed since that time.

The Generic Environmental Impact Statement for license renewal of nuclear plants (U.S. NRC 1996) briefly discusses the fish kills in the VCSNS discharge bay and mentions SCE&G‘s investigations on the specific causes of the kills. It concludes that “these fish kills were localized; they do not appear to have had any adverse effect on the cooling pond (fish) population.”

2.4.2.1.3 Monticello Subimpoundment Aquatic Communities

Monticello Reservoir is hydraulically connected by a conduit to a smaller 300-acre body of water known as the Monticello Sub-Impoundment (Figure 2.1-3). This smaller sub-impoundment is managed for recreational boating and fishing by SCE&G and SCDNR. SCE&G maintains the property, which includes boat launch, swimming, and picnic facilities; SCDNR manages the sub-impoundment's fisheries by setting creel and size limits on fish. SCDNR has also sunk fish attractors in several places in the sub-impoundment to provide habitat for sunfish, crappie, and largemouth bass and improve fishing. Fishing is permitted on Wednesdays and Saturdays only.

Comprehensive surveys of the sub-impoundment’s fishery were last conducted in 1984 (Dames & Moore 1985). At that time, the fish community of the sub-impoundment was characterized by relatively low species richness (12 species collected in 1983 and 1984), with collections dominated by gizzard shad and centrarchids (*e.g.,* bluegill, redear sunfish, black crappie, largemouth bass) (Dames & Moore 1985).

SCDNR periodically collects data on condition and size structure of the sub-impoundment’s largemouth bass in order to better manage the population and provide quality fishing (Osier 2006). Based on this data, the population appears to be dominated by intermediate-size fish (10-14 inches total length) that are probably two to four years old. The average weight, length, and condition of largemouth bass collected from the subimpoundment were slightly lower in 2005 than 2003, but small sample sizes did not allow statistical comparisons.

The sub-impoundment had a reputation in the region as a producer of trophy largemouth bass in the 1980s, but appears to have passed its peak and is no longer the producer of large bass that it once was. Small ponds and reservoirs tend to be most productive in the 5 to 10 years after impoundment, then move through a predictable series of successional changes as they slowly fill with sediment and aquatic vegetation becomes more abundant in shallows. Once vegetation becomes established, nutrients tend to be absorbed by these vascular plants rather than by phytoplankton, which are the base of the food chain. When phytoplankton densities decrease, zooplankton populations decline, larval fish growth and survival is affected, and the entire fish community begins to show

reduced growth rates and smaller average sizes. This appears to have been the case at the sub-impoundment which historically had abundant growth of algae and native macrophytes, and in recent years has been invaded by water primrose, an exotic (native to South America) aquatic perennial that grows along pond and lake margins, forming floating mats that crowd out more desirable aquatic plants. Once established, this nuisance species is notoriously difficult and expensive to control.

2.4.2.2 Onsite Streams

Mayo Creek is the only stream in the project area that offers substantial year-round flow and habitat adequate to support reasonably diverse assemblages of benthic macroinvertebrates and fish. Several other unnamed drainages that appear on U.S. Geological Survey topographic maps as streams flowing into the Parr Reservoir immediately north and south of the project site are either intermittent streams (known locally as “wet weather” streams) or small perennial streams that may be only inches wide in late summer.

In some places, these small streams are dammed by snags and leafpack, creating pools that may be six to eight feet wide after heavy rains. Based on a July 2006 reconnaissance conducted by SCE&G and Tetra Tech NUS biologists, these pools serve as refuges for fish, crayfish, and aquatic insects during droughts and low-water periods (TtNUS 2007). The importance of these “pool refugia” to fish and aquatic insects in intermittent streams is well known (Labbe and Fausch 2000; Magoulick 2000). Pools with relatively stable hydrology (water levels) in intermittent streams are associated with successful reproduction, population growth, low rates of extinction, and immigration of fish, whereas pools with more variable hydrology (drying completely or nearly so) tend to be characterized by population declines and emigration (Magoulick and Kobza 2003; Love 2004).

Mayo Creek is approximately 3 miles long and drains an area of about 4 square miles (TtNUS 2007). It rises a half-mile southeast of the Unit 1 generating facilities, flows south for approximately 1 mile then curves to the southwest before emptying into the Broad River at Hampton Island, just below the Parr Shoals Dam (Figure 2.1-3). For much of its length, it moves through a mixed hardwood forest, and is almost completely shaded by a well-developed tree canopy. The tree canopy (shade) apparently moderates water temperatures in summer, which ranged from 23° to 25°C (74° to 76°F) on July 20, 2006, when stream levels were low and ambient temperatures approached 100°F (TtNUS 2007). Fish are found in all stream reaches, but are most numerous in middle and upper reaches that contain a mix of substrate and habitat types. The lower portion of Mayo Creek, immediately above its confluence with the Broad River, is noticeably wider and deeper than the upper portion, as Broad River water backs into the stream. The stream bottom here has a thick covering of silt, and habitat for fish and invertebrates is marginal at best.

Although the Mayo Creek drainage is largely forested and there has been no logging in its floodplain, it nevertheless carries a heavy silt load (TtNUS 2007). For reasons that may be related to characteristics of the watershed and the stream’s

morphology, it is subject to flash floods after heavy rains. These floods have eroded and undercut the stream's banks along much of its length and covered the stream bottom in many places with a heavy layer of silt.

Mayo Creek aquatic surveys were first conducted in July and November 2006 (TtNUS 2007). The aquatic surveys were designed to gather baseline information on the stream's fish and mussel communities, supporting the assessment of construction impacts in this Environmental Report. The surveys were also intended to identify any special status species that might be present, ensuring that protection of any such species be factored into project planning. The Mayo Creek was selected for surveys because it is the only substantial stream in the project area, and the only one likely to contain significant numbers of fish and macrobenthos. Other streams in the project area are assumed to support smaller, less diverse aquatic communities that are a subset of the Mayo Creek communities, with species predominating that are able to tolerate high levels of turbidity and high summer water temperatures.

A total of 495 fish representing 14 species were collected during the 2006 Mayo Creek study, using a backpack electrofisher and minnow traps. Collections were dominated by Cyprinids (minnows), and Lepomids (sunfish). Bluehead chub (37.2% of the total), yellowfin shiner (18.2% of the total), sandbar shiner (16.4% of the total), and creek chub (8.1% of the total) were the species most often collected (TtNUS 2007). Collectively, these four Cyprinid species made up 79.9% of all fish collected during the study. Other species commonly collected were redbreast sunfish, brassy jumprock, tessellated darter, seagreen darter, and bluegill. Species collected were those typically associated with small, undisturbed streams in the Upper Coastal Plain and Piedmont of the Carolinas and Georgia (TtNUS 2007). Measures of abundance (catch per unit effort) and species richness/ species diversity were markedly higher in Transects 2 and 3, a portion of the stream with a well-developed canopy and relatively stable streambanks, than in Transect 1, which had less stable streambanks and a heavier silt load.

Additional surveys of Mayo Creek fish were conducted in February and April 2009 to ensure that community attributes were characterized for all four seasons (TtNUS 2009b). A total of 312 fish representing 10 species were collected in February and April 2009. Collections were dominated by Cyprinids (minnows; four species), which made up 75.6 percent of all fish collected. Yellowfin shiner (45.8 percent of total), bluehead chub (22.8 percent), and redbreast (12.8 percent) were the species most often collected. In 2006, bluehead chub ranked first in collections, comprising 37.2 percent of fish collected, and yellowfin shiner was second (18.2 percent). Creek chubs and sandbar shiners were relatively common in 2009, but were noticeably less abundant than they were in 2006. In general, the fish community in 2009 looked very much like the fish community in 2006—numerically dominated by two minnow species (bluehead chub and yellowfin shiner), with substantial numbers of redbreast sunfish, smaller numbers of other minnows, small suckers, and darters.

Two previously unobserved species were collected in 2009, the Northern hogsucker (*Hypentelium nigricans*) and the redear sunfish (*Lepomis*

microlophus). The Northern hogsucker is found on the Atlantic slope from New York to Georgia, mostly above the Fall Line. In South Carolina, it occurs mostly in the Piedmont and Blue Ridge portions of the Savannah and Santee river drainages, including the Saluda, Broad, Congaree, Catawba, and Wateree rivers (Rohde et al. 2009). This species normally inhabits riffles and rapids of clear creeks and rivers, and is thought to be relatively intolerant of siltation and pollution (Rohde et al. 2009). The redear sunfish is found across the southeastern U.S., from the Carolinas to Texas. It occurs throughout South Carolina, from the Coastal Plain to the Blue Ridge, where it is found in a wide range of habitats, from swamps to farm ponds to rivers to large U.S. Army Corps of Engineers impoundments (Rohde et al. 2009).

Surveys of Mayo Creek in 2006 and 2009 revealed a surprisingly diverse assemblage of fishes (16 species) dominated numerically by Cyprinids (minnows). Five minnow species comprised almost 81 percent of all fish collected in 2006; four minnow species made up almost 76 percent of fish collected in 2009. Four centrarchid (sunfish) species and three percid (darter) species were also present, but tended to be less abundant. Smaller numbers of catastomids (suckers; two species) and ictalurids (catfish; two species) were also present. No state or federally listed fish species were collected. No species designated "species of concern" by the state of South Carolina or USFWS were collected. Several uncommon fish species were collected, but none has been afforded state or federal protection.

Several species of freshwater mussel and the non-native clam *Corbicula* are found in the lower Broad River (Bettinger, Crane, and Bulak 2003) into which Mayo Creek flows. However, it appears that conditions in Mayo Creek and its tributaries are not conducive to survival and/or propagation of bivalves. Although systematic surveys of mussels and clams were not conducted, biologists were instructed to note their presence and collect specimens if any were discovered. No live mussel specimens and no shells were observed in Mayo Creek or its tributaries. Small numbers of *Corbicula* shells were seen at Transect MC-2 in February 2009 (TtNUS 2009b).

Carnagey Biological Services, under contract to SCE&G, conducted benthic macroinvertebrate community assessments of Mayo Creek in July 2008, October 2008, January 2009, and April 2009 (CBS 2008c, CBS 2008d, CBS 2009c, CBS 2009d). These assessments were intended to gauge the condition of the stream's macroinvertebrate community and establish a baseline for impact assessment and monitoring purposes. Benthic macroinvertebrates were collected at three representative locations in the middle reaches of Mayo Creek.

Station 1, which was intended to serve as a control, was located approximately 1.5 kilometers upstream of Parr Road below the confluence of a small unnamed tributary (CBS 2008c). Station 2 was located approximately 170 meters upstream of Parr Road. Station 3 was established approximately 50 meters downstream of Parr Road. Substrates at all three locations consisted mainly of sand, with some gravel, cobble, and boulders present.

Benthic macroinvertebrates were collected at the three locations with a D-frame dipnet and by hand picking organisms from the substrate with forceps (CBS 2008c). All habitats were sampled and specimens pooled to form a single composite sample. Macroinvertebrates were sorted from debris in the laboratory with the aid of stereomicroscope. Specimens were counted and identified to the lowest positive taxonomic level with the aid of a microscope, standard references, and taxonomic keys.

Comparisons of the macroinvertebrate communities were based on the known pollution tolerances and life histories of the organisms collected and on differences in taxonomic composition between sampling stations. Differences in taxonomic composition were determined using metrics outlined in Rapid Bioassessment Protocol III of the EPA's *Rapid Bioassessment Protocols for Use in Streams and Rivers* (Plafkin *et al.* 1989 *in* CBS 2008c) and SCDHEC's *Standard Operating and Quality Control Procedures for Macroinvertebrate Sampling* (SCDHEC 1999 *in* CBS 2008c).

Results of the July 2008 benthic macroinvertebrate assessment indicated that Mayo Creek's macroinvertebrate community was stressed at all three stations, presumably because of a prolonged drought (CBS 2008c). The NCBI ratings for Stations 1 and 3 were "good-fair," while the rating for Station 2 was "good" (Table 2.4-5). Stations 1 and 3 had SCDHEC Bioclassification ratings of "fair," and Station 2 was rated "good-fair." The dominant benthic organism at all three stations was the mayfly *Caenis* (Table 2.4-6), a widely distributed Ephemeropteran that tolerates less-than-optimal water quality.

The October 2008 benthic macroinvertebrate assessment indicated that Mayo Creek was "somewhat stressed" at all three stations (CBS 2008d). Although the NCBI and SCDHEC Bioclassification scores showed little change from July to October (Table 2.4-5), EPT Abundance and EPT/Chironomid Abundance values were indicative of improved water quality. As in July, *Caenis* sp. were numerically dominant at all three stations (Table 2.4-6).

The January 2009 benthic macroinvertebrate assessment was indicative of a marked improvement in conditions (CBS 2009c). The EPT Index was noticeably higher than in previous quarters (Table 2.4-5). The NCBI rating was better at all three stations, while the SCDHEC Bioclassification score was better at two of three stations. Better ratings and scores were associated with winter rains and higher stream flows. *Maccaffertium modestum* (aka *Stenonema modestum*) and *Caenis* sp. were the dominant taxa (Table 2.4-6). Like *Caenis*, *M. modestum* is a common, fairly pollution-tolerant mayfly.

The April 2009 benthic macroinvertebrate assessment showed, for the first time, no impairment at any of the three stations (CBS 2009d). All three of the Mayo Creek stations had NCBI ratings of "excellent" and SCDHEC bioclassification scores of "good" (Table 2.4-5). Taxa richness was higher at all three stations in April 2009 than in July 2008, October 2008, and January 2009. EPT Index values were the highest observed over the course of the study, as were EPT Abundance values. *Caenis* sp. and *Acentrella* sp. dominated collections in April 2009

(Table 2.4-6). *Acentrella* is a somewhat less pollution-tolerant mayfly. Its appearance in samples (in January) coincided with higher stream flows and improvements in most of the bioassessment metrics.

The progressive improvement in the various metrics (bioindicators) observed over the course of the 2008–2009 study was almost certainly associated with increased rainfall and higher stream flows in 2009. Water quantity, rather than quality, appeared to drive the improvement. Water quality in Mayo Creek was consistently good, even in July 2008, when the drought had substantially reduced stream flows. In July 2008, when stream flows were the lowest observed during the study, water temperatures were surprisingly low (20.9 to 22.6°C) and dissolved oxygen levels relatively high (6.5 to 7.2 mg/L) (CBS 2008c). Water quality measurements in all four seasons met water quality standards for Class FW ("Freshwaters") waters in South Carolina (CBS 2008c, 2008d, 2009c, 2009d). Waterbodies classified as Freshwaters should be "suitable for fishing and the survival and propagation of a balanced indigenous community of fauna and flora" (S.C. Code of Regulations, Chapter 61-68).

2.4.3 IMPORTANT AQUATIC RESOURCES

The NRC requires applicants for construction and operating licenses to consider impacts to “important species” including rare species and commercially or recreationally valuable species (U.S. NRC 1999). Rare species include species listed by the USFWS or National Marine Fisheries Service as threatened or endangered, species proposed for listing by these agencies, species that are candidates for listing by these agencies, and species that are listed as threatened or endangered by the state in which the proposed facilities are located. Although diadromous (migratory) fish are not one of the groups designated by the NRC as “important,” it is clear from the instructions to NRC staff (U.S. NRC 1999) that migratory fish must be considered in any impact assessment. Moreover, SCDNR and the USFWS have committed to restoring diadromous fish stocks in South Carolina, and have worked closely with both SCE&G and Santee Cooper in the past to protect and restore runs of fish affected by power plant operations (SCDNR 2005a; SCDNR 2006).

2.4.3.1 Rare/Sensitive Species

Construction and operation of proposed new units at the VCSNS site could potentially impact aquatic populations, including sensitive species, in Parr Reservoir (Newberry and Fairfield Counties), Monticello Reservoir (Fairfield County), onsite streams (Fairfield County), and the Broad River downstream of Parr Shoals Dam (Fairfield and Richland Counties). Consequently, SCE&G reviewed SCDNR and USFWS county lists to identify sensitive aquatic species in these three counties. Sensitive species in this context are federally or state-listed species, species that are candidates for federal listing, and species proposed for listing by the USFWS.

The shortnose sturgeon (*Acipenser brevirostrum*), a federally endangered species, is known to occur in Richland County (USFWS 2008). Small numbers of

shortnose sturgeon ascend the Congaree River from the Santee-Cooper system (Lake Moultrie, Lake Marion, and Rediversion Canal) to spawn near Columbia, South Carolina, approximately 40 miles upstream of Lake Marion (Collins et al. 2003). These sturgeon have historically been prevented from moving from the Congaree River into the Broad River by the Columbia Diversion Dam, which is associated with a hydroelectric facility (Columbia Canal Hydro). SCE&G, in consultation with state and federal resource agencies, built a fish passage facility at the Columbia Diversion Dam in 2006 that gives migratory fish species access to 25 miles of the Broad River from which they were previously excluded. This could, in theory, allow shortnose sturgeon to move from the Congaree River into the Broad River, and then upstream as far as Parr Shoals. Given that sturgeon return to natal streams and established spawning areas with a fairly high degree of spawning site fidelity, there is no reason to believe that Santee-Cooper/Congaree River sturgeon would abandon historical spawning areas in the Congaree River to spawn in the Broad River. However, this cannot be ruled out as a possibility.

The Charleston Ecological Services office of the USFWS lists the Carolina heelsplitter (*Lasmigona decorata*), a federally endangered mussel, as possibly occurring in Fairfield, Newberry, and Richland Counties (USFWS 2008). The species was historically known from the Catawba and Pee Dee river systems in North and South Carolina and the Savannah River system in South Carolina. Until 2004, only eight populations of this rare mussel were thought to survive, four in North Carolina and four in South Carolina (Price 2005). In 2005, two more populations were discovered in tributaries of the Catawba River in Chester County (Price 2005). Although apparently once found in large rivers and streams, the Carolina heelsplitter is now found in only cool, shallow, heavily shaded streams of moderate gradient with stable streambanks. Where present, they are found in small numbers (Price 2005). It is unclear why the USFWS lists the species as possibly occurring in Fairfield, Newberry, and Richland Counties. SCDNR (2006) does not show the Carolina heelsplitter occurring in these counties. Although the Carolina heelsplitter may once have occupied the Saluda River drainage, there is no evidence to suggest that the species was ever found in the Broad River drainage.

The Charleston Ecological Services office lists the Carolina darter (*Etheostoma collis*) as existing in Fairfield and Richland Counties (USFWS 2008). The Carolina darter is shown on the Charleston Ecological Services records as a *Species of Concern*, a classification that has no official status but is taken into consideration by the Service during project reviews. The Saluda crayfish (*Distocambarus youngineri*), also listed by the Charleston Ecological Services office as a *Species of Concern*, is known to exist in Newberry County (USFWS 2008).

As discussed previously, the SCDNR surveyed the fish of the Broad River between January 2001 and May 2002 at 10 sample sites from Gaston Shoals to Bookman Island, which is below the Parr Shoals Dam. Although some rare species such as fantail darter (*Etheostoma flabellare*) were collected, no state or federally listed species were found (Bettinger, Crane, and Bulak 2003). As part of the same study, SCDNR biologists surveyed freshwater mussels at six Broad River sites in the summer of 2002. Seven distinct “shell forms” were found that

were presumed to represent seven different species. Of these seven shell forms, only two, Eastern elliptio (*Elliptio complanata*) and Eastern creekshell (*Villosa delumbis*), could be identified with certainty. The other shell forms likely belonged to the "*Elliptio lanceolata* group," and resembled *E. gracilentus*, *E. angustata*, and *E. perlatus*. The other two shell forms collected resembled *E. icterina* and *Uniomerus cariolanus*. None of these are listed by the state of South Carolina or the USFWS (SCDNR 2006; USFWS 2008) as rare species. *Elliptio complanata*, the species most often collected, is widespread within South Carolina, occurring in river systems from the Savannah to the Pee Dee (Bogan and Alderman 2004). It is known for its ability to tolerate low dissolved oxygen levels and survive droughts that take a heavy toll on other freshwater mussel species (Johnson et al. 2001).

SCE&G, along with several state and federal resource agencies and three other electric utilities, is involved in the restoration of the robust redhorse (*Moxostoma robustum*), a large catastomid believed to be extinct until 1991, when it was "rediscovered" in the Oconee River in Georgia (Bailey 2005). Nearly 19,000 robust redhorse fingerlings were stocked in the Broad River below two SCE&G hydroelectric facility dams (Neal Shoals Dam and Parr Shoals Dam) in 2004 (Self and Bettinger 2005); additional fish were stocked in the Broad River above Columbia in 2005 (SCDNR 2005b). Stockings are expected to continue until a self-sustaining population is achieved (Self and Bettinger 2005). Although this species is not state or federally listed, its range has been severely reduced by habitat loss (impoundment of native rivers) and habitat degradation (water quality problems associated with land development in watersheds). SCE&G is one of the signatories of the Memorandum of Understanding that established a Robust Redhorse Conservation Committee "actively committed to the restoration of the species throughout its known range" (RRCC 1995; Bailey 2005).

2.4.3.2 Diadromous Species

Based on a literature review, the Clean Water Act 316(a) and (b) studies for Unit 1 conducted in the 1980s, and extensive fish surveys conducted by the SCDNR in 2001 and 2002, SCE&G concludes that no diadromous populations (or landlocked descendents of once-diadromous populations) survive in the Broad River system. There are several semi-anadromous species, such as white perch and white bass, that make spawning runs within the Broad River system, but no representatives of species that move between freshwater and saltwater to spawn.

No anadromous fish have ascended the Broad River from the Atlantic Coast of South Carolina since the 1820s, when the Columbia Canal was built to connect the Broad River and the Congaree River. This canal, actually a lock and dam system, allowed river boats to circumnavigate shoals at the confluence of the Broad and Congaree rivers and move upstream into a deeper stretch of the Broad River. The Columbia Diversion Dam, which lies at the head of the Columbia Canal, was the main barrier to upstream movement of migratory fish. South Carolina Power Company, which was later to become SCE&G, built a small hydroelectric plant on the Columbia Canal in the 1880s to supply power to a textile mill, the first electrically powered textile mill in the world.

SCE&G completed work on a fishway (fish passage facility) at the Columbia Diversion Dam in 2006 that gives migratory fish species access to 25 miles of the Broad River from which they were previously excluded (American Rivers 2006). Plans for the fishway were developed by SCE&G in consultation with SCDNR, USFWS, and the National Marine Fisheries Service as part of the Federal Energy Regulatory Commission relicensing of the Columbia Canal Hydro (Moak 2004). The fishway consists of a series of pools arranged in stairstep fashion that will allow fish to negotiate the 14-foot high dam. The fishway was specifically designed to accommodate upstream passage of American shad and blueback herring, which were documented downstream of the dam in studies associated with the relicensing of the project (Moak 2004).

Now that the Columbia Diversion Dam fishway is operational, it is possible for anadromous species such as American shad and blueback herring to move from the Atlantic Ocean to the base of the Parr Shoals Dam via the Santee River, the St. Stephen Dam and fish lift, Lake Moultrie, the Diversion Canal that connects Lake Moultrie to Lake Marion, Lake Marion, the Congaree River, the Columbia Canal, the new fishway, and a 25-mile stretch of the Broad River. Some shad, herring, and eels will undoubtedly make this long and arduous journey, but the probability of large numbers of fish doing so appears remote.

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Table 2.4-1
Protected Species in Fairfield County and in Counties Crossed by Existing Transmission Lines

Scientific Name	Common Name	Federal Status[a]	State Status[b]	County[b]
Birds				
Haliaeetus leucocephalus	Bald eagle	—	E	Aiken, Edgefield, Fairfield, Newberry, Richland, Saluda
Picoides borealis	Red-cockaded woodpecker	E	E	Aiken, Edgefield, Richland, Saluda
Mycteria americana	Wood stork	E	E	Aiken, Newberry
Mammals				
Corynorhinus rafinesquii	Rafinesque's big-eared bat	—	E	Aiken, Richland
Reptiles				
Clemmys guttata	Spotted turtle	—	T	Aiken
Gopherus polyphemus	Gopher tortoise	—	E	Aiken
Amphibians				
Hyla andersonii	Pine barrens treefrog	—	T	Richland
Plethodon websteri	Webster's salamander	—	E	Edgefield, Saluda
Rana capito capito	Carolina gopher frog	—	E	Aiken
Fish				
Acipenser brevirostrum	Shortnose sturgeon	E	E	Aiken, Richland
Invertebrates				
Lasmigona decorata	Carolina heelsplitter	E	E	Edgefield, Saluda
Vascular Plants				
Amphianthus pusillus	Pool sprite, little amphianthus	T	T	Saluda
Aster georgianus	Georgia aster	C	-	Edgefield, Fairfield, Saluda
Echinacea laevigata	Smooth coneflower	E	E	Aiken, Richland
Lysimachia asperulifolia	Rough-leaved loosestrife	E	E	Richland
Oxypolis canbyi	Canby's dropwort	E	E	Richland
Ptilimnium nodosum	Harperella	E	E	Aiken, Saluda
Ribes echinellum	Miccosukee gooseberry	T	T	Edgefield
Trillium reliquum	Relict trillium	E	E	Aiken, Edgefield

a) Source: USFWS (2008)
b) Source: SCDNR (2006), USFWS (2008)

E = Endangered, T = Threatened, C = Candidate, — = Not listed

Table 2.4-2 (Sheet 1 of 2)
Protected Species in Counties Crossed by Proposed Transmission Lines

Scientific Name	Common Name	Federal Status[a]	State Status[a]	County[b]
Birds				
Charadrius melodus	Piping plover	T	—	Colleton
Charadrius wilsonia	Wilson's plover	—	T	Colleton
Elanoides forficatus	American swallow-tailed kite	—	E	Dorchester
Haliaeetus leucocephalus	Bald eagle	—	E	Aiken, Chester, Colleton, Dorchester, Fairfield, Hampton, Lancaster, Lexington, Newberry Orangeburg, Richland, Saluda
Picoides borealis	Red-cockaded woodpecker	E	E	Aiken, Chester, Colleton, Dorchester, Hampton, Lexington, Newberry Orangeburg, Richland, Saluda
Mycteria americana	Wood stork	E	E	Aiken, Colleton, Dorchester, Hampton
Sterna antillarum	Least tern	—	E	Colleton
Mammals				
Corynorhinus rafinesquii	Rafinesque's big-eared bat	—	E	Aiken, Colleton, Dorchester, Hampton, Orangeburg, Richland
Reptiles				
Caretta caretta	Loggerhead sea turtle	T	T	Colleton
Chelonia mydas	Green sea turtle	T	—	Colleton
Clemmys guttata	Spotted turtle	—	T	Aiken, Colleton, Hampton
Dermochelys coriacea	Leatherback sea turtle	E	-	Colleton
Gopherus polyphemus	Gopher tortoise	—	E	Aiken, Colleton, Dorchester, Hampton
Lepidochelys kempii	Kemp's ridley sea turtle	E	-	Colleton
Amphibians				
Ambystoma cingulatum	Flatwoods salamander	T	E	Orangeburg
Hyla andersonii	Pine barrens treefrog	—	T	Richland

Table 2.4-2 (Sheet 2 of 2)
Protected Species in Counties Crossed by Proposed Transmission Lines

Scientific Name	Common Name	Federal Status[a]	State Status[a]	County[b]
Amphibians (continued)				
Plethodon websteri	Webster's salamander	—	E	Saluda
Pseudobranchus striatus	Dwarf siren	—	T	Hampton, Orangeburg
Rana capito capito	Carolina gopher frog	—	E	Aiken, Dorchester, Hampton, Orangeburg
Invertebrates				
Lasmigona decorata	Carolina heelsplitter	E	E	Chester, Lancaster, Saluda
Fish				
Acipenser brevirostrum	Shortnose sturgeon	E	E	Aiken, Colleton, Dorchester, Hampton, Lexington, Orangeburg, Richland
Vascular Plants				
Amphianthus pusillus	Pool sprite, little amphianthus	T	T	Lancaster, Saluda
Aster georgianus	Georgia aster	C	—	Chester, Fairfield. Richland, Saluda
Echinacea laevigata	Smooth coneflower	E	E	Aiken, Lancaster, Lexington, Richland
Isoetes melanospora	Black-spored quillwort	E	—	Lancaster
Helianthus schweinitzii	Schweinitz's sunflower	E	E	Lancaster, Lexington
Lindera melissifolia	Pondberry	E	E	Colleton, Dorchester
Lysimachia asperulifolia	Rough-leaved loosestrife	E	E	Richland
Narthecium americanum	Bog asphodel	C	—	Dorchester
Oxypolis canbyi	Canby's dropwort	E	E	Colleton, Dorchester, Hampton, Orangeburg, Richland
Trillium reliquum	Relict trillium	E	E	Aiken
Ptilimnium nodosum	Harperella	E	E	Aiken, Saluda

a) Source: USFWS (2008)
b) Source: SCDNR (2006), USFWS (2008)

E = Endangered; T = Threatened; C = Candidate; — = Not listed

Table 2.4-3 (Sheet 1 of 3)
Avian Species Recorded During Surveys at the VCSNS Site

Species	Status[c]	Survey Period[a] and Abundance[b]							
		May 2002	Dec 2002	Jun–Jul 2006	Sep 2006	Apr 2007	Oct 2007	Aug 2008	Oct 2008
Wading Birds, Shorebirds, and other Water Birds									
Blue-winged teal (*Anas discors*)	W	—	Occ	—	—	—	—	—	—
Mallard (*Anas platyrhynchos)*	W	—	Occ	—	—	—	Occ	—	—
Black duck (*Anas rubripes)*	W	—	Occ	—	—	—	—	—	—
Great egret (*Ardea alba*)	Y	Occ	Occ	Occ	—	Occ	—	—	—
Great blue heron (*Ardea herodias*)	Y	Occ	-	Occ	Occ	Occ	Occ	Occ	Occ
Canada goose *(Branta canadensis)*	Y	Occ	Occ	Com	Occ	Occ	Occ	Occ	Com
Green heron (*Butorides virescens*)	Y	Occ	—	Occ	—	—	—	—	—
Killdeer (*Charadrius vociferus*)	Y	—	—	Occ	—	Occ	—	—	Occ
Little blue heron (*Egretta caerulea*)	Y	-—	—	Occ	—	Occ	—	—	—
Herring gull *(Larus argentatus)*	W	—	Occ	—	—	—	—	—	Occ
Double-crested cormorant (*Phalacrocorax auritus*)	Y	Occ	Occ	Com	Com	Occ	Occ	—	—
Birds of Prey and Soaring Birds									
Cooper's hawk (*Accipiter cooperii*)	Y	Occ	—	Occ	—	—	Occ	—	—
Red-tailed hawk (*Buteo jamaicensis*)	Y	Occ	Occ	Occ	Occ	Occ	—	Occ	Occ
Red-shouldered hawk (*Buteo lineatus*)	Y	Occ	Occ	Occ	Occ	Occ	Occ	—	Occ
Turkey vulture (*Cathartes aura*)	Y	Com	Com	Abu	Com	Com	Com	Com	Com
Black vulture (*Coragyps atratus*)	Y	Com	Occ	Com	Com	Occ	Abu	Occ	Occ
Bald eagle (*Haliaeetus leucocephalus*)	Y	Occ	—	—	Occ	Occ	Occ	—	Occ
Passerines and Other Birds									
Red-winged blackbird (*Agelaius phoeniceus*)	Y	Occ	—	Occ	—	—	—	—	—
Ruby-throated hummingbird (*Archilochus colubris*)	S	—	—	Occ	—	—	—	—	—
Great horned owl (*Bubo virginiana*)	Y	—	—	—	Occ	—	—	—	—
Northern cardinal (*Cardinalis cardinalis*)	Y	Com	Occ	Abu	Com	Com	Com	Com	Occ

Table 2.4-3 (Sheet 2 of 3)
Avian Species Recorded During Surveys at the VCSNS Site

Species	Status[c]	Survey Period[a] and Abundance[b]							
		May 2002	Dec 2002	Jun–Jul 2006	Sep 2006	Apr 2007	Oct 2007	Aug 2008	Oct 2008
Passerines and Other Birds (continued)									
Pine siskin (*Carduelis pinus*)	W	-—	Occ	—	—	—	Occ	—	—
Northern bobwhite quail (*Colinus virginianus*)	Y	Occ	—	Occ	—	Occ	—	—	—
Yellow-billed cuckoo (*Coccyzus americanus*)	S	—	—	Occ	—	Occ	—	—	—
Northern flicker (*Colaptes auratus*)	Y	Occ	—	Occ	Occ	-	Occ	Occ	Occ
Eastern wood pewee (*Contopus virens*)	S	Occ	—	Occ	—	Occ	—	—	—
American crow (*Corvus brachyrhynchos*)	Y	Com	Occ	Abu	Com	Com	Occ	Com	Com
Blue jay (*Cyanocitta cristata*)	Y	Occ	Occ	Com	Com	Occ	Com	Com	Com
Yellow-rumped warbler (*Dendroica coronata*)	W	—	—	—	—	—	Occ	—	Occ
Prairie warbler (*Dendroica discolor*)	S	Com	—	Com	-	Com	—	—	—
Pine warbler (*Dendroica pinus*)	Y	Occ	—	Occ	Occ	—	Occ	Occ	Occ
Pileated woodpecker (*Dryocopus pileatus*)	Y	Occ	Occ	Occ	—	Occ	Occ	Occ	Occ
Dark-eyed junco (*Junco hyemalis*)	W	—	Occ	-	—	—	Occ	—	—
Loggerhead shrike (*Lanius ludovicianus*)	Y	Occ	—	Occ	—	—	—	—	—
Belted kingfisher (*Megaceryle alcyon)*	Y	Occ	Occ	Occ	—	—	Occ	—	—
Red-bellied woodpecker (*Melanerpes carolinus*)	Y	Com	Occ	Com	Com	Occ	Com	Occ	Com
Wild turkey (*Meleagris gallopavo*)	Y	Occ	—	Occ	Occ	Occ	Occ	Occ	Occ
Song sparrow (*Melospiza melodia*)	W	—	Occ	—	—	—	Occ	—	—
Northern mockingbird (*Mimus polyglottos*)	Y	Com	Occ	Com	Abu	Com	Com	Com	Com
Great crested flycatcher (*Myiarchus crinitus*)	S	Occ	—	Occ	—	—	—	—	—
Tufted titmouse (*Parus bicolor*)	Y	Com	Occ	Com	-	Com	Com	Occ	Com
Carolina chickadee (*Parus carolinensis*)	Y	Com	Occ	Com	Com	Com	Com	Occ	Com
Indigo bunting (*Passerina cyanea*)	S	—	—	Occ	—	—	—	—	—
Downy woodpecker (*Picoides pubescens*)	Y	Occ	—	Occ	—	—	Occ	—	Occ
Rufous-sided towhee (*Pipilo erythrophthalmus*)	Y	Occ	Occ	Occ	Occ	Occ	Occ	Occ	Occ

Table 2.4-3 (Sheet 3 of 3)
Avian Species Recorded During Surveys at the VCSNS Site

Species	Status[c]	Survey Period[a] and Abundance[b]							
		May 2002	Dec 2002	Jun–Jul 2006	Sep 2006	Apr 2007	Oct 2007	Aug 2008	Oct 2008
Passerines and Other Birds (continued)									
Summer tanager (*Piranga rubra*)	S	Occ	—	Occ	—	Occ	—	—	—
Golden-crowned kinglet (*Regulus satrapa*)	W	—	—	—	—	—	Occ	—	Occ
Eastern phoebe (*Sayornis phoebe*)	Y	Occ	—	Occ	—	—	Occ	—	—
Eastern bluebird (*Siala sialis*)	Y	Occ	—	—	Occ	—	—	—	Occ
Brown-headed nuthatch (*Sitta pusilla*)	Y	—	Occ	Occ	—	—	—	Occ	Occ
Yellow-bellied sapsucker (*Sphyrapicus varius*)	W	—	—	—	—	—	Occ	—	Occ
Northern rough-winged swallow (*Stelgidopteryx serripennis*)	S	—	—	Occ	—	—	—	—	—
Barred owl (*Strix varia*)	Y	Occ	—	Occ	—	—	—	—	—
Carolina wren (*Thryothorus ludovicianus*)	Y	Occ	—	Occ	Occ	—	—	Occ	—
American robin (*Turdus migratorius)*	Y	Com	Occ	Occ	Com	Occ	Com	Com	Occ
Brown thrasher (*Toxostoma rufum*)	Y	Occ	—	—	Occ	Occ	—	—	—
White-eyed vireo (*Vireo griseus*)	S	Occ	—	Occ	—	Occ	—	—	—
Red-eyed vireo (*Vireo olivaceus*)	S	Occ	—	Occ	—	—	—	—	—
Mourning dove (*Zenaida macroura*)	Y	Com	Occ	Com	Occ	Com	Com	Com	Com
White-throated sparrow (*Zonotrichia albicollis*)	W	—	Occ	—	—	—	Occ	—	—

a) Survey periods were May 30-31, 2002; December 10, 2002; June 27 and July 20-21, 2006; September 18, 2006; April 5-6, 2007; October 4, 2007, August 22, 2008; October 14, 2008; and October 27-31, 2008.

b) Abundance classifications within expected habitats were subjectively based on observations relative to time surveyed; Abu = abundant; Com = common; Occ = occasional, uncommon, or rare; - indicates species was not observed.

c) Species occurrence in the region encompassing VCSNS, based on range maps (Peterson 1980): Y = present throughout the year; S = summer (breeding season); W = winter only.

Table 2.4-4
Aquatic and Wetland Plants Observed at Parr Reservoir in 2008

Species	Public Boat Landing on Hellers Creek	50 Yds Above the Mouth of Hellers Creek	50 Yds Above the Mouth of Frees Creek	Public Boat Landing on Cannons Creek	600 Yds Above Proposed Blowdown Location	200 Yds Above Proposed Blowdown Location	100 Yds Above Proposed Blowdown Location	Proposed Cooling Tower Blowdown Location	100 Yds Below Proposed Blowdown Location	200 Yds Below Proposed Blowdown Location	600 Yds Below Proposed Blowdown Location
Alligatorweed	X	X	X	X	X	X	X	X	X	X	X
Bulrushes	X	X			X	X	X	X	X	X	
Bur-Marigold			X		X	X	X	X	X	X	X
Cattail	X				X		X		X	X	
Coontail					X	X	X	X		X	X
Lizard's Tail		X			X	X	X	X	X	X	X
Marsh Pennywort			X			X	X	X	X	X	
Pickerelweed	X		X			X	X	X	X	X	X
Rushes		X	X				X	X			
Smartweed	X			X	X	X	X	X	X	X	X
Water Primrose	X	X	X	X	X	X	X	X	X	X	X

Source: SCANA Services 2008b

Table 2.4-5
Rapid Bioassessment Metrics Calculated for the Three Sampling Stations on Mayo Creek, Fairfield County, South Carolina, 2008–2009

	July 2008 Station			October 2008 Station			January 2009 Station			April 2009 Station		
Metric	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	3
Taxa Richness	26	33	26	30	23	25	31	29	29	43	38	34
Number of Specimens	151	149	129	182	165	157	150	143	146	244	204	215
EPT Index	8	9	9	9	9	7	14	13	17	21	19	17
EPT Abundance	97	97	92	130	131	108	106	93	118	189	172	163
Chironomid Taxa	5	4	2	1	3	2	6	3	5	4	2	7
Chironomid Abundance	24	5	3	2	3	3	19	5	17	18	2	18
EPT/Chironomid Abundance	4.04	19.40	30.67	65.00	43.67	36.00	5.58	18.60	6.94	10.50	86.00	9.06
NC Biotic Index (rating)	6.17 (good-fair)	5.73 (good)	5.93 (good-fair)	5.52 (good)	5.81 (good-fair)	6.26 (good-fair)	5.12 (excellent)	5.21 (good)	5.46 (good)	4.59 (excellent)	4.19 (excellent)	4.36 (excellent)
SCDHEC Bioclassification (rating)	2.3 (fair)	2.8 (good-fair)	2.3 (fair)	2.8 (good-fair)	2.5 (good-fair)	2.2 (fair)	3.7 (good)	3.2 (good-fair)	3.3 (good-fair)	4.0 (good)	4.0 (good)	3.8 (good)
Percent of Dominant Taxon	23.84	22.15	41.86	24.18	44.85	40.76	20.67	17.48	27.40	12.70	31.37	18.14

Source: CBS 2008c, CBS 2008d, CBS 2009c, CBS 2009d

Table 2.4-6 (Sheet 1 of 2)
Dominant taxa (>5% of the collection) for the Three Sampling Stations on Mayo Creek, Fairfield County, South Carolina, 2008–2009

July 2008			October 2008			January 2009			April 2009		
Station 1 Taxon	**No.**	**Rel. Abd.**	**Station 1 Taxon**	**No.**	**Rel. Abd.**	**Station 1 Taxon**	**No.**	**Rel. Abd.**	**Station 1 Taxon**	**No.**	**Rel. Abd.**
Caenis sp.	36	23.84	*Caenis* sp.	44	24.18	*Maccaffertium modestum*	31	20.67	*Acentrella* sp.	31	12.70
Stenacron interpunctatum	19	12.58	*Cheumatopsyche* sp.	31	17.03	*Cheumatopsyche* sp.	18	12.00	*Ephemerella* sp.	30	12.30
Maccaffertium modestum	15	9.93	*Chimarra* sp.	22	12.09	*Acentrella ampla*	17	11.33	*Caenis* sp.	25	10.25
Cheumatopsyche sp.	15	9.93	*Maccaffertium modestum*	13	7.14	*Simulium mixtum*	11	7.33	*Maccaffertium modestum*	23	9.43
Microtendipes pedellus	12	7.95				*Cricotopus* sp.	10	6.67	*Isoperla sp.*	14	5.74
						Ephemerella catawba	9	6.00			
Station 2 Taxon	**No.**	**Rel. Abd.**	**Station 2 Taxon**	**No.**	**Rel. Abd.**	**Station 2 Taxon**	**No.**	**Rel. Abd.**	**Station 2 Taxon**	**No.**	**Rel. Abd.**
Caenis sp.	33	22.15	*Caenis* sp.	74	44.85	*Maccaffertium modestum*	25	17.48	*Caenis* sp.	64	31.37
Cheumatopsyche sp.	18	12.08	*Cheumatopsyche* sp.	19	11.52	*Simulium mixtum*	22	15.38	*Ephemerella* sp.	20	9.80
Maccaffertium modestum	14	9.40	*Maccaffertium modestum*	13	7.88	*Acentrella ampla*	19	13.29	*Agnetina* sp.	17	8.33
Isonychia sp.	12	8.05	*Isonychia* sp.	11	6.67	*Caenis sp.*	13	9.09	*Maccaffertium modestum.*	12	5.88
Triaenodes ignitus	10	6.71				*Ephemerella catawba*	11	7.69	*Isonychia* sp.	12	5.88
						Cheumatopsyche sp.	10	6.99	*Telogonopsis deficiens*	11	5.39

Table 2.4-6 (Sheet 2 of 2)
Dominant taxa (>5% of the collection) for the Three Sampling Stations on Mayo Creek, Fairfield County, South Carolina, 2008–2009

July 2008			October 2008			January 2009			April 2009		
Station 3 Taxon	**No.**	**Rel. Abd.**	**Station 3 Taxon**	**No.**	**Rel. Abd.**	**Station 3 Taxon**	**No.**	**Rel. Abd.**	**Station 3 Taxon**	**No.**	**Rel. Abd.**
Caenis sp.	54	41.86	*Caenis* sp.	64	40.76	*Caenis* sp.	40	27.40	*Caenis* sp.	39	18.14
Maccaffertium modestum	11`	8.53	*Cheumatopsyche* sp.	24	15.29	Acentrella ampla	17	11.64	*Baetis intercalaris*	25	11.63
Stenacron interpunctatum	8	6.20	*Hydrachna* sp.	9	5.73	*Cheumatopsyche* sp.	16	10.96	*Acentrella* sp.	19	8.84
Hydrachna sp.	7	5.43	*Corbicula fluminea*	9	5.73	*Maccaffertium modestum*	15	10.27	*Agnetina* sp.	14	6.51
			Cambaridae *(unidentified crawfish)*	8	5.10	*Orthocladius sp.*	11	7.53	*Simulium ubiquitum*	13	6.05
			Isonychia sp.	8	5.10				*Isonychia* sp.	12	5.58
									Amphinemura sp.	12	5.58
									Maccaffertium modestum	11	5.12
									Ephemerella sp.	11	5.12

Source: CBS 2008c, CBS 2008d, CBS 2009c, CBS 2009d

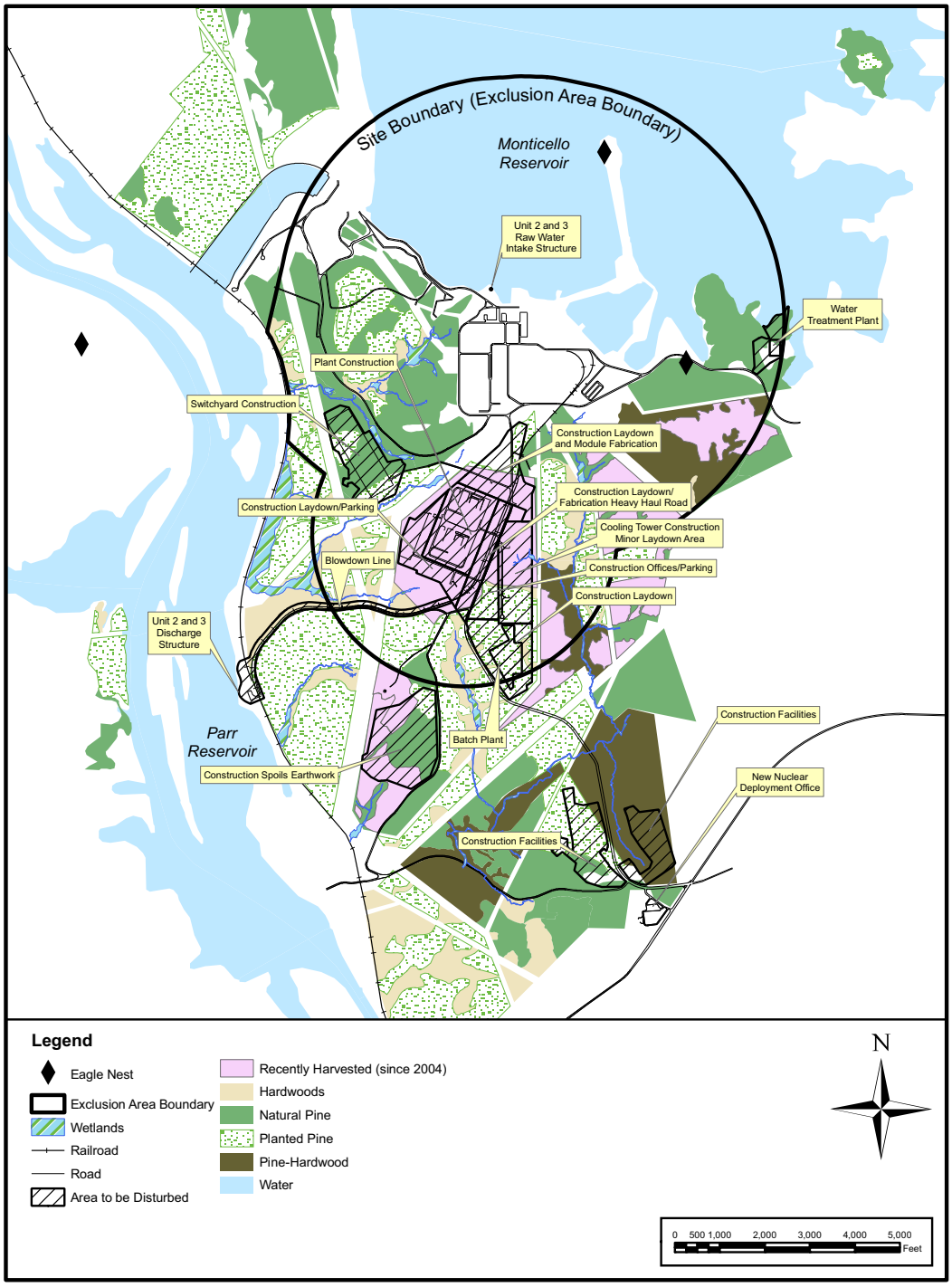

Figure 2.4-1. Habitats and Areas That Will Be Disturbed During Construction of Units 2 and 3

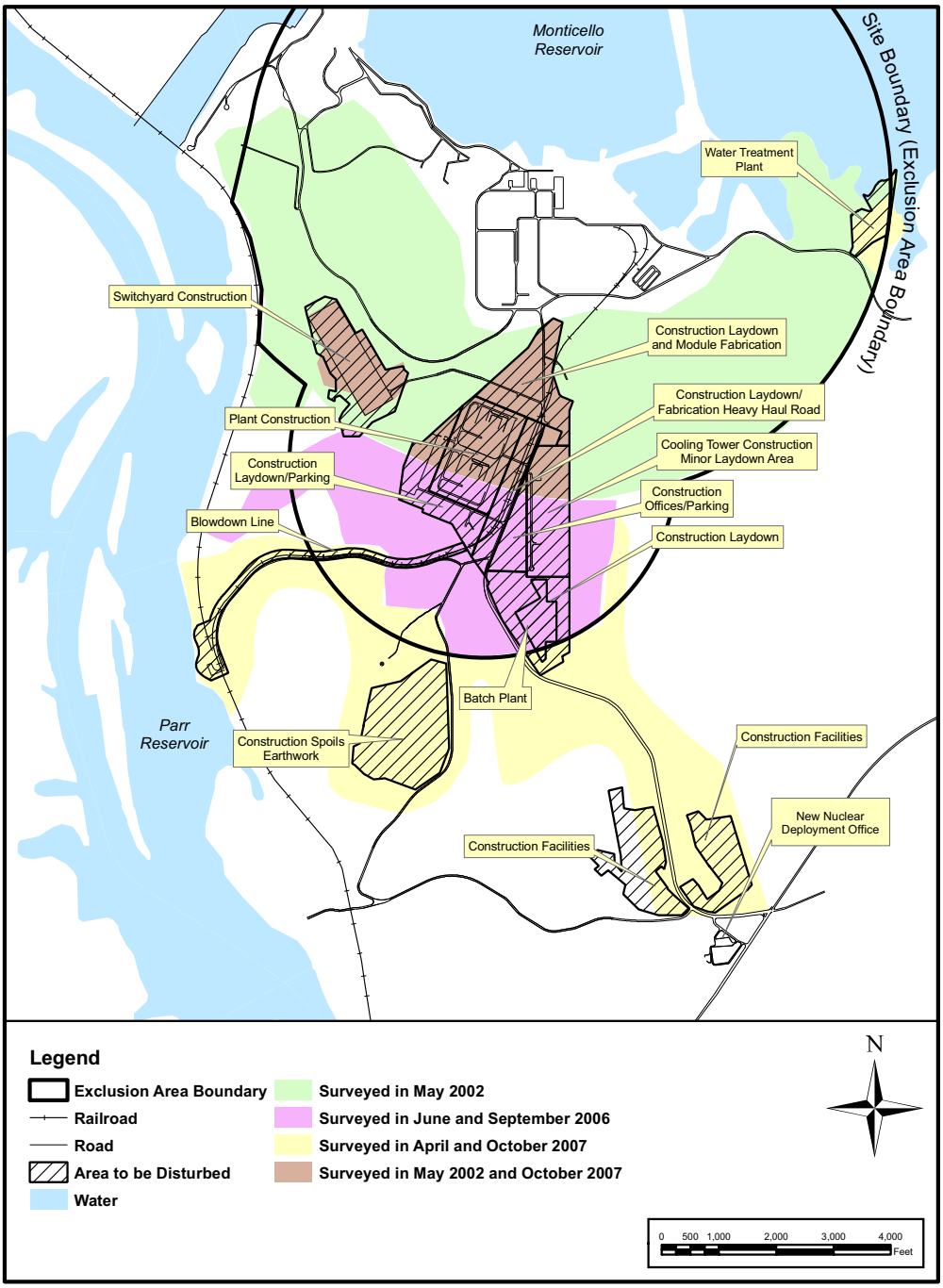

Figure 2.4-2. Areas Surveyed for Endangered and Threatened Species at VCSNS, 2002–2007

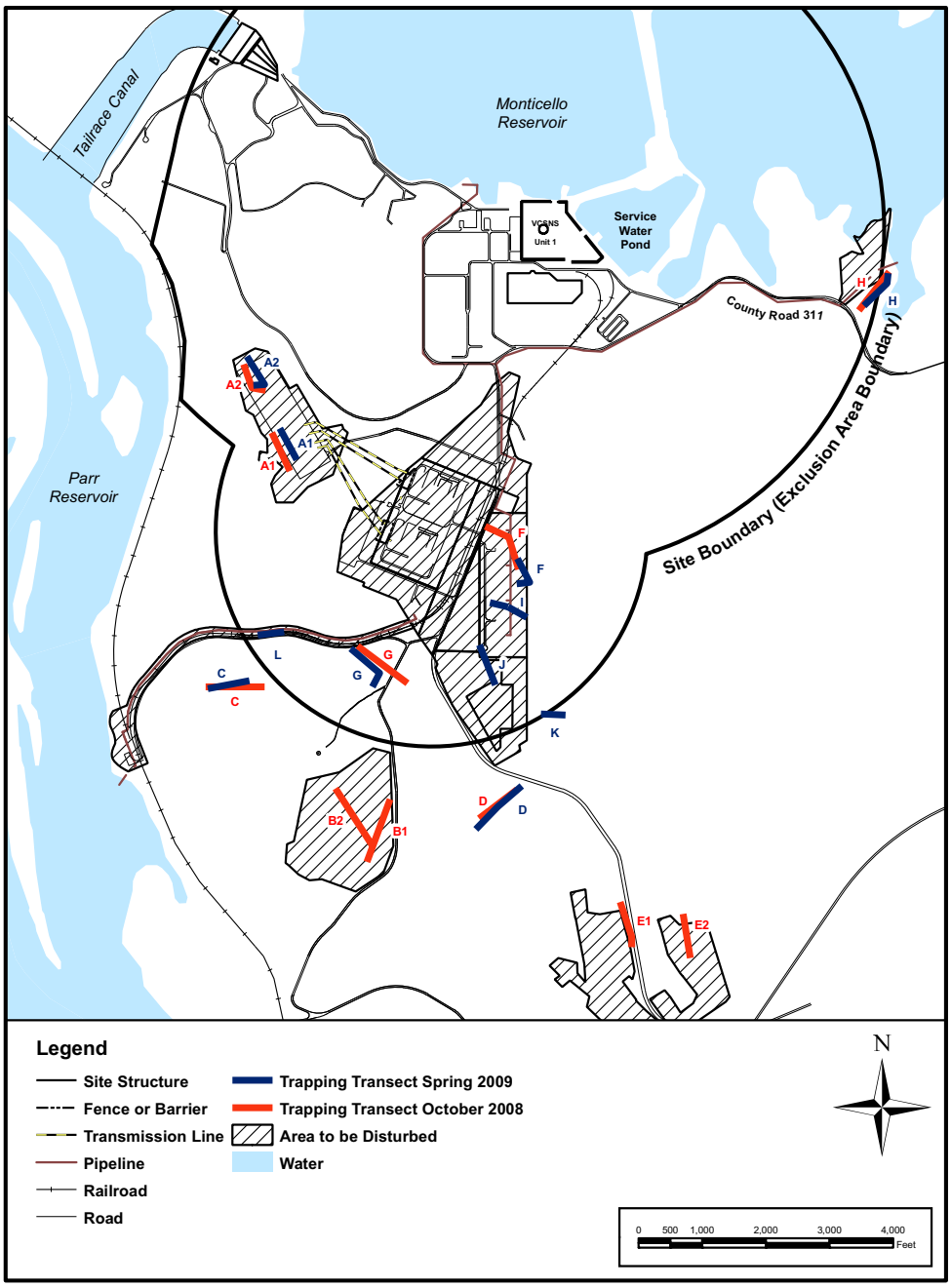

Figure 2.4-3. Small Mammal Trapping Transects on the VCSNS Site